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A HISTORY OF MAGIC
AND EXPERIMENTAL SCIENCE

VOLUMES VII AND VIII
THE SEVENTEENTH CENTURY

VOLUME VIII

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AND EXPERIMENTAL SCIENCE
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A HISTORY OF MAGIC AND EXPERIMENTAL SCIENCE

VOLUMES VII AND VIII
THE SEVENTEENTH CENTURY

BY LYNN THORNDIKE

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ABBREVIATIONS

AE	Acta eruditorum
Alegambe	Bibliotheca scriptorum societatis Iesu, Antwerp, 1643; Rome, 1676
BEC	Bibliothèque de l'Ecole des Chartes: revue d'erudition consacrée spécialement à l'étude du Moyen Age, Paris, 1839 to date
BL	Bodleian Library, Oxford
BM	British Museum, London
BMsl	British Museum, London, collection of Sloane manuscripts
BN	Bibliothèque Nationale, Paris
c	century
c.	circa
Col	Columbia University Library, New York
comm.	commentary or commentator
Cornell	Cornell University Library, Ithaca, N.Y.
Correspondance	Correspondance de P. Marin Mersenne, publiée par Mme. Paul Tannery, ed. Cornelis de Waard, 4 vols., 1932, 1936, 1946, (1955)
dedic	dedication, dedicated to, etc.
DNB	Dictionary of National Biography, London, 1885-1901, 63 vols.
Duveen	Denis I. Duveen, Bibliotheca Alchemica et Chemica, London, 1948
EB	Encyclopedia Britannica
ed	edited by, edition, editor
Ferg or Ferguson	John Ferguson, Bibliotheca Chemica: a catalogue of rare alchemical, chemical and pharmaceutical books, manuscripts and tracts... in the collection of J. Young, Glasgow, 1906
fr	français or French
Graesse	J. G. T. Graesse, Trésor de livres rares et précieux, ou, Nouveau dictionnaire bibliographique, Dresden, 1859-1869, 7 vols.
GS	George Sarton, Introduction to the History of Science, 3 vols. in 5, Baltimore, 1927, 1931, 1947
Hoefer	J. C. F. Hoefer, Histoire de la chimie..., Paris, 1842-1843, 2 vols.
Jöcher	Ch. G. Jöcher, Allgemeines Gelehrten Lexicon, Leipzig, 1750-1751, 4 vols.
JS	Journal des Sçavans
LC	Library of Congress
LR	Lindenius Renovatus (J. A. van der Linden, De scriptis medicis, revised edition by G. A. Mercklin, Nürnberg, 1886)

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MS, MSS	Manuscript, Manuscripts
n.	note or footnote
n.d.	no date of publication
NH	Natural History
NYAM	New York Academy of Medicine
NYP	New York Public Library
p. pp.	page, pages
Poggendorff	J. C. Poggendorff, Biographisch-Literarisches Handwörterbuch
pr	printed, printer
Pritzel	G. A. Pritzel, Thesaurus literaturae botanicae
pt.	part
PT	Philosophical Transactions
Sbaralea	Supplementum et castigatio ad Scriptores trium ordinum S. Francisci a Waddingo aliisque descriptos, Rome, 1806, 2 vols.; revised edition, 1909, 1921
s. l.	sine loco (without place of publication)
Sudhoff (1902)	Karl Sudhoff, "Iatromathematiker vornehmlich im 15. und 16. Jahrhundert," Abhandlungen zur Geschichte der Medizin, Heft II (1902), Breslau, viii, 92 pp.
T	Lynn Thorndike, A History of Magic and Experimental Science, New York, 1923, 1934, 1941, 6 vols.
tr	translated, translation, translator
VA	Vatican, and Vatican Latin manuscript
VAb	Vatican, Barberini Latin manuscript
vol.	volume
Wadding	Luke Wadding (1588-1657), Scriptores ordinis minorum..., editio novissima, Rome, 1906
Will	Georg Andreas Will, Nürnbergisches Gelehrten-Lexicon, 1755-1758, 4 vols.
Zedler	J. Zedler, Grosses Vollständiges Universal Lexicon aller Wissenschaften und Künste, Halle and Leipzig, 1732-1750, 64 vols.
Zetzner	Lazarus Zetzner, Theatrum chemicum, Strasburg, 1659-1661, 6 vols.

NATURAL HISTORY, EXPERIMENTAL SCIENCE
A HISTORY OF MAGIC
AND EXPERIMENTAL SCIENCE

THE SEVENTEENTH CENTURY

CHAPTER XXIV

NATURAL HISTORY, ESPECIALLY OF ANIMALS

Introduction—Museo Calceolario—Caspar Bartholinus on the unicorn, etc.—Wilhelm and Peter Lauremberg—Imperato's *Discorsi*—Catelan on the mandrake: Thomasius—Cesi—Castelli on the odoriferous hyena—Besler's *Gazophylacium*—Boate—Moscardo—Rattray on sympathy and antipathy—Klobius on amber—Lovell's *Panzologicomineralogia*—Redi on vipers: Severino, Charas, Bourdelot, Platt—Redi's *Esperienze*: Tyson, Charas, Zambecari—Letters of J. D. Major and Sachs von Löwenheimb: Rolfinck—Scilla on fossils—Senguerd and Grube on the tarantula—Thevenot—Boccone—Pechlin, Müller, P. L. Sachs, Lorenzini, Grew—Buonanni on shellfish—König on the animal kingdom—Wurffhain's *Salamandrologia*: similar works by Marius and Paullini—Plott—Barnacle geese: Moray, Sibbald, Robinson—Panthot—Progress by Ray and Steno—Swammerdam's General History of Insects.

One of the followers of Democritus or Descartes may venture perhaps to give some tolerable explication of the appearances in heaven and earth, allow him but his atoms and motion. But when he comes to plants and animals, he'll find himself non-plussed and give you no likely account of their production.

—HUYGENS

In the present volumes a chapter on Mineralogy has already roughly paralleled that on The Lore of Gems in our volumes on the sixteenth century, where pharmacy was treated in connection with the work of Brasavola, and zoology and botany were considered together under the caption of The Sixteenth Century Naturalists. These themes will now be continued under a somewhat different arrangement of three successive chapters on Natural History, Especially of Animals, Botany, and Pharmacy. The division is somewhat artificial, for the same men commonly pursued both zoological and botanical researches, and the connection between pharmacy and botany was also very close. The massive tomes of

Aldrovandi, of whom we treated in our sixth volume, continued to appear until mid-century. They discouraged others from attempting general works of synthesis in natural history, and for some time it is mainly works on particular topics or animals that we have to record as specimens in that field. Our arrangement will be primarily chronological.

Jeremias Wilde, in a treatise on the ant in fifteen chapters, attributed seven properties to ants, of which the seventh was knowledge of the future, and held that they had a religion and observed certain feasts or days.¹ In the same year, 1615, Eric Krabbe published a discourse at Marburg on the shrewdness of animals (*Oratio de solertia animalium*), a favorite topic in the past.

That Pliny was still highly esteemed as an authority in natural history is shown by the essay of Paul Cigalinus on the faith and authority of Pliny in the Frankfurt, 1608, edition of Pliny's *Historia naturalis*, and by Boxhorn's Panegyric on Pliny, published at Leyden in 1632.

The catalogue of the Museo Calceolario at Verona, which took its name from its past founder and present owner, was begun for him by Benedictus Cerutus and completed by Andrea Chiocco in 1622.² It falls into six sections. In the first were shrubs and very large plants, with some fine pictures of coral, particular kinds of halcyons, testaceans and crustaceans, fish and dried amphibians. To the second section belonged various kinds of earths, ochres, rubrics, salts, alums, sulphurs and bitumens. Third were gems and other stones, including those marked by nature with figures—a long section covering pages 185 to 431 but consisting mostly of quotation from Marbod and others. Section four dealt with metals; five, with plants, roots and exotic fruits, also foreign gums and fat juices; six, with birds, quadrupeds, lizards, amphibian animals and miscellaneous matters. An alphabetical index followed. The text except for the second section was illustrated with pictures of the specimens and also often gave their moral significance. Such

¹ *De formica*, Ambergae apud Schönfeld, 1615, in-16, caps. 8 and 9.

² *Musaeum Calceolarianum Veronense. Musaeum Franc. Calceolari Iun. Veronensis a Benedicto Ceruto medico inceptum et ab Andrea Chiocco med. physico excell. collegii luculenter descriptum et perfectum*, 1622, in-fol., 746 pp. BM 462.1.16.

past authors as Pliny, Dioscorides and Albertus Magnus are frequently cited.

Scaliger is cited as to barnacle geese, and a picture is shown of a young one in a shell, "delineated to the life" but not very convincingly. However, the professor of medicinal simples at Pisa and prefect of the botanical garden there had recently told Chiocco that in the museum of the Grand Duke, "among other miracles of nature," were branches torn from a tree in northern regions from whose bark hung shell-like protuberances about the size of almonds, from which he said the birds were hatched when they fell into the sea.³ The torpedo fish is also not omitted, and, "lest it seem superstitious and ridiculous," one should read Aelian, Pliny and Albertus Magnus.⁴

Chiocco is amazed that a recent Italian writer has declared it false that the toad-stone grows in the toad's head and has held that specimens of it were found in rocks and were very similar to small fungi. He should have said that many of them were from rocks and had like properties against poison, the stone and fevers, and have distinguished between the two varieties. But he never should have denied the experience of many years and truth corroborated by experiments of so many years and confirmed by the testimony of approved naturalists. Chiocco expostulates concerning this for several folio pages.⁵ But there is so much disagreement among authorities as to the lynx-stone that he does not dare to form an opinion about it. There is some mystery also in the herb *lunaria*, which they think extracts the nails from the hooves of horses feeding on the mountains, and which therefore seems to have the force of the magnet. There is a bit of true and legitimate monoceros horn in the Museum which comes from that which Mattioli transmitted to Calceolarius senior in 1565 at Prague by order of Maximilian, emperor of Austria, in order that a most efficacious antidote against poison might be composed, which was brought about with great credit to Calceolarius, so that the emperor gave what was left over to the Museum.⁶

³ *Ibid.*, 25-27.

⁴ *Ibid.*, 69.

⁵ *Ibid.*, 363-68. The allusion is to Imperato's father: see our Chapter 9.

⁶ *Ibid.*, 377, 519, 687.

Apparently a museum of natural history at that time did more to encourage credulity as to marvels and monsters than it did to foster experimental research.

In northern Europe Caspar Bartholinus (1585–1629) of Copenhagen opened his treatise on the unicorn with the statement that there was nothing new in some men denying what they had not seen. In consequence many things vouched for by writers worthy of faith were not merely called into doubt but pronounced false. Better and more cautious was the attitude of those who accepted affirmations of trustworthy authors, until, after scouring every angle of the globe, no support was found for their assertion. Some men even had had one horn. Turning, however, from monsters to species, although admitting that reindeer have two horns, unlike Catelan who in 1624 had listed them as one-horned quadrupeds, Caspar lists eight kinds of larger animals with a single horn, including *marina Borealia* (swordfish?), whose horns are now found in the possession of leading men and are sold as genuine. It is evident that the unicorn of the Bible is not the rhinoceros, nor are rhinoceros and monoceros the same. At bottom Caspar's attitude is sceptical, for he asserts that the horn of the monoceros has almost no force against poison, and that better substitutes are not lacking which are shown by experiments to be far more reliable, such as ivory, hartshorn, and especially fossil horn which is commonly mistaken for that of the monoceros.⁷

The treatise on the unicorn is followed by another on the nephritic stone and amulets.⁸ It is green jasper (jade?),⁹ and is especially sought after by the princes of India. Caspar touches on its qualities and occult virtues, wearing it externally so that it touches the skin against stone and gravel, various histories and experiments attesting its virtues from trustworthy authors, and instances of other amulets to demonstrate their efficacy.

The third opusculum is on pygmies. It is questioned whether

⁷ *Opuscula quatuor singularia: i. De unicornu eiusque affinibus et succedaneis*, 1628, fols. 1r-48r. BM 957. e.35.

⁸ *Ibid.*, fols. 1r-29v, *De lapide nephritico et amuletis praecipuis*.

⁹ In Italian, *fiancho* and *osiada*; in French, *une siadre*; in Spanish, *igiada*, in "Belgian", *calsvee*.

they are men, and whether the accounts of them are fabulous.¹⁰ The fourth and last opusculum on the study of medicine¹¹ lies outside the scope of this chapter.

In the north also, at Rostock on the Baltic, the Laurenberg or Lauremberg family were local representatives of the interest in nature. The father, Wilhelm (1547–1612), was professor of mathematics and medicine there, and wrote minor treatises in both fields.¹² The sons, Wilhelm and Peter, were more strictly naturalists, but still in the old-fashioned sense. As Aldrovandi had discoursed at length on the eagle,¹³ so Wilhelm the Younger held forth in 1627 on the *aetites* or eagle-stone in a treatise devoted entirely to it,¹⁴ while Peter, in his *Apparatus plantarius* of 1632 on bulbous and tuberoso plants, set forth their nomenclature, multiple differences and species, vines, culinary and medical use, culture and method of planting, preserving and propagating, and also what poets, philologists, philosophers and sacred letters had said of them worthy of memory—again in a manner and arrangement reminiscent of Aldrovandi.¹⁵

We have said that Wilhelm the Younger devoted an entire treatise to the *aetites*. But it is some time before he gets to the stone itself. First he has to mention the marvelous medicinal properties of the brain of the eagle and of its tongue suspended from the patient's neck by a linen cloth, for which details he cites Pliny, Kiranides, Aldrovandi and Galen, *Euporista* III, 37.¹⁶ Even after he has begun to speak of the eagle stone itself, he stops to tell how the

¹⁰ *Ibid.*, De pygmaeis, fols. 2r-29r.

¹¹ *Consilium de studio medico inchoando continuando et absolvendo*, 8 fols., delivered in 1626.

¹² David Eugene Smith, "Medicine and Mathematics in the Sixteenth Century." *Annals of Medical History* (1917), 125-40, at p. 137.

¹³ See T VI, 277-78.

¹⁴ *Historica descriptio aetitis seu lapidis aquilae* . . . , Rostochii, 1627. The type page is very small, only about two by four inches.

¹⁵ *Petri Laurembergii Rostochiensis Apparatus plantarius primus: distribu-*

tus in duos libros I De plantis bulbosis, II De plantis tuberosis, quibus exhibentur praeter nomenclaturas multiplices earum differentiae et species, Vites, Usus tam culinaris quam medicus, Cultura sive ratio eas plantandi conservandi propagandi. Itemque quae poetae, philologi, philosophi, sacrae litterae &c de iis memoratu dignis annotarunt. Adiunctae sunt plantarum quarundam novarum novae Ichnographiae & descriptiones, 1632.

¹⁶ *Historica descriptio aetitis*, fol. B 3 r-v.

sea in one night fomed a dyke near Rostock, full of stones and gems including the *aetites*, to protect the shore from its inundations.¹⁷ The prelude of marvel-mongering warns us what to expect as we proceed.

Do not think that the eagle does not know what it is about in transporting this stone to its nest. In the first place, whereas the eagle is of a very hot temperament, the *aetites* is very cold and so keeps the bird from cooking its eggs when it sits on them. Secondly, this stone wards off insects and serpents which are apt to devour its young, while the eagle is searching for food for them. Finally, the eagle uses the stone to lessen the pains of the hen in laying. Thus far Wilhelm has cited Lucan, Strabo, Porta, Aldrovandi and Gesner in his support. He further adds from Gesner that the stone is so cold that fire does not affect it. Those are in error who hold that the stone is not found in the eagle's nest but grows in its body.¹⁸

Wilhelm again digresses to differing opinions as to the matter and the efficient cause of stones in general. He next notes that eagle-stones from different regions vary in hardness and softness, friability, color and size. Then comes further digression on nature's preference for the spherical shape and on fragrant stones. Such odor, he thinks, is because the end of the rainbow touches these stones. The eagle-stone is hollow and rattles when shaken, and various substances are found inside it. Nine species of it are listed. There follows a digression on parent stones. A lady in Luxemburg owned two diamonds which bore others. Wilhelm agrees with Rueus and de Boodt that celestial fire was the cause of this. They say that the female stone bears offspring only in the male's presence, that in his absence she loses color and grows pale, but on the male stone's approach gradually regains her previous pulchritude. Wilhelm, however, asserts that the female stone bears in the male's absence, albeit small stones which grow in size with the moon and also change color as the moon waxes and wanes.

The Lapps, who instruct their children in magic from the cradle, who know the secrets both of nature and the future, and who are

¹⁷ *Ibid.*, fols. B 6 v - (B 8) v.

the text, I will henceforth note the

¹⁸ *Ibid.*, fols. (B 10) r - (B 12) r.

fols. only where this is not the case.

As I in the main follow the order of

often transported invisibly through the air, conjure eagles to bring the *aetites* to them. This leads to quotation of the *Golden Ass* of Apuleius concerning magic and to discussion of the cabalists. Returning from this digression, Wilhelm enumerates various sub-varieties of eagle-stones. Of *Gaeodes*, for example, there are seven kinds. Then there are *Krokaleoi* and *Skirrhodon* or *Scyrrhodum*. Of *Rhytodektas*, which is not hard like the preceding varieties but contains liquid and fluid matter, there are two subdivisions. Meanwhile Wilhelm has quoted Pliny frequently but has also told of stones near Hildesheim, Mecklenburg, and the Baltic.

We turn to the virtues of *aetites*. Gesner has questioned whether it alleviates the pains of childbirth, denying any sympathetic relationship between it and the foetus or pregnant woman. But Wilhelm protests against denying to the eagle-stone alone virtues which are freely conceded to other stones and which are based upon experience. If the diamond is an amulet against fascination, incantations, succubi and the magic illusions of demons, if pearls comfort the heart and vital spirits, if wearing an emerald prevents epilepsy, fever and poisoning, if herbs too have great powers, why deny such to the eagle-stone? Wilhelm appeals to the force of sympathy, asks who will dare to affirm that the hidden qualities of things consist in likeness alone, and cites various authorities in his favor. The Norwegian male *aetites* has this peculiar power that, if one urinates upon it, it will cure stone in kidneys or bladder.¹⁹ It drives off snakes, bound on with the eagle-fish is said to restore fractured bones, and is employed in Italy with some thirty other ingredients as a remedy for the pest.²⁰ Oppian asserts that it prevents water from boiling, but Wilhelm has tested this with ten different varieties of *aetites*, and none produced this effect.²¹

Lauremberg condemns certain usages as superstitious.²² One is when bread, on which powdered eagle-stone has been sprinkled, is given to persons suspected of theft, and he who fails to swallow it is revealed as the thief. There is a similar ordeal with cheese,

¹⁹ *Ibid.*, fol. G 2 v.

²⁰ *Ibid.*, fol. G 6 r-v, G 7 v - (G 8) v.

²¹ *Ibid.*, fol. G 6 v.

²² *Ibid.*, fols. G 3 r - 4 v, for the following paragraph.

which is first inscribed thus:

x pax x mox x milax x urtu x filex x
or
x magula x regula x Meger x Rgilla x Tolix x.

According to Wilhelm, Brasavola, Rueus and de Boodt say that *aetites* gives presages of the future, makes its wearer rich, wins love, makes one invincible and popular, "and six hundred more of that sort which they assert of *aetites* without reason." There is disagreement whether such usages are licit. Their advocates point out that wearing jasper or a peony about the neck prevents epilepsy, and that words, characters and figures are employed in other natural operations. Wilhelm, however, regards as superstitious all amulets containing words, verses, characters or figures, or which are engraved when the sun is in this or that sign of the zodiac. These have no virtues from nature or the stars, but work only with the cooperation of an evil spirit. They are superstitious, magical, and not permitted to Christians. But the wearing of gems against diseases is licit, benign and natural.

A later writer to treat of the eagle-stone was Johann Lorenz Bausch in *Schediasmata bina curiosa de lapide haematide et aetite*, Leipzig, 1665.²³

Bound with Wilhelm's treatise on the eagle-stone are his instructions how to set up a botanical garden,²⁴ and his Latin translation of a dissertation by Augerius Clutus, an M.D. of Amsterdam, on Calsvee or nephritic stone or green jasper, of which we have already heard Caspar Bartholinus treat.²⁵ One variety was brought from New Spain in America; another, famed in India, China, Persia, the Near East, and in ancient and medieval authors, came from the Caucasus. It cured or relieved the stone. Bound on her arm, it cured a princess of western India. Indeed, the Hindus set such store by it, that it was seldom brought west.

The treatise of Peter Laurenborg on bulbous and tuberose plants,

²³ It has already been discussed in our Chapter 9 on Mineralogy.

²⁴ *Botanotheca*, Rostock, 1626.

²⁵ *Augerii Cluti Calsvee sive Dissertatio lapidis nephritici seu jaspidis*

viridis, a quibusdam Callois dicti, naturam proprietates et operationes exhibens, quam sermone Latino recenset M. Gulielmus Gulielmi F. Laurenborg, Rostochii, 1627.

treats of twenty-four bulbs, including garlic, onions, orchids and tulips, and eighteen tubers, with a full page illustration of each.²⁶ Some are from Canada and Virginia, while *glans terrestris Malacensis* seems a sweet potato. Peter regards the moly of Homer as a poetic figment, but he quotes Plutarch that, when the bear first emerges from the cave where it has spent the winter, it eats the herb, Beard of Aaron, in order to move its bowels. Chemists make a medical preparation from the roots of the same herb. The flowers of the narcissus, macerated in olive oil, are used for recent wounds and in cases of colic, while a water distilled from the flowers is good for epilepsy.²⁷

Peter also ventured into the domain of chemical medicine, at first criticizing anonymously the chymiatric Aphorisms of Angelo Sala, and becoming engaged in consequence in a controversy from 1622 to 1625 with Anton Günther Billich, Sala's nephew, in which Arnold Schröder also participated.²⁸

The *Discorsi intorno a diverse cose naturali*, published at Naples in 1628 by Francesco Imperato, have already been noticed as to gems and other stones in our chapter on mineralogy. We there heard him accept his father's rejection of the stone supposed to grow in toads, and in another *Discorso* he held that the so-called barnacle geese were really hatched from eggs. But he remained credulous as to the bird which was said to pick the crocodile's teeth for it, and in yet a fourth *Discorso* on the animal or lizard called *Stellio* quoted Pliny that there was no better cure for epilepsy—which is perhaps true in the sense that there is no cure at all. The scope and quality of the interest of Imperato and his readers in nature is further suggested by the subjects of other *Discorsi*: animals turned to stone, pygmies, the paper of the ancients, and the root mandrake, commonly supposed to resemble a man.

On this last point we may turn to the longer treatise of Laurens Catelan.²⁹ He distinguishes between the ordinary garden variety

²⁶ For the title see note 15 above.

²⁷ *Apparatus plantarius*: pp. 131, 135, 158, 91, 143, 141, 98.

²⁸ For titles of the seven works involved see Robert Capobus, *Angelus Sala, leibarzt des Johann Albrecht II*

..., Berlin, 1933, p. 47.

²⁹ *Rare et curieux discours de la plante appelée Mandragore*, Paris, 1638, 52 pp. The title is given in full in our chapter on Mineralogy.

and that sprung from the semen of men hanged on gibbets or broken on the wheel. This is denied by many, and the *homunculus* of Paracelsus may be a bit of diabolical magic. But is not the plant *Apium* produced from human blood, *Atriplex canina* from dog's urine, and asparagus from ram's horns? From the blood which the dragon sucks from the elephant to cool the ardor of its entrails, and then revomits when the elephant falls on it, springs the tree that bears the gum known as dragon's blood. The ceremony employed in digging up the mandrake root is repeated from Pliny, and the practice of having a dog drag it out of the ground to escape its fatal exhalations. Some say that it is found only shortly before the rising of the Pleiades; others, that only certain sorceresses can obtain it. Dr. Schleger of Hamburg told Catelan that the local senate there had three women whipped who did so. Mattioli and Porta are cited as to its fraudulent production. The magic cult of it is mentioned and the use of its stupefying effect for criminal ends, and its employment in philters. But such effects must be attributed to the devil, and he can work them with a counterfeit root as well as with a genuine one, although the latter may be obtained without his aid. Catelan subscribes to the doctrine of signatures in plants, and then turns to the ordinary variety of mandrake. It subdivides into a male and a female variety, and their virtues are scarcely less strange, marvelous and *ravissantes* than those of the first kind whose root is in the form of a man. As it, taken in a decoction or powder, was good for impotency of the male, so they, with figures resembling womb and breasts, are especially for women, and the reason that there are two varieties for them and only one for men, is that there are two distinct and separate causes of sterility in women.

Years later Jakob Thomasius in a disputation on the mandrake endeavored to distinguish between the true or natural and false or artificial variety.³⁰ He cited Platearius indirectly through Bartholomew of England that the root was artificially formed by rustics or witches into human form, and repeated the belief that from the

³⁰ *Disputatio de mandragora* (dated 19 Calend. Jan. 1665), printed at Halae Magdeb., 1739, 24 pp. in quarto

minori: BM B.45 (6.). The other dissertations in the volume are all of the 18th century.

urine emitted in the last agony by an innocent man who had been hanged for the crime of theft, there grew beneath the gallows an herb with broad leaves, yellow flower, and a root in the form of a man even to the hair and marks of sex. It will be noted that there are considerable variations between his statement of the superstition and Catelan's.

Leo Allatius tells us in his *Apes Urbanae*³¹ of 1633, that Federicus Caesius (or, Cesi), founder of the earliest modern scientific society, the Academy of the Lynxes (*Lincei*), who had already printed *Tabulae Phytosophicae*³² and one or two other works, would shortly publish a *Metallophytum*, *Physica mathesis*, Theater of Nature (a huge volume), and a Universal Mirror of Reason in which is contained the universal art of the sciences,³³ a Physical Exposition of All Prodigies or Prodigious Things, and an Exposition of Celestial Nature, both in many books. Cesi's early death in 1630 probably prevented the appearance of any of these works, but the list serves to illustrate the interests of a naturalist of that period and their confusion of the monstrous and marvelous with the normal, natural and scientific.

The treatise of Pietro Castelli, on the odoriferous hyena which produces *zibeth* and is commonly called civet, first appeared in 1638 at Messina³⁴ and was reissued at Frankfurt thirty years later.³⁵ Castelli uses such dubious authorities as Aelian, Pliny, Ovid, and Solinus as well as Aristotle and recent writers. After discussing fragrant excrements of animals, he states that the civet cat is not the same animal as the pard of antiquity nor as the hyena. Their genitals are differently situated. He repeats the

³¹ *Op. cit.*, pp. 121-22.

³² BN Fol.S.954. This re-edition of the work in 1904 by Romualdus Pirotta says that the first twelve and part of the thirteenth Table were already printed in 1628, but that the work was published only two years later after Cesi's death by the *Lincei*.

³³ Pirotta states that Cesi planned "un' opera grandiosa" to be entitled *Specchio della Ragione e Teatro della Natura*, and which was to be, as he

wrote in 1628, "non ad Polycleti sed naturae normam ex philosophiae principis."

³⁴ *De hyaena odorifera zibethum gignente quae civetto vulgo appellatur*, Messanae, typis viduë I. F. Bianco, 1638, in-4, 52 pp. BM 975.d.25. The hyena, civet cat, and skunk are of course three different genera.

³⁵ Editio nova, auctior, in-12, 79 pp. BM has 4 copies.

story that the hyena calls shepherds by name in order to take them by deceit. Busbequius³⁶ seems to have seen two true hyenas at Constantinople, but it is difficult for Castelli to understand why his description of them does not tally better with those of the ancients. Of the American odorate hyena he knows little, and the description of it which he takes from I. Faber does not fit the skunk at all well. The odorate African hyena, "which is our civetta," is more like a wolf than a cat. Presently he has a chapter on the castor, *fiber*, or beaver, followed by another on what the Arabic word, *zibeth*, means. Authorities disagree, but he interprets it as excrement or a liquid squirted by the animal.³⁷ The treatise is illustrated by engravings which are somewhat superior to the text.

Michael Ruprecht Besler was ordinary physician to the Republic of Nürnberg and senior inspector of apothecary shops. His *Gazophylacium* is a folio volume of plates illustrative of rarities from the three kingdoms, vegetable, animal and mineral.³⁸ For example, there is a singular species of aconite with the leaves of *tanacetum* (tansie) from the Tridentine Alps with white flowers, and a remarkable bunch looking like grapes cut from the trunk of a tree in 1641 from which hung *pruni myrobalani* (or, *mirobolani*) to the number of one hundred and twenty. Among animals the mononoceros is said to take the palm. It is taller than a young horse of thirty months, has a horn in its forehead three cubits long, a head like a deer, and a mane like a young mule. No picture is given of it, however, but only of four horns, one of which is labelled, "Genuine hare horn," but none genuine monoceros horn. The plates for the mineral kingdom include ancient coins, gems and seals, and the sword of John Ziska, the Hussite general.

Gerard Boate, in *Ireland's Naturall Historie*, published at London in 1652 by Samuel Hartlib, one of the forerunners of the Royal

³⁶ O. G. de Busbecq (1522-1592) was imperial ambassador at Constantinople. His Turkish Letters were published in English translation by E. S. Forster from the Latin of the Elzevir edition of 1633, at Oxford in 1927, xvi, 265 pp.

³⁷ It was also used for an animal: see the Italian *zibetto* for civet-cat.

³⁸ *Gazophylacium rerum naturalium e regno uegetabili animali et minerali depromptarum nunquam hactenus in lucem editarum fidelis cum fig. aen. ad vivum repraesentatio*, Norimb., 1642, regal. fol. BN Rés S.306.

Society, could find no trace in Ireland of the fabulous fountains recounted by Giraldus Cambrensis.³⁹ His book is chiefly geographical, although chapters 16 to 18 are on mines there, and the 24th and last, on disease.

The first volume of the catalogue of the museum of Ludovico Moscardo was printed at Padua in 1656,⁴⁰ roughly a century before the foundation of the British Museum in 1754. Its first book listed antiquities, the second was on the mineral kingdom, the third on corals, animals, fruit etc. In these two books much was taken from Pliny's Natural History, and the pictures were fewer than in the first book. A second volume, which appeared sixteen years later at Verona, was chiefly concerned with ancient art.

In 1660 appeared at Nürnberg the volume *Theatrum sympatheticum*, already described in a previous chapter.⁴¹ In the same year at Tübingen and previously in 1658 at Glasgow had been issued, *A New Approach to Find the Occult Causes of Sympathy and Antipathy through principles of natural philosophy drawn from the artificial anatomy of Ferments*,⁴² by the Scot, Sylvester Rattray, an M.D. of Glasgow. In 1662 Rattray's work was prefixed to a new edition of the *Theatrum*, a quarto of 722 pages containing twenty-six treatises as against the four tracts in the duodecimo editions of 1660 and 1661. Except Fracastoro, all the authors were of the seventeenth century.

The first part of Rattray's *Aditus novus* follows a set order, considering first the antipathy and then the sympathy of vegetables, animals and minerals in that order; then the antipathy of man with parts of animals, vegetation and minerals, followed by the antipathy of other animals with these three in the same order. The same order is then followed for sympathy. Next comes the sympathy and antipathy of minerals with vegetation and vice versa,

³⁹ *Op. cit.*, p. 56.

⁴⁰ *Note ovvero memorie del Museo Moscardo*, in-fol. 306 pp. BN S.1337.

⁴¹ *Theatrum sympatheticum in quo sympathiae actiones variae tam macroquam microcosmicae exhibentur et mechanicè physice mathematicè chemicè et medicè, occasione pulveris sympathetici, ita quidem elucidantur.*

Norimbergae, 1660.

⁴² *Aditus novus ad occultas sympathiae et antipathiae causas invenendas; per principia philosophiae naturalis, ex fermentorum artificiosa anatomia hausta.* I have used the Glasgow, 1658 edition of 135 pp., 8vo, BN R.48035. The Tübingen edition runs to 216 pp. 12mo.

then special antipathies and sympathies, then sympathies and antipathies which fall under none of the foregoing heads.

A few specific examples from this series may be noted.⁴³ A tooth from a corpse which has long rotted makes teeth fall out by mere touch, and the hair from such a corpse produces baldness by mere contact. If a wolfskin is put among sheep, their wool will fall off spontaneously. The still palpitating heart of a turtle dove and the eyes of live frogs, swallowed or worn as amulets, cure tertian fever. Onions are the only bulbs that diminish in size while the moon waxes.

The rest of the work is less classified. The attempt is made to explain sympathy and antipathy and action at a distance as the result of ferments. Animals and vegetables have their determined places and ferments. But it is argued, probably following van Helmont, that all things which used to be thought mixed substances are made from water alone—water, however, impregnated with ferments.⁴⁴ All generation and corruption is by force of ferments,⁴⁵ and the only true remedy is extinction of the ferment which causes the disease, not extinction of the fantastic idea or any universal panacea.⁴⁶ Incidentally Rattray believes in spontaneous generation and holds that those animals which are produced by ferments in their proper places without seed of parents differ in no respect from those propagated by seed.⁴⁷

Rattray also still holds that marvelous effects come from specific forms,⁴⁸ and that all things have sense.⁴⁹ We are therefore not surprised to find him accepting the old belief that earth from the Nile moistens at the time of the inundation, or that spirit of blood of a living person, hermetically sealed in glass, will show his state of health or disease, though he be far absent, by its change in color and in turbidity.⁵⁰ Van Helmont explained such action at a distance by ecstatic virtue.⁵¹ The influence of fear⁵² and the power of imagination are also great. The figure of a cherry was imprinted

⁴³ *Op. cit.*, pp. 11, 19, 24, 39.

⁴⁴ *Ibid.*, pp. 53 *et seq.*, 82.

⁴⁵ *Ibid.*, p. 73.

⁴⁶ *Ibid.*, pp. 68 *et seq.*

⁴⁷ *Ibid.*, pp. 52, 77.

⁴⁸ *Ibid.*, p. 81.

⁴⁹ *Ibid.*, p. 102.

⁵⁰ *Ibid.*, pp. 43, 104, 107.

⁵¹ *Ibid.*, p. 109.

⁵² *Ibid.*, pp. 120-1.

on the foetus when the pregnant mother was struck by a cherry.⁵³ The corpse bleeds not only in the presence of the one who wounded it but at the mere mention of his name.⁵⁴ In all such cases species or images impressed on the spirits of the body act as ferments would, and "all those species thus impressed retain a tincture of the ferment of the sensible object."⁵⁵ The seed contains all the members, lineaments, colors, odors, dispositions, inclinations, and peculiar marks of the coming body.⁵⁶ Rattray also mentions "seminaries of hereditary disease," probably showing the influence of Fracastoro.

Another suggested explanation of action at a distance is by emission of rays containing vital spirit and energy and found even in excrements. Rattray denies that corpuscles or material effluvia are emitted, but believes that ferments by their spiritual rays cover a certain sphere of action.⁵⁷

A third explanation comes from the atomists who believe that effluvia are constantly being thrown off under the pressure of surrounding bodies, and that some atoms are so swift and subtle that they pass through all media without any opposition, that certain places are more suited to receive them, that they do not rest until they reach such cognate pores, and that no distance impedes their movement to their proper places. The more they approach their homes, the less becomes the resistance and the greater the pressure, and their movement so much faster.⁵⁸ Rattray rejects this explanation and has no use for atomism, but he fails to disprove it.

The author of *Mosaic Philosophy*, i.e., Robert Fludd,⁵⁹ says that all natural actions are effected immediately by the spirit of God moving over the face of the waters, but that is to deny any natural philosophy and to make all actions supernatural. Kircher, on the other hand, held that it was only weapon ointment which cured at a distance, otherwise none would be safe from the venom of the basilisk of Libya, the dipsas snake of Egypt, the dragon of Africa, or the effluvia of Alpine aconite. But Rattray contends that such

⁵³ *Ibid.*, p. 113.

⁵⁴ *Ibid.*, p. 115.

⁵⁵ *Ibid.*, pp. 116-18.

⁵⁶ *Ibid.*, p. 119.

⁵⁷ *Ibid.*, pp. 121-23.

⁵⁸ *Ibid.*, pp. 124-25.

⁵⁹ *Philosophia mosaica*, Goudae, 1638, in-fol.

things have a determined sphere of action with they cannot exceed. Incidentally he further criticizes Kircher for denying sympathy and so action at a distance between the magnet and the pole, and for rejecting Gilbert's tenet that the earth is a magnet.⁶⁰

Finally Rattray refutes the explanation of sympathetic action as a virtue from the stars, because the earth, before the sun was created, had ferments in itself of all vegetation and consequently all virtues. Every composite consists of matter, form and ferment. From matter it has its quantity and consistency; from form, that it lives and feels vividly or obscurely; from ferment, all other actions. The blood in the glass is affected by the same ferment as the blood in the veins. Or if the arm, from which flesh has been taken to remake the nose of another person, rots, that nose will rot too.⁶¹ Such was the far-fetched, occult and magical view of nature, of natural action, and of relations between bodies which found many followers in the seventeenth century.

A book on amber, published by Justus Fidus Klobius of Wittenberg in 1660,⁶² examined eighteen opinions as to its origin and preferred the view that it was the dung of a bird native to Madagascar, the Maldives and East Indies, or possibly the excrement of a certain kind of whale. A contemporary reviewer added evidence from Purchas that spermaceti had been found in the head and ambergris in the entrails of the whale *Trompa*, when one was dissected.⁶³

In 1659 Robert Lovell had published at Oxford *Pambotanologia* or a complete herbal in English, which had met with a sufficiently cordial reception to embolden him to issue at the same place a *Panzoologicominerologia* or complete history of animals and minerals two years later. Both were compilations, "containing the summe of all authors, both ancient and modern," and the inclusion of sympathy and antipathy in the long title of the latter warns us that it will not be free from magic. Every animal and mineral cures

⁶⁰ For the argument in this paragraph, *Aditus novus*, 127-29. The geography appears somewhat faulty, the dipsas being usually located in Libya.

⁶¹ *Ibid.*, 130-32.

⁶² *Ambrae historiam ad omnipoten-*

tis Dei gloriam et hominum sanitatem exhibet J. F. Klobius, Wittenberg, 1660, in-4, 4 fols., 76 pp.

⁶³ PT II (1667), 538. See also JS V (1677), 144-45, "Extrait du Journal d'Italie."

something. Birds are divided into terrestrial carnivorous, phytivorous, insectivorous, aquatic with undivided feet, aquatic with divided feet, and exotic, which are chiefly American. Cetaceans and zoophytes are included under fish. Concerning the horse, Albertus Magnus is given as authority that the teeth of a gelded horse, placed under the head or pillow, prevent snorting in sleep. The filings of the front hooves given with water "help the frettings in horses."⁶⁴ Lovell is brief as to barnacle geese but full on the salamander. In Trent, the Alps and Germany it is found in cold moist places and is very cold itself, and its bite deadly. "Arnold" says that once it has bitten, it never lets go, and, if pulled off, leaves its teeth in the wound, and there is no remedy therefor. "Therefore they must be suffered to hang on till they are wearied and be put off by medicines." The cure is by drinking a decoction of frogs and applying the flesh of the salamander. It is most poisonous when dead by putrefaction. While alive it emits a humor which quenches fire.⁶⁵ Serpents

are generated of the putrefaction of the earth, of the blood of certain birds, and of the marrow of man's back. They generate by conjunction so that they seem but one serpent having two heads, they lay eggs and hatch them, hanging together like a bracelet; but some of them bring forth animals.

At the rising of the dog star they are so furious that they cannot rest. Insects also are produced partly by sexual intercourse, partly by spontaneous generation. Lovell divides both animals and insects among the seven planets.⁶⁶ With the treatment of "Geologia" a new pagination begins. Marvelous properties are ascribed to gems,⁶⁷ though some of them are called superstitious. The sardonius keeps its bearer chaste, removes mental depression and cheers one up,

It hindreth the effects of the onyx-stone, causing sadness, fears, hatred, wars, contentions, and terrible dreams, all which proceed from melan-

⁶⁴ *Panzologicomineralogia*, 1661, p. 79.

⁶⁵ *Ibid.*, p. 255.

⁶⁶ *Ibid.*, pp. with signatures (b 8) v, c r, c v, c 2 v- (c 3) r.

⁶⁷ *Ibid.*, p. 63 *et seq.*

choly which this stone (i.e., the onyx) causeth, being worne about the neck or on the finger."⁶⁸



Snakes had been closely associated with magic long before Pharaoh's magicians turned their wands into them, or Moses lifted up the brazen serpent in the wilderness. Vipers in particular shared this aura of the marvelous by virtue of the exaggerated excellence ascribed to them in medicine, and were still prized for their fat, volatile salt, and use in theriac and trochees through the seventeenth century. But the folk-lore associated with them began to be dissipated when Franciscus Caballus of Brescia in 1499 denied the prevalent belief that the viper conceived by biting off the head of the male and that the young then avenged their sire by gnawing their way out through the vitals of their mother.⁶⁹ The old notion, however, was repeated by writers through the sixteenth century. Now, in the seventeenth century, Francesco Redi,⁷⁰ who was soon to disprove the spontaneous generation of insects, after examining a large number of vipers which had been collected to make theriac for the Grand Duke of Tuscany,⁷¹ came to the conclusion that the poison was in a yellowish liquor contained in a bag about the teeth, as is further the case with snakes generally.

Earlier in the century Marco Aurelio Severino (1580-1656), professor of anatomy and surgery in the University of Naples, had published a work on the viper whose title announced "new experiments."⁷² But on the basis of only two experiences, one with the crest of a cock and the other on a bite of the hand of one of his

⁶⁸ *Ibid.*, p. 80.

⁶⁹ T IV, 597, note 9.

⁷⁰ Ugo Viviani published three volumes on Redi in *Collana di pubblicazioni storiche e letterarie Aretine*, IX (1924), *Vita* (by Perelli who died in 1811), *Opere, Iconografia, Bibliografia*; X (1928), *Vocabulario inedito delle Voci Aretine*; XI (1931), *E Libro inedito dei "Ricordi" di Francesco Redi Aretino*.

⁷¹ Similarly John Locke on September 26, 1676. "delivered to Mr. Hunt

6 vipers for Dr. Thomas," and on October 27, 1676, "Paid Mr. Puech for 6 vipers 2-5-0." *Travels in France*, ed. John Lough, 1953, pp. 109, 114. Neither passage is noted in the Index, where p. 259 is the sole reference for Viper.

⁷² *Vipera Pythia, id est, de viperæ natura, veneno, medicina demonstrationes et experimenta nova*, Padua, apud Paulum Frambottum, 1643, 1651, in-4. His other writings occupy two pages in LR.

household, he had denied absolutely that the yellow liquid was poisonous.⁷³ He also had still repeated such "bagatelles," as Redi called them, as that applying a freshly cut off head of a viper to its bite was a marvelous antidote, that music would revive the dead victim of a viper's bite, and that the spittle of a fasting man would kill a viper.⁷⁴

Redi's own treatise on vipers was published in Italian in the form, not of a scientific monograph with a full and detailed record of his experiments, but of a literary letter, rather rambling and digressive and with quotations from classical Latin poets like Martial or Greek verse, addressed to Lorenzo Magalotti.⁷⁵ It includes discussions of the Psylli and Marsi of antiquity, the deaths of Socrates and Cleopatra, and refers in modern times to the discoveries of Galileo. Redi opens with the statement that every day he becomes more and more convinced not to believe assertions concerning natural phenomena unless he has seen them with his own eyes and proved them by repeated experiment. Most writers repeat credulously what they read or hear. Opinions differ, however, as to how the viper poisons, some saying by its gall, others by its tail, and others by its teeth. Most medical authors hold that swallowing the gall of the viper is a mortal poison. But Giovan Battista Odierna, in a letter to Marco Aurelio Severino, said that he had given bread soaked in it to a cat without injurious effect upon the animal. Albertus Magnus, Mercurialis, Capo di Vacca and Zacuto all say that the wine in which a viper has drowned is poisonous; Aetius and Dioscorides affirm this, if the viper has merely drunk of the wine. But Redi cites Galen concerning the viper found in the jug of wine,⁷⁶ quotes Celsus

... non gustu sed in vulnere nocent

⁷³ Francesco Redi, *Osservazioni intorno alle vipere* . . . , 1664, p. 25: "il savio ed ottimo vecchio Marco Aurelio Severino versatissimo nelle cognizione delle vipere & sperimentatissimo, dice indubitatamente che quel liquor giallo stillate su le ferite non l'auueleni, persuaso da due sole esperienze, una su la cresta di un gallo, e l'altra su la mano punto di un suo famigliaio."

⁷⁴ *Ibid.*, pp. 39, 53, 79.

⁷⁵ *Osservazioni intorno alle vipere fatte da Francesco Redi . . . e da lui scritta in una lettera all'illustrissimo signor Lorenzo Magalotti*, Firenze all'insegna della Stella, 1664, in-4, 94 pp. Copy used: NYAM RB. In the ensuing summary I usually follow the order of the text.

⁷⁶ *Ibid.*, p. 20. See T I, 170-71.

and thirteen lines from Lucan on Cato in Libya, and asserts that he has proved by more than a hundred experiments on various animals that no part of the viper, not even the yellow liquor, taken internally is poisonous, and that one can eat animals which have been killed by vipers without injury.

Galen wisely recommends a ligature to keep the venom from the rest of the blood, in case one is bitten by a viper, but the material used is a matter of indifference. Gilbert of England is superstitious in saying that a thong of deerskin should be employed. The story of Athenaeus that two malefactors condemned to be bitten by asps were saved by eating a citron is a fable; Redi tried it on two cocks in vain. He also tested and found false the notion of Croll that capers would cure the viper's bite, because the thorns of the caper bush resembled the viper's teeth. Indeed, Redi pronounces fabulous the whole doctrine of signatures in plants with its astral and magical virtue. He likewise disproved the miraculous properties ascribed by Pliny and Dioscorides to other herbs. Either they never possessed such virtues, or had them only in ancient times, "when cows talked." Redi also rejected Avenzoar's assertion that wearing a viper's head hung round one's neck by a silken thread would cure quinsy.

Redi doubts if there are any subtle conduits between the gall bladder and the teeth of the viper, or that they derive their venom from eating poisonous herbs, scorpions and the like. Their tail is not poisonous, and their brain is not black, as Baldo Angelo Abati⁷⁷ said. As to the number of their teeth there has been a wide divergence of opinion among past authors. Nicander, followed by the author of the book on theriac to Piso, by Rasis, Avicenna, Actuarius and Giovanni Gorreo, gave the male two and the female more. Aetius gave the male viper two teeth; the female, four. With him agree Isaac, Caballo of Brescia, Zacuto, Mercurialis, Amato Lusitano, Francesco Sanchez, Caspar Hofmann, and yet others. Paul of Aegina and Haly Abbas say that there are only two in both sexes. Vincent of Beauvais said three; Abati and Vesling, four. Albertus Magnus allowed the male two in the upper and two in the lower jaw. Marco Aurelio Severino put three, four,

⁷⁷ Concerning Abbatius, T IV, 597, note 9.

five or six in the upper jaw. Odierna in his diligent and curious letter to Severino, *De dente viperina*, counted forty-eight minor teeth but was silent as to the number of major teeth or poisonous fangs. But in more than three hundred vipers examined by Redi both sexes had only two canine teeth with which they inflict their poisonous bite.⁷⁸

Some deny that worms are generated in the bowels of the viper, but experience has taught Redi the contrary. In a single female he found more than thirty living worms in the stomach and intestines. Aldrovandi and others have spoken of the stench of vipers, but it is true only of a fluid released in the act of generation. "Galen and many worthy moderns have taught that eating the flesh of vipers induces a burning and inextinguishable thirst."⁷⁹ But a gentleman who drank and ate viper powder, broth, flesh, and wine in which vipers had been drowned, three times a day for four weeks, was never thirsty. Furthermore a septuagenarian within a month and a half ate more than ninety vipers, as did a woman of twenty-five. Redi further demonstrated to his own satisfaction that the salt of vipers had no purging virtue, but he does not question the medicinal value of theriac, "maraviglioso antidoto."⁸⁰ He proved experimentally that the spittle of a fasting man was not injurious to either vipers or scorpions. Aldrovandi had explained its supposed action by antipathy, but P. J. Faber and Severino had adopted a more up-to-date chemical explanation, that the sal ammoniac in the spittle was fatal to vipers. Redi found that it did not even deprive them of their venomousness. Albertus Magnus had said that a scorpion immersed in a flask of oil would live for twenty days, but Redi found that it survived for only sixty hours.

That Redi had no great respect for alchemical writers may be inferred from his accusing "the much vaunted Basil Valentine" of "an infinity of vain imaginings," and in particular for affirming that only six grains of salt of rhubarb or of senna or of *esula* were enough to produce a good evacuation.⁸¹ Redi also tested and dis-

⁷⁸ *Osservazioni* (1664), pp. 46-49.

⁷⁹ *Ibid.*, p. 71.

⁸⁰ *Ibid.*, p. 9, "la Triaca . . . maraviglioso antidoto."

⁸¹ *Ibid.*, p. 78.

proved many antipathies which were supposed to exist between various plants and trees and vipers. He discovered that, instead of being killed or routed by them, vipers rather enjoyed the leaves of ash, beech and oak trees, and the herbs betony and dittany.⁸² He also rejected the fable of the love of the viper and the fish *murena*, and the assertion of Rasis that the mere sight of an emerald would make a viper's eyes liquefy and squirt from their sockets.⁸³

Redi's Letter was reviewed in both *Philosophical Transactions* and the *Journal des Sçavans*,⁸⁴ and was utilized by Paschius in reviewing the achievements of the century.⁸⁵ One further feature of his *Osservazioni* remains to be noted, a negative one which did not impress these reviewers as did his disproving fabulous assertions and sympathies and antipathies by putting them to the test of experimentation. It is that he did not attempt to explain these supposed or other actual natural phenomena by the hypothesis of material spirits or invisible effluvia. Rather, he maintained a discreet silence as to both.

This apparent achievement of modern science was, however, within a few years challenged, on professedly at least the same basis of observation and experiment. Moyse Charas had in 1668 published a book of over three hundred pages on the theriac of Andromachus. The following year, in *Nouvelles experiences sur la vipere* (Paris, 1669), he alleged that he had shown that the yellowish liquor was merely a harmless saliva by repeated experiments in the presence of numerous physicians and many other persons. He had wounded a number of animals with a detached viper-tooth and then poured the liquor into the wound with no ill effects. He therefore attributed the poisonous effect of the viper's bite rather to its vexed and enraged spirits, and as proof thereof adduced the following experiment. He had held the jaws of the viper while thrusting its teeth into a living animal, again with no venomous result, because the spirits could not pass abroad from "that forced and restrained posture." He further praised the volatile

⁸² *Ibid.*, pp. 84-85.

⁸³ *Ibid.*, p. 90.

⁸⁴ PT I, 160-62. JS I, 194-97.

⁸⁵ Paschius, *De novis inventis*, 1700, pp. 403-4.

salt of vipers as a remedy for their bite. Thus not only was experimental method divided against itself, as was frequently the case in other fields in the seventeenth century, but the old notions of spirits and of like-cures-like received affirmation, to say nothing of emotion being ascribed to an animal of a low order and even being made the basis of physical action. That all this was still congenial to many minds, however, is seen in the statement of *Philosophical Transactions* that the book of Charas was likely to be translated into English immediately.⁸⁶ It had been so translated when Redi replied in 1670.⁸⁷

Redi replied that he had repeated his former experiments again and again and was more convinced than ever "that the venom of the *Italian* vipers doth not consist in an imaginary *Idea* of revengefull Choler, but in that yellow liquor above mentioned." He further advised "the learn'd authors of the *French* experiments" to make new observations, and added, perhaps sarcastically and equivocally,

and if they shall be found to conform to those they have printed, and indeed contrary to his, that then it might be agreed upon, that there was a truth discover'd hitherto unknown, *viz.* That the venom of *French* vipers consists in a cholerick and vindicative idea of the Fancy.

Besides many other new experiments, Redi recounted the following. He had stored in a glass vessel the venom from no less than 250 vipers for use in experiments. Before he got round to these, it had turned into a kind of glue of the color of amber, and after thirty days "became dry and friable and easily reducible to powder." He so pulverized it and found that the powder, injected into wounds which he made in pullets and pigeons resulted shortly in their death.

L'abbé Pierre-Michon Bourdelot continued the discussion in *Recherches & Observations sur les Viperes* (Paris, 1671). Bourdelot (1610–1685) had been successively physician to the comte de Noail-

⁸⁶ *Philosophical Transactions*, IV, 1091-93.

⁸⁷ PT V, 2036-38. *Lettera di Francesco Redi sopra alcune Opposizioni fatte alle sue Osservazioni intorno alle*

Vipere. In Firenze, 1670. The English translation of Charas' *New Experiments upon Vipers* is dated London, 1670.

les, Henri prince of Condé, French royalty, and Christina of Sweden. He had held meetings of savants at l'hôtel de Condé and resumed these upon his return from Sweden.⁸⁸ In a sense he tried to take middle ground between Redi and Charas, but his mental make-up much more resembled that of Charas. He declared that the liquor in question was not yellow in French vipers, that in hot countries like Italy it might poison *per se*, but in France and colder parts "needs to be made keen by the bilious breath of the angered viper." To enforce this point, he told how only half of the grafts thrived which were made by a certain gardener, because he held one in his hand and the other in his mouth, where his decayed teeth caused it to wither, "how certain breaths of wind corrupt meat, especially when it thunders and lightens," how the breath of some men and animals has a like effect, that the bite of a red-haired person is venomous, and so on. Sometime he was going to try the experiment of putting some of the foam of a mad dog into the wound of a sound one, to see if it will make him mad and show "whether it be not the breath" rather than the bite of the mad dog, "which by its agitated spirits causeth that commotion of madness." Whereupon he observes further that "the breath coming from the spongy lungs of vipers enraged is of greater force" than all others. Vipers abound in spirits and are a means of prolonging human life, and the heart or liver of a viper "is one of the greatest Alixitory's in the world." He further affirms that he himself has seen in the Grotta dei Serpi near Bracciano "stubborn maladies" cured "by big snakes winding themselves about the bodies of the sick exposed there."⁸⁹ Thus Redi seems to have cut off one of the hydra heads of superstition only to have a half a dozen others spring up in its place. Not so easily was experimentation rid of magic.

In fact, Charas himself was again heard from in the same year, 1671.⁹⁰ He still held to his original thesis, which he asserted had been confirmed by experiments made in the presence of two and

⁸⁸ *Lettres de Gui Patin*, ed. Paul Triaire, I (1907), pp. 264-65. BN S. 12828 and 12829 are copies of Bourdelot's *Recherches*, in-16, 79 pp.

⁸⁹ *Philosophical Transactions*, VI, 3013-16.

⁹⁰ *Suite des nouvelles experiences sur la vipere avec une dissertation sur son venin*, Paris, 1671, in-8. Reviewed in *Philosophical Transactions*, VII (1872), 4073-77.

three hundred persons. He also was impervious to Redi's sarcasm which he took seriously, affirming that his contention was true of vipers from all parts of France, regardless of climate and latitude. Charas now spoke of the poison of the viper as being invisible and spiritual, which led the reviewer of his work in *Philosophical Transactions* to insist that these spirits were corpuscular and that Charas must be using the word "spiritual" only in contrast to the quite material yellow fluid of Redi.

Nor can he mean that these spirits have neither place nor extension; for how could they part from the viper without having been in her body; and how could they enter into the body of the animal bitten without being there?

A notice of Charas's book in the *Recoeil des memoires et conferences... presentées a M. Le Dauphin* in 1672 by J. B. Denis,⁹¹ similarly objected to Charas's holding that the poison was immaterial and a pure effect of the imagination of the viper when it formed the idea of vengeance, and attributed it rather to subtle but material spirits in the blood which mounted to the head of the viper as it became irritated. Charas for his part went on "to illustrate his notion of the Idea of the Viper for Revenge," by alleging "the imagination of terror by a toad impressed in a ferret." The ferret ran in circles about the toad, crying as if for succour, until finally, completely fascinated, it entered the toad's gaping mouth, as Charas himself saw and saved the ferret by killing the toad. Charas also narrated the strange case of a Neapolitan soldier who had served for four years in the French infantry, but who annually about the 24th of July began to feel the effects of a bite by a tarantula received in Italy, when he would dance for three days in succession and cease only on the fourth.

Redi's cause soon received further support in a letter of August 6, 1672 to *Philosophical Transactions* from Thomas Platt of Florence. A discussion of the matter having arisen among several gentlemen, it was decided to put it to an experimental test, and Platt's host procured a supply of vipers' heads which had been

⁹¹ Bound with vol. III of the *Journal des sçavans*, but with a separate pagination, pp. 87-90.

cut off and of pigeons. But Platt could not wait until the others arrived, so it was first tested before the two of them, then before a larger and distinguished company, and yet a third time when "the news of these experiments made many persons curious to see them performed once more." In all cases the result was the same. Pigeons which were pricked with the thorn of a rose bush about the size of the viper's fangs or even by a larger pin-point suffered no serious ill effects, whereas those who were wounded with the teeth of the cut-off heads of vipers soon died, showing that Redi was right and that enraged spirits and an idea of revenge had nothing to do with it. Another notion, that swallowing a viper's head was a sure preservative and remedy against its bite was also disproved experimentally. Both a cock and a pigeon which had eaten such a head and then were wounded with another died.⁹²

Meanwhile Redi had in 1671 published a more general work in which, as the result of repeated testing and experimentation, he disproved a number of superstitious or erroneous notions concerning natural phenomena, especially those brought from the Indies.⁹³ He found that the torpedo fish exerted no numbing effect unless actually touched, and dissected one to try to find out where the numbing force resided. The snake-stone found in the heads of a genus of snake in Hindustan called *Cobra de Cabelo* by the Portuguese and described by Garcia da Orta and others, was supposed, if applied to a wound made by the bite or sting of a venomous animal, to adhere to it until it had imbibed the poison and then fall off. But Redi disproved this by many experiments. Similarly invalidated was the assertion of Ximenes that certain stones from Brazil, Cuba and Mexico, if pulverized, cured nephritical pains and even broke the stone; the belief that the eagle-stone

⁹² PT VII, 5060-66.

⁹³ Francesco Redi, *Esperienze intorno à diverse cose naturali & particolarmente à quelle che son portate dell'Indie*, Florence, 1671, in-4. *Philosophical Transactions*, VIII (1673), 6001-6. There were Latin editions at Amsterdam in 1675 and 1685, and an-

other Italian edition at Florence in 1686. In Denis's *Recoeil des memoires et conferences* of 1672, pp. 262-72, the title is given as "Observations curieuses de Monsieur Redi . . . sur diverses choses naturelles extraites d'une Lettre qu'il a ecrite a R. P. Kircher."

or *aetites* facilitated childbirth, and that the stones swallowed by natives of the Caymans cured quartan fever, as Monardes stated. The old notion that swallows used swallow-wort (celandine, *chelidonia*) or swallow-stone (*chelidonium*) to restore the sight of the young birds was disproved by Redi. He showed that this would happen without the application of any herb or stone not only in the case of swallows but other birds such as pigeons, chickens, geese, ducks and turkeys, whose corneae he punctured and found that the aqueous humor was replenished within twenty-four hours. His pupil Zambeccari and others later performed the same experiment with mammals.⁹⁴

Some roots which had been supposed to work against fever failed to do so for Redi, but quinine did. Chinese fennel was but little more efficacious than the European variety; keeping sassafras in sea-water for a week or even a fortnight failed to render it fresh and potable; there was no support for the statement that the knobs and beards facing north on a certain plant in Cambaja cured apoplexy, while those turning south were deadly poison. He found groundless the reports that the blood of the rhinoceros cured colic and haemorrhages, that its skin benefitted the stomach, and that its horns were an antidote for poison. Oil of tobacco did not kill all animals nor in the same time; the effects of tobacco from different regions such as Brazil and Saint Christopher's were different. On the other hand, experimentation with various fowl showed that they did digest glass and gems to some extent, these losing weight after a period inside the bird. Redi further carried on observations of the growing and casting of their horns by stags. He quite discredited, although he was not in a position to test, the story that the leaves of certain trees were metamorphosed into swallows, and that in China there were fish which took to the air as birds in summer, but became fish again with scales instead of feathers as winter came on.

Redi's experiments led him into the field of chemistry as well as natural history. He found that *aqua vitae* would float on olive oil when highly rectified but not when undephlegmed. Mem-

⁹⁴ See articles on Zambeccari, by Saul Jarcho, *Bulletin of the History of Medicine*, IX (1941), 151, 322-24.

bers of the Florentine Academy had found that all natural waters grew turbid from the infusion of water distilled in a leaden bell except the conduit water of Pisa, but Redi found that it did too. The Academy's experimentation further showed that waters distilled in glass vessels, if mingled with ones distilled in leaden vessels, did not become turbid, but Redi's experiments hardly agreed with this. He distilled pellitory in glass and changed the receiving vessel fourteen times and mingled all fourteen waters in turn with rose-water distilled in lead. They all became turbid, although he repeated the experiment in several months. But when he distilled in a bath what was left after these fourteen shiftings, and this time in a silver vessel with a glass head, after changing the receiver eight times he found that the water in the eighth receiver remained clear, although mixed with several distillations of water distilled in a lead vessel. But the first seven distillings all grew turbid when thus mixed. Cinnamon water distilled in a gold or silver or glass vessel and kept in glass, always remained clear, but in crystal of Pisa it first grew turbid within a few hours, then milky, became yellow in a few days, and finally turned bitter. On the other hand, in crystal of Rome and Venice it did not become turbid until after two or three days and never turned yellow or bitter, while in crystal of Paris it took even longer to grow turbid. A powder of nitre, salt of tartar, and flower of sulphur would sometimes fulminate, but sometimes not.

The breadth of Redi's scientific interest is further demonstrated by a book in 1678 in which he adduced evidence that eye-glasses were invented before 1311.⁹⁵

The problem of snake poison was raised once more in connection with a very detailed account of the dissection of a rattlesnake, published by Edward Tyson in 1683 in *Philosophical Transactions*.⁹⁶ The teeth were of two sorts: lesser teeth in each jaw to catch and hold the food and the poisonous fangs outside the upper jaw which kill it. By gently pressing the side of the gum with his finger, Tyson made the yellowish fluid flow through the hollow fang. But trying this several times spoiled "our enquiry into the baggs

⁹⁵ *Lettere intorno all'invenzione degli occhiali.*

⁹⁶ PT XIII, 25-54, "Vipera Caudisona."

and the glands that furnish them with that liquor," and relieved him of the distasteful task of deciding whether Redi or Charas was right.⁹⁷ He did, however, point out that the yellowish fluid did not serve the purpose of mere saliva as Charas had held, and even ventured to say:

For I am not yet so fully convinc'd (tho I have a just deference for Monsieur Charas and a due regard for his laborious researches and inquiries) of his sentiment of the innocence of this liquor.⁹⁸

On the other hand, Tyson felt that Redi was too sceptical as to the virtues of the snake-stone (*Pierre de Cobras de Cabelo*) and cited instances of its successful application even in other cases than snakebite and including his own medical practice.⁹⁹ But in another article in the same volume on *Lumbricus teres*, the round multiparous worm bred in human bodies, Tyson agreed with Henry ab Heer in warning against giving the powder of these worms to expel others, since thereby "we . . . may sow the seed for propagating more."¹⁰⁰

Less praiseworthy was a collection of instances of the growth of hair in inner parts of the body, which Tyson was led to communicate to *Philosophical Transactions* by reports of a corpse found covered with hair forty-three years after death and of a thief who was hanged and whose body was covered with hair all over within a few hours after his death. But such monstrosities so appealed to the scientists of that age, that they were repeated in the *Journal des Sçavans*.¹⁰¹

As for Charas, his erroneous experimentation and belief in enraged animal spirits do not seem to have militated against further literary and pharmaceutical activity upon his part. In 1676, as apothecary of the king in his Jardin Royal des Plantes, he issued the *Pharmacopee royale, Galenique et Chymique*, which was almost immediately translated into English,¹⁰² in 1684 into Latin, and of which further French editions appeared in 1682, 1691, and

⁹⁷ *Ibid.*, pp. 45-46.

⁹⁸ *Ibid.*, p. 48.

⁹⁹ *Ibid.*, pp. 49-50.

¹⁰⁰ *Ibid.*, p. 159.

¹⁰¹ JS XI (1684), 25-26.

¹⁰² The English translation is reviewed in PT, XII (1678), 963-64.

as late as 1753. The original French edition was for sale at the author's house, rue des Boucheries, at the sign of the golden vipers.¹⁰³

Michael Ettmuller (1644–83) in the collected works published in the year of his death still attributed the fatal effect of the viper's bite to its anger and the "idea of fury of the Archeus" (using Helmontian phraseology) imprinted on its teeth and saliva.¹⁰⁴

In 1694 appeared a second edition of *Nouvelles experiences sur la vipere*, in which Charas added accounts of his having been bitten twice by vipers when exhibiting them before l'Académie Royale des Sciences on August 20, 1692 and September 2 of the same year. In the first case, where a finger of his left hand had been bitten, he sucked out the yellow juice and some pus, but found the taste so unpleasant, that he squeezed the wound with the fingers of his right hand, bringing out more pus "and some of the irritated spirits." But fearing that he had not stayed the course of the irritated spirits, he applied a ligature to the finger, and took some volatile salt of vipers which produced a profuse sweat, and after five hours removed the ligature, as it hurt his finger. In the second case, after sucking and squeezing out the blood from the bitten finger, he kept the ligature on for only an hour and took no volatile salt of vipers, "and was perfectly cured."¹⁰⁵ In view of the speed with which animal spirits were supposed to dart about within the human body, it is amazing that he should have thought that he could bind up the finger or even suck the wound before the irritated spirits had been impelled all over his body through the blood stream and nervous system, whereas the removal of the yellow juice should have convinced him that it contained the poison. But he remained set in his previous opinions despite these personal experiences.

Giuseppe Zambecari (1655–1728), who worked under Redi at the Ospedale di Santa Maria Nuova in Florence before he began to teach at Pisa in 1681, addressed to Redi in 1680 an account of experiments of splenectomy and the excision of other organs, per-

¹⁰³ JS IV, ii (1676), 271.

¹⁰⁵ JS XXII, 429–33.

¹⁰⁴ PT XV, 1143.

formed chiefly with dogs,¹⁰⁶ which was re-edited three times before the close of the century.¹⁰⁷



In 1664 Johann Daniel Major (1634–1693), who was then practicing medicine in Wittenberg but in 1665 became professor of medicine at Kiel, published a dissertation on petrified crabs and snakes in the form of an epistle, dated from Wittenberg on July 12, 1663, to which Philipp Jacob Sachs von Löwenheimb, or a or de Lewenheimb (1627–1672), replied in the same year with another on the marvelous nature of stones.¹⁰⁸ The finding of a snake of stone in the stomach of a stag caused Major to wonder why only the snake was petrified and no portion of the stag, and to declare that human life hardly suffices to explore even a tenth part of the portents which are of daily occurrence. The Duke of Saxony sent to the Grand Duke of Tuscany a chest full of medicaments prepared from deer alone. Major refers to the chemical resuscitation of plants from their ashes, to the finding of fossils far from the sea which Luther ascribed to the Flood, and of animals which are still alive inside of stones. Caspar Schott tells of two live dogs found enclosed in stone, but this was attributed to demon activity or illusion.¹⁰⁹

Sachs in his reply agrees that nature daily excites human minds with new portents and to admiration of and diligent research into its marvels. Thomas Bartholinus¹¹⁰ tells of an embryo pregnant with another embryo; Ambrose Paré¹¹¹ records a case of a human head projecting from a man's belly; and Eusebio Nieremberg,¹¹² professor at Madrid, states that a mare in Spain gave birth to a

¹⁰⁶ For an English translation of the *Esperienze* by Saul Jarcho see *Bulletin of the History of Medicine*, IX (1941), 311–31.

¹⁰⁷ *Ibid.*, pp. 153–54.

¹⁰⁸ J. D. Major, *Dissertatio epistolica de cancris et serpentibus petrificatis* (pp. 4–49) cui accessit *responsoria dissertatio historico-medica* P. J. Sachs *de miranda lapidum natura* (pp. 50–110), Jena, 1664, in-8: BN S.12577;

BM 987.b.7.

¹⁰⁹ *Ibid.*, 45, citing Casp. Schott, *Physic. curios., lib. 8, cap. 19, § 5*, p. 977.

¹¹⁰ *Ibid.*, 54, citing Thom. Bartholinus, *Cent. VI, Obs.* 100.

¹¹¹ *Ibid.*, 55, citing Ambr. Paraeus, *chirurg., XXIV, 2*.

¹¹² *Idem*, citing Euseb. Nieremberg, *Hist. Nat., VI, 2*.

mule which was pregnant with another mule. Bartholinus, it is true, in a letter of April 10, 1663, warns that Nieremberg seldom speaks from his own experience. But David Spilenbergerus of Hungary, in a letter of May 25, 1663, tells of a calf which was pregnant at birth and prays God that it be not an omen of invasion by Turks and Tartars. Instances of worms and tapeworms brought forth pregnant with other worms, adduced by Manardo, Amatus and Panarolo, are not so surprising, since nature more easily plays with insects than with a most perfect animal such as man, where such an aberration is inordinate. Sachs repeats the old notion that stags extract snakes from their holes by the breath of their nostrils, then kill them with their hooves and eat them. He inquires why so many antidotes for poisons come from the stag's body, and cites Caspar Bauhin as to deer's tears.¹¹³ He suggests that in the case instanced by Major, the stag may have eaten the snake piece-meal, but the bits have coalesced anew by virtue of their natural balsam. He suspends judgment as to fossil crabs and fish, and passes on to mineral waters and petrifying waters. But he hardly gets to a number of observations which Major had made as to salts.

Such were the aberrations of naturalists, far exceeding those of nature, in the seventeenth century; such was their love of the marvelous and inclination toward the magical, outdistancing both natural magic and the marvels of nature. Yet Major three years later published a book on Infusory Surgery,¹¹⁴ and Werner Rolfinck, in the dedicatory preface to his botanical work of 1670,¹¹⁵ hailed Major as the inventor of infusory surgery. Rolfinck further praised Major as a great teacher and physician. When he revealed the arcana of the microcosm in the anatomical theater, the entire audience would burst into applause. When he entered the vegetable kingdom, he showed that everything was full of miracles of nature. Besides infusion, he was responsible for a new method of transplantation, for anointing the scalp to cure even certain non-cephalic diseases, and for a doctrine of circulation of the nutritive juice of plants. This encomium, too, is not free from an admixture

¹¹³ *Ibid.*, 59, citing Casp. Bauhin *de lap. bez.*, caps. 7-11.

¹¹⁴ *Chirurgia infusoria*, Kiloni, 1667,

328 pp. including the Index.

¹¹⁵ *De vegetabilibus, plantis . . . in genere libri duo*, Jena, 1670, in-4.

of marvels and magic with science, especially if the term, transplantation, is taken in the sense, which was then common, of the magical transfer of disease.

Incidentally it may be noted that back in 1639 Rolfinck was *Praeses* and Gottfried Moebius (the Elder) *respondens* of a dissertation at Jena on the nature of the stag and its use and hermetic arcana.¹¹⁶ Gui Patin, acknowledging receipt of books by Rolfinck, wrote on November, 8, 1658: "If this man knows no more of medical practice than what appears in his writings, he will do well not to come to Paris."¹¹⁷ As for Major, we shall find him grown more sceptical in his book on Errant Genius of 1678,¹¹⁸ while Rolfinck had already in 1661 listed *non-entia chimica*.

The work of Agostino Scilla, a Sicilian painter, on marine fossils was somewhat obscured by a vague opening title, *Vain Speculation Disproved by the Senses*,¹¹⁹ and somewhat weakened by the fact that the author keeps apologizing for his non-literary style. But it is free from magic and superstition. On the basis of his own observations which are illustrated by plates of such fossils in the islands of Isola and Malta, and the mountains about Messina, Scilla was forced to the conclusion that they all came from the sea and had been real animals which petrified, rather than that they were generated from pure rock and were freaks of nature. Scilla's treatise received a long review in *Philosophical Transactions*, with some added notes by a fellow of the Royal Society.¹²⁰ But it appears not to have been translated into Latin until the middle of the next century, when there were three editions.¹²¹ On the other hand, the Essay of Scilla's contemporary, Shirley, which contended that "stones and all other sublunary bodies are made of water, condensed by the power of seeds," and which consisted chiefly of quotations, was translated from English into Latin within three years.¹²² But that was the end of it.

¹¹⁶ *Diss. de natura cervi . . . etc.*, Jena, 1639, in-4: BM B.623.(5.); T. 618.(20.).

¹¹⁷ *Lettres* (1846), III, 99.

¹¹⁸ See our chapter 33 on Alchemy After 1650.

¹¹⁹ *La vana speculazione disingannata dal senso. Lettera risponsiva cir-*

ca i corpi marini che petrificati si trovano in varii luoghi terrestri, Napoli, 1670, in-4.

¹²⁰ PT XIX, 181-99.

¹²¹ BN has those of Rome, 1747, 1752, 1759; BM, those of 1752 and 1759.

¹²² See our chapter 9 on Mineralogy.

In what seems to have been his first published work, a monograph on the tarantula, Wolferd Senguerd tried to explain the strange effects of its poison, which had hitherto been ascribed to occult qualities, by natural reasons.¹²³ The poison was believed not to take effect for a whole year and for the next two years to produce only certain diseases varying with the constitution of the patient and of the particular spider which bit him, such as loss of appetite, fever, general ill health, laughing or crying, sleeping or insomnia, delighting in certain colors such as yellow or red or green, and imagining oneself to be king or slave. But all those afflicted had the common characteristic of liking music and dancing to it, although the particular tune varied with different tarantulas and different patients. Senguerd's natural explanation was that the tarantula bit with a moist mouth in the hottest season, and that its poison, diffused through the human body, especially affected the spirits in the arteries and nerves, "as also the brain and fibres." Stirring up the spirits in muscles and nerves increased the heat in the heart, thereby corrupting the bile and perhaps obstructing the pores, causing fever, distemper and the inclination to dance. Ascending to the brain, it either obstructs the animal spirits and so induces sleep, or opens a wider path for them and so keeps one awake. "The air being moved by a musical air suitable to the patient, the poison of this spider and the spirits of the man are by the same agitation put into a commotion." Dancing results; its vehement motion heats the blood, opens the pores, rarefies and disperses the poison, and ejects it by perspiration. But mere sudorifics will not accomplish the same result. Not all are cured, for in some cases the poison injected was so pertinacious and un-rarefiable, that patients have danced for thirty or forty years, and all in vain.

The only respect in which this "natural explanation" is superior to that of occult qualities would seem to be that it is longer and more complicated. Yet it was deemed worthy of a rather extended

¹²³ I. W. Sengwerdus, *De tarantula. In quo, praeter eius descriptionem, effectus veneni tarantulae qui hactenus fuere occultis qualitatibus adscripti rationibus naturalibus deducuntur &*

illustrantur, Leyden, 1668, in-12. I have not seen the book itself but follow the excellent review of it in *Philosophical Transactions*, III, 660-62.

notice in the *Philosophical Transactions* of the Royal Society.

Hermann Grube treated the same subject eleven years later,¹²⁴ apparently without knowing of the treatise by Senguerd. His citations are mainly of earlier writers, Kircher, Forest,¹²⁵ Franciscus Joel, Felix Platter, Henry Cornelius Agrippa, but especially Scaliger against Cardan. In any case, he offered a different explanation from Senguerd, a ferment and volatile salt in the tarantula which was supposed to explain all the symptoms resulting from its bite, although these were very varied: some patients laughing, others weeping; some falling asleep, others unable to; some nauseated and vomiting, others incurring cold sweats, vertigo and delirium; some running about, others remaining inert.¹²⁶ It was, however, necessary further to postulate an affinity of music with our spirits on the one hand and its consensus with the tarantula on the other.¹²⁷

Travelers' tales continued, and the need of a book such as Redi's was shown in an installment of Thévenot's *Rélations de divers voyages curieux* published the next year (1672), in which a Biscayan or Basque, named Acarete, recounting an overland trip from Buenos Ayres to Peru, in describing the wild variety of llamas known as Guanacos, said that they had a bezoar stone in their insides. Of the ostriches in South America he related that when the eggs were about to hatch, the hen would place four at the four corners of the hatching place and break the shells, so that they would putrefy, producing an abundance of worms for the newly hatched birds to feed on.¹²⁸

Paolo Boccone (1633-1704) was a naturalist of Palermo who traveled rather widely in Europe. His special contribution was in the field of botany, where he was the first to note or at least clearly to distinguish a number of species.¹²⁹ In a letter in the *Journal des Sçavans* he identified *ferula Saracenica*, which grew

¹²⁴ *De ictu tarantulae et vi musices in eius curatione conjecturae physico-medicae*, Frankfurt, 1679.

¹²⁵ L. Meunier, "Un grand praticien au XVIe siècle. Le Hollandais Pierre van Forest (Petrus Forestus) 1522-1595," *Janus*, VII (1902), 307-12, 365-69, 466-69.

¹²⁶ *De ictu tarantulae*, pp. 24, 28,

32, 22.

¹²⁷ *Ibid.*, pp. 40, 59.

¹²⁸ *Philosophical Transactions*, VII, 5128-30.

¹²⁹ *Manifestum botanicum de plantis Siculis*, Catania, 1668; *Icones et descriptiones rariorum plantarum Siciliae Melitae Galliae et Italiae*, Oxford, 1674; and other works.

near Palermo, with *panax Syriacum*, and its gum, which was a sovereign remedy for wounds, he identified with the *opoponax* of the ancients. Of all the kinds of *panax* thus far known it was the only one with gum of that sort.¹³⁰ The two works by Boccone which we shall here examine are of a more general character and illustrate the widespread interest in nature and science which marked the later seventeenth century. His *Recherches et Observations Curieuses*, or, *naturelles*, were first printed at Paris in 1671,¹³¹ then at Amsterdam in 1674, at Bologna in Italian translation in 1684, again at Amsterdam in 1744. They open with a letter to a physician of Avignon arguing that coral is not a plant but a stone. In his reply, the physician complains that Cassendi has little on the subject of vegetation, Descartes nothing at all, but that he himself, if he only had the leisure, could expound it all clearly adhering to the principles of true physics and by the geometrical method.¹³² Presently Boccone expresses his astonishment that a leech which is well known to the fishermen and savants of Messina has not yet been examined by any Sicilian.¹³³ He is aware that some parts of animals petrify¹³⁴ and believes that *glossopetrae* are for the most part the teeth of former fishes.¹³⁵ He notes that islands have formed between Holland and England, while elsewhere along the coasts of France, England and Italy whole regions have been submerged.¹³⁶

The liveliest section of the *Recherches* is a vivid account of what purports to be a conversation between Boccone himself and a noble of the court of France.¹³⁷ He represents himself as a Sicilian who has come to Paris to learn and because of the king's reputation for favoring learning. Also because Italy, which is not so rich as other lands, cannot recompense the study of science. He has been a herbalist for about twenty years. He finds Paris the gayest of cities and much admires its gatherings of the intelligent and curious, and its conferences of savants. He himself has instituted fort-

¹³⁰ JS IV, ii (1676), 25-26.

¹³¹ Copy used: BN S.21119.

¹³² *Ibid.*, I, 35.

¹³³ *Ibid.*, I, 49.

¹³⁴ *Ibid.*, I, 49; II, 41.

¹³⁵ *Ibid.*, I, 40; pp. 47-48, "Je ne

croy pas qu'il y ait homme si stupide, dit-il (Fabius Columna), qui en les voyant ne les juge des os plutôt que des pierres."

¹³⁶ *Ibid.*, I, 44.

¹³⁷ It begins at II, 82.

nightly conferences in his house on alternate Thursdays at 1 P.M. with an admission fee. Each person attending may bring with him six specimens, fresh or dried, of rare plants, but the order of considering these will be determined by drawing lots. There are eight places "pour le cercle." The others present may listen or look up such passages in books as are wanted. Two note-books will be kept: one in which to preserve the specimens, the other in which to record all the opinions expressed and names given to the plants. Each one of the eight in the favored circle will ply a pen, but after a general agreement has been reached, the particular writing of each will be effaced, and the net result presumably recorded in the permanent notebook. Botanical books will be at hand. If a plant is new or from distant regions such as the Indies, it will be looked up and described, and then this account will be revised by one or two outside the conference, so as not to prevent the ordinary exercises. If medical or pharmaceutical students desire a special session, it can be arranged. Ladies are invited to attend as they do in England. Boccone taught two at Lyons, and in Italy gentlemen of the first quality.

A list is then given of specimens shown at his conferences. They include the leaf and fruit of *Musa Serapionis* from Egypt, a wood called *aspalatus Caesalpini*, fossil ivory or mineral unicorn, a mineral bezoard found in Sicily, papyrus from Sicily, pepper from the Canaries, the *Tethys* of Aldrovandi, the skeleton of an infant and a very well preserved hand of an adult, the lynx stone, a stone found in Malta which seems a petrified mass of fish's eggs. The virtues of the plant called Surgeons' Wisdom (*Sophia Chirurgorum*) have been investigated to see if there is any sure experience as to it, and a comparison has been made of serpents' tongues from Malta with those of the teeth of the fish called *Carcharias* or Sea-Dog (*Chien de mer*).

Boccone's *Museo di fisica e di esperienze*, published at Venice in 1697, consists of some forty-six *Osservazioni* on particular natural topics addressed to almost as many different persons, including the chancellor of Bohemia, the president of the imperial camera, Vienna, Lord Charles Townsend of London, two chamberlains of Vienna, a knight of the Golden Fleece, il Principe della Cattolica,

Palermo, the Modenese ambassador at Madrid, the president of the Royal Society, the president of the city of Breslau, the Grand Chamberlain of Poland, a senator of Bologna and patrician of Venice, bishops and abbots, and the general of the Venetian army. The first four *Osservazioni* are on the Sicilian earthquake of 1693, but one communication is dated as early as 13 February, 1680. Other themes are alkali and medicinal earths, *terra Lemnia*, manna, an urn containing ashes and a balsamic liquor found in the island of Malta, tarantulas and antidotes for their bite, some regular periods of fevers, the curious actions of certain animals, the extraordinary effects of certain plants, the prodigious effluvia of some plants and animals, some neglected vulgar common plants, Italian cheeses, *alum di Rocca*, and marine plants.

Many held that amber was the tear or gum of pine and fir trees in Sweden, Pomerania and Prussia which was carried by the wind and buried in the sands along the shores of the Baltic, but Boccone raises various objections to this correct view and holds that amber is found in parts of Italy, as are petroleum and naphtha. The *sal mirabile* of Glauber, used to coagulate all liquors or oils is only *il capo morto* or *tête morte* of a distillation made of common salt dissolved in water and a portion of oil of vitriol mixed in the solution and then distilled dry. It will coagulate petroleum into a substance similar to amber. Boccone therefore thinks that petroleum is a species of liquid amber and that this opinion of his "is still sustained by the most learned modern writers."¹³⁸

Boccone now essays a Cartesian explanation of the formation of coral. He holds that the little vortices and tourbillons of the sea, the rains of heaven, and the rivers which continually flow into salt waters, contribute to the movement, separation and precipitation of particles. "And in the production of coral, I imagine, that there is first cast and moulded the capsule which later is filled with the particles and molecules composing the coral."¹³⁹ As gems were formed of fluid matter, so the first impression of coral was fluid.¹⁴⁰ Boccone goes on to try to give a mechanical and chemical explanation why some coral is red and other, white.

¹³⁸ *Museo*, pp. 32-37.

¹⁴⁰ *Ibid.*, p. 253.

¹³⁹ *Ibid.*, p. 251.

Fossil fishes and other heterogeneous matter found in the earth and in stones are the effects and proofs of varied revolutions of the earth such as floods and earthquakes which confuse all the agitated matter and transport it to improper sites.¹⁴¹ While admitting that some mountains are higher than some clouds, Boccone argues from the fact that the highest mountains are covered with snow, that the snow-clouds must rise to a greater height.¹⁴²

An English sailor who had spent over six years in San Domingo, Cuba and other islands of the West Indies told Boccone of an herb that cured snake-bite (*Snecrut*, Snakeroot) and was also used in fevers. This sailor said that ambergris was a bitumen. The Turks eat it as an aphrodisiac. Boccone thinks that Cornuto's *snaqroel* and Thomas Willis's *serpentina Virginiana* are the same herb. He could not procure the last-named in Italy, Venice or Vienna, but a doctor in Silesia had the dried root and used it in fevers.¹⁴³

A treatise by Joh. Nic. Pechlinius, M.D. on lack of air and food, and life under water, printed at Kiel in 1676,¹⁴⁴ was occasioned by a report from Sweden that a man who had drowned under ice was revived after sixteen hours. Pechlin believed that swallows spent the winter under the ice along the shores of the Baltic and revived again in spring, and would do so in winter if brought close to a hot stove. But the notion that bears waxed fat in winter by merely sucking their paws he repudiated, holding that they slept at intervals and lived on provisions which they had stored up, and that licking their greasy paws was merely in order to soften up the stomach and bowels. But Pechlin told some stories "so much more prodigious" than that of the Swede who was under water for sixteen hours, that the reviewer in *Philosophical Transactions* did not dare to insert them in its pages.¹⁴⁵

Godofredus Müller devoted 668 pages to all the terrestrial quadrupeds mentioned in the Bible. They were forty-five in number and arranged in alphabetical order from *agnus* (lamb) to *Zijun*, dismissed in four lines as unknown.¹⁴⁶

¹⁴¹ *Ibid.*, p. 281.

¹⁴² *Ibid.*, pp. 232, 236.

¹⁴³ *Ibid.*, pp. 274, 276.

¹⁴⁴ *De aeris et alimenti defectu et*

vita sub aquis, Kiloni, 1676, in-8, 188 pp.

¹⁴⁵ PT XI, 675-77.

¹⁴⁶ *Quadrupedum terrestrium om-*

We have already heard several writers suggest that the horn so-called of the unicorn or monoceros really came from a fish. In 1676 Paul Ludwig Sachs¹⁴⁷ identified it with a sword-fish caught by fishermen from Hamburg in August, 1669.¹⁴⁸

Stefano Lorenzini published *Observations on the torpedo* (electric ray) in which, like Redi, he declared that it numbed another living body only if touched by it directly and not at a distance or indirectly.¹⁴⁹

The Catalogue of the Museum of the Royal Society by Nehemiah Grew identified the hippopotamus with the Behemoth of Scripture, and the crocodile with Leviathan.¹⁵⁰ This Catalogue and the treatise by Grew on the comparative anatomy of stomachs and guts which accompanied it, formed the subject of the leading article in the first three issues of *Acta eruditorum*.

In a work on shellfish by the Jesuit, Filippo Buonanni, which first appeared at Rome in 1681 in Italian,¹⁵¹ and then in 1684 there in Latin,¹⁵² accompanied by numerous illustrations, the questions were still discussed why shellfish were fatter at full moon,¹⁵³ and whether the *echeneis* or *remora* could stop a ship. The explanation, here ascribed to Aristotle,¹⁵⁴ that it did so by wiggling the steering apparatus did not appeal to Buonanni. But the belief might be due to some common third cause, such as an adverse current, which

nium in sacris literis . . . , Wittenberg, 1676. BM 987.a.31.(1.). A similar work earlier in the century which I have not examined was by Archibald Simson, pastor at Dalkeith, Scotland, *Hieroglyphica animalium terrestrium volatiliū natatiliū reptiliū insectorum, vegetivorum, metallorum, lapidum etc. quae in Scripturis Sacris inveniuntur et plurimorum aliorum, cum eorum interpretationibus*, Edinburgh, 1622-1624, 2 vols., in-4: BM 1015.b.1 (3.).

¹⁴⁷ *Monocerologia seu de genuinis unicornibus dissertatio*, Raceburgi (Ratzeburg), 1676: BN S.12580 and S.12581.

¹⁴⁸ JS VII (1679), 92-93.

¹⁴⁹ *Osservazioni intorno alle torpedini fatte da Stefano Lorenzini*, Florence, 1678, in-4, 136 pp. JS VII (1679), 150-52.

¹⁵⁰ *Musaeum regalis societatis* . . . , London, 1681, pp. 14, 41.

¹⁵¹ *Ricreatione dell'occhio e della mente, nell'osservatione delle chiocciole . . . con quattrocento e cinquante figure di testacei diversi*.

¹⁵² *Recreatio mentis et oculi in observatione animalium testaceorum*: copy used, Col 594 B64.

¹⁵³ *Ibid.*, pp. 248-50; Pars III, Problema xxxi.

¹⁵⁴ *Ibid.*, pp. 265-69; III, xxxvi; p. 267, "Proponit hoc Problema Aristoteles," with the marginal reference, "In mechanicis."

both stopped the ship and made the tiny remora cling to it. Buonanni denied that shellfish engaged in reproductive intercourse or had eggs.¹⁵⁵ In a later work he argued at greater length in favor of spontaneous generation.¹⁵⁶

The inaugural dissertation for the doctorate by Emanuel König of Basel in 1682, on *The Animal Kingdom*, is very well arranged and well written and, not to mention quotations from the classics and the Bible, displays a remarkably wide acquaintance with and reading of recent and contemporary medical and scientific literature. This is already manifested in the preface and continues to be shown in frequent citations throughout the text. The first section on the internal fabric of the body of animals and the varied workings of the sensitive soul, divides into twenty-five articles concerning (1) the name, Animal Kingdom; (2) definition and generation of animals in general; (3) the sensitive soul; (4) dissolution of food and distribution of chyle; (5) the blood and (6) the movement of heart and lungs on its account; (7) the harmony of the parts of animals, secretion of spirits and division of senses; (8) the five external senses; (9) the internal senses and seat of the soul; (10) on the appetite, progressive movement and cognition of brutes; (11) on sleep, waking and dreams; (12) the rational soul; (13) on the marvelous machine-like bodies of animals; (14) on the spirits as causes of the chief actions; (15) the humors; (16) the solid parts of animals and various excrescences from the skin; (17) of the harmony in the body of animals and the organs which serve the propagation of the species; (18) the organs serving the preparation, elaboration and distribution of chyle; (19) those serving the distribution of the blood; (20) respiratory organs; (21) structure and use of the spleen, peritoneum, omentum and diaphragm; (22) organs purifying the blood and nervous juice; (23) organs destined for the secretion and distribution of the spirits—brain, cerebellum and nerves; (24) organs of the external senses—skin, eye, ear, nose and tongue; (25) organs of motion, muscles and bones.

¹⁵⁵ *Ibid.*, pp. 22-29; I, iv.

¹⁵⁶ *Observationes circa viventia quae in rebus non viventibus reperiuntur. Cum micrographia curiosa . . .*, Rome, 1699, in-4. Copy used, from

the Medical Library, Columbia University. An earlier edition of Rome, 1691, is reviewed in *Acta eruditorum*, XII (1693), 437-43.

The much shorter second section deals with the five chief classes of animals: namely, quadrupeds, flying animals or birds, swimming animals or fish, serpents and insects. But it is recognized that this is a very rough classification. Under fish, for instance, are treated both whales and bloodless animals. But whales are further termed viviparous aquatilia, cetaceous, "or better, marine monsters."¹⁵⁷ Bloodless animals are sub-divided into soft, crustaceous, testaceous and plant-animals or zoophytes. The third and final section is on the use of animals for food and as medicine.

As the foregoing table of chapters has already suggested, spirits play a leading part in König's physiology. They are in the animal mechanism what the *primum mobile* is in the macrocosm, or, according to Francis Bacon in his *History of Life and Death*, the big supreme wheel which keeps the other lesser ones in the clock-work of the body going.¹⁵⁸ The view of Willis, Glisson, Cole and other English writers that in the fibres of the nerves there was, besides the animal spirits, a viscous fluid, had to König's satisfaction been exploded by Scaphus a Helvetii, Wepfer, Peyer, Graefius, and others.¹⁵⁹

König not only displays a wide acquaintance with longer works but has ransacked the Proceedings, Papers and Communications of various scientific societies, the Royal Society in England, the *Ephemerides Gallorum*, as he calls them, the German *Collegium Leopoldinum Naturae Curiosorum*, in Italy the *Collegium experimentale Florentinum*, for Denmark the *Acta philosophica et medica Hafniensia* of Bartholinus.

König was acquainted with the communication of Leeuwenhoek to Oldenburg, secretary of the Royal Society, that saline particles of quadrangular figure may be seen in the blood through the microscope, and that the blood is composed of very small red globules swimming in a crystalline humidity like water and each moving about its own axis. In a diseased condition they become solid and hard; in a healthy person are soft and fluid so that their shape,

¹⁵⁷ *Regnum animale*, Basel, 1682, 176 pp.; at p. 112. Copy used: Col 194 D45 I3, where it follows *Opera* of Descartes, 1687, and Senguerdus,

Philosophia naturalis, 1681.

¹⁵⁸ *Ibid.*, p. 39.

¹⁵⁹ *Ibid.*, p. 88.

altered to an oval, more readily passes through the capillaries.¹⁰⁰

König was much impressed by the harmony which to his mind existed between different parts of the bodies of animals. The stomach and lacteal vessels delight in chyle; then the heart and blood-vessels are overcome with joy by this same chyle, and the stomach is refreshed anew by this nectar. And so from stomach and heart this joy is prolonged to the brain, which again makes heart and stomach sharers of its joy and strikes softly with its most grateful influx and irradiation, and comforts much their strength and movement. The greatest part of the blood which goes from the heart through the great artery, which soon divides into two branches, in all perfect animals directs its course to the brain by the carotid and cervical arteries. In the brain the blood, full of nitro-aerial particles taken from the air, is despoiled of its more subtle parts in the very narrow pores, volatilized and rendered more fitting to the pores of the nerves and converted into animal spirits, by means of which both internal and external senses operate and also the motory system.¹⁰¹

König at first speaks of brute animals—as had been customary since Descartes classified them as automata—as delicate machines most exquisitely constructed by the Supreme Artificer, and their natural instinct as solely due to the movement of bodily organs, varied influx of (material) spirits, various opening of pores, and disposition of external causes without counsel, ratiocination or act of cognition. But he finally suggests that God may work in them, and that the knowledge by which they seem to act depends not on themselves but His wisdom.¹⁰²

Of astrology or a belief in the influence of the stars I have found only one or two faint traces in König's work. In one place he distinguishes animals as martial, jovial, lunar, saturnine and mercurial.¹⁰³ In another he cites Kerckring's Anatomical Observations

¹⁰⁰ *Ibid.*, p. 43.

¹⁰¹ *Regnum animale*, Basel, 1682, pp. 21-23, *Articulus vii*, "De harmonico partium animalium consensu, spirituum secretionem, ac sensuum divisionem." See further *Artic. xvii*, pp. 51-58, "De harmonia in corpore ani-

malium ac organis speciei propagationi inservientibus."

¹⁰² *Ibid.*, *Artic. x*, pp. 31-33. See also *Artic. xiii*, "De corpore animalium instar machinarum mire fabricato."

¹⁰³ *Ibid.*, p. 17.

concerning a woman whose face was rotund and beautiful at the full of the moon but at new moon became so deformed that she dared not appear in public. He himself had observed on the thumb of a sexagenarian a tumor which at new moon was only the size of a filbert but as the moon waxed resembled a ball.¹⁶⁴

Cures by use of characters König spurned with "other nonsense." But he could not keep from repeating from Heurnius, *Methodus ad praxim medicinae*, the story of a medical student who cured an old-wife of toothache by hanging about her neck a scroll on which he wrote in Latin, "May the devil break your neck" (*Diabolus tibi rumpat collum*). Such cures may be due to imagination and obstinate faith, as in the case of the royal touch and the cures wrought by a recent stroker (Boyle's Greatrakes?). If they are true, they may, in König's opinion, be attributed to the exhalation of effluvia as well as to the force of imagination.¹⁶⁵

On the other hand, it was also his opinion, and he spoke from experience, that drinking one's own urine or that of a boy drinking wine could never be praised enough as a remedy in cases of heart-burn, hypochondria, gout, toothache, colic, jaundice and intermittent fevers.¹⁶⁶ Scrapings from one's nails was only a moderate vomitory according to J. J. a Brunn in his *System of Materia Medica*, but according to Cardilucius it was superior to doses of antimony and hellebore.¹⁶⁷ Human skull was another remedy.¹⁶⁸ As for the parts of quadrupeds, besides elephants' tusks, foxes' lungs, and ashes of a mole,¹⁶⁹ may be noted the intestines of a wolf, efficacious for colic either worn externally as an amulet or taken dried and powdered internally with Zedoar water and Syrian bark.¹⁷⁰ The heart of a green salamander worn about the neck was said to extinguish quotidian fever completely; no less than Pliny said another lizard would in cases of quartan fever.¹⁷¹ The cuttle-fish has white bones in its back which by their alkali and drying power are outstanding remedies for ulcer of the prostate in cases of gonorrhoea,¹⁷² while pulverized bedbugs and lice immediately resolve all

¹⁶⁴ *Ibid.*, p. 44.

¹⁶⁵ *Ibid.*, p. 24.

¹⁶⁶ *Ibid.*, p. 131.

¹⁶⁷ *Ibid.*, p. 133.

¹⁶⁸ *Ibid.*, p. 134.

¹⁶⁹ *Ibid.*, pp. 147, 136, 138.

¹⁷⁰ *Ibid.*, p. 135.

¹⁷¹ *Ibid.*, p. 140.

¹⁷² *Ibid.*, p. 155.

difficulty in urinating for both men and brutes.¹⁷³ König's work was praised in *Acta eruditorum* as the best of its kind that had appeared.¹⁷⁴

In his *Salamandrologia* Johann Paul Wurffbain (1655–1711) collected all that he could find on the salamander with innumerable citations and quotations. Successive chapters dealt with its existence, etymology, homonyms, synonyms, definition, division, icons, anatomy, nature and temperament, generation and food, its venom and the cure of it, its supposed life in fire—for which he listed fifty favoring authors and ten against based upon experiment, its medical use, and finally its employment in hieroglyphs, symbols, emblems, etc.¹⁷⁵ The tone of the book is throughout sceptical. In its *Praefamen* Wurffbain alludes to the fables of the monks and credulity of antiquity, and asserts that the Talmud is full of nonsense. Elsewhere he notes the superstition of the common crowd and asserts that credulity is the mother of all errors.¹⁷⁶ He not only denies that the salamander lives in fire but pronounces its use as an amulet superstitious.¹⁷⁷ He also rejects as false the notions that its breath can injure, and that it attacks men.¹⁷⁸ He further declares that generation from putridity is doubtful, and that the pest cannot be caused by *veneficia* (sorcery or poisons).¹⁷⁹ But while his attitude is sceptical, he repeats many marvels such as a fountain near Mansfeld which cast forth little bones, which some held were those of salamanders, or the tradition that the heart of Germanicus was incombustible, or the association of *salamandra* with *abracadabra*.¹⁸⁰

A work with a similar title was the *Castorologia*, composed years before by a Johann Marius of Ulm, added to and published at Augsburg in 1685 by J. Francus. Although the book follows Rondelet in holding that castor oil does not come from the testicles

¹⁷³ *Ibid.*, p. 164.

¹⁷⁴ *Acta eruditorum*, II (1683), 361: "ut in hunc usque diem nullam ipsi similem, multo minus hac perfectionem, aut magis consummatam Publico videre contigerit."

¹⁷⁵ *Salamandrologia descriptio historico-philologico-philosophico-medi-*

ca . . . , Nürnberg, 1683. Copy used: BM 462.a.20.

¹⁷⁶ *Ibid.*, pp. 2, 86.

¹⁷⁷ *Ibid.*, p. 125.

¹⁷⁸ *Ibid.*, pp. 88, 94, 77.

¹⁷⁹ *Ibid.*, pp. 80, 95.

¹⁸⁰ *Ibid.*, pp. 76, 108, 120-21.

of the beaver but from two bags between its hind legs, it does not agree with another sixteenth century author, Brasavola, that only the beaver's testicles or bags are used medically,¹⁸¹ since it recommends its skin for colic, hysterics and mania; its blood, for epilepsy, internal contusions, and hard teats; its fur and hair, for haemorrhage; and its teeth, as amulets for teething infants.¹⁸²

The work of Wurffbain on the salamander had first been submitted to the Academy of the Curious as to Nature and then printed with some additions.¹⁸³ This lead was promptly followed in a big way and petty manner by Christian Franz Paullini (1643–1712). His *Cynographia curiosa*, or Description of the Dog, was "according to the method and laws of the illustrious academy of the Curious as to Nature,"¹⁸⁴ and was prefaced by letters of recommendation and congratulation by no fewer than thirty-six members of that society and twenty-five others.¹⁸⁵

The work was in four sections: the first philological-physical-anatomical; the second concerning the sacred, political, economic and satanic (mentioning Agrippa's hound) use of the dog; the third chemical-medical, in eighteen chapters on the use of different parts of that animal. The fourth or physico-medical was chiefly concerned with rabies. Its third chapter was on worms everywhere in the macrocosm, and its sixth chapter on worms everywhere in the microcosm. The text is packed with citations. The distribution of material is not as systematic as one might expect. Alcibiades' dog, instead of appearing in the second section under political history, is mentioned in the anatomical part of the first section under Tail. As appendices Paullini reprints John Caius's letter to Conrad Gesner on dogs of Britain and the letter of Meibomius on Cynophoria or ignominious carrying of a dog. It would seem that the book would appeal to dog-lovers more than to zoologists.

¹⁸¹ T V, 454.

¹⁸² JS XIV, 202-5.

¹⁸³ In its full title we read, "... Academiae naturae Curiosorum exhibita atque novis aliquot capitibus experimentis figurisque eleganter aeri incisus necnon rerum et verborum indice ad-aucta."

¹⁸⁴ *Cynographia curiosa seu Canis descriptio iuxta methodum et leges illustri Academiae Naturae Curiosorum*, Nürnberg, 1685, in-4, 258 pp.

¹⁸⁵ These fill numerous unnumbered pages before the pagination of the text begins.

Paullini followed it up the very next year by a treatise on the toad which was also according to the method and laws of the Academy and which he dedicated to Wurffbain.¹⁸⁶ It was in two sections: philological-historical-physical, and medical practice. Thomas of Cantimpré's story of the ungrateful son, goose and toad¹⁸⁷ is spun out at great length.¹⁸⁸ Paullini recounts the spontaneous generation of the toad, its antipathy with the spider, the toadstone (*bufonites*), that Norwegian pitch poisons toads, and whether the basilisk is produced by a toad's sitting on the egg of a cock. The answer is, Not ordinarily. In medical practice the toad is taken internally for dropsy. Paullini devoted four chapters to its external application, the last, in the form of a paste.

From dog and toad Paullini proceeded to volumes on the sacred herb, *salvia*, in 1688; mole and eel, both in 1689; hare, in 1691; wolf, in 1694; and ass, in 1695. Judging from the three of these that I have examined, all follow a similar plan of presentation and profess to be according to the norm of the Academy.¹⁸⁹ In that on the wolf there is a chapter on its use in prodigies and portents, while that on the ass has chapters on asinine prodigies and omens, asinine dreams, asinine miracles and forecasts, pretended and superstitious ass-worship, superstitious use of the ass, and magical use of the ass.¹⁹⁰

Robert Plott or Plot (1640–1697), curator of the Ashmolean Museum and the first professor of chemistry at Oxford (1683), of whose discussion of inextinguishable lamps in ancient sepulchres and the origin of fountains we treat elsewhere, also wrote a volume on the natural history of Staffordshire. He noted a fish there that had not been observed by naturalists and a few plants that were not in Ray's Catalogue of English Plants. But "all along many monsters and *lusus naturae* are described," the finding of toads enclosed in trees

¹⁸⁶ *Bufo* . . . , Nürnberg, 1686, 120 pp. BN S.14415.

¹⁸⁷ T II, 381.

¹⁸⁸ *Bufo*, pp. 26–30.

¹⁸⁹ *Sacra herba . . . salvia, iuxta methodum et leges Academiae Naturae Curiosorum*, Augsburg, 1688, 414 pp. BN 14412. *Lycographia seu de na-*

tura . . . lupi, Frankfurt a.M., 1694, 214 pp. BN S.11776. Here the formula is altered to "ad normam imperialis Acad. Leopoldine scriptus."

¹⁹⁰ *Onographia curiosa . . . de asino liber*, Frankfurt a.M., 1695, BN S. 11778, pp. 154, 162, 189, 205, 276, 277.

and stones, a rain of frogs whose generation could not have been by seed, and "a numerous catalogue of men and women who have lived to an extraordinary age," including one who married when past one hundred. The circles in the grass called Faery Walks, however, he ascribed not to conventicles of demons and witches, nor to subterranean courses of moles and ants, but to percussion by lightning.¹⁹¹ Plot had already published a *Natural History of Oxfordshire* in 1677.

The legend of barnacle geese was fully confirmed in almost every detail by Sir Robert Moray, "lately one of his Majesties Council for the Kingdom of Scotland," in a Relation published in *Philosophical Transactions* in 1678.¹⁹² He said that in the island of East¹⁹³ he saw on the shore a fir log about two and a half feet in diameter by nine or ten feet long which had been so long out of the water that it was very dry and only on the parts next to the ground still hung "multitudes of little shells having within them little birds perfectly shap'd, supposed to be barnacles." He then described what he called "a neck longer than the shell" which seems to have been the fleshy foot-stalk by which barnacles cling to a ship's bottom. He then proceeded:

This bird in every shell that I opened, as well the least as the biggest, I found so curiously and compleatly formed that there appeared nothing wanting as to the external parts for making up a perfect sea-fowl, every little part appearing so distinctly that the whole looked like a large bird seen through a concave or diminishing glass, colour and feature being every where so clear and neat. The little bill like that of a goose, the eyes marked, the head, neck, breast, wings, tail and feet formed, the feathers every where perfectly shap'd and blackish colour'd, and the feet like those of other water fowl, to my best remembrance. All being dead and dry, I did not look after the inward parts of them.

¹⁹¹ Robert Plott, *The Natural History of Staffordshire*, 1686: reviewed, PT XVI, 207-13. The finding of long-embedded toads has more recently been vouched for in *Nantucket Argument Settlers: a Complete History of Nantucket in Condensed Form*, 1946, where, at p. 135, we read under the

year 1931, "On May 21st a toad was found imbedded in the cement wall of the George C. Gardner house on Upper Main St. It came to life after being imprisoned for 21 years."

¹⁹² PT XII, 925-27.

¹⁹³ I find no such island in the Index to *The Times Atlas of the World*.

Although he carried about twenty or twenty-four away, he sent a figure only of the neck and shell, not of the bird inside. He concluded by saying first, "Nor did I ever see any of the little birds alive nor met with any body that did," but then added, "Only some credible persons have assured me, they have seen some as big as their fist."

In sharp contrast to Moray's account was a work in French printed at Caen in 1680 by a member of the medical faculty there but written "by the late M. de Graindorge of the Montpellier faculty."¹⁹⁴ He denied that the birds called *macreuses* came from the fruit of trees in Great Britain which fell into the water, or that they grew out of driftwood or from shells. There were no such trees in Great Britain, and the examination of the barnacles on driftwood showed no such phenomenon, while the shells contained shellfish, not birds. On the other hand, Albertus Magnus, Belon and Dutch navigators to Greenland testified that these birds were hatched in nests from birds' eggs in northern latitudes, and anatomy showed that they were male and female. But since it had been the custom for five hundred years to eat them on fish-days, he thought that this usage might be continued.¹⁹⁵

Robert Sibbald in his *Scotia illustrata* (Edinburgh, 1684) again confuted the fable of Scotch geese and described *Concha Analifera* as a perfect animal which laid eggs like other fowl, but not in Scotland, where they appeared only in the autumn and winter.¹⁹⁶ Sibbald listed other marvels of Scotland, however, such as two springs only three feet apart of which one was fresh, the other salt.¹⁹⁷ The next year Tancred Robinson, a Fellow of the Royal Society contributed "Some Observations on the French Macreuse and the Scotch Bernacle", in which he noted that the same vulgar errors existed as to the origin of both, and that the French ate the *macreuse* through Lent as a fish or marine animal, but that it was really more of a duck than goose.¹⁹⁸

Sibbald went on to write a work on whales, especially those

¹⁹⁴ *Traité de l'origine des macreuses par feu M. de Graindorge D. de la faculté de M. de Montpellier et mis en lumière par M. T. Malouin D. de la F.D.M. en l'université de Caen*, 1680,

in-12.

¹⁹⁵ JS VIII (1680), 115-18.

¹⁹⁶ PT XIV, 798.

¹⁹⁷ *Acta eruditorum*, IV (1685), 175.

¹⁹⁸ PT XV, 1036-37.

washed ashore in Scotland,¹⁹⁹ in which he carefully distinguished between the different varieties of whales and described spermaceti as lying both within and outside of the skull. All whales, he said, have great love for their young. He proposed experimental tests whether whale's tooth would not be as efficacious remedially as the much vaunted horn of the sea unicorn, and the third chapter of the appendix dealt with the use in medicine of the whale's pizzle; the fourth, with ambergris, its origin, nature and virtues.

Jean B. Panthot, an M.D. of Montpellier who became dean of the College of Physicians at Lyon, maintained that all reported dragons had been either mythical or supernatural, and that the use of the gem carbuncle in place of their eyes, when blind from old age, was even more fabulous.²⁰⁰ Thus legendary zoology was being discarded little by little.

A naturalist like John Ray, who spent years in searching for rare plants in England and on the continent, found no basis in nature for such stories and superstitions, and became increasingly sceptical concerning them, as he discovered the mistakes which past authorities had made in other respects, while he found sufficient excitement and zest in his own observations. Similarly Steno's dissections of the brain were all at variance with what Descartes taught in his *De homine*, while his Observations of geological conditions of Tuscany convinced him that fossils were the remains of past animals and sedimentary deposits. His scientific activity terminated at the early age of thirty-five, and the rest of his life was spent in religious work, but those first years were too crowded with varied scientific study and observation and shrewd conjecture and inference, and what, for him at least, were new discoveries,²⁰¹ to leave much room for the occult, although he was already fascinated by religious discussion. But in natural science his own observations

¹⁹⁹ *Phalaenologia nova sive observationes de rarioribus quibusdam balanis in Scotiae littus nuper ejectis*, Edinburgi, 1692, in-4: reviewed, *PT* XVII, 972-76.

²⁰⁰ *Traité des dragons et des escarboucles*, Lyon, 1691, in-12. *JS* XX, 532-36.

²⁰¹ At the age of twenty-two he discovered the parotid duct in 1660, but Needham had already found it in 1655. He rediscovered the vitelline duct, but it is twice described by Aristotle (*Historia animalium*, VI, 3; *De generatione animalium*, III, 2).

and experiments—as when he bound the descending aorta of a living animal, whose hind legs thereupon became paralyzed, but the paralysis ceased when the ligature was removed—and ideas—as when he announced that the heart was a muscle and not the seat of vital spirits—were enough. Readers might enjoy the old legends and marvels, but scientific research was becoming intent on new discoveries.

Ray has been called “with Linnaeus the chief founder of the science of ‘systematic biology,’” and his book of 1693 on quadrupeds and serpents is said to give “the first truly systematic arrangement of animals,” based primarily upon their toes and teeth.²⁰² He spurned the reports of barnacle geese as “false and frivolous,” and was even inclined to question whether there was any such animal as a hippopotamus, but accepted the identification of swordfish and unicorn.²⁰³ He read in Moffett that the head of the caterpillar turned into the tail of the butterfly, but commented, “In every caterpillar that I have seen the exact opposite is the fact.”²⁰⁴ His curiosity, however, extended beyond strictly scientific observation to reading about Greatrakes the stoker,²⁰⁵ as well as the *Mundus Subterraneus* of Kircher, while the credulity of his contemporaries is seen in their asking him in 1671 to investigate the report “of a maggot which by proper feeding grew as large as a man’s thigh.”²⁰⁶

The first systematic observations with the microscope to be published are said to have been those of Francesco Stelluti, a member of the Academy of Lynxes, on honey-bees in 1625.²⁰⁷ But the greatest such work upon insects is that to which we now turn.

The General History of Insects of Jan Swammerdam (1637–1680) first appeared in Dutch in 1669, and was translated into Latin only after his death, in 1685.²⁰⁸ Swammerdam rejected the distinction

²⁰² Charles Singer, *A History of Biology*, 1950, pp. 181-82.

²⁰³ C. E. Raven, *John Ray*, 1942, pp. 132-35.

²⁰⁴ *Ibid.*, p. 102.

²⁰⁵ See Chapter 28 on Robert Boyle.

²⁰⁶ Raven, *op. cit.*, p. 211.

²⁰⁷ Gerland, *Geschichte der Physik*,

1913, p. 361.

²⁰⁸ *Johannis Swammerdamii Amstelædamensis doctoris medici Historia insectorum generalis in qua quaecumque ad insecta eorumque mutationes spectant dilucide ex sanioris philosophiae et experientiae principiis explicantur, cum figuris et indicibus neces-*

between perfect and imperfect animals, and likewise spontaneous generation, holding that all animals were alike generated from seed, and that the rudiment of the ant was as large as that of the greatest animal. If God had not set definite bounds to its growth, there would have been nothing to prevent the ant attaining the size of an elephant. Also ants excelled larger animals in many qualities, such as bravery, marvelous industrial rivalry, stupendous and incredible mother-love.²⁰⁹ From which passage we see that he has not entirely freed himself from the ancient and medieval belief in animal sagacity, in spiritual interference in the course of nature, and love of the marvelous. From other attributes of magic, however, his text is free.

For the chaotic and irregular world of magic, which, however, he does not mention, he would substitute a universe in which all the works of God follow uniform rules of eternal constancy,²¹⁰ in which nothing happens by chance—what swine from the herd of Epicurus dares say so?—but all the works of God everywhere conspire in marvelous harmony, and are arranged in immutable order.²¹¹ Moreover, this divinely instituted natural law is marked by the greatest possible simplicity. All the mutations of insects—from egg to worm to pupa to fully formed insect—which constitute the main theme of his book, reduce to a single genus of four species, are nothing but the slow and natural increment of their members, and are analogous to the budding of plants or the development of the frog.²¹² It is hard for him to see how past philosophers invented the metamorphosis (a magical concept, although again he does not say so) of insects, and, like Ray, he especially condemns Moffett for having held, against both reason and experience, that the head of the silkworm became the tail of the moth and the tail, its head.²¹³ In footless worms the thorax does not change in position or form, and in those with feet the six front feet do not

sariis. Ex Belgica Latinam fecit Henricus Christianus Henninius, doctor medicus. Leyden, 1685. Copy in the Medical Library of Columbia University.

²⁰⁹ *Ibid.*, pp. 2-4.

²¹⁰ *Ibid.*, p. 155.

²¹¹ *Ibid.*, pp. 19, 201.

²¹² *Ibid.*, pp. 4, 6-8, 21-22, 57.

²¹³ *Ibid.*, pp. 21, 27. Thomas Moffett died in 1604, but his *Theater of Insects* was not printed until 1634.

disappear or change notably, although Goedart tried to prove against all reason that they did so.²¹⁴

Swammerdam advocated experimentation and experimental philosophy, and represented his book as constructed by the aid of experiments.²¹⁵ In his own case, however, experimental method went little further than careful observation through the microscope based upon minute dissection and reproduction of the results in copper plate engravings. The coverings of nymphs were of such marvelous tenuity and so tightly and intricately wrapped, that they could not be unfolded except by an artful hand trained in such experiments, "as will be clear, when we publish our experiments with bees, which really are worthy of admiration."²¹⁶ Goedart either failed to perform a sufficient number of experiments, or was not sufficiently attentive to the phenomena of particular experiments, and so wrecked the ship of truth on the rocks of error. For he formed a false hypothesis and contrary to experience, that worms which did not get enough food degenerated by premature mutation into mutilated and imperfect insects. This infected all his experiments with that error and made him unable to see what was right before his eyes.²¹⁷ Yet Swammerdam himself in another place says that general hypotheses should precede special experiments, and in a third passage that some things can be present in the intellect which were never in the senses.²¹⁸ But he held that in the past innumerable philosophers, without consulting experience and following the phantasms of their brains, had prostituted themselves to disgraceful errors.²¹⁹

Indeed, Swammerdam regarded his own age as far superior in natural science to what had gone before. We should thank divine Providence for this new light which had brought out into the open so many arcana of Nature buried in the long night of centuries.²²⁰ The mutations of insects in particular had for about

²¹⁴ *Historia insectorum*, pp. 20-21.

The first edition of Goedart's *Metamorphosis naturalis*, in Dutch, was in 1659-60. It appeared in Latin in 1662 and 1668, in English in 1682; in Latin at London, with notes by Lister of the Royal Society, in 1685.

²¹⁵ *Hist. insect.*, p. 161.

²¹⁶ *Ibid.*, p. 13.

²¹⁷ *Ibid.*, p. 155.

²¹⁸ *Ibid.*, pp. 4, 157.

²¹⁹ *Ibid.*, p. 156.

²²⁰ *Ibid.*, p. 128.

two thousand years since Aristotle lain buried in the deepest night of ignorance.²²¹ He extended this criticism to his immediate predecessors. What else than mere names of insects were contained in their books? Aside from nomenclature, only wanton ingenuity and vain imagining. From this censure, however, he would exempt "most industrious Goedart, who faithfully described and depicted the mutations of caterpillars," also "most accurate Redi," who disproved spontaneous generation, and some learned Englishmen.²²² Even Harvey had erred in following Aristotle in calling the chrysalis a "perfect egg."²²³ Moffett had corrected Aristotle on this point but committed other errors.²²⁴ Aldrovandi depicted 118 species of butterflies; Moffett, 86; Hoefnagel, fifty; Goedart, 77 nocturnal moths. But what did they contribute to the science of entomology?²²⁵

The way in which Swammerdam compensates for the loss of magic by stressing "the marvelous mutations of insects"²²⁶ and the wonders of the works of God should be even further emphasized. It is true that in one or two passages he says that the vulgar marvel at the change of the caterpillar into the butterfly, because of their ignorance of the true nature of the nymph or chrysalis or aurelia, but that it is in reality no more wonderful than the budding and flowering of plants.²²⁷ But he goes on to speak of seeing all the parts of the future animalcule in the nymph as "indeed marvelous," and noted by no one before to his knowledge. And the little parts are neatly folded up in a marvelous manner. Nature indeed was never more mirific than in the mutation of butterflies. "We show the revered majesty of wisest Nature from afar and initiate" our readers into "its mysteries." Their variety of structure is marvelous and ineffable; their beauty, wonderful.²²⁸ One must recognize the hand of God, when one sees all conspiring in so great harmony, though based on such slight foundations,

²²¹ *Ibid.*, p. 161.

²²² *Ibid.*, p. 87. Elsewhere, as we have seen, he criticizes Goedart, who did not know the true nature of chrysalis and nymph, and said that the feet of the caterpillar were translocated in the mutation: *ibid.*, 14, 38, 47.

²²³ *Ibid.*, pp. 15, 29-30.

²²⁴ *Ibid.*, pp. 9, 27.

²²⁵ *Ibid.*, p. 112.

²²⁶ *Ibid.*, p. 4.

²²⁷ *Ibid.*, pp. 6, 22.

²²⁸ *Ibid.*, pp. 8, 78, 113, 116.

that it escapes all acumen of the human intellect.²²⁹ But there is no metamorphosis to substantiate the resurrection of the dead, which exceeds the laws of nature, or the transmutation of metals.²³⁰

In his grouping of insects in four orders or species, although there were some which he could not so place,²³¹ Swammerdam "laid the foundations of modern insect classification."²³² In abandoning the distinction between perfect and imperfect animals and insisting on the essential unity of all animal life, and on resemblance between plants and animals, he made an advance toward the theory of evolution. Towards it he took another important step in substituting gradual mutation for the notion of miraculous metamorphosis of insects. But he would have been as pained to find his fond dream of an all-directing divine intelligence replaced by Darwinian survival of the fittest as he was at the Epicurean explanation of natural phenomena by the chance concourse of atoms. But this man who had banished magic from botany soon turned from science to religious mysticism, and, in the latter years of his brief life, became the follower of an hysterical female fanatic.

²²⁹ *Ibid.*, p. 23.

²³⁰ *Ibid.*, pp. 23-24.

²³¹ *Ibid.*, p. 143, "Recensio quorundam insectorum quae ad nullum ordinem potuimus referre." He had listed twelve insects in the first order; 16, 39 and 17 respectively in the other three.

²³² Erik Nordenskiöld, *The History of Biology*, 1929, p. 169. On the following page Nordenskiöld says that Swammerdam's preformation theory

"entirely supplanted Harvey's theory of epigenesis." But Swammerdam uses the word, epigenesis, in connection with both his third and fourth orders: *Hist. insect.*, p. 88, "Tertius ordo naturalium mutationum aut lenti per epigenesim membrorum in insectis incrementi"; p. 121, "Quartus ordo naturalium mutationum seu lenti membrorum incrementi facti per epigenesim in insectis."

CHAPTER XXV

BOTANY

Slight progress in the first half of the century: works of 1625, Cesi, Franckenius, C. Bauhin, Forget—Signatures and virtues of herbs; problems of classification—Parkinson's *Theatrum Botanicum*—The Ambrosini brothers—Simon Paulli—Botanical gardens—Helvetius, Merret, local flora, and Rolfinck—Grew and Malpighi on the anatomy of plants—John Ray—Ammann and Zanoni on the gardens of Leipzig and Bologna—Mariotte and Dedu on the chemistry of plants—*Hortus Indicus Malabaricus*—Munting on the herb, *britannica*—Tilingius and Petri—Morison—Trionfetti and Hermann on gardens of Rome and Leyden—König, Rivinus and Plukenet—Plumier on American plants and cochineal—Tournefort—Baker's summary.

It is certain that, from the first origins of magic, herbs were forced to serve in incantations

—THOMASIVS

For about two thousand years little or no light has been shed on botany

—Acta eruditorum

In volumes five and six we saw that overdrawn and exaggerated accounts of botanical progress in the sixteenth century had been given because of insufficient acquaintance with writings of the previous centuries. It is less necessary to stress the fact that the seventeenth century made little advance in that field over its immediate predecessor until its second half, when the works of Malpighi and of Grew and Ray were of outstanding excellence and set new standards of methods of procedure. But these were not at once lived up to and followed by most other writers in that field. But first we have to note some specimens of works on plants in the earlier years of the century.

Johann Popp, Poppe or Poppius, author also of works of medicine and iatrochemistry, in 1625 published in German an Herbal in which plants of Germany were related to their signatures of celestial

influence and to their particular planets.¹ In the same year Tobia Aldini issued at Rome a description of the botanical garden of Cardinal Odoardo Farnese;² Giuseppe degli Aromatari, at Venice, on the generation of plants from seed; Domenico Vigna, at Pisa, *Animadversions on Theophrastus on plants*.

Despite such annual publication,³ of which this is a single case, Federigo Cesi, founder of the Accademia dei Lincei, deplored the lack of real study of botany in his *Tabulae Phytosophicae*,⁴ published posthumously in the year of his death, 1630, as noted in our previous chapter. His Tables are charts or outlines of words and topics, which still cite Pliny and include "some mysteries of ancient superstition," herbs' hieroglyphical bearing, their virtues and the moral lessons to be learned therefrom.⁵ He notes that the name of a plant not infrequently indicates some peculiar property that it possesses.⁶ He also still listed spontaneous generation as well as that from the seed of the plant and believed in a close relation between the celestial bodies and plants.⁷

Of thirteen works listed in the bibliography of Mollerus under the name of Joannes Franckenius (1590–1661), professor of medicine at the University of Upsala, three are on subjects which today would be regarded as superstitious:⁸ namely, signatures of herbs, the corpse bleeding in the presence of the murderer, and the efficacious influence of the stars upon this earth.⁹ Three others are alchemical; three, anatomical; one, on the origin of

¹ *Kräuter Buch, darinnen die Kräuter des Teutschen Landes... nach rechter Art der Signaturen der himmlischen Einfließung... beschrieben, auch... angezeigt wird unter welchen Planeten... ein jedes Kraut stehe*, Leipzig, 1625, in-8. BM 988.a.6; 988.h.4 (1.).

² *Exactissima descriptio rariorum quarundam plantarum quae continentur Romae in horto Farnesiano*, Rome, Mascardi, 1625, in-fol. minori.

³ See P. A. Saccardo, *La botanica in Italia*, in *Memorie del Reale Istituto Veneto di Scienze, Lettere ed Arti*, XXV, 4 (1895); XXVI, 6 (1901).

⁴ Ed. of Rome, 1904, p. 66.

⁵ *Ibid.*, pp. 35, 50, 39.

⁶ *Ibid.*, p. 56.

⁷ *Ibid.*, Tabula 6; also 14, "Caelum seu aspectus et influxus syderum"; and 15, "Superiorum mutatione inferiora quoque mutari par est."

⁸ Mollerus, *Seccia literata*, 1698, pp. 122–23.

⁹ *De signaturis herbarum idiomate Germanico*, Rostochii, 1618, in-4; *De innocenti occisorum corporum sanguine qui ad praesentiam sicarii et homicidae ubertim ex vulnere profluit et exstillat*, Upsala, 1624; *De siderum coelestium in sublunaria corpora influxu vi et efficacia*, Upsala, 1626.

forms; three, botanical. These comprise a dissertation on the virtues of tobacco, a Mirror of Botany giving the names of herbs in Latin and Swedish, and a *Botanologia*. The last was not printed until 1877.¹⁰ It was unknown through the eighteenth century and Linnaeus never saw it, although he called Franckenius the first Swedish botanist of note.¹¹ Today it is the only work by Franckenius to be found in the Bibliothèque Nationale of Paris,¹² while only it and the Mirror of Botany appear in the printed catalogue of the British Museum.

If any reader thinks that this late publication of the *Botanologia* is a sign that the reading public of the seventeenth century was more interested in alchemy, signatures, occult relationship and astrology than it was in botany, he may be right. It should be said, however, that Franckenius does not describe the particular plants¹³ but merely gives their medical effects. If, on the other hand, the reader assumes that the *Botanologia* is free from the superstitious attitude characteristic of the other three treatises, he is very much mistaken. The nineteenth-century editor of Franckenius, it is true, says that "he called in doubt or would not affirm for certain various obscure and superstitious therapeutic opinions."¹⁴ But of this I could see little or no indication. But when the editor continues, "Still, it is not to be denied that he labored with many and great therapeutic and pharmacological errors of his age,"¹⁵ he is stating it mildly, as a few concrete examples will serve to show.

It is true that I did not see much evidence of belief in signatures of herbs, although it is stated that plants differ "according to natal friendship or enmity."¹⁶ But Franckenius had already treated of

¹⁰ *Joh. Franckenii Botanologia nunc primum edita a R. F. Fristedt*, Upsala, 1877, in-4, 140 pp., vol. IX of *Nova Acta regiae societatis scientiarum Upsaliensis ad celebranda sollemnia quadringenaria universitatis Upsaliensis*.

¹¹ *Ibid.*, pp. 5-7.

¹² BN R.5031 (10 bis).

¹³ He does devote a few preliminary pages (*Op. cit.*, p. 14 *et seq.*) to "Botanologia de plantis in genere earumque

partibus et differentiis," dated in the MS, "1640, 21 Aprilis," and made up of questions and answers: What is a plant? What are shoots (*surculi*)? and so on. But with p. 23 begins, "De viribus et facultatibus plantarum." Pars II, "De arboribus, fruticibus et suffruticibus," opens at p. 125.

¹⁴ *Op. cit.*, p. 13.

¹⁵ *Idem*.

¹⁶ *Ibid.*, p. 21.

that subject in 1618. In the present work instances are many of ligatures and suspensions. Tragus writes that he has often seen cataracts and spots in the eye removed from both men and horses by merely wearing the root of *Alcea* about the neck.¹⁷ Garlic, held in the palm of the hand, cures toothache. Lonicerus asserts, and a professor at Rostock proved experimentally, that the herb *Anagallis* held in the hand checks flow of blood.¹⁸ It is more cautiously stated that some believe that *Bursa pastoris* has a similar "miraculous" effect.¹⁹ Durante says that the root of *Corona solis*, suspended from the neck, wards off apoplexy.²⁰ Aconite, which warms and dries in the fourth degree, is so poisonous that, if its root is held in the hand until it warms, it will kill the holder.²¹

Other curious information is to the effect that dogs die, if they drink the water in which roots of asparagus have been cooked.²² *Daucus* warms and dries in the third degree. Its seed taken with wine provokes the menstrua, is a violent diuretic, and removes the stone. It quiets stomach-ache, heals spider bites, and softens a chronic cough. The root has the same virtue, it may be a little weaker; used with wine, it cures venomous bites and stings.²³ Those persons who are to be burned or cut up feel no pain, if they drink mandrake juice made by boiling the root in wine down to a third and then purifying it.²⁴

The botanical activity of Jean Bauhin (1541-1613) and Gaspard Bauhin (1560-1624) belongs primarily to the sixteenth century. But we may note that the *Pinax* of the latter, published in the next to last year of his life, omitted the medical virtues of herbs and abandoned alphabetical arrangement for one in twelve main classes and numerous subordinate groups.²⁵ In other fields than

¹⁷ *Ibid.*, p. 27.

¹⁸ *Ibid.*, p. 31. There is nothing of this sort in the authorities quoted by Rufinus in the thirteenth century: see my *The Herbal of Rufinus*, 1945, p. 24. Adam Lonicerus or Lonitzer lived 1528-1586.

¹⁹ *Botanologia*, p. 46. Again nothing of the sort in Rufinus, pp. 63-64.

²⁰ *Botanologia*, p. 59. The *Herbario nuovo* of Castore Durante, first pub-

lished at Rome, 1585, had further editions at Venice in 1602, 1607, 1617, 1636, 1667 and 1684.

²¹ *Botanologia*, p. 95. Again not paralleled in Rufinus.

²² *Ibid.*, p. 38.

²³ *Ibid.*, p. 62.

²⁴ *Ibid.*, p. 90.

²⁵ *Pinax theatri botanici*, Basel, 1623, in-4, 522 pp. BN S.3564. In the preface he states that Galen started

his particular specialty, however, he shared the interest of his contemporaries in the abnormal. Ten years previous, as we have seen, he had published a volume on the bezoar stone, oriental and occidental, and in 1614 a yet longer volume on the nature of hermaphrodites and monstrous births.²⁶

The doctrine of signatures of herbs was attacked by Jean Forget of Lorraine in a work printed at Nancy in 1633.²⁷

The *Theatrum Botanicum* of John Parkinson, London apothecary and royal botanist, printed in London in 1640, is a huge folio volume of 1755 double-columned pages. Although written in English and abundantly illustrated with pictures of the herbs, the text is largely a compilation, especially from classical authors such as Pliny, Dioscorides and Galen, and sixteenth century botanists like Tragus, Lobel, Dodoens, Clusius and Pena. Arabic writers are much less frequently cited and then usually generically, while reference to medieval Latin writers, such as Arnald of Villanova, are very rare. Occasionally there is homely native information, such as that feeding on broom rape makes kine the sooner desire the bull, or that "Country men doe often give their Cattell that are troubled with coughes the broth of the hearbe (mullein) to drink with good successe," and that its leaves slightly bruised wonderfully heal in a short time the hooves of horses that have been pricked in shoeing them.²⁸ Knowledge of contemporary conditions elsewhere is also shown, as in the statement that the physicians of Padua and Naples regard juice of sumach or myrtles as a better substitute for acacia than that of sloes, or the remark that in the Near East horse-chestnuts are given to horses for coughing, shortness of wind, and the like.²⁹

The arrangement in seventeen classes or "Tribes" is: first, sweet-

him studying botany 45 years ago, and that he has taught it and anatomy for 30 years, with monthly botanical excursions in spring, summer and autumn instead of semi-annual ones. His Catalogue of Plants around Basel was printed in 1622: in-8, 113 pp.: BN S. 13646.

²⁶ *De hermaphroditum monstrorumque partium natura...*, 1614, in-8, 594 pp.: BN Th⁷³.9.

²⁷ *Artis signatae designata fallacia; de vanitate artis phytognomicae sive de vanitate signaturarum plantarum.*

²⁸ *Theatrum botanicum*, pp. 233, 63.

²⁹ *Ibid.*, pp. 1033-34, 1402.

smelling herbs; then purging herbs; third, those that are poisonous, narcotic and harmful and those which are antidotes to poisons. There follow those that break the stone, that consolidate wounds, and that are cooling, or hot and sharp. Then come umbellifers, thistles and thorny plants, ferns, legumes, cereals; grass, reeds and rushes; those that grow in swamps, sea and other waters; moss and fungi. The fifteenth class is of plants not already covered; the sixteenth covers trees and shrubs; the last includes exotic and outlandish vegetation, and some other drugs such as amber, *bitumen Judaicum*, *bolus Armenius*, bezoar stone, and *mumia*.

As this classification shows, stress is laid upon the medicinal properties of plants. The account of each herb regularly concludes with a paragraph upon its virtues, which are apt to extend to a number of diseases, although sometimes it is said that no medicinal properties are known. There is an index to these virtues, which lists twenty cases where herbs draw out splinters, thorns and fragments of broken bones; eighteen, to remove warts; a dozen, to strengthen the memory; eight, to cause mirth; six, to restore lost speech; and three, to preserve youthfulness. But references to diuretic herbs number over two hundred and those to gout more than a hundred. Magic virtues other than medical are almost never mentioned. Ruellius is quoted as saying that a viper or adder cannot move away after it has been touched with a beech rod, and it is stated that it is easy to kill a mad dog with a hazel stick.³⁰ But the divining rod is not noted. Parkinson fears that predicting from the insects found in oak galls is a pagan practice, and he regards as superstitious not allowing the mistletoe to touch the ground when one plucks it, and its use as an amulet against witchcraft, epilepsy and apoplexy.³¹ Bauhin's assertion that he was an eye-witness to finding coals under the roots of mugwort (*artemisia*) on St. John's Day and that they were an amulet against epilepsy is characterized as "foppery" and an imposture.³² But sage aids the memory and is good against the pest. The Italians say that eating it with a little salt on a fasting stomach preserves one from the bite of any venomous beast, and Boccaccio tells of

³⁰ *Ibid.*, pp. 1403, 1416.

³² *Ibid.*, p. 92.

³¹ *Ibid.*, pp. 1392, 1394.

two lovers who were killed by eating the leaves of a sage plant under which a toad had lived. To avoid such a possibility one should plant rue near the sage or drink their juices together.³³

John Ray (1627–1705) said that Parkinson, like Gerard earlier (1545–1612), only increased the reader's perplexities by his attempted classification.³⁴ Ray further complained that both Gerard and Parkinson were "wholly uncritical in their use of earlier books."³⁵ Parkinson's volume, however, is a useful, if not always dependable, work of reference, especially for the English names of plants then.

Of Bartholomaeus Ambrosinus or Bartolomeo Ambrosini (1588–1657), professor of medicinal simples at the University of Bologna and prefect of the botanical garden and the natural history museum, we had occasion to speak a number of times in our fifth and sixth volumes as editor of the posthumous works of Aldrovandi on serpents and dragons, monsters and metals. These appeared in 1640, 1642 and 1648 respectively. Before these, in 1630, he had published a minor treatise of his own entitled, *Panacea ex herbis quae a Sanctis denominantur*. Its thirty-five chapters are devoted to as many herbs with saintly names. He identifies these with other names for them and sometimes briefly describes them. What he says of their medicinal virtues to justify the title, *Panacea*, is all second-hand information and much of it from writers of the sixteenth century. Fuchs and Forest are cited that the herb of St. Simeon or Alcea, worn suspended from the neck, sharpens and protects the sight, and that vervain, thus suspended, cured a splitting headache when all other remedies failed. The doctrine of signatures in plants is tacitly accepted when Porta is quoted as to the close resemblance between the pod of the geranium and rhinoceros horn. The latter has been shown by recent experiment to detect and overcome poison, and therefore a bit of it is often held in one's mouth in order to resist pestilential vapors. Faith in compound medicines is shown to the extent of asking why, if physicians today use one herb in their plasters to dissipate tumors, they do not add other plants and roots with similar properties

³³ *Ibid.*, p. 54.

³⁴ C. E. Raven, *John Ray*, 1942,

p. 156.

³⁵ *Ibid.*, p. 77.

and so reach the desired result with the greater efficacy? In the chapter on the herb of St. Robert, Clusius is cited as to a sixth species of geranium curing headache, for Slavonic women prepare a decoction of it in running water, wash the aching part of the head in the decoction, and then apply the herb to it. But their then throwing the herb back into the running water is censured as superstitious.³⁶ This, too, however, is repeated from Clusius.

With the *Panacea* was published a brief tract by the same author on capsicum, in which five kinds of the yellow variety and twenty-five of the red are distinguished.³⁷ Also bound with the *Panacea* in the copy that I used was a later tract by Pitorio on the question whether the opobalsamum or *succus balsami*, which was brought to Rome from Venice and which the pharmacists Manfredus and Pafnutius had used in compounding theriac, was genuine.³⁸ Two leading physicians at Rome, Baldus Baldus³⁹ and Petrus Castellus,⁴⁰ by their most erudite writings had stimulated Pitorio to compose his tract, and their arguments are reviewed in his second and third chapters respectively. Pitorio notes that all ancient authors, with the exception of Pausanias, knew only Syrian or Egyptian opobalsamum, but today we have only what is supplied as tribute to the Sultan at Constantinople from Arabia Felix. The juice of balsam differs according to its age not only in odor, color

³⁶ Ambrosini, *Panacea* . . . , Bologna, 1630 (BN S.13492): pp. 25-26, 54, 52, 55, 51.

³⁷ BN S.13493.

³⁸ Peregrino Pitorio, *Opobalsami Romani censura . . . cum appendice contra Castellum pro theriacis Venetis*, Venice, 1642, 62 pp. The Appendix opens at p. 63.

³⁹ Baldo Baldi, *Del vero opobalsamo orientale*, Rome, 1646, is evidently a later work or edition.

⁴⁰ Petrus Castellus, *Balsamum examinatum*, 1640; *Opobalsamum triumphans*, 1640. Works on the subject by other authors were: Michael Döring, *Diatriba de opobalsamo Syriaco Judaico Aegyptiaco . . .*, 1620; Steph. Gasparis, *De opobalsami Romae in*

theriaca adhibiti oppugnatio, 1640; Josephus Donzellius, of Naples, *Liber de opobalsamo. Additio apologetica ad suam de opobalsamo orientali synopsin*, 1640; Franc. Perla, *De balsamo et opobalsamo orientali*, Rome, 1641, in-12; Vesling, *Opobalsami vindiciae*, Padua, 1644; Volckamer, *Opobalsami orientalis in theriaces confectionem Romae revocati examen*, Nürnberg, 1644, in-12.

Prospero Alpino, *De balsamo dialogus*, Venice, 1591, 34 fols., is said to have started an extensive literature on the subject which went on through the seventeenth century.

Pietro Castelli has been treated further in the preceding chapter 24.

and taste, but also in thickness, stickiness and lightness. Pitorio accepts Dioscorides' six distinguishing qualities for the genuine drug and comes to the conclusion that what was brought from Venice was not genuine.

Giacinto Ambrosini, brother of Bartolomeo, held the same positions of prefect of the botanical garden and professor of medicinal simples at Bologna. In the year of his brother's death he published an account of new plants in the garden,⁴¹ and later the first part of a more general work of botany.⁴² Giacinto is said to have died in 1671;⁴³ the last appearance of his name in the rolls of the faculty of Bologna was for the academic year, 1671-72.⁴⁴

Simon Pauli or Paulli (1603-1680), professor of medicine at the University of Copenhagen and eventually first royal physician of Denmark, published *Icones florae Danicae* at Copenhagen in 1647, and *Viridaria varia* in 1653. His *Quadripartitum botanicum* had previously appeared at Rostock in 1639. Gui Patin, in a letter of September 15, 1665, said that Paulli was dedicating a treatise on the abuse of tobacco to him.⁴⁵ The *Quadripartitum botanicum*, as printed at Strasburg in 1667, contains letters of Patin to Paulli. The work is more pharmaceutical than it is botanical, since Paulli refers the reader to Bauhin for synonyms and descriptions of plants and concerns himself only with their medical virtues, based partly on his own experience and especially concerned as before with the herbs of Denmark and Norway. The arrangement is by the four seasons of the year in which the plants grow, and under each season alphabetically, so that there is no progress in classification. Two or three examples may be given of the medical virtues. *Gramen ossifragum* (bone-breaking grass or herb), eaten by a beast, makes its sinews and tendons relax so that it cannot move. To turn a dapple-gray horse black, feed it in the spring a handful or

⁴¹ Hyacinthus Ambrosinus, *Hortus studiosorum Bononiae consitus: novarum plantarum hactenus non sculptarum historia*, Bologna, 1657, in-4, 103 pp.: BM 450.g.7.

⁴² *Phytologiae; hoc est, de plantis, partis primae tomus primus. In quo herbarum nostro seculo descriptarum*

nomina, aequivoca synonyma, ac etymologiae investigantur. Bologna, 1666, in-fol., 576 pp.: BM 34.f.3.

⁴³ Tiraboschi (1824), VIII, 433; Fantuzzi, *Scrittori bologn.*, I, 219 et seq.; 227 et seq.

⁴⁴ Dallari, *I rotuli*, III, i, 56.

⁴⁵ *Lettres* (1846), III, 555.

two of oak galls mixed with its oats.⁴⁶ From Plutarch, *On the Shrewdness of Animals*, is repeated the statement that the virtues of arum do not escape the bear, which eats wild arum as a purge when first it leaves its cave after a winter of hibernation.⁴⁷

On the other hand, in a number of respects Paulli shows himself to be critical, sceptical, and wary of superstitious practices. He says that in thirty-six years of medical practice he has hardly used an ounce of bezoar stone.⁴⁸ His Index lists a number of passages against *chimici*.⁴⁹ He attacks the doctrine of signatures.⁵⁰ He is sceptical as to the efficacy of the peony as an amulet against epilepsy,⁵¹ although this usage had been hallowed by Galen. Forest told of successful use of vervain as an amulet in the case of a fanciful and melancholic patient who thought herself bewitched, but Paulli is sceptical as to this too.⁵² He condemns the planting of sprouting herbs on St. John's Eve as superstitious, or to believe that an herb will rout a demon.⁵³ But he had earlier quoted such a belief without criticism, and he later quotes a statement that a certain herb prevents the fascination of infants. But again, later on, he says that this is full of superstition.⁵⁴ He found by personal investigation that there was no stone in a spider, and doubted if there were any in a toad.⁵⁵ But he did not reject occult virtues.⁵⁶ Of forty-seven virtues which were enumerated for betony, the 28th was "against horrors."⁵⁷ Of the healing power of *galega*, "among other experiments" was the duel between lizard and viper, in

⁴⁶ JS II, 374-77.

⁴⁷ *Quadripartitum botanicum*, edition of 1640, III, 28. In this edition the sections on winter and spring plants are paginated from 1 to 80, for summer from 1 to 184, and for autumn from 1 to 19. In citing, however, I use I for winter, II for spring, III for summer, and IV for autumn.

⁴⁸ *Quadripartitum botanicum*, 1667, p. 16. Not in the 1640 edition.

⁴⁹ The word does not appear in the Index of the 1640 edition.

⁵⁰ Ed. of 1640, I, 2; ed. of 1667, p. 402.

⁵¹ Ed. of 1667, pp. 106-7. In II (1640), 55, its efficacy as an amulet against epilepsy is not questioned, but carrying it on a ship to calm storms is called superstitious.

⁵² Ed. of 1667, pp. 510-11. In III (1640), 181, no scepticism is expressed.

⁵³ Ed. of 1667, pp. 114, 128. I could find only the second passage in the edition of 1640, at III, 102.

⁵⁴ Ed. of 1667, pp. 37, 502, 543.

⁵⁵ *Ibid.*, p. 163.

⁵⁶ *Ibid.*, p. 221, concerning Gentian; see also III (1640), 92 and 36.

⁵⁷ Ed. of 1667, pp. 220-22. III (1640), 35.

which the lizard, when quite exhausted and wounded by the viper, is seen to retreat and acquire new strength by eating that herb.⁵⁸

The *Quadripartitum botanicum*, as originally published at Rostock in 1639, and again in 1640,⁵⁹ was little more than a compilation from previous writers without the personal expressions of dissent and criticism which are added in the 1667 edition, as has been indicated in some of the foregoing footnotes.

Catalogues of botanical gardens kept appearing. That for Bologna in 1657 has already been mentioned. Next year Olaus Rudbekius published one for the University of Upsala.⁶⁰ Denis Joncquet, head of the royal Jardin des Plantes in Paris, composed an index of the plants which were cultivated there in 1658–1659, in the form of an alphabetical list with a line or so of text for each herb.⁶¹

Johann Friedrich Helvetius, physician to the Prince of Orange, not only listed herbs for each month from January to September, and according as they had one or more leaves, thick and very damp leaves, umbels, spines, and so on,⁶² but also according to their signatures and relation to different parts of the human body,⁶³ and to the seven planets.⁶⁴ In his later *Microscopium physiognomiae medicum* he not only paralleled the sixteenth century works of Porta on physiognomy but also Porta's *Phytognomonica* with reference to the signatures of plants.⁶⁵

Christopher Merret, M.D. (1614–1695), a member of the Royal Medical College of London and the first custodian of the Harveian Museum, may be called a naturalist upon a small and secondary

⁵⁸ Ed. of 1667, p. 312: taken from Forest (1522–1595), 2 *de falso urinarum judicio*, cap. 5, p. 156. III (1640), 90.

⁵⁹ I have examined a copy of this edition from the Surgeon General's Library: A.123438. The index is almost exclusively for diseases.

⁶⁰ *Catalogus plantarum in horto Academiae Upsaliensis ab ipso primum anno 1657 instructo*, Upsala, 1658, in-8.

⁶¹ *Hortus sive index plantarum*, Paris, 1659, in-4: BN S.4029.

⁶² *Berillus medicus. Ein Edelgestein der Artzeney*, Heidelberg, 1661, 89 pp. BM 1141.b.19.(3.).

⁶³ *Xistus herbarum. Lustiger Spatzierung der Kräuter*, Heidelberg, 1661, 89 pp. BM 1141.b.19.(2.).

⁶⁴ *Amphitheatrum physiognomiae medicum*, Heidelberg, 1660, 130 pp. BM 1141.b.19.(1.).

⁶⁵ JS, V, 280.

scale for two reasons. First, because his book is limited to the flora, fauna and minerals of Britain.⁶⁶ Second, because it is a mere handy check-list referring one to other works and not embodying his own investigation or familiarity with nature. More than two-thirds of the book is devoted to vegetation.⁶⁷ The first 126 pages are an alphabetical list of plants and trees, giving only a line or two to each with references to Gerard⁶⁸ and Parkinson⁶⁹ and a statement of the place where the plant is found. For example:

Acer maius, the great Maple, G. 1484. *Acer majus latifol.* *Sycomorus falso dictum* P 142S. *iuxta aedes nobilium.*

The plants are then classified, an alphabetical list given of their English names with Latin equivalents, a *Synopsis omnium classium*, an etymological Synopsis, and a statement of the time when the plants begin to flower. Similar but much briefer lists of quadrupeds, birds, fish, zoophytes, snakes (only three), and metals found in Britain follow.⁷⁰

Merret dedicated his little book to Baldwin Hamsey, fellow, treasurer and benefactor of the Medical College. Harvey too enriched it with his books and surgical instruments, the Marquess of Dorchester gave one hundred pounds to purchase books, John Selden presented his Arabic manuscripts, and among other donors was Elias Ashmole. Particular mention is made of Hamsey's gift of "a most elegant unicorn"—presumably the supposed horn of that animal, valued for its reputed medical properties—to present to Charles II at the time of his Restoration.

Despite this bit of erroneous zoology and medicine, Merret opens his introductory *Epistola ad lectorem*, which runs to twenty unnumbered pages, with a long tirade against medical quacks and pseudo-alchemists. These *falsarii chymici* promised to dispel the

⁶⁶ *Pinax rerum naturalium Britannicarum continens vegetabilia animalia et fossilia in hac insula reperta*, London, 1667, 8vo. Copy used: BN S. 14111. This volume once belonged to Daniel Huet (1630-1721), the learned bishop of Avranches.

⁶⁷ 165 out of 224 pages of text.

⁶⁸ John Gerard, *The Herbal or*

General History of Plants, London, 1597. *Bibliotheca Curiosa* (1676), 210, lists a later edition of 1633. Or, 1632, enlarged by Thomas Johnson, mentioned below.

⁶⁹ John Parkinson, *Theatrum Botanicum*, London, 1640.

⁷⁰ At pp. 166-, 170-, 184-, 194-, 208.

plague of 1666 but failed. Merret also takes credit unto himself for having omitted some two hundred plants, not found by himself and other experts but communicated by friends or authors of dubious faith. He lists a number of previous works on the flora of localities: Gesner on Mt. Pilatus, Baldus on the region about Verona, Caspar Bauhin's catalogue of plants growing near Basel, Schoenfelt *de stirpibus et fossilibus Silesiae*, Thomas Johnson, a London pharmacist, on the vegetation of Hampstead Heath and his trips to Kent in 1632 and 1634,⁷¹ Dr. How's *Phytologia Britannica*, 1650, and Dr. Wray (i.e., John Ray) of Trinity College, Cambridge, on Cambridgeshire. For quadrupeds Merret used Gesner, Aldrovandi, Jonston and sometimes Turnebus; for insects, Moffett. But Merret's own *Pinax* was to be stigmatized by Ray as "bungling."⁷²

Werner Rolfinck in 1670⁷³ still believed in stupendous effects produced by plants in the bodies of animals. What more marvelous than that the leaves of a certain tree turn into fish, if they fall into the river, but, if they drop on the land, become birds and fly away? Then there is the lamb plant of Tartary of which Scaliger tells and which grows from a seed like that of a melon. It bears a fruit resembling a lamb which sheds blood and feeds on the surrounding herbs until they are consumed, when it wastes away and, what is more wonderful, is sought by wolves but not by other carnivorous animals. There are talking and oracular trees, nor are instances of occult sympathy wanting in vegetables which agree and disagree with one another in marvelous ways. Rolfinck twice repeats Mattioli's story of a criminal condemned to be hanged at Venice who possessed an herb which opened doors for his thefts, but the second time says that this is impossible by the natural virtues of plants. Without knowing the virtues of herbs no one can tell whether to believe witches who claim to work their marvels naturally without pact express or tacit with demons. One old-wife

⁷¹ "1632 ed. plantas in Ericato Hamstediano crescentes, postea vero quas investigavit in itinere suo in agrum Cantianum ad eam rem suscepto anno 1632 et anno 1634." See his *Mercurius Botanicus*, London, Thom.

Cotes, 1634.

⁷² Raven, *John Ray*, 1942, pp. 78, 143, etc.

⁷³ *De vegetabilibus plantis suffruticibus fruticibus arboribus in genere libri duo*, Jena, 1670, in-4; BN S.4082.

who had cured incurable diseases for many years finally confessed on the rack that she used herbs only as a matter of form. "After mature deliberation she was burned." Plants alter the human body by both manifest and occult qualities, but the doctrine of signatures has its limitations, although it is not to be wholly rejected. The chemists tell of palingenesis of vegetables from their ashes, but Rolfinck does not accept it.⁷⁴

Rolfinck attempts to classify plants and to differentiate between them by their parts, size, qualities and final cause or use. He tells of Jacob Horst arranging his Herbal by the months in which the plants appeared, beginning with March and devoting the sixth and last book to August and the remaining months. Simon Pauli followed a similar method.⁷⁵ Rolfinck also gives valuable lists of the prefects past and present of botanical gardens, illustrating the development of that means of research.⁷⁶

In the decade of the 1670's, Grew and Malpighi, by their works on the anatomy of plants,⁷⁷ in which they studied their structure and growth, marked a new departure in botany, which before had dealt chiefly with externals. To their contemporaries it seemed that nothing was now lacking for perfect knowledge of plants.⁷⁸ But as a consequence of this self-satisfied attitude, little further progress was made with respect to plant anatomy during the remainder of the century, or indeed until the nineteenth century, the botanists of the eighteenth century being largely occupied with the problem of classification.

The writings of both Grew and Malpighi are free from magical lore as to plants, although in one place Grew speaks of "infinite occurrences and secret intrigues" in the vegetable kingdom, and elsewhere personifies nature, or asserts that theology is the be-

⁷⁴ *Ibid.*, pp. 12, 22, 24, 27, 45, 198, 205-10, 95.

⁷⁵ *Ibid.*, p. 215.

⁷⁶ *Ibid.*, pp. 132-40.

⁷⁷ Malpighi sent the first part of his *Anatomy of Plants* to the Royal Society in 1671, and the second part in 1674, with permission to print the whole. Grew's *The Anatomy of Vegetables Begun* was printed in 1671, and

other parts soon followed, the whole being reprinted together in 1682 as *The Anatomy of Plants with an Idea of a Philosophical History of Plants and Several Other Lectures Read Before the Royal Society*, Col D581.7 G868. I have consulted Malpighi's text in his *Opera omnia*, London, 1686, Col 610. M291.

⁷⁸ JS IV (1676), 12.

ginning and end of philosophy.⁷⁹ He distinguished lunar plants which twine with the moon from solar plants which twine with the sun.⁸⁰ His treatment is in the order of seed, root, trunk, bud, branch and leaf, flower, fruit, and of the seed in its state of generation. It is admittedly influenced by animal anatomy and by chemistry, and is followed by papers on mixture, on experiments with menstrooms on the parts of animals, on lixivial salts and essential and marine salts in plants, on the colors of plants, tastes in plants, and experiments of solution of salts in water. Grew realized the importance of air vessels in plants, and the effect of the air upon the colors of flowers. Malpighi treated first of the cortex, then of the bud, leaves and flowers, then of the generation of seeds and vegetation of seeds, of galls, tumors and excrescences, hairs and spines, tendrils, plants which grow in others, and roots. In the works of both men the accompanying plates are a very important feature. Indeed, they offered suggestions as to the structure of plants whose significance was grasped only after the promulgation of the cell theory in the nineteenth century. Their contemporaries, including the members of the Royal Society, were more interested in discovering a circulation of sap in plants and trees analogous to that of the blood in the bodies of animals.

Careful observation of plants, first in the immediate neighborhood of Cambridge, then in other parts of England, and in three years of travel on the continent, enabled John Ray (1627-1705) to detect many errors of previous writers, and to attempt to arrive at a better notion of what constitutes a species and at an improved method of classification, based upon flowers and seeds, and distinguishing monocotyledons and dicotyledons. He attacked the doctrine of signatures and complained that many authors accepted "fancied potencies or resemblances as in the world of magic or demonology."⁸¹ For example, he rejected as incredible the assertions that pennyroyal, when dried, would flower at mid-

⁷⁹ *The Anatomy of Plants*, 1682, p. 81; dedication to Charles II, "Yet not I but Nature speaketh these things"; and p. 79.

⁸⁰ Louis C. Miall, *The Early Naturalists*, 1912, p. 173.

⁸¹ *Catalogus Cantab.*, 1660, pp. 148-50, Appendix, 36-83: cited by C. E. Raven, *John Ray*, 1942, pp. 98-99.

winter, and that the body of a black woodpecker, suspended by a string, would shed its old feathers and grow new ones in spring. He did not believe that the plucking of herbs should be regulated by the moon or by the planets.⁸² When the second volume of his general history of plants, in which he was to describe some 18,600 varieties, appeared in 1698,⁸³ the *Journal des Sçavans*⁸⁴ hailed him as "the most tireless writer" in that field "who has appeared in this century," and his method as the most exact and convenient as yet devised. He often cited Boyle, Sydenham, Hulse⁸⁵ and Ettmuller, but it was surprising that a non-medical author should select the virtues of herbs so well and reject many superstitions.

Many of Ray's contemporaries continued to be interested chiefly in outlandish and monstrous plants, or in attempting to ally botany with chemistry and to explain the generation and growth of plants in chemical terms. Belief in the doctrine of signatures, in spontaneous generation, in sympathies and antipathies, and even more patent traces of magic still persisted in the botanical literature of the closing century.

Out of seven Observations as to Things Chinese which Andreas Muller published in 1674, the fourth dealt with the herb Gniseng, which was supposed to restore decayed bodies and for which the Chinese would give three times its weight in silver, while the fifth was about a notable conjunction of the planets in the time of Noah's flood.⁸⁶

The *Supellex botanica* which Paul Ammann published in 1675 was an enumeration of plants in the medical garden of the university and others in the vicinity of Leipzig.⁸⁷ In the preface he

⁸² *Ibid.*, p. 159.

⁸³ The first volume came out in 1686, the third in 1704, the year before Ray's death.

⁸⁴ JS XVII, 10-12.

⁸⁵ Edward Hulse, M.D. (1631-1711) was one of Ray's correspondents, and the Appendix to Ray's *Catalogus plantarum Angliae*, London, 1670, contains observations by Hulse.

⁸⁶ Andreas Muller, *Hebdomas Observationum de rebus Sinicis*, Colo-

niae Brandenburgicae, 1674; reviewed PT XII, 919-20.

⁸⁷ *Supellex botanica hoc est enumeratio plantarum quae non solum in horto medic. Acad. Lipsiensis sed in aliis circa urbem viridariis pratis ac sylvis... progerminare solent*, Leipzig, 1675, in-8. Copy used: BN Te¹⁴³. 5. The work was reviewed in JS VII (1679), 36. Ammann also published *Hortus Bosianus*, Leipzig, 1686.

emphasizes the importance of inspecting herbs in order to identify the same plant under different names in previous authors. He has had ten years of experience at Leipzig, but at the same time acknowledges the help he has received from the books of Bauhin, Montalbani, Joncquet, Robert Morison, and Paolo Boccone. His text runs to 137 pages, but usually there is a single line to an herb, many of the names being mere cross references. Following the *Supellex* is a treatise on materia medica of which we treat in the next chapter on pharmacy.

Giacomo Zanoni, head of the public garden at Bologna, described 110 plants listed in alphabetical order, some of which were mentioned by Dioscorides and Pliny, while others came from the New World, India and Crete, and most of them were now in the public garden at Bologna.⁸⁸ They included the true *chrisocome* of Dioscorides, a plant hitherto unknown to moderns, and what was the *miagro* of the ancients according to some moderns, Arabic *miagro* improperly called rose of Jericho, and a third *miagro* of Sumatra.⁸⁹ Some statements were based on Zanoni's own experience, as when he said that neither perfect animals nor insects would eat the *erismo* of Dioscorides.⁹⁰ Although the work is primarily descriptive, medicinal virtues are occasionally mentioned, and an aura of the marvelous still hovers about Zanoni's botany. *Falangio ramoso Virginiano* has virtues against snake-bite and other ailments. *Verbena confoglia d'ortica* of Canada possesses marvelous virtue against worms. "Among the more marvelous plants of the most marvelous nature" is mimosa, which not merely grows like other plants but has sense, shrinking from one's touch. Indeed, it has a great antipathy for man, and the least bit of a powder of its leaves taken in food or drink kills.⁹¹ Zanoni more than once cites Robert Morison's catalogue of additions to the garden at Blois.

The reviewer of Zanoni's book in the *Journal des Sçavans* took especial note of the sensitive plant, of the plant in Peru with such an antipathy to man that it disappeared entirely at human touch or

⁸⁸ *Istoria botanica*, Bologna, 1675, in-fol., 211 pp. and 80 full page plates. BM 449.k.9.

⁸⁹ *Ibid.*, pp. 69, 134, 138, 142.

⁹⁰ *Ibid.*, pp. 84-85.

⁹¹ *Ibid.*, pp. 92, 204, 144, 148.

approach, and the *totavari* of Malabar whose odor kept the human body motionless.⁹²

Edme Mariotte of the Académie des Sciences attempted to determine the chemical constituents of plants in the laboratory. But since all plants were subject to the same nourishment, he held that even poisonous herbs differed from others only in structure, pores and filtration,—in the combination of the corpuscles which were common to all.⁹³ Useful and injurious plants could not be distinguished by color, odor, taste, observation of their structure, or chemical analysis, but only as a result of observation and experience. "Chemistry can give no light to make known what the causes are of the particular effects of each plant."⁹⁴ Some chemists believed in a very subtle universal spirit, but Mariotte preferred to suppose a fixed basic salt, to which different spirits gave specific individual characteristics. He rejected the view that the seed of each plant not only contained the future plant in miniature but also all the others that would follow during the world's duration. He held that plants might be generated from corpuscles in the air, water or earth.

Doctor Dedu of the medical faculty of Montpellier undertook to explain the soul, birth, nutrition and growth of plants in the terms of only two kinds of atoms, namely, acids and alkalis, of which the former were sharp and pointed.⁹⁵

The interest in the monstrous not only applied to human and other animal births but was extended to the vegetable kingdom, as a review of the first volume of the monumental *Hortus Indicus Malabaricus* will serve to illustrate.⁹⁶ The work is said to be

⁹² JS VII (1679), 64-65.

⁹³ *Essais de physique, ou Memoires pour servir à la science des choses naturelles. Premier Essay de la vegetation des plantes . . .*, Paris, 1676, in-12. JS VII (1679), 258-62. I have read the work itself in a Paris, 1923, edition (*Les maitres de la pensée scientifique*).

⁹⁴ *Ibid.*, p. 112.

⁹⁵ *De l'ame des plantes, de leur naissance, de leur nourriture et de*

leur progresz, Paris, 1682, in-12. JS X (1682), 337-40. *Acta eruditorum*, II (1683), 492-93.

⁹⁶ PT XIII, 100-109, reviewing first the first volume of Amsterdam, 1678; then at p. 104, *Pars secunda*, 1679; and at p. 106, *Pars tertia*, 1682. The entire work was in 12 folio vols., Amsterdam, 1678-1703, under the direction of Hendrik van Rheede edited by Johannes Cassearius.

intended "not only to please the curious with those Monsters of vegetables, . . . but to help mankind by their excellent virtues." Soon we hear of a palm leaf thirty feet long and nine feet broad, and then of the tree *carva*, from whose roots is extracted camphor; from the bark, oil of cinnamon; from the leaves, oil of cloves; from the fruit, an oil like that of juniper, and a wax-like substance employed in plasters, unguents, candles etc.

In 1681 Abraham Munting, M.D. and professor of botany at Groningen, published his rediscovery of the ancient herb *britannica*, mentioned by Pliny as used by the Roman soldiers in Frisia against scurvy, lost knowledge of after the Danish invasions of the eighth century, but which deserved to be called the panacea not of Frisia merely but also Belgium.⁹⁷ In a treatise of the previous year Munting exclaimed at the stupendous play of nature in the multiple generation of things including monsters.⁹⁸ Munting's work on the herb *britannica* made more of a sensation at the time than might have been expected. Baker in 1700, after speaking of transplantation of disease and blood transfusion, continued:

The retrieving the ancient *Britannica* has made no less noise, Muntingius has writ a book upon it, and we were made to hope for a specific against the scurvy.⁹⁹

Apparently the notice that Munting's treatise received was due partly to antiquarian interest in classical herbs and partly to practical medical interest in a cure for scurvy.

Munting had published a book on the culture of plants in 1672 which was reprinted in 1682, and his *Curious Description of Plants* appeared posthumously in 1696.¹⁰⁰ He repeated their virtues from previous authorities, but added some practical horticultural instructions. After three years the vertical root of nut-trees should be cut off up to the lateral roots, the wound covered with wax, and the tree replanted under a waning moon. Against insect pests a handful each of rue, absinth and Virginian tobacco or two hand-

⁹⁷ *De vera antiquorum herba Britannica*, Amsterdam, 1681, in-4, BM 450. g.10.(1.); Paschius (1700), 431.

⁹⁸ *Aloidarum . . . historia*, 1680, p. 3, opening sentence. BM 450.g.10.(2.).

⁹⁹ *Reflections upon Learning*, 1700, p. 180.

¹⁰⁰ *Naauwkeurige Beschryving der Aardgewassen*; reviewed in *Acta eruditorum*, XVI (1697), 546-48.

fuls of tobacco alone should be cooked half an hour in a pot full of rain water, and the trees sprinkled with it through a sieve two or three times. Or they might be sprinkled with rain water, in which, while it stood in the sun, dove dung or sheep dung and a little nitre had been dissolved—and also sprayed with powder of tobacco. Or plants that seemed sick might be restored to health by being bathed in milk mixed with an equal amount of rain water.

The publication, by members of the German Academy of the Curious as to Nature, of books on particular animals, of which we took notice in the previous chapter, was carried into the field of botany by a book on the white lily by Matthias Tilingius, M.D., professor at the University of Hesse-Schaumburg at Rinteln, *archiater* in Hesse, and whose sobriquet in the Academy was Zephyr.¹⁰¹ He devoted four chapters to the etymology, synonyms, homonyms and paronyms of that flower, and a dozen to Biblical references to it. But his chief concern was with its marvelous nature and essence, ineffable virtues, and many arcana both spiritual and natural, which were set forth "according to the laws and method of the Academy of the Curious as to Nature." More than half of the volume was devoted to medicines in which it was an ingredient, and diseases and ailments which it would cure.¹⁰² A *Rhabarbarologia*, which Tilingius published the next year,¹⁰³ was presumably another book of the same type. So was a volume by Georg Christoph Petri on the herb, *carduus benedictus*,¹⁰⁴ which in one copy is appropriately bound with Paullini's book on the toad. Petri examined the signatures of this herb, noted that the pseudo-Apuleius assigned magic virtue to it, and gave arcana of it against the pest and quartan fever.¹⁰⁵

Robert Morison (1620–1683) was praised in *Acta eruditorum*¹⁰⁶

¹⁰¹ *Lilium curiosum seu accurata Lilii albi descriptio*, Frankfurt-am-Main, 1683, 576 pp. BM 957.i.23.

¹⁰² *Ibid.*, pp. 226–59, 260–576.

¹⁰³ Also at Frankfurt-am-Main, in-4. BM 462.c.19.

¹⁰⁴ *Asylum languentium seu Carduus sanctus vulgo benedictus, medi-*

cina patrumfamilias polychresta verusque pauperum thesaurus. Ad normam et formam Academiae Naturae Curiosorum elaboratus, Lipsiae, 1698, 250 pp. BN S.14414. LR, Jena, 1669.

¹⁰⁵ *Ibid.*, pp. 33 et seq., 239, 193, 211.

¹⁰⁶ IV (1685), 229.

not merely for having corrected Caspar Bauhin in his *Hortus Blesensis*¹⁰⁷ and *Historia Oxoniensis*,¹⁰⁸ but for having devised a new and genuine method of classifying plants, not by signatures or seasons of the year or natural place or leaves, or qualities such as taste and odor, or roots, but from flowers and fructification. After his untimely death from being thrown from a carriage, his classification was continued by Paul Ammann in an enlarged edition, in 1685,¹⁰⁹ of a work first published in 1676.¹¹⁰

When Giorgio dalla Torre, professor and prefect of the public garden at Padua, issued his *Historia plantarum* in 1685, he was criticized in *Acta eruditorum*¹¹¹ for relying too much on Theophrastus and Dioscorides and not having read Morison.

Studies of plants in given localities were continued in 1683 by that of Jan Commelin on those indigenous to Holland.¹¹²

Giovanni Battista Trionfetti, professor in the papal university at Rome and head of the botanical garden, denied that everything came from an egg and regarded such vegetation as mosses and fungi as spontaneously generated. He also believed in the metamorphosis of plants. But he described a number of plants for the first time.¹¹³

When the Catalogue of Plants in the garden of the University of Leyden by Paul Hermann came out in 1687, his name was coupled with those of Zanoni, Syenius, Morison, Munting, Breynius,¹¹⁴

¹⁰⁷ *Hortus regius Blesensis sive praeludia botanica*, London, 1669, in-8.

¹⁰⁸ *Plantarum umbelliferarum distributio nova per tabulas cognationis et affinitatis ex libro naturae observata et detecta*, Oxon., 1672, in-fol. and *Plantarum historiae universalis Oxoniensis pars secunda*, 1680.

¹⁰⁹ *Character plantarum naturalis a fine ultimo videlicet fructificatione desumptus ac... per canones et exempla digestus*, Francof. et Lipsiae, 1685, in-12.

¹¹⁰ BM 972.a.11.(2.). Lipsiae, 1676, in-8, 44 pp.

¹¹¹ V (1686), 86-87; the book was also reviewed in JS XIV, 371-74.

¹¹² *Catalogus plantarum indigenarum Hollandiae cui praemissa Lamb. Bidloo diss. de re herbaria*, Amsterdam, 1683, in-12. BM 449.a.31.

¹¹³ J. B. Trionfetti, *Observationes de ortu ac vegetatione plantarum cum novarum stirpium historia iconibus illustrata*, Rome, 1685, in-4. 3 copies in BM. Reviewed in *Acta eruditorum*, V (1686), 217-19.

¹¹⁴ Jacobus Breynius, *Exoticarum aliarumque minus cognitarum plantarum centuria prima*, Danzig, 1678, in-fol. *Prodromus fasciculi rariorum plantarum anno MDCLXXIX in hortis celeberrimis Hollandiae... observatarum...*, Danzig, 1680, 1685.

Ammann, Dodart,¹¹⁵ Trionfetti and Ray, as having renounced "fatal credulity, vain persuasion, and ridiculous superstition" in the treatment of plants.¹¹⁶ He had also spent some years in the Indies, and was hailed as *facile princeps* of the botanists "of our time." In the revised edition of 1690, he divided plants into those whose seeds were uncovered and those in which they were contained in capsules.¹¹⁷

The *Regnum vegetabile* of Emanuel König was published at Basel in 1688. It denied that plants were nourished by water alone and held that saline and nitrous ingredients were also required. It discussed the diseases of vegetation and compared the circulation of the sap with that of the blood in man. It approved of the signatures of plants to a limited extent, but argued that their occult virtues could be explained in terms of figure, magnitude, motion and rest. It further treated, however, of the magnetism or sympathy and antipathy of plants, of the transplantation of diseases from human beings to trees and herbs, and of remedies against witchcraft and incantations.¹¹⁸

Between 1690 and 1699 appeared in five parts the work of Augustus Quirinus Rivinus of Leipzig (1652–1723) in which he classified plants according to the number of petals in the flower.¹¹⁹ This method was rejected by Tournefort on the ground that not all flowers consisted of petals and that the number of petals was not the same in all species of the same genus.

The Phytographic Tables of Leonard Plukenet, printed in 1691,¹²⁰ were praised by *Philosophical Transactions* as a work

which, without flattery, may deserve the name of a performance to the improvement of so great a part of the universal history of nature as hath not been done by the whole complex of precedent ages.¹²¹

His *Almagestum botanicum* of 1696 was an alphabetical diction-

¹¹⁵ Denis Dodart, *Memoires pour servir à l'histoire des plantes*, Paris, 1676.

¹¹⁶ *Acta eruditorum*, VI (1687), 245.

¹¹⁷ *Ibid.*, X, 217–20.

¹¹⁸ Caps. 5, 8, 14, 34, 44, 49, 50, 52. *Acta eruditorum*, VIII (1689), 339–44.

¹¹⁹ *Introductio generalis in rem herbariam. Ordo plantarum quae sunt flore irregulari monopetalo* . . . etc.

¹²⁰ *Phytographia*, London, 1691, in-fol. BN S.780.

¹²¹ PT XIX, 434.

ary of six thousand plants, of which five hundred were new, with seventy copper plates. But not one of the following herbs from the thirteenth century Herbal of Rufinus¹²² was included: *aucha*, *aucheta*, *auricula leporis*, *aurigea duplex*, *bismalva*, *bruscus*, *bursa pastoris*, *caulicus agrestis*, *canusula*, *cicer imperatoris*, *cinoglossa*, *cottula fetida*, *daucus asininus*, *genuissa*, *mellumcelli*, *paradella*. But a tree-sorrel from the Canaries was identical with the magicians' moon-wood of the Arabians recorded by Lobel.¹²³

The Description of American Plants by the monk, Charles Plumier,¹²⁴ was the outcome of two voyages to the Antilles and two years spent there. The book contained life-size engravings of about six hundred plants. Each was described briefly, and the recognized varieties were grouped in three classes. In the first were ferns, polypody, hemionites, hartshorn and maiden's hair. In the second were arum, dragon's wort and a new genus, *saururus*, of herbs which resembled the tail of a lizard. In the third class were plants that twine about trees. Medical properties were given in some instances. *Arum montanum* was sovereign against the bites of venomous animals. Mountain calamint was very caustic. Father Plumier had hardly tasted it, when his mouth became so inflamed that he could not speak for almost two hours. Oxycrat lessened the inflammation, but had such an acrimonious effect upon his tongue and palate that he could not taste anything he ate for more than ten days.¹²⁵ A Latin edition appeared at Amsterdam in 1755-1760; meanwhile *Nova plantarum Americanorum genera* appeared at Paris in 1703, while in a manuscript of the early eighteenth century in the British Museum is an English translation.¹²⁶

Although Father Plumier had informed Pierre Pomet that cochineal was an insect, the latter in his *Histoire générale des drogues* preferred the statement of a merchant of San Domingo that it was the seed of a plant. Plumier justified his view in a long communi-

¹²² *The Herbal of Rufinus*, edited from the unique manuscript by Lynn Thorndike, assisted by Francis S. Benjamin, Jr.

¹²³ PT XIX, 435.

¹²⁴ *Description des plantes de l'A-*

merique avec leurs figures, Paris, 1693, in-fol.

¹²⁵ JS XXI, 486-89.

¹²⁶ Sloane MS 2337, fols. 1-118, "from the Latin printed at Paris, 1693" (sic).

cation to the *Journal des Sçavans*.¹²⁷ Hartsoecker, after examination with a microscope, declared that cochineal was an insect and often contained red eggs.¹²⁸ But he further contended that human semen contained a tiny human being already formed.¹²⁹

Tournefort was accused of merely translating and abridging the History of Plants of John Ray, in his *Elemens de botanique* of 1694, but Chomel in the *Journal des Sçavans* of May 27, 1697, held that he had adopted a classification of his own by the flowers and fruit.¹³⁰ In substituting a number of single names of his own invention for binomials in common use, he was hardly contributing, except perhaps negatively, to the evolution of the Linnaean system.

Thomas Baker, writing at the close of the century, admitted that botanical information had been "mightily enlarged" by the discovery of the East and West Indies, that "our Herbals are sufficiently stored with plants," and that progress had been made in classifying them and describing them by their marks and signatures. But he complained that their virtues were not yet known.¹³¹ Thus he appears still to hold the semi-magical doctrines of signatures and of occult virtues.

¹²⁷ JS XXII, 312-25.

¹²⁸ *Essay de dioptrique*, Paris, 1694, in-4, chap. 4.

¹²⁹ JS XXIII, 103.

¹³⁰ JS XXV, 378-81. His attempted classification is dealt with more fully in *Acta eruditorum*, XIV, 509-12.

¹³¹ *Reflections upon Learning*, 1700, 2nd ed., pp. 182-83.

CHAPTER XXVI

PHARMACY

Order of treatment—Mylius, Potier, Mynsicht—Freitag and Borrichius on opium—Gui Patin on pharmacopoeias—Alaymus and Auda—Schröder's Pharmacopoeia—Occult virtues: Wollimhaus, Puteanus, J. M. Faber—Moebius on camphor—Criticism and correction: Matthaeus, Zwelfer, Ludovici, T. Bartholinus and Grube—Bolnest—Willis—Ammann—Walter Harris—Theriac—Pharmacopoeias of the nineties—Robert Pitt—Apothecaries in Burgundy.

... explosis absurditatibus, contradictionibus et superstitionibus passim in Herbariis occurrentibus

—MATTHAEUS

The Pharmacopoeias of the seventeenth century, especially those which combined Paracelsan with Galenic drugs and procedure, were still tinged with the occult and magical. We shall illustrate this in most detail from the 1672 edition of the work of Schröder, which first appeared in 1641. But we shall lead up to this by briefer treatment of several earlier examples of this type of literature. Then we shall trace the criticism of such works, which became more marked in the latter half of the century. Incidentally there will be included one or two examples of treatises on particular drugs or compound medicines, such as opium and theriac.

Hoefer ascribed to Johann Daniel Mylius of Wetterau in Hesse a *Pharmacopoea nova de mysteriis medico-chimicis* at Frankfurt in 1618,¹ which I have not found noted elsewhere. But in 1620 Mylius published a Reformed Medical-Chemical *Antidotarium*² in four books devoted respectively to general requisites in pharmacy, some exotic remedies omitted in his *Basilicae* of 1618, of which we have treated in Chapter VI on Alchemy to 1650, precepts Galenic

¹ *Hist. de la chimie*, II, 335.

Jennisium, 1620. BM 1032.1.5. LR

² *Antidotarium medico-chymicum reformatum*, Francof. apud Lucam

568.

and chemical as to the preparation of medicines, and to resolving the forms and dividing the medicaments both of Galenists and chemists. This work was reprinted in 1638.³ Meanwhile Mylius in 1628 had published another *Pharmacopoea*, "secret and universal."⁴

Pierre Potier (1581?–1640?) of Anjou⁵ is said to have been expelled from the medical faculty of Paris in 1609 for making use of antimony.⁶ He went to Italy and in 1622 published at Bologna *Pharmacopoea spagirica nova et inedita*, which had quite a currency, being reprinted at Cologne in 1624, again at Bologna in 1635, and, after his death, with his collected works in 1645 at Lyon, and at Frankfurt in 1653, 1666 and 1698.⁷ In this last edition the *Pharmacopoea Spagyrica*, as it is there spelled, opens with a chapter on more secret preparations of medicines.⁸

Pierre Potier was somewhat given to astrological medicine as well as to iatrochemistry and spagyric pharmacy. His pharmaceutical work closes with a specific for the stomach, concerning which it is said:

Let it be illumined by the splendor of the Sun, by whose influence not only will its darkness be removed, but also, by benefit of its heat, the compacted matter is attenuated and truly fermented. From the other planets it equally receives influences and is made more specific.⁹

³ Francof. apud Clem. Schleichium, 1638, in-4.

⁴ *Pharmacopoea Spagyrico-Medica sive Practica Galeno-Chymica arcana et universalis*, Francof. apud Joh. Gottofr. Schönwetterum, 2 vols., 1628-1629, in-8.

⁵ Zedler, 28, 1869.

⁶ George Urdang, *Zur Geschichte der Metalle in den amtlichen deutschen Arzneibüchern*, Diss. at Halle-Wittenberg, 1933, 138 pp., p. 45, quoting Zedler, article on Antimonium, which refers to *Hoffmanni Paralip. Offic.* p. 550. But the article on Potier in Zedler states that he went to Italy when scarcely twenty years old.

⁷ I have used the last edition. It differs from that of 1645 in not con-

taining the alchemical tracts, *De salium extractione et praeparatione in genere*; *De magisteriis*; and *De quinta essentia*, whereas it opens with three Centuries of his medical cures and observations: *Petri Poterii Opera omnia practica et chymica cum annotationibus et additamentis... Friderici Hoffmanni filii. Accessit nova doctrina De febribus ex principiis mechanicis solide deducta*, Frankfurt, 1698.

This claim of Hoffmann's later tract on fevers to novelty and solid deduction from mechanical principles seemed largely titular, being scarcely borne out by the text.

⁸ It was listed as a separate treatise in the edition of 1645.

⁹ *Opera* (1698), p. 722.

In his medical Centuries he states that workers are less liable than other men to catarrh and fluxions, and are less sensitive to weather changes and vicissitudes of the moon and other stars.¹⁰

Inventa Chymica by Petrus Poterius of Anjou or *Manes Poteriani* were published late in the century by Johann Christoph Etner¹¹ and include various specifics and balsams.

We pass over here the Cologne Pharmacopoeia by Petrus Holtzemius of Deventer.¹²

One of the most frequently reprinted works of chemical pharmacy was the *Thesaurus* of Adrian Mynsicht (1603–1638), an M.D. of Helmstedt who became physician to the duke of Mecklenburg and others and was made imperial poet laureate in 1631, the same year in which the first edition of his *Thesaurus* or *Armentarium Medico-Chymicum*, as it was then entitled, appeared at Hamburg. It purported to reveal to the “sons of doctrine and wisdom” a most secret way of compounding drugs based on his own experience and practice. Mercklin in *Lindenius renovatus*, 1686, p. 387, already listed nine editions, including two at Lyons not mentioned by Ferguson but omitting that of Frankfurt, 1658, which Ferguson notes, while I have found noted an edition of Lyons, 1640, by Antonius Huguetan earlier than that of 1645 mentioned by Mercklin. In 1682 the work was translated into both German and English, the latter by the astrologer Partridge. Other Latin editions continued to appear at Venice, 1696, and into the next century (1701, 1707, Hanau, 1726). With the *Thesaurus* was usually printed the poetical Testament of Hadrian concerning the philosophers’ stone. It also was published separately, as at Venice in 1676. Back in 1635 in the *Musaeum Hermeticum Reformatum*, under the pseudonym Henricus Madathanus, Mynsicht had published *Aureum seculum redivivum*, and it reappeared in the 1677 edition of the *Musaeum*. For what follows I have used the edition of Rouen, 1651,¹³ but

¹⁰ *Ibid.*, p. 5.

¹¹ In BN R.7016 Etner’s signature at the close is dated November 12, 1689. There are other editions of 1692, BM 1033.e.18.(4.) and 1696; Ferguson, I, 258.

¹² *Pharmacopoea sive Dispensato-*

rium Coloniense . . . , Cologne, 1627. BN Fol. Te150.126, BM 547.k.17.

¹³ Hadrianus Mynsicht, *Thesaurus et Armentarium medico-chymicum in quo . . . pharmacorum conficiendorum secretissima ratio aperitur*, Rouen, 1651, in-8, 490 pp. BM 1034.e.17.

its undated preface to the reader is evidently reproduced from the second edition of Lübeck, 1638.

In this preface Mynsicht says that, when he first published the work some years ago, he gave the reasons why he thought that he ought not to hide the Arcana which by God's grace, ingenious sagacity, art, labor and continual practice he had succeeded in discovering. Now he adds a richer harvest of new compositions, not, it is true, utterly unknown to Hippocrates, Galen and Paracelsus, but adapted to our own times, regions—especially lower Saxony and the Baltic basin, men, and new diseases unknown to the ancients but required in this declining age of the world. The medicines of the ancients were probably suitable for the constellations under which they lived, but new ones are now needed, especially for the northern regions mentioned. Also Mynsicht substitutes for nasty, violent medicaments those which the patients will gladly take, because suave, jocund, and in small doses. And he has added new secrets to those of the first edition. He maintains the same tone in the text, introducing the first chemical medicament, Mineral Unicorn, as "This glorious and arcane medicine," which,

because of the unworthy and ungrateful sons of the world was hidden and involved in darkness, lest Spagyric gems seem cast before swine. But I willed from Christian affection and divine prompting to publish it along with other mysteries which I either received from the light of nature and of grace or my own experience or the kindness of other Spagyrists.

Each prescription that he gives is good for a great number of ailments. Emetic of tartar is efficacious primarily against melancholy, mania, insanity, delirium . . . , epilepsy, apoplexy, fascinations, philters, poisoned draughts, and all ills induced by incantations. So is tincture of hypericon, while fetid plaster is an experiment stupendous and as it were dropped from heaven for every type of sorcery.¹⁴ In his index are listed thirteen cures each for mania, for hypochondria, and for weak memory and intellect, ten for frenzy, thirty-two for apoplexy, and thirty-four for melancholy.

¹⁴ *Ibid.*, pp. 16, 57, 451.

Certain pills of his benefit all head ailments, strengthen the sight, preserve mental vigor, repair lost hearing. They are good in hypochondriac melancholy and other melancholy afflictions, for cancer, elephantiasis, quartan fever, jaundice. They are of especial worth against all obstructions of spleen and liver, purify the blood, gently purge the stomach from flatulence and humors, and preserve all the internal members from putridity.¹⁵ His Magnanimous Confection has eleven lines of ingredients.¹⁶

In a treatise on the nature of opium, dedicated to the local Estates of Groningen and Oomland, John Freitag, M.D. and professor in the University of Groningen, ascribed its narcotic effects not to occult quality but to its extreme coldness, and held that they were best corrected by hot remedies. Opium was not a poison, and wholesome remedies could be made from it, if properly prepared, for almost all bodily ills. He even went so far as to "communicate candidly outstanding and not-to-be-revealed arcana" of his own for fevers of every sort and the pest itself.¹⁷

Half a century later Olaus Borrichius held that, while opium was hot *per se* by reason of its oily parts, it was very cold in its effects. He would therefore, in administering it for medical purposes, not mix it with such drugs as bezoar stone or diaphoretic antimony, but with the hottest remedies in order to tone down its chilling properties.¹⁸

Gui Patin, in a letter of January 18, 1633, said that the apothecaries of Paris used the *Pharmacopée* of Brice Bauderon (1540–1623) of Mâcon, which was first printed in 1588 at Lyon and ran through more than a dozen editions,¹⁹ or the *Dispensatorium Ga-*

¹⁵ *Ibid.*, pp. 132–33, *Pillulae aloephanginae nostrae*.

¹⁶ *Ibid.*, p. 211. At pp. 193–202, sectio xii, *De marmaladis*, Mynsicht does not explain the word, which I failed to find in the indices of works of Locques and Zwelfer. Sectio xv is "*De Lohoch seu eclegmatis*."

¹⁷ *De opii natura et medicamentis opiatibus hactenus inexplicatis utendi methodo cui de nova phthisim curandi ratione consilium et diversae consulta-*

tiones medicinales, Groningae, 1632, in-8, 241 pp. Copy used: BN 8° Te¹⁵¹. 876.

¹⁸ *De somno et somniferis maxime papaveris dissertatio*, Francof., 1681, in-4; JS XI (1684), 150–53.

¹⁹ Patin, *Lettres* (1907), 61. There was a Latin translation by Philemon Holland, a Spanish one by Juan of Castile, and a German version by Olaus Sudenus.

leno-chimicum of Renodaeus.²⁰ But he preferred *Le médecin charitable*, "teaching the way to make and prepare at home with ease and slight expense the remedies proper to all diseases according to the advice *du médecin ordinaire*," of which the seventeenth edition had recently appeared²¹ with a treatise by himself on the conservation of health. The book had a hundred editions within a few years.²² Patin, however, was rather opposed to polypharmacy.

Marcus Antonius Alaymus of Sicily affirmed that "new and wonderful arcana of nature" were included in his work on medications which might be substituted for others. It was published at Palermo in 1637.²³

The Brief Compendium of Marvelous Secrets, written by Domenico Auda, head of the Hospital of San Spirito at Rome,²⁴ was first published in 1655, as stated in our Chapter XXI. It includes a very fine remedy against the pest tested at Nice in Provence in 1631; a powder of the duke of Acqua Sparta; a miraculous powder for the sight; one for the gravel, of the duke of Ferrara, tested at San Spirito; a marvelous remedy and one easy to compound to kill worms in the teeth; an unguent of frogs; an oil, marvelous and proven, for wounds; a water called *Noli me tangere* for *formica* and cancer; a marvelous powder for stomach-ache from Pierre Potier's *Basilica chimica*; a marvelous pectoral syrup of Lobel; to keep the hair from turning white; for the bite of a mad dog; and imperial pills of Paul III.²⁵

The author, discussing *l'arte della Speciarìa*, tells us that, after spending eleven years in various parts of France, Lombardy and Italy, he came to the pharmacy of the Hospital of San Spirito. Its apothecary, the Reverend Fra Hippolito Mancini, besides being most learned in medicine, surgery and pharmacy, was an oracle of the chemical art and an outstanding botanist. Auda in two years

²⁰ Jean de Renou, Paris, 1608; French translation in 1637.

²¹ Paris, Jean Jost, 1632, in-8. Patin warns that some editions are "imparfaites et contrefaites."

²² Patin, *Lettres* (1907), 62.

²³ For the full title, L.R., p. 774a.

²⁴ *Breve compendio di maravigliosi secreti utili e necessari ad ogni qualità di persone approvati con felice successo nelle indispositioni corporali*... I have used the edition of Venice, 1668, 301 pp. BN Te¹⁸.87.

²⁵ *Ibid.*, pp. 4-5, 11, 24, 32, 34, 51, 55, 62, 68, 71, 77, 104.

learned from him 1500 simples and the greater part of the chemistry contained in this Compendium.²⁶ Then he became a Franciscan, but after twenty-two years Alexander VII (1655–1667) by apostolic letter ordered him to leave that Order and enter that of San Spirito in order to become head of its Archiospedale.



The *Pharmacopoeia medico-chymica* of Johann Schröder (1600–1664), municipal physician at Frankfurt-am-Main, was first printed at Ulm in 1641, again in 1649, 1655 and 1662, then at Frankfurt in 1669 and 1679. In the Leyden, 1672, edition which I have used, the new editors, J. D. Horst and J. L. Wizel, in a preface of 1668, state that the work has, since its first appearance twenty-seven years ago, been printed many times in and outside of Germany. The volume of 672 pages, exclusive of appendix and elaborate indexes, divides into five books. The first is introductory; the second is concerned with the apothecary shop and has 87 chapters on such topics as waters, cortices, flowers, fungi, clysters, confections, electuaries, pills, potions, tinctures and trochees. The third, fourth and fifth books deal with the mineral, vegetable and animal kingdoms respectively. Belief in sympathy and antipathy, the doctrine of signatures, and the employment of amulets, run through the book.

The ninth chapter of the first book is on the influence of the stars which throw off "effluvia endowed with peculiar faculties." Plato and Paracelsus thought of each species on earth as under its particular star. For each planet, beginning with the sun, are given its properties and a list of minerals, vegetables and animals which are under its domination. A similar procedure follows for the twelve signs of the zodiac except that the simples related to them are now classed by the four degrees rather than the three kingdoms of nature. At the close of the chapter the author is somewhat apologetic, admitting that such matters are not fully known. But he concludes that, inasmuch as there can be no doubt of the existence of friendship and enmity between celestial and sublunar bodies, it is permissible to repeat the series collected by previous writers. In

²⁶ Its third part, pp. 155-208, is "Di secreti chimici di varie sorti."

later chapters on the time to collect simples, after quoting Paracelsus that there is a balsamic time to collect herbs—in certain months, under certain aspects of the moon, and at certain hours of the day, he gives various astrological tables on such matters as the houses and exaltations of the planets or puteal degrees, and we are offered such information as that the wise men of India divided each sign into nine parts. The concluding chapter of the introductory book is on the investigation of occult qualities, and the best way to get at them seems to be by signatures.

In the concluding chapter of the second book on balsams, liniments and unguents the twenty-seventh and penultimate item is the Sympathetic Unguent, for which Croll's recipe is given. It consists of four ounces of aged wild boar fat and four of bear fat, boiled half an hour in red wine, then poured on cold water and the fat collected which floats on the surface. Then one adds a powder of earthworms which have first been washed, the brain of a boar, red sandal wood, *mumia*, *haematites* (ours differs from that of the ancients, a later chapter, III, 9, informs us), each an ounce, with one dram of scrapings from the cranium of a man violently slain. This last is to be gathered under a waxing moon in a good astrological house, with Venus, if possible, certainly not Mars or Saturn, in conjunction. Unless a nerve or artery has been severed, this concoction is guaranteed to cure any wound, provided the weapon which inflicted the wound is anointed with it. This weapon should be kept in pure linen and in a place which is not too hot, or the patient may suffer injury. Caution should further be taken that no dust gets on it and that it is not in a cold wind, or the patient will be sore afflicted. If the wound has been made with the point of a sword, the sword should be anointed downward to the tip. If the weapon is not to be had, a stick dipped in the blood from the wound may do. The healing is worked by identity of balsam or spirit thereof in the patient and the blood. A similar influence is felt when a brother catches the plague from his brother who has it, although he may be far away. In a later chapter Croll is cited for magnetic cure of toothache by rubbing the aching tooth with the dried herb *Prunella* and then sealing up the latter in a hollow willow branch.

In a brief chapter (III, 5) on gems only eight are listed: *chrysolithos*, *granatus*, *hyacinthus*, *lapis nephriticus*, ruby, sapphire, sard and emerald, but occult medical properties are credited to them, such as the sapphire cleaning the eye and the emerald stopping flux of blood and dysentery. "It is especially recommended among amulets for epilepsy," and binding it to the thigh hastens childbirth, while placing it on the belly prevents it. They say that experiment sometimes shows that it breaks, if worn during sexual intercourse. But in addition to the chapter on gems there are others on coral, pearls, and "less precious stones," including the eagle-stone (*aetites*) and the magnet, which last is treated briefly. That the lynx stone is produced from the urine of the lynx is dismissed as a fable. Antimony is treated at greater length than gold or even mercury. Quercetanus attributed six hundred properties to it.

In the case of plants, as of stones, Schröder does not personally vouch for all that he repeats. Some believe that ashwood cut on John the Baptist's day heals wounds and contusions by mere rubbing. Some cut it before sunrise, others at high noon. Alexander of Tralles makes the root of *hyosciamus* an amulet against gout, if dug when the moon is in Aquarius or Pisces with the bone of some dead animal without touching the root and murmuring an adjuration which Schröder will not repeat as being superstitious. Paracelsus put *Hypericon* among herbs which ward off sorcery (*veneficia*) and specters and advised collecting it under the influence of Mars, Saturn and Venus, but by no means the moon, at dawn, wearing it as an amulet in one's hat or under one's pillow, often smelling of it, scattering it through the house, and hanging it from the walls. Some women comb their hair with oil of almonds and jasmine to make it grow more, but those with a bilious tendency should beware of so doing lest they incur headaches. The Illyrian or Florentine iris is well known to moderns in powders strewn on the hair. There are those who peddle the herb *millefolium* with its flowers as a peculiar secret in preserving from and curing the pest. But Schröder himself names both *galega* and gentian as alexipharmaca against poison and the pest. He also makes such statements without qualification as that the herb *linaria* is put on the abdomen for strangury, and applied externally for pain from

haemorrhoids, or that *matricaria* in cases of suffocation of the womb is applied externally to the nostrils with the sign of the cross.

Finally we may note a few examples of what Schröder says about animals. There is the greatest antipathy between the toad and spiders. Although the toad is a thoroughly base, venomous and abominable animal, it yet has its medical uses both in internal and external application. By most certain experiment it staunches nosebleed. Bound to the umbilicus, it checks hysterical flux, while applied to the soles of the feet it is beneficial for diseases of the head and heart. Schröder thinks, however, that the toad-stone is too big to have been generated in the animal's head. But it avails against pest and poison. Some say that those who wear the stone are safe from poison, and it changes color in presence of a poisoned cup. The toad's spotted body shows by the doctrine of signatures that it will cure spots on the face and the like. Ashes of roast toad suspended from the neck cure incontinence of urine resulting from lacerated neck of the bladder. Even a powder of dried toad will do, but Schröder prefers the carcass reduced to ashes. A salt can be had from calcinated toads and substituted for the powder in cases of dropsy.

A live puppy dog on the belly relieves colic, and a balsam made from whole pups drowned in white wine cures *membra contracta* and arthritic pains. A dog's skull reduced to ashes dries up ulcers and cures tumors of the testicles. Dog grease is hotter than others, and may be given internally for wounds and tuberculosis, externally in such complaints as gout and earache. The gall of a black pup cures epilepsy marvelously, if drunk or taken in a powder with the sign of the cross. Canine blood combats witchcraft and may be drunk against the bite of rabid beasts. The tooth of a dog reduced to ashes helps infants in teething.

Take a male tortoise when the moon is most on the wane before it is in conjunction with the sun. Amputate all its legs while it is alive and bind them in bags of kidskin to the limbs of a sufferer from gout, so that the right leg of the tortoise is on the right leg of the patient, the left leg on the left leg, the front right leg on the right arm, the left on the left. This from the medical *Consilia* of Solenander and the *Observationes* of Schenck (1620), but ultimately

from Rasis and Constantinus Africanus through Baptista Porta.

So the lore of old lived on.

That occult qualities and virtues still played their part in pharmacy and materia medica is further shown by such books as those of Wollimhaus at Upsala in 1646,²⁷ and of Puteanus (Du Puis) at Lyons in 1654.²⁸ Similarly a later treatise on the deadly nightshade attributed its properties not only to its extreme dryness but also to its more occult qualities.²⁹

Meanwhile Gottfried Moebius the Elder devoted 27 chapters and 104 pages, filled with numerous citations and quotations, to the Anatomy of Camphor.³⁰ He began with the etymology of the word, in the eighth chapter finally decided that camphor was of hot rather than cold quality, and in chapter eleven began to list prescriptions.

* . *

Turning now to criticism and correction of pharmaceutical literature, we first go back to consider a work of the early part of the century.

Johannes Matthaeus of Hesse, who had already published other medical works,³¹ appended to his Mirror of Health in 1620 a treatment of the virtues of herbs on a medical basis, exploding the absurdities, contradictions and superstitions which were to be met with everywhere in Herbals.³² He points out disagreement between

²⁷ Joh. Simon Wollinghaus, *De occultis medicamentorum simplicium qualitatibus in genere dissertatio*, Upsala, 1646, in-4: listed by Moller, *Specia literata* (1698), p. 198.

²⁸ Guil. Puteanus, *De occultis pharmacorum purgantium facultatibus*, Lyon, 1654.

²⁹ Joh. Matth. Faber, *Strychnomania explicans strychni manici antiquorum vel solani furiosi recentiorum historiae monumentum, indolis nocumentum, antidoti documentum*, Augsburg, 1677, in-4. Reviewed JS XI (1684), 269-73.

³⁰ *Anatomia camphorae*, Jena, 1660,

in-4: BM 546.g.13 (5.).

³¹ *Centuria difficultatum medicinalium*, 1603; on the baths of Baden, 1606; *Consilia* of various authors, 1608; *De febre pestilenti*, 1620.

³² *Speculum sanitatis. Accessit Hortulus medicus...* (with new pagination and title page and covering pp. 1-23, then at pp. 24-83 in 69 chapters) *Cum annexo examine in quo simplicium quorundam vires et facultates secundum medicinae fundamenta traduntur explosis absurditatibus, contradictionibus et superstitionibus passim in Herbariis occurrentibus*, Francofurti, 1620: BM 1039.e.19.

past authors, mistakes in the identification of the names of plants, or self-contradiction in a single author. Thus Tragus called lily of the valley heating, yet said that a water distilled from it was chilling. He said that myrtle was a food rather than a medicament, yet admitted that it was astringent.³³ Dioscorides and Pliny, Aetius and Paul of Aegina are among the authors criticized, while Tragus, Lonicerus and Tabernaemontanus are said to be "marvelously hallucinated" as to the qualities and virtues of *bistorta*.³⁴

Concerning the properties of the herb, which is now called *basilicum* but the ancients named *ocymum*, there is the greatest disagreement. Galen put it in the second degree of heating; Avicenna reduced it to the class of moistening. Dioscorides said it made the eyes misty; then, forgetting himself, asserted that its juice clarified the sight. The Africans made it malignant, so that if anyone was stung by a scorpion on the day he had eaten it, the sting would be incurable. Chrysippus affirmed it brought on insanity and lethargy; Diodotus ascribed the generation of lice to it. Matthaeus thinks that two herbs have been confused: *ocymum* from the Greek *ὄκυνς*, which is somewhat malignant and almost odorless, and *basilicum* or *ocimum* from *ὄζω* which is redolent and harmless, indeed we find it good for heart and brain.³⁵

One or two examples may be given of what Matthaeus regards as superstitious. The chemists say that pearls are a wonderful cordial because the spirits of the heart are very pure and delight in most lucid and pure pearls. Yet in administering gems, they reduce them to a powder in which they lose all their splendor.³⁶ Which would certainly seem to be an instance of magic logic stretched to the breaking point. Tabernaemontanus advised taking three leaves of the herb *sanguisorba* thrice for tertian fever. The doctrine of signatures seems involved in the opinion of many that the bulbous roots of satyrion are a sexual stimulant. But Capovaccius rightly asserts that they merely move the urine.³⁷

Matthaeus is not entirely magic-proof himself. He still accepts

³³ *Ibid.*, pp. 58, 61.

³⁴ *Ibid.*, p. 39. The writings of Jacob Theodorus, Tabernaemontanus, date from the later sixteenth century, but his *Kräuterbuch* was printed at

Basel as late as 1731.

³⁵ *Ibid.*, pp. 37-38; *ὄκυνς* is not found in Liddell and Scott.

³⁶ *Ibid.*, p. 57.

³⁷ *Ibid.*, pp. 77, 79.

occult qualities and an herb that purges by reason of its peculiar substance.³⁹ Repeated experiment has proved that an emulsion of the seed of *cannabis* causes epilepsy. Indeed, those who handle that herb for the trade often become epileptics. But it is ridiculous for Mattioli to say that this seed makes men impotent, yet causes hens to lay more eggs in winter than summer. "As if," Matthaeus continues, "hens could lay without sexual intercourse, which is the inept persuasion of many women."⁴⁰

Johann Zwelfer (1618–1668) undertook in 1652 to reform the Augsburg Pharmacopoeia,⁴¹ which he says was generally received in Germany by physicians and apothecaries. He had spent sixteen years as a pharmacist himself before going on to study chemistry and medicine, receiving the M.D. degree at Padua and practicing in Vienna. His work was re-issued in 1653 at Gouda and Rotterdam, in 1657 and 1675 at Nürnberg, and in 1672 at Dordrecht. A frequent criticism which he makes of the previous prescriptions is that they are cooked or calcined for so long that they lose their virtue, which goes off in vapor. *Oxymel Helleboratum majus Juliani* would be a panacea, if all that Conrad Gesner says of its immense virtues were true. But it often does no good and sometimes harms the patient. Zwelfer suggests a different way of preparing it, which, however, requires nearly thirty ingredients, adding a few spices, pouring distilled vinegar over them, and many further directions.⁴² As for *pillulae aloephanginae*, which Zwelfer ascribed to Mesue rather than Mynsicht, they contain too large an amount of aromatics compared to their small quantity of aloes; drying them in the sun deprives them of the virtues of the subtler aromatics; and there is no need of washing them so repeatedly in rain water.⁴³

Zwelfer was not opposed to chemical remedies as such, and is said to have invented Solar Diaphoretic Antimony; three varieties of mercury precipitate, namely, yellowish, *per se*, and solar; mer-

³⁹ Cap. 7, De aloë.

⁴⁰ *Ibid.*, pp. 41–42.

⁴¹ *Pharmacopoeia Augustana et eius mantissa cum animadversionibus*, Vienna, 1652, in-fol. I have used *Pharmacopoeia Augustana reforma-*

ta . . . cum animadversionibus J. Zwelferi, Gouda, 1653, in-8: BM 777.b.2. The preface to the reader is dated May 1, 1652 from Vienna.

⁴² *Ibid.*, pp. 136–39.

⁴³ *Ibid.*, p. 194.

cury sublimate, *turpethum minerale*, and *turpethum minerale rubrum*.⁴³

The difficulties and limitations of pharmacy in the seventeenth century are indicated by the counsel, given more than once in medical works, to physicians that they prepare and compound their prescriptions themselves. This was especially true in the case of chemical remedies, as may be illustrated from Zwelfer's Royal Pharmacopoeia of 1668.⁴⁴ He had used with great success against the plague a preparation of Diaphoretic Antimony (*Brechweinstein*, emetic tartar, or tartarized antimony) which he made himself, but had almost perished from taking the same drug as prepared by "a pseudo-chymist." He further disagreed with Tachenius as to the proper way of fixing the volatile salt of vipers, and complained that Tachenius in *Hippocrates chymicus* confused lyes and alkalis with the salts of minerals and animals, and gave the one name of alkali to such salts. François Verney, on the other hand, had criticized Zwelfer's preparation of the Compounded Acid Syrup of Mesue and the Confection of Alkermes. Zwelfer further complained that most so-called oriental bezoars were spurious, since the genuine article was very rare, being derived from a single species of wild goat which was to be found in only one corner of the East Indies.⁴⁵

Friedrich Müller, who in 1661 had produced a *Lexicon medicogaleno-chymico-pharmaceuticum*, in 1673 attacked Zwelfer in A Medical Exorcism of the Manes, Ghosts and Bewitched Spirits of Zwelfer,⁴⁶ but Mynsicht and Zwelfer were more often favorably cited by subsequent pharmacists and iatro-chemists.

Daniel Ludovici or Ludwig (1625–1680) was born at Weimar,

⁴³ Zedler.

⁴⁴ *Pharmacopoeia Regia sive Dispensatorium Novum locupletatum et absolutum cum annexa Mantissa Spagyrica et gemino discursu apologetico contra Ott. Tachenium et Franc. Vernis*, 1668, in-fol.

⁴⁵ PT V, 1176-77.

⁴⁶ *Friderici Mulleri (à Löwenstein) Exorcismus medicus manium larcarum et maleficatorum spirituum Zwelferianorum*, 1673, in-8. I have not seen

this work, which is not found in the printed catalogues of the BM and BN. The author seems a different person from Fridericus Muller, professor at Giessen, who published a treatise on the comet of December 1664-February 1665, divided into three books dealing respectively with its physical, astronomical and astrological side: *Cometologiae libri tres*, Giessen, 1665: Col 523.6 Z2, item 10.

studied under Rolfinck at Jena, and practiced at Gotha, finally becoming ducal body physician there.⁴⁷ In the first of his three dissertations on adapting pharmacy to the present age, which was first printed at Gotha in 1671,⁴⁸ he attacked polypharmacy and the over-elaboration of materia medica, and asserted that he limited his account to those drugs which were available and well known, "not by conjecture but certain experience in each case." What advantage in listing so many exotics, all the vulgar masteries of the animate and marine, minerals and metals, such a series of fixed vegetable salts, and so many electuaries? Why so many equivalents and synonyms, when one handy example would serve for all?⁴⁹

Thomas Bartholinus (1616-1680), professor of anatomy at Copenhagen, in a letter prefixed to the work of Hermann Grube on the way to know the properties of medicinal simples,⁵⁰ commended the use of domestic plants in place of foreign: dock for rhubarb, elder for sena, iris for jalap, gumphry for machoachan, angelica root for cost, fir sap instead of opobalsamum, scordium or penny-royal in place of dictamen of Crete, and walnuts for nutmegs. The book of Grube combined Cartesian principles with the "experiments of sober chemists," and took particles, figures and pores into account. Bartholinus thought the doctrine of signatures in plants of some use, noting that those with salts of like figure seemed to have similar virtues.⁵¹

Grube not only wrote on medicinal simples, but in his *De Arcanis*, four years later, criticized the polypharmacy of his age. Almost every apothecary's apprentice, he said, desired to make a great name for himself by a long series of specifics, heaped together with-

⁴⁷ Gottlieb Stolle, *Anleitung zur Historie der Medicinischen Gelahrtheit*, Jena, 1731, p. 792.

⁴⁸ *De pharmacia moderno seculo applicanda dissertationes tres*: Diss. I de remediorum selectu, selectorum sufficiente praeparatione, ac Myrothecii contractioris constitutione; Diss. II de taxarum moderatione; Diss. III, de privata remediorum dispensatione. There was a second edition in 1685 at Gotha, a third at Amsterdam in

1688, and others at Copenhagen, 1693, and Leipzig, 1696. I have examined it in his *Opera omnia*, Francof., 1712.

⁴⁹ *Opera omnia* (1712), 13-15, 21-22, 29, 41.

⁵⁰ *Commentarius de modo simplicium medicamentorum facultates cognoscendi*, Hafniae & Francofurti, 1669, in-8.

⁵¹ *Philosophical Transactions*, V, 1085-86.

out judgment. As a consequence, the formulae of many medicines were nothing but a catalogue of specifics. So many things of like efficacy were mixed together in equal quantities without rhyme or reason, that it was no wonder that the patient grew worse from the use of such medicaments. A good illustration of this was the numerous compound medicines of the Augsburg pharmacopoeia, more pompous than helpful, which Zwelfer had corrected and thereby earned the gratitude of the learned world. If one wished a compound to be really an arcanum, the ingredients should be selected in each case to suit the individual patient. Also four kinds of constituents were to be distinguished: basic, assisting, digesting and corrective. The assisting and corrective ingredients could be such as to help each other: such as *melissa* with *fumaria*, *chamaedris* with *chamaepithum*, veronica and *scolopendrium*, bugloss and violets, chicory root and *scorsonera*, cloves and peony.⁵²

The *Aurora chymica*, or rational way of preparing animals, vegetables and minerals for medical use, by Edward Bolnest, first appeared in English in 1672⁵³ and then in Latin at Hamburg in 1675.⁵⁴ After repeated distillation, calcination, cohobation, and periods of putrefying and digestion, the *Arcanum animale* is obtained. But this is only a general example and method of preparing an animal or any part of an animal. In treating this or that particular animal we must take its particular virtues into account and further regulate the dose according to the constitution of the patient. A series of chapters then deals with quintessence of mumia, quintessence of human blood, quintessence of human bones, quintessence or arcanum of turtles, of quail or other birds, swallows, sea crabs or river crabs, cantharides, centipedes, deer, hartshorn, monoceros, vipers, zibeth and ambergris, beeswax, honey, fat and marrow. Part two is a similar treatment of vegetables. The third part on metals and minerals devotes most of its space to a long chapter on gold, and to preparations of mercury and antimony.

Thomas Willis (1621–1675) in his Rational Pharmacy⁵⁵ opposed

⁵² Hermann Grube, *De arcanis medicorum* . . . , 1673, pp. 267–71.

⁵³ BM 1035.b.10.

⁵⁴ BN Te^{147.43}. This is the edition I have used: 134 pp.

⁵⁵ *Pharmaceutice rationalis sive Datriba de medicamentorum operationi-*

recourse to occult qualities to explain the effects of drugs and held that they acted directly upon the animal spirits. He praised tobacco as a sedative and coffee as relieving headaches.

The work on *materia medica*⁵⁶ which Paul Ammann, director of the medical garden at the University of Leipzig, published together with his *Supellex botanica*⁵⁷ in 1675, is a curious mixture of scepticism and credulity. He reaches the conclusion that there is nothing worse for medical practice than preposterous credulity and notes that Redi has exploded many myths.⁵⁸ Unfortunately he was as prone to follow Helmont as he was Redi. For example, in speaking of *usnea* or moss on the human cranium, he rejects as futile and not founded in nature the view of Goclenius that the vital spirits of a man who is strangled (by hanging) enter the skull and remain there for six years until the *usnea* appears. But he makes no objection to the opinion of Helmont that the seed of *usnea* comes from the heavens.⁵⁹ He is very sceptical as to the medicinal virtues of gems and precious stones, and quite curt as to those of antimony. He knows that cochineal is an insect, not a grain or fruit. He rejects the fable of the beaver biting off its testicles, and doubts if the lizard devours its slough because it knows that it is beneficial for epilepsy. He is opposed to the use of *mumia*, if not of *usnea*. The bezoar stone is known to all by fame, to few in reality. No one, so far as he knows, has ever described the root of true *rhabarbarus*. The lungs of calves and foxes seem to possess no medical efficacy. But while he knows the difference between the beaver's testicles and the bags which contain the castor oil, he says that often we cannot procure the oil and have to use the testicles. He includes animals and parts of animals as remedies: toads as amulets against pest, earthworms as a diuretic for those afflicted with the stone, and an anodyne in cases of gout and arthritis; the bone from the heart of a stag; *priapum ceti*.

bus in humano corpore, Oxford, 1674, in-4, 16 fols., 330 pp., 5 fols. A number of other editions followed. JS IV, 29-35.

⁵⁶ *Brevis ad materiam medicam in usum philiatrorum manuductio*, Leip-

zig, 1675, 195 pp.

⁵⁷ Concerning it see our previous chapter on Botany.

⁵⁸ *Brevis . . . manuductio*, pp. 194-95.

⁵⁹ *Ibid.*, p. 185.

A belt made of human skin is in great demand by women in child-birth or after it; the gall of a partridge is the best remedy for ophthalmia. He exclaims against the superstition of women who employ the rose of Jericho—although it is neither a rose nor from Jericho—on Christmas eve to determine the time of delivery and attribute more to it, especially if it has been consecrated by the pope, than they do to divine aid. But the gum of a hazel tree is preferred to practically all other medicaments in resisting epilepsy. And the Chinese ascribe as incomparable virtues to tea as the alchemists do to the philosophers' stone.⁶⁰

Walter Harris, royal physician, published his *Anti-Empirical Pharmacology* in 1683.⁶¹ He believed that, although in time past the world had been involved in dark and dismal ignorance, it was now so enlightened that all occult arts had vanished,

and nothing but superstition, a deluge of gross superstition, can revive them again. For, although the world is as naturally inclined to superstition as to any one vice that can be named, yet it is never like to overwhelm Europe as it has done.⁶²

Chemical medicines, however, were so the rage, having the charm of novelty and mystery, that the preparations of nature or of old medicine were undervalued.⁶³ All that potable gold amounted to was a mere solution of gold by corrosive spirits; Harris would rather just boil it. He was opposed to transmutation and projection, even if possible. Six great remedies which he thought were too much magnified were mercury, antimony, vitriol, steel, Jesuits' powder (i.e., quinine), and opium.⁶⁴ Dr. Willis' preparation of steel, however, was not only "hitherto a great secret and sold at a great price," but the "masterpiece of that eminent and ever famous man."⁶⁵

Also Harris still favored the use of compound medicines. "As

⁶⁰ *Ibid.*, pp. 154, 174, 156-59, 180, 50, 177, 151-52, 155, 169, 170, 184, 186, 67, 63, 65.

⁶¹ *Pharmacologia anti-empirica*, London, 1683. Copy used: BM 547. c. 9.

⁶² *Ibid.*, p. 308. Legendre, as noted

in Chapter I, employed a similar tone in 1733.

⁶³ *Ibid.*, Preface.

⁶⁴ *Ibid.*, pp. 41, 44, 49-60, 88 *et seq.*

⁶⁵ *Ibid.*, pp. 149-50.

diseases are complicated, the medicines must be so likewise." And Theriac Andromache or Venice Treacle, which had sixty odd ingredients, "will claim a preference before most others." But both it and Mithridate were now very little used in France.⁶⁶

As for characters, charms and seals, their efficacy depends on delusion of the patient's imagination. "If the disease be merely imaginary and false, the true cure must be likewise false and imaginary." Sometimes they acquire a widespread reputation. But as "reasoners and doubters try it," and it fails to work for them, others gradually lose faith in it. But Harris believes that the force of imagination is great on the patient's own body, and says, "It would be endless to recite the strange impressions of pregnant women on their foetus in the womb by the force of imagination."⁶⁷ In a closing chapter, "Of Mountebanks and other sorts of Empirics," he complains that in other countries they "are despised as the very dirt," but continue to flourish in England.

In a treatise of 1665, Jean Thomas de Riollet had replied to objections which had been made against theriac.⁶⁸ He stated that these objections had not been to theriac itself, but were either that its effects were not those claimed for it in antiquity, or that the drugs and simples employed in it in ancient times were no longer available.⁶⁹

An elaborate public preparation of theriac was made in accordance with the regulations of the medical faculty in 1685 at Paris by M. de Rouviere, apothecary in ordinary of the king, camps, hospitals and armies, and was duly recorded in the *Journal des Sçavans*. He had succeeded in obtaining its rarer constituents, such as opobalsamum, xilobalsamum and carpobalsamum, for which substitutes were too often used. He displayed 58 dozens of live vipers which had been collected the past autumn, the proper season to do so, and gave a lecture, which was loudly applauded, on their nature, where their poison resided, and their virtue as an antidote. Trochees rather than powder were then made of them

⁶⁶ *Ibid.*, pp. 284-85, 293.

⁶⁷ *Ibid.*, pp. 300, 310-12.

⁶⁸ *Remarques curieuses sur la theriaque avec un excellent traité de l'Orvietan*, Bordeaux, 1665, in-8, especially

p. 44 *et seq.*, "Response aux objections faites contre le Theriaque." Copy used: BN 8° Te151.1494. The book was noticed in JS I, 761-62.

⁶⁹ *Riollet*, pp. 9-10.

conformably to the decree of the Faculty, cooking them in a *bain-Marie* with only a little water and thus preserving the volatile salts in which their virtue chiefly consists. On March 12 he lectured on the other drugs employed; they were then put on exhibition for eight days; on the 26th they were mixed; on the 28th the operation was entirely finished "with the approbation and applause of everyone."⁷⁰

A General History of Drugs by Pierre Pomet (1658–1699), "marchand epicier et droguiste," published at Paris in 1694,⁷¹ was reviewed at length in *Journal des Sçavans* and *Acta eruditorum*,⁷² and appeared in English translation in 1712.

In the *Journal des Sçavans* of March 5, 1696, appeared an extract from the letter of a doctor of medicine recommending the theriac of the late Signor Matourousini of Venice and telling where it could be bought in Paris.

It kills worms in children, stops gripes and colic, strengthens heart and stomach, preserves from apoplexy, and prevents any poison from taking effect.

Two perfumes of the same Venetian physician and another kind of theriac were also mentioned favorably.⁷³ Again in the issue of March 19, readers were informed where the apoplectic balm, which used to be obtained in Rome, could be procured in Paris.⁷⁴ But therewith this type of pharmaceutical advertisement seems to have ceased.

The *Collectanea pharmaceutica, seu apparatus ad novam pharmacopoeam* of Louis Penicher,⁷⁵ prefect of the apothecaries of Paris, first considered the ingredients of medicines, then the way to prepare them, third internal and fourth external remedies, and finally chemical operations.

When the old Pharmacopoeia of Toulouse was revised in 1695

⁷⁰ JS XIII, 228-31.

⁷¹ *Histoire générale des drogues, traitant des plantes, des animaux et des minéraux. Ouvrage enrichy de plus de quatre cent figures... avec un discours qui explique leurs differens noms, le pays d'ou viennent, la*

manière de connoître les veritables d'avec les falsifiés, etc. Paris, 1694, in-fol.

⁷² JS XXII, 239-49; AE XIV, 11-16.

⁷³ JS XXIV, 183-84.

⁷⁴ JS XXIV, 221-22.

⁷⁵ Paris, 1695, in-4.

by five doctors selected by the local Faculty of Medicine, they omitted many useless and superfluous remedies found in other Pharmacopoeias, but made much use of the *Pharmacopée royale* of Charas,⁷⁶ and added "singular and extraordinary remedies" from their own particular experience, and recommended a method of volatilizing fixed alkali which was "not generally accepted by chemists." That such volatilized fixed alkali still contained the essence of the substance from which it was derived, they proved by experiments. Nettles boiled in ordinary water, after it had been frozen, appeared as phantoms in the ice with their natural color and figure. Or if, after a fixed salt had been obtained from them, the dregs were planted in fertile ground, a great mass of nettles would spring up.⁷⁷

Lemery's *Pharmacopée universelle* of 1697 attempted a synthesis of all existing manuals, with additions of his own, and with rejection of conflicting or useless ingredients from many previous compound medicines.⁷⁸

By the beginning of the eighteenth century Robert Pitt (1653-1713), who taught anatomy at Oxford and served at St. Bartholomew's hospital from 1698 to 1707, held that no humor in any animal could alter or dissolve gold, which was therefore inoperative. Precious stones were too hard and impenetrable to exert any medicinal virtue. He further doubted the efficacy of sarsaparilla and opposed the use of mummy.

The dry'd hearts of many animals, the livers, the spleens burnt to a powder, the skins of the stomachs or guts of cocks and worms, and the dry'd lungs of foxes ought to be rejected as loathsome and offensive.

He was against trochees and powders of vipers or the use of the skull of a dead man for epilepsy.

After these it may seem needless to speak of the gainfull Industry which has brought the horns of the elk, buffalo, rhinoceros and of the fish the unicorn (i.e., swordfish) which has been thought sufficient alone to expel

⁷⁶ The *Pharmacopée royale* of Charas, first printed in 1676, has been mentioned in Chapter 24 on Natural

History.

⁷⁷ JS XXIV, 309-12.

⁷⁸ JS XXV, 727-29.

all poisons, or the hoofs of the elk and the Ounce, or the bone of the heart of the stag.⁷⁹

In listing "Preparations Galenical and Chymical now in use," he stated that the chemical medicines

are the remains of a prodigious number . . . which have been, after they had deluded and destroyed the greatest numbers of the afflicted . . . , reserv'd as the most innocent or the most useful.⁸⁰

Yet he regarded amulets as useful for diseases marked by great anxiety and fear, and he still believed in the existence of material spirits within the human body.

As a result of an elaborate and thorough-going investigation of pharmacy in Burgundy before 1803,⁸¹ A. Baudot came to the conclusion that apothecaries were numerous there in the sixteenth century, decreased in number in the seventeenth, and in the eighteenth were reduced to a half or a third of what they had been two centuries before or in small towns disappeared entirely. He ascribed this decline to the rise of royal absolutism and of individualism. Perhaps it also indicated a decrease in the use of drugs and poly-pharmacy.

⁷⁹ *The craft and frauds of physick expos'd*, 2nd ed. of 1703, pp. 39, 41-44. First printed in 1702.

⁸⁰ *Ibid.*, pp. 106-7.

⁸¹ *Etudes historiques sur la pharmacie en Bourgogne avant 1803*, Paris, 1905 (BN Te.144.64). Pages 89-240 are devoted to the period 1480-1630;

pp. 473-535, to the years 1782-1803. Much use is made of municipal records and many extracts from documents are given. A number of individual apothecaries are described as examples; their corporate history is also traced.

CHAPTER XXVII

CHEMICAL COURSES AND MANUALS

Introduction—Tanckius—Beguin's *Tyrocinium chymicum*—Revised editions by Barth, Glückradt (Hartmann), Pelshofer, Lucas de Roy—Criticism by Billich—Johann Hartmann—Duncan Burnet—Brendel's *Chimia in artis formam redacta*—Jean Colleson—de Clave—Davidson—Sauvageon—Arnaud—Barlet—Le Fèvre—Rolfinck—Glaser—J. J. Becher—de Locques—Thibaut dit le Lorrain—Matte La Faveur—Lancilotti—de Maets—Lemery—Morley and *Collectanea chymica Leydensia*—Ettmuller—Le Mort—Wilson.

Experiments reign in chemistry

—BORRICHIOUS

... n'estant qu'une repetition ennuyeuse, dont tous les soufleurs modernes ont remply des volumes entiers, mais seulement pour instruire les ecoliers

—MALBEC DE TRESFEL

In the middle ages alchemy had been a secret and sometimes forbidden art. During the period of incunabula, or second half of the fifteenth century, works of alchemy still lurked in the manuscripts. Little by Paracelsus was printed during his lifetime, and it was only from 1560 on, with the Paracelsan revival, that his writings and other compositions by chemists or alchemists, both past and present, began really to pour from the press. With the seventeenth century chemistry commenced to be popularized. Elementary handbooks of the subject found many readers and were produced in or translated into French and other vernaculars, and popular courses, accompanied by laboratory experiments, were offered to the public. The mystic, cryptic, allegorical, enigmatic jargon of the adept gave way to the simple wording and painstaking clarity of the popular lecturer. Yet the pretense con-

tinued—and this was no doubt part of the attraction—of revealing rare recipes, tremendous secrets, and astounding experiments. Thus the work of E. R. Arnaud, printed in 1650, promised in its title not only “the definition of all the operations of chemistry,” but “very rare examples for each operation.”¹ Fifteen years later, in 1665, the “Cours theorique” of Nicolas de Locques explained “precepts and principles of chemistry which have until now been hid by the ancient philosophers,” while his “Cours pratique” treated of operations hitherto known to only a few.² Indeed, as late as 1668, the *Rares experiences* of P.M. de Respour professed to teach “the way to make the necessary agents, which have been until this day unknown and hidden from the public.”³ Such salesmanship still savored of the methods of magic, nor does the scent usually prove misleading when we turn to the body of the work.

Nor were the first popular courses and manuals purely or even primarily chemical. They were indeed apt to be primarily medical or pharmaceutical, consisting chiefly of chemical remedies, of preparations concocted in the chemical laboratory but intended for medicinal use. We have first to note, however, in chronological order a book which is primarily alchemical, although its title suggests a brief elementary manual of chemistry.

In 1605 appeared the Succinct and Brief Instruction in the Chemical Art of Joachim Tanckius, doctor of philosophy and medicine and professor at the University of Leipzig. The text was in German but with Latin quotations, titles and marginal headings.⁴ The book is still primarily devoted to the quest for the philosophers’ stone. Tanckius distinguishes between the *via universalis*, which is easy and rare and drawn from true and natural principles, and

¹ *Introduction à la chymie ou à la vraie physique où le lecteur trouvera la définition de toutes les opérations de la chymie, la façon de les faire et des exemples en suite tres-rares sur chaque opération, et le tout dans un tres-bel ordre*, Lyon, C. Prost, 1650, 8vo: copy in BN R.26957. No copy in BM.

² For the full titles in French see Ferguson, II, 42.

³ Ferguson, II, 256, for the full French title.

⁴ *Succincta et brevis artis chemiae instructio, Das ist Volkommer grundlicher Bericht der rechten und waren Alchimey . . .* (etc. at some length) *durch Joachimum Tanckium . . .*, Leipzig bey Iohan Rosen, 1605, 106 pp., followed by an Index of five double-columned pages. BM 1033.f.10 (1).

the *via particularis*, which is difficult and laborious, and which errs because of the ignorance of authors, unfitness of materials, insolence of chemists, failure to grasp fundamentals, and use of materials which have not been properly prepared. He then proceeds to consider sulphur (not the common variety but that of the philosophers), antimony, mercury, *croci* of metals and their salts, glasses of metals and their essences, mercuries of metals and their oils, and particulars in general. He then returns to the *via universalis*.

The *via universalis* divides into the dry way and the wet way. To succeed one should diligently peruse the writings of the philosophers and pray to God. Under the dry way Tanckius proceeds to cite such "philosophers" as Count Bernard (of Treves), Tezenensis, Palingenius, Rosarius, Alphidius, Aristotle, Hermes, Rebis and Rasis. One Latin quotation runs to nearly two pages. All these authorities are medieval works of alchemy, except Marcellus Palingenius,⁵ whose *Zodiacus vitae* was printed at Basel in 1537. Much is said of lilies and waters, despite the fact that it is the dry way, of child's play and work of women, and such alchemistic patter. Finally we come to philosophic distillation and sublimation of the stone, and Tanckius triumphantly concludes, "So by God's help I've stated the right road to the philosophers' stone!"

The wet way considers potable gold and cites such further medieval alchemists as Morienus, Geber and Hortulanus, as well as Paracelsus. The sun is the noblest of celestials, wine of vegetable products, man of animals, and gold of minerals. *Mumia* is the arcanum and secret of the microcosm. A philosophic fire never described by any philosopher but only whispered by the adept on his death bed is a tremendous secret. Then after three pages of Latin glorifying the stone, the work ends.⁶

The earliest textbook to obtain much currency was the Chemical Training, an attractive title, of Jean Beguin, which first appeared in 1610.⁷ Its author had spent some years in Germany, in 1604 had

⁵ The pseudonym of Pier Angelo Manzolli.

⁶ Bound with it is Tanckius's *Alchymistisch Waitzenbäumlein, das ist, Vom Stein der Weisen . . .*, Leipzig,

1605, 94 pp. BM 1033.f.10 (2.).

⁷ *Tyrocinium chymicum e naturae fonte et manali (sic) experientia depromptum, auctore eo qui se suaque Deo ter Opt. Max. libat deuouetque,*

visited mines in Hungary and Slavonia,⁸ and in 1608 had edited *Novum lumen*, a work variously ascribed to Sendivogius and to Alexander Seton. Turquet de Mayerne and Jean Ribit, sieur de la Rivière, had procured permission for him to set up a laboratory and give public lectures in chemistry, and in the edition of 1612 he is called royal almoner.⁹ The preface to this edition further informs us that the edition of 1610 had been printed privately at the suggestion of a pupil, Jeremias Barth, in order to obviate oral dictation by Beguin to his students. This first edition had been pirated at Cologne in 1611,¹⁰ and Beguin's laboratory had been robbed of preparations and manuscripts. In 1612 he issued at Paris a revised edition with omissions, improvements and a better order.¹¹ In it he states that he has met with such ingratitude from some persons, notably a gowned surgeon of Paris, who had been his pupil gratuitously, that he conceals some preparations, lest he cast his pearls before swine.

The edition of 1610 opened with a definition of alchemy which was omitted or altered in later editions but which merits attention. It is an art which teaches to separate the pure from the impure. Or an art of perfecting masteries and segregating pure essences from mixed bodies. Of its two species, the pyrotechnic and fiery and transmutatory of metals is here passed over in silence. The other variety educes most subtle spirits from metals, gems and plants, obtaining remedies the subtler, the purer, and the purer, the more efficacious.

70 pp. in-4: BM 1033.e.7; BN Te¹³¹. 164.

Tyrocinia astronomica by Balthasar Capra had appeared at Padua in 1606, and a *Tirocinium poetices*, by a Jesuit, Jacobus Pontanus, at Ingolstadt in 1604.

⁸ *Tyrocinium chymicum*, ed. of 1612, II, 12, speaks of Idria, a village of Goritz in Slavonia, as visited "ante annos octo."

⁹ T. S. Patterson, "Jean Beguin and his *Tyrocinium chymicum*," *Annals of Science*, II (1937), 243-98, especially pp. 245-46. Patterson takes as his starting point an unpublished paper

and notes by Ferguson, and corrects various previous misapprehensions, some of which (e.g., those of Mme. Metzger and the BM catalogue) I had noted independently but need not repeat now.

¹⁰ Of 90 pp. in-12. Copies are BM 8907.a.21 and BN R.52943.

¹¹ *Tyrocinium chymicum recognitum et auctum Ioanne Beguino regis eleemosynario*, Paris, 1612, 133 pp. According to Patterson, *op. cit.*, p. 249, the sole extant copy is at the Bodleian: see his Fig. 5, Plate XV, for a facsimile. I follow his account of its contents.

It purifies, segregates and perfects metals; dissolves the hardest gold, vexes metals by the weakness of vegetation; disjoins tinctures from subjects; exalts finite nature to infinite; conflates stones; elicits water; vegetates fire and in fire vegetated and quasi-perennial produces a specimen of its art and efficacy in prolonging human life. In this there is nothing mechanical save the operation itself and the fiery application.

Its theory is on a par with physics, of which it forms no ignoble part, or medicine, to which it is subservient and ancillary. Far removed from it are those rascally fume-vendors, ash-blowers and statuaries, who do not blush to pass for philosophers but ought to be considered sooty mechanics and impostors.

Next Beguin explains the terms: fermentation, putrefaction, digestion, menstruum, distillation, cohobation, spirit, circulation, filtration, *deliquium*, alkali, sublimation, calcination, cement, *alcolismus*, mastery, extract, and quintessence. He then considers the three principles, distillation of liquors and herbs, and various waters. There follow oils, alkalis, salts, "flowers"—as of benzoin, antimony and sulphur, and various metallic calcinations and preparations such as mercury sublimate, *regulus antimonii*, and mercury precipitate. After masteries of tartar, of coral and pearls, and balsams of sulphur and of lead, we come to extracts and tinctures, the quintessence, the nature of stones, laudanum, and ways of luting vessels. *Alcolismus* is reduction to most minute parts or pulverization so as to produce a powder which is almost impalpable, but it is added that chemists misuse the name to indicate liquors which have undergone repeated distillation, as when spirits of wine are called alcohol.¹² The three principles are said to be each reducible to three others, as mercury into *aqua ardens* or *aqua vitae*, the element water, and acid water; sulphur into oil odoriferous, red oil and resin; salt into volatile, fixed—which they call alkali, and damned earth (*terra damnata* or *tête morte*) which may be reduced to glass.¹³

In the edition of 1612 Beguin says that patients prefer simple chemical remedies to the nauseous compounds of the misochymists and engages in a long vindication of chemical remedies which is

¹² *Ibid.*, p. 15; p. 20 in the Cologne, 1611, edition.

¹³ Ed. of 1610, p. 18; of 1611, pp. 23-24.

not found in the 1610 edition. He then defines a somewhat different list of terms: calcination, extraction, precipitation, fumigation, sublimation, distillation, rectification, cohobation, digestion and coagulation. Next, introducing a division into books not found in the previous edition, comes a second book in twenty chapters concerning the chief substances prepared by the operations listed in the first book. Seventeen rules are given for distillation, then waters are considered, but spirits and vinegar are treated before coming to oils. Liquid tinctures, balsams, extracts and soft tinctures are treated.¹⁴ Then come metallic calcinations, followed by salts, flowers, masteries, and more solid tinctures. The brief concluding third book opens with a chapter on the fifth essence of human blood. Others followed on the quintessence of wine and coral.¹⁵

This edition of Paris, 1612 was immediately pirated at Cologne by the same printer, Anton Boëtzer, as in 1611,¹⁶ and was reprinted there in 1614.¹⁷

On March 6, 1613, Beguin wrote from Paris to Barth, who had returned to Germany, that he was preparing a version of the *Tyrocinium* in French, and would soon send it to Barth to translate into Latin. He had made seven hundred crowns by his philosophy and expected his medical practice to become more lucrative, so that he would hardly need to hold a private college any longer. He expected his method of extracting sal ammoniac from all simple purgative medicaments to be a success. On January 28, 1614, Beguin again wrote from Paris to Barth, sending him the enlarged French edition to translate into Latin and put on sale in Germany, and stating that he had not yet had time to extract the salts. On April 10, 1616, he again wrote from Paris to Barth, saying that he had heard nothing from him for two years and had heard that he was dead, and again asking him to make the Latin translation.

But why do I bother further with writings? Since I gather from no obscure signs that I shall shortly migrate from the prison-house of this

¹⁴ In chapter x at pp. 77-80.

¹⁵ A fourth chapter on the fifth essence of pearls seems to have been

added by Beguin in 1615 or Barth in 1618.

¹⁶ Patterson, *Op. cit.*, p. 271.

¹⁷ BM 1035.a.6, 195 pp.

world. Better to spend what remains of life in the chemical laboratory than at the writing desk.¹⁸

Barth, however, did not get to make and publish the Latin translation until 1618.¹⁹ Meanwhile the French revision had been printed in 1615 under the title, *Elemens artis chymicae* and with a new preface which was never reprinted. Barth asserts that the *Tyrocinium* had been printed four times in Germany and was used in its universities. He further states in his dedication to Bomsdorf, dated at Guben on September 16, 1618, that he had made additions of his own to the text.

Meanwhile another edition had appeared in Germany at Königsberg, edited by Johann Hartmann (1568–1631)—who in 1609 became the first university professor of chemistry at Marburg—under the pseudonym, Christoph Glückradt, which enabled him to cite himself without any false modesty. His dedication is dated April 1, 1618, and he more than doubled the length of the *Tyrocinium* by his notes and added medical formulae.²⁰

In 1634 Pelshofer²¹ combined the additions which Glückradt and Barth had made, and his text appears to have remained essentially unchanged in the editions of Venice, 1643²² and of Wittenberg, 1640 and 1650,²³ which all three have 480 small pages of

¹⁸ These letters of Beguin were printed by Barth in his edition.

¹⁹ *Secreta Spagyrica revelata sive Tyrocinium chymicum . . . e Gallico in Latinum translatus atque . . . locupletatus a Jeremia Barthio*, (1618), 382 pp. BM 1034.e.9. Patterson, *op. cit.*, pp. 283–84, says that the BM catalogue gives Guben, 1618, as the date and place of publication, but that Pelshofer, in his edition of 1634, says that it was published at Frankfurt-an-der-Oder.

²⁰ *Tyrocinium chymicum e naturae fonte et manuali experientia depromptum autore Ioanne Beguino regis Galliae eleemosynario. Hac quarta editione non tantum vera medicamentorum ibidem contentorum explicatione et correctione verum etiam notis elegantibus ex ipsa ἀρχαίῃσι desump-*

tis ut et aliorum medicamentorum formulis optimis et secretis illustratum, plus duplo auctum et elaboratum . . . studio et opere Christophori Glückradts Ph. & M. D. Regiomonti apud Iohannem Fabricium, anno 1618, in-8, 537 pp. Copies used: BN R.28049; BM 1034.g.6.

²¹ Ferguson, I, 93. Berne n.147 is a copy of this edition.

²² BM 8906.a.3.

²³ *Tyrocinium Chymicum Johannis Beguini regis Galliae eleemosynarii antehac a . . . Christophoro Glückradt et . . . Jeremia Barthio notis . . . illustratum . . . nunc vero a Johanne Georgio Pelshofero . . . in unum systema redactis*, Wittebergae, 1640. Copy used: BN R.28052. The pagination is the same in the edition of Wittenberg, 1650. Copy used: Col 540.1 B39.

text, not counting the prefatory matter or triple index. But an English translation which was printed at London in 1669, is only about a third as long, containing 136 small pages. It would seem to be translated from the edition of 1612, since it speaks of "last summer", where the edition of 1650 mentions the year 1611, and since it lacks not merely the additions of Glückradt and Barth, but also the concluding chapter on the quintessence of pearls and other paragraphs of the later Latin text.²⁴

Beguín had revisited Hungary in 1611, between the 1610 and 1612 editions of the *Tyrociniūm*, and tells of descending into a silver mine which was a half mile from Schemnitz, about 1500 cubits deep, and so hot that the miners worked stark-naked. Frequently mineral vapors would rise "from the center of the earth" and extinguish the lamps of the miners, "and themselves too," unless they withdrew immediately. Afterwards these exhalations would sometimes be found clinging to the walls of the mine like oil.²⁵ An allusion to the year 1613 must have been first inserted by Beguín in the French edition of 1615, which I have not seen. In disproof of the old notion that coral is soft so long as it remains under water and turns hard only when exposed to the air, Beguín notes that coral-fishers in July, 1584, found it as hard under water as it was afterwards. He then adds that this has been confirmed to him by le Sieur de la Piotier, a gentleman of Lyons, who returned two years ago from coral-fishing off the coasts of Barbary.²⁶ In Barth's edition of 1618 and the later Latin editions the former date is given as July, 1585, and the latter as 1613.²⁷

Other changes were made by Jean Lucas de Roy, "medecin

²⁴ For example, in Bk. II, chap. x, at pp. 78-79, the English version lacks "Tinctura Rhabarbari," "Tinctura Salis Tartari," "Tinctura Antimonii," "Tinctura Smaragdi," and most of "Tinctura Coraliorum," found in the Latin editions of 1643 and 1650 at pp. 264-54; while chap. xviii at p. 115 lacks text found in the Latin at pages 387, 389-91, 395-96, and chap. xiv at p. 100 ends considerably before the Latin, omitting most of pp. 335-37.

²⁵ Barth's ed. of 1618, pp. 132, 263; French translation, ed. 1624, p. 287; Latin eds. of 1643 and 1650, pp. 330-31; English translation, ed. 1669, p. 98.

²⁶ French edition of 1624, pp. 212-13, presumably repeating the French edition of 1615. Not in the English translation, another indication that it was made from the edition of 1612.

²⁷ Barth, pp. 188-90; eds. of 1643 and 1650, pp. 253-54. *

Boleducois," in a French edition at Paris in 1624.²⁸ In an address of eight pages to the reader he protests that he is a sworn enemy of the Paracelsists and a nursling of the medical school of Paris. He has seconded Beguin in his design of treating medicinal chemistry. But, since Beguin was brief in places and consequently obscure, and kept to himself many details essential to the preparation of chemical remedies—which Lucas thinks he would have supplied "in this second French edition," had he not been prevented by death from doing so—Lucas has taken it upon himself to add not only what is lacking in the rudiments, such as the structure of furnaces, shapes and uses of vessels,²⁹ degree of heat of the fire, doses and administration of medicaments, but also many secrets from his own experience. He has the division into three books of six, twenty and four chapters respectively which is characteristic of most later editions, but introduces a good deal as to solution in the first book, states that *teste morte* and phlegm are not principles, and discusses lutations in the sixth chapter of the first book.

In the original handbook of 1610 Beguin engaged little in citation of authorities. A reference to Mattioli's commentary on Dioscorides, two or three others to Geber,³⁰ are about all. Many citations were introduced by Glückradt and Barth. For example, Victor Algorethus of Verona is said to have given his name to *pulvis angelicus* or *Algorethi*, an emetic powder by which Barth and his friend Vautier, who took his M.D. at Montpellier in 1612 and later was physician to Marie de' Medici and Louis XIV,³¹ cured two patients of quartan fever and dropsy.³² The fancy names given to certain preparations, such as Mitigated Dragon, Imperial Eagle, Golden

²⁸ *Les élémens de chymie de Maistre Jean Beguin recues expliquez et augmentez par Jean Lucas de Roy . . .*, troisieme edition, A Paris, chez Mathieu le Maistre, rue S. Jean de Latran à l'Arbre sec: Et sur le Quay des Augustins deuant l'Abreuvoir, MDCXXIV, in-8, xvi, 432 pp. BN R.28042.

There was another "third" edition in 1626 and a fourth at Rouen, where the work was reprinted in 1627 and 1637; at Lyons in 1645 and 1646; again

at Rouen in 1660.

²⁹ In the first edition of 1610, p. 5, Beguin had excused himself for not discussing furnaces, vessels, other chemical apparatus, and the regimen of different fires on the ground that they were matters of usage rather than precepts and required eyes and hand, not words.

³⁰ Ed. 1610, pp. 28, 49, 56.

³¹ Gui de Patin, *Lettres* (1907), 443.

³² Ed. of Barthius, 1618, p. 250; eds. of 1640 and 1650, p. 276.

Fleece, and Diaphoretic Solar Panacea, are also mainly the work of later editors of the *Tyrocinium*. The preparation of Golden Fleece begins with the collection of May dew from wheat before sunrise in fair weather. Beguin himself, however, accepted the influence of the stars. He stated that the three chemical principles were spiritual rather than corporeal because of the influx of celestial seeds with which they were impregnated.³³ He also still attached significance to numbers, speaking of "the sacred Ternary" of the Pythagoreans.³⁴

Meyssonnier attributed to Beguin,³⁵ Maier, Goclenius and other writers on the pest the statement that carrying quicksilver was a sure preservative against the pest.

Beguin was repeatedly cited and sometimes adversely criticized by Anton Gunther Billich of Oldenburg. Writing in 1621 on the three principles of the chemists and fifth essence, Billich noted that Quercetanus had held that vitriol contained all three principles and that the presence of sulphur was indicated in a red sweet ochre which was easily separated from it. But Beguin pointed out: 1) that this ochre was not of an oily consistency but dry and powdery; 2) that it did not burn in fire like sulphur; 3) that it was nothing else than the metallic part of vitriol (i.e., iron or copper). This had also been sufficiently demonstrated by Angelus Sala, Billich's honored preceptor, who had further shown that *sal vitrioli* was not properly a salt.³⁶ But later in the same work Billich criticizes Beguin's method of extracting the fifth essence from human blood, prefers a shorter process than his for extracting it from spirit of

³³ The passage occurs not only in the later Latin editions but in the English translation of 1669, p. 21, which, as we have seen, was made from Beguin's own edition of 1612.

³⁴ English translation, 1669, p. 22.

³⁵ Lazare Meyssonnier, *La pratique des remedes de sympathie*, printed with Digby (1664), p. 222, citing liu. 2, chap. 13, but not the title of Beguin's work. Book II, chapter 13 of the *Tyrocinium Chymicum*, in the edition of Wittenberg, 1650, where it occupies pp. 304-29, contains no such

statement, the closest to it being a passage at p. 305 that the canton of Idria in the county of Goriz, Slavonia, where quicksilver mines are located, is immune from the pest, although it rages almost every year in the vicinity. Another passage, at p. 326, states that *Mercurius Veneris diaphoreticus* is an *insigne Bezoarticum* against venereal disease, if it is taken soon after infection.

³⁶ A. G. Billich, *De tribus chymicorum principis et quinta essentia*, 1621, pp. 31-32.

wine, and declares that his fifth essence from coral is of no value.³⁷

Ten years later Billich criticized the arrangement of chapters two to five in the first book of the *Tyrocinium*, and argued that Beguin's solution was not a single operation but a heap of operations.³⁸ The herb can be resuscitated from the earth, commonly called dead and *terra damnata*, which is left after the salt has been extracted. But Beguin was mistaken in saying that it could be easily turned into glass.³⁹ Beguin (II, 17) set forth the process connected with *salsilego saparum* accurately enough, but did not understand the thing itself, calling a salt essential which was not even sincere.⁴⁰ Ardent spirit of lead is a silly figment of the chemists, but Beguin (II, 4) said that it filled the whole laboratory with a fragrance far surpassing those of all odorous vegetation. The black residue or *tête morte* left by salt of lead is of no importance, if we believe Beguin, but if we consult experience, is revocable into the form of true lead.⁴¹ Both Paracelsus and Beguin already employed the term *magisterium*, but both explained it awkwardly in words and illustrated it by examples which were partly false and partly irrelevant. Billich defines it as using the integral body but, by means of suitable addition, reducing it to the form of a liquid, salt or powder.⁴² Beguin, perhaps following Croll, described both *mercurius vitae* and *bezoarticum minerale* under the caption of calcinations of antimony, but whether they are from antimony or mercury is a controversial matter.⁴³ Billich reproves Beguin for his introductory extollation of chemical above accustomed remedies, notes that he offers no preparation against witchcraft, praises him for pointing out the fiery and aerial content in oils, but states that he too rashly represented *flos seu fumus benzoini* as effective against asthma and all diseases of the lungs.⁴⁴

³⁷ *Ibid.*, pp. 58-62.

³⁸ *Observationum ac paradoxorum chymiatricorum libri duo: quorum unus medicamentorum chymicorum praeparationem, alter eorundem usum succincte perspicueque explicat*, Leyden, 1631, in-4, 174 pp.: at pp. 13-16.

³⁹ *Ibid.*, p. 31.

⁴⁰ *Ibid.*, p. 33.

⁴¹ *Ibid.*, p. 42. Billich further criticizes Beguin at p. 44.

⁴² *Ibid.*, p. 47.

⁴³ *Ibid.*, p. 89 et seq.

⁴⁴ *Ibid.*, pp. 98, 100, 102, 109. Beguin is named four times on p. 99, thrice on p. 100.

Croll and Beguin both incrated balsam, but Philipp Müller disapproved of this, because in external applications the pores were closed by the wax so that the force of the balsam could not penetrate properly, nor could it be taken internally.⁴⁵

In yet a third work, whose dedication is dated in 1639, but which I have used in the edition of 1643, Billich continued to criticize Beguin as well as Quercetanus.⁴⁶ In the opening chapter he denies Beguin's contention that alchemy is a science, and towards the close of the treatise blames Beguin for praising the waters of the chemists and ridicules his definition of Chymia as the art of compounding pleasanter, more salubrious and safer medicaments.⁴⁷ Quercetanus, Croll and Beguin failed to correct the malignity and virus of antimony and mercury by additions which only made the compound more injurious and exasperating. Beguin's boasts of artificial separation are empty words, whether you have regard to preparation or application.⁴⁸ Billich keeps trying to pick passages out of Glückradt's notes to the *Tyrocinium* which may be interpreted unfavorably to chemical remedies. Beguin promised to tell how too sharp chemicals could be softened, but failed to do so.⁴⁹ He denied the existence of *empyreuma* in chemical remedies, for, continues Billich sarcastically, ablution was as successful in getting rid of *empyreuma* as masteries of coral and pearls were in mollifying.⁵⁰ Billich confutes Beguin's statements as to salts from plants, taken partly from Quercetanus and partly his own, and affirms that "the genius of absinth" is utterly lost in salt of absinth, which bears the same relation to absinth as a corpse does to a living body. And who does not see that mastery of pearls is much more impure than the crude pearls?⁵¹ Beguin transcribed Croll's cautions as to the administration of antimony, but held that diseases commonly considered incurable, such as epilepsy, leprosy, quartan fever, gout and dropsy could be cured by the more potent and effacacious

⁴⁵ *Ibid.*, p. 105.

⁴⁶ *Thessalus in chymicis redivivus, id est, de vanitate medicinae chymicae hermeticae seu spagyricae dissertatio*, Francof., 1643, in-8: BM 1033.d.13. Chapters 2, 3, 4 and 7 are especially

directed against Quercetanus.

⁴⁷ *Ibid.*, p. 200.

⁴⁸ *Ibid.*, pp. 175, 177.

⁴⁹ *Ibid.*, p. 189.

⁵⁰ *Ibid.*, p. 191.

⁵¹ *Ibid.*, pp. 193, 197.

preparations from metals and minerals. But Billich has more faith in their violence and ill effects.⁵²

Billich's chief criticism of Beguin, namely, his reliance upon chemical remedies, was to have little effect upon subsequent courses and manuals.

Johann Hartmann (1568–1631), as we have said, has commonly been called the first professor of chemistry in a European university. He became professor of mathematics at Marburg in 1592, took the M.D. degree in 1606, and became professor of *chymiatría* there in 1609.⁵³ He did not immediately publish nor perhaps even deliver a course of chemical lectures, but his inaugural address and the disputations of students under his presidency were printed together in 1611. In his inaugural Hartmann maintained that medicine was coupled with action, not with contemplation, and that to dispute subtly, declaim or quarrel concerning natural phenomena was not to be a physician. He next discussed poisons, then held that the number of diseases was finite, and that new diseases were not generated today. His next thesis was that like was more often cured by like than contrary by contrary, a doctrine more favorable to Spagyric than to Galenic medicine. He regarded it as certain that the veins and arteries in the entire human body worked together, the veins bringing blood to the arteries, and the arteries spirit to the veins. He considered it not absurd that a vein might accompany every artery, but not an artery accompany every vein. He declared that the *antistasis*, which in great haemorrhages of wounds was made by venesection from the part opposite the wound, was unnatural and injurious.⁵⁴ It is evident that his inaugural was more medical than chemical. Of the seven following disputations, however, five are chemical or concerned with the relations between medicine and chemistry. One of them consisted

⁵² *Ibid.*, pp. 195–97.

⁵³ In the title of his Inaugural oration, as printed in *Disputationes chymico-medicae pleraeque sub praesidio Joh. Hartmanni, M.D. et Chymiatríae in Academia Marpurgensi professoris ordinarii ab aliquot medicis candidatis et studiosis ibidem pu-*

blicae censurae expositae, Marpurgi, Paulus Egenolphus typographus academicus excudit, anno 1611, p. 3: I, Misc. varia: Inauguralis M. Joh. Hartmanni mathematicum professoris. Copy used: BN T³¹.236.

⁵⁴ *Ibid.*, pp. 3–4, 7–8, 14–16.

of 168 chymio-technic theses by Johann Rhenanus as author and respondent,⁵⁵ who republished them in 1613 with an alternative title, *Sun from Well Emerging*, a dedication to Maurice, Landgrave of Hesse, and additional matter, making three books.⁵⁶

When Hartmann added notes and medical formulae and secrets to the *Tyrocinium chymicum* of Beguin in 1618, he did so under the pseudonym of Christophorus Glückradt. His own *Officina sanitatis sive praxis chymiatrica* was only published posthumously by Johann Michael and Hartmann's son, Georgius Everhartus Hartmann, in 1633, two years after the father's death.⁵⁷ Some examples of its superstitious prescriptions will be found in our chapter upon Mental Disease and Magic. It enjoyed great currency, being reprinted the next year at Frankfurt,⁵⁸ at Geneva in 1635 and 1647, "thereafter repeatedly."⁵⁹ It was greatly expanded by Cardilucius in an edition of Nürnberg, 1679.⁶⁰ In Hartmann's collected works of 1690, it appeared with additions by Conrad Johrenius.⁶¹ The issuing of Hartmann's collected works nearly sixty years after his death indicates that they were still acceptable to the reading public and that, as I state elsewhere, the alchemy and iatrochemistry and medicine of the late seventeenth century differed little from that of the early seventeenth century, especially in Germany. In this edition, besides the works by him already mentioned, were included his notes on Croll's *Basilica Chymica*

⁵⁵ *Ibid.*, pp. 71-107. Also separately in BM 1033.d.11 (2.), dated Marburg, 1610.

⁵⁶ *Solis e puteo emergentis sive Dissertationis Chymio-technicae libri tres* . . . , Francof., 1613. Bks. 2 and 3 have new titles pages and 31 and 24 pp. each. Other works ascribed to Rhenanus are: *Urocriterium chymiatricum*, Marburg, 1610; Francof., 1614; *Syntagma harmoniae chymico-philosophicae*, Francof., 1625; *Binae epistolae de solutione materiae*, Francof., 1635; and *Opera chymiatrica* Francof., 1635, 1641, 1668, 1676.

⁵⁷ Lipsiae, 1633: BN 4°Te¹³¹.90; BM 1033.l.10.

⁵⁸ Anton Maria Kobolt, *Baierisches*

Gelehrten-Lexicon, Landshut, 1795, pp. 306-7.

⁵⁹ Ferguson, I, 365-66.

⁶⁰ BN 4°Te¹³¹.92; with 1082 pages against 246 smaller pages in the edition of 1633. Cardilucius also claimed to have corrected numerous misprints.

⁶¹ *Opera omnia medico-chymica . . . partim antehac seorsim impressa, partim vero jam ex authoris MSS nondum antea editis collecta et in unum volumen congesta atque pluribus aucta a Conrado Johrenio, Ph. et M.D. et prof. quondam Rintheliensi, nunc illustrissimi comitis regentis Lippiaci consiliario et archiatro*, Francof., sumptis Philippi Fieveti bibliop., 1690.

and treatise on signatures,⁶² his own tract on opium,⁶³ *Miscellanea medico-chymica*,⁶⁴ and an Introduction to Vital Philosophy.⁶⁵ The last named treatise considers the difference of lives and the variety of balsam in the macrocosm, transplantation of disease, astral impression, the anatomy of astral diseases, and microcosm and macrocosm, before turning from the causes of diseases to their cure.

The *Iatrochymicus* of the Scot, Duncan Burnet (Bornettus), concerning the artificial preparation and composition of chemical medicaments was written for candidates in medicine and "interior" philosophy and published by one of them, Johann Daniel Mylius, at Frankfurt in 1616, and is a brief manual with little evidence of anything magical.⁶⁶ Borel in 1654 also listed an edition of 1621. The preface justifies the addition of this work to those of Beguin, Croll, and Philipp Müller of Freiburg-im-Breisgau. A brief first part treats of *materia*, instrument and place, and the meaning of certain words such as *menstruum*, *tinctura* and *caput mortuum*. We are told that the chemical and philosophical and medical month has forty days.⁶⁷ The second part⁶⁸ deals with chemical terms: conception, putrefaction, maceration, cohobation, calcination actual and potential, precipitation, fumigation, stratification and emplastication, and so on to fixation. Coagulation is discussed twice.⁶⁹ The third part on practice opens with masteries, defined as medicines without separation and essential preparation by adding anything in which such matter is attracted and conserved. Or it is medicine from the whole without any separation except the removal of impurities.⁷⁰ We soon come to extraction of medicaments, the separation of the parts of a body in a dry, firm and coherent form, all syrups prepared from the juices of herbs and flowers,

⁶² *Ibid.*, II, 1-128, 129-50.

⁶³ *Ibid.*, V, 1-23. Previously printed at Wittenberg, 1635, 1658. BM 1038. b.6 (2.).

⁶⁴ *Opera*, VI, 1-76.

⁶⁵ *Ibid.*, VII, 1-60.

⁶⁶ *Iatrochymicus sive de praeparatione et compositione medicamentorum artificiosa. Tractatus Duncani Bornetti Scoti in quo methodice perspicue ac breviter quidquid ad Iatro-*

chymica pertinet candidatis medicinae ac philosophiae interioris aperitur, studio ac opera Ioannis Danielis Mylii Wetterano Hassi medicinae Hippocraticae et chymicae candidati nunc primum in lucem editus. Francof., 1616, in-4, 115 pp. BM 1033.h.40.

⁶⁷ *Ibid.*, p. 8.

⁶⁸ *Ibid.*, pp. 9-45.

⁶⁹ *Ibid.*, pp. 35, 42.

⁷⁰ *Ibid.*, p. 47.

and a class comprising all soft vegetables and not petrified, also animals, bones excepted.⁷¹ Then follow gold⁷² and other metals, antimony, quicksilver, sulphur, orpiment and arsenic,⁷³ and so forth, finally ending with gems, pearls and corals.⁷⁴

The first edition of *Chimia in artis formam redacta*, by Zacharias Brendel (1592–1638), M.D., was at Jena in 1630. In the full title it is further described as a public lecture course at the University of Jena, in which, besides an easy method of learning chemical operations and the correction of many medicaments, various chemical discourses are printed, closing with an accurate account of a most famous preparation of potable gold, now for certain reasons made public.⁷⁵ A second posthumous edition by Rolfinck in 1641⁷⁶ praised Brendel in its preface and made only minor additions, keeping the same table of contents. Other editions followed in 1659 and 1668 at Amsterdam, and at Leyden in 1671.⁷⁷ But although Rolfinck retained the title, *Chimia in artis formam redacta*, for a work which he published in 1661, he no longer mentioned Brendel and composed a quite different and practically independent text, of which we shall treat later.

⁷¹ *Ibid.*, 57, 68, 69, 71.

⁷² *Ibid.*, 79 *et seq.*

⁷³ *Ibid.*, 101.

⁷⁴ *Ibid.*, 110, 112, 114.

⁷⁵ *Chymia in artis formam redacta et publicis praelectionibus philiatris in Academia Ienensi communicata, ubi, praeter methodum addiscendi εγγχεισθῆσαι chymicas facillimam (sic) et plurimorum medicamentorum correctionem, varii discursus chymici reperiuntur, quorum agmen claudit disquisitio accurata de famosissima praeparatione auri potabilis, nunc certis de causis publici iuris facta, auctore Zacharia Brendelio, Ienae, J. Reiffenberger, 1630, in-12, xxii, 218 pp. and Tables. BN R.29969. BM 1036.a.2(1.).*

The new BM printed catalogue, which gives only the short form of title, incorrectly adds, "Post obitum auctoris consilio Veneri Rolfinck, Jenae, 1630, in 12° ex officina A. Doude."

But Brendel was still alive in 1630; Rolfinck's posthumous edition was in 1641; and Doude printed the work at Leyden in 1671, not Jena in 1630.

Mr. C. B. Oldman, Principal Keeper of the Department of Printed Books at the British Museum, informs me that the error occurred because "information from the title-page of the 1671 edition... was transferred to" the description of the 1630 edition.

⁷⁶ BM 1034.f.2; BN R.29971; 175 pp. Ferguson, I, 124, says that this 1641 edition was also issued with the same title but differently arranged.

⁷⁷ BM 1036.a.26(1.). Ferguson describes this 1671 edition as in-18, but the BM catalogue and LR 367 as in-12. Stolle (1731), 780, note a, and 790, note m, corrected the erroneous statement of LR 1053 that it was printed with the *Tyrocinium chymicum* of Beguin at Amsterdam in 1659.

The following summary of the contents of Brendel's work is based on the original edition of 1630. Brendel opens with praise of chemistry, then defines and divides it. Fire forms the backbone of the organization of his text, beginning with degrees of fire, four in number, following the traditional medical doctrine of degrees. Under the third degree he considers sublimation of sulphur and flowers of sulphur; under the fourth degree, the spirit of vitriol and its distillation. Passing on to kinds of fire, he takes up the vapor bath, distillation of balsamic liquor, and rectification of oil of amber. A long fourth chapter⁷⁸ includes the bath of Mary, distillation of vinegar, spirit of wine, *laudanum opiatum*, the way to extract essences or purify extracts, *laudanum opiatum* again, refutations of Oswald Croll, notabilia as to henbane from Hartmann's commentary on the *Tyrocinium Chymicum*, and another digression concerning scammony and its preparation. After a short fifth chapter on the dry bath, we come to fire of ashes in chapter six and fire of sand and iron filings in chapter seven. The last⁷⁹ treats of such matters as sublimations and preparation of artificial cinnabar, the mineral bezoar, acid liquor from woods, berries etc., and *vires olei Heracleini*.⁸⁰ Chapter eight on the open fire takes up first the distillation of oils, then that of various spirits, using a retort. Melting or fusing fire, cementation and reverberation bring us to the epilogue, but then are added two Discourses on the blessed water of Ruland or the true use of glass of antimony, and the true description of potable gold, concerning which many previous writers have babbled ignorantly but Basil Valentine alone approached the truth.⁸¹ The work is thus somewhat alchemical as well as chemical, but otherwise contains little or nothing that can be called magical.

Jean Colleson, who first published his *L'Idée parfaite de la philosophie hermétique* at Paris in 1630, is said by Hoefer to have offered to give public courses on the Hermetic philosophy.⁸² This seems to be based on the statement of Lenglet du Fresnoy⁸³ in

⁷⁸ *Chymia in artis formam redacta*, 1630, pp. 54-100.

cursus II.

⁷⁹ *Ibid.*, pp. 112-156.

⁸² Hoefer, *Hist. de la chemie*, II (1843), 332.

⁸⁰ *Ibid.*, pp. 133-53.

⁸³ Quoted by Ferguson, I (1906),

⁸¹ *Ibid.*, 186, Discursus I; 198, Dis- 171.

the next century that he offered to teach the secret of the philosophers' stone, but that persons of distinction refused to become his pupils, apparently because they did not trust him. His book, however, found sufficient readers to be reprinted with additions the next year⁸⁴ and to appear in Latin translation in the *Theatrum Chemicum* of Zetzner in 1661.⁸⁵ It was dedicated to no less a personage than Gaston de Bourbon, brother of Louis XIII.

We have seen that Estienne de Clave, M.D., was involved in the condemnation by the Sorbonne of alchemical theses in 1624 and retired for a time to Brittany.⁸⁶ In a manuscript in French at Rennes is a Treatise of Chemistry under Monsieur de Clave, begun on March 14, 1630, followed by a Treatment of maladies of the human body by means of chemical remedies "according to our experience," finished March 11, 1630.⁸⁷ But in the same year he gave other lectures in chemistry at Paris.⁸⁸

We shall here, however, be chiefly concerned with *Le cours de chimie* by him which was printed at Paris in 1646, apparently after his death. Its publisher explains that the esteem in which are held the works of de Clave thus far printed has incited him to search for those still in manuscript in order to give them to the public, and, among others, this which contains his last course in chemistry. Like other manuals thus far mentioned, it is a small volume of pocket size and has 188 pages. De Clave seems to have published *Principes de nature* in 1635,⁸⁹ and his present publisher calls this new *Cours de chimie*, "the second book of *Principes de nature*."⁹⁰

⁸⁴ *L'Idée Parfaite de la Philosophie Hermetique. Ou l'Abregé de la Theorie & Pratique de la Pierre des Philosophes. Second Ed. Augmentée d'Observations pour l'intelligence des Principes & Fondemens de la Nature & de la Philosophie Hermetique. Avec une Meditation sur les Mysteres de la Sapience Divine & Humaine.* Par M. I. Colleson, Doyen de Maigné, Paris, 1631, in-8, 55 pp.

⁸⁵ Zetzner VI (1661), 143-62.

⁸⁶ See Chapter 6.

⁸⁷ Rennes 162, fols. 1-102 and 103-113.

⁸⁸ *Correspondance du P. Marin Mersenne*, II (1936), 434.

⁸⁹ According to Johann Wilhelm Baumer, *Bibliotheca Chemica*, 1782, cited by Ferguson, I, 163. Hoefer, II, 332, gives the title, *Nouvelles lumières philosophiques; des principes de la nature*, Paris, 1635, in-8, but would seem to have confused and combined two different books: *Principes de nature* and *Nouvelle lumière philosophique*.

⁹⁰ *Le cours de chimie, qui est le second livre des principes de nature*, Paris, 1646, 188 pp. BN R.31853.

In the interim between these two publications there had appeared at least one other volume by de Clave, his *Nouvelle lumière philosophique des vrais principes et élémens de nature et qualité d'iceux contre l'opinion commune*.⁹¹

Le cours de chimie divides into prolegomena and four books. In *Nouvelle lumière philosophique* de Clave had held that chemistry was almost unknown until Paracelsus, and that Paracelsus had regarded earth and water not as elements but as mere excrements of his three principles—sulphur, salt and mercury.⁹² Clave, on the contrary and unlike Beguin, held that all five were elements, a view also adopted by him in *Le cours de chimie* and in most subsequent manuals of the century. In his Prolegomena he points out that Aristotle taught that both simples and compounds could be resolved into First Matter, whereas “we say” that mixed bodies resolve into their elements or first principles, but that these last are incorruptible and cannot be reduced further or transformed into one another. Water is a very volatile element and “moins intrinsecque.” Spirit—which name for de Clave replaces Mercury—is an acid element, the most penetrating of all, less volatile than water and less fixed than salt and earth. Salt will coagulate and dissolve; it is caustic and very fixed and intrinsic. Earth is dry, rare and spongy. Spirit is hot and humid, heavier than water, earth and sulphur; lighter than salt. Sulphur is hot and the lightest of the five. Salt is hot and the heaviest of the five. Earth and water are neither hot nor cold *per se*.⁹³

These brief *dicta* had been preceded in *Nouvelle lumière philosophique* by detailed discussion of such questions as whether taste, sound and touch are specific qualities of the elements (p. 242–); the congelability of water, fermentability of mercury, inflammability of oil (sulphur), fusibility of salt, and friability and discontinuability of earth (p. 462); and that Aristotle erred in holding that the pure elements had no color, savor or odor (p. 463). Such specific qualities Clave regarded as occult, so that his chemistry retained

⁹¹ Paris, O. de Varennes, 1641, in-8, vi fols., 495 pp. BN R.9640. Hélène Metzger, *Les doctrines chimiques en France du début du XVII à la fin du XVIII siècles*, 1923, pp. 51-59, com-

bined quotations from it and *Le cours de chimie* in one account.

⁹² *Op. cit.*, p. 39.

⁹³ *Le cours de chimie*, pp. 2-4.

one of the chief categories of natural magic—the conception of occult virtue.

The first book of *Le cours de chemie* divides into three tractates. The first of these treats of furnaces, vessels and fire; the second discusses the five principles further; the third deals with tinctures, extracts, balms, masteries, flowers and *croci*. Book two then takes up the chemical preparation of vegetation and animals; book three, of minerals; and book four, of metals. The work then concludes with a supplementary section upon the cure of maladies by chemical remedies.

A Scot, William Davidson or Davison or Davisson by name, in 1647 became Intendant of Le Jardin du Roi, and on July 23, 1648 opened there a course in chemistry.⁹⁴ Previously he had composed a Pyrotechnic Philosophy or Course of Iatrochemistry, for which the royal privilege is dated February 5, 1635–1636, but which was not printed until 1640.⁹⁵ Its full title describes it as adorned with observations by no means commonplace, illustrated by the first elements of theoretical and practical physics, and containing new speculation as to nature, confirmed by the authority of all philosophers, recent and ancient, yet offering what hitherto has been wanting in, and wanted by, all chemists of this age. It is in two volumes and four parts, and is a very pretentious and tiresome work.

The pyrotechnics are chiefly metaphysical and rhetorical, interlarded with a perfect frenzy of quotation and citation from classical poets, neo-Platonists, Orphic hymns, and various medical men and alchemists. We are given a bit of Boethius every now and then, while verses of Fracastoro are repeated for nearly two solid pages. There are dedications to such magnates as James Stuart, duke of Lenox, and Henry Persy (*sic*), son of the duke of Northumbria.

⁹⁴ E. T. Hamy, "William Davidson . . ." *Nouvelles Archives*, série 3, vol. X (Paris, Museum nat. d'hist. naturelle), 1898, pp. 1-38.

The *Vita* of Morin which is prefixed to the posthumous edition of his *Astrologia Gallica*, states at p. iv that Davidson at first was primarily interested in astrology but then turned to

medicine, while Morin turned from medicine to astrology.

⁹⁵ *Philosophia pyrotechnica Willielmi Davissoni . . . seu cursus chymiatricus . . .*, Paris, Apud Ioannem Bes-sin prope Collegium Remense, 1640, 2 vols. of 487, 272 pp. BN R.33014-33015. See LR 372-73 for the full Latin title, too long to repeat here.

The old rabbis of the Cabala are not forgotten. Such topics are discussed as the origin of love and its efflux in the chaos of quadruple essence. Or we are treated to such apothegms and *bon mots* as, "That is good which all seek;" "Where there is order, there is multitude;" and "Everything that subsists by itself is incorruptible."⁹⁶ Yet a contemporary tells us that Davidson won much glory by his books stuffed with widely-read erudition.⁹⁷

On the other hand, Beguin's *Tyrocinium* was probably utilized by Davidson without acknowledgement,⁹⁸ and the latter's emphasis upon seeds is very likely derived from van Helmont. Davidson does not make clear what these *semina* are nor where they come from, but he asserts that their virtues are not from the elements, and that they rather constitute bodies and inform the elements, and that in them are infinite faculties which were never in the elements, such as multiplication, science and eternity.⁹⁹

After devoting the longer first volume to pseudo-philosophy and literary fireworks, Davidson continues to treat of alchemical theory in the third part and first pages of the second volume and arrives at practical chemical operations only in the fourth and last part. Even here he has an exhortation of twenty-five pages to curious and studious youths, a dialogue between a Peripatetic and a Spagyric, and repeats the doctrine of the origin of spirits from the theory of the second part.¹⁰⁰ Or he dilates on the symbolism and mutual relationship of the elements with the five simple geometric bodies, which he calls "a new idea never elaborated by anyone before me so far as I know",¹⁰¹ although it would seem an obvious transition from Kepler's relation of planetary movements to the five regular solids in his *Mysterium cosmographicum* of 1596.

Apart from these effusions, some forty-nine brief chapters, covering about 143 small pages, have treated of distillation, mercury; spirit, oil, and salt of tartar; oil, salt and spirit of guaiac; oil and

⁹⁶ *Op. cit.*, vol. I, pp. 120, 123, 145.

⁹⁷ *Vita of Morin in Astrologia Gallica*, 1661, p. iv.

⁹⁸ For example, the passage in which Beguin excused himself for not describing furnaces, vessels and other

apparatus: Beguin (1610), 5; Davidson, II, 28.

⁹⁹ *Ibid.*, I, 367.

¹⁰⁰ *Ibid.*, II, 45-70, 88-, 107. At II, 127 he repeats a story from Quercetanus already told at I, 72.

¹⁰¹ *Ibid.*, II, 184-209.

spirit of mastic; spirits and oil of turpentine; spirit, oil and volatile salt of amber; waters, oils and spirits of cinnamon; quintessence of wine and the way of extracting it from all vegetables. Also of tinctures, balsams, extracts—including laudanum, masteries, flowers and saffrons; mercury sublimate and dulcificate. Of animal preparations: honey and wax, the phlegm, spirit, oil and volatile salt of the human cranium, and of hartshorn, ivory and the like. Then *aquae fortes*, vitriol, calcination of metals actual and potential, salts, vitriolated tartar, sugar of lead, salt of pearls and coral, the emetic powder or *Algarot*, *regulus* of antimony, glass of antimony, and the conversion of iron into copper.

Davidson's volume came out in French in 1651 with another long title which described it as The elements of the philosophy of fire or chemistry, containing the finest observations concerning the solution, preparation and administration of vegetables, animals and minerals, remedies against ills of the human body, and metallurgy applied to theory by truth founded on geometric necessity and demonstrated after the manner of Euclid.¹⁰² On July 26 of the same year Davidson left Paris to become physician to the king of Poland with a salary of 10,000 livres.¹⁰³ Three years later, in 1660 at The Hague, was published a *Prodromus* by Davidson to commentaries on the Idea of Philosophic Medicine of Peter Severinus, explaining the Platonic foundation on which Hippocrates, Paracelsus and Severinus had built, together with some select chemical remedies from Davidson's own experience of forty years past. The book was reprinted at Rotterdam in 1668.¹⁰⁴

Gui Patin, noting the appearance of the first edition in a letter of August 25, 1660, called it "un Commentaire d'un certain malheureux chimiste nommé William Davisson In ideam philosophicam Medicinæ Petri Severini Dani."¹⁰⁵ Two years earlier Patin

¹⁰² *Les élémens de la philosophie de l'art du feu ou chimie, contenant les plus belles observations qui se rencontrent dans la résolution, préparation et exhibition des végétaux, animaux et minéraux, et les remèdes contre les maladies du corps humain, comme aussi la métallique appliquée à la théorie par une vérité fondée sur*

une nécessité géométrique et démontrée à la manière d'Euclide, Hellot, Paris, 1651, in-8. BN R.33016. Metzger (1923), 45-51, 472, is based on this edition.

¹⁰³ Hamy, p. 17.

¹⁰⁴ LR 873.

¹⁰⁵ *Lettres* (1846), I, 253.

had suggested that the real author of J. Chartier's work on anti-mony was

Davisson . . . , a wretched Scotch chemist and cuckold, who left Paris for fear of starving to death and went to Poland, thinking to make a fortune, but died there a beggar.¹⁰⁶

This indicates that Davidson died before 1658, but, according to Hamy, he revisited Aberdeen in 1667 and Paris in 1669.¹⁰⁷

In connection with two surprising experiments communicated by Daniel Coxe to *Philosophical Transactions* in 1674, in which vegetable salts perfectly resembled the shape of the plants from which they had been obtained, ferns in the one case and firs or pines in the other, it is noted that Davidson mentioned the same result insofar as figures of firs and pines were concerned in his book of *Chemical Operations*.¹⁰⁸ But we have seen that de Clave antedated him in this.

When the brief *Traicte chymique* of G. Sauvageon¹⁰⁹ first appeared I do not know. In the edition of 1643¹¹⁰ as well as in that of 1648,¹¹¹ the work is already described as revised and enlarged. Sauvageon also wrote on the sympathetic powder.¹¹² In 1630 he had enlarged the *Pharmacopoeia* of Brice Bauderon¹¹³ (1540–1623), first printed in 1588. Of the *Traicte chymique* there were further editions in 1644, 1648, 1650 and 1681, and perhaps others.

Gui Patin refers to an M.D. of Lyon named Sauvageon who was re-editing Riolan and to whom he lent his own copy, in which he

¹⁰⁶ *Ibid.*, III, 102-3.

¹⁰⁷ Hamy, p. 22.

¹⁰⁸ PT IX, 174, 177.

¹⁰⁹ The name does not appear in Ferguson or Zedler. Duveen lists only the 1643 edition and, like Jöcher, calls Sauvageon George. So does BM, which has only the 1681 edition.

¹¹⁰ *Traicte chymique contenant les preparacions, usages, facultez et doses des plus celebres et usitez medicamens chymiques. Reueu et augmenté en cette derniere edition.* Par G. Sauvageon D.M. Aggregé au College des Medecins de Lion. A Paris, Chez

Iean Bessin, rue de Reims près le College, 1643, 88 pp. BN 8°Te147.38.

The dedication is undated, but the "Extrait du Privilege du Roy" bears the date, 21 Nov. 1643.

¹¹¹ Same title, but Paris, J. Jost, 1648, in-4, 4, 97, 10 pp.

¹¹² *Discours de la poudre de sympathie*, in Honoré Lamy, *Abbrégé chirurgical tiré des meilleurs auteurs de la medecine*, Paris, 1644, in-8. BN 8°Td74.27.

¹¹³ H. Schelenz, *Gesch. d. Pharmazie*, 1904, pp. 503-4.

had corrected many misprints, but Sauvageon left some uncorrected.¹¹⁴ It may seem strange that the same man should edit Riolan and write on chemical remedies. But he was probably a medical eclectic, or hack writer and editor, since in 1641 he reprinted the *Universa Medicina* of Bartholomaeus Perdulcis (Perdoux).¹¹⁵ On June 11, 1649 Patin wrote:¹¹⁶

M. Sauvageon is a strange fellow. I never saw such a chicaner; I believe this man couldn't live without a lawsuit; he always has to be attacking somebody . . . He is likely to lose his suit against your booksellers of Lyon, just as he has often lost here against Tom, Dick and Harry.

Eight years later Patin was asking whether Sauvageon's *Pharmacie de Bauderon* was printed yet.¹¹⁷

The *Traicte chymique* opens with an "Advertissement au lecteur," in which chemistry and chemical remedies are defended. It is granted that existing prejudice against chemistry is partly due to its practitioners' ignorance of medicine. But to say that it was not practiced by the ancients is not a good argument against it. It is older than Paracelsus and goes back to Raymond Lull, Arnald of Villanova and Mesue. It is no longer dangerous even in the case of mineral and metal remedies. Its operations are more laborious than those of Galenic medicine or pharmacy, but are worth the pains. By it one gains a more intimate knowledge of natural actions, chiefly nutritive, and of those against nature, and of the meteors which form in the human body. This last idea was probably suggested by *De meteoris microcosmi* of Rodrigues de Castro, published in 1621. One also understands better the nature of mixed bodies from their being resolved into their components, their true principles, essential, physical and palpable—an insight never afforded by the purely intellectual metaphysics of the schools. Also

¹¹⁴ *Lettres* (1907), p. 125.

¹¹⁵ *Universa medicina ex medicorum principum sententiis consiliisque collecta, opera G. Sauvageon praeter notas in margine pluribus therapeuticis locis ex auctoris autographo aucta & ubique emendata. Cui etiam accessit de morbis animi liber. Parisiis apud Johannem Bessin, 1641, in-4.*

The previous edition had been in 1630. LR 118.

¹¹⁶ *Lettres* (1846), I, 416.

¹¹⁷ *Ibid.*, II, 323, letter of June 16, 1657. Of Sauvageon's edition BN Te¹⁴⁶.69 is Paris, 1643, and BM 547. d.13 is Rouen, 1644. Patin probably had in mind a later edition.

chemical remedies help to preserve human life, and one must not only know them but how to administer them. Sauvageon therefore, besides accounts of their virtues proper to certain diseases, will tell when and how to administer them and in what amounts.

The learned public lectures in chemistry at the Jardin Royal of the Faubourg Saint-Victor at Paris will give those who have the leisure and desire a fuller knowledge of all that we are going to set forth summarily.¹¹⁸

In the text proper vegetable remedies are first considered; then a very short section on animals is limited to honey; finally under minerals come salt, nitre, vitriol, sulphur, antimony and mercury.¹¹⁹ It is best to give mercury in pills so that it won't excite the saliva. One should take bouillon not more than two hours afterwards and eat a half hour after the bouillon, so that the mercury will not stay too long in the stomach. In incorporating the mercury into pills, it is well to add a drop or two of oil of sulphur in order to moderate its malignity and render its spirits volatile.¹²⁰ Coral is next considered, then lead and the other metals, ending with potable gold.

Yet another manual in French was E. R. Arnaud's *Introduction à la chymie*, published at Lyons in 1650, to which we have referred in opening this chapter.¹²¹ It is unusual in giving no recipes or medicines. After a deal of preliminary matter,¹²² the first book spends sixteen pages on the name, Chymie, its definition, nature, varieties and necessity; twenty pages more on its antiquity; then of its material object, furnaces, vessels and fire. The second book¹²³ is then devoted to chemical practice: calcination, dissolution, sublimation, rectification, descension, exaltation, circulation, ablu-tion, digestion, putrefaction and fermentation, extraction of essences, tinctures, etc., liquefaction, coagulation, and fixation. Thus we have in it a brief practical manual free from mysticism and magic.

¹¹⁸ The work of Jean Paul Contant, *L'enseignement de la chimie au Jardin royal des plantes de Paris*, Cahors, 1952, 136 pp., 6 Pl. has appeared since I completed this chapter.

¹¹⁹ The three sections begin at pp. 1, 33 and 38 respectively.

¹²⁰ *Ibid.*, p. 69.

¹²¹ See above, note 1.

¹²² Five unnumbered leaves of dedication, eight Au lecteur, table of authors cited, table of contents, prologue extolling chemistry (in all 6 fols.).

¹²³ At pp. 63-112.

The next decade of the century saw the publication of another course in chemistry by Annibal Barlet with a longer title couched in more mystical language.¹²⁴ The work itself lives up to the promise of the title, being much longer than de Clave's and at first an incoherent, disorderly and mystical hodge-podge. The author raves about cosmic figures, is allegorical and astrological by turns, and stresses the importance of numbers. But at page 125 he turns to instruments and vessels, at page 140 to furnaces. We soon have a cosmic furnace, however, and presently a description of alchemical characters. At page 195 processes and recipes begin, and are soon illustrated by a series of plates showing Hermes and his servitors performing the processes in a laboratory. The same division into animals, *vegetaux*, minerals and metals as in de Clave, Davidson and Sauvageon is followed. The minerals are all clearly and fully described. The processes are set forth in a far more straightforward style and practical fashion than his preliminary guff. We are told what to take, and what to do with it, and what results. Then under the caption, "Sens physique," he tells what we learn from it, but here again he is apt to become verbose and none too clear. Finally the medicinal properties are set forth.¹²⁵

Barlet also published, without indication of place or date, what appears to be an abridgement of or extract from the foregoing work.¹²⁶ Since in one passage he says, "We thus explain ourselves to our auditors, while awaiting the entire book,"¹²⁷ it would ap-

¹²⁴ *Le vray et méthodique cours de la physique résolutive, vulgairement dite Chymie, représenté par figures générales et particulières, pour connoître la Theotechnie Ergocosmique*, Paris, N. Charles, 1653, 4to. BM 1034. h.2. I have used an edition of 1657, Paris, 626 pp.; BN R.6930; BM 1034. h.3.

¹²⁵ Examples of experiments and processes are: 417, "Depuration, Fusion, Esprit, Huile et Magistrale du Nitre ou Salpêtre"; 425, "Decrepitation, Fusion, Esprit et Huile de Sel Marin, Sel Gemme et autres fixes"; 432, "Dephlegmation, Calcination, Esprit, Huile, Sel, Magistrale et Soulfre

de Vitriol"; 439, "Phlegm et Esprit d'Alum, Eaux fortes et Regales"; 447, "Sublimation, Fixation, Esprit et Huile du Sel Armoniac"; 505, "Purification, Dissolution, Sublimation et Fixation du Bismuth, Zinch et autres Marcassites."

¹²⁶ *Abregé des choses plus nécessaires. Du vray et methodique cours de la physique resolutive, vulgairement dite Chymie. Extrait de la Theotechnie ergocosmique, c'est à dire, l'Art de Dieu en l'ouvrage de l'univers*, 124 pp. BM 1032.b.13.

¹²⁷ *Ibid.*, page with the signature A iii recto.

pear that this *abregé* or *extrait* was issued shortly before the longer volume. It is illustrated by figures and charts which are folded in between the pages. The first part on resolute theory divides into three sections on: 1) intelligence, principles, elements and qualities of the compound; 2) qualities of resolute physics; 3) its truths or chief and most useful maxims. The second practical part has five sections on designs of operations, animals, vegetation, minerals and metals. We are told how to extract the water, spirit, balm, quintessence and salt of blood; how to get oil from butter, fat, and wax; the extract of flesh or fleshy parts; the mastery of bones or solid parts; how to distill the spirit, oil and volatile salt of horns, hair and feathers; how to get the spirit, salt and oil of urine; how to extract the water, spirit, oil and tincture of honey; and so on with the vegetable and mineral kingdoms.

Educated at Protestant Sedan, Nicolas Le Fèvre or Febvre succeeded Davidson at the Jardin du Roi as professor of botany and chemistry, a post which he held for twelve years.¹²⁸ In 1660 he published in two volumes a summary of his chemical teaching which was to have many editions.¹²⁹ It appeared in English in 1662¹³⁰ and again in 1664 and 1670, and also, somewhat later, several times in German. He was invited to England in 1664 by Charles II¹³¹ and died in London in 1674. He speaks of himself as "royal apothecary"¹³² there and on some title pages of his book is styled "professeur royal de Chemie et membre de la Société Royale de Londres."¹³³

Le Fèvre has been credited with distinguishing chemistry from iatrochemistry and pharmaceutical chemistry. It is true that he

¹²⁸ Hoefer, II (1843), 286. Ferguson, II, 17-18.

¹²⁹ *Traicté de la Chymie*. For the full title see Duveen 345. Ferguson gives the title as *Chimie théorique et pratique*; Dumas, as *Traité de chimie raisonnée*; J. B. A. Dumas, *Leçons sur la philosophie chimique professées au Collège de France en 1836*, Paris, 1837, in-8. (I cite the second edition of Brussels, 1839, p. 45; Col 540.9 D891.) In the edition of Le Fèvre, Paris, 1751, it is called *Cours de chimie*.

¹³⁰ Ferguson does not mention this edition but later acquired a copy of it: see *London Times*, Literary Supplement, July 22 and Aug. 5, 1926.

¹³¹ Not James II, as Dumas carelessly states.

¹³² Ferguson, *Some English Alchemical Books*, 1913, p. 86.

¹³³ Hoefer, II, 287 says that he was never a member of it, but he is so listed in Sprat's *History of the Society*, 4th edition, 1734, p. 432, "Mons. le Febvre."

said that "Chymistry makes all natural things . . . her proper and adequate object" and that "Chymistry doth not meerly consist in the skill of preparing well a remedy, as many do erroneously imagine."¹³⁴ Yet he addressed the English version of his book "To the Apothecaries of England", and much of its first volume and all of the second are devoted primarily to chemical remedies. Moreover, he held that chemistry was not concerned merely with natural body, but with a universal spirit, brought into the air by the influence of the heavens. Chemists deny that air participates in the composition of mixed bodies, and regard it as a matrix to the universal spirit which there takes on some bodily Idea, before it becomes specificated by means of particular ferments and enters into bodies produced from water and earth, which chemists accept as elements along with mercury, sulphur and salt.¹³⁵

It seemeth even that the Universal Spirit loves the earth above any other of the elements, since it descends from the highest part of Heaven . . . to take a bodily shape here on earth.¹³⁶

Otherwise the treatment seems to follow largely along usual lines, considering first chemistry in general, then the principles or elements of natural bodies, third of purity and impurity, i.e., simple and compound bodies, fourth of chemical operations, then of meteors—under which are included honey, wax and manna as well as rain and dew, then animals, vegetables, and minerals.

For Le Fèvre chemistry was still a collection of secrets, mysteries and marvels. He speaks of "the rarest secrets of the noblest philosophy," of the "wonderful spirit of Venus," of some chemical mystery being hid under the preparation of tobacco, of sal ammoniac's ravishing with wonder "even the most knowing in those mysteries which it opens."¹³⁷ Consequently "most writers in our art" have disguised it under enigmatical and figurative expressions.

He also accepted the influence of the stars repeatedly. Not only was copper called Venus because it was under that planet and related to the generative functions of man¹³⁸—and so with the

¹³⁴ *A Compleat Body of Chymistry*, London, 1670, I, 8, 12.

¹³⁵ *Ibid.*, I, 13-17, 36.

¹³⁶ *Ibid.*, I, 39.

¹³⁷ *Ibid.*, II, 46; II, 152; I, 238; II, 268.

¹³⁸ *Ibid.*, II, 151. Le Fèvre further states that copper contains much vitri-

other metals. He further associated the seed of tobacco with Aquarius and Mars, and held that, if antimony was exposed to the open air after being distilled, it would attract from the influence of the stars and the spirit of the air "enough to supply again a new distillation at the end of six weeks or two months."¹³⁹ If antimony was calcined in common fire, it lost weight; but if calcined with a burning glass, it would gain weight from the "rare effects of magical and celestial fire, drawn from the rays of the sun."

But this wonder shall cease as soon as we begin to apprehend . . . that light is that miraculous fire which constitutes the principle of antimony.¹⁴⁰

That vital light was possessed by animals was shown by the luminosity of flesh and meat. Also all animals were of a more volatile, subtle and aerial substance than plants and trees. For employment in medicine, they should be middle-aged and have died a violent death, preferably by suffocation, which Le Fèvre thought would prevent their spirits from dissipating and preserve the aforesaid vital light.¹⁴¹

Marvelous enough in all conscience, however, were the properties of vegetation. Many remedies of varied virtues could be extracted from tobacco, and four kinds of roses had as many different chemical and pharmaceutical qualities. The white kind were used only for eye complaints and diseases of women. They should be plucked a little after daybreak, when they still possessed some of the balsamic moisture acquired during the cool of the night. They should not be gathered after a rainy day, nor long after sunrise because that planet (*sic*) seems greedily to suck the balsam and nectar of all the flowers which are of an ethereal and delicate substance. And amongst all the rest roses are the most delicate.¹⁴²

Finally, we may note two examples of what Le Fèvre called experiments. Of the first he was an eye-witness. A cornet who had suffered a gunshot in the thigh near the knee, after the wound had healed, was unable to bend his knee, and "his heel did almost

ol and less earth than iron, and so less impurity.

¹³⁹ *Ibid.*, I, 239; II, 222.

¹⁴⁰ *Ibid.*, II, 215-16.

¹⁴¹ *Ibid.*, I, 115-16.

¹⁴² *Ibid.*, I, 238, 241-42.

stick unto the buttock." His surgeon-major, who was a High German, gave him daily for six weeks a dram of a powder from a human thigh or leg bone, and before the six weeks were up, he was able not only to bend his knee but to fence, play tennis, and ride horseback.¹⁴³ The other instance was an experimental proof of renovation of youth by that great arcanum, quintessence of balm. One of Le Fèvre's best friends for about a fortnight took daily on a fasting stomach a glass of white wine colored with this remedy. After his fingernails and toenails fell off painlessly, he did not try it further on himself but administered it to an old woman servant. Within ten or twelve days she began to menstruate once more but was afraid that she would die rather than rejuvenate and refused to take the draught any longer. He then steeped some grains of corn in it and gave them to an old hen which, after six days, began to lose its feathers until quite naked, but on the fifteenth day they began to grow again, her crest rose, and she began to lay.¹⁴⁴

The *Journal des Sçavans* in 1666 noted a *Discours* which M. le Fèvre had pronounced at London on the great cordial of Sir Walter Raleigh. It was composed of all the best ingredients of other cordials: flesh of vipers, bezoar, hartshorn, masteries of pearls and coral, and so forth. Le Fèvre warned that it was an error to calcine deer horn, as calcination took away all its *sal volatile* in which its virtue consisted. He also was opposed to dissolving pearls in acids, and told how to make a tincture of gold.¹⁴⁵

"*Chimia in artis formam redacta comes to light, after having feared the light for the space of some years,*" were the words with which Werner Rolfinck opened that work in 1661,¹⁴⁶ retaining the title of the manual by Brendel, his predecessor as professor at Jena, which he had slightly revised in 1641. What he now published, however, was an essentially different work in six books. The first contained prolegomena and treated of chemistry in general; the second, of the means by which chemistry gained its end. The third was on artificial works or effects of operations—chiefly on spirits

¹⁴³ *Ibid.*, I, 130.

¹⁴⁴ *Ibid.*, I, 173-74.

¹⁴⁵ JS I, 578-79.

¹⁴⁶ *Gueneri Rolfincti Phil. ac. Med. Doctoris et professoris publici Chimia*

in artis formam redacta, sex libris comprehensa, Jenae, Samuel Krebs curabat, anno MDCLXI, quarto minori, 443 pp., Index, Dedication, Preface. BM 1034.h.5 (2.).

and oils;¹⁴⁷ the fourth, on those which were in between liquids and solids—soft essences or tinctures,¹⁴⁸ elixirs, extracts, mixtures, balsams, *elaeosaccharia*, gelatines, alcohol. The fifth book dealt with solids—such as salts, masteries, flowers, *calces*, stones, *croci*, *reguli*, stars and amulets.¹⁴⁹ The sixth and last book was on imaginary and non-existent chemical effects and works¹⁵⁰—a category which we have seen introduced in the anonymous volume on *Non-Entia Chymica*, of 1645. The whole is sprinkled with alchemical symbols, Greek words and quotations, so that it would not seem an easy textbook for a beginner. In the main it is a pharmaceutical collection of chemical remedies.

Rolfinck attacks the Paracelsan doctrine that the whole world is in man and the macro-microcosm idea, which he says is no help in medicine, but presently we find him giving a "microcosmic vital cordial water."¹⁵¹ He also defends the tenet that contraries are cured by contraries against the Paracelsan theory that like cures like.¹⁵² But he still repeats Beguin's definition of a mastery as a mixed body so prepared without extraction that all its parts are kept homogeneous, but a nobler degree of substance or quality is attained by removing exterior impurities.¹⁵³ He still gives such remedies as the secret Alkahestine salt of Paracelsus, Helmont, Polemann and Glauber, or Mynsicht's antifebrile of snails themselves without calcination.¹⁵⁴ Star, "in the Parnassus of the chemists," does not indicate figure but denotes a singular medicament endowed with outstanding, nay astral, virtue.¹⁵⁵ Amulets are either simple or adorned with words and characters. After citing a number of authorities for the power of words and characters, Rolfinck decides that they have no efficacy either by nature or reason or accident. It is not probable that they obtain force from the influence of the stars, and they have no divine sanction.¹⁵⁶ Similarly, after quoting authorities pro and con as to the sympathetic unguent, he concludes that its users select wounds to cure which would heal

¹⁴⁷ It covers pp. 122-98, of which spirits occupy 132-73, oils 174-92.

¹⁴⁸ This distinction went back to Beguin.

¹⁴⁹ Pp. 280-418.

¹⁵⁰ Pp. 419-38.

¹⁵¹ Pp. 61-70, 128.

¹⁵² Pp. 72-74.

¹⁵³ P. 319.

¹⁵⁴ Pp. 289, 379.

¹⁵⁵ P. 409.

¹⁵⁶ Pp. 410-14.

anyway without any medicaments provided they are kept free from pus and dirt. The examples of magnetic sympathy adduced by Helmont are partly false, partly irrelevant.¹⁵⁷

Among chemical nonentities are listed quintessences in the Paracelsan astral sense, the resuscitation of a plant from its ashes or salts, the chemical extraction of mercury from vegetation or animal blood, the *homunculus* of Paracelsus, generation of gold in the human body—the growth of a gold tooth by a Silesian boy in 1593 being pronounced a fake, salt of metals, a universal medicine and panacea, the conversion of imperfect metals into gold or silver, or into other imperfect metals.

Thus Rolfinck seems to be making considerable strides away from alchemy and towards chemistry, and from magic to science. But one hesitates to subscribe to the statement of Stolle that he was the first really to reduce chemistry to unified form in 1661 in his *Chimia in artis formam redacta sex libris comprehensa*.¹⁵⁸

When Le Fèvre left for England, he was succeeded at the Jardin des Plantes by Christoph Glaser of Basel, who also became apothecary to the king and the duke of Orléans. Of his *Traité de la chymie*, which first appeared in 1663,¹⁵⁹ there were numerous editions and translations, including a German version with a title twenty lines long,¹⁶⁰ whereas the English translation of London, 1677, was called *A New Treatise of Chymistry*.¹⁶¹ In the preface to the original edition Glaser assures his readers that he will say nothing that he does not know, write nothing that he has not performed, and give no preparation which he has not tested experimentally. He will not employ hieroglyphic characters nor enigmatic expressions, but call everything by its common name.¹⁶²

After a few pages on chemistry in general, the three active principles—salt, sulphur and mercury, and the two passive prin-

¹⁵⁷ Pp. 417-18.

¹⁵⁸ Stolle (1731), 789. In 1660 Rolfinck had published six chemical dissertations by different students as *respondentes* under himself as *praeses*. These were reprinted in 1675: *G. Rolfinckii . . . Dissertationes chimicae sex . . .*, Jena, in-4. The BM has several

copies of both editions. And see Ferguson II, 283-84.

¹⁵⁹ I have used this edition (BN R. 37340), in-8, xvi, 381 pp., in large, bold and very readable type.

¹⁶⁰ Ferguson, I, 319-20.

¹⁶¹ Reviewed, PT XII, 886.

¹⁶² Ed. of 1663, p. 60.

ciples—phlegm and earth, comes a longer sixth chapter in which the various operations, by which mixed bodies are reduced to their principles, are set forth in alphabetical order from alcoholize and amalgamate to sublimate and vitrify.¹⁶³

To detonate and fulminate is to drive from minerals all the impure and volatile sulphurous parts, at the same time retaining all the internal and fixed sulphurous parts.

After further chapters on vessels and furnaces, with illustrative plates and explanation of their figures, and on lutations of vessels and furnaces, and degrees of fire, the first book ends.¹⁶⁴

Natural bodies are infinite in number and very different in substance and form, both internal and external, so that it is necessary to use "an infinity of means and instruments." Metals and minerals especially vary greatly in composition. Not only does each require a different preparation, but each preparation calls for a great amount of work and thought and entirely diverse modes of procedure. One cannot establish general rules for their preparation, as one can for vegetables and animals.¹⁶⁵

The section on the mineral kingdom fills more than half of the whole work,¹⁶⁶ and includes coral, ambergris and amber. In the opening chapter on gold, nothing is said of potable gold. But in connection with diaphoretic powder of gold, Glaser affirms that he will not conceal from the public what some persons in Paris have kept as a great secret. If you distemper this powder with a little water or saliva and rub a silver vessel with it, it gilds the vessel, and this lasts a long while. As we have heard Le Fèvre say, chemists call copper Venus, as much for the influence which it can receive from that planet, as for the virtue it has for diseases in the generative parts.

In treating of vegetables, to which he devotes twenty-four chapters as against twenty on minerals, but much more briefly, Glaser begins at the roots and comes gradually to their tops. In the chapter on tartar he explains that he is treating only of the tartar of wine and not of microcosmic tartar, which is a viscous substance which

¹⁶³ *Ibid.*, pp. 13-28.

¹⁶⁴ At p. 60.

¹⁶⁵ *Ibid.*, pp. 62-63, 65.

¹⁶⁶ *Ibid.*, pp. 70-272.

forms in the human body.¹⁶⁷ On animals he has only eight chapters. The first deals with oil and volatile salt of human cranium, which is particularly adapted to epileptics and hysterical maladies. The others take up the distillation of the flesh of vipers, of human blood, of urine, and May dew—which hardly seems animal, manna, honey and the distilling of wax. In the introduction to this section Glaser had said—again like Le Fèvre—that the animals in question should be middle-aged and have died a violent death. But this certainly does not apply in the case of the distillation of urine, which we are told should be that of children between eight and twelve years of age or that of young men. Glaser would appear to have copied previous manuals rather carelessly.

When the Marquise de Brinvilliers was tried on the charge of numerous poisonings, Glaser was said to have sold her the poisons, and was put in the Bastille in 1676. He was soon released but died in 1678, it was said of chagrin. Dumas regarded him as a mere manipulator and inferior to Le Fèvre as a chemist.¹⁶⁸ But his method of making potassium sulphate was celebrated, and the native salt, Glaserite, was named after him.

Johann Joachim Becher of Speyer, of whose other writings we have treated in an earlier chapter,¹⁶⁹ in 1664 published a manual entitled *Institutes of Elementary Chemistry* or *Oedipus Chemicus*, which was further described in its title as very useful and necessary for all students of medicine and chemistry to read.¹⁷⁰ The work was dedicated to the famous physician, Sylvius. The work divides into seven *tituli* or chapters, of which the first three consider the first matter of the chemists; the principles of substance, namely, sulphur and salt; and the principles of quality, which are mercury and salt. The fourth *titulus* gives a chemical interpretation of the traditional four elements: fire, air, water and earth. The fifth deals

¹⁶⁷ *Ibid.*, p. 340.

¹⁶⁸ Dumas (1878), 69-70.

¹⁶⁹ Chapter 20, *The Underground World of Kircher and Becher*.

¹⁷⁰ *Institutiones chimicae prodromae* i.e. *Ioannis Ioachimi Becheri Spirensis mathem. et med. doct. Oedipus chemicus obscuriorum terminorum et*

principiorum chemicorum mysteria aperiens et resolvens. Opusculum omnibus medicinae et chimiae studiosis lectu perutile et necessarium. There were two editions in 1664 at Frankfurt and Amsterdam. I have used the former in BN R.27992, 192 very small pages.

with the terms: generation, sperm, menstruum, matrix, weight and heat. The sixth takes up six actual chemical operations: accretion, decretion, solution, coagulation, destruction, and more than perfection or transmutation. The seventh and last is concerned with seven requisites of the artificer: terminology, instruments, materials, operations, chemical writings, a method of studying chemistry, and a method of philosophizing chemically.

In 1665, 1664 and 1668, under the joint title of Rudiments of Natural Philosophy, Nicolas de Locques, who styled himself "Spagyric physician of his Majesty," issued a *Cours theorique* and a *Cours pratique*. The former, dedicated to the king, "clearly explained the precepts and principles of chemistry which have hitherto been hidden by the ancient philosophers." The latter, dedicated to Monseigneur le duc de Mortemart, peer of France," treated according to the doctrine of Paracelsus operations hitherto known to very few persons. De Locques had already published *Propositions touchant la physique résolutive* (another designation for chemistry) in 1661,¹⁷¹ and a treatise on the magnetic virtues of the blood dedicated to "his most serene Highness, Monseigneur le prince," in 1664.¹⁷² These with a work on fermentation dedicated to "his royal Highness, le duc d'Orléans," and one of 1668 on Philosophical Elements of the arcana of the dissolvent general, were reprinted with or added to the two courses.¹⁷³

De Locques promises to show the king how all sorts of bodies can be dissolved by a single liquor and make an admirable panacea. He says that it is a secret which died with Paracelsus and Raymond Lull and which he has revived from their writings by his experiments. Actually it appears to be the quintessence of John of Rupescissa.¹⁷⁴ In his preface to the reader de Locques states that Egyptian hieroglyphics conceal chemical secrets of nature. There is little reason for dwelling on his *Cours theorique*. He defines *magistere* differently from most alchemists of his century, when he

¹⁷¹ BN Rp.8201, in-8, 38 pp.

¹⁷² BN 8°Te131.122, 1664, in-8, 56 pp.

¹⁷³ BM 1034.i.3 (1-3): *Les rudiments de la philosophie naturelle touchant le système du corps mixte. Cours*

theorique. Cours pratique. etc. The four treatises in the third and supplementary volume are each paged independently.

¹⁷⁴ See T III, 358.

affirms that natural philosophers have called it the extraction of the most formal and radical substance from the composite under the form "d'humide blanchastre, de sperme ou de chyle." He would seem to have confused it with quintessence, which he defines as an extraction of the most radical and formal substance from mixed bodies. For him arcanum is a virtue not in matter but introduced by art in the operation. His account of the circulation of the elements is all tommy-rot.

As an example of his *Cours pratique* may be given his Alcahest or *le petit circulé* of common salt. Calcinate common salt two or three times with an equal portion of powdered chalk, during three or four hours, dissolve in a great quantity of water, filter and coagulate at each distillation.

Pour on one part seven or eight parts of good spirit of salt, digest till it dissolves, putrefy for thirty days in a dunghill, then distill it, separating the phlegm which ascends first, and cast on your matter, which remains golden and becomes red, the strongest spirit. Dissolve and putrefy as above and that as often as your matter remains in red oil, which is *le petit circulé* and quintessence of salt.

If at each distillation you separate the soul of sulphur or the tincture which forms like a crust and which you should digest with the strongest spirit, you will get the oil by a marvelous short-cut. If you want it smooth and not corrosive, pour on good spirit of wine and distill them cohobating, since the spirit of wine has the virtue of drawing out and separating all its sharpness. To obtain it very exalted in its operations, after having separated the element of water in a bain-Marie, one draws the element of air from the cinders, that of fire remains below, which one extracts by the element of air which is its spirit, and you have the quintessence of salt.

But de Locques warns the reader not to get the idea that this operation is as easy as his brief directions may seem to suggest. Great and long putrefactions are necessary, although they can be much abbreviated by a marvelous separator of phlegm from spirit, which he will not reveal because of human ingratitude.¹⁷⁵

Nitre or saltpeter is composed of the subtlest part of salt and the grease of sea water on the one hand, and of light on the other.

¹⁷⁵ II, 13-14.

In consequence it has much of the fluidity and chill of water, and of the motion, action and heat of fire. It is cold to the touch but so hot that it dissolves all metals. It is the first salt of nature and the first principle of putrefaction. It is an air with a little fire congealed by water, for air cannot enter a mixture except in its own form. When nitre has lost its volatility, it melts like borax and becomes a tartarous salt. It is called air because it receives the first action of fire and makes the first movement of life. It also is called the vicar of the sun, the principle of animality in the brain, of vegetability in the liver and nutritive parts, of vitality in the heart. God has put reservoirs of it in water, earth, fire and air, in the heavens and the stars themselves. But de Locques is not speaking of vulgar saltpeter, which can produce nothing, because it is full of common salt and mixed with arsenical and corrosive spirits. The nitre of which he speaks is volatile and the only salt in nature which shares that spirituality of essence by which insects, snakes and eagles shed their skins and renew their youth, and by which life is transmitted in seeds to all things for the propagation of their species. Whence do fish draw their nourishment in the salt sea, plants on the earth's surface, and animals in the air, if not from this sweet nitre? It causes troubled seas and the inundation of the Nile. As man draws his life from occult nourishment hidden in the air, so fish are nourished by the sweet sulphur of the briny deep, and so this sweet nitre which is a congealed air is found everywhere.¹⁷⁶ Does de Locques have oxygen in mind?

After this laudation of nitre, de Locques calls wine the great agent of alchemy, then presently speaks of vitriol as the universal spirit and world soul and quintessence of all things.¹⁷⁷ In an intervening chapter he says that the stars and planets are more present at our birth than our parents are, that insects owe their form especially to the sun, and that each thing has a double body: formal, white, resplendent, masculine and paternal agent from the heavens and stars; red, maternal and feminine, from the elements. He goes on to detail the properties of each planet.¹⁷⁸ Later he gives three potable golds and one potable silver, and ascribes

¹⁷⁶ II, 34-41.

¹⁷⁷ II, 45, 72.

¹⁷⁸ Cap. 6, pp. 65-72.

medical virtues to stones and crystal. He understands by air any humid, diaphanous and rarefied body.¹⁷⁹

In the treatise on the magnetic virtue of blood, de Locques states that it is double: spirit and body, sympathy and antipathy, curative and morbid. Man, the microcosm, has his pole (balsamic salt) and magnet (the magnetic spirit of blood). But in the present work he will not detail its celestial, astral and magic virtues, of which Paracelsus has spoken amply, nor its secret preparation in quintessence, but only the secret usage which one can make of it in baths.

The date of the first edition of the course in chemistry of Pierre Thibaut dit le Lorrain was 1667,¹⁸⁰ with a dedication to Antoine Vallot, first physician of the king of France. It was republished at Leyden in 1672 and at Paris in 1679. An English translation of 1668¹⁸¹ was reprinted in 1675. The opening pages treat of the chemical laboratory and apparatus; then follow one preparation after another—spirit of salt, spirit of nitre, spirit of vitriol and black oil of vitriol, and so on—without any grouping in the three kingdoms of minerals, vegetables and animals, and concluding with tincture of gold or potable gold. The treatment of metals is fullest. Animal products are limited to oil of yolks of eggs, oil of yellow wax, spirit and oil of honey, tincture of musk and ambergris.¹⁸² Thibaut says that the getting inside simples to extract essences from them and the making of a number of medicines from one came only with Paracelsus and his successors. After his text proper has ended, he adds a brief abridgement of it.¹⁸³

Matte La Faveur, distiller and demonstrator in ordinary of chemistry in the medical faculty of the university of Montpellier, opened his *Pratique de chymie*¹⁸⁴ of 1671 with a preface to the

¹⁷⁹ Caps. 14, 15, 18 (p. 181).

¹⁸⁰ *Cours de chymie de P. Thibaut dit le Lorrain*. A Paris chez Thomas Jolly, in-8, 285 pp. and Index. Copy used: BM 1035.f.20.

¹⁸¹ *The Art of Chymistry as it is now practised . . . translated . . . into English by a Fellow of the Royal Society*, London, 1668, in-8. BM 8906.de.43.

¹⁸² Ferguson, in *Archiv f. Gesch. d.*

Naturwiss. u. d. Technik, VI (1913), 83-96; p. 93.

¹⁸³ *Cours de chymie*, 1667, pp. 260-85, "Petit traité de la Chymie ou Abre-gé du Cours cy-devant."

¹⁸⁴ *Pratique de chymie divisée en quatre partis*, par S. M. La Faveur, distillateur et démonstrateur ordinaire de la chimie en la Faculté de médecine de Montpellier, Montpellier, Daniel Pech, 1671. 12mo. 7, 360, 10, 34

reader excusing himself for publishing another "Cours de Chymie." Beguin, Hartmann, Croll, Quercetan (Du Chesne) and Schröder—had they not already taught all these preparations? And didn't it seem that in his time in France Davisson, Lefebure (Le Fèvre) and Glazer (Glaser) had left nothing new to say? But his fellow physicians have pressed him to publish and he has succumbed at last. He claims to offer some new preparations and to discover short cuts and easier methods to perform the most difficult operations. But rather than merely note his innovations, he has decided to set forth the entire subject, although this involves repetition of what others have said.

His general plan is very similar to that of de Clave. The work divides into four books, of which the first deals with definition, elements, operations and apparatus. Book II is concerned with the principal preparations of minerals; III, of vegetables; IV, of animals, with a supplementary *Advis* concerning mineral waters, telling how to recognize what they contain.¹⁸⁵ Several inserted folded plates illustrate chemical symbols and apparatus, but offer nothing unusual.

Chemistry is defined as the art of separating the parts of natural bodies, of purifying them, and then putting them together again for medical purposes,¹⁸⁶ and the author limits his book to practical chemistry. He deprecates indulging in physical theory before knowing mechanics and chemistry.¹⁸⁷ In dissolving compounds by fire one discovers five different underlying substances: phlegm, an insipid liquor in the form of water; spirit, the most active and volatile part of the compound; sulphur or oil, which is the most combustible part; salt; and dead earth.¹⁸⁸ Each of the three active principles—salt, sulphur and mercury—is different in each of the three kingdoms—animal, vegetable and mineral.¹⁸⁹ Salts are natural or artificial; the latter, simple or composite, like *sal armoniac*. Simple

pp. Copy used: BN R.43353. Michaud, *Biographie universelle* and Hoefer, *Nouvelle biographie générale* are therefore in error in dating his appointment as demonstrator in chemistry at Montpellier in 1675.

¹⁸⁵ II opens at p. 67; III, at 265; IV, at 334; while the *Advis* occupies pp. 355-360.

¹⁸⁶ *Pratique*, 1.

¹⁸⁷ *Ibid.*, 3.

¹⁸⁸ *Ibid.*, 9.

¹⁸⁹ *Ibid.*, 12.

salts subdivide into lyes, *essentiels* and volatile.¹⁹⁰ Oil of tartar is not properly an oil, but a salt dissolved.¹⁹¹

By chemical operations are obtained powders: minerals reduce to *calx*; animals and vegetables, to cinders or ashes. "Alkool est une poudre très subtile et impalpable." Flowers and sublimations are the subtlest parts of bodies. Waters are liquors produced by distillation, and are called spirits, if they are free from phlegm and very spirituous.¹⁹²

Perfect animals are those whose parts cease to move when separated from the heart. Imperfect animals are those whose parts continue to move for some time after they have been separated from the heart.¹⁹³

Processes with gold include cupellation, purification by antimony, amalgamation or calcination by mercury, *crocus solis* or *or fulminant*, *liqueur d'or* or potable gold, to which medical effects are ascribed.¹⁹⁴ *Crocus solis*, too, is employed in medicine, six, seven or eight grains being given in a syrup suited to the malady. It is further a specific for sufferers from mercury ointment, as it detaches the mercury from the body and unites it to itself. Mixed with equal parts of mineral bezoar, it is good for small pox; it checks vomiting and strengthens the stomach.¹⁹⁵

Ordinarily, to dissolve coral, spirits of vinegar or lemon juice are used or "*esprit de vitriol philosophique*" (an acid drawn by lotions from butter of antimony). But Matte La Faveur prefers to use spirits of copper (*l'esprit de Venus*) to dissolve coral or pearls.¹⁹⁶ Four chapters on amber are on its oil and the *magistere*, essence and elixir of ambergris.¹⁹⁷ Preparations from animals include a volatile salt of vipers, another of human blood, and spirit, oil and salt of hartshorn.¹⁹⁸

Among bits from the author's own experience the following may be noted. Under the caption of *Laudanum opiatum* he remarks that opium receives no virtue from the waters or spirits with which it is mixed. For when in Italy he used it successfully without other

¹⁹⁰ *Ibid.*, 15.

¹⁹¹ *Ibid.*, 17.

¹⁹² *Ibid.*, 43-45.

¹⁹³ *Ibid.*, 8.

¹⁹⁴ *Ibid.*, 71-90.

¹⁹⁵ *Ibid.*, 85.

¹⁹⁶ *Ibid.*, 258.

¹⁹⁷ *Ibid.*, 256-65.

¹⁹⁸ *Ibid.*, 336, 345, 349.

preparation than this. One day in Grenoble he saw a viper-catcher who was wounded by one in the arm. He immediately cut off the heads of two vipers, tore out their hearts and devoured them.

I went to his house two or three days later to learn the outcome. I found him in perfect health, and he told me that it was not the first time that he had availed himself of that remedy.¹⁹⁹

Two examples of chemical experiment may also be noted. Catch toads, tie them by the hind legs, hang them in the chimney-place and leave them there until they are dried. Then clean them and wash them with *eau de vie*, dry them in the sun. When you have about fifty, chop them to bits and make spirits, oil and volatile salt of toads.²⁰⁰ Life was full of perils for toads even before the advent of the electric light and the automobile.

For volatile salt of urine take about sixty pints of the urine of little children aged six or seven who drink very little wine. Put this in various hermetically sealed receptacles and leave these in horse manure or the sun for a month or six weeks to corrupt. Then distill four pints at a time down to one pint. Re-distill these fifteen pints in a *bain-Marie* in vessels with long necks and draw off about five or six pints and put in a glass vessel adding a pound and a half of saltpeter refined and dried. After more heatings and distilling the final outcome is about eight ounces of crystalline salt which must be kept in a tightly corked bottle, or the air will dissipate it.²⁰¹

In Italy Carlo Lancilotti issued a *Guida alla Chimica* at Modena in 1672 in duodecimo and a *Nova Guida alla Chimica* at Venice in 1677 in octavo.²⁰² Other editions of both soon followed.²⁰³ I

¹⁹⁹ *Ibid.*, 301, 340.

²⁰⁰ *Ibid.*, 341.

²⁰¹ *Ibid.*, 348-9.

²⁰² Ferguson, II, 6, citing Gmelin, *Gesch. d. Chemie*, 1797-99.

²⁰³ The authorities mentioned in the previous note give a re-edition of the *Guida* at Modena in 1679. BN R.40580-40582 is a 3 vols. in one, edition of Venice, 1697; while BM 1034. c.22 (1.) and (2.) are editions of the

Nova Guida at Venice, in 1681 and 1682—all these in duodecimo. In 1683 Lancilotti published *Farmaceutica Antimoniale overo Trionfo dell'Antimonio*, and *Farmaceutica Mercuriale overo Trionfo del Mercurio*, at Modena. Neither was in James Young's library, catalogued by Ferguson, but both were recently listed in a sales catalogue.

have seen the edition of 1697 in three volumes in duodecimo. The first deals with fire, furnaces, operations, waters, oils, tinctures, extracts, laudanum and masteries—an order much like that of Beguin early in the century; then tartars, vitriol, sulphurs, salts, antimony, the mineral bezoar, etc. The second volume is concerned with metals and divides into three books, of which the first treats of Saturn and Jupiter, i.e., lead and tin; the second, of Mars and Venus, or copper and iron; the third, of sun and moon, or gold and silver. The third volume takes up the animal kingdom and falls into four parts. The first is about man and the use of parts of the human body. The second is entitled, Quadrupeds, but goes on to other animals such as vipers, and its 67th and last chapter is on the toad. The third part is concerning flying animals, while the fourth is nominally about fish but adds such creatures as ants, millepedes and scorpions.

There is not much in print by Carolus Ludovicus de Maets, professor of chemistry at Leyden, but manuscripts in the British Museum of the seventeenth century preserve his "Secret chemical college" held at Leyden "privately" in 1675–1676,²⁰⁴ his medical *Collegium practicum*, held at Leyden in 1680,²⁰⁵ and Chemical Experiments, both in Latin²⁰⁶ and in an English translation of 1676.²⁰⁷ We shall presently hear of Le Mort's working in his laboratory and leaving it in 1672. Later, in 1684, de Maets published *Prodromus chemiae rationalis . . . accedunt animadversiones in Collectanea chymica Leidensia*, of which we shall have more to say presently. The Chemical *Collegium* begins with a way to embalm corpses and the preparation of artificial *mumia*, and contains such further recipes as a cosmetic to whiten the skin, a panacea of native cinnabar, and a secret essence of *satyrium* for impotency. Most of the recipes are taken from previous authors such as Paracelsus, Kruchner, Frundek, Langelott, Zwelfer, Angelo Sala, Ruland, Glauber, Tachenius, Helmont, and even medieval Artepheus. The *Collegium practicum* consists chiefly of prescriptions of chemical remedies arranged in thirty-six chapters by

²⁰⁴ Sloane 1235, fols. 1-34v; another MS is Sloane 1286, fols. 1-69.

²⁰⁶ Sloane 3287, fols. 253v-297.

²⁰⁷ Sloane 1292, fols. 69-77.

²⁰⁵ Sloane 1278.

diseases from epilepsy and apoplexy to dropsy and scurvy.

Nicolas Lemery (1645–1715) was born in Rouen and trained as an apothecary. He came to Paris and attended the lectures and experiments of Glaser, but was dissatisfied with them. After six years of travel, spent in visiting other towns of France and in teaching chemistry at Montpellier, he returned to Paris and instituted a course of lectures, at first in the laboratory of a friend who was apothecary to the prince of Condé, then in one of his own in a basement in Rue Galande.²⁰⁸ Out of these lectures grew his *Cours de Chymie*. First published in 1675, it ran through a dozen or more editions during his lifetime.²⁰⁹ The last to appear was in 1756. It was translated into Latin,²¹⁰ English, German, Italian and Spanish. English versions appeared in 1677,²¹¹ 1686 and again in 1711. There were German editions in 1698 from the French edition of 1697, and in 1734 and 1754.

Lemery's book seems to have taken the place in general favor of Beguin's *Tyrocinium*, of which the last edition had come out in 1669. He wrote lucidly and his experiments were ingenious. Dumas described another work by him on antimony as a mass of experiments conducted in the laboratory by a trained hand and described in a simple and realistic manner which was "entirely new in chemistry."²¹² He added to the chemical remedies dissertations or notes which were largely practical in character. A brief address to the reader by the printer of the Latin translation of 1681 asked why Lemery should be issued in Latin, when there were already so many chemical manuals in Latin by authors like Rolfinck, Ludovicus, Wedel, Schroeder, Hofmann and Zwelfer,

²⁰⁸ For Lemery's career I follow Ferguson and Dumas.

²⁰⁹ Hoefer, II (1843), 294, listed twelve editions at Paris, and three at Amsterdam and Leyden. The BN printed catalogue lists the *editio princeps* of 1675 (534 pp.), the fourth of 1681, seventh of 1690, tenth of 1713, and eleventh of 1730, but includes no English translations.

²¹⁰ I have used the Latin translation printed at Geneva in 1681:

Cursus chymicus continens modum parandi medicamenta chymica usitatoria brevi et facili methodo, una cum notis et dissertationibus super unamquamque praeparationem: Col 540 L54.

²¹¹ Nicholas Lemery, *A Course of Chymistry* . . . , translated by Walter Harris, Doctor of Physick, London, Walter Kettilly, 1677, in-8, 16 fols., 323 pp., 10 fols.

²¹² Dumas (1878), 75.

and replied that his book was clearer and employed a short and easy method. But it should not be inferred that he writes merely for tyros. Although he omits the mercury of metals, Helmont's alkahest, and other such *non-entia*, he should not be rejected by the masters of chemistry themselves. In the text Lemery speaks of preconceived opinions as being rejected and new views coming in, and is bold to state his own conclusions.²¹³

Lemery was originally a Protestant and after the Revocation of the Edict of Nantes fled to England. But he soon returned to France, became a Catholic, and recovered his confiscated property. In 1699 he was elected to membership in l'Académie des Sciences.

In the Latin edition of 1681, the first 52 pages are devoted to brief definition of chemistry and statement of the five principles, which are then further commented upon for 32 pages, followed by an account of furnaces, vessels and degrees of fire, and a glossary of chemical terms. The remaining 612 pages are divided unequally between the three natural kingdoms. Minerals cover 420 pages and 23 chapters—the longest being on antimony and preparations from it (52 pp.), while coral, amber and ambergris are included as minerals. The vegetable kingdom receives almost as many chapters (20), but only 159 pages, while animals have only 32 pages²¹⁴ and four chapters: on vipers, which is the longest, the distillation of urine and its volatile salt, honey, and the distillation of wax. These topics are in part identical with Thibaut's similarly brief treatment of animal products.

Besides the usual five principles, none of which could be extracted in a pure state, Lemery believed, like Le Fèvre, in a universal spirit, imperceptible to sense, which formed compound bodies according to the variety of pores or moulds in which it was confined. Chemical change was an effervescence produced by the points of

²¹³ *Cursus chymicus*, 1681, pp. 26-27.

²¹⁴ In the later French edition of 1721 used by Mme. Metzger the proportion had altered considerably, minerals receiving 400 pages, vegetables increasing to 185 pages, and animals to 102 pages: *Les doctrines ché-*

miques en France, 1923, pp. 324-25. Mme. Metzger (*Ibid.*, p. 336) credited Lemery with combatting the miraculous medical virtues attributed to the human cranium and brain, but there is no place for this in the early editions. However, omitting them may have been equally effective.

acids penetrating the pores of alkalis in due proportion. Oils, composed of more yielding parts than alkalis, were slower to effervesce or ferment.²¹⁵

Chemical terminology was still confused. Spirit of hartshorn (aqueous solution of ammonia) was *sal volatile* dissolved in a little phlegm. Spirit of wine Lemery called an oil rarefied by salts. Spirit of acid was the essential salt of acid. Many things were improperly called oils, such as oil of tartar, which was really *sal liquatum*, as we have already heard from Matte La Faveur; oil of vitriol, which was the more generous and caustic part of spirit of vitriol; and oil of antimony, a mixture of spirit of acid and antimony.²¹⁶

Lemery thought of salt as produced by long action of acid on stones. Particles of fire were included in the pores of other bodies and manifested themselves in boiling water. Lead was full of sulphur or bituminous earth, which made it soft and flexible. It seemed further to contain mercury. Iron consisted of vitriolated salt, sulphur and earth loosely interconnected. Vulgar sulphur was part oil, part saline and fixed acid. The microscope had revealed that the seed contained the future plant with all its parts.²¹⁷

Lemery was quick to jump to conclusions. He incorrectly concluded that antimony contained an acid salt, because he believed that its figure resembled that of saltpeter, and that it had an emetic property which came from its scratching the lining of the stomach. He explained the action of sleeping draughts by their glutinous particles which, carried to the small vessels of the brain, condensed the spirits and moderated their motion.²¹⁸ Such explanations, however, which then seemed plausible, probably increased the popu-

²¹⁵ *Cursus chymicus*, 1681, pp. 3-4, 8, 27, 30-34, 37.

²¹⁶ *Ibid.*, pp. 9, 12.

²¹⁷ *Ibid.*, pp. 12, 32, 149, 128, 162, 11, 21.

²¹⁸ *Ibid.*, pp. 254-55; JS IV (1675), 134.

In corollaries attached to a chemical dissertation by Wilh. H. Waldschmiedt (*De auro*, Marburg, 1685), the somniferous force of opium was ascribed

to particles which cut and detached the little fibres (*fibrillae*) of the nerves. Baths were said to induce sleep insofar as sweet particles of the herbs and liquor insinuated themselves through the pores into the blood stream and impeded it so that it did not rush into the brain with such impetus, and animal spirits were generated in less quantity.

larity of his book. On the other hand, he was not free from empirical remedies and use of parts of animals, such as an oil derived from puppy dogs boiled with earthworms for cases of dysentery.

Lemery denied medicinal effects to copper²¹⁹ and tin,²²⁰ but held that lead would repress lust if applied to the perineum, and was good for many tumors.²²¹ He thought that the particles of lead entered the pores to bind the spirits and moderate their motion. Iron was superior as a remedy to steel,²²² and iron rust was a specific against obstructions of liver, pancreas, spleen and mesentery.²²³ For potable gold he had little use, but held that *aurum fulminans* would provoke a sweat and expel noxious humors,²²⁴ and that it would not fulminate in the stomach.²²⁵ To mercury as a medicine, especially for venereal disease, he devoted much space and further referred the reader to the work on the latter subject of de Blegny, royal surgeon.²²⁶

Despite his considerable scepticism and caution as to use of metallic remedies, Lemery still believed that vipers taken internally produced various sensible medicinal effects.²²⁷ He rejected the old fables as to their generation, but, despite Redi's discovery of a secretion about their teeth, repeated the divergent views of contemporaries as to whether the viper poisoned merely by irritated spirits, or acid salts, or its gall, or by venom scattered through its entire body. This last was the reason for beating the bodies of dead vipers to drive the venom to their extremities and then cutting off the extremities before using the flesh to make trochees. But their flesh thus prepared lacks the volatile salts in which the medicinal virtue especially resides, and experience has taught us that no part of the dead viper is poisonous. Its head and tail pulverized are as good as the rest of its body; even its heart, liver and gall are employed medicinally. Its own bite is cured by crushing its head over the bite.

²¹⁹ *Cursus chymicus*, 1681, p. 148, "Sed cum ei insit quid corrosivum, nulli author fuero ut eo intus utatur."

²²⁰ *Ibid.*, p. 120, "Tribuunt ipsi virtutes adversus morbos hepatis et uteri, sed imaginaria est haec qualitas quam nullo modo comprobavit experientia."

²²¹ *Ibid.*, pp. 128-29.

²²² *Ibid.*, pp. 163, 166; at 167-74 he answers six arguments to the contrary.

²²³ *Ibid.*, p. 165.

²²⁴ *Ibid.*, p. 77.

²²⁵ *Ibid.*, p. 83.

²²⁶ *Ibid.*, p. 210.

²²⁷ *Ibid.*, 66 and 632-42 (*Pars Tertia, Caput Primum*).

Lemery not merely questioned the medicinal value of some metals: at times his text is purely chemical, as when he says of The Tree of Diana, "This experiment is of no use in medicine; I describe it merely for the sake of the curious."²²⁸ Or when he makes flowers of tin and a detonation by mixing tin and nitre.²²⁹ He dismissed the question of the transmutation of metals in a few pages, enumerating three ways in which men had tried to make gold: namely, by ridding other metals of their impurities, by extracting mercury from them as a near-gold, and by seeking for the seed of gold either in gold itself or in other minerals, vegetables and animals.²³⁰ But he deplored the time which had been wasted in the attempt.²³¹

The best and most level-headed (*aequissimi*) adherents of judicial astrology in Lemery's day (1675) were represented by him as defending the doctrine of affinity and sympathy between the seven metals and seven planets by an explanation drawn from the corpuscular hypothesis. They held that an infinite number of corpuscles streamed from the planet and the metal in question, and that their figure was such that they could only penetrate each other's pores and remain fixed there, and that consequently gold was nourished and perfected by the sun, silver by the moon, and so on. They further held that certain days were favorable to or governed by certain planets, so that it was better to work silver on Monday and iron on Tuesday (Mardi or Mars' day). Further that each planet ruled a certain part of the human body, and that this should be observed in the administration of metallic remedies: gold for the heart and cardiac complaints, silver for the brain and mental disease, tin for the lungs, iron for the liver, copper for the reins, and lead for the spleen. Lemery felt, however, that these contentions were unproved, and that it was better to explain the effects of remedies by proximate causes rather than the qualities of the stars. And many astrologers made other claims and assertions which he regarded as quite beyond the bounds of reason.²³²

Yet when he came to treat of gold in particular, he said that

²²⁸ *Ibid.*, p. 107.

²²⁹ *Ibid.*, pp. 118-22.

²³⁰ *Ibid.*, pp. 60-61.

²³¹ *Ibid.*, p. 62.

²³² *Cursus Chymicus*, 1681, pp. 55-57.

the astrologers affirmed that the sun was gold fused at the center of the world and purified by the fire of the stars surrounding it. Also that gold taken in the mouth was considered a cardiac, because the astrologers said that it received the influence of the sun which was, as it were, the heart of the universe. And he again repeated that the astrologers said that the pores of gold were so disposed that they more readily absorbed the influence of the sun than did the pores of other mixed bodies. He concluded, however, that while there was perhaps more influence of the sun on gold than on other metals, this influence did not make it more apt to dissolve in the body or to produce the great effects attributed to it.²³³ In speaking of the other metals, he usually gave the planetary name of each and explained that it was so bestowed because of the supposed connection with that planet.²³⁴ Many properties against diseases of the brain were assigned to silver, but in his opinion they had no other foundation than the imagination of many astrologers and chemists, so that it was not necessary to spend time in refuting them.²³⁵ Yet in his own preface he had said, "If from consideration of the macrocosm we turn as is proper to man the microcosm."²³⁶ But perhaps he was thoughtlessly repeating an old cliché.

Among innovations in the fourth edition of Lemery's *Cours de Chymie* in 1682, the *Journal des Sçavans* noted the following "Singular Experiment concerning poisons which coagulate the blood." When a small mouse was dropped into a glass bottle containing two scorpions and was stung by them, it died in convulsions after a few minutes. But when a larger mouse was put in and stung, it ate the scorpions and showed no ill effects. The experiment seemed to prove that the flesh of the scorpions contained volatile salts which prevented the blood of the mouse from coagulating.²³⁷

In the fifth edition of 1683 Lemery told how to extract phosphorus from urine, and came to the conclusion that mercury consisted of spherical particles.²³⁸

²³³ *Ibid.*, pp. 61, 64-66.

²³⁴ *Ibid.*, pp. 85, 128, 148, etc.

²³⁵ *Ibid.*, p. 85.

²³⁶ *Ibid.*, *Praefatio*, fol. *2 verso:
"Si a macrocosmi consideratione ad

hominem microcosmum iure dictum transeamus."

²³⁷ JS X (1682), 22.

²³⁸ JS XI (1684), 352-55.

In the seventh edition of 1690, among other novelties was a mercurial panacea sublimated twelve times and then infused in spirits of wine for a fortnight, and an account of the intense heat produced by a mixture of equal parts of sulphur and iron filings reduced to a paste with water. Lemery believed that a similar fermentation on a larger scale was responsible for volcanoes, tornadoes and thunderbolts.²³⁹

When *A Course in Chemistry* by Nicholas Lemery appeared in English translation from the fifth French edition in 1686, although there had been an earlier English version in 1677, it was reviewed in *Philosophical Transactions*, because the work "is of such reputation in the world that notice of additions to it can't be thought ungrateful to the reader."²⁴⁰ The following new items were then noted: pulverization of tin; Flowers of Jupiter (i.e., tin volatilized and raised in the form of meal by a volatile salt of saltpeter); oil of Mercury made by dissolving corrosive sublimate in spirit of wine, although that spirit is unable to dissolve quicksilver or *Mercurius dulcis*; caustic oil of antimony produced by dissolving antimony in acid spirits of salt and vitriol; oil and spirit of paper; tincture and extract of Peruvian bark (quinine); sugar and the spirit of it; phosphorus.

Notes of medical and chemical lectures by C. L. Morley at the University of Leyden from 1677 to 1679 are preserved in a long series of manuscripts of the Sloane collection at the British Museum.²⁴¹ I have not investigated what relationship they bear to the *Collectanea chymica Leydensia* which were printed under his name in 1684, but these last are professedly taken from three professors of chemistry at Leyden, namely, de Maets, Margrav or Margravius, and Le Mort,²⁴² and arranged topically in alphabetical order, with the name of the author of each recipe or item placed opposite it in the margin. De Maets immediately attacked this book in *Animadversiones* which accompanied his *Prodromus chemiae*

²³⁹ JS XVIII, 318-22.

²⁴⁰ PT XV, 1183-84.

²⁴¹ Sloane MSS 1259 to 1280 inclusive, 1282 to 1294, and 1297 to 1299.

²⁴² Christopher Love Morley, *Collectanea Chymica Leydensia*, i.e. *Maëtsiana*, *Margraviana*, *Le Mortiana* scilicet trium in Academia Lugduno-Batava facultatis chymicae . . . professorum, 1684: BM 1033.k.17.

rationalis of Leyden, 1684. He charged that it was published without de Maets' or Morley's consent or knowledge, as the printer admitted in the preface, from excerpts made for Morley's private use which he had given to a friend who gave them to the printer. "Such thefts and crimes are not to be tolerated by men of learning." Moreover, so far as de Maets can recall, he never had Morley as a private auditor, so that he must have relied on others' notes. De Maets further complains that recipes of which he indicated the authors by name are ascribed to him alone, that he is incorrectly said to have taught at Nymwegen, is made to employ native salt of antimony—which he never saw, and is misrepresented in other ways. He never just dictates recipes to his students but gives an explanation of them. The accompanying *Prodromus chemiae rationalis* of sixty pages is divided into nine chapters on extraction of tinctures or elixirs from the vegetable kingdom, calcination of antimony, calcination of mercury, various calcinations of other metals and their reduction to vitriols and *croci*, sublimations of antimony and mercury, volatile salts taken from animals, acid spirits of common salt and nitre, sulphur, oils and ardent spirits.²⁴³

When the next edition of *Collectanea chymica Leydensia* appeared in 1693, de Maets was dead, but a disciple of his, Theodorus Muykens, revised the work and added further experiments.²⁴⁴

The next chemical manual to be considered is that of Michael Ettmüller (1644–1683),²⁴⁵ a doctor of philosophy and medicine, and a celebrated professor at the University of Leipzig. It was first published after his death at Leyden in 1684 by a former student of his, Johann Christoph Aulfeld, under the title, *Chimia rationalis ac experimentalis curiosa*.²⁴⁶ Aulfeld adjures the reader,

²⁴³ Carolus de Maets, *Prodromus chemiae rationalis . . . Accedunt Animadversiones in librum cui titulus Collectanea chymica Leidensia, id est, Maetsiana, Marggraviana, Le Mortiana: opus quoad excerpta Maetsiana mutilum, multis mendis deturpatum, praecipuis suis ornamentis, ratiociniis, deductionibus, observationibus destitutum inscio et invito Maetsio in lucem editum*. Leyden, 1684, 77 pp. BM

1165.c.23 (2.). The *Animadversiones* come first at pp. 3-16; the *Prodromus* at pp. 17-77.

²⁴⁴ *Acta eruditorum*, XII (1693). 113-14. See note 304 below.

²⁴⁵ Hoefer, II (1843), 301, erred in saying that Ettmüller died in 1668.

²⁴⁶ The full title continues: *secundum principia recentiorum adornata variisque ac propriis experimentis tam chymicis quam practicis ut et medica-*

if he is a Galenist, not to read further, for he will find no Galenic doctrine in this book. This publication by Aussfeld met with considerable censure. The preface to Ettmüller's *Medicus theoria et praxi generali instructus* said that it hardly deserved to bear Ettmüller's name.²⁴⁷ The *Journal des Sçavans*, reviewing the Leyden, 1685, edition of Ettmüller's *Opera*, said that both the *Chimia rationalis* and *Medicus theoria et praxi generali instructus* had been disowned by Ettmüller's widow and heirs as unauthentic and unworthy of him, saying that he had intended to publish only at an advanced age, and that his record of daily experience must be revised before it was printed.²⁴⁸ And Georgius Francus, in the preface to the Lyon, 1690, edition of Ettmüller's *Opera*, quotes Schelhammer²⁴⁹ that after Ettmüller's death his *Chymia* was published by a certain gold-digger, a nefarious deed, since there is no doubt that, had he lived, he would have emended, altered or expunged many things which are now read publicly to his discredit.²⁵⁰ Francus also told of the complaint of the widow and heirs, but added that, since they couldn't or wouldn't supply a better text, the printer Zunner did so (in 1688).

Despite all this outcry, it seems probable that the *Chimia rationalis* of 1684, although it contains some egregious misspellings of proper names such as Olai Rudbec for Olai Borrichii, Bethroletus for Bartholetus, and Roches for Rochas,²⁵¹ and what seems to be

mentis nobilioribus referta comite semper ratione. Numquam adhuc publicam lucem visa iam vero in ordinem redacta ac boni publici causa edita cura ac sumtibus Joh. Christophori Aussfeldi Med. Doct., Lugduni Bataavorum, 1684, in-4, 159 pp. BM 1033. i.17. As the BN does not have this edition, while the BM lacks that of 1693, I had to use each separately and do not always have page references for both.

²⁴⁷ *Medicus theoria et praxi generali instructus, hoc est, Fundamenta medicinae vera olim a D. Michaelae Ettmullero . . . priusquam tradita, luci*

publicae nunc primum donata, Francof. et Lipsiae, 1685, p. 3.

²⁴⁸ JS XIV, 200-201. In its later reviews of Ettmüller's works, nothing further was said on this score. See JS XVIII, 244, on *Opera omnia*, Lyon, 1690; XVIII, 364-73, on *Nouvelle chirurgie*; and XIX, 202-4, on *Pratique de medecine*. An earlier London edition of 1683 was reviewed in PT XV, 1140-44.

²⁴⁹ "In Additamenta ad incomparab. Herm. Conringii introd. medic. XI, n. VI^{xx}, p.m. 385."

²⁵⁰ "... quae non sine ipsius ignominia nunc publice leguntur."

²⁵¹ *Op. cit.*, pp. 13, 68, 34.

an inaccurate allusion to Boyle's pouring lemon juice on coral,²⁵² is a fair reproduction of Ettmuller's course as actually conducted, whatever later revision he might have made in it, had he had the opportunity. The French version of 1693 differs from it only slightly.²⁵³ Its *Avis au lecteur* said that hitherto there had been some ground for complaint against the excellent translations which had appeared of several of Ettmuller's works, to wit, that such a modern Hippocrates ought not to abandon the language of the learned for the vernacular, lest in so doing he form *demi-medecins* who would prove more fatal to humanity than disease itself. But this objection did not apply to the present work, which is, moreover, useful to apothecaries.

In a brief foreword Ettmuller says that, in treating chemistry in a compendium, he does not wish to bind himself to the common treatment of certain elements of chemistry in scholastic order, because it involves incongruities or superfluities in certain matters. He has presented only what suffice for the medical basis of chemistry, "by which as an Ariadne's thread we are led to perfect and intimate knowledge of natural bodies." He treats of salts before chemical operations, because the latter cannot be understood without a knowledge of the particular ingredients employed in them.

After discussing in his first two chapters the chemical principles of the ancients and the saline principles of moderns and in especial acid salt, Ettmuller has successive chapters on *sal alkali*, *sal salsum*, *sal ammoniac*, *tartar vitriolatum*—a salt consisting of salt of tartar and spirit of vitriol, and common salt. Under the last he states that all mineral salts are quadruple: 1) common salt, 2) composite salts as nitre, 3) vitriol, 4) alum. But common salt is threefold as it comes from the sea or fountains or mountains. The five remaining chapters of this first section on salts then deal with *sal gemmae*, *sal nitri*,²⁵⁴ vitriol, alum, and mineral waters. Ettmuller says that

²⁵² Ed. of 1684, p. 46, ed. of 1693, p. 126. What Boyle actually says is "spirit of vinegar"; *De vi elastica aeris*, *Opera*, I (1697), 116; *Works*, I (1772), 113.

²⁵³ *Nouvelle chimie raisonnée*, Lyon, Th. Amaury, 1693, in-12, 24, 443,

60 pp. Copy used: BN R.35407.

²⁵⁴ Comparison may be made with the seven salts of Hermes in medieval manuscripts (see my notes in *Isis* XIV (1930), 187-88; XXVII (1937), 53-62). These comprise *sal ammoniacus*, *sal gemmae*, *sal nitrum*, *sal communis*,

"our *sal ammoniac*" is artificial, whereas that of the ancients was natural, being produced under the sands near the oracle of Ammon from the urine of camels. Ours is common salt dissolved in a large quantity of human urine with a little soot added, about one-hundredth part of the whole.²⁵⁵ These are cooked in a strong fire to a certain consistency, afterwards in a cold place a candescent salt forms which is called ammoniac.²⁵⁶ *Sal gemmae* is so called because it is usually drawn from mines in the form of gems. On exposure to the air it takes on weight to such a degree that five men cannot move what one could in the mine. Generally it is hard from the start. In Calabria, however, it is so soft at first that figures can be impressed on it, but hardens when exposed to the air.²⁵⁷ Nitre is indeed a marvelous salt, of the nature of sulphur and, like sulphur, volatile and inflammable.²⁵⁸ Sea salt far surpasses all the others both in chemical and alchemical operations, and its spirit excels those of common salt and fossil salt. It contains live sulphur, perfect, ardent and inflammable. It is the father of common salt and fossil salt.²⁵⁹

The second section of Ettmüller's first book, on chemical operations, consists of six chapters on solution and extraction and menstrua for this, and on effervescence, fermentation, precipitation, calcination, and coagulation. The third section on sulphuric bodies has three chapters on sulphur as a principle and common sulphur in particular, on antimony and its various preparations, and on antimonial extracts. The fourth section on mercury and bodies analogous to it, has a chapter on mercury, in which it is said that there is great confusion as to what is meant by mercury, and another on cinnabar. It is surprising that mercury, which is white, and sulphur, which is yellow, combine to produce cinnabar

and *sal alkali* of those mentioned above; also *sal calcis* and *sal alembroc*.

²⁵⁵ Hermes says it is made of human blood and common salt.

²⁵⁶ Ed. of 1684, p. 8.

²⁵⁷ *Ibid.*, p. 17. Hermes, on the contrary, says that *sal gemmae* is of crystalline color and made of *sal alkali*, common salt, and sea water or salt water. It is hot in the first degree,

humid in the third, white in the fourth, fixed in the third, not porous. He does not say that it increases in weight on exposure to the air, but that it "*habet dare pondus maius*" and "*potestatem dandi . . . maius pondus metallis non habentibus*."

²⁵⁸ *Ibid.*, p. 18.

²⁵⁹ *Ibid.*, p. 14.

which is red. This phenomenon proves the doctrine of Boyle and other moderns (Newton?), that colors depend on change in the texture of bodies, which receives and breaks the solar rays.²⁶⁰

The second book is in three sections on metals—with a chapter on gems, vegetation and animals. Ettmuller divided plants into five classes: watery and generally insipid, watery but acid, of bitter taste without odor, sharp and penetrating with a very sharp volatile salt, odoriferous and aromatic.²⁶¹ He adopted the common distinction of perfect and imperfect animals.²⁶² Urinal salt is the dominant principle in all animals. Insects or imperfect animals also have plenty of volatile salt, nitrous and not oily, and much more penetrating than the volatile salt of perfect animals. Becher derived a true nitre from earthworms. Ettmuller also discusses formic acid.²⁶³

Like most manuals of the century, Ettmuller's is in part a collection of chemical processes and recipes from previous writers. He displays wide acquaintance with the literature of the subject and in the 158 pages of the 1684 edition cites no fewer than seventy authors. Most frequently mentioned are Helmont, Paracelsus, Zwelfer and Basil Valentine.²⁶⁴ Next come Becher, Tachenius, Schroeder, Potier, Angelo Sala, Boyle, Croll, Glauber, Hartmann and Michael of Leipzig.²⁶⁵ But Ettmuller is critical in his bibliography and states his preference for certain processes or remedies over others. "Hartmann calls this vitriolated tartar a universal digestive, which is true."²⁶⁶ "Far more convenient is the method which Glauber recommends."²⁶⁷ "See Angelo Sala in the Anatomy of Vitriol, from which Kircher copied most faithfully almost all that he has about vitriol, suppressing the name of the true author."²⁶⁸ Becher is clearer than Paracelsus and Helmont as

²⁶⁰ *Ibid.*, p. 96; ed. of 1693, p. 269.

²⁶¹ Ed. of 1684, pp. 138-40.

²⁶² Sectio III, cap. i, "De animalibus perfectis et imperfectis."

²⁶³ Ed. of 1684, pp. 149-50; ed. of 1693, pp. 413-17.

²⁶⁴ According to my rough count 24, 21, 17 and 13 times respectively.

²⁶⁵ Becher 9, Tachenius 7, Schroeder and Potier each 6, the others five

each. Billich comes next with 4 citations. Johann Michael (1606-1667), professor of medicine at Leipzig, edited, as we have seen, Hartmann's *Praxis chymiatrica* in 1633.

²⁶⁶ *Chymia rationalis et experimentalis*, 1684, p. 12.

²⁶⁷ *Ibid.*, p. 15.

²⁶⁸ *Ibid.*, p. 23.

to the universal menstruum or Alkahest, but it is a *rara avis*, and Glauber's effort to make it from nitre is laughable.²⁶⁹ In the attempt to tone down antimony some take absinth instead of tartar or nitre, as Mynsicht does, but in vain.²⁷⁰ Some precipitate mercury *cum tinctura smiridis* (*smaragdi*?) and expect a great miracle. For the method Ettmuller directs one to Schroeder. "But it is an imposture, for they lean on a false foundation."²⁷¹ Michael of Leipzig prepared an aperitive crocus of Mars with lye made from the ashes of aperient herbs, such as *fumaria* and absinth, which he poured on iron filings. But it availed little, because the salts in the lye went off into a calciform body which was utterly inert.²⁷² In one passage Zwelfer is praised for notable and very true statements beyond all other authors, but in another place is laughed at.²⁷³ Polemann wrote a treatise in a precise style on the sulphur of the philosophers which was good in theory but not in practice.²⁷⁴

From some of the foregoing passages we see that, where other manuals might state a recipe or remedy in full without always naming its originator, Ettmuller often does not repeat the process but refers the reader to its original author for it. On the other hand, his criticisms of such processes seem based to a large extent upon his own testing of them. In the case of one by Poppius, "a new chemical writer," he says that he has not yet tested whether it conforms to experience.²⁷⁵ "Moderns" of the French *Académie des Sciences* had experimented with pigs and horses, which they fattened by use of crude antimony.²⁷⁶

²⁶⁹ *Ibid.*, p. 43.

²⁷⁰ *Ibid.*, p. 67; ed. 1693, p. 188.

²⁷¹ Ed. 1684, p. 91.

²⁷² *Ibid.*, p. 106.

²⁷³ *Ibid.*, p. 107, "Vide Zwelferum qui egregie et lectu prae omnibus aliis habet verissima"; p. 137, "Risum vero meretur Zwelferus."

²⁷⁴ *Ibid.*, p. 109. Joachim Polemann, *Nooum lumen medicum de mysterio sulphuris philosophorum*, 1647, and later editions.

For some of the authors cited by Ettmuller one will search in vain in BM and BN, Duveen and Ferguson,

Zedler and Jöcher; for example, Hage-wald, Hantzard, Pocaletus. Some may be misspelled; thus Locellus may be for Locatellus.

²⁷⁵ Ed. of 1684, p. 82, "An procedat experientia nondum probatum habeo." If Hamerus Poppius is meant, he was not such a new writer, since his *Basilica antimonii* appeared in 1618, while Johann Poppius published his *Chymische Medicin* in 1617.

²⁷⁶ Ed. of 1684, p. 65: "moderni in Ephemeridibus Gallicis experimentum fecere in equis et porcis quos usu antimonii crudi pingues fecere."

Ettmuller was not only critical of the particular processes recommended by various individuals, but also sceptical as to some general pretensions of alchemy. Masteries are ordinarily useless, because the tissues of the simples are destroyed by their too sharp action, although Zwelfer has introduced soluble masteries which are somewhat less harmful.²⁷⁷ So-called spirit of Saturn or lead is sophistical, as is ardent spirit of coral, which amounts to nothing but mother of vinegar and spirit of wine regenerated. It is true of any metal and of lead especially that taken by itself it cannot yield any liquid by distillation. If any is elicited, it is done by the addition of other things, and in this way a new product is made. Lead *per se* furnishes no flowers, and it is certain that all the tinctures of lead which abound in Schroeder's *Pharmacopoeia* are valueless.²⁷⁸ The indestructibility of gold shows that it cannot be of any use in medicine or alchemy. The philosophers' stone is to be sought not from gold but rather from the root of the metals. Tinctures made with corrosive salts are of little consequence, since they are merely superficial erosions of the body of the gold. Even supposing that one was fortunate enough to find a true tincture of gold, how would it act? Merely as a restorative by its anodyne virtue, not by any irradiative faculty, as Helmont claims. However, Ettmuller not merely quotes Meier as saying that the American Indians so soften gold in an insipid menstruum that it can be treated with the fingers like wax, and Laurenberg as affirming that he had seen such an insipid water in which gold melted like a lump of ice in hot water, but adds that he himself knew the chemist of a certain archbishop who had an insipid whitening water in which in the space of six hours he dissolved gold into a very red liquor which would not congeal in fire.²⁷⁹ Crude silver taken internally has no efficacy; the copper must be separated from it.²⁸⁰ In the chapter on gold Ettmuller has already called the doctrine of deriving the philosophers' stone from gold alone a *non ens*. In his closing chapter on chemical

²⁷⁷ *Chymia rationalis et experimentalis*, 1684, pp. 51-52; ed. of 1693, pp. 142-44.

²⁷⁸ Ed. of 1684, pp. 113-15.

²⁷⁹ *Ibid.*, pp. 118-19; ed. of 1693, pp. 327-38.

²⁸⁰ Ed. of 1693, p. 340; ed. of 1684, p. 122.

chimeras,²⁸¹ he puts in the same category—like Rolfinck—the derivation of quicksilver from the blood of animals and the *homunculus* of Paracelsus, supposed to be engendered artificially, but not, like Rolfinck, the possibility of the transmutation of metals.

But Ettmuller believed in chemical remedies, and they form a leading feature of his manual. Sulphur anodyne of vitriol, strongly recommended by Paracelsus and Helmont, is nothing else than fixed sulphur of copper but is not prepared directly from copper but from vitriol of copper (copper sulphate). Some distill *la tête morte* of vitriol of copper with sal ammoniac and obtain an admirable remedy. Starkey (or Stirk, from Bermuda) boiled salt of tartar with *la tête morte* of vitriol and claimed to have produced a wonderful remedy, but the process is very difficult. Boyle, who puts great faith in the writings of Helmont, composes flowers of sulphur from vitriol of copper, sublimated with sal ammoniac, and regards this as a sacred remedy for stomach complaints. He takes sal ammoniac, mixes it with *la tête morte* of vitriol of copper, well dulcified and not retaining the taste of copper, sublimates it all, dissolves it in water to sweeten it further, and obtains flowers of an orange color which he calls First Being of Venus. He ascribes anodyne virtue to these and has proved it in cases of quartan fever and rickets.²⁸²

Spirituos phlegm of hartshorn mixed with its volatile salt constitutes essencified spirit of hartshorn. *La tête morte*, having lost all acidity, has the advantageous property of absorbing all humidities and so by accident becomes very useful in medicine, whether taken internally or applied externally. It absorbs acid so well that, if spirit of vitriol is poured on it, this loses all its acidity. Evidently such *têtes mortes* are admirable remedies for *soda* or acidity of the stomach²⁸³—an interesting instance of the name of an ailment²⁸⁴ which was later applied to its remedy. It is thanks to sulphur of Venus that *la tête morte* of vitriol of copper cures dys-

²⁸¹ Ed. of 1684, p. 157, "De non entibus chemicis"; ed. of 1693, pp. 439-42, "Des non-estres chymiques."

²⁸² Ed. of 1684, pp. 30-31; ed. of 1693, pp. 82-85.

²⁸³ Ed. of 1684, p. 151; ed. of 1693,

pp. 419, 421-22.

²⁸⁴ Michael Scot in the thirteenth century, according to Maigne d'Arnis, *Lexicon . . . de la basse latinité*, 1866, used the word *soda* in the sense of headache or migraine.

entery, "qui s'arrête d'abord qu'on a jetté des excremens du malade dessus,"—a secret for which Knoephelius is to be much commended.²⁸⁵

Balm of sulphur cures internal abscesses and dangerous ulcers of the breast.²⁸⁶ The virtue of antimony in infusions is inexhaustible.²⁸⁷ Bartoletti in his treatise on respiration mentions a saffron or crocus of antimony, produced by sublimation, which has the odor of musk and which, when completely dissolved with spirit of wine and reduced to a scruple in weight, becomes an excellent purgative without causing any vomiting. Finck in his *Enchiridion chymicum* tells of making flowers of antimony with a like odor.²⁸⁸ Mercury kills worms; Zwelfer will teach you how to distill it.²⁸⁹ Mitigated Dragon, or Panchymagogue Mineral, is a very mild remedy and excellent purgative, prepared by adding mercury to mercury sublimate.²⁹⁰ Conring made laudanum from opium, adding extract of castoreum, spices, diacalaminth, and a little bezoar stone, and mixing the whole very exactly.²⁹¹

The tooth of a boar is employed in cases of pleurisy to purify the blood stream of unnatural acidity.²⁹² Volatile salt of human blood is a sovereign cure for epilepsy, as is that of the urine for the stone. The human cranium is considered an antidote for dysentery. Its moss or scrapings check all haemorrhages and are the basis of the magnetic unguent. The brain, if putrefied, yields a marvelous spirit against epilepsy. The afterbirth, if putrefied, furnishes a salutary spirit to eject the foetus, dead or alive, the dose being 30 to 40 drops taken in beer. Linen dipped in the menstrual blood of a virgin cures erysipelas, gout and tertian fever. A deer's private is a specific for dysentery, and a whale's for pleurisy.²⁹³

Such passages show Ettmuller treading close to the border which separates medicine and science from magic. He refers favorably to the sympathetic powder as well as the magnetic unguent, stating

²⁸⁵ Ed. of 1684, p. 109; ed. of 1693, p. 304.

of 1684, p. 96.

²⁹⁰ Ed. of 1693, p. 260; ed. of 1684, p. 79.

²⁹¹ Ed. of 1693, p. 408; ed. of 1684, p. 147.

²⁹² Ed. of 1693, p. 147.

²⁹³ *Ibid.*, p. 423. I could not find this passage in the ed. of 1684.

²⁸⁶ Ed. of 1693, pp. 165, 170.

²⁸⁷ *Ibid.*, pp. 185, 189.

²⁸⁸ *Ibid.*, p. 188; ed. of 1684, pp. 67-68, citing Trinellius instead of Finck.

²⁸⁹ Ed. of 1693, pp. 248, 268; ed.

that in *la tête morte* of vitriol of copper lies concealed the force of the sympathetic powder which cures wounds and other ills by magnetic virtue.²⁹⁴ He is hesitant with regard to tinctures of gems and holds that crude gems taken internally have no medicinal effect, except crystal which is soft and absorbs acidity. But he still grants gems medicinal virtue when applied externally as amulets. It is known from experience that suspending a jasper about the neck stops nosebleed. If one draws a circle around a pestilential carbuncle with a sapphire, the carbuncle will soon turn black and fall off. It is customary to draw a similar ring about the eye in order to preserve the sight in cases of measles and smallpox.²⁹⁵ He accounts for the force of such amulets by radiation, probably of metallic sulphur.

The currency of Ettmuller's writings is evidenced by the fact that in the *Compendium of Universal Medicine* of 1738 he is one of five authors, dead or living, mentioned by name in the full title from among those from whose works selections have been taken, the other four being Waldschmid, Sennert, Wedel and Boerhaave.²⁹⁶ The various editions of Ettmuller's *Opera* to which we have referred contained chiefly medical works, but that of 1690 included a *Pyrotechnia rationalis* which was very similar to a *Collegium chymicum* in the edition of 1696–1697, which roughly corresponded to the *Chimia rationalis* of 1684. It was in three sections instead of two books of seven sections, the first section of the second book being combined with the four of the first book in Section I of 40 chapters, in place of 31 in 1684, but with the same opening and closing chapters. Sections two and three on the vegetable and animal kingdoms then parallel those of 1684 on those fields.

Ettmuller's only chemical compositions printed during his lifetime were a dissertation on coral at Leipzig in 1665,²⁹⁷ and a disputation on the chemical medicine of Hippocrates held at Leipzig in October, 1670, and printed at Leyden in 1671.²⁹⁸ Coral was not

²⁹⁴ Ed. of 1684, p. 31.

²⁹⁵ *Ibid.*, pp. 125–26; ed. of 1693, pp. 349–50.

²⁹⁶ *Compendium medicinae universae*, Basel, 1738, 2 vols.

²⁹⁷ *Examen corallorum tincturae*, Lipsiae, 1665: BM B.426 (7.). Pages unnumbered.

²⁹⁸ *Medicina Hippocratis chymica disputationis loco publice . . . preposita Lipsiae a. 1670 mense Octobr.*,

a panacea, and it was disputed whether a true tincture of it was obtainable, but it was generally agreed that it was a cordial and had a peculiar sympathy with human blood, the signature of red coral seeming exactly to represent the tincture of the nectar of the microcosm. He thought of coral as a stony concretion in the form of a shrub, which was generated from a nitro-saline mineral juice, "impregnated with sulphureous clammyness elevated by subterranean heat" through the pores of the bed of the ocean, and congealed by the coldness and saltiness of the sea water.²⁹⁹ The three chapters of the disputation on the chemical medicine of Hippocrates were respectively devoted to the Hippocratic correction of the elemental qualities, Hippocratic assertion of saline faculties, and application of the Hippocratic faculties to hygiene and therapeutics. Helmont was cited and also the Experimental Philosophy of Boyle. These features were to be repeated in the *Chymia rationalis*.

Jacobus Le Mort (1650–1718) describes his early career in the preface to one of his works.³⁰⁰ His father was a chemist, and he devoted his time from an early age to furnaces and operations. From eight on he attended Latin grammar school at Leyden, then divided into seven grades. At fourteen he went to the university and studied among other subjects theology. At seventeen he attended with many others a chemical laboratory at Amsterdam conducted by a most expert German, who, however, died about a year later. Le Mort then returned to Leyden where he assisted the medical authorities, studied the book of nature through continual chemical experimentation and medical practice, and kept many case histories during the plague year of 1669. At the repeated solicitation of de Maets, who later proved ungrateful, he became his chemical assistant, but in his twenty-first year opened a chemical workshop of his own, adding a Galenic one three years later. At the age of twenty-four he also instituted private lectures on both chemical and Galenic medical theory and practice. His success

Leyden, 1671, 112 pp. BM 1036.a.3 (4.).

²⁹⁹ PT XV, 1141, reviewing Ettmüller, *Opera omnia (sic) theoretica et practica*, London, 1683, in-4.

³⁰⁰ *Chymia rationibus et experimen-*

tis auctoribus usque demonstratiois superstructa in qua malecolorum calumniae modeste simul diluuntur . . ., Lugduni Batavorum apud P. Van der Aa, 1688, 8vo, 365 pp. and Index. Copy used: BN R.41528.

aroused the jealousy of the professors and doctors of medicine who fined him alone for practicing medicine when he was a mere pharmacist without a degree, although others, he complains, were doing the same with impunity. He accordingly took his M.D. at Utrecht at the age of twenty-seven and then returned to Leyden and a rich practice, but the other physicians sent him to Coventry and would hold no consultations with him. On December 28, 1694, however, he was allowed to teach chemistry and in 1702 was made a professor. Meanwhile he had published a *Compendium chymicum* in 1682,³⁰¹ and the aforesaid *Chymia* in 1684 and 1688.³⁰² And his remedies as well as those of de Maets and Margravius³⁰³—whom he had especially accused of slandering him and misrepresenting his writings—were included in the *Collectanea chymica Leidensia* of 1684 and 1693.³⁰⁴

In his preface of 1688 Le Mort says that he has retained the order of arrangement of the *Compendium* published some years before. "For it makes little difference where the chemist begins provided he leaves nothing untouched." After listing thirty medical positions and twenty-six chemical, he considers chemistry in general, its division, solution and coagulation, fluid and solid, the five principles, and spirits. Various chemical processes are then treated, such as solution (again), calcination, extraction, sublimation, distillation, rectification, maceration, putrefaction, coagulation (again), fermentation and effervescence. We come to clays and furnaces, vegetable waters, essential oils, spirits prepared by fermentation, oils and empyreumatic spirits of vegetables, oils and volatile salts of animals, fixed salts, acid spirits, sublimations (again), extracts, balsams, compound mineral salts, calcinates, precipitates, tinctures of minerals and metals, and a separate section on metallurgy. Some

³⁰¹ A review in *Acta eruditorum*, III (1684), 48-49, describes its order of treatment. In speaking of the distillation of urine Le Mort ridiculed the notion that the urine of a wine drinker was best.

³⁰² Ferguson, II, 24-25.

³⁰³ Christian Margravius published *Materia medica contracta*, Leyden, 1674, 4to, viii, 252 pp., BN 4°Te¹³⁶,9;

and *Prodromus medicinae*, Leyden, 1685, 4to, 173 pp., BN 4°T³⁰,76. He was dead when Le Mort wrote in 1688.

³⁰⁴ *Collectanea chymica Leidensia, maëtsiana, margraciana, Le Mortiana* . . . nunc autem plurimis novis . . . experimentis . . . aucta per Theodorum Muylkens, Leyden, 1693, 8vo. 587 pp. BN R.32000. For the edition of 1684 see note 242 above.

points are repeated several times in the course of the book, which seems primarily medical, but from the full Index one may glean chemical information which is incidental in the text.

In 1696 Le Mort republished the work of 1688 as part of a longer work consisting of three parts.³⁰⁵ Of these the first part of 150 pages³⁰⁶ praised Boyle and adopted the corpuscular physics and mechanical texture of bodies. Much is said of molecules and effluvia, and medicaments are divided into three distinct classes according to the predominant corpuscles. In the preface Le Mort states that he avoids such terms as acid and alkali, since he believes that they reduce beginners to damnable ignorance, as do such terms as fermentation and ether. Nevertheless he later devoted several pages to fermentation.

The Chemical College of Caspar Cramer of Erfurt was set forth in five dissertations by Justus Vesti in the same university.³⁰⁷ Chemistry is defined as an art which alters bodies by fermentation. Fermentation, whether natural or artificial, proceeds from the inflow of an ethereal spirit or substance related to primitive light, which concurs with implanted spirit of the same essence but already combined with matter, which others have called nature, *archaeus* or star. From their concurrence arise in water and air universal ferments on which all particular ones depend and a basic salt of nature is formed. But specific forms are implanted by light from the stars. The spirit is fire that does not burn; the salt he

³⁰⁵ *Jacobi Le Mortii . . . Chymiae verae nobilitas et utilitas in physica corpusculari . . . etc.*, Lugduni Batavorum apud F. Haaring, 1696, 3 parties en 1 vol. in 4°. Copy used: BN R.7834 (1).

With this work of Le Mort is bound yet another edition of the *Collectanea Chymica Leidensia*, of the same year, 1696, but with his name, *Le Mortiana*, omitted from the title, which now reads, *Collectanea Chymica Leidensia, Maetsiana et Marcgraviana, olim publice et privatim in Academia Lugduno-Batava Chymiam profitentium*

ac docentium, 278 caps. and 288 pp.: BN R.7834 (2.).

³⁰⁶ The quarto pages are longer than the octavo pages of the 1688 edition, so that the second part on *Chymia medico-physica* now occupies 237 pp. The third part, *Pharmacia medico-physica*, has 173 pp. Each part has a new pagination.

³⁰⁷ *Collegium chymicum Casp. Crameri Med. D. et P. P. Erfurt. quinque dissertationibus editum a Justo Vesti Med. D. et P. P. in eadem Academia . . .*, Francof. et Lipsiae, 1688, in-4. Summarized in *Acta eruditorum*, VIII (1689), 307-11.

calls earth, but not common earth; what is passive and subject to alteration he calls water and earth. Air is generated from water and is simply a rarefied form of it.

Of the three principles of the chemists, mercury is identified with his spirit, and salt with his salt, but sulphur is not accepted as a principle on a level with them. The stress laid by Tachenius upon acid and alkali is disputed. Light differs from fire only in manner and density, since fire is dispersed light, while rays of light joined in a burning glass produce fire. Light may be friendly or the contrary to us, by arousing our spirits or constricting them, whence the names of heat and cold, or lunar darkness and solar fire. This fiery ferment can invade all three kingdoms, but there are two others for vegetables and animals, vinous and putrefactive.

The acid abounding in them is fixed by the ethereal spirit into oil and attenuated into ardent spirit; when destitute of acid, they lose their ether, so that they are resolved into putridity, and, if any oil remains, it becomes alkali.

Or there are intermediate substances like urine and milk. Vesti goes on to treat of mutations of metals and minerals by air, combinations of volatile salts with fixed, eductions of mercury from metals, solutions of these by strong waters, transmutations, and finally of exaltations of fermentation.

The third dissertation turns to chemical operations. They separate something from the subject, or alter it by fire, or are composite. Some are humid like distillation and digestion; others dry, like sublimation. After furnaces, vessels, and fires have been described, under distillation are treated waters, spirits and oils. The fourth dissertation is then devoted to digestion, sublimation and calcination; the fifth, to liquefaction, solution, involving discussion of universal menstrua including the Alkahest, and to precipitation. The review in *Acta eruditorum*³⁰⁸ concludes with praise of the author for his rich erudition, accurate judgement, and long laboratory experience.

Finally we may note an English manual of chemistry which appeared in the last decade of the century, the *Complete Course*

³⁰⁸ *Idem*.

of *Chemistry* of George Wilson, published at London in 1691 and 1699 or 1700, with third, fourth and fifth printings in 1709, 1721 and 1736.³⁰⁹ I have used this last edition which contains a portrait of the author in his seventy-eighth year in 1709 and his preface to the fourth edition of 1721, when he must have been ninety years old but wrote, "As long as God shall give me health, I shall continue to divert myself in the laboratory."³¹⁰ As Wilson himself says, he lacked "the great blessings of academical education,"³¹¹ so that his book is a practical collection of recipes and experiments without "Mons. Lemery's pompous way of philosophizing upon the processes," but his general plan and arrangement are very similar to Lemery's and he sometimes cites him.³¹² Unlike Lemery's book, however, Wilson's text is preceded by eight tables or plates containing chemical characters, furnaces, and vessels.

Wilson still employed in medicine such things as human skulls, millepedes, and "sows or hog-lice."³¹³ He still made use of potable gold, "as I prepar'd it for the chief physician of a great prince, 1692."³¹⁴ He also was much given to elixirs³¹⁵ and compound medicines. For king James II he often concocted the following "sweet honey-water."

Take of good French brandy one gallon; of the best virgin honey and coriander seeds one pound each; cloves, one ounce and a half; nutmegs, one ounce; benjamin and stirax, one ounce each; benilloes, number four; the yellow rind of three large lemons. Bruise the cloves, nutmegs, coriander seeds, and benjamin; cut the benilloes in small pieces; put all into a cucurbit, and pour the brandy to them; and after they have digested forty-eight hours, distil off the spirit in *Balneo-Mariae*.

To one gallon of this water add of damask-rose and orange-

³⁰⁹ Ferguson, II, 553.

³¹⁰ *Op. cit.*, p. xii.

³¹¹ *Ibid.*, 356.

³¹² *Ibid.*, 308, "is that which Mr. Lemery calls Flowers of Salt Armoniac"; 310, "The spirit and volatile salt of Armoniac which Mons. Lemery calls sweet spirit of salt armoniac."

³¹³ *Ibid.*, 305, 343, 342: "They breed in cellars and moist places, under

stones, old casks, and logs of wood; being touch'd, they gather themselves up like round beads. They are said to digest, extenuate, open, and cleanse, and resolve tartarous mucilage; are good in jaundice, cholick, stone, and difficulty of urine."

³¹⁴ *Ibid.*, 12-15.

³¹⁵ *Ibid.*, Part II, chap. xiv, pp. 264-76.

flower-water one pound and a half each; of China musk and amber-grease, five grains each. First grind well the musk and amber-grease with some of the water, and afterwards put all together into a large matrass; shake them well and let them circulate three days and nights in a gentle heat. Then let all cool; filter and keep the water in a vial well stoped for use.

It is an anti-paralytick, smooths the skin, and gives one of the most agreeable scents that can be smelt. Forty or fifty drops put into a pint of clean water are enough to wash the hands or face with; and the same proportion to punch or any other cordial-water gives a most pleasant flavor.³¹⁶

One of Wilson's metallic remedies is called "the sympathetic powder";³¹⁷ another, "the arsenical magnet";³¹⁸ although neither seems to have operated sympathetically or magnetically. This suggests that Wilson was a bit of a quack, and in the second case he goes on to say: "In the time of the plague, 1665, I made this magnet, and it was much used both in plasters and amulets." "A medicine only prepared by myself" he calls "the secret corrector."³¹⁹ He was over-credulous as to gossip, stating concerning red precipitate of mercury: "Some chirurgeons have in the army used it internally with success: and I have heard gentlemen of probity assert that they knew an old quacking nurse give a full dram to very robust fellows in venereal cases, and they have escaped."³²⁰ He affirms that ants store "their hives" with provisions in the full of the moon and rest in the new.³²¹

Most shocking, however, to modern sensibilities and professional standards is the self-advertising and pursuit of medicine for profit by Wilson and his fellow-countrymen. "Mr. Lockyer," who was perhaps not an M.D., "got a good estate" by the composition of his pill.³²² Dr. Starkey's pill was composed of extract of opium, nutmegs and saffron beaten together into a paste so that the saffron could not be distinguished from the nutmegs, and mineral bezoar and snake root reduced to an impalpable powder, and then mixed

³¹⁶ *Ibid.*, 339-40. I have slightly altered the wording.

³¹⁷ *Ibid.*, 136-7.

³¹⁸ *Ibid.*, 165.

³¹⁹ *Ibid.*, 255.

³²⁰ *Ibid.*, 73-74.

³²¹ *Ibid.*, 344.

³²² *Ibid.*, 110.

all together with half a pound of the Corrector, half an ounce of oil of sassafras, and two ounces of tincture of antimony, and beaten together in a mortar. Wilson adds: "This I had from the ingenious Dr. Starkey's own mouth, in the year 1665, a little before his death; who then told me, he gave Matthews the former (pill) for a little money; but this is that which he successfully made use of himself."³²³ But the worst is yet to come. A few pages later Wilson remarks concerning Starkey's and Matthews' pill, "Those gentlemen who have not the conveniency to prepare it, may for twenty shillings the pound have it of me."³²⁴

Finally Wilson added to his book a fourth part or appendix of seven experiments in the transmutation of metals. Boyle, he said, had believed in it. He continued, however: "I know indeed that this doctrine meets with very little acceptance amongst the learned of this age; neither shall I pretend to be an advocate for it, though the expensive and tedious experiments I have made abundantly convince me that metals may be very much meliorated, if not entirely transmuted."³²⁵ The experiments were performed or begun in 1661, in June and October, 1677, March, 1687, June, 1694, February, 1699, and August, 1704. Wilson concludes: "These and many more experiments I have made and always fell short of, or was entirely baffled in my expectations."³²⁶

³²³ *Ibid.*, 284-5.

³²⁵ *Ibid.*, 356.

³²⁴ *Ibid.*, 291.

³²⁶ *Ibid.*, 383.

CHAPTER XXVIII

ROBERT BOYLE

Previous estimates—Literary style—Content—Effluvia—Amulets—Greatrakes the Stroker—Standards of credibility—Tests by experiment; their limitations—Boyle's use of the word, experiment—Secrecy—Experiment as entertainment—Form and quality—Material spirits—Occult qualities—Influence of the stars—Beale on astrology—Boyle weak in natural history—Signatures—Virtues of gems—Bezoar stones—Gold—The Sceptical Chymist—Attitude towards transmutation, Paracelsus, chemical remedies, a universal medicine, compound medicines—Sympathetic and magnetic remedies—The toad—Use of parts of animals and of the human body—Sympathy and antipathy—Semi-magical remedies—Magic transfer of disease—Witchcraft—Magic, Religion, and Experimental Science.

Malim ego chymistam scepticum quam chymistam doctorem

—BARTHOLOMAEUS DE MOOR

Two centuries ago Robert Boyle (1627–1691) was called "that great restorer of the mechanical philosophy."¹ A century later Hoefer stated that Boyle had proved by varied experiments that air participated in chemical change, and had come to the conclusion that there was some vital substance in the air—whether solar, sidereal, or of a totally different nature—which intervened in the chief chemical processes, respiration, combustion and fermentation. Furthermore, that for Boyle air was composed of three different kinds of molecules: exhalations from waters, minerals, vegetation and animals on the earth's surface; more subtle magnetic effluvia emitted by the earth and producing the sensation of light by their shock with innumerable atoms from the stars; and third, "la portion vraiment élastique de l'air."² More recently Sir Clifford Allbutt spoke of Boyle's boundless curiosity, declared his name immortal

¹ In the Preface by T. Birch to the 1744 folio edition of Boyle's works; in Boyle, *Works*, 1772, I, 1.

² Ferd. Hoefer, *Histoire de la chimie*, 1843, II, 159-61, 165.

for his "researches upon the elasticity of the air, and on the phenomena of the air-pump," and further praised him for his insight into chemical affinity, his laws on the volume and elasticity of gases in which he anteceded Mariotte, and his quantitative work before Black.³

On the other hand, Boyle's recent biographer seemed to feel that his greatest service was in popularizing experimental science and the corpuscular theory as against the natural philosophy of Aristotle and scholasticism.⁴ P. P. Wiener had similarly held that Boyle's "main contribution" was "the active institution of the experimental philosophy, of which Francis Bacon had merely talked in Utopian fashion." But Wiener felt that Boyle "had no true appreciation of scholasticism," because he had not read the Latin writings of the Schoolmen and "identified their views with those held by the shallow self-styled Aristotelians around him."⁵

More further appeared to regard Boyle as more of a chemist than physicist. Although Boyle's first published book in 1660 was *On the Spring and Weight of the Air*, More stated that, when Hooke in 1662 moved to London as curator of the Royal Society, Boyle "abandoned any further work of a quantitative and mathematical nature." Yet in the chapter on "Boyle as Creative Natural Philosopher," it is on his monograph of 1664 on colors and his treatise of 1665 on cold that More lays most stress. It is extraordinary that he devotes only two pages to *The Usefulness of Experimental Philosophy* of 1663, and sinks these in the midst of the chapter on "Boyle and Anglican Theology."⁶ For George Sarton

Boyle was one of the best prototypes of the modern man of science, anxious to find the truth and to investigate it critically without self-deception, more deeply concerned with the quality than with the quantity of his knowledge.⁷

³ Ninth Boyle Lecture of 1902, "The Rise of the Experimental Method in Oxford," reprinted in *Greek Medicine in Rome . . . with other historical Essays*, 1921, pp. 491-525, especially pp. 516, 520, 514.

⁴ Louis Trenchard More, *The Life and Works of the Honourable Robert*

Boyle, Oxford, 1944, p. 92.

⁵ "The Experimental Philosophy of Robert Boyle," *Philosophical Review*, 41 (1932), 595-96.

⁶ L. T. More, *op. cit.*, pp. 95, 267, 72, 272-79, 174-76.

⁷ "Boyle and Bayle," *Chymia*, III (1950), 163.

Boyle is notorious as having one of the most tiresome and verbose literary styles on record. It is diffuse and rambling, apologetic and deprecatory, and without adequate terminal facilities. His recent biographer, it is true, assures us that "the popularity of his early works was extraordinary," and speaks of "their ease and simplicity of style."⁸ But "easy writing"—or, in Boyle's case, dictation to amanuenses—makes, as Charles Lamb remarked, "damned hard reading." However, Boyle's contemporaries may have been able to wade through his writings better than subsequent readers. Certainly his works would seem to have been published in abundant profusion, since no items are more frequently encountered in second-hand sales catalogues. There may, however, be another reason for this: either that few will buy them and hence they are perpetually offered for sale, or that those who do buy them and try to read them soon return them at a low price to the market.

Boyle's correspondent, Beale, thought of modern science as in its early stages and still scanty in volume of writing. He wrote to Boyle on August 10, 1666:

You have only Des Cartes, lord Bacon's good wishes, some few honest chemists, and modern discoveries in astronomy, anatomy, etc. What are all these, if compared with one St. Austin for bulk?⁹

The bulky volumes of Boyle's published works at least did something to reduce this disparity.

Another deterrent to perusal of Boyle's writings is their over-elaborate and confusing subdivision into books, parts, essays, discourses, sections, titles, chapters, observations, experiments, and what-not,¹⁰ to say nothing of profuse preliminary prefaces by publisher and author.¹¹ A lumbering attempt to cast a number of

⁸ L. T. More, *op. cit.*, p. 107.

⁹ Boyle, *Works*, 1772, VI, 415.

¹⁰ Since repetition of all these, in addition to the title of the particular work, would expand the footnotes to an unconscionable length, I have usually limited my references to volume and page of the English collected *Works* in 6 vols. of 1772, or the Latin *Opera*, 3 vols., Venice, 1697. The

latter edition introduces chapter titles and contents, with corresponding numbers, which make it easier to find things. But they, as well as the rendering of the text, do not always precisely express Boyle's thought.

¹¹ For example, *The Origin of Forms and Qualities according to the Corpuscular Philosophy* opens (*Works*, 1772, III, 1) with "The Publisher to the

these writings in the form of familiar discourse and informal conversation adds neither to the clarity nor to the rapidity of the thought. But in the midst of all this persiflage occur striking statements and luminous opinions, such as

Heat consists chiefly, if not solely, in vehement and tumultuous agitation of the small parts of Bodies . . .¹² Sound . . . consists in an undulating motion of the air. . . Suction . . . seems to depend clearly upon the weight of the atmosphere.¹³

The content of Boyle's writings has three chief constituents. The first is the result of his wide reading in a great variety of authors, and may be called traditional. The second is the outcome of his own researches or those of his assistants in the laboratory, and may be called experimental. Boyle himself often confused this with the first, as in his *Medicinal Experiments*. The third element is a mass of information and misinformation acquired as a result of converse or correspondence with, and questioning of, many different persons: navigators to the Far North or south of the equator, other travelers and "credible persons," men of every occupation from an engineer to a preserver of fruits, men of rank like a Scottish noble or the duke of York, men from every land such as a former English consul in Tripoli, and then governor of the Castle of the English African Company in Guinea, or the chief physician of the Czar of Russia.¹⁴ While Huygens and Newton were grinding lenses and solving mathematical problems, apart by themselves, Boyle was seeking data from human sources of all sorts in contemporary society. "Strange Reports" interested and excited him, as they did most of his contemporaries. He gave this title to a tract which he says he "was encouraged to make by the example of Aristotle." He adds in a footnote: "This famous philosopher in his little tract,

Ingenious Reader"; at p. 3, "The Author's Proemial Discourse to the Reader"; at p. 11, the Preface; at p. 14, "Considerations and Experiments Touching the Origin of Forms and Qualities: the Theoretical Part"; at p. 18, "An Excursion about the relative

Nature of Physical Qualities"; and so on.

¹² Quoted by Allbutt, *op. cit.*, p. 515.

¹³ *Works* (1772), V, 13; III, 199.

¹⁴ *Works* (1772), II, 514-18; V, 725; etc.

whose title some render *De Mirandis Auditionibus*, scrupled not to comprise without method divers reports, uncertain or fabulous, nor to insert several, that were not so cautiously admitted as those recited in the following collection."¹⁵ This third element is far more traditional than experimental, however much Boyle's credulity may deceive him to the contrary.

Ever since the treatise of Fracastoro on contagion and contagious diseases appeared in 1546, with its explanation of infection as produced by the exhalation of seeds of disease in the form of minute insensible particles, there had been an increasing and spreading tendency to resort to such effluvia as a physical and natural, even mechanical, solution of what had before seemed magical and occult. This trend was greatly encouraged in the seventeenth century by observation through the microscope, which showed hair on the legs of cheese-mites, and led Boyle to believe that the tiny motes seen in sunlight might "exceed many thousands" of such corpuscles and effluvia in bulk.¹⁶ We have seen Sennert take over the ideas of Fracastoro; Boyle may have derived them indirectly through Sennert or others.¹⁷ At any rate, he holds that even solid bodies give off effluvia which penetrate the pores of the closest bodies.¹⁸ Scaliger told of spiders in Gascony whose venom passed through the soles of the shoes of a person treading on them. And Boyle explained the action of the torpedo by effluvia rather than by resorting, as Sennert had done in that case, to spiritual qualities. Moreover, he believed that wounded wild animals, rapidly traversing fields, could so impregnate the air with their invisible effluvia, that the dogs pursuing them would be poisoned by it, and such effluvia even remain in the air for a year or two.¹⁹

It was thus that Boyle, like Sir Kenelm Digby, explained the action of amulets which were worn externally upon the person. Effluvia from them passed through the pores of the skin and

¹⁵ *Ibid.*, V, 604.

¹⁶ *Works*, 1772, III, 661.

¹⁷ The name of Fracastoro does not appear in the Index to the 1772 edition of Boyle's *Works*, but neither does that of Julius Palmarius (Julien Le Paul-

mier), whose *De morbis contagiosis* is cited at III, 675.

¹⁸ *Works*, 1772, III, 669. See also IV, 777-93, "An Essay on the Porousness of Solid Bodies."

¹⁹ *Works*, 1772, III, 669, 316-17; *Opera*, 1697, I, 511-12.

operated internally.²⁰ It was thus that the blood-stone,²¹ or even an agate,²² hung about the neck, checked bleeding; that a child which had been bewitched was cured by an appended mineral;²³ that wearing the tooth of a hippopotamus or a ring made from the hoof of an elk relieved cramp,²⁴ and that haemorrhoids were remedied by wearing a ring made of a certain metal.²⁵

While the general explanation of effluvia may satisfy Boyle, a modern reader may well ask, if that be so, why the amulet is not placed closer to the ailing member and the part affected. And when Boyle quotes from Galen in both Latin and English translation not only the *locus classicus* concerning the cure of epilepsy by suspension of a peony root, but the further assertion that a marvelous remedy for the tonsils and for all swellings in the neck is to strangle a viper "with divers sorts of threads, and especially with the sea purple, and then you tye those threads about the neck of your patient,"²⁶ one feels that magic ceremonial is involved as well as the action of effluvia.

A physician, who used to awake in the night terrified, was rid of such fears by wearing carnelians in a piece of flannel about his neck so that the gems hung over his heart and the mouth of his stomach. Soon after he had left off the amulet, the nocturnal terror returned. Boyle continues:

But since I have not yet had occasion to make trial of them, I shall not conclude, that the remedy will always succeed, but only (which is enough for my present purpose) that it is at least possible, that such an external remedy may be very effectual.²⁷

Boyle further states that the virtue of amulets depends upon those who wear them, as well as upon the effluvia from them.²⁸

This last point was further elaborated by a Dr. Henry Stubbe in a pamphlet published in the form of a letter to Boyle without

²⁰ *Works*, 1772, IV, 767-68. Similarly, at V, 102, Boyle states that specific remedies operate through the pores of the skin.

²¹ *Ibid.*, III, 560; see also II, 156, IV, 767.

²² *Ibid.*, III, 286-87, V, 128.

²³ *Ibid.*, II, 159.

²⁴ *Ibid.*, V, 104.

²⁵ *Ibid.*, II, 157.

²⁶ *Ibid.*, II, 172.

²⁷ *Ibid.*, V, 106-7. He adds Galen's beneficial use of a jasper as an amulet.

²⁸ *Ibid.*, V, 49.

his permission. It was concerned with the marvelous cures by Greatrakes the Stroker who, after curing scrofula by stroking the patient—a gift of royal touch which was supposed to be limited to the kings of France and England for this “king’s evil,”—had proceeded to relieve other ailments by the same method. Stubbe held that

God had bestowed upon Mr. Greatraks a peculiar temperament, or composed his body of some particular ferments, the effluvia whereof being introduced sometimes by a light, sometimes by a violent friction, should restore the temperament of the debilitated parts, reinvigorate the blood, and dissipate all the heterogeneous ferments out of the bodies of the diseased, by the eyes, nose, mouth, hands, and feet.²⁹

The passage is a good example of the great faith placed by Boyle’s contemporaries in effluvia and ferments, and the notion then prevalent that anything could be satisfactorily explained merely by bandying these two words about—surely a close approximation to belief in the efficacy of incantations and magic words and characters.

Henry More, the Cambridge Platonist, wrote to Anne Conway on April 28, 1666:

Dr. Cudworth’s little son has received reale good from Mr. Greatrakes, and Mr. Boyle told me that he had been a spectatour of at least 60 performances of his. I believe that gentleman is likely to doe him more credit than any body.³⁰

Who is to do credit to whom? Greatrakes’ performances to Boyle’s experiments, or vice versa? At any rate, the two seem somewhat confused in More’s mind.

Boyle also mentioned “pestilential steams” in his *Cosmical Suspicions*. A man who was reading the work to Beale stopped at this passage and told of “a good old woman, aged near eighty, now deceased,” who said that she could detect the plague thirty miles away by pain in three sores left by the plague before she was

²⁹ *Works* (1772), I, lxxvi; quoted by More, *op. cit.*, p. 121.

³⁰ J. F. Fulton, in *Isis*, 18 (1932),

100, quoting from *Conway Letters*, ed. Marjorie H. Nicolson, 1930, p. 269.

married. Beale adds that he had known the narrator "for many years . . . to be creditable," but that "he forgot to ask, and could not now guess, what her particular aim was in mentioning thirty miles distance."³¹

Which is a not too extreme instance of the type of hearsay evidence from very questionable sources that still seemed to satisfy investigators in the fields of medicine and natural history in the seventeenth century, as it had in the sixteenth and many preceding centuries. Boyle himself, in opening the treatise to which Beale refers, alludes to "such a degree of probability as is wont to be thought sufficient to physical (i.e., natural or medical) discourses, or at least is usually to be met with in them."³² Moreover, he felt that in consideration of the vast universe and world of nature, conjectures and even "hunches" had their place. Beale's story merely matched and served to substantiate and corroborate two or three which Boyle had recounted in the same treatise, from which a further passage may be quoted:

If these stories were related by ordinary persons of what happened to other men, the oddness of them might well tempt a wary man to suspend his judgment; but the judiciousness of the writers and the profession they were of, and their relating these as things that did more than a few times happen to themselves, may well be permitted to bring credit to their assertions.³³

Athanasius Kircher, writes one of Boyle's correspondents on March 30, 1661, from Rome,

is reputed very credulous, apt to put in print any strange, if plausible, story that is brought unto him. He is philosopher enough, to give some kind of reason or other for whatsoever you will demand of him. He has often made me smile . . .³⁴

³¹ Letter of Beale to Boyle, 12 October 1670: *Works* (1772), VI, 429.

³² *Works* (1772), III, 316; *Opera* (1697), I, 511: "quae eum habere probabilitatis gradum videntur, qui sufficiens physicae disquisitioni videtur, vel saltem vulgo adhiberi solet."

³³ *Works* (1772), III, 317. At II, 477, Boyle tells of a Dutchman who

sailed within a degree of the North Pole.

³⁴ *Works* (1772), VI, 299. There follows the account of Soland geese which we note elsewhere. Southwell then adds: "He told me of a wench that, after long complaint, felt something crawling in one of the great muscles of her back; which being opened, there hopped out a frog."

This characterization applies fairly closely to Boyle himself, although perhaps to a lesser degree. He cites the Bavarian History of Aventinus for men turned into statues, and Pamphilio of Piacenza for a woman who turned into stone dying with hideous tortures within twenty-four hours after eating an apple, although he calls the latter "an unparalleled story."³⁵ He states that the poison of a mad dog may not take effect until after many years, the explanation being,

a little foam conveyed into the blood by a slight hurt (perhaps quickly healed up) is, notwithstanding the constant heat and perspirable frame of the human body, and the dissippable texture of the foam, so preserved, and that sometimes for many years, that, at the end of that long time, it breaks out and displays its fatal efficacy with as much vigour and fury, as if it had but newly been received into the body.³⁶

As a treatment for dogs that have been bitten by a mad dog he repeats the following:

Take three plants (i.e., roots and leaves) of that herb, which is called rose-plantane or by some star-plantane; and, having chopt it small with a convenient quantity of butter, let the bitten dog take it the first day; the second day give him five plants ordered as before, and the next day seven.³⁷

Here the numerical ascent in odd numbers from 3 to 5 to 7 seems a relic of faith in magic power of numbers.

On the other hand, Boyle put some past beliefs to the test of experiment and found them unwarranted, or reasoned sanely against others. He determined by experiment that hot water would not freeze faster than cold, as Aristotle had asserted,³⁸ and against the attempt of Porta and others to distill a liquor from the tails of glow-worms which would be luminous in the dark, he notes that this property does not long survive the glow-worm itself.³⁹ He doubts if the divining rod discovers hidden veins of metal. It didn't work for him, even while walking over known mines. Agricola and even Kircher deny it, but many affirm it. Some say that

³⁵ *Works* (1772), I, 438-39.

³⁶ *Ibid.*, V, 239.

³⁷ *Ibid.*, V, 354.

³⁸ *Works* (1772), II, 700.

³⁹ *Ibid.*, I, 559.

it works only for some persons and at favorable astrological hours. Some miners use it; others laugh at it.⁴⁰

Boyle also took the pains to run down what authors had stated as their own experiment but which turned out to be mere assertion based on reading or hearsay. Thus Orthelius, commenting in 1624 on the *Novum lumen* of Sendivogius, had asserted that the liquor distilled from bismuth would expand while the moon was full and shrink as the moon waned.⁴¹ The Jesuit, Paul Casatus, whom Boyle characterizes as "a famous mathematician", and who lectured on *Mechanica* at Rome, in his *Terra machinis mota* had described the same change as if an experiment by himself.⁴² But when friends of Boyle consulted Casatus, they found that "he never made or saw the experiment himself, but relates it upon the authority of a certain Dutchman, whose name he adds not, and who therefore may probably be the same Orthelius."⁴³

It is remarkable that the same man who composed two essays on the unsuccessfulness of experiments, in which he pointed out causes of error and failure, who himself engaged in such patiently repeated experimentation, and who sharply criticized the chemical authors of his day for publishing experiments without having tried them themselves or even giving a specific authority for each experiment—it is remarkable, I say, that this same man should accept mere personal experiences, not carefully ordered laboratory processes, recounted by word of mouth to him by other persons, as of equal validity and on a par with what today would be regarded as experiment proper.

The explanation of this seeming inconsistency is not, however, difficult or far to seek. Laboratory experimentation had thus far been introduced only in the fields of physics, chemistry and anatomy, and was performed chiefly with new devices such as the air-pump which could be utilized in a purposive manner. But in such fields as general medicine, biology and mineralogy reliance

⁴⁰ *Ibid.*, I, 342-43.

⁴¹ In Zetzner, *Theatrum Chemicum*, VI (1661), 452. Only the volume is cited in *Works* (1772), II, 496.

⁴² *Terra machinis mota, in quo libro Archimedes terrae motionem spon-*

dentem ab arrogantiae suspitione vindicare laborat, Rome, 1658, in-4. Casatus also published, *Vacuum proscriptum*, Genoa, 1649, in-4.

⁴³ *Works* (1772), II, 496.

was still largely placed upon personal testimony and experience. Moreover, Boyle gave a wide extension to the use of the word, "experiment," to include, if not magic tricks, at least the "Plays of Boys." "I shall not scruple," he writes, "to confess to you that I disdain not to take Notice even of Ludicrous Experiments, and think that the 'Plays of Boys' may sometimes deserve to be the Study of Philosophers."⁴⁴ Which takes us back to Roger Bacon's ideal experimentalist who "blushed if some layman or old-wife or soldier or rustic knew what he ignored" and "examined even the experiments of old-wives and considered their divinations and incantations and those of all the magicians, and likewise the tricks and illusions of all the jugglers, in order that nothing which he ought to know might escape him."⁴⁵ When Boyle lost "four or five centuries" (like Francis Bacon, he arranged them by hundreds) of experiments of his own, he also lost "seven or eight centuries of notions, remarks, explications and illustrations of divers things in philosophy."⁴⁶ Boyle's *Medicinal Experiments*, which have been preserved, make up three volumes consisting of ten decades, three hundred and one recipes, and ninety-eight remedies respectively.⁴⁷ The Author's Preface opens with the words, "Though physick be not my profession," and the work is an example of the tendency then for individuals to make such collections for their own use or that of others. Those of Boyle are "for the most part simple and easily prepared" and are intended especially for poor country people. They employ such substances as stewed earthworms, the sole of an old shoe, or a worsted stocking that has been long worn next to the flesh.

Sir Clifford Allbutt has already noticed another characteristic of Boyle's experimental method which is closely related to magic, although Sir Clifford did not say so, namely, secrecy. Boyle in one place confesses that he "deliberately conceals some parts of

⁴⁴ Quoted by Sir Clifford Allbutt, *Greek Medicine in Rome... with other historical essays*, 1921, p. 513.

⁴⁵ *Opus tertium*, cap. 13, pp. 46-47 in Brewer's edition, *Rolls Series*, XV (1859).

⁴⁶ *Works* (1772), I, ccxxii-ccxxiii.

⁴⁷ In *Works* (1772), V, they occupy pp. 312-91, but do not appear in the *Opera* (1697). The third volume was published posthumously; items 271-301 in the second volume were added to the fourth edition from Boyle's manuscripts.

his labours," that he keeps some "experiments concealed," and that he is "always provided with some Rarity to barter with those Secretists that will not part with one Secret but in exchange for another; and think nothing worth their desiring that is known already to above one or two Persons."⁴⁸ Here we have a perfect analogy to the practice of magicians even of the present day who always strive each to have some unpublished magic trick or tricks of his own which he will impart to another only in exchange for some trick of equal rarity. When an "experiment" ceases to be secret and still somewhat problematic, it loses the charm and the invisibility of magic, to mingle with the common crowd in the open market of science. And so in Boyle himself we have an example *par excellence* of one beginning to shuffle off the mystic robes of the magician and putting on some of the habiliments of modern science.

Much of the experimentation, and especially the public experimentation, of the seventeenth century was in the nature of a fad and entertainment, a playing with apparatus rather than new discovery or original research, a repetition of, or the working of changes on, some previous experiment like that of Torricelli and proving nothing that his had not already demonstrated, a mere exercise. Instead of demonstrating dialectically what was generally believed, as the schoolmen had done, or proving geometrically what anyone could see was so with the naked eye, men now delighted in multiplying particular visible instances of what they had long since learned from general experience. For example, T. S. Patterson, in attempting to show that Mayow was indebted to Boyle, says that Boyle "showed that animals died very quickly when deprived of air," and makes much of the experiment in which a bird dies quicker in a closed glass vessel without air than with air,⁴⁹ while John F. Fulton affirms that, "in a remarkable chapter . . . which deserves some time to be reprinted in full," Boyle "showed that birds and mice die within 30 seconds to a minute of the time that air is removed from a receiver by means of an air

⁴⁸ Quoted by Allbutt, *op cit.*, pp. 515-16.

⁴⁹ "John Mayow in Contemporary

Setting: a Contribution to the History of Respiration and Combustion," *Isis*, XV (1931), 61-62.

pump."⁵⁰ Of course! What different did Boyle or anyone else expect? Everybody knew that, if you couldn't breathe, you'd suffocate. For at least some centuries everyone had known that air is what we breathe and is a substance. The interest of the experiment for the spectators was surely rather that, in a glass vessel which still seemed to be full of air, but from which the air had been removed by an air pump, a bird or mouse suddenly perished, and that they could enjoy a Roman holiday in the spectacle of its last agony. It was still the magical and spectacular element in the experiment that pleased the by-standers. And its scientific value was not at all that it showed that animals die when deprived of air—everybody knew that—but that their sudden demise demonstrated, in a picturesque and convincing manner, that there wasn't any air in the vessel. Nor should the members of the Royal Society have been greatly amazed when, in the experiment of January 18, 1664–65, "it was found that a lamp, which would only burn for some three minutes in a receiver containing air at ordinary pressure, could be made to burn for fifteen minutes when the air was compressed."⁵¹ It would seem a simple matter of multiplication.

Similarly men had employed bellows to assist combustion long before Hooke and Boyle were born, and long before bellows were invented, they had blown on the fire to stir it up, without dignifying either device with the appellation of a scientific experiment, and connecting respiration with combustion not theoretically but empirically and practically.

There was, of course, in the case of Boyle's experiments with the respiration of animals in small enclosed vessels, the fact that they would die before long, even if the air was not pumped out, although not so soon as in rarefied air or the complete absence of air. This raised the question of scientific importance how far their death was due to their having exhausted the air or something in the air by their breathing, or how far they had polluted the air by their expirations and other effluvia. But this interesting problem, for all his experiments, was for him insoluble.

⁵⁰ "Robert Boyle and his Influence," *Isis*, XVIII (1932), 58.

⁵¹ *Isis*, XV (1931), 64–65, citing Birch, *History of the Royal Society*, II, 10.

Boyle himself admits that sometimes his experiments were in the nature of an amusing show and entertainment.

We will, to divert your Lordship a little, mention here a phaenomenon of our engine, which even to divers ingenious persons hath at first sight seemed very wonderful.⁵²

In the ensuing experiment, which is a repetition in miniature of the Magdeburg experiment of von Guericke, a by-stander tries to lift the cover of the air-pump when the receiver is almost empty.

And if (as sometimes hath been done for merriment) only a bladder be tied to it, it is pleasant to see how men will marvel, that so light a body, filled at most but with air, should so forcibly draw down their hand, as if it were filled with some very ponderous thing.⁵³

Thus deception of the observer as well as marvelousness are taken over by experiment from the stock in trade of magic. Another experiment with a round glass bubble

gave us cause to wonder that the bare roundness of the figure should enable a glass, almost as thin as paper, to resist so great a pressure as that of the whole incumbent atmosphere. And having reiterated the experiment, we found again, that the pressure of the ambient body, thrusting all the parts inwards, made them, by reason of their arched figure, so support one another, that the glass remained as whole as at first.⁵⁴

Moreover, as some of the foregoing examples have already suggested, the spectators were a by no means negligible adjunct of the experiment. Boyle says:

Which sort of experiments seem so strange, that we were obliged to make it several times, which gained it the advantage of having persons of differing qualities, professions and sexes (as not only ladies and lords, but doctors and mathematicians) to witness it.⁵⁵

Once, when Boyle was testing how long a bird would live in a small sealed vessel from which the air had not been pumped, after only ten minutes "a great person, that was spectator of some of

⁵² *Works* (1772), I, 15.

⁵³ *Idem*.

⁵⁴ *Ibid.*, I, 23.

⁵⁵ *Works* (1772), I, 106.

these experiments, rescued him from the prosecution of the trial."⁵⁶ Another time a mouse had survived about three-quarters of an hour when "a Virtuoso of quality" arrived and "desired to see whether or no the mouse could be killed by the exsuction of the ambient air," and Boyle had to satisfy him.⁵⁷ In a third case, a bird was "within about half a minute cast into violent convulsions, and reduced into a sprawling condition, upon the exsuction of the air," but "by the pity of some fair ladies, related to your Lordship, who made me hastily let in some air at the stop-cock, the gasping animal was presently recovered, and in a condition to enjoy the benefit of the ladies' compassion."⁵⁸

It must have grown a little tedious sitting for a full hour waiting for the bird or mouse to die in the sealed jar. Except for compassionate ladies, most of Boyle's fashionable audiences, like the "Virtuoso of quality," probably preferred the quicker *coup de grace* by exsuction. But no doubt some of them would prefer even the longer experiment, at least in its first flush of novelty, to the tedium of trying to read a book, especially one in Latin. Hence the popularity of the new experimental "philosophy" among persons of quality. It was almost as good as a cock-fight!

In *The Christian Virtuoso* Boyle drew the distinction that the Peripatetic and scholastic schools of thought accounted for the works of nature by means of substantial forms and occult qualities, while modern experimental philosophy made a deeper research into the structure of things than these two uninformative terms.⁵⁹ In *Essays of the Strange Subtilty, Great Efficacy, Determinate Nature of Effluviiums* he said that many years ago, in an essay about an experiment with nitre, he had

endeavoured to exemplify some parts of the corpuscular philosophy, especially the production of qualities, and that

he had often looked upon these three doctrines of effluvia, of pores and figures, and of unheeded motions, as the three principal keys to the philosophy of occult qualities.⁶⁰

⁵⁶ *Idem.*

⁵⁷ *Ibid.*, p. 99.

⁵⁸ *Ibid.*, pp. 106-7.

⁵⁹ *Works*, 1772, V, 516.

⁶⁰ *Works*, 1772, III, 659-60.

Again, writing *Of the Atmospheres of Consistent Bodies*, Boyle criticized the schoolmen for ascribing

all abstruse effects to certain substantial forms, which, however, they call material, because of their dependence on matter.

But they give such descriptions of them

as belong to spiritual beings; as if all the abstruser effects of nature, if they be not performed by visible bodies, must be so by immaterial substances. Whereas betwixt visible bodies and spiritual beings there is a middle sort of agents, invisible corpuscles; by which a great part of the difficulter phaenomena of nature are produced, and by which may intelligibly be explicated those phaenomena, which it were absurd to refer to the former, and precarious to attribute to the latter.⁶¹

It may be questioned whether Boyle had any very clear idea just what substantial forms were or had been thought to be. But his invisible yet material corpuscles were very similar to the very subtle and intangible physical spirits of Telesio, Francis Bacon, and many others. Indeed, Boyle too believed in the existence of such material spirits in the human body and in non-human substances like wine. In stating that different poisons act on different parts of the body, he even implies that the brain can be injured without affecting the animal spirits, and *vice versa*, since he says that scammony especially affects the brain, and opium the animal spirits and nervous system.⁶²

Although the corpuscular philosophy was Boyle's intellectual pet, he still could debate, in sufficiently scholastic and Aristotelian style, how far the souls of creatures are the true forms of their bodies.⁶³ And he still thought in terms of qualitative action.

As it is by their qualities that bodies act immediately upon our senses, so it is by virtue of those attributes likewise that they act upon other bodies, and by that action produce in them, and oftentimes in themselves, those changes that sometimes we call alterations, and sometimes generation or corruption.⁶⁴

⁶¹ *Works*, 1772, III, 278.

⁶² *Works*, 1772, II, 191; *Opera*, 1697, II, 761. For animal spirits see further *Works*, 1772, V, 10; and for

vital spirits, Allbutt, *op. cit.*, pp. 519-20.

⁶³ *Works*, 1772, III, 117.

⁶⁴ *Works*, 1772, III, 11.

He preferred the study of qualities to that of substantial forms,⁶⁶ which admittedly cannot be known, and felt that there was a great need for an experimental history of them. Aside from some mathematical observations rather than experiments concerning sound, and Lord Bacon's brief essay on heat, "I know not," he said, "any one quality of which any author has yet given us anything competent."⁶⁶

Boyle was further inclined to admit occult or specific qualities, at least in the field of medicine. They had the support of many learned physicians including Galen, still a great authority for Boyle.⁶⁷ Galen had promised to write a treatise on things that operate by occult quality or the property of their whole substance, and later referred to it as already written, but it was not extant today. The force of poisons seemed of this sort, and opium seemed to work by such a specific or occult property.⁶⁸ Boyle also found a strange occult virtue in the ear of a cat.⁶⁹

Moreover, Boyle was persuaded that there were certain occult agents or agencies with some power of moving the internal portions of the earth. He was also of the opinion that the operations of nature are more irregular and less subject to fixed laws than we think. The world is like a great animal and produces certain effects at a defined time, just as nature does not grow beards in men until they reach a certain age. Hurricanes were becoming more frequent in America, and its climate less cold, while in Europe manna was now found in regions where it had been unknown before.⁷⁰

Boyle's attitude towards astrology and the influence of the stars was rather variable. In his *General History of the Air*, Title XIII, "Of Celestial Influences or Effluviiums in the Air to Mr. Hartlib," he remarked somewhat apologetically:

You did not expect, I am sure, I should have adventured into so particular an apology for astrology; nor did I intend it, when I begun my letter.⁷¹

⁶⁶ "Origin of Forms and Qualities according to the Corpuscular Philosophy," *Works*, 1772, III, 1-112.

⁶⁷ *Ibid.*, III, 12.

⁶⁸ *Works*, 1772, V, 532.

⁶⁹ *Works*, 1772, V, 78-79; III, 134.

⁷⁰ *Works*, 1772, II, 166.

⁷¹ *Works*, 1772, III, 316 *et seq.*; *Opera*, 1697, I, 511 *et seq.* Hurricanes along the Atlantic coast of North America, and their tendency to occur at about the time of the equinox, were noted in the early numbers of *PT*.

⁷² *Works*, 1772, V, 642.

But he accepted celestial influences in the air, that the air was regulated by the influence of the planets,⁷² and, in another work, that hidden qualities of the air might be derived from the sun and planets.⁷³ Nor did he have much enthusiasm for the study of astronomy for its own sake. Speaking of the theory of the planets, he said: If there is no "real or particular relation between us and them . . . , we know them only to know them."⁷⁴ In treating of sympathy and antipathy, he recognized the possibility of effluvia from the stars entering the pores of terrestrial bodies.⁷⁵ He also noted, as has been said, that some said that the divining rod would work only at favorable astrological hours.⁷⁶ But being planet-struck he branded as a popular superstition.⁷⁷

His position as to astrological medicine was also somewhat fluctuating. At one time he was inclined to minimize the effect of the stars upon the human body, especially in causing new diseases, although he recognized that the opinion was very general which derived them "only or chiefly from the varying influences of the heavenly bodies."⁷⁸ But in *Cosmical Suspicions* he was more ready to accept this idea, saying that he did not know whether subterranean changes or some unobserved connection between the earth and other mundane spheres was the cause of new diseases which invade whole regions and last for many years or ages, till finally they expire.⁷⁹ Yet in another passage he was disinclined to ascribe plagues to malevolent aspects of the planets: in the first place, because this was hard to prove; secondly, because they were too remote a cause for such particular phenomena as often accompanied plagues.⁸⁰

When the Galen-honored suspension of a peony failed to work against epilepsy, Boyle suspected that the herb had been unseasonably gathered, so that its effluvia lacked the requisite virtue. This suspicion was confirmed by a leading physician of western Ireland, who said that the herb should be plucked when the waning moon passed under the sign Aries. Monsieur de Grands Prez of Grenoble

⁷² *Ibid.*, V, 638, 640.

⁷³ *Ibid.*, IV, 85.

⁷⁴ *Ibid.*, V, 639.

⁷⁵ *Ibid.*, IV, 95.

⁷⁶ *Ibid.*, I, 343.

⁷⁷ *Ibid.*, V, 54.

⁷⁸ *Ibid.*, V, 67.

⁷⁹ *Ibid.*, III, 321; *Opera*, 1697, I, 516.

⁸⁰ *Works*, 1772, V, 56.

said the same and inferred therefrom the utility of astrological medicine. But, concludes Boyle,

before much weight be laid upon such improbable notions as most of those of judiciary astrologers, the influence of the constellations upon simples etc., ought by severe and competent experiments to be better made out than hitherto it has been.⁸¹

Boyle's correspondent Beale, who also was associated with the Royal Society, was more favorable to astrology. He further believed in divining dreams, and suggested that the astrology of the ancient orient "was not fimbriated with the trifles genethliacal," but based to a large extent on dreams expounded by regular colleges of interpreters. If ancient astrology had been purely superstitious or diabolical, surely the prophet Daniel "would not have been advocate for the lives, nor the provost over the colleges, of such astrologers." The long-lived patriarchs of the Old Testament had wonderful opportunities for comparing observations of many comets, and "our primitive Christians assure us that our Saviour's star was a comet."⁸²

With the historical aberrations in this epistle of Beale Boyle was in a position fully to sympathize, for he believed that Abraham had introduced astronomy among the Egyptians, that Seth had engraved on pillars an account of astronomy, and that Solomon had improved the study of natural philosophy.⁸³

Although Boyle left a rich collection of ores and minerals to the Royal Society, he was much less proficient in natural history than in chemistry and experimental physics. In one of his religious writings he distinguished only four principal divisions of animal life: birds, beasts, fish and reptiles, although he recognized that there were great differences between a parrot and a bat, or between a whale, a lobster, a star-fish and an oyster.⁸⁴ But this was then a common failing. J. Johnston (1657-1665) still divided his work, as Gesner had done a century earlier, into six parts on quadrupeds, birds, fish and cetaceous, snakes, insects, and bloodless

⁸¹ *Ibid.*, I, 346-47.

⁸² Letter of 12 October, 1670: *Works* (1772), VI, 429 *et seq.*

⁸³ *Ibid.*, II, 10. Similarly Beale

stated in his letter (*ibid.*, VI, 430), "Abraham hath in oldest monuments a great name for the syderal arts."

⁸⁴ *Works*, 1772, V, 136.

animals. Even Willoughby still classed whales as fish, although he knew that "they breathe by lungs, copulate like quadrupeds, bear living young, and agree in structure and constitution of all their internal parts with viviparous quadrupeds."⁸⁵ In the same passage Boyle distinguished the human body from others as a wonderful engine. Elsewhere he asserted that the parts of man's body were unlike those of other animals, that it could not have been produced by chance, but was made in the divine image, and that unguided matter could never have united into the bodies of perfect animals.⁸⁶ He was somewhat in doubt whether plagues were supernatural afflictions to punish mankind or natural events. Plagues afflicting animals were usually the latter.⁸⁷ Coral was classed by Boyle as a plant.⁸⁸

Boyle refers to the doctrine of signatures in plants briefly and incidentally in his *Considerations Touching the Style of the Holy Scriptures*.⁸⁹ But elsewhere he suggests the possibility of "a kind of physiognomy of many, if not most, other natural bodies, as well as of human faces, whereby an attentive and experienced considerer may himself discern in them many instructive things, that he cannot so declare to another man, as to make him discern them too."⁹⁰

Although we have heard Boyle speak approvingly of the use of precious stones as amulets, he is rather timid and cautious about ascribing even medicinal virtues to gems.⁹¹ He says many learned men today are inclined to deny to gems any virtues at all, because so many fables have been repeated concerning them. He will not go that far, and discriminates between such an author on gems as Boetius de Boot and

such notoriously fabulous writers as Mizaldus, Albertus Magnus (if his name be not injured by the imputation of a spurious book), Baptista

⁸⁵ Emile Guyénot, *L'évolution de la pensée scientifique, Les sciences de la vie au XVIIe et au XVIIIe siècles, l'idée d'évolution*, 462 pp., 1941, pp. 59-62, 71-72.

⁸⁶ *Works*, 1772, V, 441; II, 44, 54; III, 48.

⁸⁷ *Ibid.*, V, 56.

⁸⁸ *Ibid.*, III, 59.

⁸⁹ *Works* (1772), II, 261.

⁹⁰ *Ibid.*, IV, 806.

⁹¹ *Works* (1772), III, 514: "I do not unreservedly think that precious stones, especially opacous ones, can have no medical virtues at all." II, 127: "I do not yet acquiesce in their reasons, that laugh at the administration of crude gems, etc. as ridiculous; yet neither am I altogether of their adversaries' mind."

Porta, Kirannides, and some others that I forbear to name, from whose learning one would expect more wariness and judgment.⁹²

But "physicians have for so many ages thought fit to receive the fragments of precious stones into some of their most celebrated cordial compositions," and many today have assured him that gems have proved efficacious in their own practice.⁹³ The objection was raised that the mineral substances with which gems are impregnated are too tightly locked up within them to exert any medical effect upon the human body. But Boyle contends that they emit steams and expirations, and exert electrical attraction. The argument against their use powdered in cordials that the stomach could not digest them, he meets by adducing the case of the perpetual antimony pill, which, though undigested, operates in the body, and, when excreted, may be washed and so employed repeatedly.

From the numerous minerals and petrescent juices which exist underground, the "subtle and efficacious parts are preserved and united to the other ingredients of the gems," in which is produced "a great variety of operative particles," and in some "a high degree of energy."⁹⁴ Boyle was, however, more ready to reject than to accept the "extraordinary qualities," which some had ascribed to transparent gems.⁹⁵ But elsewhere he says:

I have myself seen a stone whose efficacy in stopping haemorrhages invited my wonder, and another that performed extraordinary things in more than one distemper, though I could not perceive that either of them did these things by any manifest quality.⁹⁶

Of bezoar stones Boyle treated more than once. In once place he repeated the account of them by Bontius; in another treatise discussed their quality and specific gravity; in a third suggested a test of their genuineness.⁹⁷ Bontius said that, as for the hyperbolical and portentous virtues attributed to them, he had not found such in a thousand trials. On the other hand, during the plague of 1624-1625 in Leyden, when the bezoar stone could not be procured, he had employed stone from the human bladder, commonly

⁹² *Ibid.*, III, 514.

⁹³ *Ibid.*, III, 517, 542.

⁹⁴ *Works*, 1772, III, 542-44.

⁹⁵ *Ibid.*, III, 544.

⁹⁶ *Ibid.*, V, 80.

⁹⁷ *Ibid.*, II, 129; V, 463, 589. Concerning Bontius see T VI, 319.

regarded as a useless excrement, with good effect as a diuretic and sudorific.

Boyle believed that gold as well as gems possessed medical efficacy. He was long prejudiced against potable gold⁹⁸ and other such preparations, but the extraordinary and surprising effects of a tincture of gold made in the same way in two different countries by physicians of his acquaintance "upon persons of great note," whom too he knew well before their desperate illnesses and after their remarkable recovery, forced him to change his attitude.⁹⁹ This is but one of a number of examples which might be adduced to show that trust in experience and the experimental method worked both ways with Boyle, toward correct and toward incorrect views.

In *The Sceptical Chymist*¹⁰⁰ Boyle warned readers not to believe all the professed experiments found in books of alchemy. He not only rejected the doctrine that everything in the universe was composed of salt, sulphur and mercury, along with "the learned Sennertus and all the more wary chymists," who either admitted that these three principles were composed of the four elements, or added earth and water to them as elements.¹⁰¹ He also demonstrated that the substances which were obtained from mixed bodies by distillation were not in a sufficiently pure and simple state to be called elements or principles.¹⁰²

This chemical scepticism made its way into academic dissertations later in the century. One asserts that not all mixed bodies can be resolved into mercury, sulphur and salt, and that no mineral can be. So these cannot be accepted as principles. Moreover, the chief characteristic of mercury is by no means its volatility, nor that of sulphur, its inflammability, nor that of salt, incineration nor yet coagulation. Neither is every liquor acid, nor is there any sweet chemical oil.¹⁰³

⁹⁸ *Opera* (1697), II, 698-99. *Works* (1772), II, 127-28.

⁹⁹ *Works*, (1772), V, 119.

¹⁰⁰ In the Preface.

¹⁰¹ *Works* (1772), I, 530.

¹⁰² *Ibid.*, I, 543.

¹⁰³ BM 1033.h.20 (9.). This dissertation, which is without author, title,

date or place of publication, follows others of 1685 and 1689, and precedes others of 1689, 1690 and 1693. It is made up of 124 numbered paragraphs, followed on its last four pages by 24 brief *Adsertiones* from which those given above have been culled.

Boyle did not vehemently assert that the transmutation of metals had been experimentally demonstrated, as Sennert did, although he may have dropped hints of having the secret or have suggested that others had succeeded in transmuting.¹⁰⁴ The article on Boyle in the *Dictionary of National Biography* says that his faith in the transmutation of metals is shown by his "Incalescence of Quick-silver with Gold," published February 21, 1676, in *Philosophical Transactions*,¹⁰⁵ by his *Historical Account of a Degradation of Gold* of 1678,¹⁰⁶ and by his influence in procuring in 1689 the repeal of an old statute (5 Henry IV) against "multiplying gold." But the generating of heat by mixing a "mercury" with gold was only a very slight step in the direction of transmutation or an elixir of life, while the *Degradation of Gold* reads more like a parody or mild satire upon alchemical treatises than a serious account of actual experimentation. I therefore feel that the following sentence, with which Professor More opened his chapter on "Boyle as Alchemist" is too strong:

It is generally known that Robert Boyle was an alchemist; that he accepted, theoretically and practically, the doctrine of the transmutation of the elements; and that he was convinced he had solved the problem.¹⁰⁷

Undoubtedly Boyle was interested in the problem of transmutation and hoped that it was possible. Others may have been convinced that he possessed the secret and have stolen his papers and vainly tried his recipe.¹⁰⁸ But his red earth and other Hermetic Arcana which he bequeathed to posterity have been lost. It may be doubted if they were of any more value than his medical recipes which were published posthumously. The really significant thing is that such slight progress toward a solution of the problem of transmutation

¹⁰⁴ *Works* (1772), III, 19; VI, 58.

¹⁰⁵ Reprinted in both English and Latin, *Works* (1772), IV, 219-30.

¹⁰⁶ *Ibid.*, IV, 371-79.

¹⁰⁷ Louis Trenchard More, *The Life and Works of the Honourable Robert Boyle*, Oxford, 1944, p. 214. I regret to state that the preceding chapter on "Alchemy and Mediaeval Science" is almost worthless, de-

pending largely on Figuier and A. E. Waite, and showing no acquaintance with recent research and publication on the subject.

¹⁰⁸ See Newton's Letter to Locke of August 2, 1692, in Lord King's *Life of John Locke*, I, 410-13, and in More's biographies of Boyle and of Newton.

as his writings evidence should have aroused widespread interest not only among the general public but such philosophers and scientists as Locke and Newton.

Boyle's attitude toward Paracelsus and chemical remedies resembled that of Sennert. He represented Paracelsus as having led a disordered life, as little versed in logic, and as having neglected many other disciplines useful to a physician.¹⁰⁹ His writings contain wheat mixed with chaff, excellent experiments but "phantastic and unintelligible discourses."¹¹⁰ He left some famous remedies, as did Helmont,¹¹¹ and there are most noble chemical medicines and menstruums, although very few vulgar chemical remedies are "of the noblest sort."¹¹² But chemists and naturalists may still discover new drugs, such as the *terra sigillata Silesiaca* of John Montanus and the *bolus Tockaviensis* of Crato and Sennert, which are better than the Lemnian earth and *bolus Armenus* that we now receive from Turkey.¹¹³ Pulverized pearls are a far more potent remedy than the chemical solution of them, and crude hartshorn is a better remedy than the chemical preparation.¹¹⁴ *Caput mortuum* is often more efficacious than the nobler parts extracted from a substance,¹¹⁵ of which it is a mere residue that is sometimes discarded.

Boyle's *Apparatus for a Natural History of Human Blood*¹¹⁶ is a disappointing treatise, not getting much further than the salt of human blood and the spirit of human blood, although negatively interesting in concluding that the properties of the spirit were little different from those of the spirit of hartshorn or of spirit of urine, while the salt and spirit of blood differed only in that the one was dry and the other dissolved in phlegm.¹¹⁷

Boyle's criticism in *The Sceptical Chymist* of the obscure and mystical tone of many alchemical authors did not meet with general

¹⁰⁹ *Works* (1772), II, 101; *Opera* (1697), II, 672, mistranslates the passage as, "praeterea multas medicinae partes eruditissimas neglexit."

¹¹⁰ *Works* (1772), I, 584.

¹¹¹ *Ibid.*, II, 149.

¹¹² *Ibid.*, II, 146.

¹¹³ *Ibid.*, II, 120; *Opera* (1697), II,

690, 694.

¹¹⁴ *Opera* (1697), II, 704. *Works* (1772), II, 133.

¹¹⁵ *Works* (1772), II, 128. *Opera* (1697), II, 699, is a poor translation.

¹¹⁶ *Apparatus ad historiam naturalem humani sanguinis*, London, 1684, in-12. *Works* (1772), IV, 595-759.

¹¹⁷ JS XII, 291-93.

approval at the time. Webster ten years later approved of mystical chemical writers who expressed themselves in cryptic language or allegory and whom he distinguished as one of three groups, the other two being speculative and experimental observers. He commended among the mystical authors Arnald of Villanova, Raymond Lull, Albertus Magnus, Bernard of Treves, and such past Englishmen as Roger Bacon, Thomas Norton and George Ripley, or, more recently, Sendivogius, Michael Maier and Basil Valentine, or "that much wronged though most experienced person, Theophrastus Paracelsus,"¹¹⁸ while he did not mention Boyle even among experimental observers. Webster's very title page included "the discussion of the most difficult questions belonging to mystical Chymistry."

The idea of a universal medicine or panacea, Boyle in one place was not ready either to accept or to reject, merely pointing out that some diseases which seemed of contrary nature yielded to the same treatment.¹¹⁹ Elsewhere, however, he cited Monardes concerning an Indian who "cured all sorts of diseases by the juice of one plant alone."¹²⁰ On the other hand, Boyle advocated and defended specific remedies which acted on some particular disease or part of the body and which operated by occult rather than manifest qualities.¹²¹ The corpuscles of these specifics were carried by the blood to all parts of the body, altered the local particles or ferments to which they were appropriate, restoring their texture and harmony, or opening up their pores and clearing the way for the blood.¹²²

Boyle did not much favor elaborate compound medicines such as were then employed. He wished that physicians would make use of simpler medicines, for when a multitude of ingredients is combined, it is hard to trace the effect or property of any one of them. Experienced chemists may be able to foresee what quality the mixed body will have, but he wishes that they too were more

¹¹⁸ John Webster, *Metallographia*, London, 1671, pp. 32-34.

¹¹⁹ *Works* (1772), II, 196-97; *Opera* (1697), II, 766-67.

¹²⁰ *Works*, 1772, II, 164.

¹²¹ *Works* (1772), II, 183; *Opera* (1697), II, 753.

¹²² *Works* (1772), II, 191-2; *Opera* (1697), II, 761-62.

sparing in the number of their ingredients.¹²³ However, his own medical recipes include such mixtures as the following "excellent cephalic or head-powder, good also for the eyes":

Take the leaves of flowers of betony, marjoram and damask roses; also the flowers of sage and rosemary, all at discretion. To these add the powder of lignum aloes and some seeds of *nigella Romana*; reduce all these to powder, to be used as a hair-powder, when the patient goes to bed.¹²⁴

"An excellent remedy to stanch blood in any part of the body" is:

Take plantain-water two ounces, barley-cinnamon water, six drams, spirit of vinegar one ounce, dragons-blood half a dram, syrup of myrtles five drams: mix and make a julep, of which let the patient take three spoonfuls every hour.¹²⁵

Finally we may note "An excellent Wound-Drink":

Take hart's tongue, liverwort, wood-bugle, wood-sage, wood-betony, southern-wood, wormwood, alehoof, bugloss, scabious, ribwort, white-bottles, mugwort, comfrey, mint, agrimony, strawberry and violet leaves, cinquefoil, daisy-leaves, roots, and flowers, wild honeysuckles, wild angelica, avens, plantane, clowns, wound-wort, hawthorn-buds, oak-buds, and bramble-buds.

Gather these herbs in May, or as many as can then be had; the buds in March as soon as ever they put forth, before they come to leaves; measure them and take equal quantities of them, and dry them severally in the shade, and, when thoroughly dried, put them in bags, and so keep them for use.¹²⁶

More marvelous and extraordinary than the action of amulets, to Boyle's mind, were the operations of sympathetic and magnetic remedies such as the *unguentum armarium* and sympathetic powder. They would seem fictitious and magical, if they were not proved experimentally. Boyle could not deny that he had experienced their efficacy more than once. He admitted the vanity and superstition of many who wrote about them. But he could

¹²³ *Works* (1772), II, 124; V, 116-18. *Opera* (1697), II, 694-95.

¹²⁴ *Works* (1772), V, 351.

¹²⁵ *Ibid.*, V, 335.

¹²⁶ *Ibid.*, V, 366. See *Alphita*, edited

by J. L. G. Mowat, Oxford, 1887, for the Latin equivalents and variant English spellings of these herbs. For example, at p. 45, *consolida media* is whit-bothel or White Bothen.

not forget Francis Bacon's cure of warts by rubbing them with a rind of bacon and hanging it out of a window that faced south. The testimony of many reputable physicians as to the successful use of such remedies, made it desirable to put them further to the test of more exact experimentation. Boyle praises Harvey for having repeatedly tried Helmont's experiment of curing tumors and excrescences by applying for some little time, so that the chill might penetrate deeper, the hand of a man who had died of a slow disease. Sometimes this treatment failed to work, but more often it was successful, as Harvey himself had told Boyle. But that weapon ointment and the sympathetic powder did not always work, was, in Boyle's opinion, no sufficient indictment of them, since ordinary remedies taken internally or applied directly did not always work either. It did no harm to try them, unless one trusted in them entirely and neglected other remedies.¹²⁷

Closely related to the occult action of such remedies are such beliefs of Boyle as that stains on cloth made by grape juice can easily be removed at the time of year when the grapes mature; at any other time, with difficulty; and that the Acajou fruit of the Antilles leaves a red stain on linen until the tree blossoms again.¹²⁸ Boyle would probably account for these phenomena by some property of the air at those times, much as he accounts for soil taken from the banks of the Nile neither increasing nor decreasing in weight until the inundation begins, by the increasing humidity of the air.¹²⁹ In any case, they belong in the realm of natural magic.

The toad, that ancient favorite of magic and familiar of witches, still figures in the medicine and experimental philosophy of Boyle and his learned correspondents. Incontinence of urine is cured in several cases by wearing in a little bag around the neck the powder made of a toad burned alive in a new pot—a remedy gleaned in the first instance from a gypsy.¹³⁰ Toad trochees are used for ulcers.¹³¹

¹²⁷ *Works* (1772), II, 164-68; also I, 346-47; *Opera* (1697), II, 735-38.

¹²⁸ *Opera* (1697), I, 516. *Works* (1772), III, 321.

¹²⁹ *Works* (1772), V, 723. For this "strange yet true experiment" Boyle cites Prospero Alpino, *De medicina*

Aegyptorum (Venice, 1591), IV, 8.

¹³⁰ *Works* (1772), II, 160. We have met it, however, in Schröder. Boyle cites the earlier *Observat. Medic.* of Henricus de Heer, p. 194.

¹³¹ *Works* (1772), IV, 776.

No less a person than Samuel Hartlib, noted educator and precursor of the Royal Society, wrote Boyle concerning a weather prophet whose remarkably successful predictions were made by observing the changing colors of the skin of a toad which he kept in captivity.¹³² Beale tells of handling a toad as a boy and getting scab on his hands in consequence.¹³³

Parts of animals such as dried flesh of vipers, cow or sheep dung,¹³⁴ were occasionally recommended medicinally by Boyle, and he felt that bucks-horns were almost as efficacious as stags-horns for such purposes.¹³⁵ He found great virtue in even the "solid parts of dead animals, and particularly of a sea-horse tooth outwardly applied to the body."¹³⁶ By "sea-horse" he meant a walrus. But parts of the human body were utilized by far the most frequently for remedies, especially the spirit of human blood which occupies nearly a column in the index.¹³⁷ Boyle cured nose-bleed with moss of a dead man's skull held only in the hand.¹³⁸ He treats more than once of cures effected by the application of a dead man's hand.¹³⁹

The medical virtues of man's urine, both inwardly given, and outwardly applied, would require rather a whole book, than a part of an essay, to enumerate and insist on . . . I shall now only add, that I knew an ancient gentlewoman, who being almost hopeless to recover of divers chronical distempers . . . was at length advised, instead of more costly physick, to make her morning draughts of her own water; by the use of which she strangely recovered, and is, for aught I know, still well. And the same remedy is not disdained by a person of great quality and beauty, that you know; and that too after she had travelled as far as the *Spaw* for her health's sake.¹⁴⁰

To clear the eyes, even from films, take Paracelsus's *zebethum occidentale* (viz. human dung) of a good colour and consistence; dry it slowly, till it be pulverable: then reduce it into an impalpable powder; which is

¹³² *Ibid.*, VI, 104.

¹³³ *Ibid.*, VI, 344.

¹³⁴ *Ibid.*, I, xcix; V, 356-57.

¹³⁵ *Ibid.*, II, 224.

¹³⁶ *Ibid.*, I, lxxxiv.

¹³⁷ *Ibid.*, IV, 637-40, for its outward

application, and 641-45, for its internal use.

¹³⁸ *Ibid.*, V, 106.

¹³⁹ *Ibid.*, II, 167; V, 105; VI, 347,

¹⁴⁰ *Ibid.*, II, 130.

to be blown once, twice, or thrice a day, as occasion shall require, into the patient's eyes.¹⁴¹

Boyle accepted "what we call sympathies and antipathies" as a fact. Some persons would tremble and swoon on seeing or hearing a cat, and Boyle himself could not see a spider "without feeling a notable commotion in my blood," though no spider had ever harmed him, and he did not mind the sight of vipers, toads and other venomous animals.¹⁴² He tried to account for this by "the peculiar textures and other modifications of the bodies, between whom these friendships and hostilities are said to be exercised," so that the pores of one body would be exactly fitted to the effluvia from the other body, "whether subterranean or sidereal."¹⁴³ But a man's being cured of an ague by a rat's jumping on him, Boyle attributes not to sympathy or antipathy, but to fright.¹⁴⁴

Most of the follies of seventeenth century medicine were shared by Boyle. He not merely believed in but had proved the healing virtues of human excrement and of horse manure.¹⁴⁵ Like Francis Bacon, whom, however, he does not cite in this connection, and Lauremberg, whom he does cite, he was convinced of the medicinal value of millepedes. But his chief authorities were empirics, old-wives, and his own experience. One elderly lady, who had lost the sight of one eye from cataract, after professional oculists had failed to aid her—this is a sure sign that empiricism and magic are approaching—staved off cataract in the other eye by taking on an empty stomach and crushed in white wine first five millepedes, the next day ten, the third fifteen, and so on up to fifty or sixty. Another dame in Holland was freed from confirmed cataract by taking an initial dose of three millepedes, adding one a day until she reached nine, then gradually reducing the number to three and increasing it to nine again.¹⁴⁶ And a young lady afflicted with epilepsy, whom the prescriptions of the most famous physicians had tortured without relief until she suffered as many as eight or

¹⁴¹ *Works* (1772), V, 320.

¹⁴² *Works* (1772), II, 182.

¹⁴³ *Ibid.*, IV, 95.

¹⁴⁴ *Ibid.*, II, 161.

¹⁴⁵ *Opera* (1697), II, 700: "utrisque

tamen virtutes medicas neutiquam deesse alibi comprobavi."

¹⁴⁶ *Opera* (1697), II, 702; *Works* (1772), II, 131-32; V, 321, marked A as a remedy of the highest class.

ten fits in a single day, was most happily restored to health by taking draughts of genuine mistletoe in beer or in water of black cherries on a fasting stomach and on days next to the full moon.¹⁴⁷

One of Boyle's correspondents, William Hann, gave various instances of transplantation or the magic transfer of disease. Ague was unloaded from the human patient upon a dog. Warts were got rid of by rubbing them with a stick notched as many times as there were warts, and then burying the stick in a dunghill. Hann also believed in cure by application of hairs of the dog that bit you, further specifying that the hairs should be from the dog's breast. He also alluded to

what your Honour hath in print for the cure of the yellow-jaundice by the party's urine made into a cake with ashes and buried in a dunghill.¹⁴⁸

Boyle himself told further of a man who had wasted away to a mere skeleton but recovered by hard-boiling an egg in his own urine, punching the egg-shell full of holes, and burying it in an anthill. By the time the ants had eaten the egg, the patient was on the road to recovery.¹⁴⁹ Boyle then adds other cases from Riverius and Fludd of transferring pain to a cat by putting a finger in its ear, and of gout to a dog by sleeping with the animal.

A Dr. King sent Boyle by letter an account of transfusion of the blood of a sheep into a man's arm,¹⁵⁰ and Boyle himself adverts to Dr. Lower's method of transfusing blood from one brute to another, and questions what the effects of such an operation will be: whether the recipient dog will do tricks which it has been taught as well as it did before, recognize its master as well, become tamer by infusion of the blood of a cowardly dog? What the effect of the blood of a young dog on an old one will be, and so on.¹⁵¹ The subject of blood transfusion is touched on several times in Boyle's correspondence in connection with a madman, and a letter to Boyle tells of cure of a madman by a transfusion of the blood from a calf.¹⁵²

¹⁴⁷ *Opera* (1697), II, 715; *Works* (1772), II, 144-5.

¹⁴⁸ *Works* (1772), VI, 168.

¹⁴⁹ *Ibid.*, II, 166.

¹⁵⁰ *Ibid.*, VI, 647.

¹⁵¹ *Ibid.*, III, 149, 152-3.

¹⁵² *Ibid.*, VI, 72, 238, 245, 257, 265.

While Boyle was writing his essay on the usefulness of experimental natural philosophy, he "saw a lusty and very sprightly boy, child to a famous chymical writer" and physician, who as an infant had been in such pain and refused to suck, that his father believed that his enemies had bewitched the child. But when the father, bethinking him of the *electrum minerale immaturum Paracelsi*, "did, according to Helmont's prescription, hang a piece of this noble mineral about the infant's neck, so that it might touch the tip of the stomach," the child rapidly recovered.

And though I am not forward, to impute all those diseases to witchcraft, which even learned men father upon it; yet it is considerable in our present case, that whatsoever were the cause of the disease, the distemper was very great and almost hopeless, and the cure suddenly performed by an outward application, and that of a mineral; in which compacted sort of bodies, the finer parts are thought to be more locked up.¹⁵³

Last we come to an association with magic in Boyle's writings which does not directly touch his experimental science or empirical medicine, but which is nonetheless depressing so far as he personally is concerned. For it is the expression of his hope that unimpeachable proofs may be forthcoming of the existence of witchcraft and the reality of diabolical magic. In a letter of September 18, 1677, to Joseph Glanvil, whose *Saducismus Triumphatus, or Full and Plain Evidence concerning Witches and Apparitions* was to appear in 1681, Boyle requests him, in forwarding his account of a case of witchcraft,

that at least the main circumstances of the relation may be impartially delivered and sufficiently verified, either upon your own knowledge or by the judicial records or other competent vouchers; for we live in an age and a place wherein all stories of witchcraft or other magical feats are by many, even of the wise, suspected, and by too many that would pass for wits, derided and exploded.

Boyle implies that to deny the existence of "intelligent beings that are not ordinarily visible" is equivalent to atheism. But improbable and ill-verified tales of witchcraft only encourage atheism. On the other hand, a single "circumstantial narrative, fully verified, such

¹⁵³ *Works* (1772), II, 159.

as I hope and desire that yours may prove," will outweigh a hundred improbable ones, just as the report of many eye-witnesses and of the count of Wallenstein, imperial minister to England, that a friar Wencel has several times transmuted baser metals into gold in the presence of the emperor and many noblemen and good chemists, if true, will be a better proof of the philosophers' stone than all the cheats and fictions.¹⁵⁴

Thus Boyle expresses hope for a convincing proof of the existence of witchcraft and diabolical magic, but at the same time indicates that there is growing scepticism concerning them. The association of alchemy with magic may be accidental, but the denial of witchcraft is by Boyle unmistakably connected with atheism. Magic and religion must stand or fall together. But the dark cloud has a silver lining. Experimental science is left pretty much to its own devices. As the nursery rhyme of our childhood had it:

Shoe the old horse; shoe the old mare;
Let the little colt go bare, bare, bare!

The colt, 'tis true, has inherited many characteristics from its sire and its dam. It was not spontaneously generated. Boyle repeatedly made the point that there was no incompatibility between the experimental or corpuscular philosophy and religion. Rather, the former demonstrated the existence of a God of nature, and slammed the door in the face of atheism. On the other hand, Boyle's science and medicine, as the preceding pages have shown, display many traces of a rich residue of magical method and content. But at least there were no iron shoes of creeds and devils forged to the flying feet of experimental science!

¹⁵⁴ *Works* (1772), VI, 57-59.

CHAPTER XXIX

OTHER EXPONENTS OF EXPERIMENTATION

Dobrzensky—Du Hamel's development—Kerger—Henry Power's *Experimental Philosophy*—Marchand, the great water drinker—*Accademia del Cimento*—George Sinclair—Otto von Guericke—Erasmus Bartholinus—Malebranche's criticism of experimenters—François Bayle and Bourdelot—J. C. Sturm—J. D. Major—Kestler on Kircher's experiments—Barberius—A pest experiment—Senguerd—Petrini and Matthias—Reiseliuss—Brescian experiments—Reyher.

One genuine practical experiment has more weight than a hundred reasons of speculative philosophy

—CLAUDER

Leaving astrologico-magical contemplations, let us consider contemporary experiments with air

—PASCHIUS

In this chapter we turn from Boyle to other representatives among his contemporaries of the increasing interest in experimentation and attention to experimental method.

The New Philosophy of Fountains of Jacobus Joannes Wenceslaus Dobrzensky, extraordinary professor of medicine at the University of Prague, published at Ferrara in 1657 and reprinted there in 1659,¹ combines experimentation with marvels in the way characteristic of natural magic. In the case of the famous Torricellian experiment, the production of a vacuum is denied and the space vacated by the fall of the solid mercury is said to be filled by some tenuous substance such as the quintessence of the mercury. Indeed, Torricelli is not mentioned and the experiment is called anonymous, but a letter from Godfrey Kinner is quoted attributing it to a Polish

¹ *Nova et amoenior de admirando fontium genio (ex abditis naturae claustris in orbis lucem emanante) philosophia*, Ferrara, 1657, in-fol. 123 pp.:

BN V.2470. *Nova philosophia de fontibus*, Ferrara, 1659, in-fol. same pagination: BN R.854.

Capuchin, R.P. Valerianus.² Another experiment is given to show that there is elementary water in mercury,³ and another letter is quoted from Balianus to Mersenne on November 25, 1647, asserting that he had proved that air has weight by experiments of many years past.⁴ In this letter Balianus further accepted the existence of the vacuum, but another letter is quoted in which he abandoned this view (*naturam a metu vacui vindicans*).⁵ Earlier Dobrzensky, like Francis Bacon before him, had given the following table of relative weights:⁶

gold	100	common tin	39	wax	5
mercury	71 ¹ / ₂	pure tin	38 ¹ / ₂	oil	4 ³ / ₄
lead	60 ¹ / ₂	magnet	26		
silver	54 ¹ / ₂				
copper	47 ¹ / ₂	water	5 ² / ₃		
iron	42	wine	5 ¹ / ₄		

Also, after previous propositions which were chiefly concerned with the center of gravity, he announced Proposition V, "admirable and quite incredible," that one pound of water can prevent a hundred thousand pounds from falling. Actually a very narrow container is attached to an opening near the bottom of a much larger container, and the water seeks the same level in both. It is true that, if the hole were left open, the liquid would run out from the large container. More valuable is the final statement that by this method one can tell how much wine is left in a cask—by seeing how high a level is reached in the attached gauge.⁷

After Part 2 has been devoted to such matters as water clocks and fountains,⁸ with citation of Kircher's *Ars magnetica*,⁹ we come to Part 3 which is entitled, *Thaumaturgus Hydrotechnicus*. Dobrzensky opens it by saying that, having finished with the construction

² *Ibid.*, pp. 25, 28.

³ *Ibid.*, p. 26.

⁴ *Ibid.*, pp. 29-30.

⁵ *Ibid.*, pp. 34-39.

⁶ *Ibid.*, p. 13. The table does not correspond at all closely with Bacon's.

⁷ *Ibid.*, p. 18. There is a similar figure in the earlier *Nova de machinis philosophia* of Zucchi, Rome, 1649, p. 55, in connection with Pars II,

Sectio viii, "An elevatio & consistentia ad aequalem altitudinem supra horizontem aquarum, pro quavis amplitudine vasis & angustia canalis communicantium, reguletur per principium quo motus et consistentiae per machinam explicantur."

⁸ Dobzensky, *op. cit.*, p. 43 et seq.

⁹ *Ibid.*, p. 70.

of fountains and explained by various devices "the portentous force and power" which resides in them, he knows not what gentle murmur of the waves has caught his ear, to turn his pen to other technics of fountains "and stupendous properties of liquors."¹⁰ Therewith Drebbel's Letter to the King of England concerning perpetual motion is quoted via Kircher's *Ars magnetica*, and we soon come to such magic tricks as the artificial reproduction of a floweret within a glass, and the sudden birth of a whole grove of fir trees inside of glass. A meteoro-technic machine produces dew, rain, snow, hail and thunder—we are again referred to Kircher for further details; another instrument measures the different gravity of various liquors.¹¹ Presently come such feats as raising water to mountain tops or the roofs of houses, fabricating a fountain which synchronizes with the tides, and two further efforts at perpetual motion.¹² To the Jesuit, Théodore Moretus, professor emeritus of mathematics at Prague, is ascribed a perpetual fountain which synchronizes with the sun's movements, and barometric instruments to Kircher, to another Jesuit named Valentinus Stansel, and to a third, Marius Bettinus, nor does yet another Jesuit author, Nicolò Cabeo, go unmentioned.¹³

A gradual transition to greater stress upon experimental method is well illustrated in the successive writings of Jean Baptiste Du Hamel (1624–1706). He entered the Congregation of the Oratory in 1644 and taught in its schools, but left it in 1653 and became a parish priest at Neuilli. In 1663 he was made chancellor of Bayeux cathedral. Meanwhile in 1660 he had published two works which mark the first stage in his scientific writing. The *Physical Astronomy*¹⁴ and *On Meteors and Fossils*¹⁵ were Latin dialogues between Theophilus, an adherent of ancient philosophy, Menander, a Cartesian, and a tertium quid. In the former he maintained that comets were celestial bodies—all those within the last hundred years had had less parallax than the moon—and

¹⁰ *Ibid.*, p. 79.

¹¹ *Ibid.*, pp. 80, 83-86.

¹² *Ibid.*, pp. 96, 102, 104-5.

¹³ *Ibid.*, pp. 106, 108, 113, 110,

119.

¹⁴ *Astronomia physica seu de luce natura et motibus corporum caelestium libri duo* . . . , Paris, 1660, in-4: BN R.3765.

¹⁵ *De meteoris et fossilibus libri duo*, Paris, 1660, in-4: BN R.3764.

proved that generation and corruption went on in the heavens as in the air. But he was ready to concede that comets might be sulphureous exhalations in the ether itself, as thunderbolts were in the air. He opposed astrology, noting the small size of such planets as Venus and Mercury compared to the sun.¹⁶ But he admitted a general influence of the stars, also that of the moon on humidity and the humors, and the possibility of judgment as to a person's natural temperament and aptitude.

In the other dialogue Du Hamel appears less enlightened, attributing springs and rivers to the elevation of water from the sea by subterranean fires. But these last are too inconstant to explain the regular tides, which he inclines to attribute to the moon. But how? If by magnetic force, the tides should be greater between the tropics. And he cannot believe that effluvia of corpuscles from the spots on the moon would be sufficient. He therefore holds that the ocean swells because it contains a nitrous spirit which is excited by the lunar body (how, he does not make clear), so that the middle of the sea swells sooner than its extremes. Oysters and shell-fish, the marrow of bones and pith of trees enlarge at full moon. "What except an occult force of the moon" causes this? Menander, however, rejects this suggestion of Theophilus and says that he will never give the true cause of tides until he recognizes that the earth moves, which Galileo has expounded more beautifully than anyone else. But it is added: Why are the tides greatest at full moon and in the interlunar period? Why does the sea swell twice a day? Galileo fails to explain these and other points, but Descartes does, with earth and moon in the same vortex.¹⁷

In the second book on fossils or minerals, the existence of a spirit of the universe or quintessence is asserted. It and not the influence of a lifeless heaven accounts for spontaneous generation.¹⁸ The principles of the chemists are expounded from the views of Descartes, and the question of the transmutation of metals is argued at length and objections to it solved. Theophilus com-

¹⁶ *Astronomia physica*, pp. 71-74, 119, 222-24.

¹⁷ *De meteoris* . . . , pp. 11-15, 23-27.

¹⁸ *Ibid.*, p. 115, "quae ex putredine nascuntur ubi seminae eorum rationes delitescunt? non alibi profecto quam in spiritu universi."

plains that the philosophy of Descartes, jejune, arid and obscure, is now preferred to the Peripatetic, and accuses Descartes of following Democritus and Epicurus. But Menander holds that the atoms of Descartes are superior to those of Epicurus. Salt, for example, consists of rigid corpuscles which are not easily separated, yet liquefies in water because the slippery and flexible corpuscles of the water wrap themselves around the sharp points of salt and carry these away with them.¹⁹

With regard to the marvelous virtues of gems a middle position is taken. The diamond can be broken by the hammer and liquefied in fire, and it is false to say that it will sweat in the presence of poisons, cure insanity, dispel idle fears, and counteract the virtue of the magnet. Albertus Magnus is reproved for his credulity as to the powers of gems, and other philosophers for accepting such delusions of magicians and alchemists as that stones can produce love or hate, make one lucky, or announce coming calamities. But *asterites*, plunged into vinegar, is impelled here and there of its own accord and is very valuable against pest and infections. Four grains of it powdered in water kill worms and purge the blood. Great potency against poison, pest and diarrhoea are attributed to the emerald. Some suspend it from the neck of an epileptic infant, and if the disease becomes too great, it breaks the emerald. But Du Hamel denies that it is broken by unlawful sexual intercourse, or that it puts demons to flight. Less absurd is the belief that it stops haemorrhage, if moved to the mouth; cures dysentery, if placed on the belly; and on the thigh helps delivery. But he can hardly persuade himself that a stone by mere contact stays the flow of blood and cures the gravest diseases. On the other hand, he will not join those who deny that gems have any utility other than their beauty. But he will not admit that the beryl makes us immune from the plots of enemies. Whether malachite is effective against witchcraft he leaves to theologians; "we do not exceed the limits of nature." But neither is he so inexperienced as to deny that gems effect anything except by their manifest qualities.²⁰

¹⁹ *Ibid.*, 165-167.

²⁰ *Ibid.*, II, 8; pp. 220-25 and so on to 233. The whole chapter is put

in the mouth of Simplicius, but no one disputes his statements.

Theophilus attacks the employment of chemical remedies, especially the use of mercury, antimony and potable gold, but Simplicius defends them, provided they are administered by expert doctors of medicine.²¹

In these two works of 1660, then, we see Du Hamel influenced by modern astronomical discovery and chemical theory, by Cartesianism and the atomic or corpuscular theory, but with little emphasis upon experimental method, and with the presentation of both old and new views. This would also seem his aim in 1663 in the first edition of his book on the Consent of the Old and New Philosophy, which was in only two books. In 1666 he became secretary of the Académie des Sciences,²² and in 1668 visited England and met Boyle. And in the 1669 edition at least, two chapters of the second book of *De consensu* contain various experiments as to the elasticity of air and Boyle's new experiments regarding it.

In 1670 Du Hamel published a treatise on the properties of bodies both manifest and occult, with the alternative title, or a Specimen of philosophy advanced by experiments.²³ In the opening sentence he states that he has discussed at length the natural principles, elements, and generation and corruption years ago in the Consent of Old and New Philosophy. He now turns against disputations and the schools and is all for experiment. Despite the title of his book, he opposes specific and occult qualities and asks why he should be shut off by these magic words from the truth and more secret arcana of nature.²⁴ Since Greek philosophy has ceased to grow and develop farther, he turns to the principles and experiments of the moderns which he summarizes briefly but clearly, giving credit to Boyle, Francis Bacon, Digby, Gilbert, Harvey, Glisson, Goddard, Merret, Willis and Hooke in England; to Gassendi, Descartes, Pascal, Fabry, Magnanus, Du Clos, Morin, Petit and Cordemoy in France; to Galileo, Torricelli, Cabeo, Zucchi, Ricci in Italy; to Guericke, Grimaldus, Bontius, Piso, Walaeus,

²¹ *Ibid.*, II, 12; pp. 302-6.

²² His history of it appeared in 1698, *Regiae scientiarum Academiae Historia*.

²³ *De corporum affectionibus cum*

manifestis tum occultis libri duo seu promotae per experimenta philosophiae specimen, Paris, 1670, in-12, xii, 556 pp. BN R.13536.

²⁴ *Ibid.*, pp. 15-16.

Sylvius, Tachenius and Vossius, in Holland and Germany; and to the Dane, Erasmus Bartholinus.

This impressive review of recent experimental accomplishment is not wholly free, however, from something of a magical accompaniment. Nor is the initial denial of specific and occult qualities consistently maintained. "We call poisons what in some occult way are wont to attack us or suddenly take away our life." A recent writer says that they consist of rigid, sharp, hard particles armed with points like the stings of bees and nettles as seen under the microscope. Boyle knew a physician who cured malignant ulcers painlessly, probably using *arsenicum cum nitro fixatum*. A very learned physician told Du Hamel recently that he had proved that the bite of a viper coagulated the blood by dissecting a dog which had been bitten by one.²⁵ On the other hand, it often happens that poisons increase the fermentation of the blood to excess. Willis thinks that not only the blood is infected by poisons but also the nervous juice which fosters the animal spirits and which is also the channel for the spread of hypochondriac pains. So during a plague the corrupt air which we breathe in affects the animal spirits first and thence often goes to the brain or corrupts the blood, producing anthraxes and buboes. The action of antidotes is doubtless similar, their corpuscles joining up with the poisonous particles, which are then expelled with them. Almost all sulphureous substances curb the force of the pest, purge the corrupted air, and dissipate the bad odor.²⁶

As for amulets against the pest, epilepsy and fevers, Du Hamel has nothing to say. If the claims made for them are true, he does not see how to account for so many marvelous effects, no matter how much force of occult qualities or tenuous effluvia emanates from them. But the action of quinine is also not easy to explain. He would not dare deny entirely that a very tenuous exhalation

²⁵ J. J. Wepfer, *Cicutae aquaticae historia et noxae, commentario illustrata*, Basel, (1679), denied that water-hemlock was a cold poison which caused death by chilling and coagulating the blood. He admitted that the blood of a dog to whom it had

been administered coagulated, but attributed this to the cessation of the movement of the heart. JS XI (1684), 94-96.

²⁶ Du Hamel, *op. cit.*, II, 5, De venenis et alexiteriis; pp. 427-39.

from solid bodies can change the movement of the blood and spirits. And there is no doubt that an alteration in the connection of parts takes place when iron is imbued with magnetic force. A paroxysm of epilepsy often originates in a bad odor from the soles of the feet, and Galen believed in the efficacy against such paroxysms of a suspended peony. Du Hamel then repeats a nasty prescription of Gendron, employed by Mayerne also, in which the afterbirth is a leading ingredient and which is to be taken morning and evening during the first quarter of the moon. Gendron further advised touching the forehead at the same time with a tobacco plant which had been slightly bruised and repeating this every new moon for a year. Others suspend calcinated toads in time of pest, for it is well known that that powder attracts the poisoned air. In this connection it may be noted that the *Journal des Sçavans* in 1680 published an extract from a letter from M. Dodart, a member of the *Académie Royale des Sciences*, telling how a French physician in Smyrna guarded against the pest by wearing four dried toads in his armpits and groin as vesicatories and at the same time taking pills of two drams of powdered toad.²⁷ And women of Smyrna took two drams of quicksilver accompanied by superstitious ceremonies in order to grow fat.²⁸ A Spanish surgeon merely rubbed the temples, insteps and left breast with a bit of red amber. "There is no doubt that many poisons are neutralized by antidotes cognate to themselves or amulets or sudorifics more than by emetics or purgatives." Music cures the bite of the tarantula, a scorpion applied to the wound absorbs the poison. More marvelous is Kircher's account of the stone in the skin on the head of snakes in China, which, if reduced to a powder and mixed with *terra sigillata*, adheres to the wound and sucks out all the venom. Tachenius says he has many of these stones, but Mayerne is said to have employed dried human dung. Some think that the viper and other snakes poison only when angry, and Boyle tells of dogs eating a viper without injury. But cauterization is the surest remedy, if applied soon enough. Whence it is evident that that sharp, corrosive and

²⁷ JS VIII (1680), 189.

²⁸ *Ibid.*, p. 199. Or, to become pregnant.

caustic force is chiefly constituted from the figure and connection of the parts.²⁹

One hundred years ago scurvy was almost unknown. Du Hamel gives the remedy for it of his friend Gendron. Take three pounds of good red wine, half an ounce of very red roses, an ounce and a half of rose honey, a handful of salvia, vitriol of Cyprus, half an ounce of dragon's blood, and ten cloves. Boil this a while in a new clay vessel, strain it through linen, add eight to ten drops of spirits of salt. Take a little twice a day at morning and evening, also the juice of half-cooked herbs, bite the raw flesh of doves or chickens while it is still hot, etc.³⁰ Du Hamel leaves it to others to unravel the causes of the marvelous effects of the magnet.³¹

In 1673 Du Hamel published four books on the Animate Body or another specimen of philosophy advanced by experiments.³² In 1675 at Rouen was printed the second edition of the work of 1663, of which the title now read, "Of the Agreement of ancient and modern philosophy four books, or the first part of philosophy advanced by experiments."³³ He explained that he had added in this edition many things which had been recently discovered or which at least had not come to his attention at the time of the first edition. He also omitted some things which seemed too difficult or less true to him. The first book dealt with Platonism; the second, with the Peripatetics, Epicureans and Cartesians; the third, with the elements; and the fourth, with chemical principles. But he still reaffirmed his view of 1660 that the spontaneous generation of imperfect animals was from the spirit of the universe, although he recognized that Fernel, "first of physicians since Galen," held that all forms, whether of perfect or imperfect animals, were from the heavens.³⁴

In 1678 the Old and New Philosophy was revised for school use, ran through many editions, and was used by missionaries.³⁵

²⁹ Du Hamel, 442-48.

³⁰ *Ibid.*, 449-50.

³¹ *Ibid.*, 451.

³² *De corpore animato libri quatuor seu promotae per Experimenta philosophiae specimen alterum*, Paris, 1673, in-12.

³³ *De consensu veteris et novae philosophiae libri IV seu promotae per experimenta philosophiae pars prima*, Rouen, 1675: BN R.13549.

³⁴ *Ibid.*, pp. 174-79.

³⁵ Lambert, *Hist. litt. du règne de Louis XIV*, 1751, II, 72-73.

The work of Martin Kerger, M.D. and physician at Liegnitz, on fermentation, printed in 1663, is further described in the title as "all based on perpetual experiments."³⁶ In point of fact, it abounds in citation and quotation: Thomas Willis in his *Diatriba* on fermentation, Boyle in the *Sceptical Chymist*, Helmont, Sennert frequently, Scaliger, Billich, Cesalpino, Cardan, Falloppia, Garcia ab Orta, Conimbricenses, Cassendi, Birelli several times on one page, Petrus Mornius, Scholtz, Kircher, Sperling, Bauhin, Bartholinus, Rattray. Basil Valentine is quoted for half a page in German, and Digby likewise.³⁷ Discussion of the inseparability of material forms and of the final cause of fermentation³⁸ also smacks more of scholastic than experimental method. An inclination towards the magical is indicated in discussion of the resuscitation of vegetables, of animals and of minerals, and of the preternatural use of fermentation.³⁹ But the wholesome case is recorded of a patient who in 1648 recovered from tertian fever after having tried such preternatural ferments, and who ascribed his recovery to having desisted from their use.⁴⁰

A sign of the growing popularity of experimentation and the experimental method is seen in the *Experimental Philosophy* of Henry Power, M.D. (1623-1668), actually printed in 1663,⁴¹ the same year in which he became one of the first two elected fellows of the Royal Society. It was the only work by him to be printed, although there are various things in manuscript by him in the Sloane collection,⁴² including *A Course of Chymistry*, a *Chymia*

³⁶ *De fermentatione liber physico-medicus cui de inseparabilitate formarum materialium et vita singularia sunt innexa, omnia perpetuis experimentis firmata*, Wittebergae, 1663.

³⁷ *Ibid.*, pp. 40, 134. At pp. 224-25 Sennert is quoted for half a page.

³⁸ *Ibid.*, Title and Cap. 4.

³⁹ *Ibid.*, pp. 50, 54, 60, 222.

⁴⁰ *Ibid.*, p. 247.

⁴¹ *Experimental Philosophy in Three Books. Containing New Experiments: Microscopical, Mercurial, Magnetical. With some Deductions and Probable Hypotheses raised from them in . . . illustration of the now famous Atom-*

ical Hypothesis. London, T. Roycroft, 1664, in-4, 193 pp.

In BM 537.h.1 the 4 of 1664 has been changed in ink to 3, and the separate title page before *Liber secundus* also has the date 1663.

⁴² Listed in DNB. I have examined Sloane MS 496, 98 fols., containing *Historia Physico-Anatomica cum analogia Physico-Chymica*, drawn up by him in 1666, at fols. 2r-14r, followed by other chemical contents.

Sloane 1352, entitled "*Thaumato-graphia naturalis*," is a book of excerpts by him on wonders of nature, etc.

practica of 1659, and Some Objections against Astrology. Power was greatly stimulated by the modern discovery of the telescope and microscope.

Antiquity gives us not the least hint thereof . . . the want of which incomparable artifice made them not only erre in their fond coelestial hypothesis . . . but also . . . those sons of sense were not able to see how curiously the minutest things of the world are wrought . . . Were Aristotle now alive, he might write a new History of Animals.⁴³

He had hopes of soon seeing through the microscope even the effluvia of the magnet and those "infinite insensible corpuscles" which produced such prodigious effects,⁴⁴—a dim adumbration, if you will, of the atomic bomb.

Although Power entitled his book *Experimental Philosophy*, it contains sweeping generalizations which could not be experimentally proved, such as that "there can be no rest in nature more than a vacuity in matter,"⁴⁵ or that spirits "are universally diffused through all bodies," but in the animal kingdom are more abundant and purely refined and "work nobler effects,"⁴⁶ while "a lesser quantity and slower motion of the spirits" is required for sensation than for motion. It is true that these last assertions occur in "A Digression of the Animal Spirits." But he similarly affirms that the heavens or ether "is now confess'd by all to be fluid" and consequently in perpetual motion, while "all the fixed lights of heaven are generally concluded to be pure fire." The planets are all porous, and the ether keeps streaming through them, while their internal fire and heat keep subliming atoms out of them, and, in the third place, magnetical atoms are ever "playing about them."⁴⁷ Power even makes assertions which seem directly contrary to experiment. Thus his first experiment is that of Torricelli, but his conclusions are that there is no absolute vacuity in the upper part of the tube after the mercury has fallen, and that it is not effluvia from the mercury that fill the apparently empty space, nor is it

⁴³ *Experimental Philosophy*, Preface, fols. a 3 r-v, b 2 v.

⁴⁴ *Ibid.*, c 2 v- (c 3) r. At p. 67 he speaks of "those fuliginous effluviūms which pass constantly out of us by insensible transpiration, which Sanc-

torius hath proved to exceed the bulk and weight of all our sensible evacuations whatsoever."

⁴⁵ *Op. cit.*, Preface, fol. (b 3) verso.

⁴⁶ *Ibid.*, pp. 61, 65.

⁴⁷ Preface, (b 4) r.

light or air.⁴⁸ And he still includes such particular experiments of an impossible or semi-magical sort as that of Charles Townley, "from which he would deduce a perpetual motion."⁴⁹

More than that, Power still associates magic tricks with his experimental philosophy by giving an account of Floram Marchand, the great water-drinker, who vomited all kinds of liquors from his mouth. Just before appearing on the stage he would take a gill of the decoction of brasil on a fasting stomach. On the stage were a dozen or so of glasses, some of which had been rinsed in vinegar, others in oil of tartar, others in oil of vitriol. Marchand would drink some twenty-four glasses from a pail of lukewarm water and then vomit into one of the glasses rinsed in oil of tartar a reddish liquor, "which presently is brightened up and ting'd into perfect and lovely claret." He would then drink more water to dilute the brasil and provoke vomiting. If done into a glass rinsed in vinegar, the resultant acidity would produce the color of English beer; but if into a clean glass, a paler claret. Drinking water again and vomiting into a glass washed in oil of vitriol, the result would appear to be sack. Drinking fifteen or sixteen more glasses of water and vomiting into the glass rinsed in vinegar, he now produced a liquid of the color of white wine, and then would seem to vomit rose water, angelica water, and cinnamon water into glasses which had previously been washed with those spirits.

And thus was that famous cheat performed, and indeed acted with such a port and flowing grace by that Italian bravado, that he did not only strike an admiration into vulgar heads . . . but even into the . . . more knowing.⁵⁰

Another account of Marchand's performance had been printed in 1650.⁵¹ According to it, Marchand learned the trick from an Italian named Bloise, whom Mazarin threatened with indefinite imprisonment, unless he told him how he did it. Bloise agreed on condition that Mazarin keep it secret. Rather than compete with

⁴⁸ *Ibid.*, pp. 94, 96, 98-99.

⁴⁹ *Ibid.*, p. 147.

⁵⁰ *Ibid.*, pp. 75-76.

⁵¹ Thomas Peedle and Thomas Cozbie, *The falecie of the great water-*

drinker (F. Marchand) discovered; fully representing what are the ingredients that provoke him to so wonderfull a vomit, etc. London, 1650, in-4. BM E.603. (18.).

Bloise, Marchand by the advice of two English friends left Tours and came to England. This account gives the further additional information that he cleaned out his stomach beforehand by taking a pill "confected with gall of heifer and wheat flour baked" and drinking four or five pints of lukewarm water. Then immediately before the performance, he drank half a pint of brazil water on a fasting stomach. He brought on the stage a pail of lukewarm water and sixteen glasses, all previously washed in the best white-wine vinegar. He would rinse one glass off and get claret in it both the first and second times, but beer in another glass the second time. The third time, again washing the glass first, he would obtain pale burgundy, and the next time sack. The rose water and angelica water he drank on the stage from a glass concealed behind the water pail or basket of glasses, so that the spectators thought he was drinking lukewarm water as before. He also had a tin instrument with three pipes concealed in his mouth, through which he could spurt three streams of clear water.

Power's account of Marchand's performance was based indirectly upon this earlier pamphlet, of which Dr. Reuben Robinson sent him a partial transcription or paraphrase in long-hand on December, 12, 1662.⁵²

The activity of Marchand the great water-drinker was matched later on by that of "Richardon," or Richardson, the fire-eater, of whose secret a chemical explanation was attempted in the *Journal des Sçavans* of August 26, 1680.⁵³

Nor does Power's profession of experimental philosophy deter him from following Descartes in many respects. From the aforesaid generalizations as to the heavens "will follow unavoidably some other principles of the ever-to-be-admired Des-Cartes."⁵⁴ He adopts the Cartesian explanation of light⁵⁵ and theory of colors, although he promises to support the latter "by several experiments in the

⁵² Contained in BM Sloane MS 1326, fols. 112r-114v. Robinson omitted the first page and a half of Peedle and Cozbie's account, misspelled their names as Doodle and Corby, and sometimes narrates things in a different order, or abbreviates.

⁵³ JS VIII (1680), 282-84. See also JS V, 53-55, 217-26, where the name is spelled "Richardson."

⁵⁴ Preface, fol. c r.

⁵⁵ *Ibid.*, c 2 v, "the solary atoms of light (or *globuli aetheriei* of the renowned Des-Cartes)."

extraction, commixtion and transcoloration of tinctures."⁵⁶ And in condemning the vulgar crowd's lack of understanding and reason, he says that they are at best but Descartes' *automata*.⁵⁷

For Power furthermore experimental method was still largely a matter of observation. He lists numerous Microscopical Observations, at first of insects and mites, then one "Of the seven terrestrial planets as the Chymists call them."

Look at a polish'd piece of any of these metals and you shall see them all full of fissures, cavities and asperities and irregularities, but least of all in lead which is the closest and most compact body probably in the world.⁵⁸

Highmore asserted that effluvia of the magnet had been seen through the microscope, but Power had been unable to so detect even the effluvia of camphor or sweat.⁵⁹ Similarly, when Power proposes "Subterraneous Experiments," they turn out to be "Observations about Cole-mines."⁶⁰

Power's third book of magnetical experiments was accompanied by a refutation of the Jesuit, Jacques Grandami, who in 1645 had published a treatise arguing that the earth, as a magnetic body, could not rotate and so was immobile.⁶¹ To abate a "universal clamor" that the world was in decline and near the end of its period, Power devoted his closing pages to "An essay to prove the world's duration from the slow motion of the sun's apogaeum or the earth's aphelion."⁶² He approached the notion of human descent from the ape, when, in declaiming against the irrational rabble, he declared that "pugs and baboons may claim a traduction from Adam as well as these, and have as great a share of reason to justify their parentage." On the other hand, he suggested that in the other world and after life, the animal spirits might well be the soul's only vehicle, the pneumatic body of the Apostle, since they are diffused through the ether, "as into their proper element,

⁵⁶ *Ibid.*, p. 74.

⁵⁷ *Ibid.*, p. 184.

⁵⁸ *Ibid.*, p. 45, Observation 36.

⁵⁹ *Ibid.*, p. 57, Observation 51.

⁶⁰ *Ibid.*, pp. 171-81.

⁶¹ Jacobus Grandamicus, *Nova demonstratio immobilitatis terrae petita ex virtute magnetica* . . . , 1645, in-4, vi, 170 pp. Col 621.322 G 76.

⁶² *Experimental Philosophy*, pp. 188-93.

ready to be united to the soul at the instant" of its separation from the body.⁶³ Nor did the recent advance of science lead Power to abandon the doctrine of signatures. Rather he hoped that more of them would be revealed by the microscope.⁶⁴ And for him vertigo was a proof that the animal spirits were the immediate instrument of the soul in all its operations of sense and motion, for the brain itself cannot turn around.⁶⁵ By the same token one is tempted to say that it was magic, as much as science, that made the wheels of Henry Power's experimental philosophy go round.

The *Idea or Synopsis of a New and Experimental Philosophy* by Travagino in 1666, was largely concerned with chemical remedies, and was followed the next year by a *Synopsis of a New Philosophy and Medicine* which based all fermentation on acid and salt. *Philosophical Transactions* remarked concerning two letters which Travagino had sent to England announcing and summarizing this book, "Whether this philosophy be *new* is easie to judge."⁶⁶

More strictly scientific experimentation was recorded in the account of the experiments performed by the Italian *Accademia del Cimento* which appeared in Italian in 1667, and was translated into English in 1684 by Richard Waller, a fellow of the Royal Society.⁶⁷ These experiments were concerned with air pressure, and freezing; or aimed to prove that water was incapable of compression and that there was no such thing as lightness or positive levity. Some were magnetic and others electric, the latter being chiefly performed with amber. Other subjects investigated were the change of colors in fluids, the motion of sound, and projectiles. The remaining experiments are lumped together under the designation, miscellaneous. Similar experimentation was conducted by the members of the Académie des Sciences and of the Royal Society.

A great pretense of new experimentation was made by George

⁶³ *Ibid.*, pp. 184, 72.

⁶⁴ *Ibid.*, fol. a 3 v, and p. 184.

⁶⁵ *Ibid.*, p. 68. Francis Bacon had suggested the same explanation.

⁶⁶ Franciscus Travaginus, *Idea seu synopsis novae et experimentalis illius philosophiae quam tum ad medicamenta chemica tum ad alios usus accuravit, Extat cum Georgii Aras Enchi-*

ridio Hermetico-Medico, Venet., 1666, in-12. *Synopsis novae philosophiae et medicinae cuius fundamenta seu principia salia, acidum et salsum, ex quibus oritur omne fermentum . . .*, Venet., 1667, in-12. PT II, 555.

⁶⁷ The English version was reviewed in PT XIV, 757-58.

Sinclair, formerly professor of philosophy at the University of Glasgow,⁶⁸ in his *New and Great Art of Gravity and Levity* or six books of philosophical Dialogues concerning the true and real weight of the air, printed at Rotterdam in 1669.⁶⁹ He first sets forth all the phenomena of the baroscope in order to establish forever the elasticity, pressure and weight of the air—a task already essayed by Boyle. There follow “various new experiments” with regard to the weight of sea water. Two or three new experiments are then adduced against the weight of the elements, air and water, but the difficulties raised by them are fully satisfied, and the author proceeds to show that it is possible to obtain a vacuum. Water cannot be pumped up more than thirty-four feet, and this is due to the weight and pressure of the air. From three new experiments it is shown that perpetual motion can be had, but on closer examination their fallacy is detected, but in the process various secrets of nature are uncovered. Sinclair next submits the *Funiculus* of Franciscus Linus⁷⁰ and the booklet of Deusing on vacuum and attraction to examination, and then gives an account of both comets at the end of 1664 and the beginning of 1665. But he is not through yet. There follow two books, still in dialogue form, on the theory of siphoning, revealing “secrets before unheard-of” as to the nature of fluids, and concerning instruments, chiefly the hygroscope and chronoscope or pendulum. The book at least plays up to and demonstrates the existence of the current interest in experimentation, while its pretense of revealing secrets is a residue of the interest in magic.

The reviewer of Sinclair's book in *Philosophical Transactions* was careful to point out that his experiments were not new and unheard-of, as he seemed to think, and that he had visited Boyle. He claimed that he had submitted his work to the Royal Society and waited in vain almost two years for an answer, but the Society had no record of this. Really he had left his papers with Sir Robert Moray who did not judge them proper to submit to the Royal Society,

⁶⁸ He was forced to resign in 1666 and resumed the chair only after the Revolution of 1688: DNB.

⁶⁹ *Ars nova et magna gravitatis et levitatis sive Dialogorum philosophi-*

carum libri sex de aeris vera et reali gravitate, Roterodami, 1669. BM 538. d.21.

⁷⁰ Pseudonym for Francis Hall.

"because they seem'd to him to containe nothing new or extraordinary."⁷¹

Sinclair was more successful in the field of diabolical magic than in that of natural magic or experimentation, his *Satans Invisible World Discovered* of 1685, which was full of the usual cock-and-bull stories of witchcraft, having been "frequently reprinted"⁷² during the eighteenth century or so-called "Age of Reason."⁷³

That nature abhorred a vacuum or, more properly speaking, sought for universal continuity, was a truism which remained as valid after Otto von Guericke (1602-1686) had perfected the air pump as it had seemed to be before. In the preliminary experiment of pumping water out of a tight wine cask, first the pump had to be attached more securely, and then, when three men working together on the piston had finally managed to extract the water, air penetrated through the wood and took the place of the water in the cask. The first copper globe that was tried, when emptied, collapsed with a loud bang under the external air pressure. Even when a heavier and more perfectly spherical metal container had stood the test of exhaustion of its content, if the stop-cock were opened, the outer air would rush in with such violence that it would literally take the breath away of anyone standing nearby. Nature still sought continuity, but human art and magic had triumphed over it. In the trick of the Magdeburg hemispheres before the emperor at Regensburg in 1654, human magic turned nature against itself, and it took eight spans of horses to pull apart the two halves of a sphere only a little over a foot in diameter with a vacuum within but subject to atmospheric pressure without. Even when his *New Magdeburg Experiments* were at last belatedly published in 1672,⁷⁴ von Guericke still kept secret the ex-

⁷¹ PT IV, 1017-18.

⁷² DNB.

⁷³ The Prefatory Notice to the 1871 reprint of the first edition speaks "of the various Reprints published during the eighteenth century down to that . . . issued . . . in 1814."

⁷⁴ *Experimenta nova (ut vocantur) Magdeburgica de vacuo spatio, primum a Gaspare Schotto . . . , nunc*

vero ab ipso auctore perfectius edita variisque aliis experimentis aucta. Quibus accesserunt simul certa quaedam de aeris pondere circa terram, de virtutibus mundanis et systemate mundi planetario sicut et de stellis fixis ac spatio illo immenso quod tam intra quam extra eas funditur, Amsterdam, 1672, in-fol.

planation of his Virunculus or little man of wood who moved up or down with the water in a vacuum tube to serve as a barometer.⁷⁵

Von Guericke's volume also treated of mundane virtues.⁷⁶ These were neither substances nor accidents but effluvia which were in bodies and flowed from them. But there was this difference between those originally in a body and which streamed from it, and those which flowed into another body and were received by it, that in the latter case they were accidents, while they were innate virtues of the body from which they came and could not absent themselves without great detriment or loss of its form. Thus our experimenter still employed scholastic terminology. He went on to say that these virtues were both corporeal and incorporeal. The former could not pass through metal or glass. Examples of incorporeal virtues were the impulsive, conservative, expulsive, directive or magnetic, turning or rotating, sound, heat and light. An experiment in which the enumerated virtues could be excited by attrition against a ball of sulphur,⁷⁷ sounds something like an incantation, but refers to his generating electricity by holding his hands against a rotating sphere of sulphur. Leibniz not unjustly criticized the expression "mundane virtue" as no clearer than substantial form, sympathy and antipathy, magnetic force, and immaterial species.⁷⁸

The Copernican system, with immense space surrounding the fixed stars, was adopted by von Guericke, and he thought of even the space between the planets of the solar system as vacant. Like Huygens, he believed that each planet had its own inhabitants and even rational beings, but, unlike Huygens, he denied that anything on earth would be found on any of the other planets.

In 1674 Erasmus Bartholinus, professor of mathematics and medicine at Copenhagen, published a collection of Academic Questions on the Marvels of Nature.⁷⁹ If we disregard one on the study of Danish which dates from 1657, they fall between the years 1660, when that on the figure of snow was first printed, and 1673, when

⁷⁵ PT VII, 5104.

⁷⁶ Gerland, *Gesch. d. Physik*, pp.

⁷⁶ *Experimenta nova*, IV, i, p. 125
et seq.; Gerland, *Geschichte d. Physik*,
1913, 502-3.

507-8.

⁷⁹ *De naturae mirabilibus quaestiones academicae*, Hafniae, 1674, in-4,
200 pp. BM 536.f.18 (1.).

⁷⁷ *Experimenta nova*, IV, xv, p. 147.

that on the arcana of science was delivered orally. In the other papers and addresses, too, he keeps harping on the secrets and mysteries and labyrinth of nature, or the characters in which the arcana of the world are concealed. Among the subjects of the other questions are the pores of bodies, attraction, Cartesian physics, hypotheses, custom and nature. All are full of platitudes, oratory and moralizing. But we are here primarily concerned with that on experiments, a lecture originally delivered in 1668.⁸⁰

Erasmus has already in one of the other papers expressed his joy at being born in this age when the investigation of nature is so wonderful. He now adds that although natural philosophy requires long experience collected through many ages, and although the ancients investigated many splendid experiments, yet it is the glory of moderns by greater zeal and happier outcome to have made many inventions by which humanity is informed in all respects. Yet in such rich fields he notices not a few by-ways which should be avoided. We are as often deluded by our reason and judgment as we are by our senses, and a prudent physician will surely attend to true experience rather than to ambiguous reason.

Experience is the memory of past experiments. In astronomy these are of two kinds: phenomena apparent to all, and those which are observed only by skilled astronomers. The same holds true in other natural sciences. Men are prone to neglect common things and attend only to what is showy and rare—and which requires great expense. A certain not inglorious experimenter boasts that he came to the conclusion that wind was the cause of earthquakes, not by drawing this physical arcanum from the books of other philosophers, but by watching a kettle boil on the stove. Indeed, heaven has granted that all men and ages obtain a more certain and precious supply of experiments from the vast volume of nature than from the books of the philosophers. The secret force by which the magnetic needle turns north escapes observation, "yet by this experiment we cross the seas." Bartholinus regards the inventions of printing and gunpowder as experiments, and says that, if all the experiments of the mechanical arts which are called illiberal were collected, there would be a great advance in science.

⁸⁰ *Ibid.*, pp. 82-100.

But while all men experience something, few do so wisely and rightly. Accomplished are they who under the lead of long experience and learning can attain to knowledge of rarer effects, descend to the secrets of things, and burst into Nature's sanctuary. Such are medical men who have opened cadavers. Such is chemistry, whence daily rise and mature wonderful discoveries. But now Bartholinus warns against deception of the senses. Also innumerable things are hid underground, and many lie concealed in dense darkness, to which no keenness of human genius can penetrate. More instruments like the microscope are needed. Also the fables and idle tales of many authors must be avoided. It would be long to enumerate all the paths of experimentation, and about as close as Erasmus comes to purposive experiment is to say that time is required. Too often we make the mistake of extending experiments of the senses to matters which cannot be reached by them. There have been abuses of siphoning and exaggeration of its possibilities. And sequence should not be confused with causation.

Malebranche, in *La recherche de la vérité* of 1674, complained that the opinions of those who spent their time in experimentation were accepted too readily and without sufficient examination. He did not object to students of natural philosophy employing the experimental method, "provided their greatest application be made to the more necessary sciences. We find no fault with experimental philosophy, nor the improvers of it; but only with their defects."⁸¹ Of these he enumerates six. The first is that chance rather than reason guides them in the method of their experiments. Secondly, they prefer curious and extraordinary experiments to the most common. Here Malebranche would seem to be thinking of experiences rather than purposive laboratory experiments. Third, they prefer profitable experiments to those "which serve only to illuminate the mind." Fourth, they do not observe all the particular circumstances and details, such as the time, place and character of the ingredients, accurately, "though the least of these circumstances is capable of frustrating the desired effect." Fifth, they deduce too much from a single experiment, whereas many ex-

⁸¹ *Op. cit.*, II, 2, ix; I quote the English translation of 1694, p. 87.

periments are requisite to establish one good conclusion. Finally, most naturalists and chemists are too intent upon particular phenomena and do not ascend to general principles.

To conclude, they commonly want courage and constancy, and are tired and discouraged with the toil and expense. There are many other faults these gentlemen are subject to, but I design not to reckon them all up.

In our chapter on Natural History we had occasion to mention Bourdelot's intervention in 1671 in the controversy between Redi and Charas as to the poison of vipers. Four years later François Bayle, an M.D. of Toulouse, published at Paris a *Discours* on the necessity of combining experience and reason which he dedicated "A Monsieur Monsieur Bourdelot, Abbé de Massay, Seigneur de Condé, Saint Leger, etc.," praising his acquaintance with all fields of science to the skies.⁸² Although Bayle's *Discours* contained no new ideas and today seems quite commonplace, it was soon published again in Latin at The Hague,⁸³ and there is another French edition without date.⁸⁴

But it closes with a Response by Bourdelot to Bayle's dedication⁸⁵ which contains more of interest. Modestly disclaiming the scientific eminence which Bayle had accorded him, Bourdelot says that, although Bayle has retired towards the Pyrenees, far from the places where new doctrines are available, he continues to produce them himself with a marvelous fecundity, and that a man like you should be called here to Paris "to enlighten our Academies and renew their ardor for the advancement of science." Bourdelot is far from being satisfied with the present state of science and

⁸² *Discours dans lequel il est démontré que dans la Physique, dans la Médecine et dans la Chirurgie il faut joindre l'Experience à la Raison*, Paris, 1675, in-12, 97 pp. Copy used: BN T¹⁹.28.

The dedication is signed "J. Bayle," which would seem to be a misprint. François Bayle, whom we shall meet again in three later chapters, had already in 1669 published a brief summary of the philosophy of Descartes, of

which there was an English translation in 1670, *System General of Cartesian Philosophy*.

⁸³ *Dissertatio de experientia et ratione coniungenda in Physica, Medicina et Chirurgia*, 1678, in-12.

⁸⁴ In-16; BN R.27899. Printed at Toulouse with a permit of 1684.

⁸⁵ *Discours*, 1675, pp. 81-97: "Réponse de Monsieur l'abbé Bourdelot à Monsieur Bayle."

medicine. The operation of machines is very seductive and always keeps the auditorium full, but one should not stop there. It is easy to find new things, and frivolous discoveries are made a great show of. On the other hand, there are those who will not reveal their findings. Paris is full of them, especially chemists and physicians who have secrets. Since Bourdelot began to practice medicine, he has known forty or fifty men, each of whom had his particular secret. They were much sought after for a time but then abandoned. Bourdelot calls them kings for a few days, and deems it more advisable to beware of a man with a single secret than of a man of one book. He further complains that, to acquire a medical reputation at Rome, it is better to pay court to cardinals than to cultivate science. The queen of Sweden and princes have made him personally well off, but he feels that medicine has fallen on evil days in France. Somewhat similarly, in his dedication to Bourdelot, Bayle had complained that physics had become a heap or a chaos of metaphysical speculations. On the other hand, medicine was overrun with mere empirics.⁸⁶

The Experimental or Curious College of Johann Christoph Sturm, professor of mathematics and "physics" and rector of the University of Altdorf, was first held for twenty auditors in the last quarter of the year 1672 and then printed at Nürnberg in 1676 with appendices of supplementary matter.⁸⁷ The sixteen *Tentamina* are concerned with recent inventions such as the diving bell, camera obscura, magic lantern, Torricellian tube or barometer, air pump, thermometers, hygrosopes, telescopes and microscopes. Also Lana's flying ship and a numerical contrivance for communication in any language.⁸⁸ In a supplementary volume of 1685,⁸⁹ besides new forms of the foregoing instruments, there were added glass tears or Rupert's drops, speaking tubes, and the *hydria Helmontiana* adduced by Henry More⁹⁰ in support of his hylarchic principle—an incorporeal cause or world soul which moved bodies. Sturm

⁸⁶ *Discours*, 1675, pp. 57-60, 81 et seq.

⁸⁷ *Collegium experimentale sive curiosum in quo primaria huius seculi inventa et experimenta physico-mathematica . . .*, Norimbergae, 1676, 168,

122 pp. Col 530. St9 1.

⁸⁸ *Ibid.*, pp. 74-99, Tentamen XII.

⁸⁹ *Collegii experimentalis sive curiosi pars secunda . . .*, Norimbergae, 1685, 256 pp. Col 530. St9 2.

⁹⁰ *Ibid.*, pp. 92-112, 142-64, 204-24.

prints his letter to More concerning it and answers More's argument against the elasticity of the air.⁹¹

Johann Daniel Major in 1677 alluded to a scheme which he had once entertained for drawing up an elaborate history of experimental science.⁹²

Despite the real progress in physical experimentation which had been made by scientists like Galileo, Torricelli, von Guericke and Boyle, Johann Kestler, a disciple and literary helper of Athanasius Kircher, published first at Rome in 1675,⁹³ and then at Amsterdam in 1680,⁹⁴ a *Physiologia Kircheriana Experimentalis*, in which natural science was proved and established by physical, mathematical, medical, chemical, musical, magnetic and mechanical experiments drawn from the vast works of Kircher. In the Preface Kestler calls Kircher the prodigious miracle of our age, who, because of the innumerable experiments on which he founded his universal sciences, has rapt the whole world in admiration. Nevertheless Kestler notes that Meibomius attacked Kircher's musical work and that others have criticized his treatment of hieroglyphs and of alchemy.

We turn to some specimens of the experiments and first to one supposed to demonstrate that the tides are caused by the moon. Fill a basin with nitrous water mixed with common salt, expose it to moonlight on a clear night, and you will see with wonder the water immediately begin to boil and form bubbles, and this the more vehemently as the luminaries are closer to conjunction or opposition. The experiment won't work, if fresh water is used. Hence it is too that those who suffer from salt humors and nitrous and tartarous defluxions, such as the gouty, arthritic, lunatic and hypochondriac, feel the force of the moon much more than other persons do.⁹⁵

For proof that the eyes of animals enlarge and diminish as the

⁹¹ As to the controversy between Sturm and More, which dated from More's *Enchiridion Metaphysicum*, see the review of Sturm's *Physicae conciliatricis conamina*, JS XIV, 32-33.

⁹² *Genius errans sive de abusu in scientiis*, Kiel, 1677: cap. V, "Genius

errans autoris circa Experimentalis Studii Annales vastissimos condendos."

⁹³ Not in BM or BN.

⁹⁴ I have used this edition, in-fol., 2 col. BN R.963; BM 31.k.5.

⁹⁵ *Ibid.*, p. 19a.

moon waxes and wanes, we are referred to Kircher's *Ars Magnetica*, Book 3, Part V, chapter 4, where there are marvelous arcana in stones as well as plants and animals. This and a passage from Oviedo on the effect of moonlight on sealskin are combined under the heading of Experiment III.⁹⁶ The fifteenth experiment is on writing invisibly and then making the letters appear, while the twenty-eighth is on how to make auripigment.

From such relics of thirteenth century books of secrets and experiments we pass on to chemical experiments about the metamorphosis of metals. The first is on signs of hidden metal. Suspend a salty wooden stick over a boiling pot of salt water and you will find that the volatile spirits which evaporate will adhere to the salty stick by magnetic influence as to a body like themselves, and the stick weighted down by the saline particles will gradually incline towards the pot. "I think the same can happen, if a similar instrument is placed above a salt mine."⁹⁷ But if the boiling water were fresh, it would also adhere to the salt and weigh the stick down, while it may be doubted if there would be salt in the steam from salt water. The experiment is thus worthless.

Section IV consists of experiments in the artificial production of insects. The brief review of Kestler's book in the *Journal des Sçavans*⁹⁸ was devoted mainly to this section and noted his belief that he had proved experimentally that the dung of insects contained the seed which reproduced them. Many earthworms dried to a powder are to be buried in a receptacle full of rich soil and watered with rain water. Within three or four days all that earth will be full of earthworms, at first only the size of the worms in cheese but gradually from the nourishment of that rich soil growing to full sized earthworms. For the seed in the incineration of earthworms does not perish but remains virtually.⁹⁹ The second experiment in the same section deals with the generation of bees from cow-flap and the eighth with the generation of scorpions. In the last case, dead scorpions ground to a powder are put in a glass, covered with water in which clover has been soaked, and exposed to the summer sun for a day, and the mixture will turn into an

⁹⁶ *Ibid.*, p. 20a-b.

⁹⁷ *Ibid.*, p. 36a.

⁹⁸ JS VIII (1680), 317-19.

⁹⁹ *Physiologia*, p. 41a.

innumerable brood of scorpions. It may well be questioned why clover is used, since it is not known to have any sympathy with scorpions. However, Holler tells of a scorpion found in an Italian's brain and born there as a result of excessive handling and smelling of clover, and Ambrose Paré depicted it exactly.¹⁰⁰

An experiment of perpetual fire employs an unceasing flow of bitumen. There are experiments with potable gold. Air is weighed at different times. How much a plant grows on single days is explored. The gravity of liquids is measured by the refraction of a coin in them. A rarest arcanum is a way to prepare gold for illuminating.¹⁰¹

Under the caption of the marvelous nature of light and solar rays, the fourth experiment is that stars often twinkle,¹⁰² but soon we come to magic lanterns. *Experimentum mirabile II* is to open an egg on the third day of incubation and see the heart already formed.¹⁰³ Optical experiments and the transplantation of trees and herbs are soon followed by clocks and the prodigious artificial exhibition of specters of every sort.¹⁰⁴ The trick of burning camphor on the surface of water is included.¹⁰⁵

The magnetic art and diseases of the magnet and their cure are followed by a collection of magnetic experiments extracted from divers authors.¹⁰⁶ But in between we find that by compression of water in a glass tube various spectacles of playful Nature are shown together with a great mass of experiments.¹⁰⁷ A hydraulic machine is constructed which exhibits all kinds of jokes, and we are shown how to smoke tobacco through water.¹⁰⁸

In the fifth book on the philosophy of sound there is a xylophone and an acoustical instrument. Experiment three demonstrates that the voice is better heard through circular tubes and is louder than through straight ones. We also have speaking and moving statues.¹⁰⁹ The sixth book deals with the mechanics of the ancient

¹⁰⁰ *Ibid.*, p. 46a.

¹⁰¹ Experiments 15, 16, 17, 38, 40, 43, 50, at pp. 55b, 56a, 57a, 63a-b, 68.

¹⁰² *Ibid.*, p. 80a.

¹⁰³ *Ibid.*, p. 89b.

¹⁰⁴ *Ibid.*, p. 113.

¹⁰⁵ *Ibid.*, p. 117, Experiment 12.

¹⁰⁶ *Ibid.*, pp. 132-, 142-, 157-.

¹⁰⁷ *Ibid.*, p. 149a-.

¹⁰⁸ *Ibid.*, pp. 166b, 170b-171b; Experiments v and viii.

¹⁰⁹ *Ibid.*, pp. 185, 190, 193, 194a, 200-201.

Egyptians, including water clocks. The seventh book is chiefly pyrotechnic but has a chapter on iatro-chemical practice and ends with a pipe-organ.¹¹⁰

There are many references to experiments in the work of Barberius on the workings of nitro-aerial spirit in the human body.¹¹¹ Highmore denied that air was mixed with the blood, but his experiment must have been made with a dead lung. Barberius's own experiment and still better Truston's proved the contrary.¹¹² When the heart ceased its motion, Lower blew in air through the *vena cava*, and the movement of the heart was resumed. Boyle proved by experimentation that animals die, if deprived of air. "Maiuvius," by whom Mayow seems meant, put sulphur in the closed glass vessel along with the animal. A burning glass kindled the sulphur to flame before the animal died, but failed to do so afterwards. Valaeus by use of a ligature demonstrated that the blood of the mother passed through the umbilical vein to the liver of the foetus. Lower instilled the warm blood of another animal into the right ventricle of the heart of an animal which was not allowed to breathe, and it continued to live for several hours.¹¹³ Lower also injected beer into the jugular vein, whence it soon passed out without affecting the movement of the heart, with which therefore the blood evidently had little to do.¹¹⁴

But despite all the experiments and citation of an equal number of authorities, we cannot accept the assertion of Barberius that Lower and Willis have proved that the motion of the heart is produced by nothing else than animal spirits,¹¹⁵ or his affirmation that the first vitalization of the egg is performed by nitro-aerial spirit,¹¹⁶ or his further identification of it with the first element of Descartes.¹¹⁷

A doctor at Vienna performed the following chemical experi-

¹¹⁰ *Ibid.*, pp. 204, 231, 238, 248.

¹¹¹ Ludov. Maria Barberius, *Spiritus nitro-aerei operationes in microcosmo*, Bologna, 1680, 156 pp. BM 780.a.19.

¹¹² *Ibid.*, pp. 3-4. Malachia Thruston's *De respirationis usu primario*, London, 1670, was reviewed in PT IV, 1142.

¹¹³ Barberius, pp. 7, 12-13, 17-18, 21; more experiments of Boyle and "Maiuvius" at pp. 18-19, 27. At p. 118 another experiment by Lower with a dog.

¹¹⁴ *Ibid.*, p. 145.

¹¹⁵ *Ibid.*, p. 144.

¹¹⁶ *Ibid.*, p. 59.

¹¹⁷ *Ibid.*, p. 40.

ment in connection with the pest.¹¹⁸ He opened a bubo of a patient, removed the pestilential matter and put it in a retort, which he subjected to a gradually increasing heat, obtaining first a fairly clear water, then a greasy oil, and finally a volatile salt. When he uncorked the retort, an almost unsupportable stench made him tremble all over, although he had plugged up his ears and nostrils and had in his mouth a sponge soaked in vinegar and theriacal waters. When the vapor had dissipated and his trembling had ceased, he had the patient taste some of the salt and put some on his own tongue. From its extreme acidity he concluded that it was the cause of the continual vomiting and diarrhoea of those afflicted with the plague, and that the best remedies were sudorifics and cardiacs. The dean of the medical faculty of Heidelberg and Charas, who was then in England, were, however, inclined to question the advisability of such experiments in time of pest, also whether it revealed the nature of the poison, whether chemical fire was not too disproportionate to that of the human body to warrant his conclusion, whether he should have had the patient and himself taste the salt, and whether its acrimony could account for the plague symptoms.¹¹⁹

In another chapter we have seen that Wolferd Senguerd, in his *Natural Philosophy* of 1681, cited no authorities and gave numerous experiments. In a volume of *Experimental Research* printed in 1699,¹²⁰ he included subsequent experiments of 1687, 1688, 1689 and 1693. They seem to add little to the results of Boyle. Senguerd held that the corpuscles of elastic bodies must be rigid, oblong and branching.¹²¹

Arnoldus Bachimius, in a book entitled *Pan-Sophia* or *Universal*

¹¹⁸ *De contagione Viennensi experimentum medicum* Doct. Jean. Bap. Alpruni Augustissimae Imperatricis Eleonorae Aulæ medici destinati ab excelso regimine pro pestiferorum cura, Pragae, 1680.

¹¹⁹ JS VIII (1680), 167-77.

¹²⁰ *Inquisitiones experimentalis quibus praeter particularia nonnulla phaenomena atmosphaerici aeris natura explicatius traditur . . . Adjectae sunt*

ephemerides nostri aeris . . . a calendis februaryis anni 1697 ad finem subsequentis a. 1698 . . . ed. 2a priore plusquam altera parte auctior. Leyden, 1699, in-4, vi, 158 pp. & App. BN R.4651. The first instalment of this work came out in 1690, and was reviewed in *Acta eruditorum*, IX, 137-38.

¹²¹ *Inquisitiones*, pp. 93-94.

Experimental Philosophy, which was printed at Nürnberg in 1682, proposed to examine and test by fire and to reveal the nature of all things in a state of nude virginity.¹²²

Of a more antiquated type were the *Universali esperimenti* of Antonio Petrini, preserved in a manuscript of the Riccardian library in Florence,¹²³ which on its last page has the date, May 9, 1683.¹²⁴ These experiments are with the virtues of herbs and stones, with parts of animals such as the tooth of a dog and *la verga del lupo*, electuaries and unguents, how to dye hair or cure gout and wounds, or reconcile husband and wife. There are *segreti mirabili bellissimi*, various natural secrets, things most marvelous of varied virtue, from Greeks, Indians and Arabs.¹²⁵ At the close are lucky and unlucky days, and symbols of the planets, probably for use on astrological images.

The word, experiment, was still used to designate a medical prescription or secret recipe by Daniel Meno Matthiae in 1683.¹²⁶

A siphon invented by a citizen of Wurtemberg about 1684, which seemed to work without suction, owed its efficacy to a hidden reservoir and tube.¹²⁷ Reiselius added a method of making it flow

¹²² *Pan-Sophia enchiretca (sic) seu philosophia universalis experimentalis . . . per ignem examinata et probata, per quam natura universalis rerum omnium vestibus denudata in virginitate . . . exponitur*, Nürnberg, 1682, in-12, 221 pp.

¹²³ MS Riccard. 2629, "Universali esperimenti dati da me illuc Antonio Petrinii . . ." On the verso of the title page is what appears to be a dedication to some member of the Medici family, "Collorenso Medicii." This MS was examined for me by Dr. Peter Riesenbergh, a member of my seminar in 1949-50, and a Fulbright scholar in 1951-53.

¹²⁴ *Ibid.*, fol. 89v, "9 Maggio 1683."

¹²⁵ Most of these phrases occur in the long title, or in the dedication at fol. 3r, but for dog and wolf see the chapter on animals at fols. 61r-63v. There is an alphabetical index at fols.

3v-5v. From fol. 6v to 48r, pictures of plants occupy the verso of each leaf and a statement of the virtues of each is on the recto opposite. At fol. 8r, "... metter pace tra la moglie e il marito." Briefer statements of the virtues of herbs without drawings of them continue to fol. 54v. Fols. 55r-60v contain the second book on the virtues of stones. After the chapter on animals already mentioned, comes a collection of recipes at fols. 64r-79v. A third book on the virtues of stones fills fols. 80r-84v, then with its tenth chapter at fol. 85r turns to the carving on stones of operative images.

¹²⁶ *Experimentorum medico-chymicorum Decades tres in annum 1679. 80.81, quae lectori communicant arcanissimas medicaminum praeparationes*, Francof., 1683, in-12.

¹²⁷ Salomon Reiselius. *Sipho Wurtembergicus per majora experimenta*

from the top, concerning which the members of the Royal Society were sceptical. But Denis Papin held it possible, although he estimated that it would require the descent of about one hundred times as much water as ascended.¹²⁸

From the Acts of the new academy at Brescia of Philo-Exotics of Nature and Art, numbers 10, 11, 17, 18, 25 and 29 were excerpted by *Acta eruditorum*¹²⁹ as of especial interest to its readers. Of these Number 17 was "a singular experiment in which two quite limpid liquors, when mixed together, coalesced into a body" of the consistency of butter, or more so, very white and quite dry. Dr. Hieronymus Alegri of Verona had hit upon it by chance and wished to keep it secret, but the Philo-Exotics set out to try to discover the two liquids, and Rev. Franciscus Tertius de Lanis, a Jesuit father, succeeded. Number 18 was a case of the transplantation of disease. A noble youth of Brescia had a tumor under his jaws which was so enlarged by venomous spirits that he could not swallow a bit of food or drop of water. When the surgeon removed the bandages and a servant threw them out the window, a passing pig which licked them emitted a terrible grunt, writhed in pain in the mud, and began to swell up, until by administering purgatives, it was restored to health on the third day. On the other hand, hardly had the servant thrown out the bandages than the patient began to feel relief and by the next day was quite all right. It reminded one of Christ's casting the demons out of the possessed and their entering the herd of swine. But that was a miracle of divine power, this was a work of nature. For the venomous spirits in the bandages attracted a long chain of like spirits into the body of the pig, until by sympathetic or magnetic virtue they were all transplanted there. Number 25 was a similar "new experiment" of transplanting quartan fever from another noble youth of Brescia into the body of a dog by making a cake of the patient's urine and flour and giving it to the animal to eat.

Samuel Reyher of Kiel, whom we have already met in other

firmatus, in vertice effluens, correctus et detectus, Stuttgart, 1690, in-4. Reviewed in *Acta eruditorum*, IX (1690), 142-47.

¹²⁸ *Acta eruditorum*, IX, 223-28, "Excerpta ex literis Dn. Dion. Papin . . ."

¹²⁹ V (1686), 556-65.

connections, described "a new experiment in which the sweetness of salt water" was examined on February 6, 1697.¹³⁰ He broke the ice, which was a foot thick, and found that bits of it tasted sweet. The water next to the ice underneath was also destitute of salt, but when he siphoned out water from lower beneath the surface, it proved to be salt. He gives pictures of the frozen ice and so forth, and offers two reasons for the phenomena. The first is compression of the water and at the same time expression of the saline particles. For he believes that, while water cannot be compressed by machines, as air can, it is very easily compressed by cold. The second reason is the heaviness of salt, because of which it spontaneously seeks the bottom. He adds that sea water is not so easily frozen as fresh water.

It is hardly necessary to comment upon the contents of the foregoing chapter further than to say that evidently experimental method is still far from having attained perfection and still smacks of its magical origin.

¹³⁰ *Experimentum novum quo aquae marinae dulcedo* 6 Feb. 1697 examinata describitur, Kiliae Holsatorum. BM 7004.de.1 (14.).

Gmelin, *Geschichte der Chemie*, II (1798), 18-19, lists a title in which experimental philosophy is associated with the Biblical account of creation:

Arn. Bach. Denston, *Pan-sophia enchi- retica seu philosophia universalis experimentalis in Academia Moysis primum per sex capita libri primi Geneseos tradita per quam natura universalis rerum omnium vestibus denudata*, Nürnberg, 1682, in-12.

CHAPTER XXX

ACADEMIES AND SCIENTIFIC SOCIETIES

Miscellanea Naturae Curiosorum—*Acta Hafniensia*—Monsters—Imagination of pregnant mother—Other effects of the imagination—Sympathy and antipathy—Empirics and impostors—Epilepsy, melancholy and hypochondria—Chemistry and alchemy—Strange deaths, injuries and diseases—Cures and remedies—Fat of vipers—Anatomical—More marvels—Plants and minerals—Similar interests elsewhere: England, Denmark, Liceto—*Journal des Sçavans*—The Royal Society: *Philosophical Transactions*—Halley's letters—Questionnaires to foreign parts—Mad dogs—Scepticism rare—Interest of the English reading public in marvels and monstrosities.

If any age, surely this present century, as it has been so far, will continue to be most fertile in experiments, a century in which there are so many celebrated literary societies and colleges of the erudite, who under the patronage and auspices of the greatest kings and princes in England, France, Florence, Rome, Venice and in our own Germany usefully spend their time in investigation and accurate recording of curious things.

—PASCHIUS

Ephemerides Curiosae S. Rom. Imperii, Acta elegantissima Hafnien-sium, Transactiones Anglicae et similia, quoad maximam sui partem, historiae merae sunt... ex quibus physicae specialis chaos aliquid confletur.

—J. D. MAJOR

The *Miscellanea* or *Ephemerides* of the German *Academia Naturae Curiosorum*, an enlargement and reorganization of the *Collegium Naturae Curiosorum* which had been founded in 1652, began to be published in 1670, and consisted of short communications, called *Observationes*, from the members and others, running from a few lines to a few pages of text. Those for the first ten years fill seven volumes, years IV and V, VI and VII, and IX and X being

coupled in single volumes. A second *Decuria* or set of volumes covering ten years was published from 1683 to 1692.¹ In 1687, ten years after the Emperor Leopold became its patron, the society changed its name in his honor to *Academia Caesarea Leopoldina*, and its publications are sometimes catalogued under the caption, *Kaiserliche Leopoldinisch-Carolinische deutsche Akademie der Naturforscher*.

Thomas Bartholinus of Copenhagen made a number of contributions to the first annual volume of the German Academy, but he then began to edit in connection with the medical faculty of Copenhagen a series of *Acta medica et philosophica Hafniensia* in five volumes for the years 1671-79,² which was of a similar character and content, and illustrated like the other with anatomical

¹ In citing the volumes I shall indicate those of the first decade by Roman numeral for the volume and Arabic numeral for the *Observatio* in question, and distinguish the volumes from 1683 to 1692 by prefixing *Decur. II*, to the other numbers.

For the *Annus primus* or first volume I have seen only the second edition of 1684 which has a succession of three title pages. On the first is printed only *Decuriae annorum primae Miscellaneorum medico-physicorum sive Ephemeridum Germanicarum Annus Primus*. The *verso* of the leaf is left blank and the next *recto* is occupied by a flowery circular figure. Around its circumference is printed, *Curiosorum Sac. Rom. Imper. Academiae Naturae*; in the center, *Ephem. physico medicarum Curiosorum Germ.* Two horns of plenty occupy the lower part of the figure. Above the mouth of one are the words:

Animalia
Mineralia
Vegetab.

Above the mouth of the other we read:

Botanica
Chymia
Anatomia.

Below the center of the figure is printed, *Dec. I. Annus I*. After another blank *verso* comes the third title page, reading: *Miscellanea curiosa sive Ephemeridum medico-physicarum Germanicarum Academiae Naturae Curiosorum Decuriae I Annus Primus Anni M.DC.LXX continens celeberrimorum medicorum in et extra Germaniam Observationes Medicas et Physicas, vel Anatomicas, vel Botanicas, vel Pathologicas, vel Chirurgicas, vel Therapeuticas vel Chymicas. Praefixa epistola invitatoria ad celeberrimos medicos Europae. Editio secunda . . . Francof. et Lipsiae, sumpt. Haer. Joh. Fritschii et Joh. Fried. Gleditschii, Anno M.DC.LXXXIV.*

In volume two the title page reads: *Miscellanea Curiosa Medico-Physica Academiae Naturae Curiosorum sive Ephemeridum Medico-Physicarum Germanicarum Curiosorum. Annus secundus anni scilicet MDCLXXI . . . Jenae Sumptibus Esiae Fellgibeli Bibliopolae Wratislav. Typis Samuelis Krebsii. Anno 1671.*

² I shall cite it as *Acta Hafn.* with Roman numerals for the volume and Arabic for the Observation.

plates and pictures of monstrosities. Both series were then regarded as of sufficient interest and importance to have their contents itemized individually in *Lindenius Renovatus*, the great medical bibliography of 1686.

Historians of science have commonly represented the great experimenters of the seventeenth century as intent on discovering immutable laws of nature which operated with mathematical precision, regularity and uniformity. The Ephemerides of the German Academy of those curious about nature and the *Acta Hafniensia* paint a quite different picture. In the case of many of their observations and scholia the interest is rather in the odd and curious, the astounding and marvelous, the unnatural and the abnormal.

Monsters and freaks of nature receive perhaps the most attention.³ Karl Rayger wrote at one time of a monster with two heads, at another time of a monstrous head without brain or cranium.⁴ David Spielenberger contributed a few lines concerning two monstrous births, one without a head and with eyes in its shoulders, the other without any eyes.⁵ In the same volume Johann Scultetus of Nürnberg at greater length listed past two-headed monsters, inquired as to the cause of their generation, and spoke of them as warnings of divine wrath like that most fatal star of the year 1665.⁶ Georg Seger, physician to the king of Poland and honorary professor at Thorn, at various times reported a calf with two heads, a two-headed lamb, eggs with a double yolk, and a bearded lady.⁷ G. W. Wedel, ducal physician of Saxe-Gotha, and Thomas Bartholinus, perpetual dean of medicine at Copenhagen, report cases of men with a single testicle; others note those with three.⁸ Georg Hannaus tells of a woman with three breasts.⁹ Elsewhere we hear of a girl with two tongues.¹⁰ A Swiss physician, J. J. Wepfer,

³ For interesting monsters and monstrous births in the late sixteenth and early seventeenth century: T VI, 286-87.

⁴ I, 7; III, 280. See also II, 36, Mauritii Hofmani anatome partus cerebro carentis; III, 129; and VIII, 64, Caroli Raygeri de puella sine cerebro vitali. Fribe, too, observed a mon-

strous birth with two heads: III, 165.

⁵ III, 108. Another headless infant is recorded at III, 277.

⁶ III, 224.

⁷ II, 94; IX-X, 97; III, 188; IX-X, 95.

⁸ II, 236.

⁹ *Acta Hafn.*, III, 93.

¹⁰ IX-X, 137.

who in 1658 had initiated the modern meaning of apoplexy as a cerebral attack caused by cerebral haemorrhage or thrombosis,¹¹ describes a monster which breathed through its neck,¹² and a girl born without a brain.¹³

Hermaphrodites, human or bestial, were not forgotten either at Berlin¹⁴ or Copenhagen,¹⁵ or, for that matter, in Toulouse and London.¹⁶ Oldenburg wrote to Boyle on December 24, 1667:

The (Royal) Society shall not meet till January 2, at which time, I believe, they will receive a good account of a pretty hermaphrodite, now in London, which was lately visited by Dr. Allen and myself.¹⁷

J. J. Waldschmid discusses an abominable human monster.¹⁸ Johann Georg Greisel, extraordinary professor of anatomy at Vienna, and Johann Konrad Peyer of Schaffhausen describe Siamese twins.¹⁹

Wedel tells of a monstrous tumor of the thigh and a monstrous branch of a pine,²⁰ later of a monstrous fish with feet.²¹ "A miraculous tumor of the tongue," from which a certain baron eventually died, is interpreted—and that by Paul de Sorbait, first professor of medical practice at the University of Vienna and physician to the Empress Eleonora—as a special providence to punish him for his bitter words against the clergy.²² Fridericus Lachmund of Hildesheim reported as to the monstrous cranium of a goose;²³ G. C. Petri, dean of the medical faculty at Erfurt and physician to the Elector of Mainz, called attention to monstrous kidneys;²⁴ Hannaeus recounted a rare history of a monstrous case of dropsy.²⁵ Other members observed monstrous fungi as well as a monstrous

¹¹ *Observationes anatomicae ex cadaveribus eorum quos sustulit apoplexia . . .*, Schaffhausen, 1658, in-8; reprinted in 1675 and 1681.

¹² II, 174.

¹³ III, 129.

¹⁴ II, 803, G. C. Petri, *Conceptio hermaphroditica seu androgynea*; III, 167, J. J. Wepfer, *De ariete hermaphrodito*; I, 125, T. Bartholinus, *De asello hermaphroditico*, and Scholion, *De animalibus hermaphroditicis*.

¹⁵ *Acta Hafn.*, IV, 79, Georg Han-

naeus, *De hermaphrodito*.

¹⁶ PT XVI, 282-83, for a letter from Toulouse concerning a hermaphrodite near that city.

¹⁷ Boyle, *Works* (1772), VI, 257.

¹⁸ II, 211.

¹⁹ I, 55; *Decur.* II, II, 111.

²⁰ III, 69, 142.

²¹ *Decur.* II, Ann. I, 157.

²² II, 107.

²³ IV-V, 181.

²⁴ II, 68.

²⁵ *Acta Hafn.*, V, 12.

foetus.²⁶ Johannes Jaenisius of Breslau described a monstrous wild variety of bugloss.²⁷ Wurffbain wrote on monstrous crabs' eyes;²⁸ yet other members, on monstrous eggs.²⁹ A monstrous hare is reported more than once and is shown in plates racing along with one head, two front legs, two bodies and four hind legs, or with two heads and four front legs but with one head and two legs facing upwards.³⁰ Lucas Schroeck noted the monstrous ears of a certain snake.³¹ T. Bartholinus called attention to a Danish siren.³² V. A. Moellenbrock recorded a case of inversion of the heart.³³ J. G. Sommer ventilated the monstrous causes of disease.³⁴ Others discussed men with horns and men shaped like fish.³⁵ Sachs à Lewenheimb noted a monstrous turnip which was shaped like a man,³⁶ and gave examples of monstrous foetuses caused by the imagination of the mother.³⁷

This last point was an *idée fixe* in the seventeenth century. Mercklin, senior physician of the Republic of Nürnberg, Sommer and others adduced instances of it in the *Ephemerides* of the Curious.³⁸ Its continuance well into the eighteenth century is indicated by the fact that an English work on the subject which appeared in London in 1729,³⁹ was re-issued in French translation at Leyden in 1737.⁴⁰

A striking example may be added from outside the pages of the *Miscellanea curiosorum* in the *Philosophical Transactions* of the English Royal Society for July-August, 1687, in the form of a communication from Edward Smith, secretary of the Philo-

²⁶ II, 54; III, 299.

²⁷ I, 102.

²⁸ Decur. II, I, 154.

²⁹ Decur. II, I, 16; II, 119; IV, 44.

³⁰ II, 94, 199, 200, by Seger, Reisel and Jung respectively.

³¹ Decur. II, I, 125, Scholia.

³² I, 23.

³³ II, 76.

³⁴ Decur. II, I, 177.

³⁵ I, Scholia to 23 and 30.

³⁶ I, 48.

³⁷ II, 61, Scholia.

³⁸ G. A. Mercklin, Jr., *De gravidæ imaginatione foetui noxia*, VIII, 46;

J. G. Sommer, *De imaginationis effectu ex terrore matris in recens nato*, Decur. II, I, 40; *De imaginationis vi in praegnantibus*, I, 135, Scholia; Geo. Seger, *De gangraena ex terrore materno embryoni impressa*, IV-V, 147.

³⁹ James Augustus Blondel, *The Power of the Mother's Imagination over the Foetus Examined . . .*, in-8, xi, 143 pp.

⁴⁰ James Augustus Blondel, *Dissertation physique sur la force de l'imagination des femmes enceintes sur le fœtus*, traduit de l'anglaise par A. Brun, Leyden, 1737, in-8.

sophical Society at Dublin. A pregnant woman was frightened by a cow which she was milking, knocked down, and struck within an inch of her eye by one of the cow's teats. Her female child, who was now thirteen years of age, had in exactly the same place a piece of protruding flesh resembling a cow's teat, about three and a half inches long, very red, with a bone in the middle of it for about half its length. It was perforated and she wept through it. When she laughed, on the other hand, it would wrinkle up and contract to two-thirds of its ordinary length. "She is as sensible there as in any other part."⁴¹

The power of imagination was also stressed in other connections. Johannes Schmid discussed purgation from imagination and false imagination of melancholy.⁴² Borrichius treated of the force of imagination in the Danish *Acta*, where he also warned against frightening children by horrible sights or threats of punishment.⁴³ T. Bartholinus wrote on fever brought on by imagination,⁴⁴ and Simon Scholtz, Scholz, or Schultzius, a physician of Thorn, on death being so produced.⁴⁵ He also attributed to imagination a black spot the size of his fist which Valentinus Reich found on his breast after dreaming that a giant had hit him with a stone. It did not occur to Scholz that Reich may have hit himself in his sleep.⁴⁶

Sympathy and antipathy were topics which our academicians frequently considered. Georg Sebastian Jung passed on from "a trustworthy person" the story of a girl who could not endure the sight either of a head of cabbage cooked whole or that of a cooked calf's head, but lapsed into a swoon or syncope, if compelled to look at them, "for she did the cooking." But this antipathy was not traced to any allergy or dislike of her job on her part, but to two birthmarks or moles which she showed upon her hypochondria⁴⁷ and which exactly depicted a calf's head and a cabbage.⁴⁸

⁴¹ PT XVI, 334.

⁴² IV-V, 160; IX-X, 41. Schmiedtius in LR.

⁴³ *Acta Hafn.*, III, 48, 51.

⁴⁴ II, 165.

⁴⁵ II, 137. Simon Scholtz in LR.

⁴⁶ II, 138.

⁴⁷ "Puella haec in hypochondriis binos naevos maternos ostendit."

⁴⁸ I, 135. Jung was author of *Malum aureum hoc est Cydonii collectio decorticatio enucleatio et praeparatio physico-medica, ad Academiae Naturae Curiosorum leges et methodum facta*, Vienna, 1673.

Caspar T. Bierling or Vierling, a practitioner at Magdeburg, discussed "various antipathies";⁴⁹ Hannaeus recorded the case of a man who had a singular abhorrence of his own name.⁵⁰ Johannes Paterson Hain of Upper Hungary told of an antipathy to mercury;⁵¹ Franciscus Matthaeus Hertod, provincial physician to the Estates of Moravia, of an antipathy to bread;⁵² Schmid, of a singular antipathy;⁵³ and Joel Langelottus, of a marvelous example thereof.⁵⁴ There are scholia as to various marvelous antipathies,⁵⁵ while C. F. Garmann discussed that between snakes and toads in particular,⁵⁶ and Simon Scholtz treated the sympathy and antipathy between spider and cat.⁵⁷ Borrichius noted a marvelous agreement of eye and ring-finger.⁵⁸ Andreas Cnoeffel, Polish royal physician, gave a sympathetic remedy for scurvy;⁵⁹ Simon Aloysius Tudecius, a physician of Prague, wrote "de cannulis sympatheticis entalibus aliis dictis";⁶⁰ and J. L. Hannemann treated of cure of haemorrhage by sympathetic powder.⁶¹

Occasionally the communications take cognizance of, if not descend to the level of, popular impostors, ignorant practitioners, witches and magicians. There are Scholia concerning women practicing medicine unskilfully,⁶² and Caspar Kölichen was not above reporting as to the pills of an empiric and also those of an old-wife.⁶³ J. M. Fehr, the president of the Academy of the Curious, described a monstrous tumor that came close to withcraft.⁶⁴ Do-laeus recounted the marvelous cure of wounds which had been inflicted by witches,⁶⁵ and also cases of fascination.⁶⁶ Simon Scholtz told of the following magical cure of fever by transplantation. An old-wife took parings of the fingernails and toenails of a woman who was afflicted with tertian fever, tied them in linen to the tail of a tench, and, after breathing on and whispering some words to the fish, released it in the Vistula. The patient was thereby rid of

⁴⁹ II, 207.

⁵⁰ *Acta Hafn.*, V, 15.

⁵¹ II, 118.

⁵² II, 144.

⁵³ IX-X, 47.

⁵⁴ VI-VII, 14.

⁵⁵ I, 134-35.

⁵⁶ I, 137.

⁵⁷ III, 146.

⁵⁸ *Acta Hafn.*, V, 51.

⁵⁹ IV-V, 51.

⁶⁰ IX-X, 118.

⁶¹ *Decur.* II, IV, 55.

⁶² II, 26.

⁶³ *Acta Hafn.*, I, 88; II, 93.

⁶⁴ II, 4.

⁶⁵ VI-VII, 61.

⁶⁶ *Decur.* II, I, 37.

her fever but contracted colic, which was worse, in its place.⁶⁷ Joel Langelottus, physician to the duke of Holstein, noted a transfer of epilepsy from a maid servant to a dog similar to that recounted by Robert Fludd in a case of gout.⁶⁸ Daniel Winckler wrote of death as well as epilepsy being caused by a specter,⁶⁹ and Georg Seger recorded a deadly dream in a haunted house.⁷⁰

Epilepsy, a strange disease which in our previous volumes we have often seen treated by magical procedure, was still a frequent object of observation and discussion. Seger submitted one communication on its being brought on by incautious use of oil of juniper, and another upon its cure by fire.⁷¹ Wedel called attention to lunar periodization of epilepsy;⁷² G. A. Mercklin, Jr., to a case of epilepsy recurring from lesion of the big toe of the left foot.⁷³ Winckler recorded the cure of epilepsy by blindness,⁷⁴ as well as its being caused by a specter. Melchior Fribe told of a marvelous epilepsy, melancholico-hypochondriac and truly ecstatic.⁷⁵ Samuel Ledelius denied that human blood would cure epilepsy,⁷⁶ although he was to discuss the use of human bones against dysentery.⁷⁷ Simon Scholtz adduced an amulet for epilepsy,⁷⁸ and Borrichius noted the use of the heart of a mole in cases of it,⁷⁹ the underground animal being presumably supposed to keep the patient from falling to the ground.

Mysterious cases of melancholy and hypochondria, and of abnormal mentality, also excited the interest of the *Curiosi*. Borrichius called attention to a singular case of melancholy,⁸⁰ and Bierling observed "a wondrous kind of annual melancholy degenerating into mania."⁸¹ Dobrzensky, rector and extraordinary professor at Prague, recorded the miserable death of a hypochondriac from mercury ointment, and suggested an analogy, as of macrocosm and microcosm, between an earthquake of the previous year in the

⁶⁷ III, 89.

⁶⁸ VI-VII, 11.

⁶⁹ VI-VII, 28, 32.

⁷⁰ III, 95.

⁷¹ II, 8, 9.

⁷² Decur. II, II, 148.

⁷³ VI-VII, 77.

⁷⁴ VI-VII, 50.

⁷⁵ IV-V, 81.

⁷⁶ IX-X, 149.

⁷⁷ Decur. II, II, 38.

⁷⁸ IV-V, 42.

⁷⁹ *Acta Hafn.*, IV, 50.

⁸⁰ *Acta Hafn.*, IV, 45.

⁸¹ II, 151.

Tyrol and hypochondriacs.⁸² Hain noted that the excrements of a hypochondriac were all black.⁸³

Alphonse Khonn, who contributed to the *Ephemerides* accounts of the head of a foetus retained for seven years in the womb, of a monstrous birth aborted by marvelous power of the imagination, and *De mola portentosa*,⁸⁴ further published separately in 1671 at Augsburg a translation from the Italian of the book of Paolo Zacchia on hypochondriacal affections.⁸⁵

From Dolaeus we hear of a girl who had been made speechless by small pox but recovered her voice unexpectedly after seven years.⁸⁶ Hertod tells of speechlessness induced by the odor of crabs and which is further explained as a result of the abhorrence of the patient's mother while pregnant to this odor.⁸⁷ Borrichius tells of a boy who had been uneducated all his life but who, as death approached, suddenly became learned and informing.⁸⁸ Georg Hieronymus Velschius or Welsch narrates the detection of pretended fasting by a girl of Augsburg.⁸⁹

Many contributors concerned themselves with alchemical or chemical themes and experiments. Wedel discussed chemical gold;⁹⁰ P. J. Sachs and Hain, vegetable gold as well;⁹¹ Wedel further wrote of oak leaves changed to bronze, and the mutation of Mars into Venus (iron into copper).⁹²

Similarly Isaac Newton, writing at the age of twenty-seven a letter of suggestions to a friend who was about to travel on the Continent, advised him to note "any transmutations out of one species into another, as out of iron into copper," and whether, at Schemnitz in Hungary, "they change iron into copper by dissolving it in a vitriolate water, which they find in cavities of rocks in the mines, and then melting the slimy solution in a strong fire, which, in the cooling, proves (to be) copper."⁹³

⁸² I, 80; II, 66.

⁸³ I, 63.

⁸⁴ VI-VII, 222; IX-X, 22-23.

⁸⁵ LR 33, 874.

⁸⁶ Decur. II, I, 38.

⁸⁷ II, 145.

⁸⁸ *Acta Hafn.*, V, 67.

⁸⁹ III, 35.

⁹⁰ IV-V, *Analecta* ad I, 17.

⁹¹ I, 131; II, 118.

⁹² VI-VII, 119-20.

⁹³ Louis Trenchard More, *Isaac Newton*, 1934, pp. 50-51. See below (note 232) for a similar query made two years earlier by the Royal Society.

Wedel also treated of sal ammoniac, the stone prunella without sulphur.⁹⁴ Elsholtz suggested collecting salt from the air and sulphur from the sun.⁹⁵ Borrichius noted the passage of fire through the pores of a glass vessel without injuring it, water that didn't boil in the midst of boiling water, and blindness brought on by unskilled employment of mercurial water. He further inquired whether volatile salt might be had from birds and fish, whether volatile salt of the human cranium should be given to the sick, and made a chemical examination of the sperm of frogs.⁹⁶ Johann Georg Volckamer (1616-1693) recounted the marvelous distillation of a skull fresh from the place of execution.⁹⁷ He had received his M.D. in 1643 from the University of Altdorf, where he became dean in 1664, and was one of the Latin correspondents of Gui Patin.⁹⁸ It was his son, J. G. Volckamer (1662-1744), a botanist, who published *Flora Norimbergensis* in 1700.⁹⁹ Spirit of rhinoceros horn was mentioned in *Acta Hafniensia*.¹⁰⁰

Dobrzensky regretted that a Jew at Prague, who in 1671 knew how to bring unripe pearls to perfection, had died before he could learn his secret. In the accompanying Scholion, Sachs à Lewenheim cited other authors and an experiment in whitening pearls.¹⁰¹ The Appendix to the volume for the fourth and fifth years of the Ephemerides, with a separate numbering of 303 pages, comprises sixteen tracts, of which the majority are alchemical, including two on phosphorus (isolated in 1669 by Brand of Hamburg), two by Wedel on the volatile salt of plants,¹⁰² and two on *spiritus mundi*.

Strange deaths, injuries and diseases were often the themes of the Observations. Seger described death from neglect of a slight wound in the cranium;¹⁰³ Wedel, a fall from a height unharmed;¹⁰⁴ Frideric Ferdinand Illmer à Wartenberg, ordinary professor at Vienna, a strange headache without any fever which came on

⁹⁴ II, 196.

⁹⁵ VI-VII, 18.

⁹⁶ *Acta Hafn.*, I, 72-73; II, 67-68,

74.

⁹⁷ *Decur.* II, II, 192.

⁹⁸ *Lettres* (1907), 553.

⁹⁹ Pritzel 9850.

¹⁰⁰ *Acta Hafn.*, III, 89.

¹⁰¹ II, 183, and Scholion.

¹⁰² He published a separate *Experimentum chemicum novum de sale volatili plantarum*, Jena, 1675, 96 pp. BN R.27992 bis.

¹⁰³ III, 199.

¹⁰⁴ III, 71.

suddenly and resulted in death in a fortnight;¹⁰⁵ Tudecius, sudden death from excessive laughter;¹⁰⁶ Simon Scholtz, from excessive corpulence.¹⁰⁷ Lachmund discussed an intestinal ulcer familiar to the Brazilians; strange worms in feet, thighs and scrotum; coughing up fragments of bone; the swallowing by an infant twenty-four weeks old of a bit of a spike which stayed in the jaws until the third day; the menstrual mortification of a girl's ears, nostrils and fingers; the growth of a horn on a woman's instep; and a movable bone in the forehead of an adult virgin.¹⁰⁸ He added another observation of a rare headache, and Hannaeus treated the same topic in *Acta Hafniensia*.¹⁰⁹ Schmid recorded cases of hydrophobia hidden for twenty years and of contagious gout.¹¹⁰ The latter theme had already been treated by Simon Scholtz.¹¹¹ Borrichius dilated on the marvelous nature of certain hereditary diseases.¹¹² Gottofredus Schultz had an Observation on manna as a cause of abortion and Wedel, one on incontinence of urine from a cough.¹¹³ Certain men are reported to be afflicted with the same symptoms as pregnant women.¹¹⁴ Salomon Reisel, archiater of the county of Hanover, told of a flame bursting forth from the eye which was bright enough to read by.¹¹⁵ Wedel announced a new cause of lipothymy, syncope and palpitation of the heart.¹¹⁶

We pass on to some examples of cures and remedies. J. G. Riva,¹¹⁷ J. G. Elsner, J. S. Elsholtz,¹¹⁸ and Olaus Borrichius¹¹⁹ all write on restoring the humors of the eye. This subject had been brought to public attention by two letters of Giuseppe Francesco Burrhus or Borri to Thomas Bartholinus, published in 1669, in the second of which he asserted that he had restored the sight to both

¹⁰⁵ I, 68.

¹⁰⁶ IX-X, 125.

¹⁰⁷ II, 87.

¹⁰⁸ IV-V, 173-4-5-6, 178, 180; VI-VII, 184.

¹⁰⁹ *Acta Hafn.*, III, 66.

¹¹⁰ IX-X, 43-44.

¹¹¹ VI-VII, 143.

¹¹² *Acta Hafn.*, IV, 70.

¹¹³ VI-VII, 241; IX-X, 84. LR ascribes both to Schultz.

¹¹⁴ II, 215bis; 216 is omitted.

¹¹⁵ VIII, 28.

¹¹⁶ II, 197.

¹¹⁷ I, 117, De restitutione humorum oculi. Elsner is represented in the accompanying Scholia.

¹¹⁸ VI-VII, 126, De artificii quo oculorum humores restituuntur vestigiis apud veteres.

¹¹⁹ *Acta Hafn.*, I, 69bis, De oculi humoribus excussis redeuntibus non ex adventitio per siphones infuso sed ex depluente a cerebri liquore.

brutes and human beings by squeezing out the humors of the eye and applying a certain water of swallow-wort and a phlegm of iron vitriol.¹²⁰ He also employed a calorific solution of gold extinguishing ignited gold in a golden vessel.¹²¹ Borrichius, however, would restore the humors not by any extraneous infusion but by drawing off liquor from the brain.

Hannaeus told of a boy who was cured of jaundice by swallowing seven or nine lice. But soon worse symptoms developed; his death followed, and a *post mortem* revealed a large colony of lice in his insides.¹²² Dolaeus employed tiger skin to aid delivery.¹²³ Hanne-mann cured burning fever with spirits of wine,¹²⁴ and gave a secret preparation of opium.¹²⁵ J. P. Albrecht found excrement to be of outstanding virtue in dealing with some ailments.¹²⁶ Tudecius cured rheumatism merely by repeated bleeding.¹²⁷ Simon Scholtz informs us of "a miraculous plaster."¹²⁸ Remedies are listed which have been prepared from the urines of various animals.¹²⁹

One is amazed to hear Wedel say that the medical properties of the viper, "once ignored, are employed extensively in our time," since Galen gave elaborate instructions as to the preparation of theriac from the flesh of vipers, while in the sixteenth century Guinther of Andernach recommended oil of vipers, and Brasavola represented the fat of the viper as esteemed by standard authors.¹³⁰ Yet what Wedel has particularly to discuss, passing over other viperine preparations as now better known, is the fat of the viper as a remedy for ophthalmia.¹³¹ He opened his communication with the proverb, *Ubi virus, ibi virtus*, and the assertion that Nature is a beneficent mother and, where she seems to do most harm to humanity, there really offers a supreme remedy, and also has endowed every simple from the threefold kingdom (animal, vegetable and mineral) with excellent virtues, but hidden these from

¹²⁰ *Epistolae duae ad Thomam Bartholinum*, Copenhagen, 1669, in-4. Reviewed in *Philosophical Transactions*, V, 2081-82.

¹²¹ J. D. Major, *Genius errans*, Kiel, 1677, caps. 16, 32.

¹²² *Acta Hafn.*, III, 91.

¹²³ VI-VII, 59.

¹²⁴ *Decur.* II, II, 53.

¹²⁵ *Decur.* II, IV, 15.

¹²⁶ *Decur.* II, I, 81.

¹²⁷ IX-X, 120.

¹²⁸ VIII, 16.

¹²⁹ II, 219, Scholia.

¹³⁰ T I, 170-72; V, 451; VI, 219.

¹³¹ II, 125.

the unworthy, and, in order to the more attract those who explore her arcana, has buried her treasures most safely where their presence is least likely to be suspected. Such personification of nature, emphasis upon secrets, and association of poison with medicine, savor, it is scarcely necessary to comment, more of magic than of science. As for vipers, Paul Ammann, extraordinary professor at Leipzig, goes Wedel one better in the same volume by narrating a cure of malignant fever by eating live vipers.¹³² He again, in the treatise on materia medica printed with his *Supellex botanica* in 1675, told of the case at Saumur in France in 1670, when the patient afflicted with malignant fever swallowed three live vipers and subsequently excreted them in a swollen condition, and regained his health.¹³³

Some marvelous and sensational items are related to anatomy. Seger gives details from the dissection of a two-headed lamb, and from that of a thief aged fifty.¹³⁴ Illmer notes the successful extraction of a dead foetus in a difficult case of delivery;¹³⁵ Goeller offers an observation from the dissection of a monstrous human abortion.¹³⁶ Polisius discusses worms found in the ventricles of the heart;¹³⁷ G. Schultz, worms in the teeth.¹³⁸ Dobrzensky considers the artificial formation of pygmies.¹³⁹ Johann Konrad Peyer made an incursion into the field of comparative anatomy in his Observation on the belly of the stork and a certain affinity with the ruminants.¹⁴⁰ Lucas Schroeck noted differences in the anatomy of man and ape.¹⁴¹ Huldenreich called attention to a liver weighing fourteen pounds;¹⁴² Wurffbain, to a human brain which after death turned into most minute snails.¹⁴³ Lorenzini told of dissecting a torpedo and of the stupefying force of that fish.¹⁴⁴

G. A. Mercklin Jr. recounted a case of precocious teething by a newborn child,¹⁴⁵ while Lachmund recorded the case of a child

¹³² II, 187.

¹³³ *Brevis ad materiam medicam... manuductio*, Leipzig, 1675, p. 160.

¹³⁴ IX-X, 97; VIII, 32.

¹³⁵ I, 49.

¹³⁶ Decur. II, II, 143.

¹³⁷ IX-X, 13.

¹³⁸ IX-X, 187.

¹³⁹ I, 79.

¹⁴⁰ Decur. II, II, 97.

¹⁴¹ Decur. II, I, 61.

¹⁴² VI-VII, 219.

¹⁴³ Decur. II, II, 137.

¹⁴⁴ IX-X, 172-173.

¹⁴⁵ VIII, 47.

of two years who had no teeth as yet.¹⁴⁶ He also observed the existence of a childish skull in an adult male,¹⁴⁷ while Fridericus Ortlob noted an instance of perpetual infancy.¹⁴⁸ Dolaëus reported the cutting of a new canine tooth by an octogenarian.¹⁴⁹

Instances of human beings vomiting forth toads are given by Seger and Vollgnad,¹⁵⁰ while Lucas Schroeck adduces a case of the excretion of a toad,¹⁵¹ and Schmid is authority for vomiting a mole.¹⁵² Living animals are also said to come from abscesses.¹⁵³ Paul de Sorbait saw with his own eyes a live toad issue from an abscess of a vintress who had contracted goitre by drinking cold and dirty water. Paul hazards the conjecture that seminal virtues exuding with the water in the membranes of the neck were the cause of this strange generation.¹⁵⁴

Eating cooked scorpion and salamander without injury is vouched for by Vierling or Bierling,¹⁵⁵ and swallowing a spider harmlessly is attested by Seger,¹⁵⁶ who also writes on eating absurd things.¹⁵⁷ The basilisk is discussed by Wedel and Jaenisius;¹⁵⁸ a hen's egg which contained a serpent, by Scholtz.¹⁵⁹ Lachmund speaks of bats with tails, of tortoises which, it is popularly supposed, cannot leave their shells, of an egg retained by a goose from February to September, of birds unnaturally white, and of a snow-white mouse.¹⁶⁰ Joh. Ludovicus Witzel treats of white crows.¹⁶¹ Wurff-bain expatiates on the incombustibility of the salamander;¹⁶² Elsholtz, on blinding swallows and restoring their sight;¹⁶³ Borrichius, on a long-lived flea.¹⁶⁴ Wedel holds that scorpions are not generated from clover.¹⁶⁵ Velschius quotes the *Pinacotheca* of Ludwig Gue-tius concerning a black metallic powder from the maw of an

¹⁴⁶ VI-VII, 183.

¹⁴⁷ VI-VII, 180-81.

¹⁴⁸ IV-V, 198.

¹⁴⁹ IX-X, 134.

¹⁵⁰ II, 56; I, 103.

¹⁵¹ IX-X, 165.

¹⁵² VIII, 90.

¹⁵³ II, 103, Scholia.

¹⁵⁴ II, 103.

¹⁵⁵ II, 205-6.

¹⁵⁶ IV-V, 85.

¹⁵⁷ IV-V, 143.

¹⁵⁸ III, 128 and Scholia.

¹⁵⁹ III, 190.

¹⁶⁰ IV-V, 182, 183, 187, 184, 185.

¹⁶¹ III, 57.

¹⁶² Decur. II, II, 60, Scholia. He published an enlargement of it under the title, *Salamandrologia* . . . , Nürnberg, 1683, in-4: BM 462.a.20.

¹⁶³ VIII, 18.

¹⁶⁴ *Acta Hafn.*, IV, 52.

¹⁶⁵ III, 79.

ostrich.¹⁶⁶ But others say that coins and pièces of metal devoured by ostriches are either excreted whole or remain entire in the crop, and Velschius himself was never able to test by experiment whether the ostrich was capable of digesting iron or copper. Vierling regards the milking of a cow by a snake as a notable zoological phenomenon,¹⁶⁷ and Seger interests himself in the hearing of fish.¹⁶⁸ Wedel is astounded at a face wound inflicted by a deer.¹⁶⁹ Hanaeus reports the existence of crab's eyes signed with the name of Christian V, king of Denmark.¹⁷⁰ Illmer writes on drinking chocolate sweetened with powdered dormice in place of sugar.¹⁷¹ Elsner treats of viviparous eels, and the nature and preparation of spermaceti.¹⁷² The theme of J. D. Major, professor of anatomy and botany at Kiel, is tearing out the heart while the animal is still living.¹⁷³ We are informed that there are insects and worms of diverse species and figures corresponding to the diversity of herbs and plants.¹⁷⁴

Although we have already heard of vegetable gold, of monstrous plants as well as animals, and of use of herbs as well as parts of animals as remedies, there appears on the whole to be more notice taken of animal than of plant marvels in the *Ephemerides* and *Acta*. A few examples from the vegetable kingdom have not yet been mentioned in other connections. Martin Bernhardt à Berniz, court physician in Poland, records a monstrous fungus in a beehive, as well as the monstrous claw of a crab and the presence of a stone in a widow.¹⁷⁵ The cinnamon tree¹⁷⁶ and the herb, bone-breaker,¹⁷⁷ are not forgotten. The effect of the latter, however, was to soften rather than break the bones of animals which ate it. In the Scholion is the statement from a letter of Georg Reichvoein to Simon Pauli, that the animal can be cured by offering it the bones of another animal which had died from eating the herb. To match the salamander in the animal kingdom, Volckamer af-

¹⁶⁶ III, 37.

¹⁶⁷ II, 155.

¹⁶⁸ IV-V, 145.

¹⁶⁹ IX-X, 168.

¹⁷⁰ *Acta Hafn.*, III, 65.

¹⁷¹ III, 40.

¹⁷² I, 119, 136.

¹⁷³ VIII, 10.

¹⁷⁴ II, 190, Scholia.

¹⁷⁵ II, 54, 100-1, 139.

¹⁷⁶ *Acta Hafn.*, III, 90.

¹⁷⁷ T. Bartholinus, *De herba ossifraga*, I, 38, and Scholion.

firms the existence of an incombustible umbilicated plant.¹⁷⁸ Velschius writes of a cardioid lignum aloes, of sassafras wood from a different root, of Japanese tobacco, and of "some American fruits not yet described."¹⁷⁹

The wonders of the mineral kingdom do not go unheralded. Velschius remarks the existence of an aphrodisian agate,¹⁸⁰ and of "pregnant stones, gems within gems."¹⁸¹ Dolaeus lists the virtues of the bloodstone or *Haematites*;¹⁸² Elsholtz is interested in belemnite.¹⁸³ Borrichius writes of the odor of gems, and of the generation of stones in macrocosm and microcosm.¹⁸⁴ Salomon Reisel reports finding a petrified serpent in the stomach of a stag.¹⁸⁵ Schenck and Dobrzensky pass on the news from Padua of the petrified brain of an ox.¹⁸⁶ Volckamer tells of a bezoar stone from the larger apes of Borneo;¹⁸⁷ J. D. Major, of a bezoartic goat-horn.¹⁸⁸ He also discusses the much debated problem of the generation of amber,¹⁸⁹ while Elsholtz treats of fossil amber.¹⁹⁰

In addition to the periodical *Ephemerides* containing contributions from the members of the Academy, we have books by them which, although not published by the Academy, aimed to realize its purposes and ideals. Thus Johann Lorenz Bausch, its founder and first president, in the last year of his life issued two treatises on the bloodstone and the eagle-stone after or according to the mind or spirit of the Academy of those Curious as to Nature.¹⁹¹ And Lucas Schroek, another member of the Academy and contributor to its *Ephemerides*, wrote a History of Musk according to the standards of the Academy.¹⁹² Similar works by Wurffbain and Paullini have been noted in our twenty-fourth chapter on Natural History.

¹⁷⁸ Decur. II, II, 61, Scholia.

¹⁷⁹ I, 151, 152, 153, 159.

¹⁸⁰ I, 156.

¹⁸¹ III, 32.

¹⁸² VI-VII, 62. Lapis Haematites or Crocus Martis (Fe_2O_3).

¹⁸³ IX-X, 87.

¹⁸⁴ *Acta Hafn.*, V, 37, 81.

¹⁸⁵ I, 14.

¹⁸⁶ I, 26, 130.

¹⁸⁷ Decur. II, II, 189.

¹⁸⁸ VIII, 1.

¹⁸⁹ *Acta Hafn.*, II, 122.

¹⁹⁰ IX-X, 87.

¹⁹¹ *Schediasmata bina curiosa de lapide haematite et aetite ad mentem Academiae Naturae Curiosorum congesta*, Leipzig, 1665. Already discussed in our ninth chapter.

¹⁹² *Historia moschi ad normam Academiae Naturae Curiosorum*, Augsburg, 1682, in-4, 224 pp.

Philip Jacobus Hartmann, Ph.D. and M.D., of the Academy of the Curious as to Nature, in an Exercise as to the generation in the air of minerals, vegetables and animals,¹⁹³ discussed prodigious rains and their causes but rejected the arguments of those who held that animals or vegetables were so generated. He further affirmed that there was no instance extant of harm coming from a rain of vegetables. Nature cannot produce plants or animals except from seed, nor are the claims of the chemists to work such miracles valid. Hartmann produced midges from May dew, which he collected from various vegetables, but he could see their sperm in it smaller than grains of pepper, and no other insect was so generated. A rain of pearls has been attributed to witchcraft, but Hartmann reserves the question of the generation of minerals in the air to another treatise.

It should be kept in mind that the German Academy was primarily medical and composed of physicians, whose observations were likely to consist of odd and exceptional incidents connected with their practice, and especially with childbirth. Many of their observations, it is true, extended into the related fields of anatomy, botany, chemistry, mineralogy and zoology. But they seldom deal with mathematical problems, experiments in physics, or astronomical observations; less so, indeed, than the close relationship which had existed between medicine and mathematics, and medicine and astronomy, in previous centuries might lead one to expect; much less so than the records of such scientific societies as the *Lincei* and *Accademia del Cimento*, or Royal Society and *Académie des Sciences*. Without the guidance of mathematical method or the restrictive regularity of mechanical experimentation, and dealing with the more complex organic and vital phenomena, the German academicians were more liable to yield to credulity, imagination, and the psychic,—to display more features of the magic of the past and fewer of the experimental science of the future. The same distinction still prevailed in the eighteenth century in the French *Encyclopédie*, whose articles in the fields of medical and biological science were much more tinged by the occult and super-

¹⁹³ Phil. Jac. Hartmann, *Exercitatio lium et animalium in aere*, 1689: BM 536.f.17.(8.), 53 pp.

stitious than were those in the fields of physics and mathematics.¹⁹⁴ Communications to the *Miscellanea* were sometimes received from persons outside of Germany, but their interests were usually similar to those of the *Curiosi*.

Such interests, however, were not peculiar to the German *Academia Naturae Curiosorum*. When the Grand Duke of Tuscany visited the English Royal Society in 1669, he was shown with pride and viewed with interest

the greatest rarities: . . . an ostrich, whose young were always born alive; an herb which grew in the stomach of a thrush; and the skin of a Moor, tanned, with the beard and hair white. But more worthy of observation than all the rest is a clock whose movements are derived from the vicinity of a lodestone, and it is so adjusted as to discover the distance of countries at sea by the longitude.¹⁹⁵

Very similar were the contents of the Danish royal museum at Copenhagen nearly thirty years later when the catalogue of 1696 listed *inter alia* Egyptian mummies, a foetus turned to stone which a Frenchwoman had carried for the space of twenty-eight years, a stone weighing twelve and a half ounces taken from a human bladder, embryos of one and seven thumbs length, a dried liver, the hairy hand of a wild man from India,¹⁹⁶ monstrous fingernails grown by a youth of Copenhagen, hairs with skin torn out by an angry hand, sandals made of human skin, the ear of an elephant which measured three and a half by two and a half feet, various bezoardic stones both oriental and occidental, a salamander, and two hands of a siren.¹⁹⁷

Back in 1639 Edward May had published *A most certaine and true relation of a strange monster or serpent found in the left ventricle of the heart of John Pennant Gentleman of the age of 21*

¹⁹⁴ Lynn Thorndike, "L'Encyclopédie and the History of Science," *Isis*, VI (1924), 361-86, especially p. 376 *et seq.*

¹⁹⁵ Quoted by Louis T. More, *Isaac Newton*, 1934, p. 94, from Weld's *History of the Royal Society*, I, 219. More adds: "The exhibits are enumerated in order to show that science was

still in the period of credulous acceptance of the marvelous."

¹⁹⁶ Or perhaps an American Indian, "*—manus villosa hominis silvestris Indici*".

¹⁹⁷ The passage has already been incidentally noted in a previous volume: T VI, 269, note 64.

yeares, with pictures of the same and a statement signed by witnesses.¹⁹⁸

In Italy in 1633, Leo Allatius, in his volume on illustrious men at Rome during the three years preceding, had listed among more than a dozen works by Alsario della Croce, a disputation of some 47 pages on a wonderful worm which came out of one nostril as well as a treatise on the envy and witchcraft of the ancients.¹⁹⁹

Fortunio Liceto, in the decade from 1640 to 1650, published seven volumes containing his answers to sets of queries made by famous men in letters to him.²⁰⁰ Among the themes so discussed are the motion of the heart, the origin of the nerves, the brain mitigating the fervor of the heart, the powers of imagination, Providence, a gryphon with a halo, an earthquake, a marvelous enigma, an enormous catastrophe of disease, a woman with a hotter constitution than men. In the seventh set the questions become theological.

The first issue of the *Journal des Sçavans* closed with a letter from England of November 12, 1664, concerning a monstrous birth with two heads, four arms and hands, one trunk, and two feet. The twins were christened Mary and Martha, but lived only two days.²⁰¹ Boyle's monstrous calf was noticed later in the same volume.²⁰² In J. B. Denis's *Recoeuil des memoires et conferences* presented to the Dauphin is a letter about an infant with a beard and other parts like a man of thirty, a letter anent and picture of a merman, and a notice and picture of two monstrous births at Paris and Strasbourg.²⁰³ In 1675 the *Journal des Sçavans* extracted from the Registers of l'*Académie des Sciences* the report of Perrault

¹⁹⁸ London, 1639, in-4, 38 pp. BM B.426 (2.).

¹⁹⁹ Leo Allatius, *Apes Urbanae sive de viris illustribus qui ab anno MDCXXX per totum MDCXXXII Romae adfuerunt ac typis aliquid evulgarunt*, Rome, 1633. I have used the Hamburg, 1711, edition, see p. 356 et seq.

Vincentius Alsarius Crucius is described by Allatius as a Genoese who became professor of medicine in the university at Rome. There is a copy

of his *Disputatio de verme admirando ex altera narium egresso*, 1610 in BN Td¹¹².5, but not of *De invidia et fascino veterum*, printed at Lucca.

²⁰⁰ *De Quaesitis per epistolas a claris viris responsa*, Bologna, 1640, in-4, 326 pp. And so on. All in the BN catalogue.

²⁰¹ JS, I, 19-20.

²⁰² JS, I, 229.

²⁰³ Of 1672, with JS III, but with separate pagination: pp. 14-15, 103-9, 148.

concerning a young woman of twenty-two or twenty-three who in a convulsion vomited 28 or 30 intestinal worms in his presence, while he was assured that usually she vomited more than a hundred at a time.²⁰⁴ In 1677 the *Journal* gave "a prodigious experience with regard to fire," of an English chemist "Richarson" who chewed live coals and held red hot irons in his hands.²⁰⁵ And no less a personage than Leibniz contributed to the issue of July 5, 1677, an account of a roebuck with a coiffure as well as horns.²⁰⁶ The case of an infant who remained for twenty-six years outside of the womb in the belly of the mother and was alive for twenty of them was reported from Toulouse by François Bayle, M.D., and discussed at some length by Pierre Rainssant, professor of medicine at Reims.²⁰⁷ In the following year Bayle published a separate work on it.²⁰⁸ In the year after that, the *Journal* noted a monstrous cat and a monster in a friar.²⁰⁹ In 1681, however, the account of a prodigious egg laid by a hen at Rome was prefaced by a statement that the *Journal* was careful not to print the first reports it received of such phenomena, and that last year the news of a pretended monster had been proved false, as the editor of the *Journal* had suspected that it would be. Since, however, persons of the first quality like Madame la Grand' Duchesse and the papal nuncio had confirmed the report of the egg, the *Journal* published it, with a picture showing that the shell was marked with several stars rather than the figure of a comet as was popularly believed.²¹⁰ Other accounts of monsters continued to appear in the *Journal*,²¹¹ which furthermore frequently gave extracts "containing some singular observations" from the "Journal d'Allemagne ou Ephemerides des Curieux de la nature." On April 12, 1688, it reviewed a *Historia medica de acephalis* by Marcus Mappus, a physician of Strasburg, in which the belief in headless men was dismissed as a fable.²¹²

It was from reading in the Transactions of the Royal Society that an English cook had cured his warts by rubbing them with the hand of his dead master, that Samuel Ledelius was moved to add

²⁰⁴ JS IV, 150-51.

²⁰⁵ JS V, 53-55, 217-26.

²⁰⁶ JS V, 205-7.

²⁰⁷ JS VI (1678), 305-7, 348-57.

²⁰⁸ Reviwed, JS VII (1679), 24-26.

²⁰⁹ JS VIII (1680), 222, 336.

²¹⁰ JS IX (1681), 25-26.

²¹¹ JS IX, 219-21, 278-80; X (1682) 89, 313-14.

²¹² JS XV, 535-39.

a cure of scrofula by the same method. Doctor John Beale "made an outstanding experiment of removing extreme and perilous scrofula by application of the hand of a dead man." The patient felt as if a cold jet had struck his heart and almost fainted. Ledelius goes on to suggest a connection between this cure and the touching for scrofula by the kings of France, England and Spain, and the Hapsburgs. He adds a powder of his own composition which he found effective during his early years of practice at Sagan, where cases of scrofula were not infrequent. Among its ingredients were sea sponge, *aqua scrophularis*, *vincetoxicum*, ginger, cinnamon, pepper, *sal gemmae*, and bone of cuttle fish. He administered it daily from full moon to new moon with great success.²¹³

It has also been said that the Proceedings of the Royal Society in Boyle's time abounded in "papers on the medicinal power of gems and the astrological influences of the planets as physical problems worthy of the new experimental methods of inquiry."²¹⁴ Similarly it has been recognized that many of the members of the Royal Society in the seventeenth century "were merely dilettantes seeking amusement," and that the early records of the Society are "a weird agglomeration of trivialities and discoveries which the attrition of subsequent investigation has shown to be of basic importance."²¹⁵

In the first volume of the *Philosophical Transactions* of the Royal Society in 1665, are communications from Boyle concerning a "very odd monstrous calf" and the monstrous head of a colt.²¹⁶ Also some "observations and Experiments upon May-Dew," which would putrefy in the shade but not in the sun, and the killing of a rattlesnake in Virginia in July, 1657, in less than half an hour by holding bruised pennyroyal or dittany to its nose, and the additional observation that no rattlesnakes are seen where this herb grows.²¹⁷

²¹³ Decur. II, Ann. II (1684), 141. See PT I, 208, for Beale on removing warts by the touch of a dead hand.

²¹⁴ P. P. Wiener, "The Experimental Philosophy of Robert Boyle," *Philosophical Review*, 41 (1932), 594-609, at p. 595. Apparently most of this remained unpublished. I did not

note many such "papers" in PT.

²¹⁵ *The Diary of Robert Hooke*, edited by Henry W. Robinson and Walter Adams, London, 1935, p. xx.

²¹⁶ PT I, 10, 20-21, 85-86.

²¹⁷ PT I, 33-36, 43, 78. The observations concerning May-dew were also included in JS I, 214-16.

Secrets are mentioned every now and then, such as an admirable secret, not yet revealed, to keep ships from being worm-eaten. The Portuguese build their ships of hard wood and scorch them, while a Londoner suggests the use of pitch.²¹⁸ A letter from Steno reports that a knight named Corvini assured him of the following experiment with a salamander which he had imported from the Indies. When Corvini threw it into the fire, it soon swelled up and vomited a quantity of thick slimy matter which quenched the neighboring coals. As soon as they rekindled, the salamander put them out again in the same way, and by this means saved itself for two hours, when Corvini removed it for fear it could not survive much longer. It lived for nine months afterwards, although for eleven months it had no other sustenance than what it got by licking the earth on which it was brought from the Indies, and which it moistened with its urine, as the earth dried up. When Corvini substituted Italian soil, the salamander expired in three days time.²¹⁹ New teeth crop out in a man of eighty-one and a woman of seventy-five.²²⁰

Monstrosities continued to be recorded in subsequent volumes. A monstrous birth was in the form of an ape with a mass of flesh over its shoulders like a little cloak, because the mother had seen an ape thus clothed upon the stage, when she had gone five months with child. Passing over two monstrous sheep, we note a headless child which lived for four days, thus refuting the theory of Descartes that the pineal gland is the connection between mind and body. Or we hear of hailstones eight, nine and twelve inches in circumference and of 96 stones in a boy.²²¹ Somewhat fantastic experiments also continue, such as Hooke's preserving animals alive by blowing air with a bellows through their lungs, or Dr. Richard Lower's making a dog draw its breath "exactly like a wind-broken horse."²²² Yet along with such trivialities are announced Mariotte's discovery of the blind spot by experiment, and Pecquet's showing,

²¹⁸ PT I, 190.

²¹⁹ PT I, 377-78.

²²⁰ PT I, 380-81.

²²¹ PT II, 479-82. See V, 1188-89 for two monstrous births; 2096-98 for

monstrous twins; 2158-59, for two petrifications in human bodies.

²²² PT II, 539-40; 544-46, "as it was devised and experimented by Dr. Richard Lower."

also by experiment, that it is in the retina, not in the optic nerve.²²³

How British scientists reacted to the publication of the German physicians may be further illustrated by a review that appeared in *Philosophical Transactions*²²⁴ of the volume for the years 1673 and 1674 of *Ephemerides medico-physicae Germanicae*.²²⁵ The reviewer states that it contains 210 observations, "among which not a few seem considerable and uncommon." For example: *menses* coming at eight and nine years of age; a prince that lived a long time despite great and dangerous diseases; a preservation from drunkenness by the gaping of a suture of the head; a case of scurvy cured by a dog's licking the parts affected, and then the cure of the dog, which had become "altogether scabby," by use of *Mercurius dulcis*; two men troubled with haemorrhoids from youth to the ages of eighty and ninety respectively; stone in the bladder cured by use of an oil from black flints "such as we strike fire with"; fomentations made with a decoction of ants, "very anti-paralytical"; a girl of eight who greedily devoured "a great store" of mortar without other apparent ill effect than paleness; a man at Prague who ate a whole live hog piece-meal with the bristles on; and a Bavarian prince who not only was able to lift a weight of 340 pounds but also to "throw it a considerable distance." Before such science, magic might well hang its head and take a back seat.

As for topics considered by the members of the English Royal Society, its contemporary historian, Sprat, lists along with such practical or would-be practical matters as growing potatoes, planting verjuice grapes in England, brewing beer with ginger instead of hops, and making wine from sugar canes, and along with scientific subjects such as the manner of the circulation of the blood in fish, strata seen in a well at Amsterdam and in diverse cliffs, a report of two new stars observed in 1666, one in Andromeda, the other in Cygnus, and both in the same place where they appeared sixty years before and had not been seen since, the following more curious and marvelous topics. A way of turning water into earth, a reported rain of fish and frogs, that silk worms in Virginia are not hurt by thunder, of swallows living after they had been frozen under water,

²²³ PT III, 668-69.

²²⁴ PT XI, 742-44.

²²⁵ *Annus IV & V, Francof. & Lipsiae, 1676.*

of barnacles and solon geese, of several monsters, and of sympathetic cures and trials.²²⁶ For, as Sprat remarks later, "there are many qualities and figures and powers of things that break the common laws and transgress the standing rules of nature."²²⁷ Even in the early eighteenth century Woodward was expelled from the Council of the Royal Society for refusing to apologize for remarks he had made reflecting upon Dr. Hans Sloane who had stated that gallstones caused colic, which Woodward denied.²²⁸

On March 27, 1686, Halley as secretary of the Royal Society wrote to Ashe of the Philosophical Society at Dublin:

Your new method of demonstrating the knottiest Propositions of Euclid, your new-invented Dial, your Experiments of Injections of Liquors into Animals, and the account of your mathematical Girl, are things that will be very acceptable to us: as likewise whatsoever, whether Natural, Artificial or Mathematical Curiosity comes before you.

On May 27 of the same year he acknowledges the receipt from Molyneux of the same Irish society of

the figure of the Horny Girle, which is certainly a most extraordinary curiosity, and which I belive very much puzzles the Physicians to account for; wee are made to belive we shall see her here at Bartholomew faire.

On July 9 he writes to yet another correspondent:

I have this day seen a great curiosity viz a Calicoe shirt brought from India, which is wove without a seam all of one piece, which I should have thought impossible had I not seen it. It explains the Scripture relation of our Saviours coat which was without seam.

On November 13 he writes to the noted mathematician Wallis:

The child you mention to have seen with 6 fingers on a hand & as many toes on each foot, is a great curiosity, especially if they be so contrived that the hand be not therby made less fit to do its office. Nor is the quantity of Water found in the Dropsicall maid less prodigious, it being hardly conceavable how the Muscles of the Abdomen should be distended to so great a Capacity.

²²⁶ Tho. Sprat, *The History of the Royal Society of London*, 4th edition, 1734, pp. 191-99.

²²⁷ *Ibid.*, p. 214.

²²⁸ L. T. More, *Isaac Newton*, 1934, pp. 537-38.

A little later in the same letter he mentions a dwarf only 16 inches high "said to have been presented lately to the French King." The next year in another letter to Wallis he tells somewhat sceptically of "a very odd relation of an Hermaphrodite" at Toulouse. In 1696 Halley writes to Hans Sloane concerning a monstrous birth from a greyhound of which Wallis had informed the Society.²²⁹

Some further idea of the stubborn survival of such notions and traditions, and of the half credulous, half sceptical attitude which was maintained towards them may be had from the questionnaires sent out to different parts of the world by the Royal Society. Among 38 questions addressed to correspondents in Surat and other parts of the East Indies the following may be noted. 1) Whether diamonds and other gems grow again after a few years in the mines whence they have been dug? 5) Whether in Sumatra there is a fountain of medicinal oil? 6) "What is the opinion of the more inquisitive men in those parts of Amber-gris?" 8) Whether on the coast of Coromandel, where hot winds blow from landward from 8 A.M. to 4 P.M., earthen bottles containing well-water or other potable liquor, left all day long in the scorching heat, are found at 4 P.M. to contain a drink cooler "than any depth of cellerage with us can make it? And whether, on the contrary, the bottles being" left in the air during the cool sea-gales, "which come in after the said hour, and continue all night till 8 in the morning to the refreshment of all creatures, the liquors grow hot and unfit for drink?" 13) Whether lignum aloes is the wood or root of a tree? 15) Whether there is a wood in Java that smells like human excrement? 16) Whether in the Molucca Islands there is a red wood which burns, sparkles and flames without being consumed; "yet may be reduced to powder, by rubbing between one's fingers?" 17) Whether there is a plant from which the falling leaves turn into butterflies? 18) Whether there is a poison that kills by its odor, and yet the smell is scarcely noticeable? 19) Whether it is true that human ordure taken internally is the only antidote thus far known against the "famous and fatal Macassar-poyson?" 23) "Whether the camphire of Borneo be not the exsudation or gum of

²²⁹ E. F. MacPike, *Correspondence and Papers of Edmond Halley*, 1932, pp. 61, 64, 67, 70, 71, 81, 98.

a tree?" 24) Whether the Indians can so prepare the stupefying herb known as *Dutroa* or *Datura* that it will kill a man who has eaten it long afterward at a specified time? 25) Whether there is so great an antipathy between the betel-nut and the fruit called Durion that a few leaves of the former will rot "a whole shop-full of Durions?" And on the other hand, whether those who are oversurfeited from eating Durions may obtain instant relief by "laying a leaf or two of Betele upon their breasts or stomachs?" 27) Whether there are two kinds of the tree called *Arbor triste*, one shedding its flowers at sunrise and the other at sunset? 30) Whether shell-fish which in these parts are plump at full moon and lean at new moon, are just the opposite in the East Indies? 33) "To inquire after the fish call'd caballa, said to be very powerful in stanching of blood." 34) Whether there are oysters or other shell-fish weighing 300 pounds near Java? 35) Whether in Malacca there sometimes grows in the stomach of an animal like the porcupine a stone called *Pedro Porco* "esteemed for its cordial virtue above bezoar?" 37) "Whether the rhinoceros have such an antipathy against elephants as is commonly related!"²³⁰

The Inquiries for Egypt, by Thomas Henshaw Esq., published in *Philosophical Transactions*,²³¹ are largely concerned with what truth there is in a number of old statements and beliefs. 3) "Whether the earth of Egypt, adjoining to the river Nile, preserv'd and weigh'd daily, keeps the same weight till the 17th of June and then grows daily heavier with the increase of the river?" 4) Whether deaths from the plague cease after that day? 9) Whether the ichneumon can kill a crocodile by "skipping into his mouth and gnawing his way out?" 10) Whether there are on the banks of the Nile talismans or astrological images which the crocodiles cannot pass? 13) Whether legs and arms still continue to stand out of the ground on Good Friday? "And how that imposture is performed?" 14) "Whether children born there in the eighth month do usually live, contrary to what is believed to happen in other countries?"

Of 21 Inquiries for Hungary and Transylvania made by the Royal Society, and which deal chiefly with the mines there, several are

²³⁰ *Philosophical Transactions*, II, (1667), 415-19.

²³¹ PT II (1667), 470-72.

of an alchemical character: 9) Whether in the mines of gold, silver, copper, iron, lead, there be generally found quicksilver and sulphur? 10) Whether no quicksilver at all is found in the copper mines of Herren-ground? 16) "Whether the iron that is said to be turned into copper by the vitriolate springs at Chemnitz . . . do after that transmutation or precipitation contain a pretty deal of gold?" 30) Whether in places near the gold mines the leaves of trees are gilded? Other queries concern marvelous streams and bodies of water: 13) a river said by Busbekius to be so hot, and yet full of fish, that one would expect them to be boiled; 15) an Avernus exhaling such poisonous steams that birds flying over it fall down stupefied or dead; 19) a great lake in Moravia which had mysteriously disappeared. Finally, 18) "Whether they find trees or any other bodies in the solid salt of their salt-mines?"²³²

Of twenty-two queries addressed to Hevelius at Danzig, one asked what amber was, another whether swallows lived in the winter under the ice on the surface of bodies of water, and whether there were subterranean passages between the maelstroms in the Sea of Norway and Bodnick Bay. Hevelius replied that amber was a kind of fossil pitch or bitumen; that fishermen affirmed that swallows hibernated under ice, but that he had never seen it himself; and that Scheffer asserted the existence of such passages, but on hearsay evidence.²³³

Dr. Stubbes confirmed the observation of Oviedo that lice "leave the Spaniards as they go to the Indies . . . and meet them again in the same latitude in their return."²³⁴ The explanation was given that they began to sweat excessively as they approached the tropics and thus drowned the old lice, while the perspiration did not lodge in the pores long enough to produce any new vermin by spontaneous generation. But

In their return, the sweat lodgeth longer in the pores and habit of the body, and the particular forms or ferments, being exalted and unloosen'd and put into activity, shape out those creatures, and so they breed them.²³⁵

²³² PT II (1667), 467-69.

²³³ PT I, 344-50.

²³⁴ Another common version of this legend was that the lice disappeared

at the line or equator, and returned when one recrossed it northward.

²³⁵ PT III (1668), 720.

A French Natural History of the Antilles affirmed that *l'herbe aux flesches*, "being stamped," would cure wounds made with poisoned arrows.²³⁶ The fruit of the mancenille tree would kill anyone who ate it except crabs; the touch of a juice from its bark made the skin swell and blinded the eye for several days; even its shadow made the bodies of those resting under it swollen; and meat boiled over a fire of its wood burned the mouth and throat.²³⁷ Dr. Stubbes, in a later communication, remarked:

About the Manchinel-Tree I shall only say, it is a wood of an excellent grain, equalling the Jamaica-wood, but large to four foot diameter. The Spaniards turn it into beds, and the English usually floor their rooms with it in Jamaica; yet it is as malignant, I am told, as 'tis described.²³⁸

The skin of the animal called Tatou (armadillo) was bulletproof and cured deafness and earache.²³⁹

Mad dogs received repeated attention in the sixteenth volume of *Philosophical Transactions*. By royal command, Sir Robert Gourdon contributed to the Royal Society "A Receipt to cure mad dogs or men or beasts bitten by mad dogs." For beasts one was to take a handful each of agrimony roots, primrose roots, dragon roots, single peony roots and leaves of box; two handfuls of the Starr of the Earth; one ounce each of black of crabs' claws and Venice treacle. These were to be beaten and bruised together, boiled in a gallon of milk until the half of it evaporated, put unstrained in a bottle, and administered three or four spoonfuls at a time for three mornings before new and full moon. The animal was to be bled a little the day before the medicine was given. For human use the decoction was to be infused in two quarts of strong white wine for at least twelve hours, strained, and taken a gill at a time evening and morning for three days preceding the new and the full moon.²⁴⁰

Another communication was made by Sir Theodore de Vaux, Knight, from the papers of Theodore Turquet de Mayerne (1573-1655).²⁴¹ First seven diseases of dogs were distinguished: hot

²³⁶ *Philosophical Transactions*, III (1668), 636.

²³⁷ *Ibid.*, 636-37.

²³⁸ *Ibid.*, III, 706.

²³⁹ *Ibid.*, 637.

²⁴⁰ PT XVI, 298.

²⁴¹ PT XVI, 408-10.

madness in which they attack every thing and can hold out but four days; running madness, when they attack only other dogs and may live for nine months; *la rage mue*, which is in the blood; falling madness, a sort of epilepsy having its seat in the head; blasting or withering in the bowels which shrivel up; a sleepy sickness from little worms in the mouth of the stomach; and rheumatic disease with swelling of the head and yellowing of the eyes. Only the first two of these were properly madness and incurable. In the other five the dog won't eat and, unless remedies are applied, dies of hunger after eight or nine days without hurting anybody. "The first two are caught by the breath of dogs being together, as is the plague among men; the latter are likewise contagious but curable."

Four recipes follow. "A never-failing remedy for the bite of a mad dog by Sir Theodore Mayern" consists of equal portions of Virginia snake-root and flowers of St. John's wort gathered in their prime and finely powdered. Another prescription is of rue, London (or better, Venice) treacle, garlic, fine tin filings, taken in white wine or ale after fasting three hours, with the dregs bound on the wound and renewed every twenty-four hours. "This remedy I have given many times by Sir Theodore Mayern's direction, and I have never found it to fail." A simpler cure is to pluck the feathers from the breech of an old cock and apply them severally to the bite or bites. If the dog was mad, the cock will die and the patient recover. If the cock doesn't die, the dog wasn't mad. The last recipe is the most complex. First the victim is to be plunged fasting as soon as may be nine times into the sea. Then the bite is to be washed in lye of ashes of oak wood and urine, and a cataplasm applied of London treacle, hedge garlic, rue and salt. Next one takes of dried rue and *scordium* two drams each, one and a half of Virginia snake-root, three of flowers of St. John's wort, four drams each of tin filings and garlic, and an ounce of London treacle. These are beaten and mixed all together and enough syrup of lemon added to make an electuary of four and one half ounces, which is to be divided into nine equal parts of a half ounce each and taken one daily, followed by a small draught of good strong ale, a walk, and not dine for four hours.

Despite all these remedies and sure cures, a subsequent issue of the *Transactions* could only record the death of a child of three who was bitten by a mad dog. He grew delirious and soon "the malignity had made so virulent an impression upon the animal spirits," that he made signs as if to bite, his voice became like the bark of a dog, he foamed at the mouth, and died.²⁴²

At the end of a long account of a case of hydrophobia contained in a letter from York of March 26, 1683 to *Philosophical Transactions*,²⁴³ in which the wound inflicted by the dog had healed and the victim had forgotten all about it, Martin Lister (1638?–1712) came to two conclusions: first, that some organic parts of the patient's body were "transformed into or affected after the nature of a dog;" second, that his spittle was envenomed, probably by that of the dog.

We turn for a moment to a bit of wholesome scepticism. Leeuwenhoek, in a letter of April 5, 1697, to the Royal Society, wrote very sceptically concerning a German at Amsterdam who claimed to work great cures by applying a sympathetic powder to the patient's urine, but could give no satisfactory physiological or anatomical explanation how it could operate at a distance. A married couple known to Leeuwenhoek died of consumption despite the promise of a cure by this powder made to them by this empiric.²⁴⁴

George Sarton has recently written:

The revolution completed by the middle of the seventeenth century implied at least three things: the experimental method, the sceptical or critical spirit, rationalism. The academies were extremely helpful in the development of these, chiefly the first two.²⁴⁵

We may agree that the academies helped to foster the experimental method, but the specific cases which we have noted show that their spirit was curious and credulous rather than sceptical and critical.

Marvels and monstrosities were relished as much, if not more,

²⁴² PT XVIII, 24-25.

²⁴³ PT XIII, 162-70.

²⁴⁴ PT XIX, 518-21.

²⁴⁵ "Boyle and Bayle: the Sceptical Chemist and the Sceptical Historian," *Chymia*, III (1950), 155.

by the general reading public, as a few English examples will illustrate. In 1660 appeared the following account of the strange gathering of frogs and toads in Gloucestershire:

Strange and True Newes from Gloucester or a Perfect Relation of the Wonderful and Miraculous Power of God shewed for injustice at Fairford, betwixt Farrington and Scicester; where an innumerable company of Froggs and Toads (on a sudden) over-spread the Ground, Orchards and Houses of the Lord of the Town, and a Justice near adjacent: and how they divided themselves into two distinct Bodies and orderly made up to the house of the said Justice, some climbing up the walls and into the Windows and Chambers: and afterwards how strangely and unexpectedly they vanisht away to the admiration of All.

In 1674 there was published

Strange and Wonderful News from Saffron-Hill in London: Being a True and Perfect Relation of a Bricklayer that was Miraculously struck Dumb, on Thursday the 19 of March last past, as he was at Supper, and still continues in that sad condition.

In 1677 we have

Wonderful News from Wales or a True Narrative of an Old Woman Living near Lanselin in Denbyshire whose memory serves her Truly and Perfectly to relate what she hath seen and done One Hundred and Thirty Years ago. Having now the full number of her Teeth; the most of them were lost when she was Three score Years and Ten, etc.

As the following titles attest, the year 1679 was marked both by earthquakes and an infant prodigy:

A Brief Relation of A Wonderful Accident, a Dissolution of the Earth in the Forest of Charnwood about Two Miles from Loughborough in Leicestershire.

Rare, True and Wonderful Relation of a Town in Piedmont, Within these few Weeks sunk under Ground, so as nothing of it appears, only two of the Inhabitants survive the misery.

The Miraculous Child or Wonderful News from Manchester. A most true and certain Account how one Charles Bennet, a Child but Three years old, doth speak Latine, Greek and Hebrew, though never taught

those languages, and answers all Questions relating to the Bible, etc., in a wonderful manner.

Strange News from west-Smithfield or the Man-Child of Manchester: Being a true and impartial account of the prodigious Knowledge and Elocution of a Male-Infant, of three years of age, newly brought up to the Bear-Inn in Smithfield, who at his first speaking, corrected his Father as he was reading in the Bible.

Next year the scene shifts to London and we read a

True Relation of the Sad and Deplorable Condition of a Poor Woman in Rosemary-lane near Tower-hill, whose Feet are Rotted off from her Body, there being handfulls of Maggots breeding in the Stumps, and though daily Destroyed yet again Increase; which some have Imputed to proceed from her wishing that her Limbs might rot, concerning a thing not true, etc.

The two final examples are from about 1690:

Strange News from Tower-Ditch: Being a Perfect Relation of all the vast Quantity of Fish taken there on 20th October. With the strange manner of their coming in, in such abundance, and how some of them dyed and Stunk, as soon as they were handled; others were very sweet, and eaten without any Ill Effects.

Most Strange and Wonderfull Apperation of Blood in a Poole at Gar-raton in Leics., which continued for the space of four dayes, the red-nesse of the colour for the space of those foure dayes every day increasing higher and higher, to the infinit amazment of many hundreds of beholders of all degrees and conditions, who have dipped their handketchers in this bloody poole, the scarlet complection of the linnen will be a testimoniall of this wonderfull truth to many succeeding generations.²⁴⁶

Midway between such ebullitions of the popular press and the observations of academicians and publications of learned societies, lay a miscellaneous and popular science, to which we turn in the next chapter.

²⁴⁶ I take these items from a sales-catalogue of Francis Edwards, Ltd., 83 Marylebone High St., London, W. 1. For a German parallel consult Eugen

Hollander, *Wunder, Wundergeburt und Wundergestalt in Einblattdrucken des 15-18 Jahrhunderts*, 1921.

CHAPTER XXXI

MISCELLANEOUS AND POPULAR SCIENCE

Introduction—Rollenhagen's *Warhafft Lügen*—Frantzius on animals—Dinet—Baricellus, *Hortus genialis*—Getto—A Montpellier manuscript—René François (Estienne Binet)—Beyerlinck—Marcellius—Scanus—de Rochas—Naldius—Johannes de Mey—Maraviglia—Voigt—René Bary—Various works by Le Grand—François Bayle—Saint Romain—*Essais de physique*—de Tertiis—Chauvin's *Lexicon rationale*.

Le secret de se faire entendre sur toutes sortes de choses n'est pas le don de tous les Sçavans.

—RENÉ BARY

In this chapter we shall examine a number of books that deal in whole or part with nature, but seem intended for the general reader and are themselves of a general character, not falling within any particular field of natural science, and being composed by authors who were not themselves scientific specialists. They are thus of a miscellaneous character. I have hesitated to call them popular science, since many of them are written in the language of the learned, Latin, and not in a vernacular, or were reviewed in the periodicals of scientific societies. At any rate, they seem written for and by persons who were not very learned or scientific, or who were willing to lay learning and science aside for a while in favor of amusement or general information and misinformation.

Georg Rollenhagen (1542–1609), rector at Magdeburg, in 1603 published in German a collection of "credible lies," together with four books of marvelous, unheard of, and unbelievable Indian Travels of Alexander the Great, Plinius Secundus, Lucian the Orator, and St. Brendan.¹ Already by 1614 the work had reached its

¹ *Vier Bücher Wunderbarlicher . . . glaubwürdigen Lügen . . . aus Griechischer und Lateinischer Sprach mit fleis verteutschet durch G. Rollenhagen, Magdeburg, 1603, in-4: BM*
Indianischer reysen . . . von dem grossen Alexander . . . Mit etlichen Warhafften, jedoch bey vielen Gelehrten

fourth edition, and there were others as late as 1687 and 1717, while the *Warhaftigen Lügen* appeared separately in 1680. Most of its twenty-six chapters are about animals, including the basilisk, the struggle of the elephant and flying dragon, the snakes and crabs that the stag catches and eats, the false notion that the hare is an hermaphrodite, the lion and the lynx-stone, pelican, and phoenix. Although the satirically-worded title might seem to have given the natural history of the century a wholesome sceptical send-off, the later reprintings of the work show that the public enjoyed reading such old animal legends, and that these survived whether they were still believed or not.

In the final chapter, on the crow adorned with strange feathers, Rollenhagen's son charges David Origanus (1558-1628) with having printed as his own an astrological treatise which his father had composed for his students with a 1583 geniture of the son. He further accuses Jacobus Sommerfeld of having plagiarized from his father in his *De studiis recte instituendis* of 1600.

The History of Animals by Wolfgang Frantzius, professor of history and theology at Wittenberg, was first published there in 1613, and had several later editions.² The book was composed for students of theology and preachers, and shows that zoology was still written and read from this point of view. It is, so to speak, a seventeenth-century *Physiologus*. Its four parts on quadrupeds, birds, fish, serpents and insects, have 29, 28, 9 and 15 chapters respectively. Is there any such animal as a unicorn? The Bible implies that there is, and Scaliger says that a friend of his had seen one. The rhinoceros differs from the monoceros in that it has two horns. The horn of the monoceros is a safeguard against poison and makes poisoned water healthful again by touching it, so that princes and rich men once had cups of this horn.³ The ostrich is caught and killed as it approaches its eggs. It is of very hot tem-

12330.d.10. BM 12330.d.9 is the 4th edition, Alt Stettin, 1614. I have used the separate edition of 1680: *Warhaftigen Lügen von geistlichen und natürlichen Dingen* . . . etc., 384 pp. in-12: BM 12430.a.35. (1.).

² I have consulted that of Amsterdam, 1665: *Historia animalium in qua plerorumque animalium praecipuae proprietates in gratiam studiosorum theologiae et ministrorum verbi Dei breviter accomodantur*, 888 small pp.

³ *Ibid.*, pp. 109, 113.

perament, and some say that it can even digest iron, but others deny this.⁴ The bear is called *ursus* from *urgendo*.⁵ Scaliger denies that it licks its cubs into shape, noting that a pregnant bear in the Alps, which was dissected, had a foetus which was fully formed in all members. But others say that the cubs are enclosed in a very thick membrane which the dam has to lick off. Bears are very fond of honey and look for it in hollow trees. But sometimes they do this not for the sake of the honey but in order, through being stung by the bees, to free themselves from headache, with which they are not infrequently afflicted. And in order to relieve stomach-ache, they eat ants, thereby provoking vomiting. Bears are turned to flight by the sound of a drum made of horsehide. A bear can take all the skin off a man's back with one blow. A pregnant bear is rarely captured. Although Frantzius had questioned whether bears lick their cubs into shape, he accepts the old notion that they grow fat while hibernating, and that they suck their front paws upon awakening from their winter's sleep. He concludes by comparing bears first with Persians, and then with philosophers and scholars.⁶

The domestic cat is lively as a kitten but sleepy and slothful as it grows old. It washes itself and wanders at night. Cats love *domos* (homes), whereas dogs love *dominos* (masters). The reason why some persons cannot endure the effluvia of cats is that their mother, while pregnant, was disturbed by cats. A cat always falls on its feet, has a bad breath, likes to eat mice, birds and fish, yet shuns water. Cats are fond of being stroked gently, of having their heads fondled, and of rubbing against you. The pupils of their eyes are said to enlarge and contract as the moon waxes and wanes. They are compared with calumniators.⁷

The Five Books of Hieroglyphs of Pierre Dinet, printed at Paris in 1614 in French, really has nothing about hieroglyphs, a word used no doubt to attract readers by a pretense of mysticism and magic, and is better described by the rest of its title, "wherein are contained the rarest secrets of nature and properties of all things," although this too suggests the occult. The work is really just a

⁴ *Ibid.*, p. 344.

⁵ *Ibid.*, p. 79.

⁶ *Ibid.*, pp. 79-88.

⁷ *Ibid.*, pp. 196-200. Frantzius also quotes Gregory Nazianus and Aelian, and discusses caterwauls.

popular miscellany or encyclopedia which makes especial use of the classics. Its first book deals with earth, metals, gems and minerals; book two with the vegetable kingdom; three, with animals; four, with man; and the fifth and last with the gods, heavens, and so forth.⁸

The Genial Garden of Julius Caesar Baricellus, printed at Cologne and Geneva in 1620,⁹ offers an example of a miscellany in which, under the pretense of offering wonderful arcana and the fruits of the author's own observations, various bits of popular science and medicine from the works of past authors are thrown together without any order or discrimination. We note some specimens of its content following its own sequence and not attempting any topical arrangement, or to separate scepticism from superstition.

Why did the Amazons cut off the right breast? In order to make their right hands and arms stronger. Transformations of men into beasts are not real. Astuteness of the demon among the Indians. What Pico thought of the variety of the sciences. It has been found that animals can be born and live in fire, but soon we are told that it is most false that the salamander can live in fire. Meanwhile we have been assured that many men see as well in the dark as in the light. A sabbatic river is described, and we are told how to break the hardest rocks. It has often been found by experience that men who are seriously ill see various human apparitions. Adam and his contemporaries had most perfect knowledge of nature. Headache, Peter Forest says, is relieved by mere suspension of vervain. The fig tree tames a bull and makes chicken hung from it tender and easy to cook. If steel is put in boiling water and Roman vitriol for a quarter of an hour, some of it can be scraped off. "Prick up your ears, clever reader, since from this small beginning many very useful things in medicine follow." Oil of vitriol and sulphur draws boys who are almost dead from worms back to life.

⁸ *Cinq livres des Hiéroglyphiques, où sont contenus les plus rares secrets de la nature et proprietez de toutes choses . . .*, Paris, 1614, in-4, 709 pp. Book III begins at p. 303; IV, at 460; V, at 548.

⁹ *Hortulus genialis sive arcanorum*

valde admirabilium tam in arte medica quam reliqua philosophia compendium curiosis naturae scrutatoribus lectu tam utile quam iucundum ex ipsius auctoris praecipue observationibus concinnatum.. I have used the Cologne edition: BN Z.41310. In-12, 353 pp.

Baricellus has a remedy for constipation so tested that one winter about a thousand men in an epidemic were cured by it. The color of the tongue of ram or ewe shows what the color of the lamb will be. The notion that a basilisk is hatched from the egg of a cock is ridiculous. But men become mute and astounded at the unexpected sight of a wolf. Leonard Vairus, *De fascino*, says many crimes are perpetrated by witches. That the emperor Nero cured facial contusions received in his nocturnal escapades before the next day by a mixture of thapsia, frankincense and wax is credited by Baricellus to the Herbal of Durans, but actually goes back to Pliny.¹⁰ It is most false that the viper kills the male in conceiving and is killed by its brood in delivery. Why are there many sheep and few wolves, although the wolf has many cubs and the ewe only one lamb, and men eat sheep and not wolves? One reason is God's goodness, another that wolves eat one another. A pregnant woman will have intercourse, but no pregnant brute animal will, except a mare.

Small pox is a new disease first mentioned by the Arabs. The American Indians never had it until the Spaniards arrived. Hieronymus Mercurialis showed that it originated from the stars and is hereditary. There is no antipathy between rue and cabbage. The account of the marvelous nature of the agate comes from the work of Camillo Lunardi on stones. The herb *bardana* has great sympathy with the womb, and there is the greatest antipathy between wolf and lamb. According to Holler, an Italian who smelled too often of the herb *basilica* died of headaches produced by a scorpion generated in his brain. This is verified by the turning into scorpions of leaves of the *basilica* which putrefy under tiles. Yet smelling of *basilica* is a marvelous cure for syncope and mental disease. The fish torpedo cures headaches which come from a hot cause.

The homunculus of Paracelsus is not merely ridiculous but abominable. A conjunction of Mars and Saturn in Taurus presages a bubonic plague. Nature shows wisdom in the cure of difficult diseases. The seven ancient wonders of the world are repeated from Rhodiginus. Bones from the heart of a stag preserve men from poisonous bites. Mizauld is authority how to turn white wine red without detriment.

¹⁰ NH XIII, 43.

To explain why the lion fears the cock, Ficino points out that in the order of Phoebus the cock is superior to the lion, and Proclus says that a demon in the form of a lion disappears at the sight of a cock. Vairus and Lucretius say that certain seeds come from the eyes of the cock which cause the lion incredible pain. But Baricellus believes that, where natural reasons are sufficient, one should not resort to the occult and astrological. His explanation is that, since lions abound in yellow bile and heat, they are moved by a cockerow as a dog is by the barking of another dog. Also, the red crest of the cock excites the lion's bile as a red cloth disturbs bulls. But the lion's fear is hardly likely to last long.

The ring finger has the greatest sympathy with the heart, Lemnius says. Wecker tells how to make cooked meat appear raw. We are also instructed how to excite flame in water. Where disease prevails, there especially healing herbs grow. From physical beauty and deformity moral character in living beings may be conjectured, Porta holds. And this much probably gives a sufficient picture of the character of Baricellus's book.¹¹ He had earlier published a work on human sweat, which may have been less popular and scatter-brained, but which I have not examined.¹²

Although its text does not correspond at all closely to its titles, the *Diacameron, id est Dator vitae* of Giulio Getto may be briefly mentioned as an example of popular interest in natural history.¹³ It promises singular secrets of medicine, prolongation of life and rejuvenation. It offers "the substance of celestial virtue" to sane and sick in the preparation of medicine. It contains scattered references to metals and alchemy, and a page per planet (two for the moon) giving its relation to parts of the body and diseases, its herb, metal and character in different languages. It contains a sonnet on wild lettuce and bits on the herbs called locust's foot

¹¹ I looked over the first 200 of its 353 pages. If I had read more, I would probably have found yet more parallels with the later book of Le Grand (1681), of which we treat presently.

¹² *De hydnosia natura sive sudore humani corporis libri quator*, Naples, 1614, in-4, 428 pp. BM 549.a.9; BN

Td⁵⁰.3.

¹³ *Diacameron, id est Dator vitae. Il principale delli singolari segreti di medicina affermato da gli antichi filosofi ritrovarsi nelli capelli della vergine pascale, herba naturale, della quale hora trattando...* Opera nova di Giulio Getto, Tarvisii, 1623, in-4, 82 pp. BN 4°Te¹³¹.75.

and *Vergine Pascale*. It holds that names are imposed from effects.

What topics in natural history especially interested men of the seventeenth century is further illustrated by the contents of a manuscript at Montpellier.¹⁴ After a brief tract by Francesco Stelluti of the *Accademia dei Lincei* (who was the first, in 1625, to publish systematic observations with the microscope on honey-bees) on fossil wood,¹⁵ with letters of Federico Cesi, founder of the aforesaid Academy of the Lynxes, and of Peiresc on the same subject, comes a chapter on amber. There follows a letter of V. Mirabella on the bones of giants, a note on an incombustible cloth (*tela*) found at Pozzuoli, another on winds, and a third on a bloody rain. We turn next to animals: that called *Dafasa* in Ethiopian, the salamander, and the dimensions of the elephant. Extracts from various travels are followed by discussion of the cocoa of Paraguay, various animals, how to preserve flowers and bulbs, a list of the plants of San Remo, a description of the Barberini garden.

The book on the marvels of nature and most noble artifices by René François, royal preacher,¹⁶ devotes only a fraction of its space to such natural marvels as the phoenix, remora and ambergris, and was written to amuse the general reader by its sprightly style and fancy rather than to advance science. Perhaps its most useful information is a list of military commands then in use. René François was the pseudonym of Estienne Binet (1569–1639), a Jesuit of Dijon who died in Paris. The *Essay des merveilles de nature* first appeared at Rouen in 1621¹⁷ and ran through many editions¹⁸ attesting the widespread popular interest both in nature and in marvels. But it is lyrical, metaphorical, moralizing and sermonizing in tone rather than scientific. Comets are still located in the sphere

¹⁴ École de médecine 170, from *Biblioteca Albani*.

¹⁵ Presumably the same treatise as *De ligno fossili minerali noviter detecto, ad Franciscum Barberinum S.R.E. Card. tractatus*, Romae, 1635 (in Italian): Latin version in *Miscellanea curiosorum naturae*, vol. III (1673).

¹⁶ *Essay des merveilles de nature, et des plus nobles artifices. Piece tres-necessaire à tous ceux qui font pro-*

fession d'Eloquence. I have used the 6th edition, Rouen, 1626: copy in the Typographic Library, Columbia University.

¹⁷ R. de Beauvais, 4to, 569 pp.: BN Z.3996.

¹⁸ The ninth appeared at Rouen in 1644. Michaud, IV. 547-48, states that more than twenty editions were published before the close of the century.

of fire,¹⁹ and philosophers are represented as unable to explain the rainbow as well as the action of the remora and the origin of ambergris. Binet prefers to believe that the latter is bitumen from fountains beneath the sea rather than that it is the excrement of whales.²⁰ Although he says that astrologers ordinarily lie, and that the stars cannot force free will, he still believes that there is no star without its particular virtue, though this may be unknown.²¹ He still devotes considerable space to the virtues of gems.²² Powdered pearl is good for all diseases; the opal, for head and sight. "L'Aimant pers est bon pour estancher l'eau qui flotte entre la peau et la chair." But Paris of the seventeenth century ridicules Pliny's statement that the diamond is broken only by the fresh, warm blood of a goat.

Zwinger's Theater of Human Life had been issued in one volume in 1565, in enlarged editions of 1571 and 1586, then by his son in 1604. The arrangement was topical by subjects. In 1631 a further enlargement in alphabetical order by Laurens Beyerlinck (1578—1627) was published at Cologne in eight double columned folio volumes.²³ Beyerlinck had died on June 22, 1627 at the age of 49, and his enlargement was completed by Antonius Hieratus. What I wish to point out here is that the attention given to occult themes did not show any diminution in Beyerlinck's revision,²⁴ although it can scarcely be said to have become more favorable. Zwinger had had three long articles on astrology, divination and magic. To the treatment of astrology was now added Ranzovius's catalogue of emperors, kings and illustrious men who had practised astrology. To that on magic seven sections were added on its divisions, invention and names among the Hebrews; its impostures and frauds;

¹⁹ Ed. of 1626, p. 560, "les comettes s'allument là haut dans l'element du feu."

²⁰ *Ibid.*, 507, "Est-ce pas abuser de la creance de la Chrestienté de dire que c'est l'ordure de la baleine qui se metamorphose en cette douceur precieuse?"

²¹ *Ibid.*, 556, 559.

²² *Ibid.*, 68-82.

²³ *Magnum theatrum vitae humanae, hoc est rerum dicinarum humanarumque syntagma, catholicum, philosophicum, historicum, dogmaticum . . . auctore Laurentio Beyerlinck, Coloniae Agrippinae, A. et A. Hierati fratres, 1631.*

²⁴ This is not difficult to estimate, since new articles and additions to previous articles are marked with asterisks.

the impotent illusion of the demons in magic deceits; conversions of magicians and burnings of their books; forbidden magic and the penalties therefor; the bad ends of magicians and their feats; and the penalties for those consulting magi and haruspices. There were also new articles on amulet, antichrist, apparition, arcanum, benediction, cabala, ceremony, fascination (very brief), incantation, incubi, and maleficium. In the old article on year, only seven lines were devoted to climacteric years as against three or four columns by Beyerlinck. There also were new articles of a scientific character, as on animal, antipodes, dog, echo, eclipse, element, elephant, moon, wolf—with the statement that lycanthropy is an illusion, magnet—but without mentioning Gilbert, melancholy and meteors. Another notable increment was a number of articles on ecclesiastical and religious topics from a Roman Catholic standpoint. The old article, "Aqua," which did not mention chemical waters, was retained, but there were new articles on balsam and longevity as well as arcanum.

The *Armamentarium scientificum* (Scientific Armory) of Henry Marcellius (1593–1664), a Jesuit from Brabant who taught philosophy and mathematics at Mainz and then moral theology at Reims, Molsheim and Bamberg, is a very misleading title, since its two volumes of 623 and of nearly a thousand pages respectively, published at Paris in 1635, contain almost no scientific detail, being limited to generalities and glimpses of the obvious. Beginning in 1615, Marcellius conceived the not overly happy idea of collecting axioms, apothegms, pithy sayings and epigrammatic remarks from the various standard authors whom he read, and of grouping these under various topics to which they applied. He claims that no one hitherto has so gathered the sayings of the sages in a natural order of doctrine. He begins with Principia, not however in the Aristotelian sense of form, matter and privation, but in the sense of postulates, definitions and hypotheses. By the fourteenth *titulus* he has gotten to chance and fortune; the fifteenth concerns nature; the sixteenth, art; but the first volume closes with the four cardinal virtues of prudence, justice, temperance and fortitude, and it is only at page 625 of the second volume that we really come to science proper. The maxims and epigrams anent use and experience

contain no hint of the experimental method.²⁵ When we pass to particular sciences, however, logic receives little better treatment, only four axioms being quoted as to it.²⁶ Mathematics fares somewhat better, but the aphorisms anent it are limited to such brief dicta as that mathematical entities are not substances; that a boy can be a mathematician but not a sage or naturalist; that arithmetic and geometry are sisters; and that no one is a good astronomer who is not a physicist²⁷—which last, it may surprise some to learn—is taken from Albertus Magnus on Sleep and Waking, III,i,11. Physics (*Physica*) and Medicine are coupled together, although we are told that medicine begins where physics ends, and such non-scientific authors are quoted as Saint Jerome and Platina.²⁸ Even when we pass to more specific topics such as the sense of smell, the information imparted is sparse. The sense of smell is midway in dignity, last in necessity. Odor is of the dry, taste of the wet. We rarely dream of odors, the reason being that its species are weak and evanescent, unlike colors and figures.²⁹ Motion receives fuller treatment,³⁰ and, besides Aristotle and Aquinas, Marcellius cites Hurtado, Themistius, Zimara, Bede, Cajetan, the Coimbra commentators, Capreolus, Suarez, Vasquez, Albertinus, "Tanner and other recent authors," Galen and Hippocrates, St. Bernard, Curtius and Ficino. But he fails to quote from Ockham, Buridan or Galileo. Proportion of equals and unequals is discussed,³¹ but no works on the subject are mentioned, and the discussion is largely concerned with social relations. The sympathy between soul and body is touched upon,³² but not sympathy and antipathy between different animals, plants and minerals. Indeed, such subjects as alchemy, astrology, divination, magic and occult virtue are passed over in silence. But considering the scanty treatment of nature and science, this omission is not so surprising. Had more detail as to nature and science been included, it would not have been so easy to exclude occult science and natural magic.

Johannes Scanus, who also wrote books on geography, philosophy and social satire, in 1639 published a volume on Marvels of Nature,

²⁵ *Op. cit.*, II, 635.

²⁶ *Ibid.*, II, 660.

²⁷ *Ibid.*, II, 661-8.

²⁸ *Ibid.*, II, 668-74.

²⁹ *Ibid.*, II, 802-3.

³⁰ *Ibid.*, II, 917-45.

³¹ *Ibid.*, II, 884.

³² *Ibid.*, II, 861.

or a description of men, mountains, trees, herbs, animals, birds and reptiles,³³ which I have not seen.

Henry de Rochas was a physician and royal councillor, whose father had been general of the mines in Provence. His *La physique demonstrative* has two title pages. The first, itself dated July 21, 1642, states that the work is dedicated to Richelieu, and bears the legend, "Avec privilege du Roy, 1641." But the dedicatory epistle itself is undated, as is that "Au Lecteur." At the end of the volume is the statement that printing it was completed ("Achevé d'imprimer") on October 31, 1642, but the date given on the second title page is 1644.³⁴ Despite its title, the work is chemical and alchemical. The first book of 208 small pages is devoted to mineral waters:³⁵ sulphuric, vitriolic, aluminous, nitrous and ferrous. The second book of 148 pages also has five parts: the philosophy of the universal spirit, the origin of nature, the Hermetic philosophy, the chemical principles, and "Le cabinet des curieux." The third book of 363 pages is entitled, "The Triumph of Spagyric Medicine."

A few years later, in 1648, Henry de Rochas, "escuyer Sieur d'Ayglun," councillor and physician in ordinary to the king, published a book with a similar title, *La physique reformée*, but in the form of a refutation of popular errors and the assertion of philosophical truth.³⁶ The standpoint of the work is indicated by the following passage:

When I stop to consider the ills which result from the bad principles of ordinary philosophy, I am amazed not only that great minds have conceived so many absurdities but also to see that they have been

³³ *Mirabilia naturae, seu descriptio rerum in natura mirabilium, hominum, montium, arborum, herbarum, animalium, volucrum et reptilium*, Aarhus, 1639, in-12. I derive the title from Alberti Bartholini *De scriptis Danorum liber posthumus*, ed. Joh. Molleus, 1699, p. 89. It is not found in the catalogues of the BM or BN.

³⁴ Copy used: BM 774.e.8.

³⁵ Between 1634 and 1648 several treatises appeared in French on mineral waters by Henry de Rochas (Fergu-

son II, 282) and one of them in Latin translation in Zetzner's *Theatrum Chemicum* in 1661, VI, 716-.

³⁶ *La physique reformée contenant la refutation des erreurs populaires et le triomphe des veritez philosophiques . . .*, A Paris, 1648. Et se vend chez l'Auteur rue Baillet qui traverse de la Monnoye à la rue de l'Arbre-sec, près l'Eglise S. Germain de l'Auxerrois. 567 pp. No Index. Copy used: BM 537.b.6.

accepted as certitudes for so many centuries and by so many excellent men, ancient and modern.³⁷

On the positive side, the Bible and chemistry seem Rochas's chief sources of ideas. Like Helmont, he holds that water is the first matter of all mixed bodies; and a vivifying spirit or heat, their form. Fire, air and earth are not elements and do not enter into the composition of mixed bodies. It is an error to call fire hot and dry; air, hot and humid; earth, excessively dry and moderately cold, and to say that it is heavier than other elements; to call water intensely cold and remissly humid. Rather, humidity is absolutely inseparable from it. Indeed, it is an error to maintain that each element has an intense quality and a remiss quality, and other elementary qualities of sympathy and antipathy. It is erroneous to regard privation as a principle of composition—yet he holds that cold is privation of heat, and that dryness is merely lack of humidity.³⁸ It is an error to teach that the elements corrupt and that they change into one another. Only water converts itself into all the others. Pest tracts are mistaken in attributing the plague to corruption of the air. It is incorrect to think that air increases the weight of the salts of dry substances.

Air is nonetheless of great importance. It penetrates everything and cannot be bounded. It is the first principle of life whether animal, vegetable or mineral. It is the first to receive the influences of the heavenly bodies. It is the same substance as that which surrounds them,³⁹ except that the heavens and light have more of that vivifying spirit which constitutes the form of both. But water is older and more essential than sunlight, for it was created first, and then God separated a portion to make the heavens and light. Rochas even denies that evaporation is caused by the attraction of the sun, and represents *eau de vie* as a substance or spirit so astral, that it fears no putrefaction and effects marvelous cures by restoring *l'humide radical*.⁴⁰

We turn to triumphant truths. Galen held that diseases were cured by their contraries, but chemists contend that like cures like. Diseases are caused and cured by the three chemical principles.

³⁷ *Ibid.*, 65-66.

³⁸ *Ibid.*, 121.

³⁹ *Ibid.*, 24, 32, 46.

⁴⁰ *Ibid.*, 70-73, 81-83.

Sulphur produces quartan fever and all other melancholic maladies; salt causes gout; spirit of arsenic produces the pest. The four principal specifics for the diseases of mercury, sulphur, salt and poison are a mineral coagulative and a vegetable, magnetic water, Hermetic water, and celestial water. Rochas gives many particular cases and cures of his own to support these contentions.⁴¹

Thus in place of old errors Rochas has adopted a number of new ones. But he also still adheres to a number of old errors. He still believes that rivers originate from the sea. The voyages of discovery and the increased knowledge of the New World and Far East have led him to draw an even rosier picture of the torrid zone as temperate and habitable than Avicenna and Albertus Magnus drew in the middle ages. But he regards the discovery of America by Columbus as fatal from the moral and humane viewpoints. The influx of gold, the spread of luxury and vanity, the avarice and ambition of the Spaniards, the slaughter of millions of innocent natives, the depopulation of Spain itself, have changed everything from good to evil, and things will go from bad to worse, unless God sends us extraordinary grace. Rochas supposes three worlds: supercelestial, celestial and elementary or inferior, and complains that the critics of chemistry also attack astrology, "the loftiest and truest of all the sciences of the world." He defends astrological medicine in particular, citing Hippocrates, Galen, Cardan, Ficino and Magini in its favor. The effects of the sympathetic unguent are not entirely due to sympathy, as many think, but by the influence of the stars "and a certain force so secret that it ought not to be divulged in print," although it might be communicated orally or cabalistically to fitting persons. A powder of sympathy which he made in 1602 in the presence of the duke of Savoy and in 1608 at Montpellier, and which is now in vogue, acts not by sympathy but by the virtue of vitriol, of which it is mainly composed. The fact that the lion is intimidated by the crowing of the cock is due neither to antipathy nor to the force of the sun, but to the lion's being abashed that a little rooster has a much stronger and louder voice than the king of beasts.⁴² An explanation which

⁴¹ *Ibid.*, 273-516.

⁴² *Ibid.*, 45, 17-22, 73, 530, 124-25, 129-30.

is far from being an improvement! However, Rochas perhaps deserves some credit for questioning or reducing the scope of sympathy and antipathy.

The treatise of Matthias Naldius of Siena, professor of natural philosophy in its university, on *Pamphilia* or friendship of the universe,⁴³ although in Latin and dedicated to the Grand Duke, may be dismissed as trifling. It has chapters on centaurs, concerning whom Naldi is sceptical, pygmies and giants, mules and monstrous births. Its third book is given over to beauty aids.

Johannes de Mey in 1651 published a commentary on passages in the Pentateuch concerning natural phenomena.⁴⁴ This was followed the next year by parts two, three and four, or a commentary on some selected passages from the Old and New Testament dealing with the things of nature.⁴⁵ In 1655 the first part was re-issued and combined with that of 1652 as *Sacra Physiologia*, second edition.⁴⁶ In 1661 appeared a third edition which seems to have left the 1655 portion intact but made some additions and changes in that of 1652.⁴⁷ *Physiologia* was of course used by Mey in the sense of natural philosophy or science in general.

Mey's main contention is that scriptural statements concerning physical matters are true. If the Bible is to be trusted only for

⁴³ Παμφιλία seu de mundi universi amicitia qua (cui in BN catalogue) dissidentes philosophorum opiniones conciliantur et parantur ex re medica amicitiae et praesertim conjugis conducentia formositas et foecunditas, Senis apud Bonettos, 1647, in-4, xvi, 397 pp. BN R.8087.

It also considers "Quae bonum semen faciant?"

⁴⁴ *Commentaria physica sive Expositio aliquot locorum Pentateuchi mosaici in quibus agitur de rebus naturalibus* . . . , Medioburgi, apud J. Fierensium, 1651, in-4, 216 pp. BN A. 3591. This I have not seen.

⁴⁵ *Commentariorum physicorum Pars 2, 3 et quarta sive Expositio aliquot locorum selectorum ex libris Vet. et Nov. Testamenti in quibus agitur*

de rebus naturalibus . . . (from the title page).

⁴⁶ *Sacra physiologia sive expositio locorum sacrae scripturae in quibus agitur de rebus naturalibus*, 1655, 1652, in-4. BM 1016.I.10.

⁴⁷ *Sacra physiologia*, third edition, "auctior," 1661. BM 845.g.20. At pp. 287-88 an addition is made to the paragraph in II (1652), 63-64; at p. 305 a paragraph is added to "Aula Neronis mirabilis" of II, 80; at p. 394 a half page of text is added to II, 168; at 432, *Horologium*, are two paragraphs not in II (1652); at 440 are added a few lines concerning the microscope which are not in II (1652), 212; and so on. At 519, half a page concerning *Ius naturale* is added to II, 287, while to II, 288 are added pp. 520-28.

statements which directly apply to God and religion, it will certainly be filled with nonsense and fallacies. To say that some of its statements follow current opinion or appearances will lead to rejection of other passages. Its figurative representation of God with human attributes is a different matter, for the divine nature is incomprehensible, and so in that case it is permissible to employ intelligible analogies. But Mey is not satisfied with the dictum of Lansberg that the foundations of astronomy and geometry are not to be sought in Scripture but in those sciences themselves,⁴⁸—a contention made in support of the Copernican theory. On the other hand, Mey affirms that natural law is so immutable that it cannot be changed even by God.⁴⁹ Nor does he hesitate to interpret the waters above the firmament as clouds, asserting that waters above the starry heaven would be useless.⁵⁰ But he repeats the pious dodge that the star of the Magi was not a star but some very bright but small body specially formed by God in the lower region of the air, like the column of fire which guided the Israelites in the Old Testament, and arbitrarily moved by the divine will to direct the Magi on their way. And the other lame cliché, going back to Origen, that the Magi knew that it was for the king of the Jews not from astrology but from the prophecy of Balaam.⁵¹

Poor Magi! who for all their astronomical science could not tell a light near the ground from a star. A poor god! who would so delude them. A poor Gospel and Bible that could not tell the story straight but called the flame a star! Poor Mey! to accept such twisted reasoning.

The same position, based chiefly upon citations of the church fathers, had been maintained by the Jesuit, Melchior Inchofer, in 1639.⁵² For good measure, he further maintained the tradition of the church that, although Herod killed all the infants in Bethlehem and thereabouts up to two years of age, the Magi took not more than thirteen days after they saw the star to reach Christ. He

⁴⁸ *Sacra physiologia*, II (1652), 203; 3rd ed., p. 430.

⁴⁹ *Ibid.*, II (1652), 288.

⁵⁰ *Ibid.*, I (1655), 10-11.

⁵¹ *Ibid.*, II (1652), 261. T I, 444. That there are three regions of air

was affirmed at II, 139; (1661), p. 364.

⁵² *Tres Magi Evangelici*, pp. 49-51. Copy used: BM 1012.c.16. Inchofer also wrote, *De terrae solisque motu cel statione*, Rome, 1633.

recognizes that some of this time would be spent in preparing their gifts and in their conference with Herod, but explains that the dromedaries on which they rode can travel very fast.⁵³ All of which shows that, no matter how literally anyone may profess to accept the Bible, he can always make it mean anything that he wants.

We are not further interested, however, in Mey's attitude towards the Bible and the Magi, but in that towards magic and science. And he manages to introduce a number of matters which have at best a very remote connection with the Scriptures. Thus in connection with Genesis II, 12, "And the gold of that land is good," he quotes Levinus Lemnius, Aldrovandi and Augurellus for two or three pages. Or he discusses *mumia* in connection with the embalming of Jacob (Genesis I, 2).⁵⁴ The tarantula is treated, although not mentioned in the Bible.⁵⁵

The stars are natural causes of much in nature, but not of future contingents, and there are other particular causes of human action, such as education and custom, which are unknown to astrologers and render their predictions uncertain. Although in one passage Mey accepts the analogy of microcosm and macrocosm, in another he affirms that the stars possess no powers except those of illuminating and heating. Moistening is an accidental effect of the moon, but is conspicuous in plants and animals, which the full moon fills with humors. Those born at new moon are much weaker than those born at full moon. Epileptics and phrenetics feel terrible pains at full moon because of exuberance of humors, but it is a good time to wean infants. The ancient Germans used to fight then. Shellfish augment, bones abound in marrow, catarrhs are more frequent. Weather changes especially follow the moon's quarters. The moon moistens because it heats less than the sun and spreads humors through the body, whereas the heat of the sun dissolves and consumes them. Epileptics are often called lunatics by physicians, either because they are more often born at new moon and suffer severer attacks then, or because epilepsy follows the phases of the moon, as do other brain diseases.⁵⁶

⁵³ *Tres Magi*, p. 47.

⁵⁴ *Sacra philosophia*, I, 26-28, 83.

⁵⁵ *Ibid.*, II (1652), 247.

⁵⁶ *Sacra physiologia*, I, 23-24, 175;

II, 251, 103-4, 265-66.

Even demons and angels cannot predict future contingents, although they have far more natural knowledge as to the future and the occult than men do. Mey lists various divining arts, but later treats of dreams without reference to foretelling the future from them. He gives arguments for the art of physiognomy and thinks the *Physiognomy of Aristotle* a genuine work.⁵⁷ His discussion of Pharaoh's magicians and divine miracle has nothing of interest.

The Biblical assertion that the serpent was astute, more so than any beast of the field which Jehovah made, is quoted and not denied, but the power of words and characters is denied anent the asp's closing its ear to incantations. But Levinus Lemnius is again cited as to the property of the saliva of a fasting man to kill scorpions. A propos of remedies employed by brutes, Mey remarks that he does not believe that greater knowledge is to be ascribed to them than to man. They probably learn them by experience and memory rather than by any natural instinct or innate wisdom. He would not, however, deny reason entirely to the brutes. Elephants fear water, have a sense of shame, feel gratitude, and are said to bury their dead, respect their parents, exercise justice, and hate adultery. But Mey questions whether they are religious and venerate the celestial bodies. The crocodile plays dead and catches birds in its open mouth, but spares the trochilus which warns it of the approach of the ichneumon—which would dart down its throat and devour its vitals—and picks its teeth free from leeches, which the crocodile cannot do itself because it has no tongue.⁵⁸ As against these time-worn tales, the third edition adds to the text of the second a denial of barnacle geese and that the viper conceives through the mouth and is disrupted by its brood.⁵⁹ The then current denial that the salamander lives in fire and explanation that it exudes a fluid which stays the flames for a while is given in the second volume as a supplement to the first.⁶⁰

⁵⁷ *Ibid.*, I, 166-67, 169; II, 67 *et seq.*, 223. The third edition also has the arguments for physiognomy.

⁵⁸ *Ibid.*, II, 75, 240-41, 188-89. The passage regarding brutes' learning by experience and memory is added in the 1661 ed., p. 400, to the text of

II (1652), 173, while (1661), 419, omits the closing sentence of II (1652), 192.

⁵⁹ *Ibid.*, (1661), 445, paragraph added to II (1652), 217.

⁶⁰ *Ibid.*, II, (1652), 286.

In early autumn under a waxing moon a little stone, called *cheli-donius* after the bird, comes from the gizzard of the swallow. It is efficacious against epilepsy because it dries up and consumes the tenacious humor which offers a seed-bed for that disease. The toadstone breaks up the tumors and inflations produced by venomous beasts.⁶¹ The fossil shellfish found on very high mountains and elsewhere cannot be due to the universal deluge, since they are found only in certain localities, since the deluge was a flood of rain and not of sea water, and since it was so long ago that they would have disappeared by now. Another explanation offered is that these mountains were once under the sea, but Mey prefers the third suggestion that such fossils are freaks of nature.⁶²

Mey excuses himself for not going into the subject of gems on the ground that this pertains to physical doctrine, but warns that not all which is said of their virtues in the writings of physical scientists is to be believed. He tells his own experience of a sepulcher or sarcophagus (*sepulcrum*) at Poitiers which, when scratched, gave forth an odor like that of a cadaver. They say that it consumes corpses, nothing but the teeth being left after forty days.⁶³ He did not, however, believe in an incombustible oil or that anything could burn without being consumed. The so-called perpetual lamps in tombs must have been some lucid body that shone in the dark.⁶⁴ He accepted sympathy and antipathy between plants.⁶⁵ But in the third edition he denies antipathy between sheep and wolf, or drums of sheepskin and wolfskin, or that a man is rendered speechless by the sight of a wolf.⁶⁶ He informs us that seven years ago he visited some of the islands of America.⁶⁷ But he does not seem to have learned a great deal there. Explaining why Ethiopians are black, he states that heat is fomented and conserved in the sands of the deserts.⁶⁸

Medical men today defined melancholy as a depravation of imagination and judgment in which patients without any reason became very sad and afraid and imagined horrid and sometimes

⁶¹ *Ibid.*, II, 115.

⁶² *Ibid.*, II, 149-50. "a natura formatrice."

⁶³ *Ibid.*, I, 127-28.

⁶⁴ *Ibid.*, II, 136.

⁶⁵ *Ibid.*, II, 98.

⁶⁶ *Ibid.*, (1661), 498, paragraph added to II (1652), 267.

⁶⁷ *Ibid.*, II, 119.

⁶⁸ *Ibid.*, II, 136.

ridiculous things, and persuaded themselves of their truth. Physicians also enumerate various kinds of diseases resulting from the bite or from drinking the blood of the beast in question, in which men imitate its ways, such as lycanthropy and rabies. Sometimes the disease results soon after the cause, sometimes after a long time. Brasavola recounts a case of rabies seventeen years after the victim had been bitten; Alzahararius, one after forty years. Mey is aware, however, that many reported cases of prolonged fasts are fictitious.⁶⁹ He also calls false the notion that maniacs can speak languages and acquire science previously unknown to them.⁷⁰ Epilepsy is produced by flatulent juices which fill the cranium, obstruct the pores of the nerves, and affect the spirits disastrously. Human blood is not good for epileptics but makes them ferocious and cruel, as experience teaches. Indeed, the blood of no animal can be drunk without detriment and may induce the temperament of the animal, as already stated.⁷¹

The third edition still said that all waters come from the sea and are dispersed all over the earth by subterranean channels as by the veins, but, whether by accident or design, it left out the line describing the liver as the factory of the blood.⁷² Thus a slight improvement in the direction of scientific accuracy accompanied the slight decrease in superstition and misinformation which has been already indicated.

The title, *Errors of the Wise*, of a work by Giuseppe Maria Maraviglia seemed promising for our investigation, but the text turned out to have nothing concerning science and superstition, or medicine and magic.⁷³ Of his *Pseudomantia* we shall treat in a later chapter on Divination.

Gottfried Voigt followed in the path of Rollenhagen in two

⁶⁹ *Ibid.*, II, 21, 257, 130; ed. of 1661, pp. 245, 487, 355.

⁷⁰ *Ibid.*, I, 178-79.

⁷¹ *Ibid.*, II, 265-67; (1661), 496-97.

⁷² *Ibid.*, II, 251, the passage read: "Nam sicuti in humano corpore hepar omnis sanguinis officina est sic quoque in mundano corpore omnes aquae e mari oriuntur et per ductus subterraneas tamquam per venas in universam

terram disperguntur." In (1661), 481, the line which I have italicized was omitted. Perhaps the misrepresentation of the circulation of the blood was detected at the last moment.

⁷³ *Degli errori de' savi*, in-12, Venice, 1662, BN Z.39280. The *savi* considered are *virtuosi*, p. 1-; *letterati*, 79-; *critici*, 163-; *contenti*, 239-; *politici*, 318-; *dominanti*, 361-.

volumes on *Physical Curiosities* and *Physical Delights* which appeared respectively at Güstrow in 1668⁷⁴ and Rostock in 1671.⁷⁵ In the preface of the former he rails against the idle fables concerning animals to be found in the writings of the ancients. The text divides into five sections on the resuscitation of brutes from their ashes, the similar resurrection of plants, the fable of the swan-song, the congress and birth of vipers, and the birth of the chameleon, with the additional question whether it is nourished and lives on air or odor or dew alone. Voigt's attitude is sceptical, but in the first two cases he examines experimental proofs which have been adduced. In the first section, which does not include the phoenix, the thirteenth and last experiment is of the phantastic resuscitation of man. Voigt denies that it can be performed chemically from the blood. In the case of the resuscitation of plants from their ashes are experiments of Kircher, of a Polish doctor, and of Paracelsus. In the case of the swan's song Voigt refutes the arguments of those confirming it, especially Aldrovandi. Against the legendary account of the viper's conception and delivery he lists over a page of names of authorities from Apollonius of Tyana down.

In 1665 at Wittenberg, under C. Faseltus as *praeses*, Voigt had offered an *Exercitatio* on the corpse of the victim bleeding in the presence of the murderer.⁷⁶ The same theme now occupied the first 88 pages of his *Physical Delights*. Galeotto Marzio in the fifteenth century⁷⁷ had explained it by interaction of the spirits of the slain and the killer, but Voigt denies that the spirits can leave their own body for another and later return to their own. Sympathy was another suggested explanation, but Voigt insists that it would not exist between slayer and slain. Antipathy was also suggested, but he asserts that all natural antipathy should be congenital and innate. Campanella, Coelius Rhodiginus, and Kornmann had found the cause in some relics of the soul remaining in the corpse or blood, but Voigt holds this impossible. Nor would he accept the theory of Cornelius Gemma that an image of the murderer lurked

⁷⁴ *Curiositates physicae* . . . , Güstrovii, 1668, in-4. The BM has four copies of it.

⁷⁵ *Deliciae physicae* . . . , Rostochii, 1671, in-8. BM has two copies.

⁷⁶ *Exercitatio de stillicidio sanguinis ex interemti hominis cadavere praesente occisore*, Praes. C. Faselto, Wittebergae, 1665, in-4. BM 1179.c.7 (9.).

⁷⁷ T IV, 404.

in the clotted blood for three days and that the ideas inherent therein caused the blood to flow when he approached. Majolus sought the cause in attraction of the air and infection of the spirits, but Voigt denies that any spirits remain in the blood. Watson believed that it did not happen often or necessarily, and that when it did occur, it was due to the constitution of the bodies of the victim and murderer. Neowald held that it was produced by the devil. Voigt's conclusion is that the corpse of a man violently slain may bleed naturally, whether its slayer be present or absent; such corpses have often bled in the presence of completely innocent persons.

Other animal myths which Voigt rejects are crocodile tears—only rational beings are capable of true grief; the bear licking its cubs into shape—they are not born unshapen and imperfect; and "the love of sheep and wolf."⁷⁸ But he holds that the devil transports witches to their sabbats.⁷⁹ He denies, however, that demons can generate human beings. Supposititious infants are neither men nor monsters nor effects of nature, but sports of Satan.⁸⁰ Other chapter subjects are fossil fish, flying fish, hartshorn, and falling stars. He believes that the last presage drought and winds.⁸¹ *Deliciae physicae* was deemed worthy of review in *Philosophical Transactions* which mentioned that, in connection with fossil fish, Voigt noted that "a whole ship fit to sail in the sea" had been found in 1594 near Maestricht "under a sandy hillock," and that in 1462 another very old ship had been discovered by miners near Berne, "together with its hempen sails and anchors."⁸² We have already heard of the find of 1594 from Helmont. Voigt further mentions "civitates et animantes subterraneae."

René Bary, royal counselor and historiographer, had already composed a logic and a moral philosophy, and had for several years been an auditor of the Rohaults and Denis, before in 1671 he essayed a physics in three volumes.⁸³ Written in French, it is

⁷⁸ *Deliciae physicae*, cap. 2, de lacrymis crocodili, pp. 89-131; cap. 3, de catulis ursarum, 132-154; cap. 4, de amore ovis et lupi, 155-183.

⁷⁹ *Ibid.*, cap. 7, pp. 218-60.

⁸⁰ *Ibid.*, cap. 8, pp. 261-95.

⁸¹ *Ibid.*, p. 365.

⁸² PT, VI, 3017-18.

⁸³ *La physique, où selon les anciens et les modernes il est traité de tout ce qu'il y a de plus curieux dans la nature, est divisé en trois tomes, et dans le*

professedly and evidently a piece of popularization. Truth is difficult to discover, and though our age is fertile in experiences and reasons, our posterity will have plenty of problems still to solve. This is not merely because nature is veiled, but because human nature is bizarre. Attention is centred on a few points, such as the weight of air, the rainbow, the tides, light, the magnet, while a hundred things of equal importance are neglected. Descartes speaks of stones only in passing and says almost nothing of plants and animals. The ability to make oneself understood on all sorts of topics is not the gift of all savants. Nor should physics be presented superficially. The ancient naturalists contain almost as much nonsense as information, and to pile report on report is only to heap up a mass of credulities and lies. Bary has found surprising light in the new philosophy and intends to shed some of it by reflection upon his readers.⁸⁴

The order of presentation, however, is not very divergent from the good old Aristotelian *cursus*. Which is the nobler, form or matter? Monsters, prodigies and miracles are discussed. Nature is compared with art and distinguished from the preternatural and supernatural. We pass on to body in general, extension, is there physical infinity? continuum, place and vacuum, penetration and rarefaction, time and motion, violent motion, alteration, reaction, and a little discourse on extension or intension and the diminution of qualities. Come generation, resistances, mixtures, augmentation and diminution, local movement, heat and cold, liquidity and other qualities including elasticity. Follow light, colors, savors, odors, sound, voice, echo.

With regard to the world we meet the old familiar questions whether it was created, whether there are many worlds, whether it was created in an instant, whether an angel could create it, at what season of the year creation occurred, is the world animated? what is its shape? for whom was it made? will it perish? Under the heavens, the empyrean, moving intelligences, action of the heavens on sublunars and astrological images, crystalline heaven, primum mobile, ninth sphere, and firmament are all still considered. The sun

troisième tome il est métaphysiquement traité de Dieu. J. Couterot,

Paris, 1671, in-12. BN R.13751-13753.

⁸⁴ *Ibid.*, Avant-propos.

is regarded as one of the planets and as moving about the earth. Interest in the moon centers chiefly in its various influences upon plants and animals. Its virtue varies according to the sign it is in. Lunatics should be beaten, wood cut, sheep sheared, and animals castrated, all according to the moon.

Bary still adheres to the four elements. On tides he follows Descartes. Not all springs, if any, are from the sea, but marvelous fountains are not forgotten. Somewhat belatedly he sets forth the elements of the chemists and of Descartes. He has both celestial and sublunar comets. He still speaks of the substantial form of stones and uses Cardan concerning them, who says that they have roots. Their final causes are for medicine and architecture, but men abuse them for luxury and adornment. Various gems are considered. Gesner is cited as to the medical properties of the emerald, but we are warned that the amethyst does not dissipate fumes or prevent intoxication.⁸⁵

It would appear that Bary, despite his professed attachment to the new philosophy, felt that the reading public would still take a pretty stiff dose of the sixteenth century and scholasticism, provided it was sufficiently sugar-coated by popular presentation.

Antoine Le Grand was born at Douai early in the century and died in Oxfordshire towards its close. He wrote on all sorts of subjects from *Le sage des Stoïques* and *L'Épicure spirituel* to the philosophy of Descartes,⁸⁶ sacred history from creation to Constantine the Great, and the sacrifice of the mass. Furthermore he was widely read, most of his books having several editions before the close of the century. We shall treat here of three works by him in the field of popular science.

His *History of Nature*, which was dedicated to Robert Boyle,

⁸⁵ *Ibid.*, I, 711, 714. Soon the first volume ends at p. 759. The much shorter second volume takes up minerals and metals at pp. 1-93, and plants at pp. 94-244. The same pagination continues in tome III, where pp. 245-463 are devoted to animals, and 464-660 to man, 661-731 to the soul. The metaphysical treatise on God then has a new pagination, 1-76, and the whole

work ends.

⁸⁶ *Philosophia veterum e mente Renati Descartes more scholastico breviter digesta*, London, 1671. Enlarged and revised as *Institutio philosophiæ secundum principia Renati Descartes, nova methodo adornata et explicata ad usum juventutis academicæ*, London, 1672, 1675, 1680, 1683; Nürnberg, 1695.

first appeared at London in 1673,⁸⁷ and reached its fourth edition in 1702 at Nürnberg. It was deemed worthy of notice both in *Philosophical Transactions* and the *Journal des Sçavans*.⁸⁸ It was in nine parts. The first argued against the existence of a vacuum. The second, on qualities, held that even occult qualities might be explained in terms of the figures of corpuscles and pores. The third was a history of the universe with Le Grand's opinion of the influence of celestial on inferior bodies. The other six dealt with the four elements, minerals, meteors, plants, animals, and man. Le Grand denied the influence of the moon, that the basilisk killed by its glance, that the corpse bleeds at the approach of the murderer, and that wearing laurel makes one immune from lightning. On the other hand, he affirmed that an entire forest sprang up after great rains, and that exceptionally delicate cucumbers could be grown by soaking the seeds in milk.

Le Grand, in a dissertation on the lack of sense and cognition in brutes which was printed at Leyden and London in 1675 and at Nürnberg in 1679,⁸⁹ held like Descartes that brutes were machines and had only sensitive memory, not intellectual. He also credited them with fear, which is not a characteristic of machines. All other brutes fear the lion, but it fears the cock, for which the explanation of Lucretius is quoted. Le Grand is ready to believe almost anything about animals, as that swallows spend the winter congealed in the swamps of Poland, and is equally ready with an explanation. In a brute animal some change in body, blood or spirits always accompanies sensitive appetite. When in the ventricles of the brain pores are opened by the transit of animal spirits, these pores retain a greater facility of opening again than those through which the spirits have not yet penetrated. Such is his explanation of sensitive memory in brutes. But inasmuch as animal spirits were used to explain almost all human actions, it would seem either that they

⁸⁷ *Historia naturae varis experimentis et ratiociniis elucidata*. The dedication is reproduced by John Fulton in his *Bibliography of the Writings of Robert Boyle*, Oxford Bibliographical Society, III (1931-1933), p. 356.

⁸⁸ PT VIII, 6046-47; JS VII, 107-9. I have not seen the book itself but use these reviews in describing it.

⁸⁹ *Dissertatio de carentia sensus et cogitationis in brutis*, London, 1675, in-12, 206 pp., BN R.16124, is the edition and copy I have used.

should do more than this for brutes, or that mere machines should not have animal spirits at all.

Be that as it may, it is upon this basis that Le Grand accounts for all seemingly intelligent actions of animals, such as the tricks of foxes. Thus a fox suspends itself by its teeth from a limb of a tree overhanging a stream and submerges in the water, with the result that the lice leave its fur for the bough above. The explanation is that once, feeling hot and itchy, the fox gradually waded deeper into the water, caught the branch with its teeth to avoid being swept away by the current, lost its lice and felt relief, remembered this and so repeated the process when it felt hot and itchy again. Similar explanations are given of a fox's urinating on its tail to obliterate its tracks, testing the ice by ear before crossing a frozen river, playing dead and wrapping its body in red clay to appear bloody and attract birds, or racing round a tree until the birds contract vertigo from watching the fox and fall off their perch. Or fixing its eyes on them frightens them and "already thinking themselves captured by their enemy"—thus Le Grand inadvertently admits that fowl, if not foxes, think; and how do they recognize it as a foe, if the incident has not happened before?—they contract stupor, their spirits become confused and do not perform their natural functions, first they vacillate, then tumble off half inanimate. Le Grand later states that animals transmit the fear of man to their foetuses, so that young animals fear him without previous experience and memory, but for fowl to transmit fear of foxes through their eggs would seem even more far-fetched. Digby told of a fox which saved itself by entering a storehouse where sides of meat were hung and jumping up and suspending itself among these. Le Grand admits that this, if true, is difficult to explain, unless the fox had no other place to hide and joined the sides of beef, "which seemed to enjoy a quiet and lofty place"—which again would seem to imply thinking on the part of the fox.

The reason why the hyena imitates the human voice to call shepherds and devour them, is that its bodily anatomy is so disposed that, when the human voice strikes its ears, it deduces the animal spirits into those muscles which serve to form the voice. More sensibly Le Grand remarks that parrots do not really speak, and

that animals do not actually understand words and commands, which are just a sign for them to do something in which they have been trained. But he goes on to argue that birds build nests, migrate seasonally, and divine the weather from a change of bodily temperament, especially in the generative organs. When the weight of eggs makes them heavy and inept for flight, they begin to rest and to delight in a soft warm place. Machines do not experience such sensations of pain and enjoyment, or of comfort and discomfort. But Le Grand really does not mean that brutes are machines, since he states that they have all the movements of the spirits and gland (pineal?) which excite passions in us.

We come to Le Grand's *Curious Scrutinizer* of hidden things of nature, which perhaps first appeared in 1676,⁹⁰ was certainly printed at Frankfurt and Nürnberg in 1681,⁹¹ and translated into German in 1682. Such words and phrases in the full title as curious, arcana of nature, and sympathy and antipathy, suggest a close relationship to natural magic. The arcana of nature, says Le Grand, always excite human admiration, because we are ignorant of their causes, and he speaks of Egyptian remedies for quartan fever as "secret experiments."⁹² On the other hand, the title's allusion to the author's observations is misleading, since he cites authorities for almost everything that he says. His citations range from Aristotle, Hippocrates and Galen down through Rasis, Avicenna, Averroes, Albertus Magnus and Arnald of Villanova, Ficino, Ganivet and Bernardino de' Busti, to a great variety of writers of the sixteenth and seventeenth century. Moreover, many of these citations and the matter which accompanies them are taken without acknowledgement from the book of Baricellus, published back in 1620.

⁹⁰ I have failed to find such an edition.

⁹¹ I have used the edition of Nürnberg, 1681: *Curiosus rerum abditarum naturaeque arcanorum perscrutator, sive Compendium rerum jucundarum et memorabilium in quo naturae arcana, multae rerum sympathiae et antipathiae, et auctoris observationes referantur, cum indice locupletissimo*. Norimberga sumptibus Johannis Zi-

geri bibliopolae, typis Christophori Gerhardi, anno MDCLXXXI, 250 pp. and index. Copy used: Col 610 L52. It will be recalled that a fourteenth century scientist called himself *Perscrutator*: see T III, 103-18, Chapter VI, "*Perscrutator*: a self-confident scientist."

⁹² *Curiosus rerum abditarum* . . . , pp. 71, 182-83.

The text is a hodge-podge of totally disconnected paragraphs thrown together in no discernable order. Some are historical rather than concerned with the world of nature. Others combine the two interests, as in the account from Livy of Hannibal breaking the rocks in the Alps with heated vinegar, the statement that Attila barked like a dog, or the tale from Josephus of a sabbatical river.⁹³ Many of the so-called arcana are familiar topics, such as the problem of the time of creation, the peculiar property of the river Nile, the hostility of rue and garlic to snakes, that bull's blood is a fatal poison, that men are mute at the sight of a wolf, that an antipathy exists between sheep and wolf.⁹⁴

A certain amount of scepticism is expressed. Reported transformations of men into beasts are untrue.⁹⁵ Mattioli proved that salamanders cannot live in fire by throwing a number of them into the flames. None survived.⁹⁶ But Aristotle states that certain insects live in furnaces of Cyprus.⁹⁷ That a basilisk is hatched from an egg laid by a cock is a ridiculous story, or that the viper conceives by biting off the head of the male and is in turn consumed by its brood.⁹⁸ The statement of Paracelsus that a *homunculus* was generated in a glass phial is absurd, and the beaver does not castrate itself when hunted.⁹⁹ Regarding the marvelous remedy from Miquel Pasqual for the stone—it will even remove the stone from your finger-ring—compounded of the liver, lungs, kidneys, testicles and *priapus* of a goat mixed with saffron, cinnamon and honey, Le Grand comments, "A thing indeed monstrous, if it is true."¹⁰⁰ But again most of these sceptical passages are mere repetitions of Baricellus.

Le Grand is still favorable to the influence of the stars. Farmers observe the constellations in predicting the weather.¹⁰¹ Bodin assures us that lunatics are worst at the full of the moon.¹⁰² Small pox and the measles, which are first mentioned by Arabic writers, were new diseases produced in the first instance by the sky, but

⁹³ *Ibid.*, pp. 19, 53, 15. At least two of the three are in Baricellus.

⁹⁴ *Ibid.*, pp. 4, 10, 18, 38, 64.

⁹⁵ *Ibid.*, p. 7.

⁹⁶ *Ibid.*, pp. 14-15.

⁹⁷ *Ibid.*, p. 10.

⁹⁸ *Ibid.*, pp. 37, 40-41.

⁹⁹ *Ibid.*, pp. 72, 199.

¹⁰⁰ *Ibid.*, pp. 139-140.

¹⁰¹ *Ibid.*, p. 6.

¹⁰² *Ibid.*, p. 25.

now transmitted hereditarily (from Mercurialis *via* Baricellus).¹⁰³ Hippocrates (pseudo) and Jean Ganivet (1431) agree that a physician must know astronomy,¹⁰⁴ and the conjunction of Saturn and Mars in Taurus indicates a pest among cattle,¹⁰⁵ while lions have fever, when the sun is in Leo.¹⁰⁶ Whereas Le Grand was said to have denied the influence of the moon in an earlier work, he now asserts that it is fatal for a man to sleep in moonshine,¹⁰⁷ and astrologers often predict correctly because man is so prone to follow sense appetite.¹⁰⁸

Sympathies and antipathies command Le Grand's adherence as a rule, but, like Baricellus, he denies any antipathy between rue and cabbage.¹⁰⁹ However, he accepts, again like Baricellus, sympathy between the ring finger and the heart, of eels with the north wind, and the extreme antipathy between snakes and the ash-tree.¹¹⁰ *Nux moscata* or *muscata*, *miristica* or *myristica*, has marvelous sympathy with man, making its bearer vigorous and handsome.¹¹¹ The bird *oryalus* cures jaundice by its glance.¹¹² Where diseases flourish, there especially, as Baricellus had also stated, do remedies for them arise.¹¹³ Such is the sympathy of the herb, *bardana major*, with the womb, that it elevates it, if worn on top of the head, and brings it down, if put under the instep.¹¹⁴ Who does not marvel that dogs become dumb on touching the hyena's shadow? Why are wolves unable to injure the sheep, if the bell-wether wears a head of wild garlic about its neck? These are indeed marvels which reduce to the sympathies and antipathies of things and the arcana of nature.¹¹⁵

Le Grand repeats the explanation of Baricellus why the lion fears the cock as a discussion of his own with his jurist friend, Carolo Cifello.¹¹⁶ The testicles of horses have a marvelous virtue of dispelling the afterbirth, and human saliva kills scorpions.¹¹⁷ Quick-

¹⁰³ *Ibid.*, pp. 49-51.

¹⁰⁴ *Ibid.*, p. 76. For Ganivet: T IV, 134-39. We have heard both authors cited by Ruttörfer in 1666.

¹⁰⁵ *Ibid.*, p. 77.

¹⁰⁶ *Ibid.*, p. 170.

¹⁰⁷ *Ibid.*, p. 237; also p. 162, "Magnum esse in haec inferiora lunae confluxum."

¹⁰⁸ *Ibid.*, p. 127.

¹⁰⁹ *Ibid.*, p. 52.

¹¹⁰ *Ibid.*, pp. 108, 169, 173.

¹¹¹ *Ibid.*, p. 94.

¹¹² *Ibid.*, p. 138.

¹¹³ *Ibid.*, p. 117.

¹¹⁴ *Ibid.*, p. 60.

¹¹⁵ *Ibid.*, p. 71.

¹¹⁶ *Ibid.*, pp. 101-2.

¹¹⁷ *Ibid.*, p. 220.

silver worn in an amulet protects from pest and fascination, while the mere suspension of mistletoe aids epileptics.¹¹⁸

Le Grand still accepts the generation of animals from putrid matter. They did not exist at creation, but God put in matter the seminal causes from which they were generated, after corruption had set in.¹¹⁹ As wolves grow old, poisonous serpents are generated in their kidneys.¹²⁰ Various ways are suggested to insure the birth of male human offspring.¹²¹ The male is animated in the womb on the fortieth day; the female, not until the eightieth or ninetieth.¹²²

Aristotle's assertion that all animals except man die from the bite of a mad dog, indicates that it was not yet recognized as the cause of hydrophobia, which in the *Symposium* of Plutarch is spoken of as a new disease.¹²³ When many died at Benevento of an unknown cause, dissection revealed a short red worm in the brain. After various vermicides had failed to kill it, slits of radish boiled in malmsey wine not only did so but cured all those affected and allayed the epidemic.¹²⁴

Le Grand exclaims at the marvelous sagacity of mice which abandon a house that is about to fall in ruin, and of lice that leave the bodies of the dying.¹²⁵ He esteems chemical preparations as well as the virtues of herbs and parts of animals, and believes in the medicinal use of gold.¹²⁶

After giving a recipe for infernal fire, Le Grand adds that "impious Paracelsus" claimed to have had it from a demon.¹²⁷ Le Grand himself twice attributed to demon activity the finding of such objects as knives, large bones, keys and stones in the human stomach.¹²⁸

The *Physical and Medical Problems* of François Bayle, published at Toulouse in 1677, profess to detect various errors of ancients and moderns.¹²⁹ Unfortunately Bayle himself was not yet entirely free

¹¹⁸ *Ibid.*, pp. 228, 238.

¹¹⁹ *Ibid.*, pp. 28-29.

¹²⁰ *Ibid.*, p. 160.

¹²¹ *Ibid.*, pp. 161-62.

¹²² *Ibid.*, pp. 123-24.

¹²³ *Ibid.*, pp. 103-5.

¹²⁴ *Ibid.*, p. 90. "Forestus ex lib. Cornelii."

¹²⁵ *Ibid.*, pp. 5, 53.

¹²⁶ *Ibid.*, p. 150, "Auri usum in medicina pro conservando valetudine mirabilem obtinere proprietatem."

¹²⁷ *Ibid.*, p. 200.

¹²⁸ *Ibid.*, pp. 147-48, 216-17.

¹²⁹ *Problemata physica et medica in quibus errorum veterum et recentiorum errores deteguntur praecipue circa quasdam sanguinis evacuationes tum*

from such errors, still believing that the sun moves through the zodiac¹³⁰ and denying that the moon has anything to do with the tides.¹³¹ More correctly he denies that the moon affects the bones or fluids in the bodies of animals and critical days in disease, although he grants that it may be advisable to plant certain seeds in certain phases of the moon.¹³² He also denies that there is any force in numbers to provoke crises, and that the heavenly bodies are incorruptible.¹³³ He further states, in apparent ignorance of Kepler's laws, that astronomers have not yet succeeded in computing exactly the periods of the planets or progress of the stars, and that consequently astrologers often err in predicting conjunctions of the planets. He limits the influence of the celestial bodies upon inferiors to little more than the light and heat from the sun.¹³⁴ Epidemics are not due to planets or comets or eclipses, and the treatise of astrological medicine ascribed to Hippocrates is spurious.¹³⁵ Bayle also rejects as a fable the tradition that the tiny remora stops a ship. The very small bit of the vessel to which it attaches itself would be torn off rather than the whole ship retarded. And what fulcrum would the remora have for leverage in mid-sea?¹³⁶

Of more importance than Bayle's rather limited scepticism is the general character of the problems in which he and his readers were interested. He questions whether, in inflammation of the spleen and other ailments requiring venesection, this should be performed on the left arm; why opening a vein in the arm sometimes restores suppressed *menstrua*, sometimes checks them; whether, when pain in the side reaches the armpit and shoulder, blood should be let from the arm of the same side.¹³⁷ Recent scientific progress receives recognition in the query whether the weight of the air is necessary for animals' safety. The affirmative answer, however, is based on

sponte tum arte factas et circa crises earumque causas ac verae quorundam remediorum indicationes demonstrantur, Tolosae apud B. Guillemette, 1677.

¹³⁰ *Ibid.*, Problema 112 (p. 178-), "An solus sol per eclipticam motu varias anni tempestates afficiat?"

¹³¹ *Ibid.*, Prob. 104, "An luna corporibus humidis dominetur? . . . vero-

simillimum esse ad illum efficiendum lunam prorsus nihil conferre."

¹³² *Ibid.*, Prob. 104-107.

¹³³ *Ibid.*, Prob. 103, 109.

¹³⁴ *Ibid.*, Prob. 109-111.

¹³⁵ Prob. 114-115.

¹³⁶ Prob. 62, pp. 86-87.

¹³⁷ Prob. 8, 10, 11.

the belief that the weight of the air prevents the subtler part of the blood from evaporating.¹³⁸ Other problems are why the left ventricle of the heart is stronger than the right, why a rope sometimes burns when broken and why a moistened rope will hold a greater weight, why calcined metals increase in weight—not from light, perhaps from the air.¹³⁹

More traditional and stereotyped are such questions as why flesh rots quicker in moonlight than in sunlight, why bodies of the drowned float after a few days, why fire burns better in intense cold, whether the inundation of the Nile is because its waters are rarefied by nitre, why a hard boiled egg rotates on its axis more readily than a raw egg, whether all hot baths are caused by subterranean fires, why it is hard in pleurisy to lie on the side opposite to the affected side, why we weep in grief, why most men are right-handed, why angry persons do not become rigid as frightened persons do, why music induces sleep.¹⁴⁰

In the preface to the reader, Bayle stated that the smallest things, which, because of their slight bulk, are popularly thought to be of no account, are the principles of great and portentous effects. With this pass-word from ancient magic to modern atomic physics, we terminate our account of his book.

The work of G. B. de Saint-Romain in 1679 may hardly be regarded as a text-book or course of university lectures, since its title is *Natural Science Freed from the Chicanes of the Schools*. It is further described in the full title as a new work, enriched with many experiences drawn from medicine and chemistry and with some observations useful to bodily health.¹⁴¹ Its four parts consider natural causes and principles, the celestial world and things above man, things under man, and things in man or man himself.

For Saint-Romain first matter is neither Aristotle's nor the four elements nor the three principles of the chemists nor the three elements of Descartes, but atoms or corpuscles. They are very

¹³⁸ Prob. 12.

¹³⁹ Prob. 19, 34-35, 43.

¹⁴⁰ Prob. 47-48, 54, 65-66, 69, 74, 81, 88, 118, 119 and last.

¹⁴¹ *La science naturelle dégagée des chicanes de l'école: ouvrage nouveau,*

enrichi de plusieurs expériences curieuses tirées de la Médecine et de la Chymie; et de quelques observations utiles à la santé du corps. Paris, 1679, 391 pp. Copy used: BM 1035.a.25.

subtle and imperceptible but solid and indivisible and of varying sizes and figures, so that they are differently received in the pores of bodies. Whether they are of the same or different specific weights he fails to say. If free and not entangled, they keep moving, but he again neglects to say whether they have varying velocities.¹⁴² The soul is in the pineal gland, as Descartes thinks, or in the hollowed bodies of the brain, where it performs the functions of perception and common sense, and in the callous body, where it forms images of things and judges them, and in the ashy portion where it exercises the acts of memory, according to the opinion of Duncan.¹⁴³

This adoption of atomism and the corpuscular theory does not mean that Saint-Romain rejects the phenomena which had been attributed to occult qualities or to sympathy and antipathy. He merely explains them differently in terms of corpuscles, exhalations and pores. He still asserts that a drum of sheepskin will not resound in the presence of one of wolfskin, and that the basilisk kills by its glance. He would explain the action of Digby's sympathetic powder by "the continual commerce of spirits," which keep going forth from bodies and entering into union with others.¹⁴⁴ The divining rod bends, because the mineral or aquatic effluvia or spirits fit the pores of the rod, and provided the effluvia from the hand of the dowser favor and do not prevent this.¹⁴⁵ It is the same with amulets. Wearing genuine jade cures gravel absolutely. Quicksilver or a toad worn about the neck preserve from pest; carrying the tooth of a dead man cures toothache, etc., etc. "I do not question the truth of these experiences, since I am certain of most of them." They cure by the emission of atoms or spirits which penetrate the human body and fortify the animal spirits there or ward off external poisons.¹⁴⁶ Such action may operate at a distance of a hundred leagues or more.¹⁴⁷

So-called antipathies may be similarly explained. The basilisk does not kill by antipathy but by venomous spirits from its eyes.

¹⁴² *Ibid.*, pp. 113-16, 121-23.

¹⁴³ *Ibid.*, p. 130. For William Duncan's *Physiologia* consult the Index.

¹⁴⁴ *Ibid.*, I, 6, "De la Sympathie et Antipathie et des effets qui en dépendent"; pp. 33, 34, 39.

¹⁴⁵ *Ibid.*, I, 8, "Explication de plusieurs autres effets qu'on prétend attribuer à la Sympathie"; p. 42.

¹⁴⁶ *Ibid.*, I, 9, pp. 44-45.

¹⁴⁷ JS VII, 37.

Basilisks are found only in secret, deep and damp places, such as the bottom of a well. A mirror exposed to the basilisk's glance, kills it. But one cannot say that the basilisk has an antipathy for itself; rather the reflected spirits move more violently and pierce its eyes to the brain and heart. Similarly certain vapors of hypochondriacs sometimes mount from the mesentery or stomach to the brain with such violence that they cause epilepsy, apoplexy, vertigo or lethargy, or are borne to the heart and result in immediate death. Supposed antipathies between vegetables may be accounted for in like manner. Putting a sheet of paper or linen between the vine and a cabbage plant prevents their interaction, although the antipathy would remain the same. Purgatives act not by sympathy and antipathy, contrariety or likeness, but because they irritate by the contexture of particles which they contain. The animal spirits come to the rescue and carry off with them the noxious humors.¹⁴⁸

Saint-Romain seems to approach the relation of sympathy himself when he says that crude antimony and the diaphoretic which the late Monsieur de Lorme called his milk of pearls "are of a very friendly nature," and can be used without danger.¹⁴⁹ Put wine in a cup made of antimony in the evening and drink it in the morning and you will be purged thoroughly "above and below." The process can be repeated daily without the cup diminishing appreciably in size or losing any of its virtue, yet the effect is due to the emission of corpuscles of antimony, and Saint-Romain holds that in the course of years of such use the cup would eventually wear out.¹⁵⁰

If one make a regulus of iron, one finds at the bottom a large star with five great rays in relief. It is prettier and its rays better formed, if the regulus is made on a Tuesday or Friday in fine weather between seven and eight in the morning or between 2 and 3 P.M.

And to add marvel on marvel, it is certain that, if you add *la Rose*,

¹⁴⁸ *La science naturelle*, I, 10, "Des effets qui paroissent dans la nature et qu'on attribue à l'antipathie"; pp. 50, 52, 54-55, 58-59.

¹⁴⁹ *Ibid.*, p. 61.

¹⁵⁰ *Ibid.*, p. 62. An earlier work was *The Antimonial Cup twice cast*,

or, *A Treatise . . . shewing the abuse thereof*. First written in Latine by James Primerose, Dr. of Physicke, in consideration of a small pamphlet set forth by the Founder of the Cup, translated into English by Robert Wittie, M. A. Philiatr., London, 1640.

which is the Venus of the chemists, to the iron, you will produce a regule where will be seen two stars interlaced by their rays, distinct and in relief. And if you push the regule to its last perfection, the star will disappear and in its place will be seen a very delicate little net in the form of a fish-net. I write nothing that I have not seen and done, since I do not write here on the good faith of others.¹⁵¹

Saint-Romain states that everyone accepts the relation of the seven metals to the seven planets, "and a commerce invisible and particular between the heavens and the earth by secret influences." The day and hour of the planet contribute to the success of the chemical experiment with its related metal. The vapors rising from antimony mingle on high with those of their planet, then descend on the metal in a purer state. He also notes the relation of the planets to parts of the human body.¹⁵² He tells of a man in Provence who made gold on six different occasions by exposing three drugs in a vessel to the rays of the sun, with use of a concave mirror. A water was produced, from which a powder was made, and from it gold.¹⁵³

But Saint-Romain accepts the Copernican theory as well as all this magical and astrological and alchemical lore. He discusses the movement of the earth, the sun as the center of the world, and the moon and its mutations.¹⁵⁴ Indeed, although the majority now ascribe the tides to the moon, he prefers the movement of the earth as their cause.¹⁵⁵ At the same time, he keeps talking of tourbillons, and makes the inaccurate assertion that Copernicus, as well as Seneca and other ancients, taught that comets existed from the foundation of the world but, like the other planets, had an eccentric movement and much of the time were too far distant to be seen. All such opinions are, however, very uncertain. His own is that the sun is like gold in a cupel and raises fumes and vapors of which the crassest, gross and inflammable, form comets whose movement is regulated by the solar tourbillon, although some comets, as Aristotle taught, may be terrestrial exhalations.¹⁵⁶ Temporary fountains are

¹⁵¹ *La science naturelle*, pp. 63-64.

¹⁵² *Ibid.*, pp. 64-65.

¹⁵³ JS VII, 39.

¹⁵⁴ *La science naturelle*, Part II,

caps. 8, 9, 10; pp. 173, 178, 189.

¹⁵⁵ *Ibid.*, III, 16; pp. 282-83.

¹⁵⁶ *Ibid.*, II, 11; pp. 194-97.

from rainfall, but permanent streams are from the sea which is higher than plains and valleys¹⁵⁷—an absurd assertion, since then rivers would have to flow uphill to reach the sea. He somewhat redeems himself by a chapter on the circulation of the blood and another on sleep, dreams and death, in which he abstains from considering divination from dreams.¹⁵⁸

In 1684 appeared anonymous *Essays in Physics*, proved by experience and confirmed by Holy Scripture,¹⁵⁹ which were chiefly concerned to combat most of the recent findings of science. The author's three principles were water, the spirit of the Lord which moved over the face of the waters, and light. He denied that air had weight, that brutes were machines; defended substantial forms, and held that colors were really in objects. Comets and new stars were formed out of the waters above the firmament. He preferred such alchemical authors as Augurellus and Helmont to Cartesians and corpuscular philosophers, and accepted the apparent resuscitation of plants in the laboratory as proof of their specific forms. Since plants were created before the stars, their specific forms came from primitive light, while those of animals were from sun or moon. Plants had a zenith and nadir corresponding to the poles of the magnet, and must be handled accordingly.¹⁶⁰

The *Physical Curiosities of Josephus de Tertiis*¹⁶¹ has a title similar to those of works by Voigt and Le Grand which have already been examined. Its more particular interest in hay and straw will not here concern us.¹⁶² Concerning fascination he states that the fascinator must be close to the fascinated, and that flattery is an aid in fascination by opening up the pores. The virtue of amulets depends upon their effluvia. Rattray is cited as to transplantation of disease and weapon ointment. Sympathy in plants is noted, and

¹⁵⁷ *Ibid.*, III, 17; p. 284.

¹⁵⁸ *Ibid.*, Part IV, caps. 19, 21; pp. 369, 375.

¹⁵⁹ *Essais de physique, prouvez par l'experience et confirmez par l'Ecriture Sainte*, Paris, apud A. Pralard, 1684, in-8.

¹⁶⁰ *Acta eruditorum*, IV (1685), 496-501.

¹⁶¹ *De curiositatibus physicis trac-*

tatus in quo natura stramentorum foenatorum et qualitates odoris et effluviarum, elementorum mutatio et praecipue aeris examinatur..., Medio-burgi, 1686. BM 1172.e.6 (4). Also at Leyden in 1686.

¹⁶² He tells the reader that he was in charge of the horses of the duc de Nivernais.

the shadow of metals as well as of plants is said to have good and evil effects.¹⁶³

De Tertiis contends that von Guericke's experiments show that air is an effluvium and not an element. Experiments of academies at Rome and Florence proved that it is convertible into water. So there are only three elements, earth, water and fire which he identifies with the three chemical principles of salt, mercury and sulphur. If air is an element, how do the chemists extract a salt from it? But that it is a food many recorded instances of long fasting demonstrate. Many animals eat nothing while hibernating; Homer tells of horses conceived from the wind; and there are men on the Ganges who live on the odor of apples.¹⁶⁴

The attitude in matters of magic and experimental science of the Rational Lexicon of Etienne Chauvin in 1692¹⁶⁵ is in marked contrast to the earlier encyclopedias of Zwinger and Beyerlinck. There is no treatment of magic or divination, not even of physiognomy or chiromancy, while the article on dream says nothing of divination therefrom. Astrology is pronounced indubitably vain and false for nine reasons which we need not repeat, as they had been repeated many times before. Conjunction receives a treatment two and a half columns long but without a word as to planetary conjunctions and astrology. Under gems there is nothing as to their virtues; on herbs only a few lines. Coral and emerald receive no separate treatment. On the other hand, the article on chemistry and alchemy of Zwinger and Beyerlinck gives way to separate accounts of gold, silver and other particular substances. But potable gold is not mentioned. Their eighteen pages on demon and six on angel shrink to a single page on the latter. Under Virtue only moral and intellectual are included, not occult.

I made out a list of some 160 topics which I have frequently encountered in this review of the seventeenth century. Less than half of them received recognition in the Rational Lexicon. Under the letter A, I found no aetites, alcahest, alcohol, almanach, ambergris, amulet, anatomy, antimony, apparitions, arcanum or asbestos.

¹⁶³ *Ibid.*, pp. 21, 23, 28, 31, 39, 46.

¹⁶⁵ *Lexicon rationale sive thesaurus*

¹⁶⁴ *Ibid.*, pp. 62, 69-70, 84-88, 91, 96.

philosophicus, Rotterdam, 1692, in-fol. BN R.338.

Only antipathy, antipodes and *aquae*—in this case resembling Zwinger and Beyerlinck in not mentioning chemical waters. As for antipathy, perhaps we shall one day learn how the spirits issue from one body and enter another to produce these effects of sympathy and antipathy, for the spirits can work wonders in this way, and it is not going too far to assert that the hate of one body towards another can be explained mechanically.

There are articles on Aristotle and Plato, Gassendi and Descartes, but none on Galen, Gilbert, Galileo, Kepler, Francis Bacon or Newton, although in connection with tides is mentioned Galileo's attribution of them to the motion of the earth. But under gravitation and heavens no mention is made of Newton's law. Physical attraction is pronounced a mere figment by recent philosophers. Cartesian vortices are favorably received.¹⁶⁶ Some moderns put one hemisphere of the moon in the earth's vortex and the other hemisphere in the sphere of the planets. It seems probable to the Cartesians that comets are planets; more recent scientists hold that they are in the vortices of the fixed stars, as our planets are in the vortex of the sun. They also doubt if fire is a distinct substance and suggest that it is merely a very swift motion of particles of sulphur.

Chauvin includes the circulation of the blood and omits spontaneous generation; he lists various barometers and thermometers. He has a column on artificial phosphorus and two on natural. He says nothing of balsam, bezoar, *blas* or climacteric years; but does have an article on fascination in which he mentions the basilisk and would attribute its effects like those of the torpedo fish to effluvia, to which the young and those with open pores are more subject, and accepts the clouding of a mirror by a menstruating woman. He also still accepts the formation of animal spirits in the brain from the blood. Some contend that they emanate from the flame of vital blood like rays of light; others identify them with nitro-aerial particles of air, brought into the blood by respiration, and transmitted by it to the brain; others assimilate them to the ether. Such were the vagaries of which the mechanistic and corpuscular philosophy was capable.

¹⁶⁶ See the article, *Vortex mundanus*, also under *Systema mundi*, and *Comet*.

Chauvin has a column on monsters, sharing the interest in them of the members of scientific societies, but not regarding them as signs or portents. He still devotes two columns to the question whether springs originate from precipitation or the sea. He has reduced the three regions of air to two, variously estimated as extending eight, forty or fifty miles above sea level. But it seems certain that the highest mountains surpass this by many parasangs and reach the purest ether. He has no article on signatures and even omits the recent fads of transplantation and transfusion as well as transmutation, but he believes that the aqueous humor of the eye can be restored. Thus, despite his abandonment of an animistic and magical outlook for a mechanistic one—he devotes over three columns each to pneumatic and to bestial machines—he is still about as likely to be wrong as right.

CHAPTER XXXII

ASTROLOGY AFTER 1650

Placido Titi—Hibner on seals—Hardick Warren—Childrey's Copernican astrology—Opposition to astrology by John Gaule, Tobias Wagner, and Jacques de Billy—Eclipse of 1654: Huygens' comment—Allaeus, "a Christian Arab"—Macrocosm and microcosm: Schütz, Horne—Dingley, Wilsford, Strauch, Petit, Helvetius—Abdias Trew—Marten Schoock—Noceto—Levera—Opposition by Erasmus Bartholinus and Dérodon—Osiander—A conference on comets—Mauritius de Flisco—Placet on macrocosm and microcosm—Denis on astrology and comets—Hoffmann and astrological medicine—Mathematical Lexicon of Hieronymus Vitalis—Beutel—Hannemann—Astrology in England: Hobbes, Blagrove, Halley—More astrological medicine: Christinus, Wedel—Godard—Cassini and the comet of 1677—Hevelius, Barberius, Schweling—Comets and conjunctions of the early eighties—Pierre Bayle on the comet of 1680—Malleme des Messanges—Grasseti on astrology and chiromancy—Astrology and experimental method: Montanari, de Bonattis—de Tertiis and astrological necromancy—John Goad and weather prediction—Manuscripts at Karlsruhe—Welper—Bulstrode—Pourchot—Summary.

Il n'y a jamais eu rien de plus impertinent, rien de plus chymérique que l'astrologie, rien de plus ignominieux à la nature humaine.

—BAYLE

Placido Titi or Placidus de Titis of Perugia, a monk of the Olivet Congregation, served as a sort of patron saint for astrologers in the second half of the seventeenth century and lent something like an odor of sanctity to that sorely beset art. In 1650 had first appeared his *Physiomatica* or celestial philosophy demonstrated by natural principles¹ which had hitherto been lacking, another of the by this time fairly frequent attempts to rehabilitate astrology upon a natural basis. In the same year he published three books of physico-mathematical questions.² In 1654 his *Nuncius astro-*

¹ *Physiomatica sive coelestis philosophia naturalibus hucusque desideratis ostensa principiis*, Milan, per Io. Bapt. Malatestam, 1650.

² *Quaestionum physico-mathematicarum libri tres*, Milan, 1650, in-4, 323 pp. BM 718.h.9.

nomicus—a title reminiscent of Galileo's *Sidereus nuncius*—was printed at Milan, and was issued in Italian the same year as *Il corriere astronomico*. In 1657 his Tables of the Primum Mobile were accompanied by thirty examples of nativities.³ In 1658, when the Latin translation which Gogava had made in mid-sixteenth century of the *Quadripartitum* of Ptolemy was finally printed, notes by Placidus de Titis were added, and the work was in sufficient demand to be reprinted in 1660 and 1665.⁴ Meanwhile in 1660 he had published a work on critical days in two volumes.⁵ Zedler in the eighteenth century noted that in this work, too, Placido tried to account for the influence of the stars on natural grounds and manifest causes. But Zedler did not accept his conclusion. Placido issued Ephemerides in 1661⁶ and died in 1668, but his *Physiomatica* was re-issued in 1675 along with the three books of physio-mathematical questions and additions to his doctrine by Cursinus Francobacci.⁷

The Approbation of Tito's book which was made on September 20, 1650 by the reverend father, Raphael Aversa, of whose two volumes of 1625 and 1627 we have treated in our chapter on the *Cursus Philosophicus* Before Descartes, found it desirable to point out that in several passages of the work it was of course understood that the stars are only secondary causes, which incline but do not necessitate. When, for example, the author says that life is moderated by the *Prorogator* alone, he does not mean to exclude the

³ *Tabulae primi mobilis cum thesibus ad theoricen et canonibus ad praxim additis in rerum demonstrationem et supputationum exemplum triginta clarissimorum natalium thematibus* . . . , Padua, typis Pauli Frambotti, 1657, in-4, 413 pp. BM 8610.ee.11.

⁴ P. Riccardi, *Bibliotheca matematica italiana*, for the full title and editions.

⁵ *De diebus decretoriis et aegrorum decubitu* . . . , Pavia, 1660, 2 vols., in-4. BM 8610.bb.45.

⁶ See Riccardi.

⁷ There are three separate title pages in BN V.8375, the copy which I have examined: *Physiomatica*

sive coelestis philosophia naturalibus hucusque desideratis ostensa principiis. Quaestionum physiomaticarum libri tres in quibus ex naturae principiis hucusque desideratis demonstratur astrologiae pars illa quae ad Meteorologiam Medicinam Navigium et Agriculturam spectat cum xii exemplis in fine allatis auctore Didaco Pritto Pelusiens. Ad Placidianam doctrinam additamenta excerpta ex iii libro astronomicarum rerum praemittendarum ad futuram astrologiam Italicam a Cursino Francobacci ex Africano Scirottha Romano. All three title pages have Fran. Vigoni as printer, Milan, 1675.

influence of the First Cause but only to exclude the action of other stars in comparison to the star to which he attributes the function of *Prorogator*.⁸

Placido held that the heavens acted upon the earth only by their light, thus abandoning any occult influence. If there were other stars in the sky than those we see, they do not act on us. But the qualities and natures of mixed bodies have their origin from the stars. Moreover, the distinction of signs of the zodiac and astrological houses in the sky is real, and though it may seem silly to predicate sex of the signs, they have it virtually. He also treats of the dignities of the planets in the signs and of directions; argues that there is some validity in nativities, and gives twelve examples of them, mostly taken from Argolus. Occasionally he answers arguments of Pico della Mirandola against astrology. As for the tides, however, he holds that sun and moon do not draw the waters of the sea as a magnet attracts iron, but cause the tides by rarefaction and condensation.

The *Mystery of the Seals of Herbs and of Stones* by Israel Hibner, professor of mathematics at the University of Erfurt, appeared there in 1651 in German⁹ and at London in an English translation by B. Clayton in 1698,¹⁰ showing that there was still interest in such pseudo-science at the very close of the century. The work was perhaps suggested by the medieval treatise of the pseudo-Hermes on fifteen stars, stones and herbs. It opens with tables relating diseases, herbs, etc. to the seven planets. After touching upon wonders and miracles of herbs, it discusses at what times to gather herbs and roots, and then considers particular herbs in the order of the planets.¹¹ Then come predictions for the next two or three years,¹² and after these cures by celestial influence

⁸ *Physiomatica*, 1675, p. 105; I, 17, "De prorogatoribus et eorum immobilitate," for Placido's treatment of the *Prorogator*.

⁹ *Mysterium sigillorum herbarum et lapidum*, Erfurt, 1651, 166 pp.: BM 1141.c.8 (3.). Sudhoff (1902), 77, and Hofer, *Hist. de chimie*, II, 334, call the author Hiebner, but the BM and BN catalogues spell it Hibner.

¹⁰ BM 1141.a.18.

¹¹ *Mysterium sigillorum*, 1651, pp. 65-92, from Saturn to the moon.

¹² After the prediction from autumn 1651 to spring 1652, it is stated that "Die folgenden Zeiten" from spring 1652 to spring 1653 are at the end of the volume, but I did not see them there.

with the aid of the seven metals and gems. A seal for each planet is depicted and a list of its gems is given. Finally the virtues of the seals are set forth. Zedler ascribes also to Hibner a *Practica reformata*, printed at Frankfurt in 1640.

Hardick Warren, who described himself as "a well-wisher to the most secret occult arts and learning," issued a brief defense of magic and astrology in 1651.¹³ As might be inferred from his further statement,

I have in the magical part of this treatise followed the method of . . . Agrippa, whose learned work . . . I honor above all the books in the world except the Sacred Writ,

his attitude is quite conservative and traditional.

Magick is the connection of natural agents and patients . . . to . . . such effects as are wonderful to those that know not their cause.

All inferior things are under the Superiors, and astrology is an art "by which the influence and virtual operations of the superior bodies, with their effects and significations are brought to light." They rule over kingdoms and states and influence particular cities. Thus the conjunction of 1444 presaged the fall of Constantinople (in 1453), and the conjunction of 1642 will do London no good. Albumasar and Pierre d'Ailly are cited as to the Flood. The stars also rule over individual human beings. Astrology has no connection with the devil, is of great antiquity, and was practised by the best and holiest men.

Less confined to generalities, and by a man of higher scientific attainments, was another English tract which appeared in the year following.

Joshua Childrey (1623–1670) was a correspondent of Oldenburg, secretary of the Royal Society, and wrote *Britannia Baconica*, or the natural rarities of England, Scotland and Wales, according as they are to be found in every shire, historically related according to the precepts of Lord Bacon, which rapidly ran through three editions in London (1660, 1661 and 1662) and two at Paris (1667

¹³ *Magick and Astrology vindicated from false aspersions and calumnies*, London, 1651, in-4, 31 numbered

pages; those To the reader are un-numbered.

and n.d.).¹⁴ In a brief earlier essay of 1652 he had suggested reforms in astrology.¹⁵ Because it was still based on the Ptolemaic system, "many times there is above a month's difference between the apparent and true aspects." But when Childrey calculated the positions of the planets according to the Copernican or heliocentric system, as he had done for some months, he found that the events corresponded very closely to his expectations. He therefore urged that the places and aspects of the planets should be altered both in almanachs forecasting the weather and in revolutions and genitures. He would do away with houses, exaltations, triplicities, *termini*, *facies*, *pars fortunae*, combustions and so forth, and depend mainly on aspects, except that he would pay little heed to the aspects of the moon with planets other than the earth, "since they move about" different "centers, and their aspects therefore are properly not aspects." He would abandon retrograde and stationary, and judge from apogee and perigee, north or south declination, and latitude. He would begin the year at the winter solstice instead of the vernal equinox, and predict from the hour of conception rather than that of birth. He criticizes those astrologers who predicted the end of the world from the eclipse of March, 1652, and that to come in 1654. He also opposes the idea that eclipses do not operate right away but only after a time. Childrey himself issued an Ephemeris for the year 1653.¹⁶

We turn to three opponents of astrology.

John Gaule, who "studied at both Oxford and Cambridge, but did not graduate" is further characterized in the *Dictionary of National Biography* as "an unlearned and wearisome ranter." In 1646 he had published *Select Cases of Conscience touching witches and witchcraft*.¹⁷ In 1652 appeared his *The Mag-Astro-Mancer*.¹⁸ After an opening chapter of 45 pages to show that the Bible was opposed

¹⁴ All five are found in the BM. Of Childrey there is a long account in DNB.

¹⁵ *Indago astrologica: or, a brief and modest inquiry into some principal points of astrology, as it was delivered by the fathers of it, and is now generally received by the sons of it*, London,

1652, in-4, 16 pp. BM E.662 (5.).

¹⁶ *Syzygiasticon instauratum*, 1653, in-8: BM E.1471 (1.).

¹⁷ BM E.1192, in-12.

¹⁸ *Or the Magicall-Astrologically-Diviner posed and puzzled*, London, in-4; BM 718.e.22. Col B.156.7. G 235.

to magic and astrology, he more briefly contended that they were against Faith and authority, too curious and not scientific, and of obscure origin. He then argued against them from the law of nature, the order of causes, and reason. He attacked the supposed experimental basis of astrology, questioned its underlying hypotheses and principles, and held that it consisted more in cavils and corrections than in rules and directions. He charged both magic and astrology with absurd errors, heresy and other bad effects. Turning again to astrology more particularly, he questioned the inference from temperament to moral character, dwelt upon the fatuity of a belief in fate, and insisted upon the affinity of astrology to witchcraft. He held magic and astrology responsible for divination from dreams, physiognomy and metoposcopy, the Cabala and the use of amulets. Arguing that prophecy had now ceased and that miracles were rare, he attacked the miraculous character of magic, divination and astrological prediction, the ceremonies of magic and astrology, and the practice of astrological interrogations and elections in particular. After a chapter of 24 unnumbered pages asserting that magicians and astrologers have themselves acknowledged the vanity and impiety of their arts, a long final chapter in 35 sections (pp. 241–376) is devoted to proofs from history against them.

Four years later, in 1656, Tobias Wagner, professor of theological controversies at Tübingen, dean of the church there and superintendent in the stipend of the duke, presided over a dissertation destroying genethliacal astrology from theological and physical principles and the admissions of astrologers themselves, to which the respondent was Johannes Brandius.¹⁹ In a preface to the reader²⁰ Wagner states that under genethliacal astrology he includes the fortunes of cities and regions as well as the nativities of individuals, but not meteorological astrology. He also notes that the author of the book on the Pre-Adamites affirms that there was extended astronomical observation before Adam.²¹ Then follow

¹⁹ *Astrologia genethliaca ex theologicis ac physicis principiis ipsisque astrologorum penetralibus . . . destructa*, Stuttgart, 1656, 134 pp.: copy used: BM 718.f.35.

²⁰ On unnumbered pages preceding the text proper.

²¹ Pages with the signatures b verso – b 2 recto.

two long quotations: one from Rigord concerning letters of astrologers of 1179 with regard to the year 1186; the other from Joseph Scaliger's prolegomena to Manilius against the astrology of Cardan.²² It is stated that Cardan lived to be eighty, whereas he actually died at seventy-five, another instance of the historical inaccuracy of opponents of astrology.

In the text proper Kepler is adduced as an authority a number of times. He is quoted about not throwing the baby out with the bath, and as to astrology being the stupid daughter of astronomy. Though an astrologer himself, he admitted that even the weather cannot always be precisely predicted, rejected the assignment of regions to certain signs of the zodiac, and reformed many hypotheses of the astrologers.²³ Calvin and Luther are also quoted, and it is asserted that few Calvinists or Lutherans support genethliology—a very dubious generalization.²⁴ On the other hand, Urban VIII is called an astrologer²⁵ despite his Bull of 1631 against the art. The chief philosophers were against genethliology,²⁶ but more space is given to arguments from Scripture and creation²⁷ than to those based on reason,²⁸ and it is declared that the astrologers are most absurd of all when they try to defend their art from Scripture.²⁹ Various familiar objections are revamped, such as that the head and tail of the Dragon have no reality and hence no influence or significance; that persons with different genitures die at the same moment, while those with identical nativities have dissimilar lives and deaths; and that the exact moment of conception or nativity is uncertain.³⁰ But the chief objection to genethliology is that it involves necessity, and that the astrologers' insistence that the stars only incline is inconsistent.³¹ Furthermore, predictions of misery, ignominy and violent death are bad for human morale.³² The particular astrologer who is most criticized is Origanus, who died back in 1628.³³ The volume closes with an appendix³⁴ on eclipses,

²² *Ibid.*, b 3 r — (b 4) v.

²³ *Ibid.*, pp. 5, 7, 18, 70-71, 110.

²⁴ *Ibid.*, pp. 19, 75-76, 106.

²⁵ *Ibid.*, p. 97.

²⁶ *Ibid.*, p. 109.

²⁷ *Ibid.*, pp. 25-68.

²⁸ *Ibid.*, p. 69 *et seq.*

²⁹ *Ibid.*, p. 126.

³⁰ *Ibid.*, pp. 74, 87, 91.

³¹ *Ibid.*, pp. 79, 121.

³² *Ibid.*, p. 82.

³³ *Ibid.*, pp. 23, 72.

³⁴ *Ibid.*, pp. 128-34.

especially the solar eclipse of August, 1654, and on calendariography, probably in order to demonstrate that its hostility to genethliacal astrology does not extend to astronomy.

While Wagner and Brandius had set out to destroy astrology, Jacques de Billy professed to bury it, since he entitled his book, written in French and published at Paris the next year, 1657, *Le tombeau de l'astrologie iudiciaire*.³⁵ After an opening chapter on past opponents of astrology,³⁶ he confined himself chiefly to criticism of details of astrological technique, such as *Pars fortunae*, *Hylech*, *Alcochoden*, *degrez tenebreux*, and *significator* and *promissor*, coming only in Chapter 18 to the pernicious consequences of judicial astrology,³⁷ and closing with two chapters giving examples of erroneous astrological predictions and answering the examples which the astrologers adduced in their support.³⁸

The hold which astrology still had on the populace and general public is shown by the following incidents. In a history of Provence published ten years later, H. Bouche recalled the widespread alarm and *sottises* occasioned, not only in Provence but throughout France, Spain, Italy and Germany, by astrological predictions bearing upon the approach of an eclipse announced for August 12, 1654. Many conversions took place before it, and even the physicians advised men to stay indoors that day. In many churches of Provence the sacrament was exposed all that day long, a practice of which our author disapproves. The whole matter reminds the sceptical Bouche of the similar *sottises* which took place the previous year, when floods, winds and earthquakes were predicted in Germany, Burgundy, Dauphiné and Italy for the month of February. In Aix some persons walled up the entrances to their houses, while others ascended high places under the pretext of pilgrimage. But it turned out to be the sweetest and most temperate February for fifty years.³⁹

³⁵ Copy used, BM 718.g.10 (4.), 196 pp. in-4.

³⁶ *Ibid.*, pp. 1-22.

³⁷ *Ibid.*, pp. 128-35.

³⁸ *Ibid.*, pp. 152-96.

³⁹ H. Bouche, *Histoire de Provence*, II (1664), 987-88. One is reminded of

the similar assertions by Bodin, *Les six livres de la republique*, 1576, pp. 434-35, Naudé, Bayle and others that February, 1524 was very dry, despite predictions of a flood for that time: see T V, 178 *et seq.*, 231-33.

The eclipse in question actually occurred on August 11, and Kinner a Löwenthorn, in a letter to Huygens of September 16, 1654, regarded the failure of the astronomers to predict the time of the eclipse accurately as a great blow to the astrologers.⁴⁰ Huygens replied on November 26 that he felt that it was a mistake to try to bind the movements of the stars to fixed laws and perpetual Tables, for he was not persuaded that they followed the same course without change.⁴¹ Nor would he quarrel with Kinner's poor opinion of judicial astrology, which the latter reaffirmed in another letter of December 26, stating that he thought there was no place for it in a lover of truth.⁴² Freedom of the will was not Huygens' reason for rejecting astrology, since he stated elsewhere, "Human thoughts and actions all follow after one another of necessity as in machines. We do not have the liberty of thinking and of willing as we imagine."⁴³

In 1654 was printed at Rennes a New Method of Astrology attributed to Franciscus Allaeus, "a Christian Arab."⁴⁴ He calls his method new but thinks that it was employed by the ancients, who were without a great array of astronomical Tables and proceeded from the tenth house in mid-sky. There follows a universal figure for laying out every astrological *thema*, which consists of seven revolving circles representing the immovable sphere, the zodiac, a repetition of the zodiac for purposes of noting directions of the planets, a circle of the months, a circle in divisions of thirty or sixty degrees which is useful to measure the *eventus profectionis* and to find the hour of revolution, the twenty-four hours of the day and the twelve astrological houses, and a seventh circle designating the aspects of the planets. He assumes a span of human life of

⁴⁰ Huygens, *Opera*, I (1888), 297.

⁴¹ *Ibid.*, p. 307: "Sed in eo omnes hallucinari ego quoque crediderim, quod periodos syderum ad certas leges tabulasque perpetuas revocare conantur. Neque enim eundem cursum immutabiliter ea sequi persuasum habeo."

⁴² *Ibid.*, p. 315.

⁴³ Vollgraff in *Archives internat.*

d'hist. des sciences, 28 (1948), 167.

⁴⁴ *Astrologiae nova methodus Francisci Allaei Arabis Christiani*: BM 48. h.14. MS. Ste. Geneviève 1055 is later, being dated 1666. In Lucca MS 2233, 17th century, is a "Brevis expositio principiorum astrologiae Franc. Allaei arabi christiani," preceded in a later hand by "Nonnulla . . . de Franc. Allaeo."

sixty years, and for sixty-one starts again with one. Another figure for the erection of each particular *thema* has two circles showing the years of the world, the unequal houses now received by all, the direction from the first equal house to the tenth and from the tenth to the seventh, the *termini* of the planets according to the Egyptians, degrees of the zodiac with decans, and an inner circle of the zodiac. With a *figura coeli* for Henri IV, king of France, as a specific illustration, the section on method ends.

Then with a new pagination begins the *Fate of the Universe Observed* by F. Allaeus in 1654,⁴⁵ but at page 47 is the statement, "We stop at the year 1640, when this was written, and in this figure and those which follow we speak only of time past, for judgment as to the future is perilous . . . Suffice it to have shown the way and method . . ." This too, however, is not quite accurate for, after having in a first part discussed the hour of creation and *magni anni*, and in a second part having traced history astrologically to the birth of Christ and then as far as Calvin, and in a third part having given a figure for the horoscope of any kingdom, city or religious Order, and particular figures for the Christian religion, France, Islam, Spain and England, and tracing their history, with 1615 the last year for France, 1571 for Islam, and 1625 for Spain, there is added in the case of England: for 1649, "princes decapitated;" for 1666, "great calamity;" for 1691, "great disturbance of the state," and so on.⁴⁶

There then follows, again with a new pagination, a commentary by the Capuchin, Ives de Paris,⁴⁷ who is presumably the real author of what precedes, defending it and describing it as taken from a book composed by an Arab years ago but recently printed. The book was reprinted in 1658.⁴⁸ It is said to have been burned at

⁴⁵ *Fatum universi observatum a F. Allaeio* 1654, 62 pp. and an unnumbered leaf, on the recto of which is an Index or rather Table of Contents, while on the verso we read, "Rhodonis ex typis Iuliani Herbert in vico Divi Germani sub signo Sancti Iuliani. M.DC.LIV."

⁴⁶ "Anno 1705 adversa omnia . . . , anno 1756 minatur maximum excidi-

um . . . , Circa an. 1887 maxima adversitas."

⁴⁷ "Ad illustrissimos viros amplissimi senatus Armorici in librum de fato universi nuper editum Disceptatio P. Ivonis Parisini Capuc." 25 pp. n.d.

⁴⁸ With a different pagination of 57 and 26 pp. for the second and third parts.

Nantes by the public hangman.⁴⁹

A Harmony of the Macrocosm with the Microcosm by Tobias Schütz, court surgeon to the Elector of Brandenburg, to whom it is dedicated, appeared in German in 1654.⁵⁰ The frontispiece is a portrait of the author in his thirty-fifth year, and the preface is followed by a chart of the spheres, with a male figure for the microcosm and a female for the macrocosm, surrounded by seraphim and cherubim, portraits of Hermes Trismegistus and Paracelsus, and diagrams of the four elements and three Paracelsian principles. The first part of the text describes the superior and inferior worlds, while the second is devoted to astrological medicine,⁵¹ dealing successively with Saturnine diseases of the spleen and remedies for them, Jovial liver complaints, Martial ailments of the gall, solar diseases of the heart, Venus and kidney disease, Mercury and the lungs, and lunar diseases of the head. In an appendix Schütz excuses himself for not adding, as he had intended, a third part on harmonic cures, sympathy and antipathy, and transplantation of disease.

The continued currency of the idea that man is a microcosm is seen in Joannes van Horne giving that title to a work on anatomy published at Leyden in 1660, 1662 and 1665,⁵² and at Leipzig in 1675.

Similarly Geiger had published a treatise on the hypochondriac microcosm in 1652; Schilling, a physiological-anatomical discourse on the misery of the microcosm and excellence of perfection, in 1658, and a work on the bones of the microcosm in 1669; and Deusing, a volume on the genesis of the microcosm, or the generation of the foetus in the womb, in 1665. Stockhamer's *Microcosmographia* of 1682, was a description of the parts of the human

⁴⁹ J. M. Quérard, *Les supercheries littéraires dévoilées*, I (1869), 266.

⁵⁰ *Harmonia macrocosmi cum microcosmo, das ist, Eine Ubereinstimmung der grossen mit der kleinen Welt als dem Menschen . . .*, Franckfurt am Mäyn, Verlegt von Daniel Reicheln Buchhandlern in Berlin, Im Jahr 1654.

⁵¹ The first part has 39 chapters

and 124 pp. The second part has a new preface and pagination, 106 pp. and Indices.

⁵² ΜΙΚΡΟΚΟΣΜΟΣ seu brevis manuductio ad historiam corporis humani. In gratiam discipulorum tertium edita, Leyden, 1665, 160 pp.: BM 548.a.13 (3.). The BM also has the two earlier editions.

body, "embellished with new findings of this age."⁵³

R. Dingley's *Vox coeli or philosophical, historicall and theological observations of thunder*⁵⁴ is largely religious and moral. But it contends that the highest operations and most excellent works of God cannot be reached by the human understanding, and that thunder is chiefly caused by good and evil angels. It often fools astrologers who presume to foretell it in their almanacs, and such men should not be tolerated in a Christian state.

A different attitude was displayed in a work published in the same year by Thomas Wilsford and entitled *Nature's Secrets; or the admirable and wonderfull history of the generation of meteors*...⁵⁵ It included such astrological matters as the aspects of the planets, sympathy of the twelve signs and seven planets with the four elements, and weather prediction, asserting, "That the stars have their influences upon sublunary bodies... is not denied by any learned man."⁵⁶ It further gave

Presages of the weather by Experience collected from the inflammation of comets, fiery impressions, influences: and apparitions of the Stars reflecting on sublunary meteors;

weather signs from beasts and reptiles, winged creatures, fishes, vegetables and minerals; and the "direful effects of some prodigious meteors," closing with a Compendium of Meteors and Signs, "former and present..., prodigious, stupendous and portentous."⁵⁷

The *Astrognosia* of Aegidius Strauch, professor at Wittenberg, may be described as an astronomical textbook with astrological trimmings. It was first published in 1659, and reached its fifth edition in 1694. It even seems to have appeared in 1712 as *Astro-*

⁵³ Malachias Geiger, *Microcosmus hypochondriacus*, Munich, 1652. H. S. Schilling, *Discursus physiologico-anatomicus de microcosmi miseria et perfectionis excellentia*, Wittenberg, 1658, in-4; *Osteologia microcosmica*, Dresden, 1669, in-4. Anton Deusing, *Genesis microcosmi seu de generatione foetus in utero*, 1665, BN 8° Tb⁶⁸.43; reviewed JS I, 417-22. Fran. Stockhamerus, *Microcosmographia sive par-*

tium humani corporis... descriptio, novis huius seculi inventis exornata, Vienna, 1682, in-12; JS XI, 80.

⁵⁴ London, 1658, in-8; BM E.1868 (1.).

⁵⁵ London, 1658, in-8, 199 pp.: BM E.1775 (2.).

⁵⁶ *Ibid.*, pp. 14, 23, 71-72, 75 *et seq.*

⁵⁷ *Ibid.*, pp. 109, 130-38, 160 *et seq.*, 195.

logia aphoristica,⁵⁸ but all editions were printed at Wittenberg and its use was probably confined primarily to that university.

With the *Astronomia physica* of Du Hamel in 1660 were printed observations of recent eclipses by Pierre Petit.⁵⁹ To those of the solar eclipse on November 14, 1659 he added predictions, and in the case of that of April 8, 1652 said that it was more than certain that unhappy and unusual events would follow this eclipse, and that kings had to fear clamors of their subjects, defections and rebellions. He added observations of two solar eclipses of August 12, 1654 and January 26, 1656, and of lunar eclipses on August 27, 1654 and June 25, 1657. Clouds prevented him from seeing the last well. He felt that Huygens' pendulum clock would make future observations more exact. He closed with a caustic criticism of an anonymous *Abrégé de l'astronomie inferieure* of 1644 as the work of some spagyric.

In the *Amphitheatrum physiognomiae medicum* of Helvetius herbs were related to the seven planets, being listed alphabetically under each planet in Latin, with their German names in parallel columns.⁶⁰ In his later *Microscopium physiognomiae medicum*, dedicated to William III of Orange, whose portrait forms the frontispiece, human physiognomies and physical constitutions are connected with the planets, and the book as a whole is described as a sort of Christian magic.⁶¹

Abdias Trew or Treu (1597–1669) was born in Anspach and died at Altdorf, where he taught mathematics and "physics."⁶² He wrote on fortification,⁶³ geometry,⁶⁴ the calendar,⁶⁵ and a miscellany on various subdivisions of mathematics and subjects related

⁵⁸ In the fifth edition, *Astrognoia synoptice et methodice in usum Gymnasiorum et Academicarum adornata*, the text divides into 237 Aphorisms, followed by 19 Canons.

⁵⁹ *Observationes aliquot eclipsum solis et lunae*, 1660, in-4. BM 52.f.13.

⁶⁰ Heidelberg, 1660, 130 pp. Copy used: BM 1141.b.19. (1.).

⁶¹ Amsterdam, 1676, 52 fols., 244 pp., 2 ff. BM 46.a.28.

⁶² Will, vol. IV, 61, lists an "Oratio

inauguralis," by him, "de mutua Physicae et Matheseos connexione habita die 10 Octobris 1650, cum profess. Phys. aggredereetur"; while his *Practica* for the year 1667 speaks of him as "bei der Nürnbergischen Universität Altdorff Math. u. Phys. Professorem."

⁶³ *Compendium fortificationis*, 1641.

⁶⁴ *Summa geometriae practicae*, etc., Nürnberg, 1663.

⁶⁵ In German, Lüneburg, 1666.

thereto.⁶⁶ But in some respects he appears to have been conservative, not to say backward, scientifically, disputing concerning the immobility of the earth against Copernicus in 1636, on the origin of forms in 1651,⁶⁷ and ten year later defending the Physics of Aristotle.⁶⁸ It is therefore not surprising to find him clinging as best he might to the last breastworks of astrology.

Sudhoff has listed Trew's criticisms of astrology:⁶⁹ that weather prediction from the stars was too uncertain, that the zodiac no longer occupied its original position, that it was absurd to associate *trigones* with the four primary qualities, or to argue from the names of the signs as to their effects. That to attribute influence to the head and tail of the Dragon, to retrograde movement,⁷⁰ to combustion and eclipses, was chimerical. But this was mere jetsam which Trew threw overboard in an effort to save the foundering ship. He not merely retained planetary aspects from the old astrological technique, and in his *Astrologia medica*,⁷¹ after dismissing the absurdities of vulgar astrology, went on to treat of the true workings of the heavenly bodies on these inferiors, of the relation of natural bodies to the stars, of man and his ailments insofar as they are subject to the heavens, and of the application of astrology to medicine and its particular parts. He also composed a *Nucleus astrologiae correctae, oder Bericht vom Nativitätstellen*,⁷² and a *Methodus genethliaca, die Ordnung und Nutz des Nativitätstel-*

⁶⁶ *Directorium Mathematicum ad cuius ductum et informationem tota Mathesis et omnes eiusdem partes, nominatim arithmetica, geometria, astronomia, geographia, optica, harmonica et mechanica methodice doceri et facile disci possunt*, Nürnberg, 4to, 1657. Listed by Cornelius à Beughem, *Bibliographia mathematica*, Amsterdam, 1688, p. 140.

Will also lists a disputation by him, *De scientiis mathematicis*, 1644.

There is further ascribed to him a *Compendium compendiorum astronomiae et astrologiae*, 1660.

⁶⁷ See Will's list of his disputations. It is well to remember, however, that

a progressive scientist such as Boyle still discussed the origin of forms. And we have seen Martin Kerger write in the same year as Boyle, 1663, on the inseparability of material forms and on fermentation.

⁶⁸ *Defensio Physicae Aristotelicae contra Michaellem Walthonium*, Altdorf, 1661.

⁶⁹ Sudhoff (1902), 82.

⁷⁰ We shall, however, soon hear Trew attribute strong influence to a planet when retrograde.

⁷¹ For the full Latin title: LR 1. Sudhoff (1902), 81.

⁷² Nürnberg, 1651.

lens.⁷³ He not only published a *Practica universalis* in 1660, but also a particular *Practica* for the year 1667, in which he dealt successively with the four seasons, the weather for the coming twelve months, eclipses, fertility and sterility, health and sickness, and world affairs.⁷⁴

Four disputations in the field of astrological medicine by Trew were printed at Altdorf in 1663.⁷⁵ His son Sigismund was respondent to the first and fourth, John Chris. Wagner to the second, and Andreas Scarmann to the third, but the texts themselves all seem to be the work of Abdias Trew.⁷⁶ In the first, on the absurdities of vulgar astrology and the true operations of the celestial bodies upon these inferiors, he partly agrees, partly takes issue with the qualities ascribed to the planets by the astrologers. He claims to have noticed from his observatory that Mercury, when near the sun, tempers its heat by stirring up breezes. He would qualify the sweeping statement that Mars and Saturn are evil. He is opposed to the stars operating by occult influence, but approves of the division of the zodiac into signs and various groupings of and distinctions between these. Many astrologers go too far in predicting from great conjunctions, but he does not reject them entirely, citing his Observations concerning Great Conjunctions and Oppositions, published ten years before. He rejects, as Sudhoff has already noted, the division of the zodiac among the members of the human body, and has sometimes violated the rules against bleeding under certain constellations without suffering any evil therefrom. But we should remember that Bernard Gordon had done the same in 1307.⁷⁷ Trew

⁷³ Altdorf, 1663. Will is my source for this and the next title. In 1639 Trew had disputed *de influentiis coelestibus*; in 1645, concerning controversial astrological questions: Will, IV, 60.

⁷⁴ *Gründliche und von allen abergläubischen und ungereimten Meynungen der gemeinen von Heiden hergebrachten Astrologia und Calendar-Kunst abgesonderte und auss der rechten Sternkunst deducirte Practica auff das Jahr . . . MDCLXVII*: copy used, BM 8610.bb.41. At the end are

given by days of the week the arrival and departure of posts and boats for Nürnberg and Leipzig, and a list of Court Days at Hamburg through the year.

⁷⁵ *Astrologia medica quatuor disputationibus comprehensa quarum prima . . . etc.*, Altdorffii, Typis Georgi Hagen, Universitatis Typographi.

⁷⁶ At p. 11 of the first disputation he refers to *Phys. mea Aristotelica part. spec. I, 2, Theor. 35*.

⁷⁷ T II, 856-57.

is against distinguishing the signs of the zodiac as masculine and feminine. Also, with the precession of the equinoxes, the signs have greatly altered their positions. Aries has hardly a part of its head in its sign, and Taurus not even the head, while Gemini is almost entirely in Cancer. Trew further rejects astrological houses and exaltations of the planets, and ridicules statements found in the *Centiloquium Bethem*.⁷⁸ He holds, on the contrary, that the effects of the planets are strongest, when those bodies are stationary or retrograde, because then they remain longer in the same position and so make a more lasting impression. He retains the aspects of the planets and notes that Kepler had added three.

In the second disputation Trew says that, as medicine declined with the loss of the tree of life and the flood, so superstition corrupted astrology. No doubt the antediluvians knew a great deal, but Cham (i.e., Zoroaster) introduced magic arts. When, after the Gothic invasions of the Roman Empire, astrology underwent exile, as Kepler says, into Africa, it became tainted with Arabic dogmas, of which Guido Bonatti was a great collector. Trew dates the *Amicus medicorum* of Ganivet incorrectly in 1496, and states that Regiomontanus first invented Ephemerides and the rules of elections which we still have with us. Thus, as usual, the critic of astrology is uncritical as to its history.

Turning to the titular theme of the second disputation, which is the relation in general of natural bodies to the stars acting upon them, Trew asserts that the moon and Venus rule watery meteors, while Mercury is the chief author of winds. He again pauses to smile at the ineptitudes of vulgar astrology, but affirms that the sidereal influences are so great that they penetrate even to minerals in the bowels of the earth, as even Pico della Mirandola admitted, although in another place he denied their efficacy when below the horizon. Trew grants that gold is under the sun, and silver ruled by the moon, but questions the supposed relationship between tin and Jupiter, or copper and Venus. The astrologers have intro-

⁷⁸ Trew dates it after Alfonso the Wise, whereas it is really the *De consuetudinibus* of Abraham Avenezra (c. 1090-1167), and only the Latin

translation by Peter of Abano is slightly later than Alfonso. See *Isis*, 35 (1944), 299b.

duced great perplexity as to the relation of plants to the planets, and he questions their distribution of animals and of parts of the human body among the planets, and even calls absurd the opinion as to the agreement of macrocosm and microcosm.

In the third disputation Trew attacks the *Trutina* of Hermes relating the times of birth and of conception, but grants that diseases originated from the stars. Epidemics, however, are not always caused by the so-called bad planets, but sometimes by a good planet such as Jupiter. Acute diseases are often governed by Mars. If it was in quadrate aspect or opposition before the crisis, it was a sign of recovery. But if it was eight or nine signs away, either death or some marked change for the worse will follow. Sometimes the immediate cause of disease is a relationship between the star then influential and the nativity of the patient.

The fourth disputation is full of details of astrological medicine. A table is given of critical hours for the entire year, and a "beautiful" passage is quoted from Argolus on critical days. But Trew cannot subscribe to the remarks of Ptolemy as to the efficacy of the number seven or the figure of sixteen sides or to the medical month of Galen. Now as an old man he remembers almost all the times past when grave sicknesses afflicted him and cannot find one that cannot be accounted for astrologically, although then he may not have realized it, because unskilled in the stars. A physician should consult the nativity of a patient who is falling sick. In the case of a convalescent he should ascertain whether the constellations which brought on the disease may not return and induce the same or a like illness. In planting or sowing medicinal herbs, if they are to be used just for their flowers, it should be done soon after new moon; if for their fruit or seed, after the first quarter; if for their roots, between full moon and the second quarter. As to the collection of plants Trew cites the *Pharmacopeia* of Schröder with approval but does not accept all his dignities of the planets. As for Carrihterus, whom Schröder cites, although he was imperial physician, Trew wishes to note that not all he wrote was his own, much less based on his own experience, but largely mere speculation based on vulgar astrology.

It is a mistake to think that the moon alone and not other planets

increases watery humors by its light. As a rule one should not administer cold medicines under a hot star or vice versa. Discussing whether under the influence of the evil planets, Mars and Saturn, purgation of the humors which they foster may be safely undertaken, Trew says that he would gladly take purgatives when the moon was moving away from the planet which fostered the humor to that which was contrary to it, for example, from Mars to Venus in cholera, Saturn to Jupiter or Venus in melancholy or phlegm. There is no doubt that it is better to evacuate phlegm under a waning than a waxing moon, and little doubt in the case of choler, but more in the case of melancholy.

This is certain that under a waxing moon all purgations are made more easily and with less disturbance to the patient.

Clysters are happily applied as the moon recedes from Saturn. Trew would not have believed the following before he tried it. Purgatives have little or no effect under the conjunction of Jupiter which doubtless impedes the fermentation by its purity. But no harm followed from the purge not working, and the ills for which it was prescribed disappeared, so that he suspects that Jupiter gently altered the vicious humors which were to have been expurgated. But this is not the case under other aspects of Jupiter. Trew goes on to note what planets to observe in administering medicines for particular members of the human body, and further declares that the aspects of the planets are of great moment in surgery and phlebotomy as in other medical operations before mentioned.

Marten Schoock, in his *Celestial Physics* published at Amsterdam in 1663, devoted a good deal of space to astrology and may be said to have blown both hot and cold on the question of its validity. He rejected the attribution of sex, color, and the qualities of cold, dry and humid to the planets. Besides differing in light, situation, motion and magnitude, they probably also differ specifically, but this specific difference cannot be accurately noted.⁷⁹ Schoock agrees with Aquinas that the star of the Magi was a divine phenomenon in the air, like the column of fire which led the Israelites in the Old Testament, and not a comet or one of the fixed stars or an

⁷⁹ *Physica caelestis*, Amsterdam, 1663, pp. 98-100, 349.

angel.⁸⁰ The stars do not act directly upon the human will and even as a universal physical cause are limited by secondary causes. They act by their light and perhaps by their motion, but their so-called occult influence may perhaps be reduced to the effects of their light.⁸¹ The signs of the zodiac and other constellations are not real images of animals. But Schoock concedes some influences on the weather to the stars and, like Kepler, even to their aspects.⁸² "The celestial luminaries which serve the whole world also exert singular efficacy in the microcosm or human body," as in the case of critical days and of lunatics, although the devil sometimes interferes in the latter.⁸³ But Schoock will not listen to Albertus Magnus, Guy de Chauliac, Ficino and Quercetanus, who ascribe outbreaks of the plague to conjunctions of the planets. He cites Trigautius (who would seem to have been somewhat mistaken) that the pest is unknown throughout the vast empire of China, and Scaliger with regard to the Niger basin in Africa. Free will is his chief reason for not accepting prediction of wars and political change from the stars. Weather prediction would be more certain, if we had meteorological observations related to the constitution of the heavens for each clime. But he gives the division into astrological houses according to Regiomontanus.⁸⁴ The "dreams of the genethliaci," however, should be exploded, and under the caption of "judicial astrology" Schoock devotes a dozen pages to repetition of the time-worn arguments against it.⁸⁵

Turning to comets, after two pages of quotations, chiefly from classical literature, as to their ill effects, he questions if they may not also have beneficial ones. He is unwilling to accept all the effects that are commonly attributed to them. Yet they have, if not their effects, at least their events, and if they are not always causes, they should at least be recognized as signs. They are causes of meteorological change and at least signs of other atrocious and sad effects. But too precise effects upon inferiors should not be rashly attributed to them. They should be considered unusual signs with extraordinary humility before God, the ruler of the universe.⁸⁶

⁸⁰ *Ibid.*, pp. 268-70.

⁸¹ *Ibid.*, pp. 346-48.

⁸² *Ibid.*, pp. 351-52, 367-70.

⁸³ *Ibid.*, p. 372.

⁸⁴ *Ibid.*, pp. 377-81.

⁸⁵ *Ibid.*, pp. 381-93.

⁸⁶ *Ibid.*, pp. 393-401.

The astrologers predict from eclipses not only according to the triplicities but even the decans, but about all that Schoock will concede is that eclipses are an aid in reckoning longitude. He rejects Kircher's attempt to relate outbreaks of the plague to sun-spots.⁸⁷ Finally we come to the celestial alphabet of the Cabala and Paracelsus, Postel and Fludd, and to Gaffarel's book on talismanic sculpture. But it is pronounced vain and idle, and therewith Schoock's *Celestial Physics* ends.⁸⁸

In his work of the year before on *Ferment and Fermentation* Schoock had assumed a certain amount of celestial influence. Nothing can ferment, unless it is moist, and bakers put less yeast in their dough at the time of the full moon. The spirit of earth is celestial fire using the air as its vehicle.⁸⁹

Gian Battista Noceto, a Jesuit from Genoa, in a work written in Italian but published at Paris in 1663,⁹⁰ compared astrology, not to a foundering ship, but to the hydra which grew two heads every time one was cut off. His tirade against the art mingles occasional popular anecdotes with frequent citation against astrologers of authorities such as Avicenna, Sisto da Hemminga, Ambrose, Philo, Gregory of Nyssa, Synesius, and cardinal Gaetano.⁹¹ Noceto represents not merely Aristotle but even Ptolemy as opposed to astrology.⁹² He repeats such familiar arguments against astrology as that Ludovico il Moro came to a bad end because he was guided by an astrologer,⁹³ that today the stars occupy positions never considered by astrologers before, that it is impossible to measure the risings and settings of the stars accurately,⁹⁴ and that true predictions are often due to pacts with demons.

Zedler lists a book by Franciscus Levera on another subject which was printed at Rome in 1628,⁹⁵ and Leo Allatius states that

⁸⁷ *Ibid.*, pp. 401-6.

⁸⁸ *Ibid.*, p. 412, "Ex his omnibus liquet quam vana sit Gaffarelli sententia."

⁸⁹ Marten Schoock, *De fermento et fermentatione*, 1662, pp. 85, 146.

⁹⁰ *Astrologia ottima indifferente pessima censure pubblicate dal P. Gian Battista Noceto Genovese della Com-*

pagnia di Giesu, 276 tiny pp. Copy consulted: BN V.21826.

⁹¹ *Ibid.*, 8-9, 10-11, 14, 23, 24, 28, 133.

⁹² *Ibid.*, 6-7, 9.

⁹³ *Ibid.*, 73.

⁹⁴ *Ibid.*, 134.

⁹⁵ *Enucleatio urbanae Congregationis et ad ipsius amplificationem adhortatio*.

a long letter by him to Argolus on latitudes, directions, celestial houses and the measure of directions was published at Rome in 1629.⁹⁶ Also that he had already written on perpetual motion, an explanation of old and new astronomy from experience, and upon the times of universal and particular events many recondite and most useful things to cure and ward off ills.⁹⁷

We are here concerned with two works which he published at Rome in 1663 and 1664⁹⁸ and which manifest his continued interest in astrology. The Forerunner of Restored Astronomy, which he dedicated to Christina of Sweden on the Ides of August, 1662, still regarded the earth as immobile at the center of the world. But he contended, against the Peripatetics, that Aristotle had identified the heavens with the fourth element of fire, and that both fixed stars and planets shone by their own light as well as that of the sun and were generally of fiery nature. He still accepted four qualities as well as four elements and further believed in occult virtues. He still accepted such foundations of astrology as the attribution of natural properties and virtues to the signs and other divisions of the zodiac, aspects of the planets, *antiscii* and astrological houses. He went on to consider such matters as directions, significators and *promissores*, revolutions of the years, *pars fortunæ*, and the prerogatives and virtues of the fixed stars.⁹⁹

The other book of 1664, which was also dedicated to Christina, dealt more fully with the powers and excellence of the fixed stars according to their four chief positions, and with their significations as observed by astronomers of old and more recently. A first chapter considered their natural powers and significations, a second, their vertical position with reference to various cities and noted places of Europe and its virtue; a third chapter did the same

⁹⁶ *Epistola satis prolix ad Andream Argolum, De latitudinibus directionibus coelestibus domiciliis et directionum mensura*, Romae apud Facciotum, 1629, in-4.

⁹⁷ Leo Allatius, *Apes urbanae sive de viris illustribus qui ab anno 1630 per totum 1632 Romae adfuerunt* (Rome, 1833), ed. of Hamburg, 1711, p. 146.

⁹⁸ Beughem, *Bibl. Math.*, 1688, p. 84, lists a *De doctrina motuum*, Rome, 1659, in-4, by him, but it is not in the BM and BN catalogues.

⁹⁹ *Prodromus universae astronomiae restitutae*, Rome, 1663: BM 532.k.14. (1.). For some portions of the work only the headings of the chapters are printed.

for their horizontal position. Then followed a compendium of their morning and evening risings and settings, taken from Ptolemy, with their observed significations as to changes of weather.¹⁰⁰

Erasmus Bartholinus or Rasmus Berthelsen (1625–1698), a son of the afore mentioned Caspar Bartholinus, was professor of medicine and mathematics at Copenhagen and published experiments with Icelandic crystal. In 1648 he printed a medico-mathematical disputation, in 1651 *Principia matheseos universalis*; in 1661 a dissertation by him on the figures of snow-flakes accompanied the work of Thomas Bartholinus on the medical use of snow. He wrote on the great conjunction of Saturn and Jupiter in 1663,¹⁰¹ and a tract of eighty-eight pages on the recent comets of 1664–1665.¹⁰² In opening he said that everyone now followed Tycho Brahe against the Aristotelian doctrine of comets. When he came to an examination of the effects of comets, he remarked that it was strange that many who trust in nothing without satisfactory demonstration nonetheless believe in the predictions of astrologers from comets even without probable arguments. It was not yet clear whether comets and celestial bodies portended the future.

In 1663 Georg Schwab printed a dissertation *De astrolatria* which I have not seen, and in the same year appeared the second edition of the *Discours contre l'astrologie judiciaire*¹⁰³ by David Dérodon, professor of philosophy at Nîmes. He advanced sixteen reasons for opposing astrology, of which the first was that many different personalities with different fates were born at the same instant. In this connection he brought up the monster recorded by Buchanan which had two heads, four arms, and two stomachs, but a single body below the navel. It lived for twenty-five years, but one upper half died before the other, and they differed in

¹⁰⁰ . . . *de inerrantium stellarum viribus et excellentia secundum quatuor positus earum insignes . . . earumque significationibus observatis tam a priscis astronomis quam a modernis . . . Una cum tabula . . . declinationum . . . prima signorum graduum et minutorum zodiaci, secunda ortuum et occasuum stellarum fixarum illustriorum, etc.*, Rome, 1664, 105 pp. BM 532.

k.14 (4.).

¹⁰¹ *Consideratio astronomica conjunctionis magnae Saturni et Iovis praesentis anni 1663.*

¹⁰² *De cometis anni 1664 et 1665 opusculum ex observationibus Hauniae habitis adornatum*, Hafniae, 1665: BN V.7980; BM 532.e.16 (2.).

¹⁰³ Geneva, 1663; copy used, BN R.33476, 44 pp.

other respects. So it would not seem that Dérodon opposes judicial astrology for want of credulity. He goes on to contend that the effects of the stars differ in different places, and that the astrological rules for ancient Egypt are not valid here and now. He again asks why horoscopes are not drawn up for brutes. The stars as bodies can act only upon bodies. He denies that astrology is founded on long experience; argues that the telescope has revealed stars which astrologers have not taken into account; and asks how stars can exert any influence when below the horizon. The eighth reason is the absurdities of astrological technique. The fixed stars have shifted their positions with time, yet the weather remains the same at the same time of the year. One cannot tell accurately either the time of the equinox or of conjunctions and oppositions of sun and moon, or of birth. Most astrological predictions are false, and can do much harm both to the public and individual welfare. Physicians by employing drugs can procure a favorable or unfavorable time of birth. It is impious to say that stars created by God incline us to evil; free will is another obstacle; and God forbade astrology in Deuteronomy XVIII, 10, while Dérodon explains away Biblical passages which might seem to favor astrology. But he warns the reader not to take his sixteen reasons as invalidating astrological medicine, to which he has no objection.

J. A. Osiander, in a tract on the star of Bethlehem, held that it was not a comet or ordinary star, but devoted much of his twenty-four pages to comets. Scaliger argued that many were not followed by human disasters, and Mazzotta contended that some comets had a good influence. But Osiander cites examples since 1600 to show that comets are always followed by disasters. Indeed, he thinks that the whole machine of the world is approaching its fatal period. He notes the views of Tycho Brahe, Fludd, Fortunio Liceto and Kepler as to comets but purposely omits that of Descartes. He states that those who explain comets as a conflux of stars or of their rays have been solidly refuted by Jean Dullaert of Ghent.¹⁰⁴

On January 10, 1665 a conference concerning comets was held

¹⁰⁴ *Stella insolita dux et lux magorum*, s.l., 1664, 24 pp. Copy used; BN V.12185.

at the Jesuit Collège de Clermont in Paris in the presence of the duc and prince de Conti and numerous prelates and courtiers. Father d'Arrouis argued that comets were combinations of small wandering stars; Roberval, that they were terrestrial exhalations. Phelippeaux, a Flemish physician, supported the Cartesian explanation of them, while Grandamy repeated the view which he had expressed concerning the comet of 1618. Night broke off the conference before Father Garnier could develop his theory that comets were fires enclosed in air, as bubbles of air are enclosed in water.¹⁰⁵ But nothing seems to have been said as to prediction from comets. In the *Prodromus cometicus* of Helvetius, which appeared in the same year, concerning the recent comet, he reserved treatment of its signification.¹⁰⁶ A single leaf satire on tracts upon comets which pretended to be a translation from the English also appeared and was found worthy of notice in the *Journal des Sçavans*. It alluded to a newly invented parallactic instrument, but also to the doctrine of the ancient Chaldeans and Arabs, and mingled the cabala with algebra.¹⁰⁷

It must have been discouraging to those who still inclined to attribute significance to conjunctions of the planets to find that the conjunction of Saturn and Jupiter on October 16, 1663, was six days ahead of the Tables of Argolus, five ahead of those of Eichstadt, three in advance of those of Kepler and Riccioli, and a day behind the Tables of Lansberg.¹⁰⁸ The disagreement of the Tables with one another was as significant as their failure to foresee the time of the conjunction.

The work which count Mauritius de Flisco published in 1665 on fate and fatal years of men and kingdoms,¹⁰⁹ was classed by Morhof under superstitious astrology.¹¹⁰ In its preface the author tells of his other youthful astrological writings. Numerous genitures¹¹¹ which are given include those of Giovanni Maria Visconti,

¹⁰⁵ JS I, 51-60. Grandamy, *Le cours de la comete*, is reviewed at pp. 155-56.

¹⁰⁶ Danzig, 1665, in-fol. JS I, 307-10.

¹⁰⁷ JS I, 167-68.

¹⁰⁸ JS I, 726-27.

¹⁰⁹ *Decas de fato annisque fatalibus tam hominibus quam regnis mundi*, Francof., 1665, in-4, 257 pp. Col 156.4 F648 (lost). BM 718.e.25.

¹¹⁰ *Polyhistor*, 1732, p. 453.

¹¹¹ *Decas de fato*, pp. 41-60, 113-124.

born in 1388, Savonarola, Stoeffler, Pico della Mirandola, Cocles, Henries III and IV of France, and Gustavus Adolphus. A dozen pages or so are devoted to physiognomy, metoposcopy and chiromancy, and as many more to prodigies and portents. Other topics considered are critical days and climacteric years, comets and eclipses, fate in numbers and cubes of numbers, fate in kingdoms and the fall of Rome.

The conception of macrocosm and microcosm was retained and even exploited by the Premonstratensian father, François Placet, in his book on the Corruption of the Great and Little Worlds, which first appeared in 1666,¹¹² and enjoyed two more editions in 1668. But, instead of stressing the influence of the heavens on man, Placet affirms the effect of human sin upon the macrocosm. The sun lost seven-eighths of its light, and before Adam's fall the moon was as brilliant as the sun is now. No rain fell until Adam did, and all the earth was a paradise, although one might expect from the conditions which Placet has just asserted that it would be as hot as hell. And men were vegetarians. He goes on to speak of the changes produced by the flood, such as the separation of America from the rest of the world, and of the ruin of monarchs and monarchies, of which the stars are perhaps signs rather than causes. But the number seven is fatal to states and empires. He condemns, however, the vanity of some astrologers who count three thousand years before the end of the world. In the second part on the corruption of the little world, Placet notes extravagances of imagination which have resulted from sin, and the vanity of dreams. Sin also produced disease and monsters, and since the deluge there have been giants and pygmies. Furthermore, the devil exercised cruel tyranny over all the states of the world before the Incarnation of the Word. Christ freed the world from the tyranny of the devil, but sorcerers keep it in his power.

The third edition of Placet's book was supplemented by a *Traité des Talismans*, in which he attacked astrological images, and in the

¹¹² *La corruption du grand et petit monde. Où il est traité des changemens funestes arrivez en tout l'Univers et en la Nature humaine depuis le peché d'Adam.* Par le P. F. François

Placet religieux de l'ordre de Premonstré et Prieur de Bellozanne. Printed at Rouen and sold at Paris, 1666, 359 pp. BN D.48311.

same year, 1668, he published a separate treatise on the superstition of the time as shown in talismans,¹¹³ which was reviewed in the *Journal des Sçavans* in 1672.

In 1668, Jean Baptiste Denis, councillor and physician in ordinary to the king of France, published a speech which he had delivered against judicial astrology and horoscopes at one of the public conferences which were held at his house every Saturday.¹¹⁴ He says that, when his talk was over, several persons raised objections in favor of astrology, to which he replied extemporaneously. He offers to publish these responses with further reflections, if some of those who asked for a copy of his address in order to reply to it, advance something which deserves an answer.¹¹⁵ Evidently astrology still found defenders as well as assailants at the cultured French capital.

On the occasion of the comet of 1664–1665, Denis had published a *Discours* following the principles of Descartes, on the nature, causes and movements of comets, and against predicting good or bad effects from them.¹¹⁶ In the dedication to Colbert, Denis expressed the hope of freeing men from fear of comets. In the text he gave examples of their being followed by happy events and, while admitting that they might be divine warnings, held that physically considered they were nothing to fear. He emphasized the irregularity of movement of the recent comet of December, 1664–January, 1665, and the fact that its tail or beard (this altered) was always directly opposed to the sun. The light of the sun reflected from it might produce some effect on earth, but this would be very slight.¹¹⁷ During December the comet approached the earth, but through January receded. Much of Denis' space

¹¹³ *La superstition du temps reconnu aux Talismans* . . . , a Paris chez Fr. Clousner, 1668, in-12. Copies in BM and BN.

¹¹⁴ I. Denis, *Discours sur l'astrologie judiciaire et sur les horoscopes* . . . dans une des conférences publiques qui se sont chez luy tous les Samedis, Paris, 1668, 36 pp. Copy used: BM 718.g.10 (6.).

¹¹⁵ *Ibid.*, p. 36.

¹¹⁶ J. B. Denis, *Recoeil des memoires* . . . etc. . . , p. 95, bound with JS III. The *Discours* was issued in 1665 by three different Parisian printers: C. Savreux (BN V.21272, which I have examined), J. Guignard (BN V.21251), and P. Promé (BN V.21275). The first two editions were anonymous.

¹¹⁷ *Op. cit.*, pp. 146–54, 6–8, 130.

was devoted to opposing the views of those who believed that comets were terrestrial exhalations, or sweats of the entire elementary sphere, or composed of some celestial matter more condensed than usual, or the union of a number of small stars. This last view was that of Democritus and Anaxagoras and had been sustained recently in public theses at the Collège de Clermont, as we have seen.

Friedrich Hoffmann the Elder of Halle, in his *Opus de methodo medendi* of 1668,¹¹⁸ answered the question whether the study of astrology was necessary for a physician in the affirmative, stating that as anatomy was the right eye of medicine, so astrology was the left. He cited J. D. Horst's *Manuductio ad medicinam*¹¹⁹ as to the importance of noting the patient's nativity, or, if that were lacking, at least the state of the heavens at the beginning of the disease. Eichstadt (1596–1660) in his *Ephemerides*, in the second book on critical days,¹²⁰ had well outlined the influence of the moon and other planets on the crisis in acute diseases, and Moebius,¹²¹ who had once been Hoffmann's colleague, had stressed the importance of not merely looking at the moon but considering the forces from the other planets which the moon receives and passes on.¹²² Hoffmann also believed that a universal spirit or Azoth was elevated by the stars from the center of the earth.¹²³

Hoffmann further engaged in a long discussion whether contraries were cured by contraries or likes by likes, and whether there was a universal medicine, whether the use of native cinabar and of antimony was suspect, and whether a bone was found in the heart of a deer. He believed that elk horn and its hoof had noble virtues and that goat's blood excelled in diaphoretic virtue.¹²⁴ So did certain stones such as the Judaic lynx stone, which, however, was not the coagulated urine of

¹¹⁸ *Opus de methodo medendi iuxta seriem Wallaeianam annexis fundamentis astrologicis . . .*, Leipzig, 1668, in-4, 448 pp. BN 4° Te⁷.23.

¹¹⁹ A textbook originally written for the students of medicine at Marburg. Fourth edition at Ulm, 1660.

¹²⁰ Laur. Eichstadius, *De diebus criticis*, p. 321 partis alterius Epheme-

ridum, Stetini apud Geo. Rhetium, 1634, in-4.

¹²¹ *Inst. Medic.*, lib. III, part. iii, cap. 8, De crisi.

¹²² *Opus de methodo medendi*, pp. 15-19.

¹²³ *Ibid.*, p. 268.

¹²⁴ *Ibid.*, pp. 25-, 37, 142, 155, 157.

the lynx. The nephritic stone from New Spain, hung on the arm, would expel gravel with the urine but was more efficacious if taken powdered in liquid form *cum aqua saxifraga*. The *lapis microcosmi* or stone in human beings had like properties, whether taken internally, suspended externally, or held in the hand. In human urine, too, were many arcana for expelling urine and the stone, while cow-flap gathered in May made a wonderful water against the stone.¹²⁵

The Mathematical Lexicon of Hieronymus Vitalis, printed at Paris in 1668, is full of astrological information.¹²⁶ Yet the author was a Theatine of Capua, he dedicated the volume to one of the cardinals, and it bears ecclesiastical approvals. Astrology is described as an experimental science formed *a posteriori* from long usage and observation of effects. It does not quite deserve the name of science, since it neither scrutinizes things by causes nor has the certitude which is the soul of science, but proceeds by conjectures and experiments. From repeated previous experience the astrologer knows that like effects will follow from the same complex of causes. The church forbids predictions which infringe upon freedom of the will, but not natural astrology and genethliology, which is neither beyond the scope of nature nor prohibited by any law.¹²⁷ In this definition and in that of Directions and other terms of astrological technique, Vitalis depends largely upon Placido Titi. The head of Medusa, a most pernicious star, once was vertical over Greece and now over the kingdom of Naples. St. Thomas recognized the malignity of this star in his 24th opusculum, article 4, saying that it was very funereal.¹²⁸ The marvelous virtues of mixed bodies come not from their elementary qualities but from the celestial bodies. Sapphire, *prasius*, mint, *artemisia* and mandrake have a jovial and saturnine nature and are assimilated

¹²⁵ *Ibid.*, pp. 188-90.

¹²⁶ *Lexicon mathematicum astronomicum geometricum hoc est rerum omnium ad utramque immo et ad omnem fere mathesim quomodocumque spectantium collectio et explicatio* . . . , Paris, 1668, 540 pp. Followed by *Digressio physio-theologico ad verbum*

sympathia, De magnetica vulnerum curatione, pp. 1-60, then an index for both works at pp. 61-100. BM 529.h.3.

¹²⁷ *Ibid.*, pp. 70-71.

¹²⁸ *Ibid.*, p. 21. The reference is to *De fato*, which is probably not by Aquinas: see T II, 612-15.

to Hircus, a fixed star located in the constellation Auriga. So, they assert, the virtues of the emerald come from *Spica Virginis*. So beryls and agates derive theirs from either dog star, on which account they are said to bestow charm upon their wearers.¹²⁹

In the digression which accompanies the Lexicon the magnetic cure of wounds by weapon ointment is defended as performed by nature immediately. It is asserted that many things are necessarily to be attributed to occult virtue, and a very credulous attitude is displayed towards such beliefs as the corpse bleeding at the approach of the murderer or the story of the grafted nose rotting when the man died whose skin had been used in the operation.¹³⁰

When the Lexicon appeared at Rome in a revised edition of 1690, it had undergone radical change. Only 306 of the 1345 terms and topics in the old edition remained among the 1269 of the new, and most of the astrology had gone by the board.¹³¹

The *Arboretum mathematicum* of Tobias Beutel, issued by the Electoral Press at Dresden in 1669, devoted much of its more than seven hundred pages to astrology, giving the horoscopes of historical characters and reigning monarchs, besides the latitude and longitude of some five hundred cities.

In 1670 J. L. Hannemann argued for resumption of belief in a universal spirit or world-soul.¹³² It would obviate resort to occult qualities in order to explain such phenomena as the action of the magnet, sympathy and antipathy, as shown in blood transfusion and the familiar story of the grafted nose. He further held that it was mentioned in the Bible. Concurrent causes were *idea ideans*, form, order and harmony. The astral spirit may imitate the works of God imperfectly, as in the case of a comet which is a celestial monster. And if the astral spirit influences the *idea ideans* excessively, then there is a monster in the animal kingdom. But *idea ideans*, form, order and harmony are the principal concurrent causes; lesser causes follow such as the planets. However, the planets influence the animal kingdom; chiromancy and physiog-

¹²⁹ *Ibid.*, p. 292.

¹³⁰ See especially pp. 46, 48, 51, 55, and 57-60 of the *Digressio*.

¹³¹ *Acta eruditorum*, X (1691), 301-2.

¹³² *Spiritus universalis mundo restitutus*, Hamburg, 1670, in-12. BM 8630.ccc.12.

nomys have their basis in the influence of the planets; herbs too are related to the planets. The astral spirit influences metals and earth, and also sympathy and antipathy. Favorable reference is made to Digby's sympathetic powder. Twenty-nine years later Hannemann wrote in German a defense of astrology¹³³ against Leonhard Christoph Sturm's *Bileam's Abfertigung*.¹³⁴ In it he also defended chiromancy, metoposcopy and geomancy.

The careers of such English astrologers as John Booker, William Lilly, George Wharton, John Heydon, and John Gadbury¹³⁵ show that public predictions might also be political pamphlets, while private practice and instruction might prove quite remunerative, although many of the intelligentsia scoffed at them as charlatans, and despite their engaging in controversies with and vilification of one another. Booker gave his annual almanac, which first appeared in 1631, the high-sounding title, *Telescopium uranum*, and he was for a time licenser of "mathematical" books. He had gained fame by predicting from a solar eclipse the deaths of the Elector Palatine and Gustavus Adolphus. In the course of the English Civil War "both sides used astrologers and acted on their prognostications."¹³⁶ Wharton was a friend of Elias Ashmole, translated the chiromancy of Rothmann,¹³⁷ and was made a baronet in 1677. After his death in 1681, his collected works were published by Gadbury.¹³⁸ Besides predictions, they included discussions of comets and eclipses, aspects and houses, earthquakes and weather,

¹³³ *Verthädigung der Astrologie . . . etc.*, Hamburg, 1699, in-4. BM 718.g.8 (11.).

¹³⁴ *oder Gründliche Wiederlegung der Astrologie und aller anverwandten Wahrsager-Künste aus der Heil. Schrift, der realen philosophie, der unfehlbaren Mathesi und der Historie*, Braunschweig, 1699, in-4, 40 pp. BM 718.g.8 (12.). Sturm replied with *Antwort auf die Verthädigung der Astrologie*, Braunschweig, 1699, 24 pp. The three works are bound together in Col 520 St9 (in the David Eugene Smith Collection).

¹³⁵ See the articles on them in DNB.

For other English "astrological physicians" see Hugh G. Dick, "Students of Physic and Astrology," *Journal of the History of Medicine*, I (1946), 300-315.

¹³⁶ A. E. Shipley, "The Revival of Science in the Seventeenth Century," *Vanuxen Lectures of 1913*, Princeton University Press, 1914, p. 116.

¹³⁷ T VI, 506-7.

¹³⁸ *The works of that late most excellent philosopher and astronomer, Sir G. Wharton, collected into one entire volume by John Gadbury*, London, 1683, 17 fols., 671 pp. Copy used: BM 245.i.1.

and excerpts from Cardan and Morin—one by the latter being on how astrology may be restored—and a discourse on the soul of the world or universal spirit. John Heydon was included in Morhof's list of early modern defenders of astrology and called a "noted trifler."¹³⁹

Sir Thomas Browne (1605–1682) not only gave evidence which helped to convict two women of witchcraft, but was "a firm believer in horoscopes." While, however, he did not deny the influence of the stars, he said that he often suspected "the due application thereof."¹⁴⁰

Thomas Hobbes (1588–1679) on the contrary held in his English works that

whatsoever we know by right ratiocination, can neither be false nor doubtful; and therefore astrology, as it is now held forth, and all such divinations rather than sciences are excluded.¹⁴¹

In Latin he stated that for astrology to venture to judge concerning fortuitous events by contemplating the stars was not science but a human device for mulcting the stupid populace.¹⁴²

Joseph Blagrave's (1610–1682) literary output began with annual predictions for 1658, 1659 and 1660 and closed with a posthumous *Introduction to Astrology* in 1682.¹⁴³ We shall confine ourselves here to the *Astrological Practice of Physick* which he dedicated to Elias Ashmole in 1671.¹⁴⁴ He first considers the relation of herbs to the planets and then gives rules for gathering them at the right planetary hours. Numbers are allotted to the planets and we are told how to identify the disease by astrology, if and when the patient will live or die, and the cure. Aspects and houses are illustrated by a *figura coeli*, and we are instructed how to give judgment by the figure of the twelve houses. After observations concerning the ascendent,¹⁴⁵ come brief rules as to the length of the sickness and its outcome. The influence of the moon in the twelve signs is fol-

¹³⁹ "Insignis nugator," *Polyhistor*, II, 457.

¹⁴⁰ Shipley, *op. cit.*, p. 116.

¹⁴¹ *English Works*, I (1839), 11.

¹⁴² *Latin Opera*, II (1839), 127.

¹⁴³ DNB.

¹⁴⁴ London, 187 pp. Copy used: BM 1034.b.23.

¹⁴⁵ *Ibid.*, p. 39. Pages 41–72 are then omitted and are not covered in the table of contents.

lowed by directions how to prepare various extracts and syrups, purging and blood-letting according to astrological observations, and a catalogue of ailments with the herbs for each.¹⁴⁶ An account of cures includes an astrological method of curing king's evil and procedure against sorcery. We are then told how to make the sympathetic powder for cure of wounds¹⁴⁷ and concerning the unguent or wonderful ointment for wounds composed of the four elemental parts of the human body, "the seven planets being applied thereto." The ingredients are two ounces each of moss of dead man's skull and human grease, one-quarter ounce of mummy, and one-half ounce of human blood, two ounces each of linseed oil and oil of roses and a half-ounce of "bole armeniack." We are told that the last three are chiefly added to make an ointment of the mixture, although they unquestionably have great virtue of their own.¹⁴⁸

After a cure for witchcraft and sorcery,¹⁴⁹ we are instructed how by the magnet of our body "to extract a spiritual mummy whereby to cure most diseases . . ." by transplantation into a growing vegetable, and how by sympathy to know another's state of health or read his mind at a distance. Astrological interrogations are followed by directions how to cast out devils and a personal experience of that sort. The astrological cure of agues and of madness terminate the volume.¹⁵⁰

Edmond Halley wrote on November 16, 1679 to John Aubrey:

As to the advice you give me, to study Astrology, I profess it seems a very ill time for it, when the Arch-conjurer Gadbury is in some prospect of being hanged for it. However, I went to the library and lookt out the booke you recommended to me which I find to be published in anno 1557, so that I doubt not but the more moderne Astrologers having more experience of things may have added to him considerably; however, upon your recommendations I will read it over.¹⁵¹

John Gadbury, despite this prospect, lived on to 1704.

¹⁴⁶ *Ibid.*, pp. 94-113 for this last.

¹⁴⁷ *Ibid.*, p. 131.

¹⁴⁸ *Ibid.*, p. 134.

¹⁴⁹ *Ibid.*, p. 135, but pp. 136-151 are omitted.

¹⁵⁰ *Ibid.*, pp. 157, 160, 161-, 168, 174, 176, 184.

¹⁵¹ E. F. MacPike, *Correspondence and Papers of Edmond Halley*, 1932, pp. 47-48. A note in Aubrey's hand states that the volume is *Leovitiis de Coniunctionibus magnis*, concerning which see T VI, 116-19.

Of Cartesian astrology by Gadroys, Magerlinus and others we have already treated, while of Wirdig we shall treat in a later chapter.

Bernardinus Christinus a Juvellina, before he became a Franciscan, had studied medicine under Lazare Rivière (1589–1655) at Montpellier. In 1676 he published at Venice a volume in which he prefixed what were described as hitherto unprinted Arcana of Riverius to other medical works of his own.¹⁵² These included rules of astrological medicine which took into account the signs of the zodiac, the virtue and power of the planets, the position of the moon in the signs, and the fixed stars. There were other editions in 1680 and 1696, and an English translation in 1685.¹⁵³

The *Physiologia medica* of Georg Wolfgang Wedel first appeared in 1680, but even in the second edition of 1704, the author was unwilling to give up astrological medicine, holding that the stars alter and dispose the temperament. For, since they produced marvelous change in the macrocosm, why not in the microcosm or human body? Astral influence was obvious in some diseases; attacks of epilepsy, for example, could be predicted with certainty from unfavorable aspects of the planets. The humors were surely affected by the moon. Moreover, celestial influence was apparent not only in disease but in character and ability. As the foetus issued from the womb, it was exposed to the rays of the heavenly bodies and received that disposition which they then exhibited.¹⁵⁴

The sort of astrological treatise that could be printed in a Catholic country without violating the papal bulls of 1586 and 1631, is illustrated by the publication by P. Godard at Rouen in 1678, "with privilege of the court," of a Manual of Astronomy or Introduction to Astrological Judgments. The long title goes on to say that it contains an abridgement of Ephemerides for the rest of the century with the rules, observations and prognostications based on them to serve medicine, agriculture and navigation as well as for horoscopes, without however derogating from free will or the decrees of the Catholic Church. But to this is added a brief

¹⁵² For the full titles, LR 125 and 7461.a.59.
739-40; BM 1165.i.3.

¹⁵⁴ *Physiologia medica*, Jena, 1704, in-4 (BM 549.d.27), p. 75 *et seq.*

treatise on talismans, despite the fact that the use of astrological images was generally held to be contrary to the aforesaid papal bulls, and a discussion of the sympathetic powder and sympathetic ink.¹⁵⁵

Why an astronomer, accustomed at least to some extent to the use of the sexagesimal system, should regard the number, one hundred, or the lapse of a century, as of any efficacy or significance, is difficult to fathom. But Giovanni Domenico Cassini (1625–1712), who discovered four satellites of Saturn and was the first of four Cassini's—great grandfather, grandfather, father and son—who were one after another director of the Paris observatory in lineal succession, suggested that the comet of 1677 was the same as that which had appeared in 1477 and 1577.¹⁵⁶ Had he been able to look forward instead of backward, he would seem to have had more reason to emphasize the number four.

In dedicating his Ephemerides for 1668 to cardinal Jacobus Rospiolus, Cassini had reminded that prelate of the favorable position of the stars when he assumed office.¹⁵⁷

Although astrological concern as to comets was on the decline

¹⁵⁵ P. Godard, *Mathemat., Manuel astronomique ou introduction aux jugemens astrologiques, contenant un abrégé . . . tant des Ephémérides pour le reste de ce présent Siècle que des Règles, observations, sentences et pronostications qui en dependent pour servir tant à la médecine, agriculture et navigation qu'aux horoscopes, sans néanmoins déroger au libéral arbitre ny aux decrets de l'Eglise Catholique. Auquel est ajouté un petit traité des talismans ou figures, et de la poudre et de l'encre de Sympathie*, Rouen, 1678, 32 pp., Tables, 55 pp. BM 718.g.10. (7.).

¹⁵⁶ JS VI (1678), 277. N. Herz, *Geschichte der Bahnbestimmung von Planeten und Kometen*, II (1894), 261 et seq., says nothing of this nor of Halley's comet, but states that P. Petit suggested that the comets of 1618 and 1664 were identical; and that Cassini

held that the comet of 1577 returned in 1680, and that of 1677 was a twelve year recurrence of that of 1653 and 1665. A review of J. C. Sturm, *Cometarum natura motus et origo secundum Joh. Hevelii et P. Petiti hypotheses declarata*, Altdorf, 1681, in *Acta eruditorum*, I (1682), 118–19, says at p. 118, that it is very probable that one and the same comet has appeared at successive intervals.

¹⁵⁷ *Ephemerides Mediceorum siderum ex hypothesibus et tabulis Joan. Dominici Cassini*, Bononiae, 1668, in fol: "Iup. 26° Aries ut cometæ qui ante triennium in eadem steterat longitudine ad Aquilonem innata beneficentia omnia iam aboleret omina. Simul vero in eadem secum longitudine ad austrum renatum est sydus ipso Iove obstetricante faustissimum in collo Ceti et iuxta nodum lini Piscium."

in the course of the century, astronomical interest in them increased with the appearance of Lubienietzki's *Theatrum cometicum*¹⁵⁸ and the *Cometographia* of Hevelius.¹⁵⁹

Johann Tilemann, professor of medicine at Marburg, still accepted climacteric years in his *Hippocratica praxis* of 1681.

That Climacteric Year was still an attractive title and catchphrase is seen from the fact that Hevelius employed it for his forty-ninth (7 x 7) year of astronomical observations,¹⁶⁰ after he had published in 1679 his *Machina coelestis* with observations of the previous years, had been visited by Halley from May 20 to July 18, and had then had most of his library, press, instruments and possessions destroyed by fire on September 26.¹⁶¹ He had purchased Kepler's manuscripts from his heirs. His pointing out aberrations of the Rudolfine Tables,¹⁶² and that a conjunction of Saturn and Jupiter occurred much earlier than November 3, 1682, when the Ephemerides had predicted it, while a second conjunction came on February 8-9 instead of January 20, 1683, and a third on May 18 instead of May 26,¹⁶³ must have been discouraging to astrologers and ammunition for their opponents.

That microcosm, too, was still a word to conjure with, although it might be used without fully realizing all of its astrological implications, is shown by Barberius entitling his work of 1680,

¹⁵⁸ Three parts in-fol., Amsterdam, 1668, 1666, 1668: BM 532.k.16, where the author's name is given as Lubienietzki. In Latin also spelled Lubeniezius: *Acta eruditorum*, I (1682), 118. There was a second edition at Leyden, 1681.

¹⁵⁹ Danzig, 1668, in-fol. For a good account of it, N. Herz, *Geschichte der Bahnbestimmung von Planeten und Kometen*, II (1894), 241-49.

¹⁶⁰ Jo. Hevelii *Annus climactericus sive rerum Uranicarum et observationum quadragesimus nonus, exhibens diversas occultationes tam planetarum quam fixarum, post editam Machinam coelestem observatas . . . etc.*, Gedani, 1685, in-fol.

¹⁶¹ PT XV, 1162-63.

¹⁶² *Annus climactericus*, 1685, pp.

119, 136-37, 142.

¹⁶³ *Ibid.*, pp. 155-57. He had already dealt with this in a communication to *Acta eruditorum*, II (1683), 290-98. It had been pointed out the year before in that journal—I (1682), 365-66—that the conjunction of Saturn and Jupiter which was observed at Leipzig on October 14, 1682 (old style) had been set by Argolus and Riccioli for the 20th, by Bullialdus for the 21st, by Winghius for the 22nd, by the Rudolfine Tables for the 24th, and by Lansberg for the 29th. In the same journal—II (1683), 169—was reviewed a work in German against the astrological interpretation of such conjunctions, which J. C. Sturm had published at Altdorf in 1682.

Operations of Nitro-Aerial Spirit in the Microcosm.¹⁶⁴ Yet the book, as we have seen in chapter 29, is full of allusions to recent experiments and was said—with considerable exaggeration—by Cervetto to speak of oxygen and oxidization a century before Lavoisier.¹⁶⁵

In this same year, 1680, was printed a poem which Heinrich Schweling, son of Johann Eberhard Schweling of Bremen, had written in 1672 on microcosm and macrocosm to celebrate a friend's first anatomical exhibition.¹⁶⁶

The opening years of the ninth decade of the century were marked by striking celestial phenomena. There were comets in all three years, 1680, 1681 and 1682,¹⁶⁷ while within the space of seven months in 1682–1683 occurred no less than three conjunctions of Saturn and Jupiter, whereas there had been only one every preceding twenty years, at least as far back as that of 1563.¹⁶⁸ Flamsteed mentioned "our astrologers' fearful predictions of direful events" to follow these conjunctions.¹⁶⁹ He noted that in all the best esteemed astronomical tables available the mean motions of Saturn were too swift and those of Jupiter too slow. "Hence they made the direct conjunctions some days later, the retrograde earlier than they were found by observation."¹⁷⁰ Flamsteed not only thus still employed the language of Ptolemaic epicycles, but further explained that "these are commonly termed the lesser of the great conjunctions which continue in signs of the same triplicity for ten revolutions" or 198 years, and greatest when after forty-three revolutions, completed in 853 years and 235 days, they return to the point of the ecliptic whence they started. He said, however, that if he had his way, he would call those greatest which occurred in the signs

¹⁶⁴ Ludovicus Maria Barberius, *Spiritus nitro-aerei operationes in microcosmo*, Bologna, 1680, 156 pp. Copy used: BM 780.a.19.

¹⁶⁵ G. Cervetto, *Di Guido de Monte e della medicina Italiana nel secolo XVI*, 1839, p. 116.

¹⁶⁶ *Microcosmus schematismum macrocosmi exhibens in laudem anatomiae inque honorem celeberrimi anatomici . . . 26 Aprilis anno 1672 in*

acroaterio magno decantatus, Leyden, 1680: BM 548.a.13 (7.).

¹⁶⁷ Joh. Jac. Zimmerman, *Cometoscopia . . .*, or Three Astronomical Relations, Stuttgart, 1682, in-4.

¹⁶⁸ John Flamsteed, "An Exact Account of the Three Late Conjunctions of Saturn and Jupiter," PT XIII, 244-58.

¹⁶⁹ *Ibid.*, p. 244.

¹⁷⁰ *Ibid.*, pp. 253-54.

Cancer and Leo, "because then the planets rise highest and are longest visible in our horizon."¹⁷¹

The *Journal des Sçavans* in 1681 refuted the belief that comets were presages of ill and later in the same year devoted an entire issue to the recent comet without saying anything as to its influence.¹⁷² It listed, however, a treatise by Michael Praun inquiring whether comets were not ruled by evil genii,¹⁷³ and, in the case of the comet of 1682, remarked that it first appeared five or six nights before the birth of the Duke of Burgundy.¹⁷⁴

In 1682 appeared the work of Pierre Bayle on the comet of December, 1680.¹⁷⁵ This long lucubration, which in most editions filled two or more volumes, abounded in digressions,¹⁷⁶ and the comet became a stalking horse for a sceptical attack upon superstition in general. But we here limit ourselves to its assault upon astrology and the belief in comets as signs or causes of the future. Bayle declares that there has never been anything more impertinent, more chimerical, more ignominious to human nature than astrology. Pure caprice gave their names and figures to the signs of the zodiac, on whose supposed qualities astrological predictions are based. Why pure caprice should thus prevail in organized human thought is a question that does not seem to have occurred to him. He remarks rather wittily that, if any author ever wrote against astrology without mortally wounding it, this must have been a very difficult feat. But of course we have seen astrology survive innumerable such attacks. Bayle, however, is cheered by the thought that, whereas the French court was once filled with astrologers, the nation has gradually been cured of that disease,

¹⁷¹ *Ibid.*, p. 255.

¹⁷² Howard Robinson, *The Great Comet of 1680*, 1916, p. 80. JS IX (1681), 14, 53-56, 157-68.

¹⁷³ JS X (1682), 86-87: *Michaelis Praun Cometæ malus genius sive Dissertatio singularis qua ad excitanda eruditorum ingenia disquiritur an non cometæ per malos genios regantur*, Francof., 1681, in-4.

¹⁷⁴ JS X, 340.

¹⁷⁵ *Lettre à M.L.A.D.C., docteur de Sorbonne: où il est prouvé par plu-*

sieurs raisons tirées de la philosophie et de la théologie que les comètes ne sont point le présage d'aucun malheur. Avec plusieurs réflexions morales et politiques et plusieurs observations historiques et la réfutation de quelques erreurs populaires. A Cologne, chez Pierre Marteau (Rotterdam, Reinier Leers), 1682, in-12. BN Z.20568.

¹⁷⁶ *Ibid.*, pp. 262-452 are chiefly taken up with a discussion whether atheism is worse than idolatry and more contrary to morality.

whether from love of change or because "this century's attachment to philosophy has fortified our reason."¹⁷⁷

Bayle admits the influence of the moon upon the tides, but not upon the weather, and affirms, citing Rohault,¹⁷⁸ that actual examination of the marrow of animals has shown that it does not vary with the phases of the moon. Nor do crabs and oysters. He also asks why we are not sensible to the changes in position of the moon, as we are to gradual change in the heat of the sun.¹⁷⁹ That belief in astrology has been long established has no weight with him. The notions that a man weighs more fasting than after a meal, that a drum of sheepskin quivers at the beat of a drum of wolfskin, and that, in the case of vipers, the male is killed at conception and the mother, at birth, are all proved false today.¹⁸⁰

As for comets, the notion that they are divine signs and warnings can be opposed with the same arms of piety and religion as have hitherto been employed in their favor. Bayle also explodes the argument from experience. As for their being natural causes, he contends that they are too far off for even their light to affect the earth at all seriously,¹⁸¹ although a follower of Descartes¹⁸² has argued that a comet disturbs the vortex as a small object starts eddies in a great body of still water. This Bayle discusses at length on the basis of mechanics, action by contact, and the principle of saturation, with arguments from analogy as to the percentage of antimony needed to poison and how far from its surface the earth exerts influence. He finally concludes that there is no reason for exhalations from comets to descend to earth, and no positive reason for assigning influence to comets. He says not a word of the possibility of occult influence or of celestial bodies differing from terrestrial. He goes on to deny that there are more evil events in comet years or those immediately following than in other years, and also to deny influence to eclipses.¹⁸³

Returning to comets after a long digression, Bayle asks how it is possible to imagine that a comet is the cause of wars which

¹⁷⁷ *Ibid.*, pp. 39, 45-46, 47, 57, 60.

¹⁸¹ *Ibid.*, pp. 7-8, 17.

¹⁷⁸ *Ibid.*, pp. 109-10; "Phys. II, 27; *L'art de pens.* 18-3."

¹⁸² de Malleme de Messange, *Diss. sur les comètes*, p. 12.

¹⁷⁹ Bayle, *Lettre etc.*, pp. 109-11.

¹⁸³ *Lettre*, pp. 20 et seq., 33, 64, 129.

¹⁸⁰ *Ibid.*, pp. 118-19.

occur a year or two later, or of that prodigious diversity of events which take place in a long war? Especially since one intercepted letter may ruin a whole campaign, or an order executed an hour too late, or the death of a single man.

How can one think that the atoms of the comet fluttering in air would produce all these things? Would it not be necessary that they each have an intelligence to guide them?

The real cause of the most important wars is sometimes a mere caprice—the same cause that built up the elaborate system of astrology—a grudge, a love affair, a nothing, instead of all nature working several years to set it in motion. An astrologer might reply that the comet might affect the bile or atrabile and so the caprice or amour of a peevish prince. But Bayle's conclusion is that to consider comets as the efficient cause of wars, new religions, conspiracies, and other such pests of society, which are really dependent on human free will and the combination of a thousand fortuitous happenings, is not merely heresy but the greatest of all absurdities.¹⁸⁴

After two editions in 1682, Bayle's book on the comet was reprinted only once in the seventeenth century, in 1699, but there were six editions in the first half of the eighteenth century, and an English translation in 1708.¹⁸⁵

Claude Mallement de Messange,¹⁸⁶ or Mallemans de Messanges,¹⁸⁷ whom Bayle cites, had published in 1678 a *New System of the World* in which he had the sun, with Mercury as its moon, revolve in a circle in a Cartesian vortex with the other planets, including the earth, also describing circular orbits about the same imaginary fixed point.¹⁸⁸ In his *Dissertation on Comets* he held that they seemed to move in a straight line, were swifter and more brilliant in mid-course than when they first appeared or were about to vanish, rarely covered more than one-third of the

¹⁸⁴ *Ibid.*, pp. 512, 514, 567.

¹⁸⁵ For these editions see Howard Robinson, *Bayle the Sceptic*, 1931, pp. 310-11.

¹⁸⁶ This is the spelling in the two following works by him and in JS

VII, 29.

¹⁸⁷ This spelling is used in the BN catalogue.

¹⁸⁸ *Nouveau Système du monde*, Paris, 1678, in-4; again in 1679 in-fol.

sky in their course, and were the largest of all the stars. In passing from one tourbillon to another, they pushed ahead of them gross matter to which our bodies are not proportioned and troubled the purity of the air, and so might alter health, injure crops, and the like, but not cause the death of kings in particular.¹⁸⁹

In 1683, under the alias of Giovanni Battista Tasgresti, G. B. Grassetti published at Rome and dedicated to Cardinal Flavio Chigi a treatise on true and false astrology, with an appendix on true and false chiromancy.¹⁹⁰ The section on true astrology is almost all astronomical but concedes that very probably the heavens, besides producing light and heat, have some occult virtue which is the cause of some effects in inferior bodies. This is the opinion of the majority of theologians, including Aquinas and Scotus, and philosophers, and is supported by "molte esperienze." The tides are due to the occult influence of the moon; Hippocrates and skilled physicians say that very grave changes in maladies occur at the equinoxes and solstices; and the formation of metals in the earth is attributed to this occult influence of the stars.¹⁹¹ In the section on false astrology, Grassetti proclaims the ignorance of *genethliaci*, the fraud and gaucherie of judicial astrologers, and criticizes the method employed in casting nativities. But for him the two most efficacious arguments against astrologers are their disagreement as to the rules of their art, and their inability to predict their own misfortunes and deaths.¹⁹²

Grassetti approves of natural chiromancy but not of the astrological chiromancy of Cocles and the Lutheran, John of Indagine.¹⁹³ He describes the lines of the hand and natural conjectures from them, also those from other qualities of the hand and from the five fingers and their nails.

Grassetti's treatise is probably a fairly faithful reflection of orthodox Roman Catholic attitude in such matters towards the close of the century. While his attack is directed against the astrologers

¹⁸⁹ *Diss. sur les comètes*, Paris, J. Cusson, 1681, in-4, 17 pp. Copy used: BN V.12195.

¹⁹⁰ *La vera e la falsa astrologia. Con l'aggiunta della vera e della falsa chiromanzia*, Roma, 1683, in-12, 308

pp. I have used the edition of Rome, 1697: BM 718.d.17.

¹⁹¹ *Ibid.*, pp. 75-78.

¹⁹² *Ibid.*, pp. 169-, 184-, 191-, 255.

¹⁹³ *Ibid.*, p. 273.

rather than the influence of the stars, and against predicting the fate of the individual and astrological chiromancy in particular, he says little in favor of astrological medicine or agriculture or weather prediction, although these had not been forbidden by the papal bulls of 1586 and 1631.

Geminiano Montanari, formerly professor of mathematics at Bologna and then of astronomy at Padua, instead of merely fulminating against astrology or repeating old arguments, attempted to show its falsity by experiments as well.¹⁹⁴ His book is furthermore written in a sober, dispassionate and impartial manner which accords well with experimental science. Although Aristotle says nothing of occult influence, Montanari concedes it to the astrologers for the sake of argument, but denies that it follows their rules.¹⁹⁵ He admits that Ficino, whom he regards as "beyond doubt the first among the Platonic philosophers of the past century," seems to believe in astrological images in his *De vita coelitus comparanda*, although he tried later to excuse himself.¹⁹⁶

A very delicate and sensitive thermometer showed a rise in temperature when the rays of the moon were turned on it by a big burning-glass, but there was no sensible effect using a small mirror and ordinary thermometer. Certain impostors make the dog-star appear by day in a mirror under water. A gardener told Montanari that on the day when the moon was in conjunction with the sun he put ashes in a glass vase with running water, and that the mixture would boil when the conjunction occurred, and that he could then plant violets and other flowers with the assurance that they would do well. But Montanari found that the effervescence did not occur exactly at the new moon, and also that it would occur on other days, and therefore had no connection with the new moon but varied with the quality and quantity of the water and the ashes.¹⁹⁷ He granted, however, that critical days in disease depended on the moon and that the tides were caused more by the moon than by the sun.¹⁹⁸ But, although he believed that the con-

¹⁹⁴ *Astrologia convinta di falso col mezzo di nuove esperienze e ragioni fisico-astronomiche, o sia la caccia del frugnolo*, Venice, 1685, in-4, 158 pp. Copy used: BM 718.g.10 (8.).

¹⁹⁵ *Ibid.*, 6-7, 53.

¹⁹⁶ *Ibid.*, 49-50. See T IV, 565 et seq.

¹⁹⁷ *Ibid.*, 5, 13-14.

¹⁹⁸ *Ibid.*, 9, 60.

junctions and oppositions of sun and moon also affected epileptics and lunatics, he doubted, since we do not feel the heat of the other five planets, whether their aspects had any sensible influence upon sublunar objects.¹⁹⁹ He thought that the undoubted influence of the sun and moon had been extended unwarrantedly to the other planets.²⁰⁰ He found that the events of his own life had only a slight and casual correspondence with his nativity, and two excellent astrologers disagreed by more than an hour as to the time of his birth.²⁰¹ He attributed the trouble with his eyes not to the stars but to excessive study and observation through the telescope, which would not have occurred, had he not by an act of free will abandoned the profession of the law to accept the offer of Alfonso IV (of Este) of a post in his court and a professorship at Bologna.²⁰² He affirms that most medical men do not observe astrological rules, and that mineralogists do not find any virtue of the planets in metals and deny the existence of spirits in mines.²⁰³ It is impossible to learn anything experimentally as to the influence of the *primum mobile*.²⁰⁴

Montanari regarded ancient astronomy as imperfect, held that comets and their movements were not understood by the ancient Egyptians and Greeks, and that the columns, which astrologers were said to have left inscribed with the rules of their art before the Flood, were a fable.²⁰⁵ He also branded many chemists as chimerical.²⁰⁶ Cardan was superstitious and a lover of the marvelous, more rash than rational.²⁰⁷ But, like other critics of astrology, Montanari is none too consistent in his scepticism. He says that Gassendi well questions whether the *Quadripartitum* is by Ptolemy, yet it is an authentic work; on the other hand, a few pages later, he cites the *Centiloquium* without question as by Ptolemy, whereas it is spurious.²⁰⁸ He believes that an eel's liver facilitates delivery in child-birth.²⁰⁹

But planetary hours are idle and useless; the signs of the zodiac

¹⁹⁹ *Ibid.*, 60-61.

²⁰⁰ *Ibid.*, 64.

²⁰¹ *Ibid.*, 112, 109.

²⁰² *Ibid.*, 121-23.

²⁰³ *Ibid.*, 30, 65.

²⁰⁴ *Ibid.*, 42.

²⁰⁵ *Ibid.*, 72-73, 71, 68.

²⁰⁶ *Ibid.*, 65.

²⁰⁷ *Ibid.*, 47, 76-77, 82-83.

²⁰⁸ *Ibid.*, 60, 67.

²⁰⁹ *Ibid.*, 98.

are not masculine and feminine, and the planets are not related to them as astrologers say; the great conjunctions of Saturn and Jupiter, and the doctrine of directions are confuted; the figures for the foundations of cities are futile, as is the Trutina of Hermes; the apogees of the planets and their transit from one sign to another exert no influence; astrological houses are improbable and their arrangement uncertain; revolutions both of the world and of nativities are false.²¹⁰ In short, Montanari rejects almost the entire technique of the art, in addition to declaring it against the Christian Faith and freedom of the will.²¹¹ But his attempt to introduce an experimental testing, although it is not carried very far, is the most distinctive feature of his book, although the fact that even a professor at Bologna turned against astrology is also worthy of remark.

A. F. de Bonattis, on the other hand, in a book dedicated to the Doge of Venice and printed at Padua in 1687, endeavored to put astrology upon an experimental basis and redeem it from past errors and superstition by collecting actual horoscopes. His volume consists of seventy-two pages of preliminary text in fine type with 48 lines to a page, followed by the collection of horoscopes or nativities occupying 331 pages.²¹² He says in the preface that he found many past authors had wandered far from physical truth, while others were belied by experience, and that at one time he almost gave up the art of astrology. But he was convinced that all the changes in inferior bodies—saving freedom of the will—came from superiors by motion, light and occult influence.²¹³ His teacher at Padua, Giovanni Francesco Confaloniero or Confalonerius,²¹⁴ helped him a great deal. Some features of astrological technique are rejected by him, such as the *pars fortunae* and "nonsensical elections and lordships of planets over hours, discovered by magic art rather than by astrologers." He marvels also that astrologers have composed so many fables and invented so many absurdities

²¹⁰ *Ibid.*, 48-49, 62, 56, 74, 103, 86-87, 98, 76, 92-94, 128.

²¹¹ *Ibid.*, 99.

²¹² *Universa astrosophia naturalis, caris et hucusque nunquam editis experimentis comprobata et ab argu-*

mentis quamplurimis a falsitate in contrarium deductis rationibus ac auctoritatibus vindicata, Padua, 1687: copy used, BM 718.f.9.

²¹³ See also I, 12, p. 47.

²¹⁴ Mentioned also at p. 31.

in connection with the *aphetae* and term of life.²¹⁵ But astrological houses are not entirely fabulous; directions, revolutions, *antiscii* and critical days are to be retained.²¹⁶ In his opinion the length of life can be forecast, if those directions are followed which he has set forth in the examples of genitures, which are drawn in part from Placidus de Titis and from Confalonierus.²¹⁷

De Bonattis does not attempt to lay an experimental foundation for all astrology but merely to make a modest beginning in this particular problem of determining the length of life. He therefore has brought together genitures of those who have not lived beyond their twentieth year and more especially of those who came forth dead from the maternal womb or died soon after. Secondly, he has collected nativities of those who died a violent death, in each case first the roots, then the directions, then the revolutions of years, and, when known, lethal crises. He has used the astronomical tables of Bullialdus and Flaminius de Mezavachis (Flaminio Mezzavacca) with some correction by later mathematicians especially Zimmerman. He has not used the Ephemerides of Argolus because they do not correspond to the latest observations and reckoning, especially in the case of the three inferior planets. Riccioli and Cassini would be even better but have come to hand too late to use. Many of the horoscopes are of persons of Verona, more from Padua. All are of the seventeenth century and some as recent as the 1680's. The first group of cases of violent death were chiefly from fire-arms; both examples of persons struck by lightning are from the past year, 1686. A second group of death by drowning or falling begins with Julia of Padua, born in 1603, and who, deserted by her lover, drowned herself in the river in 1626. Next come eighteen cases of those who have had narrow escapes from violent death and are for the most part still living. One survived a fall from a high building. Another nearly drowned and two years later suffered for fifteen days from malignant fever. Another fell from a boat into the river. Another at the age of fifteen was attacked by robbers and left senseless. Finally come eleven examples of twins.

²¹⁵ *Ibid.*, pp. 27-28, 31.

²¹⁶ *Ibid.*, pp. 35, 42, 44, 56-63.

²¹⁷ *Ibid.*, p. 31.

In a treatise on dog-days and gout,²¹⁸ which appeared at Paris in 1688, the author attributed power over inferior bodies to sun, moon and stars.

Even in the Institutes of Rational Medicine according to recent theory and practice of Waldschmid, although there be no astrological medicine, chyliification was accounted for by the ether or most subtle matter in the world, which disposed saliva, lymph, gastric juice and foods to fermentation.²¹⁹

Josephus de Tertiis, of whose Physical Curiosities we have spoken,²²⁰ was also the author of a treatise on astrological necromancy addressed to Madame Colonna and found in a Barberini manuscript at the Vatican.²²¹ Astronomical tables from October 1670 to October 1671 and a *figura coeli* for the vernal equinox of 1671 occur in a much smaller manuscript pasted in at the close of the volume, but may indicate its approximate date of writing. The first sixty-two leaves are occupied by astrological tables covering from the first of January to the twenty-ninth of December. The next fifteen leaves are filled with *figurae coeli* or horoscopes, at the rate of six per page. Then for several leaves follow names of angels for the hours of each day of the week, next those for the mansions of the moon, but only the "good genius" column is filled in, not that headed "Malogenio." The same is the case with those for the signs of the zodiac, points of the compass, seven planets and four elements. A brief text giving astrological and astronomical directions²²² is then followed by a horoscope for the celestial figure and another for the figure of the good genius.

It is probable, however, that the astrological necromancy is later than 1671, for in 1690, under the title, *De gradu horoscopante*, Joseph de Tertiis published at Paris nine Tables to save astrologers labor in determining the ascendent, drawing up a *figura coeli*,

²¹⁸ For the full French title, some eleven lines long, see JS XVI, 434.

²¹⁹ Joh. Jac. Waldschmid, *Institutiones medicinae rationalis recentiorum theoriae et praxi accomodata*, Marburg, 1688, in-12; reviewed in *Acta eruditorum*, VIII (1689), 104-5.

²²⁰ In Chapter 31.

²²¹ Barb. 245, 17c, De triplici figura demonis cacodemonis et coelesti autore Don Ioseph de Tertiis ad illustrissimam et excellentissimam Madamam Colonniam.

²²² Barb. 245, fols. 84r-86v: "In questo libro s'osservar non solo l'ascendente ma anio lo dispostore dell'hora et la figura celeste..."

determining the positions of planets in the mansions of the moon, and finding such aspects, besides the ancient ones, as

le demi sexte, quincunx, quintile, biquintile, le demi-quarré, & le quadre et demi, donnant 30 degrez au demi sexte, & 150 au quincunx, c'est à dire cinq signes, au quintile deux signes avec douze degrez, au biquintile quatre signes et 24 degrez; au demi-quarré un signe et 15 degrez, et au quadre et demi 4 signes & 15 degrez.

The *Journal des Sçavans*,²²³ after three pages of such information, concluded that there was nothing more commonly received than these opinions but also nothing less founded in reason. For, if the planets act on earth only by their light, how can such different effects result from their merely occupying different positions in the sky? To which an astrologer might well have retorted: How can so many different effects result from mere fermentation of acids and alkalis, or from the position of particles in pores? Was not position and figure the very essence of the corpuscular philosophy? Or, as Leibniz remarked, if the essence of bodies or matter is extension, extension alone should suffice to account for all the properties of bodies or of matter.²²⁴ Leibniz would add movement, but so would the astrologer.

John Goad (1616–1689), head master of the Merchant Taylors' School from 1661 to 1681, when he was dismissed as a Roman Catholic, published in 1686 in English,²²⁵ and in 1690 in Latin,²²⁶ a work on astrological weather prediction which won him a great reputation.²²⁷ Although the book is primarily astrological, Goad recognized the need of collecting local weather data, because the state of the air was "marvelously difform" and varied not only in different regions but in different places of the same region. Often

²²³ JS XIX, 110–14.

²²⁴ JS XIX, 387.

²²⁵ *Astro-Meteorologica, or Aphorisms and Discourses of the Bodies Celestial, their natures and influences discovered from the variety of the alterations of the air, temperate or intemperate, as to heat or cold, frost, snow, hail, fog, rain, etc.*, London, 1686, in-fol. BM 31.e.7.

²²⁶ *Astro-Meteorologica sana, sive principia physico-mathematica quibus mutationem aeris, morborum epidemiorum, cometarum, terrae motuum, aliorumque insigniorum naturae effectuum ratio reddi possit*, London, 1690, in-4, xiii, 182 pp. BM 718.e.30. This is the edition which I have used.

²²⁷ DNB.

the same celestial causes had diverse effects, often no effects at all, because of the defect of the matter and the diversity of the places on which they acted. Brazil had no earthquakes because it was destitute of metals and subterranean fire, and was immune from epidemics because of a wind continually blowing in from the ocean. Goad's own rules for weather prediction applied especially to the latitude of London.²²⁸

Goad believed that it had been demonstrated by long experience that weather changes depended not only on the motion of the sun but on that of the planets, and were further affected by the fixed stars and signs of the zodiac.²²⁹ He not only cited recent astrologers such as Offusius and Morin, and Kepler repeatedly, but the *Tetrabiblos* of Ptolemy was still an authority for him, and he said that it was hard to tear himself from the received opinions of the ancients.²³⁰ He still held that the slowness, stationary position, and retrograde movement of the planets increased heat and had "marvelous force." Whether planets were really stationary and retrograde, just as whether the sun moved or the earth, did not bother him, "since it is most certain that real effects occur" when they seem to be so.²³¹ Different types of weather resulted when five or six adjacent signs of the zodiac were occupied by planets, when four were, or when only three or two, or all the planets were in a single sign. Goad still attributed force to *antiscia*. A quadrate aspect was most forceful, when one planet was on the horizon and the other at the meridian. The quadrate aspect was more potent than the sextile, and the trine than the quadrate, because their angles were subtended by a greater arc of the zodiac.²³² During a new moon the days were hotter and the nights cooler than during a full moon. Sailors and the inhabitants of maritime regions exposed to floods should note carefully conjunctions of Venus and Mercury and their aspects with the sun, for destructive storms were apt to be excited, especially if the three superior planets concurred. That Saturn was a cold and rigorous star, all agreed, ancients or moderns. And it was proved by daily experience that the planets were more

²²⁸ *Astro-Meteorologia*, 1690, pp. 4-5.

²²⁹ *Ibid.*, pp. 5, 6, 8.

²³⁰ *Ibid.*, p. 33.

²³¹ *Ibid.*, p. 13.

²³² *Ibid.*, pp. 19, 21, 28-29.

potent in some signs and degrees than in others.²³³ It was also most certain that comets could be predicted from the concourse of the three superior planets, but they might appear either in the same sign or that opposite or that midway between the planets to which they owed their origin.²³⁴ Besides comets, Goad included epidemics and pest, and earthquakes, as well as thunder storms, floods and tempests, among the meteorological phenomena predictable from the heavens.

Despite its astrology, Goad's book was reviewed in *Acta eruditorum*.²³⁵

At Venice in 1690, Francesco Minniti published a short treatise on the influence of the stars on man the microcosm, with a plate showing the relation of the signs of the zodiac to the parts of the human body. The relation of man to medicinal simples of the vegetable kingdom was also considered. After an appendix on navigation, the work closed with a collection of arcane experiments.²³⁶

Grandducal manuscripts preserved at Karlsruhe of the seventeenth and eighteenth centuries illustrate the confusion and intermingling of science and occult science which still prevailed. In one manuscript a nativity in German and a tract on physiognomy in Latin are found among works on mathematics, optics and fortifications (Karlsruhe D. 152, 17-18c). In another a horoscope of May 2, 1670, astrological reflections of 1681, an annual prediction for 1673 and a prophecy of Nostradamus for 1678 occur together with tracts on the compass, calendar, comet of 1680-1681, geometry, perspective, machinery and arithmetic (D. 153, 17-18c).

Eberhard Welper, who had attained the baccalaureate at Strasburg in 1609, and had published astronomical observations and astrological predictions there on the comet of 1618, was still turning out astrological books in the sixties, while his *Tractatus genethliologicus* was issued posthumously there in 1700.²³⁷

²³³ *Ibid.*, pp. 39, 50, 58, 66.

²³⁴ *Ibid.*, pp. 156, 159.

²³⁵ VII (1688), 22-24.

²³⁶ *Armonia Astro-Medico-Anatomica, o sia Colleganza degl'astri con il microcosmo e di questo con i vege-*

tabili, con un appendice della Nautica, ed in calce con un raccolto di arcani sperimentati, Venice, Gio. Francesco Valvasense, 1690, in-4, 24 pp.

²³⁷ The titles of the works are given in the BM catalogue.

Whitelocke Bulstrode (1650–1724), in his *Essay of Transmigration* of 1692,²³⁹ might deplore the fact that

the minds of most men stand bent and inclined to the pedantry of their profession and education. Not one man in ten thousand is other than what he learned from his tutor or master.²³⁹

He might reduce the elements to only two, fire and water.²⁴⁰ This did not prevent his maintaining the intension and remission of forms against Descartes' insistence upon quantity and extension.²⁴¹ And he still believed that the seven planets govern inferiors, and that the heavenly bodies bestow an influence or universal spirit on the earth.²⁴²

The heavenly bodies are continuously at work for us . . . , emitting a vital heat which, clothing itself with an aerial spirit, enters into the chambers of the deep and there frames all that variety which, coming forth, we call the works of Nature.²⁴³

In France, however, the sceptical attitude of Gassendi and Bayle towards astrology was becoming widespread. In his manual of philosophy for school use, first published in 1695, Edmond Pourchot said that astrologers could give no reason for the division of the sky into twelve houses, the head and tail of the dragon, *pars fortunae*, *hyleg* and *alcochoden*, and other features of astrological technique. The entry of the sun into the sign Aries could forecast nothing more than imminent heat and lengthening days. What connection could there be between the aspects of the planets and our atmospheric conditions? Astrological images were inane, and the force attributed to climacteric years was purely imaginary. In short, he was ashamed to set forth such nonsense, which was unworthy of philosophers. Nevertheless he did so, and the instructions how to draw up a *Thema* or horoscope and divide the heavens into houses were still found in the third edition of 1711.²⁴⁴ Apparently students and readers were still interested in and curious concerning such matters.

²³⁹ Copy used: BM 526.g.20.

²³⁹ *Ibid.*, pp. 184–85.

²⁴⁰ *Ibid.*, pp. 146–47.

²⁴¹ *Ibid.*, p. 176.

²⁴² *Ibid.*, pp. 46, 97.

²⁴³ *Ibid.*, p. with signature, b 2 r.

²⁴⁴ Purchotius, *Institutio philosophica ad faciliorem veterum ac recentiorum philosophorum lectionem comparata*, III, 91–100.

From this congeries of varied attitudes for and against astrology and celestial influence, a general trend or two may be deduced. Cartesianism for a time offered new support, astrological medicine still survived to some extent, experimental method was enlisted on both sides. But on the whole the attitude of Kepler and Francis Bacon, that astrology should be expurgated and reformed rather than utterly rejected, which had marked the early century, is giving way to the position of extreme condemnation, adopted by Bayle in 1682, and by Pourchot in 1695, and to be continued by Voltaire and *l'Encyclopédie* in the next century.

CHAPTER XXXIII

ALCHEMY AND CHEMISTRY AFTER 1650

The 'fifties—A universal medicine?—Schoock on fermentation—Tachenius and Dieterich—Guisson—Helvetius—Respour—Birrius—Borrichius—Alchemical collections, 1670-1690—Kerckring—Malbec de Tresfel—Tilemann, Langelott, Morhof, and Bohn—The gold tooth again: Tylkowski—Tilingius—Du Clos on mineral waters—Molitor on artificial baths—Sympson—Pebble water—Pantaleon—Isolation of phosphorus: Krafft, Kirchmaier, Kunkel, Balduin—A. O. Faber—Major's *Genius errans*—Borri of Milan—The Mute Book—Clauder—Pernauer—Steeb, Hannemann, Wedel, Du Clos—Le Conte—Jungken—Vigani—Weidenfeld—Robert Plot and perpetual lamps—Cassius—Casati—Other authors—Chemical analysis of ants—F. Hoffman the Younger—Hennickius—Stisser—Le Mort—Hannemann again.

Messieurs les Chymistes parlent un langage inconnu au reste du monde.
—JOURNAL DES SÇAVANS, XIII, 181

Glauber, treated in our chapter on Alchemy to 1650, continued to write thereafter, and Thomas Vaughan (1622-1666) now flourished. Of alchemical works by other authors in the sixth decade of the century we shall note only one or two.

There is little justification for the use of the word, magic, in the title, *Pseudographia Anthropomagica: or a magical description of the soul*, which Agricola Carpenter published at London in 1652.¹ Since it contains some chemistry and employs a jargon which includes such Helmontian expressions as *archeus*, I mention it here.

Elias Johannes Hessling started a small controversy by his *Theophrastus Redivivus* on the Azoth² of the philosophers, first published in 1659.³

An anonymous tract on the Relationship of Gold, Sugar and the Spirit (or, quintessence) of Wine, which was printed at Giessen in

¹ In-12. BM E.1369 (5.).

² See "Azoch" in Index of T III, and "Azoth" in Index of T VI.

³ For the jaw-breaking full title and subsequent controversy see Ferguson I, 401-2.

1659,⁴ is assigned by Ferguson to Johann Tacke (Takius) who died in 1675 and published other alchemical works.⁵

Interest in a universal medicine perhaps exceeded that in the transmutation of metals in the later seventeenth century. In the year 1660 treatises on this theme were published at The Hague and at Brussels by Johann Ludwig Frundek and Georgius Figulus. The former's *Elixir of the Tree of Life*⁶ described five operations in its making, the dose according to the age of the patient, the cure of various diseases by it including cases of his own, and a list of ailments and how to administer his elixir in each. Figulus gave his treatise the high-sounding title, *New and Unheard-of Cabalistic-Chemical Mirror of a Universal Medicine*.⁷ After a long dedication to Louis Bourbon, "le grand Condé,"⁸ Figulus states that "this medicine" is an oil from seven qualities or from the first being of the seven metals, so purged and mortified that nothing remains save spirit, soul and fifth essence, with an agreeable odor unmatched in the whole world.⁹ He then inquires when it is best used for preservation of health, for cure, and for what diseases. He criticizes a medical work of 1606, notes the danger of different measures being used by apothecaries and physicians, cites the Bible¹⁰ and other authors, and meanders on concerning this and that.

As day unto day sheweth forth speech and night unto night uttereth knowledge, so one text explains another, one book another, one disease another. Medicine reveals medicine, herb herb, beast beast, and mineral detects mineral, while natural phenomena manifest their Creator.¹¹

Turning to more practical considerations, he tells where his medicine may be purchased in Brussels.¹² Then comes an epilogue with a

⁴ *De consanguinitate auri sacchari et spiritus vini*, 56 pp. BM 1033.e.13. At p. 28 the caption is, *De quinta essentia vini*.

⁵ Ferguson, II, 426.

⁶ Joh. Ludov. à Frundek, Germanus, *Tractatus de elixire arboris vitae, id est, medicina mea universali*, Hagae Comitum, 1660, 147 pp. Copy used: BN 8° Te¹⁵¹.407.

⁷ *Novum et inauditum medicinae universalis speculum cabalistico-chymicum*, Brussels, Jo. Mommart, 1660, in-16, 207 pp. Copy used: BN 8° Te¹⁵¹.170.

⁸ *Ibid.*, pp. 3-39.

⁹ *Ibid.*, pp. 44-47.

¹⁰ *Ibid.*, pp. 96-100, especially.

¹¹ *Ibid.*, p. 102.

¹² *Ibid.*, p. 114.

commentary on the Emerald Tablet of Hermes, and finally examples of medical practice confirmed by live testimony.¹³ For example, on November 20, 1626, John de la Ponte before a notary declared that three of his children were cured by Judocus van der Heyden,¹⁴ previously mentioned as the one from whom the universal medicine could be had.

The treatise of Luigi Conti of Macerata on the two miracles of art and nature, which first appeared in Latin in 1661 at Venice, had another Latin edition at Frankfurt in 1664,¹⁵ while a French translation was printed at Paris in 1669 and 1678. In the Latin title the two miracles were the liquor Alchaest and the philosophers' stone,¹⁶ but in the title of the French version the latter became the universal medicine.¹⁷

S. A. Fabricius, on the contrary, wrote on the universal medicine to oppose it.¹⁸ Some said that it acted by marvelously strengthening nature to resist disease; some said that it resolved, consumed and dissipated all diseases and causes of diseases; some, like Dienheim (back in 1610), represented it as a quintessence which so disposed depraved humors that a cure could be effected by ordinary medicines. Fabricius, on the contrary, argues that the causes of illness are most diverse and depend upon occult as well as manifest qualities. If there is one panacea, why did God provide so many and so varied medicaments? If there is one panacea, why not close all the apothecary shops and abolish all the books of medicine? No single medicine can at the same time strengthen the spirit, nourish the body, and consume vicious humors. And there are some diseases, such as hectic fever, in which nourishment, and that not spirituous, is more beneficial than medicaments. A universal medicine would be a revival of the tree of life. Fabricius stands on the

¹³ *Ibid.*, pp. 117 et seq.; 138 et seq.

¹⁴ *Ibid.*, p. 150.

¹⁵ And in the next century in Manget, *Bibliotheca chemica*, 1702.

¹⁶ *Clara fidelisque admonitoria disceptatio . . . de duobus artis et naturae miraculis, hoc est, de liquore Alchaest necnon lapide philosophico . . .* Venice, 1661, in-4: BM 1033.h.11. (11.).

¹⁷ *Discours philosophique traitans*

des deux merveilles de l'art et de la nature, c'est à dire de la liqueur de l'alchaest et de la médecine unioerselle . . . composez en latin par M. Des Comtes . . . et traduits en français par Robert Preud'homme . . . Paris, J. de Villery, 1669, in-12, 204 pp.: BN Te¹³¹.119. See above, VII, 231-2.

¹⁸ *De medicina unioersali*, Venice, 1668. BM 778.d.38.

words of Galen, "It is impossible to find a drug which is the best for many ailments."

To the argument that the universal medicine acts like fire, which burns all, and antimony, which consumes all metals that are mixed with gold but not the gold, Fabricius answers that the comparison with antimony is just an analogy, and that fire does not burn all, and that, if the universal medicine did, it would destroy the blood and good juices in the body. He denies that, because there are poisons which are fatal to all men, so there are medicines which are beneficial to all and take away all disease. Nor does it follow that, since there are medicines for each part of the body, there should be one for the entire body. Croll argued that, as there was one common *mumia* or spirit of life for all men, and one idea of disease, which was no other than interception of the spirit of life, so there was one medicine. Fabricius grants the premise, but for the human species, not for individuals. But medicine must cure individuals. Nor is disease merely the interception of the spirit of life. As for Dienheim's argument, a single agent cannot restrain the varied corruptions of morbid humors, and every medicine acts by a virtue peculiar to itself.

Fabricius also wrote a brief Discourse on the term of human life which is medical and free from astrology, and a treatise against the notion that images or shapes like puppy dogs appeared in the urine of those afflicted with hydrophobia.¹⁹ Meibomius had already pointed out that they imagined various semblances, just as different persons see different images in the moon.²⁰ But Gaspar à Reies had held that there was such force in poison to alter the body, that it could transmute it to its own likeness and form its humors into canine figures.²¹

The work of Johann de Montesnyder on the universal medicine is alchemical rather than medical and is written in German.²² It

¹⁹ *Discursus medicus de termino vitae humanae*, Rome, 1666, in-4, 8 pp., BM 784.f.42. *Disquisitio medica de catulis hydrophoborum*, Padua, 1665. BM 1191.k.26.

²⁰ Heinrich Meibomius *in disp. sua de hydrophobia*, Helmstedt, 1659, Theses 32 et 33.

²¹ Gaspar à Reies, *Campus Elysius jucundarum quaestionum omnibus literatis medicis inprimis maxime delectabilis*, Brussels, in-fol., Quaest. 62, fol. 477.

²² *De medicina universali ex tribus generibus extracta per universale menstruum*, 1678. BM 1034.f.22 (2.).

discusses such topics and questions as the universal menstruum of all metals and minerals; the magical elements, that is, the threefold fire of the ancient sages; the destruction of the metals and their reduction to the three principles; whether the universal medicine is to be found in the seven stars, i.e., metals, or just in gold and first matter. The work ends:

Hoc dico

Amore

More

Ore

Re.²³

But then, with a new title page, we have 150 fundamental rules taken by A. Gottlob from the foregoing treatise on the universal medicine.²⁴

Montesnyder had previously composed a work on the Metamorphosis of the Planets (i.e., metals),²⁵ in the preface to which he mentions a still earlier treatise, *De elementis magicis*, which I have not seen. The text speaks of three worlds, how to distinguish the hermaphroditish little irrational mineral world from the lunar feminine *Gebuhrt*, of the double and universal nature of the hermaphroditish microcosm, how the planets serve the monarch of this world, how Mercury, after he triumphs, changes himself into mercury of the philosophers, and many other metaphorical representations of the chemical process.

We have seen ferments emphasized by Helmont and by Rattray in 1658. One of those omnibus compilations upon a particular topic, of which the seventeenth century was so fond, was slung together by Marten Schoock on the subject of ferment and fermentation,²⁶ with abundant quotation from Greek and Latin poetry and prose, including such authors as Plautus and Terence, Columella, Diodorus Siculus, Horapollon, Peter of Abano, Hoghelande, Billich, Highmore and Willis. After five opening chapters on ferment in

²³ *Ibid.*, p. 138.

²⁴ *Spagyrische Grundregeln aus der vortrefflichen Joh. de Monte-Snyders Tract. de medicina universali . . .*, von A. Gottlob., 1678.

²⁵ *Metamorphosis planetarum*, 1663, 133 pp. BM 1034.f.22 (1.).

²⁶ *De fermento et fermentatione*, Groningen, 1662, in-12, 670 pp. BM 784.a.21.

bread and the unleavened bread of the ancient Hebrews, and a sixth on Plato's definition of ferment, the chemical definition was reached. Schoock held that the cause of fermentation was spirit, which led to a long discussion as to what spirit was. He believed that there was fermentation in the generation of animals, especially those said to be spontaneously generated, although he recognized that they were not generated without seed or something like it. But he was inclined to think that in chylicification there was merely cooking and not fermentation. The theory that the blood is subject to fermentation in the spleen, put forward by Helmont and developed further by Willis, he represents as a novelty which owed its origin to the chemists. But he seems to accept fermentation of the blood somewhere in the body. Another theory requiring further proof is that scurvy comes from a lack of ferment. Effervescence in fever is not fermentation.

In one passage Schoock excludes occult qualities, but adds, "not that I think they are never to be recognized." He goes on to speak of peculiar sympathy. Elsewhere he cites Untzer on epilepsy, that to produce it is required not only mordacity of vapors but also a depravity and venom antipathetic to the brain from the property of the whole substance or its specific form.²⁷ When spices are turned to vapor, they penetrate deeply and break up crass and sluggish humors. Or Highmore, *De hysterica passione*, cap. 6, p. 36, is quoted that odors may bring on hysteria. Also what they call sympathetic epilepsy is vaporous in origin.²⁸ But Schoock is opposed to Digby's weapon ointment. In a *Post-loquium* he says that he is not yet satisfied as to many positions which he has put forth and could wish to be instructed on many points by further and more certain experiments.

In the same year, 1662, Timaeus von Gueldenkleee warned that the teeth were liable to fall out as a result of untimely use of spirit of vitriol, which Croll and Horst had recommended for the teeth.²⁹

Otto Tachenius or Tackenius, son of a miller and former abbeys,

²⁷ *Ibid.*, pp. 510, 513 and 553, citing "Untzerus I, 13 de epilepsia": i.e., Matthias Untzer, *Hieronosologia chymiatrica, hoc est epilepsiae*...

Hallae-Saxonum, 1616, in-4. BM 1033.h.13 (2.).

²⁸ *De fermento*, pp. 519-21, 550.

²⁹ *Casus medicinalis praxi*..., 1662, pp. 73b-74a.

worked with David Welman, a pharmacist of his native Lemgo, and then with Rotger Timpler, a physician, but was caught stealing and dismissed. He then went to Danzig and Warsaw, according to one account;³⁰ according to another,³¹ he went first to Kiel, next in 1640 to Danzig, then in 1641 to Königsberg, where he became acquainted with Helwig Dieterich, whose Eulogy of the Celestial and Terrestrial Planets, of Macrocosm and Microcosm, had appeared in 1627. In 1644 he departed to Italy, in 1652 received the M.D. degree at Padua, and thereafter settled in Venice. In the same year, 1652,³² was printed at Hamburg his attack upon the Alcahest of Helmont.

Tachenius also gained a reputation from the preparation and sale of his volatile viperine salt, and it plays a leading part in the title of his *Hippocrates chymicus*, "which shows the ancient foundations of the newest viperine salt," and which first appeared at Venice in 1666, in-12.³³ It was a clever piece of salesmanship on the part of Tachenius to associate his salt with the name of Hippocrates as well as with chemical remedies. He also advanced the thesis that all sublunars are compounds of two things, acid and alkali.³⁴ The acidity of his viperine salt was occult, and so its saltiness was the more subtle and pleasant. It was his own invention, as proof of which he quoted a letter of Severinus from Naples of May 15, 1650.³⁵ He also told how occult acid is made manifest.³⁶ The book was reprinted several times before the close of the century and appeared in English translation in 1677 and 1690.³⁷ Modern writers

³⁰ Joh. Phil. Burggrafius (an M.D. of Darmstadt), *Libitina ovens . . . de medicorum praecipuis fatis*, Francof., 1701, pp. 65-67.

³¹ Zedler, who does not list Burggrafius in his bibliography of nine items.

³² Stolle (1731), 298, and Hoefer II (1843), 226, date it incorrectly in 1655. Burggrafius and Zedler put it in 1652. There is also disagreement whether the title was *Epistola* or *Epistolae de famoso liquore Alcahest Helmontii*. I have not seen the work which is not in BM.

³³ I have used BM 1037.a.13: *Hippocrates chymicus qui novissimi viperi-*

ni salis antiquissima fundamenta ostendit, Brunsvigae, 1668, in-12. It contains the approbation by the reformers of the University of Padua dated April 3, 1666, and the dedicatory epistle of the Ides of May, 1666.

³⁴ *Ibid.*, p. 51.

³⁵ *Ibid.*, pp. 79-82.

³⁶ *Ibid.*, cap. 13, p. 85 *et seq.*

³⁷ Latin editions at Brunswick, 1668; Paris, 2 vols., 1669-1672; Leyden, 1671; Paris, 1674; Venice, 1678. There is a copy of the 1677 English translation in the New York Academy of Medicine, RB C case. For the 1690 edition: BM 7509.6.

like Ferguson have said that "Tachenius laid the foundations of qualitative chemistry in a more systematic manner than his predecessors."³⁸ But contemporary reviews of the first edition in the *Journal des Sçavans*³⁹ and *Philosophical Transactions*⁴⁰ noted the following matters as among its chief contentions and points of interest. Nothing penetrates so much as alkali. It is an error to use spirit of vitriol to whiten the teeth, as is commonly done, since it rather discolours them yellow, which recalls the earlier statement by Timaeus von Gueldenklee. Rotten wood contains no alkali, all having been exhaled in the process of rotting. Thurneisser's⁴¹ apparent turning half of an iron nail into gold at Florence was accomplished by soldering the gold on and giving it a surface color of iron. Then, when it was dipped into the oil that was supposed to transmute it into gold, the oil simply removed the iron wash.⁴²

In 1686 the following passage occurred in the *Journal des Sçavans*:

There is scarcely an opinion which in so short a time has made more rapid progress than that of acid and alkali. Men are not content to give those names to other salts on the pretext of similar effects. They have extended their physical properties so far as to make them the principles of natural phenomena. Tachenius is the first . . . who has given them that scope and, to make his view more authentic, he has claimed to rest it on the authority of Hippocrates, maintaining that the water and fire, of which he would have all animals, even men, composed, are nothing else than acid and alkali.⁴³

The History of Medicine by J. C. Barchusen, published at Amsterdam in 1710, in reviewing the progress or change in thought after the death of Helmont in 1644, states that Tackenius, as his name is here spelled, omitted Helmont's Blas, Gas and other obscurities and reduced all to acid and alkali. Professing to revive Hippocrates' two sources of bodies, fire and water, he distinguished universal from singular fire. The former came from the sun, was the parent

³⁸ Ferguson, II, 424.

³⁹ For Jan. 10, 1687: II, 10-13.

⁴⁰ IV (1670), 1019-21. It is very similar to the JS review.

⁴¹ JS spells it Turneisser; PT, Turnheisser.

⁴² Binninger, writing in 1673, says that he could detect no fraud in the nail: *Joh. Nicolai Binningeri . . . Observationum et curationum medicinalium centuriae quinque . . .*, Montbelgardi, 1673, p. 24.

⁴³ JS XIV, 222.

of all natural forms, and an occult and inconspicuous acid spirit. Singular fire was present in every mixed body in a way that escaped the eye, and was the same as what Hippocrates called spirit, breath, wind or air. The other principle of nature, water, was obedient to fire, was a mean between dense and thin, between earth and air, and was of a dissolving and feminine nature, volatile of body and multiple in figure. It also was empty or full of pores, so that it could receive the acid spirit of the sun. In short, it was alkali. Fire moved all; water nourished all. Together they constituted a vital ferment and all that the world comprehends within itself.

The chemistry and medicine of Tachenius were still animistic, if not magical. He ascribed a sort of soul, prudence and intelligence to acids, and every acid consisted of soul and spirit. Alkali in magnetic wise was full of the force of attraction, drawing the virtues of superiors to itself and altering acid from its natural property to a salty concretion. Moreover, each disease had a soul, although most of them had this in common, that they resulted from fermentation or the conjunction of acid and alkali. These dogmas of Tachenius, Barchusen concludes, were for the most part professed by Bontekoe, Overcamp and others, but they added the viscid to acid and alkali.⁴⁴

In a letter of April 27, 1668, to the prince of Brunswick and Lüneburg, Tachenius recounted an experiment at Venice as to the virtue against snake bite of a stone from the head of the *cobra de capelos*, which an Armenian had brought to Venice. A half hour after a dog had been bitten by a viper, the stone was placed on the wound and could not be detached, until after two hours it fell off of itself, and the dog got better. The stone was then soaked in milk and another dog which drank the milk died the next night. When the stone was applied a second time to the wound it fell off after only half an hour, and a dog which drank the milk in which it had again been soaked was still alive three days later. When they tried to apply the stone to the wound a third time, it would not stay on at all.⁴⁵

The early career of Tachenius had been, as we have seen, somewhat shady, and he had been dishonorably discharged by more

⁴⁴ J. C. Barchusen, *Historia medicinae* . . . , Amsterdam, 1710, pp. 490-96.

⁴⁵ JS, Sept. 17, 1668; II, 396-98.

than one employer. Numerous letters and other documents substantiating this were printed by Helvig Dieterich in 1655,⁴⁶ after Tachenius had accused him of publishing in garbled form the letter on the Alcahest which he had entrusted to him to see through the press. It was also declared that the viperine salt of Tachenius had been sold in such large quantities that it could not possibly be genuine. Burggrafius said that many suspected that he used volatile salt of hartshorn with a bit of its fixed salt, or flowers of sal ammoniac, or volatile salt of urine, adding some of the fixed, and ascribed the same virtues to it, word for word, as Glauber did to the spirit of sal ammoniac.⁴⁷

The three principles of the chemists were attacked in 1666 by Pierre Guisson, M.D.,⁴⁸ who, although he had sweated for several weeks at volatilizing Venetian talc by sublimations, admitted that he was not a son of the art nor fully initiated into its mysteries. But he had been with Boyle at Oxford and on familiar terms with Barlet, Willis, Digby, Glauber, Schröder "and many other leading chemists of our age."⁴⁹ He never saw nor heard them demonstrate the common hypothesis of three chemical principles. Many bodies cannot be divided into them by fire; many divide into five heterogeneous parts. Fire is not a universal and adequate analyst of bodies. It is doubtful if the heterogeneous parts pre-existed in the compound in the state in which they are seen when separated by the aid of fire. And there are some ingredients in compounds which are inscrutable by our senses.⁵⁰

Johann Friedrich Schweitzer or Helvetius (1625–1709), physician to the Prince of Orange, and great grandfather to the philosopher Helvétius, affirmed the truth of transmutation into gold in his Golden Calf in 1667.⁵¹ After the title page, two pages reproduce

⁴⁶ *Vindiciae adversus O. Tackenius*, 1655. BM 1033.k.14.

⁴⁷ *Libitina ovans*, 1701, p. 66.

⁴⁸ P. Guissonius, *Ep. diss. de anon. libello*, Francof., 1666, in-8, 24 pp. BM 1033.e.59. It was also printed with the *Opera* of Pierre Potier in 1666 (LR 893) and 1698 (at pp. 831-50).

⁴⁹ *Ibid.*, pp. 6, 9, 14. He further

mentions "Feureus, Chauveautius . . . Marcassius." Feureus may be meant for Le Fevre.

⁵⁰ *Ibid.*, p. 13.

⁵¹ *Vitulus aureus quem mundus adorat et orat, in quo tractatur de rarissimo naturae miraculo transmutandi metalla*, Amsterdam, Joh. Jansson, 1667, in-8, 72 pp. Copy used: BN R.38331.

both sides of the pfennig struck in commemoration of transmutation performed at Prague in 1648 in the presence of the Emperor, Ferdinand III. Next comes the *Epistola nuncupatoria*, followed by extracts from Helmont, Paracelsus and Khunrath. After noting one or two previous instances of transmutation, Helvetius tells the story of his visitor of December 27, 1666, and their conversation. The visitor failed to return the next day, as he had promised, but a tiny bit of powder which he left with Helvetius turned six drams and two scruples of lead into gold that stood all tests. Their dialogue is then repeated at greater length, Elias the artist representing the visitor, and *Medicus*, Helvetius.⁵²

Rare Experiences by P. M. de Respour with the mineral spirit to prepare and transmute metallic bodies appeared in print at Paris in 1668.⁵³ Of its three books the first dealt with nature in general; the second, with metallic agents; the third is on the Return of Hermes. Respour was one of six men, including Le Fevre and Lemery, who were listed in Lambert's Literary History of the Reign of Louis XIV as showing in their writings the debt of medicine to chemistry.⁵⁴ His work further enjoyed a considerable vogue in Germany in the middle of the next century, appearing in translation by J. F. Henckel with added notes at Dresden and Leipzig in 1743, in a revision by J. G. Lehmann at Leipzig in 1772, and in the original French at Leipzig in 1778. Otherwise the book would hardly deserve notice. It is written in a very bumptious and garrulous tone, without tact or any gift of expression. It purports to accomplish such feats as separating sulphur from the magnet, so that a dram will attract as much iron as a pound would previously. In closing the second book, Respour says twice that he may have left something for the intelligent to solve, and that he has not divulged all. The third book is in dialogue form and opens with a conference of two philosophers. Then a philosopher utters his thoughts to Hermes without knowing it. Next two alchemists talk before Hermes, who then expounds the Emerald Table. They force him to

⁵² *Ibid.*, pp. 45-72.

⁵³ *Rares experiences sur l'esprit mineral pour la preparation et transmutation des corps metalliques*: BN R. 48920. For other editions and trans-

lations see Ferguson, II, 250.

⁵⁴ *Hist. litt. du règne de Louis XIV*, 1751, 3 vols., II, vi, Discours sur la chymie.

stay until they have shown him their laboratory, after which the book concludes with three parables concerning *le Grand Oeuvre*.

Martin Birrius, a physician of Amsterdam who is mentioned in Morhof's *Epistola* on the transmutation of metals in 1673,⁵⁵ five years before had published three treatises on the same subject,⁵⁶ of which he represented the author as unknown,⁵⁷ but as very adept and well informed as to natural phenomena.

In the preface Birrius further says that in the course of time alchemy became so involved in obscurities that it fell into contempt, but that there is an arcanum which not merely works wonders in curing diseases but purges sick metals and brings them to the perfect form of gold and silver. Similarly the first of the three tracts contends that it is idle to argue against the possibility of transmutation, which the writer has seen achieved again and again. It is not an easy process, has been kept hidden by the philosophers, and is by nature most occult. Sagacity, ingenuity and practical know-how are essential to obtain the substance which is midway between mineral and metal, occult and noble, all volatile, gold in the supreme degree, a thousand times more perfect than ordinary gold.

The first tract furthermore makes much of the concepts of form and of celestial virtue.⁵⁸ The same individual can assume successively the forms of all the metals.⁵⁹ In the process of the philosophers' stone, "all is sperm, which circulating receives the force of superiors and inferiors, and then is made all form or celestial virtue."⁶⁰ Or again, gold does not easily lay aside its form but fights till it succumbs and dies, when a new pure body must be raised from the corpse.⁶¹ Or, in purifying mercury there is left a crude metallic matter undigested and frigid, but "this is the true matter to which the form of philosophic mercury is lacking."⁶²

Medieval alchemists too are largely cited: Hermes, Bernard of

⁵⁵ Morhof, *De metallorum transmutatione . . . epistola*, 1673, p. 20.

⁵⁶ *Tres tractatus de metallorum transmutatione*, Amsterdam, 1668, in-8, 110 pp.

⁵⁷ Preface to the Reader, fol. 4^o recto. The author has been variously identified with Philalethes or, because

he makes water the true material principle of all bodies, with van Helmont.

⁵⁸ *Ibid.*, p. 27.

⁵⁹ *Ibid.*, pp. 7-8.

⁶⁰ *Ibid.*, p. 36.

⁶¹ *Ibid.*, p. 41.

⁶² *Ibid.*, pp. 48-49.

Treves, my favorite (*mihi summe colendus*), Ripley, *Novum lumen*, *Scala philosophorum*, *Rosarium magnum*, Arnald of Villanova, *Ludus puerorum*, Aegidius de Vadis, Morienus, "quinque etiam tractatus Rosarii abbreviati," Petrus Bonus of Ferrara, Johannes Mechungus (Jean de Meung?), Artephius and Lull, although Pontano, Augurellus, Flamel, Sendivogius, Sennert and Dionysius Zacharias are more recent.⁶³

On the other hand, our author recognizes only three elements, earth, water and air, entirely rejecting the idea of elemental fire, and regarding the native quality of all these three as cold. Nor do they by mixture enter the composition of natural bodies, of which water alone is the material principle, while earth is the mere bed or foundation in which they grow and are conserved, while air, into which they grow, is the medium and bearer of celestial virtues, with which it is filled, while through it they are communicated to all these inferiors. At creation the seeds of all things were put in water by the Creator.⁶⁴

Mercury is the material of all metals from which gold and silver come.⁶⁵ Our author also has much to say of a seed of gold. This metallic seed is very different from vegetable and animal seed. The place where it resides is water and it is invisible.⁶⁶ Mercury is the first philosophic agent or matrix into which our seed is to be put and matured. "Take what is of itself most impure, that is, our harlot; purge it thoroughly of all uncleanness and extract thence what is most pure, that is, our menstruum, the royal diadem."⁶⁷

The second and third treatises sing the same song as the first. We are told that metallic bodies must be reduced to a homogeneous water which does not wet the hands, that from this water there may result a new species of metal far nobler than any metal.⁶⁸

In this same year, 1668, appeared the work of Olaus Borrichius (Ole Borch) on the origin and progress of chemistry, a term which for him included alchemy.⁶⁹ He was very credulous as to its great antiquity, naming Tubal Cain or Vulcan as its inventor and accepting

⁶³ Citations at pp. 17, 83-84, 93, 110.

⁶⁸ *Ibid.*, p. 61.

⁶⁴ *Ibid.*, pp. 20-24.

⁶⁹ *De ortu et progressu chemiae*,

⁶⁵ *Ibid.*, pp. 27-28.

Copenhagen, 1668, in-4, 150 pp. BN R.7052.

⁶⁶ *Ibid.*, pp. 32-36.

⁶⁷ *Ibid.*, pp. 42-44.

the testimony of Manetho which both Conring⁷⁰ and Ursinus⁷¹ had rejected. He said that Homer showed that Hermes was a chemist, and that chemical writings of Cleopatra were still extant.⁷² Kircher's very sensible and overwhelming attack upon the genuineness of the Emerald Tablet of Hermes failed to convince Borrichius.⁷³ He believed that if drugs revealed by angels or in dreams were proscribed, a great number of salutary remedies would be lost.⁷⁴ He argued that chemistry was of use in medicine and surgery, of service in the arts and warfare, in distilling sweet water from salt for navigators to the Indies, and in making life agreeable to Poles, Lithuanians, Russians, Swedes, Lapps and Icelanders by distillation of wine and brewing of beer. No profane science came closer than it to contemplating divinity in nature; none scrutinized more profoundly the works of God's hands; none was in closer accord with sacred Scripture, as he illustrated by quoting the second epistle of Peter, Deuteronomy, Isaiah, Job, Psalms, Revelations, and the four Gospels.⁷⁵ Each of the seven metals, for which he gave their planetary names, was a cure for a different part of the body, beginning with tincture of moon (silver) for headache.⁷⁶ There were limits to his credulity, however, as he was sceptical as to inextinguishable lamps.⁷⁷ But he believed that telescopes were known to Roger Bacon, who was a favorite of his, and that he was the author of other great inventions.⁷⁸ He accepted as genuine the alchemical writings ascribed to Albertus Magnus, Arnald of Villanova, Raymond Lull, and Nicolas Flamel.

The review of this work by Borrichius in *Philosophical Transactions* (III, 779-84) noted other points than we have: a powder which twenty-five years ago at Brussels so impregnated a water that, when mercury was dropped into it, silver branches formed; a ductile salt made of sal ammoniac; Venetian glass reduced to an

⁷⁰ For his *De hermetica Aegyptiorum vetere et Paracelsicorum nova medicina*, 1648, see Chapter VI on Alchemy to 1650.

⁷¹ Johan Heinrich Ursin, *De Zoroastre Bactriano, Hermete Trismegisto . . . etc.*, Nürnberg, 1661, in-8. In general the book is worthless historically.

⁷² *De ortu et progressu*, 1668, pp. 54, 96.

⁷³ *Ibid.*, p. 72.

⁷⁴ *Ibid.*, p. 15.

⁷⁵ *Ibid.*, pp. 5-8.

⁷⁶ *Ibid.*, pp. 4-5.

⁷⁷ *Ibid.*, pp. 107-8.

⁷⁸ *Ibid.*, pp. 123, 125.

alcohol; disagreement with Kircher as to how far common salt could be altered by human art; and abbot Boncaudius obtaining perpetual heat by sinking ten pounds of mercury into the ground.

In 1674 Borrichius answered the book of Conring⁷⁹ and defended chemical remedies, Paracelsan pharmacy, and potable gold. Conring had said that Paracelsus was the first to introduce the doctrine of signatures in plants, but Borrichius points out instances of it in Dioscorides and Pliny, and defends the doctrine.⁸⁰ Botanical Experiments and On Occult Qualities are among the titles of writings ascribed to Borrichius in the *Vita* by Rostgaard, but I have not found them.

Of prominent chemists of his own time Borrichius listed Boyle in England, Gobelin at Paris, Talduccius in Florence, Vulpianus at Rome, Ludovicus de Comitibus at Venice, Beza at Strasburg, Michael at Leipzig, Rolfinck at Jena, Rappius at Mainz, and Faussius at Heidelberg.⁸¹

Chemical Processes by Olaus Borrichius, professor at Copenhagen, are preserved in a neatly written hand in a manuscript at the British Museum and are in two books. The first deals chiefly with chemical principles and with solution, calcination, extraction and coagulation. The second book on the effects of chemical operations, considers the seven metals from gold to lead, semi-metals, coral and amber, and the vegetable kingdom.⁸²

In our previous chapter on alchemy we noted some examples of collections of past alchemical literature which appeared in the seventeenth century. Gmelin noted others which were published between

⁷⁹ *Hermetis Aegyptiorum et chemicorum sapientia ab Hermanni Conringii animadversionibus vindicata*, Hafniae, 1674, in-4.

⁸⁰ *Ibid.*, pp. 380-81.

⁸¹ Of these names I have failed to identify further Gobelin, Talduccius (who is not mentioned by Giulio Negri, *Istoria degli scrittori fiorentini*), Vulpianus and Rappius. Of Boyle, Luigi Conti and Rolfinck we speak elsewhere. By Johann Adam Beza, *Disputatio solennis de varis medicæ artis curationis problematibus, Praeses*

M. Sebis, Argentorati, 1660, in-4 (BM 1179.i.3. (25.)). Johann Michael (1606-1667) edited the *Praxis chymica* of Johann Hartmann and other works. His own *Opera omnia* appeared at Nürnberg in 1688 and 1698 (Ferg. II, 94). Joh. Caspar Fausius, as the name is more often spelled, was physician to the Elector as well as a professor at Heidelberg and died in 1671.

⁸² Sloane MS 1235, fols. 35r-60r: "Domini Olai Borrichii professoris Hafniensis Processus Chymici."

1670 and 1690, which may be briefly indicated here, since his *Geschichte der Chemie* of 1798 may be inaccessible to many of our readers. *Sieben schöne und auserlesene Tractätlein vom Stein der Weisen*, published at Hamburg in 1675, included works by Hermes Trismegistus, Raymond Lull, the pseudo-Aristotle, John Dastin and Albertus Magnus. There were twenty-one treatises in the *Musaeum Hermeticum reformatum et amplificatum* of Frankfurt, 1677. *Vier chymische Tractätlein* came out at Bautzen, and *Ginaeceum chymicum* at Venice and Lyons, in 1679. There were ten tracts in *Collectanea chymica* of London, 1684. Meanwhile the first volume of le sieur Salmon, *Bibliothèque des philosophes chimistes*, had appeared at Paris in 1672 and the second, in 1678. Gmelin further listed thirteen editions of single medieval and early modern alchemists in the 1670's and 1680's.⁸³

Theodor Kerckring did not take to heart the protest of Robert Boyle in *The Sceptical Chymist* against obscure and mystical alchemical literature, since in his commentary on *The Triumphal Car of Antimony* by Basil Valentine published ten year later, he said, "Patience in searching, ability in expending, unwearied attention and deep meditation are the requisites to attain the knowledge of what is here contained." He held that red oil of the glass of antimony was the truly universal medicine, that balsam or tincture of the sulphur of antimony had cured a cancer of the breast, and further put faith in a balsam of life.⁸⁴

Towards the close of two brief treatises which he published in 1671,⁸⁵ Malbec de Tresfel distinguished sharply between them and textbooks in chemistry. He had not set forth ordinary operations but regarded himself as the inventor of something new and as warning the public against malpractices (*les friponneries*) and abuses

⁸³ *Op. cit.*, II (1798), 3-5. At pp. 6-11, he lists 22 anonymous works (I do not count his *Icon philosophiae occultae*, which was by Claude Germain, as Gmelin correctly notes elsewhere). At pp. 11-15 he gives works of Vaughan and others writing under assumed names; at pp. 24-30 are listed works chiefly in German.

⁸⁴ *Commentarius in Currum Tri-*

umphalem Antimonii Basil. Valentini a se Latinitate donatum, Amsterdam, 1671, in-12. PT VI, 2162-63.

⁸⁵ *Abrégé de la théorie et des véritables principes de l'art appelé chymie, Abrégé des opérations vulgaires et sophistiques de la fausse chymie*, Paris, 1671, in-12, 84 and 116 pp. with only 17 lines per page. Copy used: BN R.52803.

in connection with chemical remedies. But true chemical remedies and more particularly metallic ones were praised highly by him.⁸⁶ Herbs and roots have no relationship with the astral parts of man, and, being themselves corruptible, cannot overcome the principle of corruption in disease. He will not deny that they, and also the parts of animals, have some medical virtue, but they must be constellated and prepared at the proper hours and times, as Caricter, a learned German author, showed in his history of plants.⁸⁷ But Malbec leaves out animal and vegetable preparations, and such things as vipers and toads, as almost useless in medicine, and concentrates upon the mineral kingdom.⁸⁸

In opening the first of his two treatises, however, Malbec explains certain elementary matters much as other manuals did: the three kingdoms; the five constituents—phlegm, *terre damné*, mercury, sulphur and salt; fire—a fourth invisible element; the two principles—mercury and sulphur; furnaces; and the chief processes of dissolution, distillation, sublimation and calcination.

Then he begins to depart from the beaten track and affirms that true medicine requires knowledge of God, nature, art, astrology, physics and chemistry. Soon we come to the grand secret remedies of Hermetic medicine. Antimony is declared the most perfect of all mixed bodies. It has as many virtues, properties and qualities in medicine as all the others put together. From it one can draw the five qualities necessary for all alterations of the human body, namely, emetic, cathartic, diuretic, diaphoretic, and panacetic.⁸⁹

O admirable creature of God! Not content with producing so many marvels, you furthermore have power to bind, unite and render homogeneous corporally and spiritually those seven inferior stars to make that great elixir which learned Paracelsus has named Tincture of Lily, which reestablishes in a moment all the noble parts in their first

⁸⁶ *Ibid.*, pp. 113-14.

⁸⁷ *Abrégé de la théorie*, pp. 81-83. The allusion is to Bartholomäus Carichter of the sixteenth century, whose *Kräuter und Artzneybuch* was printed at Strasburg, 1619.

⁸⁸ *Ibid.*, *Abrégé des opérations*, pp. 10-11. At p. 84 he considers blood,

urine and honey as dissolvents from the animal kingdom, but dismisses them as rather ineffective, going on at pp. 36-43 to vegetable agents and dissolvents, which are limited to spirit of wine and distilled vinegar.

⁸⁹ *Abrégé de la théorie*, p. 46.

natural state by the relationship and harmony which these seven metals have with the seven stars or superior bodies, as well as with the seven mineral members or seven noble parts of man which govern the whole machine of the microcosm, which is the mean uniting those two extremes and receives the character and impression of the causes and effects of superior and inferior.⁹⁰

Malbec soon passes on to briefer treatments of vitriol, sulphur, saltpeter, pearls and corals, and has only this much to say of the bezoar and ambergris:

The bezoar and ambergris have virtues cardiac and admirable and which are closely related to the principle of life. They conserve the *humidum radicale* when they obtain passage by the force and virtue of certain particular agents, which render them capable of communicating their admirable qualities to the natural heat.⁹¹

Then, after touching on tartar and wine, he considers the seven metals more fully.⁹²

In the second treatise preparations of antimony are distinguished as safe or dangerous. When borax or saltpeter is added to Glass of Antimony, it is no longer Glass of Antimony. When apothecaries make their emetic called *Crocus metallorum*, they mix antimony well-pounded with as much saltpeter and put it in a mortar or earthen pot and throw a live coal inside. When the fire has ceased and it is quite cold, they pound it more and infuse a little in wine. But it would be less injurious, if they washed it in hot water a number of times, and infused it with Spanish wine or muscatel, and put in some spices to resist its poison and violence, and administered only a half-ounce and gave some liquor immediately after one vomited. Moreover, the *Crocus* should never be given, when the moon is in signs which are terrestrial, cold and dry, as are Taurus, Virgo and Capricorn, which keep the pores closed. As a result, the *Crocus* produces such violent effects that the patient dies, if he is weak, or at best the stomach is left weak and upset. From butter of antimony is made the emetic called Algarot or Mercury of Life which is very dangerous. The diaphoretic antimony of Basil Valentine

⁹⁰ *Ibid.*, pp. 51-52.

⁹¹ *Ibid.*, p. 60-61.

⁹² *Ibid.*, pp. 63-79.

is all right, if well made by a secret process (*tour de main*), but otherwise is too crude and requires long purification.⁹³

Gold is a fine medicine and does all in the microcosm that the sun does in the macrocosm, dispelling vapors and the like. It can be reduced to a powder so subtle that it is digestible. But the subject of potable gold Malbec reserves for particular conferences.⁹⁴

Johann Tilemann of Marburg in 1673 reprinted at Hamburg⁹⁵ seventeen Experiments concerning solutions of gold which he had published three years before in Italy. A preface by Joel Langelott dealt with the method of making true potable gold and with other chemical arcana.

Langelott addressed to the German Academy of the Curious as to Nature a letter concerning matters passed over in chemistry, including secrets of no slight moment hitherto regarded as non-entities.⁹⁶ Morhof said that it was also praised by the members of the Royal Society. It included the treatment of gold by a "philosophical mill-stone," the fermentation of tartar, the spirit of its volatile salt, essence of opium, eduction of mercury from antimony, and the analysis of coral into a rubicund mucilage.⁹⁷

Joel Langelott not only himself reaffirmed chemical secrets of great moment, which had come to be regarded as worthless,⁹⁸ but persuaded his friend Morhof, author later of the *Polyhistor*, to write

⁹³ *Abrégé des operations*, pp. 60-62, 65-68, 76.

⁹⁴ *Ibid.*, 69-73. Yet at p. 88, he says, speaking of gold, "J'ai assez parlé de sa nature, de ses preparations secretes, et des divisions et differences des ors potables."

Perhaps because of such apparent contradictions, Mme. Metzger (1923), 92-93, 477, found Tresfel difficult to follow, but his general plan and arrangement are clear enough.

⁹⁵ *Experimenta circa veras et irreductibiles auri solutiones ante triennium in Italia edita et nunc in gratiam Philo-Chymicorum denuo recusa cum praefatione D. Joelis Langelotti qua miranda vis TRITUS porro explicatur methodusque panditur non solum ce-*

rum aurum potabile sed et ex arcanis chymicis praecipua quaedam consequendi. Lege et iudica. Hamburg, 1673, 34 pp. BM 1033.e.50. The preface to the reader is dated 1669.

⁹⁶ *Epistola de quibusdam in chymia praetermissis quorum occasione secreta . . . demonstrantur*, Hamburg, G. Schultz, 1672, in-8, 32 pp. It appeared in German the same year at Nürnberg, and in 1673 in the proceedings of the Academy, *Miscellanea*, anno III, Obs. 59.

⁹⁷ D. G. Morhof, *De metallorum transmutatione ad Joelem Langelottum epistola*, Hamburg, 1673, in-8, 168 pp., at pp. 4-6.

⁹⁸ See note 96.

on the transmutation of metals.⁹⁹ Morhof first treated of the origin of metals and the possibility of transmutation, then gave an account of past alchemical authors, and finally of "experiments of this art," including such credulous accounts as that of Edward Kelley and John Dee, and Helmont's story of Butler's stone.

In 1675 Johann Bohn (1640–1719), known today as a physiologist, published a Letter to Langelott on the insufficiency of alkali and acid to serve as principles or elements of natural bodies.¹⁰⁰ As Francis Bacon had overthrown the Peripatetic elements and Boyle the principia of the chemists, so he questioned alkali and acid and their mutual effervescence. He complained that there were no competent definitions of alkali and acid. There were chemical reactions without effervescence, such as dissolving rosins with white of egg, various gums by turpentine, and coagulating quicksilver by the fumes of molten lead. It was further dubious if all effervescence was of acid and alkali. Many effects were attributed to them incorrectly, and the inflammability of bodies was not dependent upon their acidity.¹⁰¹

In the closing years of the previous century there had been quite a stir concerning a boy in Silesia who at the age of seven was reported to have cut a tooth of gold. Martin Ruland Jr. or Fils had issued a "New and within the Memory of Man Unheard-of History" of it in 1595 at Frankfurt,¹⁰² and Jacob Horst had published a treatise on it in the same year at Leipzig.¹⁰³ Johann Ingolstetter (1563–1619) in a work of 1596 contended that neither the tooth nor its generation was natural,¹⁰⁴ and then answered

⁹⁹ See not 97.

¹⁰⁰ For this and other works by Bohn see LR 544–45. It does not include his *Circulus anatomico-physiologicus seu oeconomia corporis animalis*, Leipzig, 1686.

¹⁰¹ PT X, 407–409.

¹⁰² *Nova et in omni memoria omnino inaudita historia de aureo dente qui nuper in Silesia puero cuidam septenni succrevisse magna omnium admiratione animadversus est et eiusdem de eodem Judicium*, Francofurti, apud Petrum Kopffium, 1595, in-4.

¹⁰³ *De aureo dente maxillari pueri Silesii: primum, utrum naturalis ei generatio fuit necne: deinde, an digna eius interpretatio dari queat. Et de noctambulonum natura differentiis et causis eorumque tam praeservativa quam curativa*, Lipsiae, apud Valentinum Voegelin, 1595, in-8 et in-12. According to Ruland (1597), Horst wrote "Helmstadii in Academia Iulia 12 Ianuarii anno 1595."

¹⁰⁴ *De aureo dente Silesii pueri responsio, qua demonstratur neque dentem neque eius generationem esse na-*

Horst¹⁰⁵ and Ruland¹⁰⁶ in separate treatises. Ruland replied in turn to Ingolstetter.¹⁰⁷

Stolle in 1731 represented Ruland as believing the tooth to be natural in 1595, but as having been shown that it was artificial in 1597.¹⁰⁸ Ruland does state in the dedication to the later work that the genuineness of the tooth has been called in doubt, but that recent letters received by him have confirmed it.¹⁰⁹ However, both he and Ingolstetter were less concerned as to whether this particular tooth was genuine gold than they were with the general question, closely related to alchemy, whether a gold tooth ever could be naturally generated.¹¹⁰ Ruland's reply touched upon such other matters as the magnet's drawing iron, Christ's turning water into wine, and Peter's walking on the water, whether teeth are sentient, and whether heat is greater in boys than young men.¹¹¹

We have already noted in a previous chapter that Heinrich Krevet, in *Aphorismi de metallis*, published at Hamburg in 1615, in "Coronides" at its close, referred to the Silesian boy with the gold tooth.

Now nearly eighty years after Ruland's work of 1595 the old canard was revived, as we learn from the Jesuit, Adalbert Tyl-

turalem, Lipsiae, apud Abrah. Lamberg, 1596, in-8.

¹⁰⁵ *De natura occultorum et prodigiosorum dissertatio ad Jacobum Horstium qua respondetur ipsius libello de aureo qui putabatur dente*, Lipsiae, apud eundem, 1597, 1598, in-8.

¹⁰⁶ *Dissertatio de natura naturalium et non naturalium opposita demonstrationi Iudicii Martini Rulandi de aureo dente*, Ibid., 1596, in-8.

¹⁰⁷ *Demonstratio iudicii de dente aureo pueri Silesii adversus responsionem M. Ioh. Ingolstetteri*, Francofurti apud Cornelium Scritonium, 1597, in-8. The text is dated at the end (p. 155) at Ratisbon, November, 1596. The dedication is dated Jan. 1, 1596 (i.e., 1597).

¹⁰⁸ Gottlieb Stolle, *Anleitung zur*

Historie der medicinischen Gelahrtheit, Jena, 1731, 262-63.

¹⁰⁹ *Demonstratio* (1597), A 2 verso - A 3 recto: "Historia perhibebatur tandem dubia fallax multis dentem hunc aureum duntaxat armatura circumdatum scriptitantibus. Quid igitur veri de re falsitati obnoxia statuendum? . . . At confirmatur adhuc dens vere aureus nuper demum ad me literis perlatis testibus locupletissimis. Investigatio ergo veritatis perficiatur. Quamquam negato etiam aureo dente, hypothetica indagatio utilitatem iucunditatem culturam ingenii conferat . . ."

¹¹⁰ Ingolstetter's first objection to Ruland's original tract was not that the tooth was not genuine, but that he had not adequately defined the terms, nature, natural and non-natural: *Ibid.*, 21.

¹¹¹ *Ibid.*, pp. 23, 25-26, 31, 52, 112.

kowski, who published in 1674 at Danzig A Physical Disquisition on the prodigy of two boys, one with a golden tooth, the other with a gigantic head, seen in Vilna, Lithuania. Although Tytkowski's publications were issued separately and not in the Ephemerides of the Academy of the Curious, they often bore that word in their titles, as in the case of a *Meteorologia curiosa* and a *Philosophia curiosa*, or curious questions and conclusions from the universal philosophy of Aristotle, both of which works were printed at Cracow.¹¹² When the report spread that as a result of an attack of fever the gold tooth had turned white, Tytkowski examined it himself and found that it was really a tooth of bone, and that the physicians, surgeons and goldsmiths of Vilna had been deceived by a plate of gold into thinking that it was solid gold.¹¹³

Matthias Tilingius, whose works on plants are mentioned in the chapter on Botany, also wrote on laudanum in 1671, and mineral cinnabar or natural minium in 1681. In 1674 he discussed fermentation or the intestine motion of particles in any body, following Willis and Moebius,¹¹⁴ and an Introduction to Chemiatic Practice,¹¹⁵ of over a thousand pages, with a chart of liquid, solid and half-way drugs and of *non entia*. After a preface of 42 pages on the dignity and nobility of chemistry, and a preliminary discourse of 80 pages on chemistry in general, instruments, operations, and chemical species in general, came a section of 60 pages on universal medicines or panaceas, divided into three parts on the philosophers' stone, potable gold, and others. Next came nearly 300 pages on universal evacuants, comforters and anodynes, subdivided into digestives, vomitives, purgatives, diuretics, diaphoretics, odorifics, mitigatives, sleeping draughts, and sedatives. The remaining over 500 pages were occupied by specifics for every part of the body, ending with 26 cosmetics, and including such doses as spirit of human brain, spirit of human after-birth, goose dung, and salt of toads and frogs. It may be recalled that Mersenne had been in-

¹¹² For the Latin titles, LR 7. *Acta eruditorum* I (1682), 148-51, selected 18 memorabilia in natural history from part II on Physica of the *Philosophia curiosa*, 1680.

¹¹³ JS IX (1681), 351-52.

¹¹⁴ See BM printed catalogue for the Latin titles etc. of the three works thus far mentioned.

¹¹⁵ *Prodromus praxeos chimiaticae ... mysteriorum ... secretissimorum*, Rintelii, 1674, in-8. BM 1034.b.16.

terested in transmuting mercury into silver by use of an oil made from the dung of a goose which had been fed lead filings.

The report made in 1670–1671 and printed in 1675 by Samuel Cottureau Du Clos of the results of the examination of the mineral waters of France by members of the Académie des Sciences provides a frank statement of the limited chemical knowledge then.¹¹⁶ It states that few solid salts are known, and that there may be many which have no relation to common salt, nitre, alum and vitriol, which are the four familiar varieties. Common salt is a mixture of two different parts. One condenses and crystallizes after the evaporation of a portion of the water in which it is dissolved, and is the more sulphuric of the two. The other part does not crystallize and condenses only when the water in which it is dissolved totally evaporates. Vitriol has two similar parts, and true nitrates are apparently composed of two different saline constituents, one more sulphuric than the other. The salts condensed after the evaporation of the mineral waters which were examined reduced to two groups: some to the nitre of the ancients, which is a sulphurous mineral salt resembling the alkali of plants; others to one or the other part of common salt or to their mixture together. No alum or vitriol was found in any of the French mineral waters.

It was harder to distinguish the kinds of earth found in these waters than it had been to tell the salts. Most of them were white and subtle. Some formed films on the surface of the water, others appeared in flakes, mucilage or clots or *pailletes*. Others resembled tiny grains of sand or a fine brown powder. Some dissolved in vinegar; some did not. Some changed color, when exposed to fire; others didn't. Some calcined; others vitrified. There was no sulphur or bitumen in the waters sent to the Academy for examination.

The Academy grouped them in eight classes: 1) those that were hot and contained salt related to common salt; 2) those that were hot and contained salt like the nitre of the ancients; 3) those that were lukewarm and insipid; 4) those that were lukewarm and sour (*aigrettes*) and vinous and which contained some true nitre. The other four were all cold and 5) insipid, some with salt like common salt, others with no salt; 6) tasting of iron or with a sharp taste;

¹¹⁶ *Observations sur les eaux minerales*, Paris, 1675. BN S.19861.

7) with a sour or vinous taste, containing common salt; 8) sour or vinous with true nitre. They found no hot waters that were sour, and no cold and insipid waters which were nitrous. They tested their reaction to common water in which mercury sublimate had been dissolved, and to that in which vitriol had been dissolved, and how they altered the color of common water charged with tincture of sunflower (dyer's croton). But when they came to examine the waters from Spa in Belgium, they found that they did not fit into any of these eight classes. The residue from seven pounds, six ounces, and six grains of Spa water weighed only forty-eight grains, of which three-quarters were a light fine russet-colored earth, the other quarter a sulphurous salt. This latter made mercury sublimate precipitate in a white color, as the salt of the Marne does and as do the volatile salts of plants and animals, and not to red or orange, as do true nitres and *alchali*.

Du Clos thought that the chief effect of the great quantities of mineral water which doctors made their patients drink in the effort to cure maladies which did not yield to ordinary remedies, was to wash out the bowels. But this effect was considerable, because most chronic diseases came from obstruction of the bowels.

Besides salts and earth, mineral waters probably contained other non-solid ingredients which were so subtle and volatile that they left no trace. The sour or vinous taste disappeared upon exposure to the air or heat and was probably from some very volatile spirituous matter which it would be good to know. Also the two kinds of salts might sub-divide into many species which had their specific properties.

Mineral waters originate either from rainfall or the percolation of the waters of rivers, lakes or sea. Du Clos still speaks of a mid-region of air as that where clouds form and whence rain falls. But the causes of the heat of certain mineral waters are little known. Experience shows that air is essential to combustion, so that hot springs cannot be attributed to subterranean fires, and are more likely due to hot exhalations. But Du Clos does not explain whence their heat comes. Hot springs do not burn the tongue as ordinary hot water does, and are hotter at their sources by night than by day—the fresh night air preventing dissipation of their vapors.

When exposed to the air far from their sources, they do not cool so fast as ordinary hot water, yet they do not boil any sooner than ordinary cold water does. The reason for this is that foreign substances in them must be driven out by the heat before they can begin to boil.

Hot springs probably come from deep in the earth. It is not easy to learn the qualities of the vapors or exhalations that are mingled with mineral waters. They are not necessarily bituminous or sulphurous, though some are, as at Aix-la-Chapelle there are sulphur springs. In a burning fountain of Dauphiné, flame issues with the water. Ordinary waters, too, differ in their ingredients, and the more subtle, less heavy, and less mixed are deemed the best.

More efficacious than natural mineral waters, according to J. H. Molitor, doctor of philosophy and of medicine, were those artificial baths which he prepared from the seven metals with due regard to the constellations and planetary hours.¹¹⁷ Other ingredients than the seven metals employed by him were alum, antimony, arsenic (corrected), nitre, salt, sulphur and vitriol. If such simples were joined in a perfect union and not merely mixed together, the compound would retain their virtues. Answering the question why such baths were an infallible cure for philters, he attributed to them not only a sulphuric virtue which attenuated the cold, crass humor of melancholy by heating, but also some specific property. "For they act miraculously in the said disease," as in a case on February 3, 1675 of a theological student who had been so affected by an enormous philter that many despaired of his life.¹¹⁸ Molitor also stated that gonorrhoea was not always the result of venereal contact but might be brought on by intense lust.

William Sympson or Simpson, who offered "a new hypothesis" of acid and sulphur in place of the acid and alkali of Tachenius, found the causes of hot baths and "spaws" in the fermentation of mineral juices produced by acids and sulphurs. To these he also traced damp in mines, earthquakes, winds, meteors, snow, hail,

¹¹⁷ Joan. Horatii Molitoris . . . *De thermis artificialibus septem mineralium planetarum*, Jena, 1676, in-12, 72 pp., followed by an Index of 8 unnumbered pages, and 150 *Aphorismi*

medici which occupy about 20 more unnumbered pages. BM 1171.a.3 (2). JS VI (1678), 409-10.

¹¹⁸ *De thermis*, p. 58.

heat, light, and all fires; the venom of animals, colors, the tastes and odors and medical properties of vegetables, and propagation by seeds. Moreover,

all coagulations, congelations, condensations, salifications, petrifications are primarily ascribable to acids which combine with sulphurous parts into a tertium quid or neutral result.

In another book two years later Simpson tried to tie up his hypothesis with the corpuscular philosophy and the Helmontian production of all from water by means of seeds and ferments, and set forth seven complications. The first was with ethereal matter. The second was a gentle reaction of acid and sulphur which resulted in generation, if exerted from the center, and in corruption, if from the outer surface. Third were stronger collisions of the particles, as in ripening plants or chemical effervescence. Fourth came the most violent collisions of all, producing fire. Fifth was transmission from their own into other bodies. Sixth were "colliqueative fires," caustic, corrosive and putrefactive. Last was fixation in an intimate and radical union, such as the elixir, alkahest, or Mercury of the Philosophers.¹¹⁹

Most chemists knew how to vegetate gold and silver, but few knew the secret of vegetating iron and copper, until a Greek chemist showed how to do it at Paris in 1676 with pebble water. Two minutes after the metals, prepared for this operation by being treated with nitric acid (*aqua fortis*), had been put in the pebble water, one saw a sort of tree form in the water. If taken out of the liquid, the tree kept its figure for some time, but if left in too long, the liquid would thicken and become opaque. Also there was nothing better for the stone than this same pebble water.¹²⁰

The mercury-alone doctrine, which I set forth for the fourteenth century in my third volume, was revived by an anonymous Pan-

¹¹⁹ W. Simpson, *Zymologia chymica or a Philosophical Discourse of Fermentation, from a new hypothesis of Acidum and Sulphur*, 1675, in-8. W. Simpson, *Philosophical Dialogues concerning the Principles of Natural Bodies*, London, 1677. Reviewed PT

X, 410-16; XII, 883-86. Simpson had earlier published *Hydrologia chymica: or the Chymical Anatomy of the Scarbrough and other Spaws in Yorkshire*, London, 1669, in-8.

¹²⁰ JS, V, 296-97.

taleon (the pseudonym of Franz Cassmann) in works published at Nürnberg in 1676.¹²¹ After reviewing the alchemical tenets of Geber, Raymond Lull, Arnald of Villanova, Bernard of Treves, and Paracelsus, he decided that the best menstruum was mercury purged of earth and phlegm. Of this there were two varieties, dry and wet. Once possessed of the latter dissolvent, one could multiply metals ad infinitum in the sight of all without fear that one's secret would be discovered.¹²² True chemical science did not require all the recent frills and spirits, nor all the elaborate and clumsy apparatus. It could do the whole business in one simple distillation, because it followed nature and worked with its competent occult instruments.¹²³

A mysterious approach and secret method might characterize scientific discovery as well as alchemical quackery. This is well illustrated in the case of the isolation of phosphorus, which is widely distributed in nature but never found free. A phosphorescent substance, called Bologna stone (barium sulphide), had been known since the beginning of the century. On April 2, 1676, in Berlin before the Margrave of Brandenburg and all his court, at nine o'clock in the evening, Johann Daniel Krafft, 'recently returned from Batavia, put on exhibition the following experiment or bit of natural magic. He opened a little vial which had been hermetically sealed, took from it a particle of what he called perpetual fire, and placed it on a sheet of blue paper. When all the candles had been extinguished, the particle shone like a glowworm on a summer evening. When he rubbed his fingers with it, they too became all resplendent. It reminded those present of de Thou's story of the stone presented to Henri II of France at Bologna by a stranger from the Indies.¹²⁴ Actually Krafft is said to have bought the secret from Brand of Hamburg, who had isolated phosphorus in 1669.¹²⁵

¹²¹ *Tumulus Hermetis apertus, and Examen alchymisticum quo adeptus a sophista et verus philosophus ab impostore dignoscuntur*, and *Bifolium metallicum*; BM 1034.f.27 (1.) (2.) (3.). But I have listed them in the order of their composition.

¹²² JS VI, 237-38.

¹²³ *Bifolium metallicum*, Nürnberg, 1676, p. 51.

¹²⁴ JS VI (1678), 245-47, reviewing *De phosphoris quatuor, Observatio Jo. Elsholtz 1676. Accedit eiusdem de phosphoro liquido observatio 1677*, Berolini.

¹²⁵ EB article "Phosphorus."

Krafft went on to exhibit his find in liquid and dry form at Hanover, of which Leibniz sent an account to the *Journal des Sçavans*,¹²⁶ and in England, where it made a great sensation. It seemed that at last a satisfactory explanation had been found for the so-called inextinguishable or perpetual lamps found in ancient sepulchers.¹²⁷

In the same year at Wittenberg Georg Caspar Kirchmaier published a brief announcement of the discovery of phosphorus under the name *Noctiluca constants*¹²⁸ and named Kunckel (or, Kunkel)¹²⁹ as its inventor. He prefaced this by a chapter on the divine nature and origin of light and fires, and a second chapter on perennial lamps, compiled from previous writers.

Johann Kunkel (c. 1612–1702), was successively employed by the dukes of Lauenburg, elector of Saxony, then, after an interval of 1677–1679, by the elector of Brandenburg, and, after 1689, by the King of Sweden, where he was ennobled in 1693 as von Loevenstern.¹³⁰ In 1676 he published in German *Nützliche Observationes* which were issued in Latin translation in 1678. In these three treatises he maintained that the philosophers' stone was a real specific substance and gave precise instructions for making gold which began by alternating layers of powdered *sal gemmae* and very thin silver plate in an earthen vessel.¹³¹ He asserted that the Elector August of Saxony in about the year 1590 (August died in 1586) had turned mercury into gold with a tincture, but as it took 1604 parts of mercury to make one of gold, the operation would not seem to have been very profitable. For himself Kunkel claimed the ability to extract the mercury from any metal in six

¹²⁶ JS V (1677), 237–39.

¹²⁷ JS VI (1678), 248.

¹²⁸ *Noctiluca constans et per vices fulgurans, diutissime quaesita, nunc reperta; dissertatione brevi praevia de luce igne ac perennibus lucernis*, Wittenberg, 1676, in-4, 24 unnumbered pages. BM 1033.h.11 (16.).

¹²⁹ EB, article on Phosphorus, on the other hand, states that in 1678 Kunckel succeeded in obtaining phosphorus, as Brand had done, by evaporating

urine and distilling the residue with sand, and that Boyle did the same in 1680. The year 1678 was that of the publication of Kunkel's *Oeffentliche Zuschrift von dem phosphoro mirabili*.

¹³⁰ H. Kopp, *Die Alchemie*, 1886, I, 58–65; Hoefer, II (1843), 199 *et seq.* At pp. 201–206 Hoefer gives Kunkel's account of the discovery of phosphorus.

¹³¹ For a brief resumé of the rest of the process: JS VI (1678), 436–37.

hours' time.¹³² Thus the discovery of phosphorus would seem to have encouraged rather than detracted from the pursuit of the philosophers' stone. Kunkel composed other works of more practical use such as his *Experimental Glass-Making*,¹³³ but his *Laboratorium chymicum* appeared only after his death, in 1716, and belongs to the next century, when it reached a fourth edition by 1767.¹³⁴

In 1680 Kirchmaier published another dissertation at Wittenberg on phosphorescent substances and the nature of light and fire. The dedication is dated August 20, 1679.¹³⁵ In it he speaks of the varied phenomena of the magic lantern being now supplemented by the pleasing spectacles of philosophic fire and perpetual light. Like Elsholtz, whose *Observation on four phosphorents* had appeared in 1676,¹³⁶ he distinguished from true phosphorus the Bologna stone, emeraldine phosphorus, and the Hermetic phosphorus of Balduin. Kirchmaier repeats Potier's¹³⁷ instructions as to the preparation of the Bologna stone, but adds that he left out one essential. Mentzelius¹³⁸ gave Kirchmaier the key to this, but he does not disclose it in the present dissertation. He asserts that the *phosphorus hermeticus* of Balduin can be duplicated with nitre, sugar or Cretan earth. Kirchmaier states further that true phosphorus was already known in the thirteenth century to Bartholomaeus Anglicus, but the passage which he quotes¹³⁹ hardly justifies his contention. He had already quoted it from a manuscript in his *Noctiluca* of 1676.

Shortly after the death of Christian Adolph Balduin or Baudouin, the *Journal des Sçavans* of February, 1682, attributed to him the

¹³² *Ibid.*, 435-36.

¹³³ *Ars vitraria experimentalis*, Frankfurt and Leipzig, 1679, and again in 1689.

¹³⁴ *Collegium physico-chymicum experimentale oder Laboratorium chymicum*, Hamburg and Leipzig, 1716. Fourth edition at Berlin, 1767. His *The Chymical Touchstone de acido et urinoso sale calido et frigido*, 1684, reviewed in PT XV, 896-914, is, I presume, the same as his *Probierestein de acido et urinoso sale calido et frigido*, which Hoefer dates in 1685. Neither

title appears in the printed BM and BN catalogues.

¹³⁵ *De phosphoris et natura lucis necnon de igne*, in *Dissertationes Chymicae*, 1680-1693: BM 1033.h.20.

¹³⁶ See above, note 124.

¹³⁷ For Pierre Potier see Chapter 26 on Pharmacy.

¹³⁸ Chr. Mentzel, *Lapis bononiensis in obscuro lucens collatus cum phosphoro hermetico Chr. A. Balduini*, 1675, in-12.

¹³⁹ *De proprietatibus rerum*, VIII, 40.

discovery of phosphorus, which was set forth as a secret in obscure terms in his *Aurum aurae*.¹⁴⁰ Balduin also had published *Phosphorus hermeticus* in 1675, but it dealt with a phosphorescent substance and not phosphorus, and *Hermes curiosus sive experimenta physico-chymica nova* in 1680.¹⁴¹ He gave these "new experiments" such fancy titles as Imperial Eagle, Lightning imperial apple, Fiery Vertumnus, Glassy sphere, Artificial Sun in perpetual motion, and Encaustum Hermeticum.¹⁴² Yet he was a member of the German Academy of the Curious and of the English Royal Society.

Actually the *Aurum aurae* deals with the extraction of gold from the air by universal magnetism.¹⁴³ This gold is astral, a celestial matter found in the air especially at the time of the equinoxes, when the air abounds in ethereal and balsamic atoms. A marvelous gourd-like instrument is required, made of porous whalebone. Balduin digresses to speak of a globe of sulphur which he made last year after the model of Otto von Guericke of Magdeburg.¹⁴⁴ Later he alludes to Schott's spagyric index for clocks to tell the time to select Hermetic material.¹⁴⁵ For the time as well as the method of attracting gold from the air is important. Ficino observed the mansions of the moon. In the northern sky an animal outlined by seven stars has a corresponding terrestrial animal of the same nature. There follow instructions as to Mars existing in the house of the sun, a daughter who feeds on the blood of her brothers, each existing in its own house that it may increase, with the sun in the house of Mars. And this young lady is submerged by her sister, dwelling in her own house, by the number of the maternal celestial signature.¹⁴⁶ It is accepted, however, that the heavens influence only by their

¹⁴⁰ JS X (1682), 65: "Dés l'an 1675 il donna dans son livre intitulé *Aurum aurae* la première connaissance de cette admirable matière qu'il appelle un Aymant lumineux." The *Aurum aurae*, however, was printed in 1673 (BM 1036.a.4. (1.)) and twice in 1674 (BM 1034.c.16. (2.) and 1036.a.4. (2.)).

¹⁴¹ Leipzig, 1680: BM 1036.a.45; Col Spec. Coll. B 540.1 B192.

¹⁴² JS X, 66-70.

¹⁴³ *Aurum aurae vi magnetismi universalis attractum per inventorem*

anagrammatizomenum Sic sol duplus abundat in auris (*infra, supra*) *grammatizomenum: Sic* (*infra, supra*) *sol duplus abundat in auris*, 1673, in-12, 82 pp. BM 1036.a.4 (1.). To make the anagram fit the author's name, its h's must be dropped, thus: Cristianus Adolpus Balduinus. No place of publication is indicated.

¹⁴⁴ *Ibid.*, pp. 35, 38, 42.

¹⁴⁵ *Ibid.*, p. 53, citing Schott, *Technica curiosa*, IX, proposition 26.

¹⁴⁶ *Aurum aurae*, pp. 52-54.

light and motion. Concluding chapters are on the potable gold of the air, and the virtues of gold of the air in the three kingdoms, animal, mineral and vegetable.¹⁴⁷

In 1677, under the title, *Golden Venus*, Balduin gave an account of a copper meteorite which had fallen near Haina on May 28 of that year.¹⁴⁸ He had performed eighteen chemical experiments with it, treating it with this and that. He further considered the question whether its fall was miraculous and whether it portended something. He cited historians as to similar occurrences in the past, and discrepant opinions of the erudite. He himself held that it was not a miracle. "I will not deny that it may be a portent, but not one contrary to nature." He hoped that it might be a sign of peace.

Jungken in 1681 spoke of the magnet of Balduin, by which he drew gold or a tincture from the air, as made of nitre. Balduin asserted that this potable gold had marked virtues. Fixed nitre furnishes the material for phosphorus, as Balduin reveals in these words:

When a few years ago I was working at making Alcahest, after the distillation was over I found the chilled glass retort shining within like red-hot iron.

He distilled Alcahest from the fixed nitre, which had extracted gold from the air, in a retort over an intensified fire.¹⁴⁹

In 1677 Albert Otto Faber revived with variations the *aurum potabile* of Anthony in 1610 under James I, and, since he was allowed to address his book to Charles II and to pose as his physician, his book had considerable currency and appeared on the continent in German and Latin versions.¹⁵⁰ Faber distinguished

¹⁴⁷ Caps. ix-xii, pp. 59-82.

¹⁴⁸ *Venus aurea in forma chryso-collae fossilis cum fulmine coelitus delapsa prope Haynam d. 28 Maii, 1677*, Haynac, in-12, 84 pp. BM 8755.a.12.

¹⁴⁹ Joh. H. Jungken, *Chymia experimentalis curiosa*, Francof., 1681, pp. 224-26.

¹⁵⁰ I have used the German *Von dem medicinalischen auro potabili an den grossmächtigen Fürsten Carolum II im Gross-Britannien, Frankreich*

und Irland König Beschirmern des Glaubens. Ein in der Praxi gegründet Erzählung . . . aus dem Englischen ins Hochteutsche übersetzt und ist zu bekommen zu Franckfurt, Amsterdam und Dantzig, 1677. Copy used: BN R.7014. BM 1034.h.24 (3.) is the Latin edition printed at Frankfurt in 1678. On the English edition, Harriet Sampson, "Dr. Faber and his Celebrated Cordial," *Isis*, 34 (1943), 472-98.

three forms of this medicinal gold: one, gum-like and as red as blood; two, dissolved in spirits of wine to give the tincture of gold; three, an ounce of this tincture dissolved in sixteen ounces of another appropriate liquor.¹⁵¹ He argued that a single medicine could cure all diseases.¹⁵² Like Figulus, he listed various cures by it,¹⁵³ and gave his new address in London where it could be procured.¹⁵⁴

In the same year, 1677, appeared the *Genius errans* of Johann Daniel Major, who was, like Balduin, a member of the Academy of the Curious. Of its forty chapters, three quarters dealt with alchemy but in a satirical spirit, especially denying the possibility of potable gold,¹⁵⁵ and particularly the reported extinction of gold in a golden vase by Burrhus or Borri of Milan, famed also for his reputed restoration of the humor of the eye.¹⁵⁶

Major made the good point that in order to progress in any science one should know its past history. But to illustrate his contention he mentioned the "famous machine of the universe which Drebbel presented to King James of England," the "invention of Kerckring," who enveloped dead bodies in beautiful yellow amber, and Digby's drawing all sorts of metals from a red earth procured from Arcueil near Paris.¹⁵⁷

A Short Relation of the life of Cavaliere Giuseppe Francesco Borri¹⁵⁸ which was printed with *La Chiave del Gabinetto* in 1681,¹⁵⁹ states that when the Inquisition in January, 1661, turned its attention

¹⁵¹ German ed. of 1677, p. 5.

¹⁵² *Ibid.*, pp. 15-19.

¹⁵³ *Ibid.*, pp. 6-11. For those in the Appendix, from March 18, 1677 to May 5, 1678, see *Isis*, 34, 494-95.

¹⁵⁴ *Isis*, 34, 495.

¹⁵⁵ *Genius errans sive de abusu in scientiis*, Kiel, 1677: copy used, BN Rés. Z.607; pp. unnumbered, about 280; last signature (Mm 4) v.

¹⁵⁶ *Ibid.*, cap. 32, "partim ad restituendos dissectos hominum oculos per auri candefacti libram . . ."

¹⁵⁷ JS VII (1679), 12-13.

¹⁵⁸ *Breve relazione della vita del Cavagliere Gioseppe Francesco Borri Milanese*, at pp. 333-80 of the volume listed in the following note. More

recent accounts are: Cantù, *Eretici d'Italia*, III (1866), 329-92; G. de Castro, "Un precursore milanese di Cagliostro," *Archivio storico lombardo*, serie III, fasc. iv. (1896), 350-89; Arturo Magnocavallo, "Notizie e documenti inediti intorno all'alchimista Giuseppe Borri", *Ibid.*, xviii (1902), 381-400.

¹⁵⁹ *La Chiave del Gabinetto del Cavaliere G. F. Borri Milanese col favore della quale si vedono varie lettere scientifiche, chimice e curiosissime . . . e molti segreti bellissimi*, Cologne, 1681, in-12. BN Rés. R.2293. BM 1035.a.27. The catalogue states that the imprint is fictitious and that the book was probably printed at Geneva.

to his heretical band in Milan, he fled to Switzerland and Strasburg, where he practiced alchemy and medicine, and performed some marvelous experiments in both, and printed a letter about restoring the eye, "which circulated everywhere." He passed on to Amsterdam, where too he won a reputation for cures. We are told in *La Chiave* that of those who visited his Gabinetto in Amsterdam, some were interested in devils, some in angels, some in genii, some in incubi, some in curing every ill, others in the stars, others in the secrets of divinity, but almost all of them in the philosophers' stone. A Danish knight filled his brain with chimerical creatures which he supposed existed in every element: sylphs, gnomes, undine and salamanders. *La Chiave* itself is concerned with such alchemical matters as the natural and artificial formation of metals, the theory that the seed of gold is the true philosophers' stone, how to congeal mercury, how to reduce it to silver and gold, a marvelous secret of a distilled water to wash one's face with, and various most beautiful secrets.¹⁶⁰

Borri contracted debts at Amsterdam and withdrew secretly to Hamburg, where he was in the good graces of Queen Christina of Sweden before she retired to Rome. Then he went to Denmark, where he gained credit with the then king, who spent huge sums in the quest for the philosophers' stone. After that monarch's death he set out for Turkey and was only a day's journey away in Moravia, when the count of Goldingen arrested him, taking him for one of the recent conspirators in the Empire, and informed the Emperor by letter. Meanwhile the papal nuncio recognized his name and laid claim to his person, which the emperor granted. However, he performed many miracles at Vienna and induced the emperor to make it a condition of his going to Rome that his life be spared.¹⁶¹ En route he changed silver to gold at Venice with a powder of projection. At Rome he abjured his heresy and was condemned to perpetual imprisonment in the dungeons of the Inquisition, but

¹⁶⁰ It also contains at pp. 191-326, a long argument that there are no souls in animals.

¹⁶¹ Magnocavallo, who publishes the nuncio's correspondence from the Vatican archives, finds no mention of

this in it, and attributes the milder sentence of imprisonment to his having dropped his heresy on leaving Italy and devoted himself to medicine and alchemy.

was allowed to attend the French ambassador and, after he had cured him, was moved to the castle of Sant' Angelo, and even allowed to visit patients outside. He performed, according to Corte,¹⁶² prodigious cures in Rome, and was frequently visited by Queen Christina. But she died in 1689; in 1691 the former nuncio at Vienna became pope Innocent XII, and Borri was more strictly confined in the Castle S. Angelo until he died in 1695.¹⁶³

The aforesaid letter on restoring the humor of the eye, already mentioned in our chapter on Academies, was one of two which were sent to Thomas Bartholinus of Denmark.¹⁶⁴ In the other Borri said that breathing was caused by the fermentation of various liquors in the heart which sent vapors to the lungs which attracted the air thither. A very subtle liquor in the brain was the seat of the rational soul, and mental ability depended upon the temperament of this liquor and not on the conformation of the brain. A man smoked tobacco so much that a post mortem found only a little black clot in his head composed of several membranes, and yet his soul had functioned to the last.¹⁶⁵

The Mute Book of Altus had no text but depicted the mysteries of transmutation in a series of fifteen plates.¹⁶⁶

In his treatise on the Universal Tincture or philosophers' stone, Gabriel Clauder, physician to the Duke of Saxony¹⁶⁷ and a member

¹⁶² Bartolomeo Corte, *Notizie storiche intorno a' medici scrittori milanesi* . . . , Milan, 1718, p. 184. Borri's *Istruzione politiche*, Cologne(?), 1681, in-12, 255 pp., to the king of Denmark (BM 1035.a.27 (2.)), do not concern us here.

¹⁶³ Corte says on August 20, at the age of seventy; Magnocavallo, in November, and dates his birth "towards 1625"; Hoefer, II, 330-31, seems mistaken in putting his birth in 1616. See also Gmelin, II (1798), 20.

¹⁶⁴ *Epistolae duae ad Thomam Bartholinum de ortu cerebri et usu medico necnon artificio oculorum humores restituendi*, Hafniae, 1669.

¹⁶⁵ JS II, 540-44, especially 541-42.

¹⁶⁶ *Mutus liber in quo tamen tota*

philosophia Hermetica figuris hieroglyphicis depingitur autore cuius nomen est Altus. In-fol. Rupellae apud Petrum Savouret. Et se trouve à Paris, chez Pierre le Petit & Estienne Michallet: JS V (1677), 242-45.

Ferguson says that the first edition was at La Rochelle in 1677, in-fol. BM 1812.b.25 is La Rochelle(?), 1680(?).

¹⁶⁷ *Gabrielis Clauderi D. medici ducalis Saxonici Academici Curiosi Dissertatio de tinctura universali (vulgo lapis philosophorum dicta) in qua 1 Quid Haec sit, 2 Quod detur in rerum natura, 3 An Christiano sit immediate in hanc inquirere, 4 e qua materia, & 5 quomodo praeparatur, per rationes et variorum experientiam perspicue*

of the Academy of the Curious as to Nature, showed the influence of recent experiments with air by making it the chief constituent in the matter of the universal tincture. The food of life lies hidden in it and many *capita mortua chymica* regain their pristine quality by exposure to it.¹⁶⁸ Despite this up-to-date attitude, Clauder still believes that the influence of the stars contributes a great deal to the transmutation of metals, and he is still given to the antitheses of celestial and sublunar, superiors and inferiors, and the harmony of macrocosm and microcosm. Balsamic times of the year such as the equinox and month of March are of great assistance in collecting the universal matter. In short, the great transmutation of metals cannot be effected without the influence and concourse of the stars or of aerial salt.¹⁶⁹

But salts *per se* are not sufficient to perform the transmutation of metals.¹⁷⁰ There is incomparable balsamic force hidden in gold, but vulgar gold and silver can be used only to a limited extent in maturing the preparation of the universal tincture.¹⁷¹ And May dew is only the remote material of it.¹⁷²

The spirit of the universe is supremely volatile, invisible, penetrable. Volatile salt of air and fixed salt of earth cannot be perfectly united except by fermentation. To obtain the spirit of the universe or water of air, as the sun enters Aries, or in April or May, after there has been no rain for a week or more, but abundant dew-fall after midnight, one should take rich soil at dawn, expose it by means of a burning glass to the rays of the sun for three hours, and drain the spirit of the universe through a linen cloth, which will catch the extraneous moisture, into a glass vessel.¹⁷³

From previous alchemical literature Clauder retains such patter as that God will not concede the tincture to the impious and unworthy, and will take it away from those who abuse it.¹⁷⁴ Also

proponitur; aliaque curiosa & utilia huic analoga adnectuntur, Altenburg, 1678. 6 fols., 272 pp., Index of 12 fols.

¹⁶⁸ *Ibid.*, pp. 196-98, etc. At Venice, Padua and other places in Italy he saw vipers enclosed in a large glass vessel grow on air alone.

¹⁶⁹ *Ibid.*, pp. 71, 210, 220, etc. We heard Balduin speak similarly of the

equinox. See also Locke's *Travels in France*, 1953, p. 60.

¹⁷⁰ *Diss. de tinctura*, pp. 219-20.

¹⁷¹ *Ibid.*, pp. 206, 243.

¹⁷² *Ibid.*, pp. 215-16.

¹⁷³ *Ibid.*, pp. 199-200, 209, 247-49.

¹⁷⁴ *Ibid.*, pp. 66 *et seq.*, 128-30, etc.

that a single grain of it will transmute some ounces, nay pounds, of mercury into true gold.¹⁷⁵ Calling it the work of women and children somewhat sticks in his crop, however.¹⁷⁶

Yet the author of this treatise could appreciate the accomplishments of Harvey and other recent inventions in medicine and anatomy,¹⁷⁷ and digresses to other points of scientific interest. Thus he explains that the reason why the southern *terra incognita* has not been found "to this day by the most industrious merchants and sailors" is that the compass will not work as one approaches the south pole.¹⁷⁸ And he notes that Helmont, Zwölfer, (i.e., Zwelfer) and Helvetius, though patrons of alchemy, dissuaded men from attempting the universal tincture or philosophers' stone.¹⁷⁹

Clauder's book was somewhat misrepresented in a notice in the *Journal des Sçavans*, which misspelled his name as Glauber and quoted him as saying that, if one only followed his directions, it was impossible not to succeed in transmutation.¹⁸⁰

In the same year, 1678, Bohn followed up his letter on alkali and acid of 1675 by arguing that the influx or influence of air on sublunar objects was not material according to either the Peripatetics or the chemists but purely formal.¹⁸¹

In 1679 George Ferdinand Pernauer published at Regensburg a *Marvelous Panacea*, of which the secret was known to him alone and was the quintessence of gold of rare virtue.¹⁸² He published it at the urging of friends for the good of his neighbors and against those who denied the power of gold, but he did so in secret fashion and obscure words. It was a powder whiter than snow in color and soluble in any liquor. He lists its virtues under five heads and

¹⁷⁵ *Ibid.*, pp. 83, 86, 96-97.

¹⁷⁶ *Ibid.*, p. 229.

¹⁷⁷ *Ibid.*, pp. 2-3.

¹⁷⁸ *Ibid.*, p. 164.

¹⁷⁹ *Ibid.*, p. 155. I have not examined Clauder's *Methodus balsemandi corpora humana*, Altenburg, 1679.

¹⁸⁰ JS VII (1679), 132. In 1684 Clauder produced at Jena a Dissertation on native Hungarian cinnabar, "ad normam Acad. Nat. Curiosorum."

¹⁸¹ Johannes Bohnius, *Meditationes*

physico-chymicae de aeris in sublunaria influxu, ubi statuitur hunc neque secundum Peripateticos nec Chymicos materialem sed formalem saltem videri, Lipsiae, 1678, in-8. BM 1033. c.16 (6.). I did not get to examine this.

¹⁸² *Panacea mirabilis corrigendi potissimum vitiosi sanguinis seu quinta essentia auri rarae virtutis . . . a Georgio Ferdinando Pernauero*, Ratisbonae, Literis Dahnsteinerianis, anno 1679, 25 pp. Copy used: BN 8° Td103.70.

distinguishes between the dose for infants and adults. His praise is not of common gold but of that translated into a spiritual essence by our art. Its matter is air, fire, wind, salt, sea water, sulphur, mercury, mountain, valley, "and it is found in ourselves." He cites Arnald of Villanova, and both quotes and cites Raymond Lull.

Johann Christoph Steeb wrote on the elixir of gold and life and a newly discovered genuine preparation of potable gold treated mathematically, hieroglyphically, anagogically and cabalistically. He quoted Greek, Hebrew, and the Arab, Artefius, who lived 1025 years.¹⁸³ Bound with Steeb's book in the British Museum's copy is a universal natural preservative, especially from the pest, dedicated by Dobrzensky to Emperor Leopold I, and an anonymous tract in which the possibility of transmutation is "clearly shown." Steeb also published, in 1679, a Sephirotic Heaven purporting to derive new principles of medicine, chemistry, astronomy, astrology, botany, zoology, anthropology and other sciences from the most ancient Hebraic truth through the gates of intelligence revealed to Moses.¹⁸⁴

In a treatise dedicated from Kiel on February 1, 1679, but perhaps not printed until 1680, Johann Ludwig Hannemann, ordinary professor of natural philosophy there since 1675, defended the chemical resuscitation of plants, declaring that every particle or atom possessed the virtue of reviving the entire compound, and that the least drop of semen contained the complete anatomy of the whole species. He listed experiments to prove that the resuscitation of plants was possible, but they were the reported experiments of others, not his own. To the question, of what use were such experiments, he replied that they supported belief in the resurrection of the dead.¹⁸⁵

G. W. Wedel, in *Physiologia medica*, first printed in 1680,¹⁸⁶

¹⁸³ *Dulcedo de forti sive Elixir solis et vitae, vera per dulcem liquorem auri solutio radicalis atque auri potabilis genuina praeparatio noviter reperta mathematice hieroglyphice anagogice cabalistiche introducta*, Amsterdam, 1679, 53 numbered paragraphs: BM 1033.e.17 (1.). According to LR 553a the work was first published in 1673.

¹⁸⁴ LR 553a for the full Latin title.

¹⁸⁵ *Phoenix botanicus*, Kiel(?), 1680 (?). BM has two copies. Seen, BM 1033.h.11 (19.). In an Epilogue he admits that the contents of the book are mostly borrowed.

¹⁸⁶ I have used the second edition of 1704, like the first at Jena, with a dedication dated September 1, 1679. BM 549.d.27.

would retain the three chemical principles of salt, sulphur and mercury, but regarded as insufficient the more recent hypotheses of acid and alkali, acid and sulphur, or acid and volatile. Particular facts were not to be had from obscure speculation and terminology but from experimental contact. Scheunemann and others had obscured chemistry by their speculative detorsions; others had stressed transmutation too much.

Samuel Cottereau Du Clos, whose *Observations on Mineral Waters* have been considered, in 1677 produced a brief dissertation on the principles of mixed bodies.¹⁸⁷ Such bodies could act upon each other without physical contact by means of a universal spirit which surrounded and penetrated bodies, and through which Nature impressed on them the specific characters of its type ideas, the originals of which Du Clos, like Plato, held existed in the mind of the First Cause.¹⁸⁸ Gmelin tells of a Du Clos, a physician of Paris, but whose Christian name he gives as Dominic, who, after a lifelong search for the philosophers' stone, burned his manuscripts lest they mislead others into such activity.¹⁸⁹

The difficulties of the seventeenth century alchemist or chemist, not merely in attempting the transmutation of metals or the quest for a universal medicine, but as a result of proceeding on the assumption that all metals are composed of mercury and sulphur, or that mercury and sulphur are basic principles, are well illustrated by Jean Le Conte's attempt to obtain the Fire of Venus, which Helmont had so extolled and which was supposed to consist of sulphur elicited from copper and strictly emended by philosophical rite.¹⁹⁰ Le Conte says that he was not the last to attempt it. Polemanus, of most acute genius among moderns, gave some fundamental instructions in his treatise on the mystery of the sulphur of the philosophers. He advised avoiding violent dissolutions and of

¹⁸⁷ *Dissertation sur les principes des mixtes naturels*, faite en l'an 1677, par le Sr Du Clos, Amsterdam, 1680, in-12, 103 pp. Copy used: BN R.13581.

¹⁸⁸ *Ibid.*, pp. 51-52.

¹⁸⁹ *Gesch. d. Chemie*, II, 19.

¹⁹⁰ *Clavis Hermetica seu metallorum mineraliumque legitima solutio, cui ignis Veneris aliaque non spernenda*

remedia absque ambagibus candide elucidata ac nuperrime aperta subnecuntur, Lyons, 1680, 19 pp. BM 1165.c.23 (1.). The tract is dedicated to D'Aquin (or, Daquin), physician to Louis XIV, and to whom we have seen Saint Romain dedicate his treatise on jade in 1679.

gentler corrosives chose the spirit of salt obtained by distillation from the residue left in the bottom of the vessel after the sublimation of sal ammoniac with bloodstone (a kind of red copper ore). This dissolved the copper into a fine green vitriol which he kept distilling until the entire substance of the copper, most subtly volatilized with the spirit, passed through the alembic in the form of a green oil. He separated the corrosive from the copper by spirit of wine in many distillations, lest it solidify again, and then employed spirit of volatilized alzali (alkali?) to elicit the tincture of sulphur. But he did not reveal the method of volatilizing the alzali, so that all le Conte got was a damnable and pernicious vomitive. He did refer the reader to Raymond Lull and Helmont. But if you followed them, you would experience with how great difficulty spirit of wine and many other oleaginous substances come together and unite with alzali, unless some spirit of homogeneous nature intercedes by merely dissolving and not destroying. "There is nothing so arduous in all chemistry."¹⁹¹

Le Conte knew nothing in all nature more subtle than the dry and sulphurous spirit of vitriol. If taken with spirit of wine, it immediately pervaded all parts of the body and mingled so tumultuously with the vital and animal spirits that diseases temporarily dormant, like epilepsy, apoplexy and *hoemicrania*, often burst forth with injury to the patient. But when incorporated with alzali, it was a wonderful medicine, as stated in the preface of the work of Helmont in French translation.¹⁹²

Le Conte says that metallic sulphurs require stronger dissolvents than mineral sulphurs do, because they are more firmly solidified and are combined with their mercury more strictly and compactly. What he has used in preparing Fire of Venus operates only on sulphurs of solar character, and has no action on mercury.¹⁹³ But he still believed that a universal medicine was concealed in metals and minerals.¹⁹⁴

The Curious Experimental Chemistry of Johann Helfrich Jungken first appeared in 1681,¹⁹⁵ then with a different title in 1682,¹⁹⁶ and

¹⁹¹ *Ibid.*, pp. 1-4.

¹⁹² *Ibid.*, pp. 7-9.

¹⁹³ *Ibid.*, pp. 9-10.

¹⁹⁴ *Ibid.*, p. 6.

¹⁹⁵ *Chymia experimentalis curiosa*,

ex principiis mathematicis demonstrata; in qua ex triplici regno remedia generosiora... exhibentur, Francofurti, 1681, in-8. BM 1034.e.20.

¹⁹⁶ *Medicus praesenti seculo accom-*

again, with the original title but much enlarged content, in 1702.¹⁹⁷ The book is to a large extent drawn from other authors such as Helmont, Sylvius, Tackenius, Tentzelius, Volckamer, Ettmüller, Ludovici, Zwelfer, Hoffmann, Wedelius, Cardilucius, Le Mort, Boyle, Lemery, and Barchusen. It observes the division into animal kingdom, vegetables, minerals and metals; then adds another part on medicaments or *methodus medendi*, to which the 1702 edition adds further sections on diseases of children and experiments concerned with the principles of natural phenomena.

The chapter on human blood¹⁹⁸ teaches how to resolve it into its constituents. Boyle in the *Sceptical Chymist* tells of getting six ounces of phlegm out of seven of blood, and he and Helmont extol the use of its volatile salt in epilepsy, asthma, apoplexy and other obstinate diseases. A prescription for epilepsy is given in which it is one of eight ingredients, and presently a similar prescription for arthma.¹⁹⁹ Its foetid oil, however, is rarely used because its stink excites headache, and it is hostile to the spirits and abominable to the stomach. But oily volatile salt of blood seems to have been the basis of Burggrav's lamp of life and death. As for inextinguishable or perpetual lamps, a Swiss from Berne named du Praz told Jungken that as a young soldier he found such a glass vessel in an old tomb near Grenoble, and that it had continued to burn for some months afterwards, until it slipped from the grasp of a monk who was handling it carelessly and broke to pieces.²⁰⁰

The twelve chapters of the section on vegetation in the edition of 1681 are reduced to eleven in 1682 and 1702, omitting fruit and considering spices, roots, the trunk or tree, leaves and herbs, flowers, seeds, gums, wine, vinegar, tartar, and such juices as opium.

In the section on metals we are told that John de Vigo either invented mercury precipitate or an improved way of precipitation.

modandus, per veram philosophiam Spagiricam rerum naturalium veris fundamentis exornandus, et faciliiori omnis generis morbos curandi methodo illustrandus . . . , Francofurti, 1682, in-8, 841 pp. BN 8° Te¹³¹.137. BM 1034.e.21.

¹⁹⁷ *Editio prioribus longe auctior*, Francofurti, 1702, in-4, 830 pp. BN 4° Te¹³¹.136. BM 1034.h.9. A distinct

chapter on phosphorus first appears in this edition at pp. 103-108; but it was mentioned in the 1681 edition in the chapter, 'Anatomia nitri,' at pp. 224-26.

¹⁹⁸ Ed. of 1682, p. 74 *et seq.*; ed. of 1702, p. 50 *et seq.*

¹⁹⁹ Such prescriptions abound in the work.

²⁰⁰ Ed. of 1682, p. 88; (1702), p. 59.

Jungken does not think much of the laborious and tedious method employed by Elias Johann Hessling in his *Azoth*, but nevertheless repeats it. Rohtmalers's Panacea was a combination of mercury and lead, but when he tried to cure a general who was stopping at Worms of gout with it, he was rewarded with a cudgeling. "Finally, affected by the noxious fumes of mercury, he died last year (1680?) at Hanover in the prime of life."²⁰¹ When mercury has been resolved into the tiniest atoms by a violent fire, it ought to be chilled and coagulated again. This was the discovery of Langelott²⁰² who thereby restored mercury of antimony from the number of non-entities,

for ordinary mercury, however, obtaining no prerogative, since in all metallic and mineral nature it is one and the same, differing only in the accident of less or greater purity.

Tin differs from lead only in purity, and in process of time easily becomes silver, as is shown by reducing tin with arsenic by burning to slag and then by art converting a portion of it into pure silver. Sigismund Wan of Vogtland practiced this art of separation with such profit, that in 1464 he built a most splendid hospital there, where his epitaph can still be seen.²⁰³

Nothing is more surprising than the absurdities which many have cherished as to the true material of a universal medicine. For when they saw that the body of gold was, so to speak, locked up with the firmest bolts, they rushed to other most inept substances. Of whom those who thought it could be got from nitre were not the worst. Still, they made a great mistake, for while its spirit with the aid of *creta* produces a shining substance, yet it is far from being that star of the east which led the Magi to the cradle of the boy king.²⁰⁴

Very few persons have succeeded in making potable gold. Fictitious tinctures there have been *ad nauseam*, but all were impostures. No true tincture can be made except from the foundation of the universal medicine extracted in a legitimate way from the

²⁰¹ Ed. of 1682, pp. 352-64; (1702), pp. 265-72.

²⁰² "Hoc est inventum Cl. Langelotti": ed. 1682, p. 413; (1702), p. 311. But Langelott's Christian name was

Joel, and Lancilotti's Carlo. Perhaps "Cl." stands for Clarissimi.

²⁰³ V, 4; ed. of 1682, p. 421.

²⁰⁴ *Ibid.*, p. 443.

sulphur of gold separated from its mercurial part.²⁰⁵ Jungken merely mentions sixteen experiments for it in the 1682 edition²⁰⁶ but adds them at length from Johann Tilemann and Joel Langelott in the 1702 edition.²⁰⁷

In going over Jungken's work again in the original edition of 1681, where there are many passages in German, I noted a passage on how to make artificial gems, five pages of panaceas, and that the final medical section, which is longer than the other five put together, closes with astrological observations.²⁰⁸

The Marrow of Chemistry by Giovanni Francesco Vigani, an Italian who came to England and was on good terms with Sir Isaac Newton until he offended him by telling a loose story concerning a nun, is a rambling and gossipy little book, but clearly written, frank and unpretentious. It found many readers, as there were editions at Danzig in 1682,²⁰⁹ London in 1683²¹⁰ and in 1684 or 1685, and Leyden in 1693.²¹¹ Vigani states that he will record only those chemical operations which he has invented or thrown light upon or performed by an easier method, but on the very next page tells twice what Boyle did. He also mentions Willis's tincture of sulphur, Sylvius's oily volatile alkali, Algarot's powder, and the blessed water of Ruland. He tells of those in Germany who boast that they can change alcohol to a white powder (he has never seen it done), of what he saw in an apothecary shop in Parma, and of a cure in Sicily. But he also tells of making last winter artificial roses which deceived the shrewdest observers, of his Regulus of antimony, how to distill amber. His green precipitate of mercury is made in a jiffy and is a sure cure for gonorrhoea, but he keeps it as the greatest secret. About as close as he comes to transmutation is in his closing statement that he has seen whitened copper no whit different from silver except that it would not withstand cupellation.

²⁰⁵ Ed. of 1682, p. 446; (1702), p. 331.

²⁰⁶ Where the section on metals ends at p. 448.

²⁰⁷ And at pp. 347-67 adds other processes from Clauder and Le Fevre.

²⁰⁸ Ed. of 1681, pp. 289, 414-18, 422, "Sectio VI Medicamentorum sin-

gularium formulas continet," 890-96, "Observationes astrologicae."

²⁰⁹ *Medulla chymie*, BM 1165.c.25 (1.). I have used this edition.

²¹⁰ BM 1033.d.28.

²¹¹ BM 10333.e.3 (4.). There was also an edition of 1718: BM 1034.f.15. (1.2).

There were some additions in the London edition. The review of it in the *Journal des Sçavans* noted an aromatic salt which made Rhine wine taste and smell like Spanish wine—but why should anyone wish to?—the reduction of oil of amber to a volatile salt, and the reproduction of amber from its *caput mortuum*. The review commended Vigani for trying to explain the causes of these chemical phenomena.²¹²

Weidenfeld in 1684 tried to counteract the obscurity of hermetic writings by making public property of his own researches concerning the spirit of wine, in which the whole secret of the art was centered.²¹³ Although he called the spirit of wine Lullian, his inspiration presumably went back to the quintessence of John of Rupescissa.²¹⁴ He had sought in vain for the alcahest in the writings of Paracelsus. He dedicated his work to Boyle, whom he admired for writing plainly and clearly, whom he went to England to see, and who received him graciously. His book is a collection of menstrua, first vegetable, then mineral, divided into simples and compounds, and taken from various earlier writers.

Robert Plot (1640–1697), who has been mentioned in previous chapters, held the first chair in chemistry to be established at the University of Oxford. No manuscript of his chemical lectures there appears to have survived,²¹⁵ and they were not printed. But a collection of his papers is preserved in a manuscript at the British Museum, and these are largely alchemical.²¹⁶ About 1677 he formed a partnership with two other men to make and sell chemical remedies, and later we find him trying to sell or interest capital in a great secret which he claimed to have discovered.²¹⁷

²¹² JS XIII, 129–31.

²¹³ J. Seger von Weidenfeld, *De secretis adeptorum sive de usu spiritus vini Lulliani*, London, 1684, in-4, 602 pp. BM 1035.a.31. JS XIII, 273–74.

²¹⁴ T III, 355–65.

²¹⁵ Rawlinson MS D.888 in the Bodleian merely gives the title, "Prælectiones chymicae in schola naturalis historiae Oxon. habitae," and not the text, as R. T. Gunther, *Early Science in Oxford*, XII (1939), 355, stated.

See F. Sherwood Taylor, "Alchemical Papers of Dr. Robert Plot," *Ambix*, IV (1949), 67–76, for this and the following data in this paragraph.

²¹⁶ Sloane 3646. Taylor gives a table of contents: *Ambix*, IV, 68–69.

²¹⁷ Taylor points out that numerous licenses in the Patent Rolls of the fifteenth century show that it had long been customary to form partnerships to search after or exploit alchemical secrets.

The problem of the lamps supposed to have been found still burning in ancient tombs was the subject of a paper read before the Philosophical Society of Oxford on May 7, 1684 by Robert Plot and printed in *Philosophical Transactions*.²¹⁸ The testimony as to such finds of ancient authors like Pliny, Plutarch and Augustine, or recent writers such as Vives, Porta, Liceto and Panciroli, was for Plot almost overwhelming. One difficulty was to find a lamp-wick that would not be consumed through the centuries. Objections had been raised to one of asbestos, and gold which is not consumed by fire had been suggested as the material. Plot had tried an iron wire but it had not worked well. There was less difficulty as to the supply of fuel, for bituminous springs were not unknown even in England. The lamps in ancient tombs, however, were usually extinguished when the least breath of outer air was admitted, while bitumen would not be. The lamp in the temple of Venus, of which Augustine wrote, was, however, always exposed to open weather. But the bluish flames that spontaneously sprang up in deep coal mines, when the supply of air became scarce, might be the solution. There was, however, the further problem of how to get the fuel into the lamp and keep the latter perpetually supplied with it. Perhaps such lamps did not burn or shine all the time in the tomb but were only enkindled as air was admitted, in which case the use of phosphorus might be the explanation, and their sudden extinction due to carelessness on the part of the workmen.

In 1685 Andreas Cassius the Younger published at Hamburg a work in twelve chapters on gold as the extreme and most perfect work of nature and chief star among terrestrials, illustrated by nobler experiments.²¹⁹ He treated it from the metallurgical, chemical and medical standpoints, and as the material of the philosophers' stone. Although he had some knowledge of mines, he still held that metals were composed of mercury and sulphur, and stated that specific differences between them depended solely on the cooking of mercury, a more or less varied matrix, and the purity of sul-

²¹⁸ PT XIV, 806-11.

²¹⁹ *De extremo illo et perfectissimo naturae opificio ac principe terraenorum sidere auro. De admiranda eius natura generatione affectionibus ef-*

fectis atque ad operationes artis habitudine. Cogitata nobilioribus experimentis illustrata. Hamburgi, sumptibus Georgii Wolffii, anno 1685, in-8, 152 pp. Col B500 C273. BN R.30761.

phur.²²⁰ At their head he put gold which was masculine, then feminine silver. Copper, tin, lead and iron were then listed as four perfect mixed minerals, while antimony, bismuth, zinc, marcasite, magnesia and cobalt were imperfect mineral mixtures. Under *menstrua*, sulphur, arsenic, realgar, cinnabar and quicksilver were more natural; and vitriol, alum, borax and sal ammoniac, less natural. Of two groups of *amphibia*, pearls, shellfish and all *testacea* were zoo-mineral, while amber, coral and petrified wood were phyto-mineral.²²¹ Cassius had a theory that the waters of the ocean moved from south to north, entered the earth at the north pole and came out again at the south pole, in a circulation analogous to that of the blood in man. As the waters moved north on the earth's surface, their salty particles received impressions from the sun and planets which produced metals and minerals during their passage through the earth's interior, where these were cooked by subterranean heat.²²²

In 1686 appeared thirteen dissertations in dialogue form on fire by a Jesuit, Paolo Casati of Piacenza, dedicated to Cosimo II, Grand-Duke of Tuscany.²²³ They suggest how little progress had been made in the direction of the later chemical elements. Casati says that some deny that fire is an element but explains the notions of elements and qualities and why they are four. Turning to the principia of the chemists, he remarks that bodies seem to consist of fixed parts, humor and spirit. The first of these three is identified with salt, the last with sulphur, while the humor which constitutes a midway bond between the other two is mercury. But to sulphur chemists attribute a conglutinating force, by its viscosity tempering the dryness of salt and liquidity of mercury, by its soft fluidity tempering the density of salt and liquidity of mercury, by its sweetness, the bitterness of salt and acidity of mercury. But this goes back to the *Tyrocinium* of Beguin early in the century. However, "the physicist investigating the first elements of bodies dissolves

²²⁰ *Ibid.*, p. 56: "Differentia vel specificatio metallicorum generum e sole saltem mercurii coctione pro varietate matricis meliori minorive sulphurisque puritate fluat."

²²¹ *Ibid.*, pp. 66-67. The text reads,

"Sal unus aurum masculinum," but *sal* may be a misprint for *sol*.

²²² *Ibid.*, p. 57.

²²³ *De igne dissertationes physicae* . . . , Venice, 1686, in-4, 392 pp. BN R.3559.

these principles of the chemists into simpler natures." It will not do to identify salt with earth, mercury with water, and sulphur with fire. Some regard mercury as composed of air and water, and sulphur as a compound of fire and water. Casati feels that a two-fold spirit is called for, one very hot or fire, the other less hot or air. He dares not identify chilling spirits with fire, although he grants that it is open to question whether they are not watery or terrestrial, rather than aerial.²²⁴ Backward as Casati's book may seem, it was to be republished at Frankfurt and Leipzig in 1688, and at Parma in 1694.²²⁵ He had written against the existence of a vacuum back in 1649, and we have seen Boyle catch him in the act of passing off the assertion of another as his own experiment in a book of 1658.

Magic was manifest in the title of a work by the Silesian alchemist, A. V. Franckenberg (1593-1652) which was not printed until thirty-six years after his death.²²⁶

In the academy of experimental philosophy of archdeacon Marsilius, Domenico Guglielmini, who was inspector of canals and professor of mathematics and hydrometry at Bologna until 1698, tried to explain the crystals formed by salts, nitre coalescing into hexagonal prisms, vitriol and tartar into parallelepipeds, rock alum in octahedrons, and common salt in cubes.²²⁷

The conservative, not to say, backward, character of alchemical writings is well illustrated by *The Revealer of the Great Secret of the Philosophers*, issued at Geneva in 1688.²²⁸ This work still affirms that all metals are composed of sulphur and mercury, but not, of course, common mercury. Nor will ordinary fire do; one must use the occult fire of the philosophers. Nine kinds of sublimation are distinguished, and seven maxims of the philosophers must be observed. Finally there are published, presumably for the

²²⁴ *Ibid.*, pp. 22-25, 30-32.

²²⁵ In 1684 Casati had published eight books of *Mechanics*, of which the first dealt with the center of gravity, second with the motion of machines, and the others with the balance, lever, clock-work, pulleys, wedge and water-screw. *Acta eruditorum*, IV (1685), 247-52. See also our volume VII, p. 601.

²²⁶ *Gemma magica oder magisches Edelstein*, Amsterdam, 1688, in-8, 159 pp.

²²⁷ *Riflessioni filosofiche*, Bologna, 1688, in-4. Reviewed in *Acta eruditorum*, VIII (1689), 235-36.

²²⁸ *Magni philosophorum arcani revelator quo Hermetis discipuli . . . omnia ad suum laborem necessaria clarissime explicata invenient*, in-12.

first time, two alchemical letters of Antonius de Abbatia, taken it may be from the very manuscript at Geneva of the sixteenth century which was noted in our fourth volume²²⁰ and which contains for the most part works attributed to authors of the thirteenth and fourteenth centuries. Perhaps the most modern feature of the book is that it purports to explain everything most clearly. That many educated persons were still interested in such professed disclosures is seen by the fact that the book's contents were summarized in the *Journal des Sçavans*.²³⁰

In 1689 at Wittenberg was published the dissertation of S. B. Manitius on the Chemical Analysis of Ants.²³¹ After five theses on definition and microscopic observations, differences in ants, their generation, internal principles, and use in general, the sixth dealt with medicaments prepared from ants. These comprised various Magnanimous Waters, including those of Schröder and Jungken, Herculean Water of Kuhnrad (Khunrath?), arthritic water of Hoffmann, compound essence of amber, spirit of ants from the Danish royal apothecary shop, and spirit from the nymphs of ants. Urinous spirit is made of ants which are cleaned and distilled in a retort, increasing the fire gradually. Mixed with spirit of salt, it produces fumes and effervesces somewhat with spirit of vitriol. But it unites in friendly fashion with sal ammoniac, with its own salt prepared from the *caput mortuum*, with salt of tartar, oil of the same, and spirit of earthworms. Ettmuller and others class it under acid spirits, but Manitius thinks it more urinous than acid because it unites more easily with urinous things than with acids. He has not observed it boil with quicklime, as they claim. It does extract rust from iron but after two days, not promptly, as spirit of acid does. And spirit of sal ammoniac does that too. It is true that mixed with sal ammoniac it does not give off a urinous odor notably, but that may be because of its oily ingredients, since the same is true of spirit of earthworms. However, once he observed it effervesce with salt of tartar, so sometimes it may have acid constituents.

²²⁰ T IV, 333; see also 356. The MS is Geneva 82 (151).

²³⁰ JS XVI, 369-72.

²³¹ *Chymica formicarum analysis*, Witebergae, 1689: BM 1033.h.20 (12). The pages are unnumbered except for signatures.

After the seventh thesis on volatile salt of ants, the eighth treats of their external use in liniment, medicated baths, febrifuges, medicaments for ear and eye, aphrodisiacs, depilatories, cosmetics, and economic use. The final thesis (8 bis) includes incense of ants and how to get rid of them. Manitiuss lists various methods such as throwing the wings of a bat on the anthill, or using the heart of a bat or owl or hoopoe, or the gall of a lynx mixed with olive oil. He has not been able to test all these, but they seem probable, when we remember that snakes shun even the shade of the ash tree and, if a circle is drawn round them made partly of ash wood and partly of fire, will go through the fire rather than pass the ash wood, as Diemerbroeck assures us in his pest tract. So the smoke from burnt hoopoe's wings routs frogs, and contrariwise catnip allures felines from afar.

In 1689 appeared an Exercise by Friedrich Hoffmann the Younger on the insufficiency of acid and viscid as causes of all diseases and the insufficiency of fluid alkali for curing them.²⁹² The hypothesis which he opposed was that all bodies consisted of solid and fluid, that in a state of health the fluid part should be kept in continual motion, that acid and viscid impeded it, while volatile fluid-forming alkaline medicaments kept it in motion, especially drinking hot tea. He recognized that acidity was the cause of many diseases and that drugs containing sal alkali were remedial. Drinking hot tea was regarded as a great remedy for haemorrhage, but he thought that this was due to the heat more than the tea, although it contained a mild salt of terrestrial sulphur. But hot water alone was very effective, and a decoction of hartshorn and bezoardic herbs drunk hot was a great help in the Hungarian disease and malignant fever. But too great fluidity of the blood was harmful, and Hoffman was opposed to excessive use of volatile salts and excessive tea-drinking. Moreover, disease was not always from acid and viscid but could also arise from volatile alkali. Many ailments such as dry scab, small pox, scurvy, arthritis, diarrhoea, dysentery, pest

²⁹² *Exercitatio acroamatica de acidit et viscidit pro stabiliendis omnium morborum causis et alcali fluidi pro*

iusdem debellandis insufficientia, 1689, 72 pp. BM 1034.e.24 (1.).

and malignant fever, were produced by sharp alkali salt, while acid food and medicine were not to be extirpated from medical practice. Opiates acted by their peculiar texture and affected the nervous juice immediately. Mercurial medicines did not act by volatile alkali but by reason of a most subtle ethereal salt. Nitre made the blood florid neither through alkali nor through acid. The virtues of sulphur, distilled oils, and camphor could hardly be explained in terms of sal alkali. Indeed, the effects of many medicines depended on their texture, disposition of particles, and native spirits. The action of various specifics could not be explained by alkali. This was true of stones of crabs, coral, pearls, lead, tin and volatile salts.

In the same year Gottofridus Hennickius, physician to the count of Erbach, published a treatise on panaceas, illustrated by curious experiments and reasonings.²³³ He treated in particular of cinnabar, antimony, mercury sublimate, and butter and cinnabar of antimony. Cinnabar could cure all diseases and operated neither by first nor secondary qualities, but by tertiary, spiritual, ethereal qualities. He affirmed that metals threw off spirituous effluvia. He looked for the cause of disease in an idea in the *archeus*, rather than in the humors, and sought cure from ideas which were beams of primeval light. He believed that his panaceas multiplied and strengthened the vital spirits, freed those who were polluted by vicious ideas from the same, and corrected anomalies. Vegetable panaceas were best suited to comfort the spirits: animal panaceas, to impress new ideas; mineral panaceas, to remove occasional causes of disease and move the mass of humors.²³⁴

Stisser was professor of anatomy, chemistry and medicine in Brunswick. Of the seven chapters of *Acta* of the chemical laboratory printed at Helmstedt in 1690,²³⁵ the first three dealt with the transmutation of metals and potable gold. These themes, however, did not recur in the ten chapters of the second volume of the *Acta* in

²³³ *De panaceis. Tractatio medico-chymica curiosis experimentis ac rationibus illustrata*, Francof., 1689, 108 pp. BM 1034.e.24 (2.).

²³⁴ *Acta eruditorum*, VIII (1689), 352-54.

²³⁵ Joh. And. Stisser, *Acta laboratorii chymici*, Helmstadii, 1690: BM 1033.h.20. (14.).

1693.²³⁶ Stisser had argued earlier for the possibility of transmuting metals in his *Commendation of Chemistry*.²³⁷

Le Mort, in his *Idea of the Action of Bodies*, published at Leyden in 1693, regarded salt, water and earth as three elementary bodies differing in the corpuscles composing them, and classed the ether itself as "the most spirituous salt of this world." He set great store by a balsamic spirit and a balsamic varnish, and listed the ingredients of either. But he attempted to explain fermentation and chemical change, heat and light, mechanically in terms of figures, surfaces, points, pores, textures and motion.²³⁸

In the preceding chapter we spoke of a work on the world soul by Johann Ludwig Hannemann in 1670 and a defense of astrology in German in 1699. In the present chapter we have already noticed his *Phoenix botanicus* of 1680. He had also published a *Curious Scrutiny of the black color of the descendants of Ham* according to the principles of the corpuscular philosophy.²³⁹ Now he turned again to alchemy and wrote a book entitled *Egg, Hermetic-Paracelsic-Trismegistic*,²⁴⁰ in Latin, interlarded with many passages in German and some in Dutch, in which he treated first of natural and then of artificial gold, including the potable variety and the medical use of gold, and then solved one hundred and eight chemical questions which had been proposed by Morhof, whom he says he would rank above Scaliger and Saumaise.²⁴¹ After terminating

²³⁶ *Actorum lab. chemici... specimen secundum*, Helmstadii, 1693. A third part appeared in 1698: BM 1033.h.21. (1.).

²³⁷ *Commendatio chemiae*, Helmstadii, 1689: BM 1033.h.20.(10). Hofer, II, 335, gave the date as 1679. In 1686 he had published *De machinis fumiductoriis* at Hamburg.

²³⁸ Jacobus Le Mortius, *Idea actionis corporum motum intestinum praesertim fermentationis delineans*, Leyden, 1693, in-12, ten chapters. *Acta eruditorum*, XII (1693), 402-7.

²³⁹ *Curiosum scrutinium nigredinis posteriorum Cham, i.e. Aethiopiae, juxta principia philosophiae corpus-*

cularis..., Kiel, 1677.

²⁴⁰ *Ovum hermetico-paracelsico-trismegistum... de auro... in quo... 108 quaestiones ab Morhofio propositae... solcuntur*, Francof., 1694, in-8, 440, 28 pp. BN R.38169. The preface and other preliminary matter are dated in January and February, 1692.

²⁴¹ This is not precisely Hannemann's order, since *aurum potabile* is mentioned as early as p. 20, while the medical use of gold begins at p. 309 after the solution of the 108 questions.

Marie Kern, in a dissertation on Morhof, Albert-Ludwig Universität, Freiburg-i-B., 1928, was unable to

the work very slowly and reluctantly with over a hundred pages more on sacred and profane use of gold, the abuse of it, apothegms concerning it, an epilogue, a fascicle of letters to celebrated physicians, and a *Postloquium*, Hannemann added an appendix of twenty-eight pages in defense of the philosophers' stone. Two years later he published another treatise on the analogy of certain theological mysteries—such as creation, the Trinity, Incarnation, resurrection, ascension and human regeneration—with the secret mastery of the philosophers' stone.²⁴²

Thus chemistry could still indulge in religious rhapsodies and magic dreams thirty years and more after the appearance of Robert Boyle's *The Sceptical Chymist*. But it has been said that Boyle, too, "expressed his philosophy in religious terms."²⁴³ Chemistry was still a naive child. It had not yet grown up and attained its scientific majority.

find the 108 questions except as edited by Hannemann, who edited them again in 1712 and 1714.

²⁴² *Osculum i.e. . . . analogia quorundam mysteriorum theologicorum cum lapidis philosophorum arcano*

magisterio, Hamburg, 1696, 108 pp. and a *Postloquium*. BM 1033.r.20(17.).

²⁴³ W. C. D. Dampier-Whetham, *A History of Science and its Relations with Philosophy and Religion*, 1929, p. 153.

CHAPTER XXXIV

MEDICINE AND PHYSIOLOGY

Clauder on progress—Yet posthumous publication—Hereditary disease—Moisture from the brain—Contagious rabies—Santorio on sympathy—Moussin's paradoxes—Stefani on the Secret of Secrets—Plemp—Homemade and instinctive medicine—Beverwyck—Caspar Hofmann—Use of parts of the human body: Burggrav, Tentzel, Beckher, Highmore—Twelve conclusions of Boulton and Maxwell—Sacred medicine of Baldit—Mayow and others on air—Juanini and Boyle on the air of Madrid—Ruminating men—Binninger—Grube's Arcana no arcana and transplantation—Wirdig and Duncan on the spirits—Schoch on the head—Experiments of Matthaëus—Bonet on northern progress—Almeloveen and Aignan defend the ancients—Lipstorp and Herfelt on the human body—Zype on reformed medicine—Wedel on reformed physiology—Petit, Geuder and Gladbach—Colbatch on acid and alkali—More progress and improvement.

Sic mundus regitur opinionibus, et medicus in tempore desipiens vel cum vulgo errans, narrans aut consentiens maxime sapit.

—WOLFF

It would be much better for medicine, if there were fewer books . . . How often the specious title of a futile book lures the purchaser.

—BARTHOLOMAEUS DE MOOR

Gabriel Clauder, writing in 1678, rhapsodized over recent new discoveries in the field of medicine: the circulation of the blood, lacteal veins, the lacteal and thoracic ducts, the lymphatic vessels, the salival and lacrymal ducts, the pancreas with its duct and juice, formerly unknown, the doctrine of fermentation, and that of the generation of animals. Botanical knowledge had increased, and chemistry had made new conquests.¹

That medicine, despite the repeated claims of its authors to novelty, was not making any very rapid progress is indicated by the fact that posthumous publications from the dead hand of a

¹ *De tinctura universali*, Altenburg, 1678, p. 10.

bygone generation were common and frequent. Of this a rather striking instance may be adduced. Thomas Mermann (1559–1612), after teaching philosophy at Pisa and obtaining the M.D. degree, returned to Germany and became court physician to the duke of Bavaria until his (Thomas's) death of apoplexy in his climacteric year. Sixty-three more years were to pass before his medical consultations and responses, which we are assured had long been in demand among men of learning, were finally collected from various manuscripts scattered in many places and written some in German, some in Italian, some in Latin, by the industry of Franciscus Ignatius Thiermairius, and were all issued in Latin at Ingolstadt in 1675 in eight books in a folio volume. The delay was less in the case of Jean Martin who died in 1609 but whose lectures on Hippocrates on internal diseases were not printed until 1637.² Gregory Horst (1578–1636) had published many separate treatises during his lifetime, but his writings continued to be sufficiently esteemed for an edition of his collected works in three volumes in 1660.³

Medicine has, of course, often claimed our attention in preceding chapters. Sennert and van Helmont, Harvey and Patin, were physicians.⁴ So were most of the members of the Academy of the Curious as to Nature.⁵ A glance at our index will reveal a host of other doctors, diseases, remedies and cures. Astrological medicine and iatrochemistry and chemical remedies have been set forth in the chapters on astrology and alchemy before and after 1650.⁶ Many of our naturalists, botanists and pharmacists were also members of the medical profession.⁷ The present chapter on medicine and physiology is therefore somewhat supplementary in character.

Dermutius de Meara, in a treatise on hereditary disease, first published in Dublin in 1619,⁸ held that no disease could be hered-

² *Praelectiones in librum Hippocratis... de morbis internis*, Paris, 1637.

³ LR gives the date as 1661, but the copy in the Columbia University medical library is dated 1660.

⁴ See Chapters 7, 8, and 18.

⁵ Chapter 30.

⁶ Chapters 5 and 6, 32 and 33.

⁷ Chapters 24, 25, 26.

⁸ *Pathologia haereditaria generalis sive de morbis haereditariis tractatus spagyrico-dogmaticus*, Dublin, 1619, in-12, 129 pp. BN 8°Td40.1.

itary which was not of a salty nature. In many cases persons of the same stock had about the same diseases in the same order and at the same age. There also were cases where diseases of parents did not appear in their children but reappeared in later generations. In diseases whose seed, principles and causes were not inborn, a very considerable power of procreating disease was to be assigned to the occult influence of the planets and fixed stars.⁹ Meara's treatise was republished at London in 1665 and at Amsterdam in 1666 or 1667. Meanwhile Robert Lyonnet, an M.D. of Montpellier, dean at Valence, and one of the consulting physicians of Louis XIII, in a dissertation dedicated to the widowed queen-mother, Anne of Austria, with a preface addressed to the medical doctors of Paris, and an approbation by four of them, including Gui Patin, had held that the various illnesses of Louis XIII were not hereditary but adventitious.¹⁰

The brain was still regarded as the source of moist distillations by Johannes Vigirius in a work printed at Geneva, in 1623, on catarrh, rheumatism, defects of teeth, tongue and voice, immoderate and unseemly flow of saliva, "and other distillations from the brain." But his book was compiled from various previous authors. However, this view was held later in the century by Borrichius who, in discussing a then favorite question, whether the humors of the eye were replaceable, held that they were not restored by infusion from without but by liquor flowing from the vessels of the brain.¹¹

Giuseppe degli Aromatari, in a work of 1625 at Venice on contagious rabies, in which he held that hydrophobia was a sort of quinsy, also tried to give a natural explanation of marvelous and magical assertions and beliefs which had become associated with it. Such were certain methods of curing it. At Lucca, for example, the members of a certain family would inscribe characters on the bottom of an earthen cup and have a priest bless the cup, then shave off the portion of the cup on which this was written and give it mixed with wine to drink to the person who had been

⁹ *Ibid.*, pp. 83, 4-5, 2, 86, 3.

¹⁰ *Brevis dissertatio de morbis haereditariis... qua probatur affectus morbosos quibus cum Ludovicus XIII*

... conflictatus est fuisse adventitios, non profectitios, ... non haereditarios, Paris, 1647, in-4, 87 pp. BN 4°Td⁴⁰.2.

¹¹ LR 698-99. *Acta Hafn.*, I, 79.

bitten by the mad dog or other rabid animal. Aromatari believes that there is nothing marvelous about this except the benediction. For all the ingredients in the potion attenuate and dry out and to some extent strengthen. So it is a rational procedure, and the sacerdotal benediction makes its virtue the greater. Or in France at the shrine of St. Hubert near the sea those who have been bitten enter the water and walk about in it. And in many places in Italy they cauterize the wound with iron nails of St. Bellinus ignited in the name of God. Aromatari considers both procedures natural and having a manifest cause, although he grants that they may work the better, the more they involve Christian piety. But to duck the patient in water is dangerous. Ash of crabs and certain herbs which are thought to operate by occult property, possess an attenuating and drying nature which is enough to explain their beneficial effect. It is sensible for those infected with rabies to abstain for a year at least from the fruit of the dogwood which injures mouth and gums, but Aromatari denies that the shade or rods of dogwood or sorb bring on rabies. Moreover, he holds that many men who are in good health and not constipated suffer no harm from the bite of a mad dog other than the mere wound.¹²

Sanctorius Sanctorius or Santorio (1561–1636) was a much-cited medical author. His *Static Medicine* in particular continued to appear in the second half of the seventeenth century and was translated into English and Dutch. Another work by him was on the method of avoiding errors in medicine, but still accepted the semi-magical notion of sympathy. Its second book, *De effectuum idiopathia et sympathia*, was chiefly occupied with the relation of sympathy between different parts of the human body.¹³

J. Mousin, in a book printed at Nancy in 1632, and dedicated to Charles IV of Lorraine, adopted a contrary or unusual view with regard to a number of medical, natural and astrological questions.

¹² *Disputatio de rabie contagiosa, cui praeposita est Epistola de generatione plantarum ex seminibus... auctore... Josepho de Aromatariis*, Venice, 1625, in-4: BN Td⁸⁵.17, pp. 85-86, 94, 88. Also at Frankfurt, 1626.

¹³ I have used the edition of 1630, *Methodi vitandorum errorum omnium qui in arte medica contingunt libri quindecim... Multa in hac nova editione ab ipso auctore addita et emendata*, Venice, 1630, in-4: BM 539.f. 16(2.).

Described in a rather flamboyant title as "A Garden Iatrophysical whence anyone may pluck a vast forest of exotic flowers, a delectable work of pleasing novelty," the text is in the form of a dialogue between Andromachus, Crito, Democedes, Crataeus and Antigonus, and takes up a series of sixteen paradoxes. Pleasure is a better preserver and restorer of health than any medicine, and there is more virtue in air than in all the drugs. Good food is to be sought most from the garden, least from the butcher. The body of the chick comes neither from the white nor the yolk of the egg. It is better to wash the eyes with cold than with tepid water. Rivers do not always flow down hill. A slender diet is not so salutary for sufferers from skin disease. Medical science by no means depends upon nor is subaltern to the vulgar physic of the schools. Purging can be safely instituted under any position of the stars. The eighth month's child is vital. The female sex is not portentous and is more perfect than the male. Dysentery can neither be brought on by eating prunes nor cured by use of astringents. Such are the paradoxes of Mousin.¹⁴ To them is prefixed a short letter of Carolus Piso praising Mousin.

Among the various medical works of Johannes Stephanus or Giovanni Stefani of Belluno is not only *Hippocratis Coi Theologia*, in which passages are noted in Plato, Aristotle and Galen which are in agreement with Christianity, but also a Commentary, published the year before, on the *Secretum secretorum* of the pseudo-Aristotle: *In Aristotelis libellum de conservacione sanitatis ad Alexandrum Magnum Commentarius*, Venice, 1637. Thus there was still interest in the seventeenth century in a work which was favorite reading of the thirteenth century, full of occult science, and commented upon then by Roger Bacon.

Another favorite from the thirteenth century, the *De secretis mulierum* ascribed to Albertus Magnus, found a seventeenth century counterpart in the *Recueil des secrets* which the famous midwife, Louyse Bourgeois, published first in 1609 and again in 1635.

The Foundations of Medicine of Vopiscus Fortunatus Plempius

¹⁴ J. Mousin, *Hortus iatrophysicus ex quo immensam exotericorum florum sylvam cuius decerpere licet; opus*

delectabile novitate iucundum, Nancy, Charlot, 1632, in-8, 444 pp. BN 8° Te¹⁴².69.

of Louvain (1601–1671), first published in 1638 and which reached its fourth edition in 1665, illustrates the ups and downs of medical and scientific thought then. In the preface he writes against Descartes, whose doctrine had been censured by the faculty of theology at Louvain and his books condemned by a decree of the Roman Inquisition. But the fourth edition includes two unpublished letters of Descartes “proving” that the movement of the heart is caused by rarefaction of the blood which dilates it and not by any pulsific virtue of its own. Plemp held that critical days were of no consequence, and that very old persons might renew their youth, as in the case of a noble Indian who lived 340 years and was rejuvenated thrice, or that of the English Minister who had new hair and teeth when past one hundred, and felt so fine that he expected to live to be two hundred, but died six years since at Neuchastel when hardly one hundred and forty. Plemp also still spoke of whales as fish.¹⁵

Ever since the *Euporista* or work on easily procurable remedies ascribed to Galen, ever since the Treasury of the Poor of Petrus Hispanus, homemade medicine had found its exponents. This may be illustrated in the seventeenth century by some excerpts from *An Alphabetical Book of Physicall Secrets* which Owen Wood issued in 1639 for the benefit of those far from or unable to afford a learned physician, “as likewise for the help of such ladies and gentlewomen who of charity labour to doe good.”¹⁶

Canker to cure. Take the oldest Oyster-shell you can find in a dunghill (that shine most are best), powder them, then set three spoonfulls of white wine vinegar over the coales. Put therein as much of the Oyster-shell powder as will thicken the vinegar, adde thereto some Allom powder, then bind a linnen cloath about a stick and dip therein. Rub the Sore therewith till it bleed, doe this three times therewith; it will be well.¹⁷

Eyes that have Pearle or Web. Take all the head of a black cat burned to ashes. Blow some of that powder with a quill thrice a day into the eye, if the paine be great, especially in the night. Lay thereon some

¹⁵ *De fundamentis medicinae libri sex*: JS I (1666), 249–68. LR 1049, for the three previous editions.

¹⁶ BM 1038.d.36, 238 pp.

¹⁷ *Ibid.*, p. 33.

Oaken leaves doubled together and wet in Rosewater on the eye. Renew them as need requireth. It cureth.¹⁸

Another rare secret for the same. Take nine Wormes. You shall finde them in old hollow timber with many legs, called Hogs or Swines Lice. If you touch them, they will be round. Stamp them with the juyce of Celendine or Betonia, then straine them well. Let the patient drink it fasting warme, not eating in two houres after. Use this three mornings together, it will cure.¹⁹

For jaundice, black and yellow, the cure is as follows:

Take earth worms, wash them in 4 or 5 waters very clean, strip them every time with your fingers all the earth out, then stamp them very small. Put stale ale unto them and straine them hard out, and drink it with saffron. It cureth at thrice taking.²⁰

A pectoral electuary that comforts memory, the sight, and all griefs is compounded of twenty-nine different herbs and spices. After having been pulverized, they are to be shaken and stirred in a quart of spring water in which stoned raisins have been boiled. One adds three pounds of English honey, boils it a quarter of an hour stirring it the while and putting in a gill of rosewater and eight powdered nutmegs.²¹

To Wood's credit it may be said that his Secrets do not indulge in astrology or ceremonial.

Homemade medicine was carried even farther in an anonymous work in French of 1682 on being one's own physician and depending on instinct as other animals than man do.²² Using simples growing on one's native soil often remedied diseases that were otherwise incurable. The author, however, did not entirely abandon his readers to their instincts, but argued that the colon was a chief cause of disease, listed signs of ill health that were observable by natural instinct, and suggested remedies, especially venesection and purging, with preference for simples against compound and chemical medicaments. Unlike Wood, he attributed much to the varying influence of the stars.

¹⁸ *Ibid.*, p. 56.

¹⁹ *Ibid.*, pp. 56-57.

²⁰ *Ibid.*, p. 105.

²¹ *Ibid.*, p. 102.

²² *Le medecin de soi-meme ou l'art de se conserver la santé par l'instinct*, Leyden, 1682, in-12. Reviewed in *Acta eruditorum*, II (1683), 158-61.

The *Thesaurus pauperum* of Petrus Hispanus in the thirteenth century found another seventeenth century counterpart in *Medicina pauperum* of Jean Prévost or Praevotius (1585—1631), a Swiss who became a professor at Padua. The book was not printed until ten years after his death,²³ but then other editions at Lyons and Milan followed rapidly, and an English translation by N. Culpeper was published in 1656 and 1670. Jean remarks more than once that a remedy or recipe is a secret.²⁴ The remedies are mostly herbs, including tobacco, and other simples, including millepedes and excrements,²⁵ rather than chemical.²⁶ Decoctions of herbs are improved by suffumigation and quenching the stone pyrites in them. After treating remedies of the manifest quality of disease, Prévost remarks that the occult quality, since it is venomous and ingrained in ill of the very substance, requires alexipharmaca.²⁷ Alexipharmaca oppose the poisonous force by their substantial property and entire temperament.²⁸ Delivery is aided by binding the eagle-stone to the thigh; jasper also and coral, and a magnet carried in the left hand. Marvelous power to extract splinters and weapons even from the deepest parts of the body is attributed to the tongue of a fox torn out in the month of March, dried, afterwards soaked in wine, and applied hot to the wound. Some ascribe like force to the fat and skin of a hare, only they don't draw the infixed object towards them but push it away, and hence make the application not to the mouth of the wound but the opposite side of the limb or body.²⁹

Some poisons madden, some induce sleep, some inflame, others extinguish the natural heat and suffocate by flatulent humidity, others kill by dryness, erode and exulcerate. Some irritate parts

²³ *Medicina pauperum ac eiusdem de venenis ac eorundem alexipharmacis opusculum*, Frankfurt, 1641, in-12, 377 pp. Copy in the Columbia University Medical Library.

²⁴ *Ibid.*, pp. 82, 100, "Pro secreto habetur"; 128, "Pro secretis habetur," et passim.

²⁵ *Ibid.*, p. 68, "Millepedes vino abluti..." etc.; p. 247, "Guainerius audet asinum stercus interne usupare

et syrupum ex saccharo et recentis stercoris expressi succo preparatum tanquam summum ad cohibendos immoderatos menses."

²⁶ The first chemical remedy I noticed was antimony at p. 43; at p. 64, "Antimonium praeparatum."

²⁷ *Ibid.*, p. 122.

²⁸ *Ibid.*, p. 149.

²⁹ *Ibid.*, pp. 129, 136.

of the body by excessive mordacity and dryness, some act by lethal astringency. Prévost also asks whether the action of poisons can be set for a certain time.³⁰ He closes with lists of alexipharmaca.³¹ *Expertus* as well as *secret* is a frequent expression with him.

When Sir John Chardin's account of his travels by the Black Sea and Colchis to Persia and the East Indies was reviewed in *Acta eruditorum*,³² the reviewer recommended to students of medicine its catalogue of various specific medicines applied with success by an old-wife in Tiflis in Georgia and the method of curing cold fevers by putting the patient in a swamp of cold water.

Out of twenty-two epistolary inquiries and replies thereto published in 1644 by Johannes Beverovicus (Beverwyck) of Dordrecht,³³ seven are concerned with Biblical passages, including the oft mooted problem whether Samuel after his death really spoke with king Saul, and the question why Christ used dust mixed with spittle in curing the blind man; and five with passages from classical authors—Pliny, Plato and Plautus. The other ten deal with stone in the kidneys, dropsy, the cure of repeated abortion, the movement of the heart and circulation of the blood (by Descartes), daily life in the past, the nature and virtues of mint, divine Providence, whether the entire man is diseased, the lynx stone, and the method of curing wounds by sympathy. Thus among the representative interests of the age, the occult still claimed a noticeable share.

Beverwyck (1594–1647) had previously published works on ancient medicine,³⁴ the stone³⁵ and indigenous medicine.³⁶ He studied at Leyden, Paris, Montpellier, and Padua, became professor of medicine at Dordrecht, was a correspondent of Gui Patin, and in political life became a councillor, then burgomaster, representative in the Estates, and President of the Admiralty.³⁷ His earliest

³⁰ *Ibid.*, pp. 335-43, 319.

³¹ *Ibid.*, pp. 356-77.

³² VI (1687), 7.

³³ Listed by Geo. Abraham Mercklin, *Lindenius Renovatus*, 1686, pp. 542-43.

³⁴ *Idea medicinae veterum*, Leyden, Elzevir, 1637.

³⁵ *De calculo renum et vesicae*, Leyden, 1638; reprinted at Amsterdam in 1656 and 1664.

³⁶ *Introductio ad medicinam indigenam*, Leyden, 1644; again in 1663.

³⁷ *Lettres de Gui Patin*, I (1907), 168-71.

publication appears to have been a symposium on the question whether the term of life was fatal or mobile.³⁸ One might expect this to involve the problem of the extent of the influence of the stars upon the length of life and time of death. But of the eight persons to whom Beverwyck wrote queries and from whom replies were received, including Mersenne, whose response was the briefest, the majority were theologians and clerics who argued more about predestination than the stars or who composed literary essays full of quotations from the classics. However, Abraham van der Mylius not only stated that many Chinese live to two hundred years, that in north Ireland and the Orcades men live until tired of life, and that in Brabant the men of Kempis far outlive their neighbors, but also that under the same sky, living in the same air, subject to the same influence of the heavens, some men live longer than others, while Beverwyck quoted the line, "The stars rule men, but God rules the stars."³⁹

Caspar Hofmann (1572-1648) was born in Gotha, received the M.D. degree at Basel in 1605, and succeeded Nicolaus Taurellus, when the latter died of the pest, as professor of medicine at the university of Altdorf. Among the numerous works by him listed in the bibliography of Van der Linden are tracts on the use of the brain and the spleen according to Aristotle, and on the controversy between Aristotle and Galen as to the thorax. Also an account of a judgment rendered by Rhadamanthus in the Elysian Fields against Galen, with the approbation of Apollo on Parnassus, and communicated by Mercury;⁴⁰ and a defense of the Germans against Galen, in which is discussed "that noble question, In what diseases venesection is to be preferred to purging?" On the other hand, Hofmann composed

³⁸ *Epistolica quaestio de vitae termino, fatali an mobili? cum doctorum responsis*, Dordrecht, 1634, in-8. An enlarged edition ("triplo auctor") appeared at Leyden, 1636, in-4, where, in 1639 and again in 1651, was printed the "third and last part concerning the same question", with a letter on it by Anne Maria à Schurman and another by John Elichmann, "ex meritis & monumentis Arabum & Persa-

rum contexta." LR 542.

³⁹ Ed. of 1634, pp. 58-60, 90.

⁴⁰ Printed at Nürnberg in 1642. The Elysian Fields also figure in the title of a later work by Casparus à Reies, *Elysium jucundarum quaestionum Campus... medicis imprimis... delectabilis, theologis deinde jurisperitis et omnium denique bonarum disciplinarum studiosis...*, Brussels, 1661; Frankfurt, 1670: LR 163.

various commentaries on works of Galen, and even wrote *Apologiae pro Galeno*, in which he asserted Galen's glory. He criticized or revived medical writers of the previous century, such as Fernel and John Argenterius⁴¹ or Franciscus Frisimelica,⁴² and was still intent—as were readers after his death—upon such themes as innate heat and spirits.⁴³

Use of parts of the human body, alive or dead, continued in the medicine of the seventeenth century, and magical properties of acting sympathetically and at a great distance were attributed especially to the blood. Closely associated therewith was the transplantation, as it was then commonly called, or magic transfer of disease from the human patient to another animal, a tree, or some other external object.

Johann Ernst Burggrav in his *Biolychnium*, printed in 1611, taught, according to Meyssonier,⁴⁴ to make a water of human blood drawn warm from the veins, mixed with another liquor, and kept in a glass bottle. The state of health and death of the person in question could then be predicted according as his blood underwent change in the phial. Burggrav himself seems rather to have described this device as a Lamp of Life and Death, fed with a liquid made from human blood which burned as long as the blood-giver lived, went out when he died, and presumably flickered when he fell ill.⁴⁵ The repeated editions of the treatise attest the interest in its magical idea.

In another treatise on the magnetic cure of disease and the *mumia*

⁴¹ *Rejectanea Pathologica qua de morbis formae & materiae a Fernelio Argenterioque per somnum visis*, Helmaestadii apud Jeremiam Rixnerum, 1639, in-8.

⁴² *Pathologia in parva qua methodus Galeni practica explicatur quam olim Franciscus Frisimelica promiserat*. Ienae, 1640, in-8. Also 1647, 1664.

⁴³ *De calido innato & spiritibus...*, Francofurti ad Moenum, 1667, in-4.

⁴⁴ *La pratique des remedes de sympathie*: printed with Digby, *Demon-*

stratio immortalitatis animae, 1664, p. 222.

⁴⁵ *Lampas vitae et mortis omniumque graviorum in microcosmo*, Leyden, Arn. Doude, 1678, in-12, 72 pp. The first edition was in 1610 or 1611. LR 574 gives a different title: *Biolychnium seu lucerna cum vita eius cui accensa est mystice vivens jugiter; cum morte eiusdem expirans omnesque affectus graviores prodens...*, Francof. apud Will. Fitzerum, 1629, in-8. Zedler further lists an edition of Franeker, 1612.

of Paracelsus, which was also cited by Meyssonnier⁴⁶ and which accompanies the *Biolychnium* in the edition of 1611,⁴⁷ Burggrav gave the following prescription for such diseases as dropsy, jaundice and leprosy. Empty an egg and fill the shell with some of the patient's blood, and close the aperture with fish-glue. Put the egg under a sitting hen for a fortnight, then feed it to a pig or a dog, and the disease will be transferred to the animal.

Although Mundella had branded the medical employment of *mumia*, i.e., the remains of an embalmed corpse, as "abominable and detestable" back in 1538,⁴⁸ it continued to be much prized as a remedy by Paracelsists into the seventeenth century. Tidicaeus of Thorn, as we have seen, inserted a digression concerning it in his work on theriac of 1607, and Croll in his *Basilica chymica* of 1609 recommended a special kind, made from the cadaver of a redheaded man aged twenty-four who had suffered a violent death, cut in pieces, sprinkled with a powder of myrrh and aloes, soaked in alcohol, hung up and dried, and what not.⁴⁹

The Diastatic Medicine⁵⁰ of Andreas Tentzel in 1629 was primarily devoted to *mumia*, of which he enlarged the scope and definition. Now there was extraction of the *mumia* of the aerial body by interception of the dying breath, and spiritual *mumia* of the living body of the microcosm and its use to promote friendship—a piece of natural magic. The influence of the heavens, the proper astrological time, and the operation of antipathy were also taken into account, as were transplantation and magnetic action at a distance. A briefer second part gave a natural explanation of the tree of life and of the knowledge of good and evil, of astronomic and mystical transplantation, and at the same time a mystical in-

⁴⁶ *Op. cit.*, p. 223, "Le sus-allegué Burgau."

⁴⁷ *Biolychnium seu lucerna cum oita eius cui accensa est mystice vivens jugiter, cum morte eiusdem expirans, omnesque affectus graviores prodens. Huic accessit Cura morborum magnetica ex Theophr. Parac (i.e. Paracelsi) mumia: itemque omnium venenorum Alexipharmacum. Auctiora et emendatiora omnia curis secundis I. E.*

Burggravi, V. D. Balch, Franekeræ, 1611, in-8, 176 pp. BM 1033.e.8.

⁴⁸ T V, 455.

⁴⁹ T V, 650.

⁵⁰ *Medicina Diastatica... ad distans et beneficio mumialis transplantationis operationem et efficaciam habens... multa... abstrusioris philosophiæ et medicinæ arcana... continet*, Jena, 1629, in-12, 188 pp.: BM 1035.a.9.

terpretation of the great secret of the cabalistic concordance between the tree of life and death and Christ and Adam. Tentzel's book continued to find readers after 1666 when it was reprinted at Erfurt by J. Birckner. Thomas Bartholinus cited cases from it for fifteen pages as a postscript to his letter on the transplantation of diseases, printed in 1673 with Hermann Grube's, *De arcanis medicorum non arcanis commentatio*, of which more anon.⁵¹

Yet more widespread appears to have been the impact of Daniel Beckher's *Medicus Microcosmus*, printed first at Rostock in 1622, then at Leyden in 1633, and again in London in 1660.⁵² Its first book was devoted to medicines from the living human body; the second book, to those from the human cadaver. The former category includes ear-wax, urine, excrement, lice, sperm and tape-worms; the latter, skin, fat, brain, cranium and mumia. Beckher, who admits that he has borrowed much from other writers, repeats Burggrav's experiment with the hen's egg and also cites the Diastatic Medicine of Tentzel.⁵³ He himself has sometimes cured a desperate toothache by taking blood from the gums with a willow stick and transplanting it. He also asserts that a magic philter can be prepared from blood.⁵⁴

Beckher makes a close connection between *usnea* or moss of the human cranium and weapon ointment or *armarium unguentum*, or *hopliatricum* or *magneticum* or *martiale* or *sympatheticum*. If some of the blood which adheres to the weapon is mixed with the ointment, healing virtue is transferred from the sky, and a natural union is effected with marvelous force, especially if the ointment is compounded under the proper constellation. Some ascribe weapon ointment to Paracelsus, says Beckher, but it is not in his writings, and Keckermann (*System. physic.*, I, 9) attributes it to Anselm of Parma.⁵⁵ Various descriptions of it are in circulation, which Beckher repeats for three solid columns. An ounce of *Usnea* should be scraped from the cranium of a man who has perished by a violent death, preferably on the gibbet, when the moon is

⁵¹ *Op. cit.*, pp. 65-80.

⁵² I have used the edition of Leyden, 1633: BM 1034.k.40.

⁵³ Since it appeared only in 1629, this would indicate that Beckher has

enlarged his work in the 1633 over the 1622 edition.

⁵⁴ Ed. of 1633, pp. 76-77.

⁵⁵ Concerning Anselm see T IV, 242-46, 677-79.

waxing and in a favorable house, that of Venus, if possible, and not of Mars or Saturn, mixed with the other ingredients of the ointment and kept in a closed glass or pill-box. It should be prepared in autumn about September 10-11,⁵⁶ which would be approximately the date of the equinox in countries which had not yet adopted the Gregorian calendar.

Beckher then gives elaborate instructions for the administration of the ointment. In a number of respects they are identical with those in Croll's *Basilica chimica* of 1609.⁵⁷ If the wound is large, the weapon with which the patient has been wounded should be anointed daily; otherwise, every two or three days. The weapon should be kept in pure linen and a warm place but not too hot, "nor squalid, lest the patient suffer harm." Care should be taken that no dust falls on the weapon or cold wind chills it, or the patient will go insane. If the wound was made with the point of the weapon, anoint toward the hilt, not moving downward, otherwise the patient will suffer injury. If you cannot tell how far the weapon penetrated, anoint all of it. Otherwise, it will do to anoint the part of the weapon with which the patient was wounded. It is not necessary to sew up the wound, "as barbers do," but merely to wrap it up in clean linen which has previously been moistened in the patient's urine. On the day when the weapon is anointed, both patient and anointer should abstain from sexual intercourse—a common prohibition in magic. Before anointing the weapon, the bleeding of the wound should be checked. In cases of fracture or broken bones, some powdered herbs (*symphiti maioris vel ostiocolle*) or roots of black hellebore may be added to the unguent. To tell if the patient will live or die, before anointing the weapon, warm it over coals but so that you can still hold your hand over it. Then sprinkle it with a fine powder of red sandalwood and blood-stone. If it sweats drops of blood, the patient will die. Toothache may be cured by scraping the tooth with a scalpel until it draws blood, and, after the blood has dried, anointing the scalpel. If in shoeing a horse a nail transfixes the animal's foot, extract the nail and anoint it.

⁵⁶ *Medicus microcosmicus*, 1633, pp. 134a-135b.

⁵⁷ *Op. cit.*, pp. 278-82.

Beckher notes the objections to weapon ointment that there is no apparent reason for its virtual action, and that cases of recovery are due not to it but to nature. But he cites in its support Johann Hartmann, professor at Marburg, in his "private chemical college"; Tidicaeus who in his treatise on theriac attributed it to the marvelous and occult consensus of natural things; and Goclenius the Younger who in his *Synarthrosis Magnetica*,⁵⁸ p. 226, says that the balsamic spirit in the unguent and the spirit of the universe work together to effect the cure.⁵⁹ Beckher's own explanation is that the basis of the unguent is *usnea* or coagulated animal spirit coalesced with vital and natural spirits, which are carried upward as a man is strangled and burst forth to the circumference of the cranium. When the weapon is anointed, the spirit of salt of the blood attracts the animal spirit from the unguent, and both are united with the spirit of the world, so that whatever of weal or woe that spirit feels coagulated outside the veins it immediately communicates by sympathy to its fellow resident within the veins.⁶⁰

In 1651 Dr. Nathaniel Highmore issued a discourse of the cure of wounds by sympathy or without any real application of medicines to the part affected; but especially by that powder known by the name of Sir Gilbert Talbot's powder.⁶¹

Highmore (1613-1685) took his M.D. degree at Oxford in 1642 and was a friend of Harvey, to whom in this same year 1651 he dedicated his *Anatomical Disquisition on the Human Body in which the circulation of the blood is pursued*. The antrum of Highmore is named after him, and in the *History of Generation* which accompanies his *Discourse on weapon ointment* he made careful observations of the development of the chick. He held that weapon ointment was neither a magical delusion nor diabolical, but explicable in terms of atoms, effluvia and pores. With the aid

⁵⁸ This work has been treated in Chapter 10.

⁵⁹ *Medicus microcosmicus*, 1633, pp. 138a-139b.

⁶⁰ *Ibid.*, pp. 140b-141a.

⁶¹ Cited by J. F. Fulton, *Sir Kenelm Digby*, 1937, p. 35. I have examined it at the New York Academy of Medicine, where it occupies pp. 113-141

of Highmore, *The History of Generation examining the several opinions of divers authors especially that of Sir Kenelm Digby in his Discourse of Bodies, with a general relation of the manner of generation as well in plants as animals*, London, 1651. Also in BM E.1369(4.).

of glasses, effluvia have been seen rising from a magnet "in the form of a mist." Furthermore, all bodies desire rest and "no distance hinders the motion of these atomes to their natural place." "The medicine is made of a zaphyrian salt, calcined by a celestial fire, operating in Leo and Cancer, into a lunar complexion." It must be kept warm enough to extract all adventitious moisture, "leaving it intensely dry," but not so hot as to evaporate "all the volatile parts and finest atomes," leaving only gross salts, "which neither can be raised to accompany the atoms of the blood, neither, if they could, would they cure, but by their sharper angles grate the orifices of the capillary veins, and so procure an efflux of blood and not a consolidation of the wound." The blood or bloody matter which is taken from the wound on a cloth must be lightly sprinkled with the powder, kept very dry, and afterwards wrapped up so as to exclude the air and keep it at a temperate heat. "When these companions," that is, the effluvia from the blood and those from the powder, "are come to the wounded part," the atoms of the blood are received in their proportionate pores, "with which covertly slip in" the other atoms or effluvia from the powder, "loosening and diluting the fluid parts that distend the pores of the wound" and knitting together the more solid parts. But if they have been kept too hot, they cause the patient pain by raising a far greater number of saline particles than usual. Moreover, this cure "by this atomically energy," wrought at a distance, is more sudden than the most excellent balsam or the powder itself could effect, if applied directly to the wound. The Discourse ends without further mention of Sir Gilbert Talbot's powder than that found in its title.⁶²

The same group of twelve conclusions which occur anonymously in MSS Sloane 1321 and 2220 of the British Museum were published, in 1656, in the *Magical but Natural Physick of Samuel Boulton*;⁶³

⁶² *Ibid.*, pp. 115, 117, 119, 123, 125-26, 129-31, 138-37.

⁶³ *Medicina magica tamen physica: Magical but natural Physick, or a Methodical Tractate of Diastatical Physick containing the general cures of all infirmities . . . and that by way of Transplantation, with a description of a most*

excellent cordial out of gold, London, 1656, in-8, 195 pp. The dedication to the Marquess of Dorchester is dated May, 1646, but this is probably a misprint for 1656, since the preface to the reader is dated on the same day of May in 1656. Copy used: BM E.1078. (2.).

and, in 1679, in a work on Magnetic Medicine attributed to a William Maxwell, a Scottish physician, but edited by the dean of the medical faculty at the university of Heidelberg.⁶⁴ Boulton confesses that the work is not all his own.

I was beholden for some parts thereof (which occasioned the whole) to a worthy gentleman of Kent, one Mr. M. B. . . . who had some loose papers of an unknown Mr., but by us supposed to proceed from . . . the late . . . Dr. Everard.

Somewhat similarly the editor of Maxwell states that the manuscript was communicated to him by Stephanus Potier, that he sees ingenious Maxwell was a recent writer, for he cites Fludd, Hartmann, Andreas Tentzel in his *Medicina Diastatica*, and Helmont. So far as citing these authors is concerned, Maxwell might have lived and written in the first half of the century, but Franck goes on to say that he cites Sebastian Wirdig's *Nova medicina spirituum*, which was published only in 1673. He also states that he had written to Oldenburg, the secretary of the Royal Society, making inquiry as to Maxwell,⁶⁵ but that Oldenburg's illness and death (in 1677) had prevented his replying.

Passing on to the author's preface, we find him complaining that he had been prevented for two years from publishing his book in London, that he had seen practically the whole world rising up against this one remedy during this past century (*hoc elabso seculo*) and deem it magical and diabolical. He promises, when domestic cares permit, to give a sure cure for the six major diseases which are regarded as incurable by most physicians: namely, mania, epilepsy, impotence, dropsy, paralysis and both intermittent and continuous fevers, which "killed so many men this year." But toward

⁶⁴ *De medicina magnetica libri iii in quibus tam Theoria quam Praxis continetur; opus novum admirabile et utilissimum ubi multa Naturae secretissima miracula panduntur, spiritus vitalis operationes hactenus incognitae revelantur, totiusque huius secretae artis fundamenta firmissimis rationibus experientia fultis ponuntur . . . auc-*

tore Guillelmo Maxvello M. D. Scotobritano. edente Georgio Franco, Francofurti, 1679, 200 pp.: BM 1038.a.26. For the Sloane MSS see Chapter X, note 219.

⁶⁵ Maxwell's *Vitrum antimonii* and *Mercurius caelestis* are mentioned by Jungken, *Chymia experimentalis*, 1681, pp. 326, 333.

the end of the volume he says that he is unable to fulfil his promise and so substitutes for the third book a single chapter on headache.⁶⁶ In the preface he further acknowledged indebtedness to an Edmund Stuford or Stafford, with whom and Robert Fludd he speaks in the course of the text of having had a conference *altero anno*.⁶⁷ Inasmuch as Fludd died in 1637, all this rather sounds as if most at least of the work had been written years before 1673, and suggests that the citation of Wirdig is a late insertion or interpellation. It therefore is not certain that Maxwell wrote after Boulton, which one copied from the other, or whether both used a common source.

But now as to the twelve basic conclusions, to each of which Boulton and Maxwell devoted a chapter.⁶⁸ The gist of the first four is that the soul can operate beyond its own body by the emission of corporeal rays full of vital spirit. The fifth is that the excrements of the bodies of animals retain some vital spirit, and so life is not to be denied them, which leads on to the sixth conclusion, that there remains a connection between the body and its excrements, no matter how far they may be separated. Maxwell thinks that negligent and superficial burial is a reason why the pest has raged in London more than usual during these years past, and notes that witches cannot operate without parts of cadavers and excrements of the one whom they wish to injure. The connection has also been proved by multiple experience with "that famous sympathetic unguent and our magnetic water and magnetic powder." Other conclusions are that, if the vital spirit is strengthened in any part of the body, it is thereby strengthened in the entire body; that where the spirit is more bare, there it works more rapidly; that it is not so immersed in blood and excrements as it is in the body, and so works more quickly in them; that mingling of spirits makes for love. But this leads to transplantation or transfer of disease from man to man, and dead to living, and furnishes a handle to excessive lust, so that Maxwell will not go into it deeply. And he says nothing of semen, because it cannot be obtained except criminally. Appropriate magnets should be selected to accompany

⁶⁶ *De medicina magnetica*, pp. 190, 191-200.

⁶⁷ *Ibid.*, p. 134.

⁶⁸ Boulton, pp. 5-70; Maxwell, pp. 3-56.

blood and sweat, "for in philters without a magnet they effect little or nothing."

Maxwell's chemical remedies, aside from occasional mention of Paracelsus, are drawn almost entirely from authors of the early century such as Quercetanus (Duchesne, died 1609), Croll—whose doctrine of signatures is noted, Hartmann, Tentzel, Angelo Sala, and Ruland. At the aforesaid conference with Fludd, the latter told of a magnet which, applied to the region of the heart, attracted with such violence that it could not be long endured. "But when I asked the use of this magnet, he shut up as if regretting his words." But Maxwell assures us that this magnet was nothing else than dried human flesh, which certainly has a maximum attractive power, but should be taken, if possible, from the still warm body of a man violently slain. However, he goes on to suggest "a better and less cruelly obtained" magnet. Another instance of the force in excrements is that boys who urinate on fire contract disease of the kidneys. He knows for certain that salt of blood, if properly prepared, is the supreme remedy. And just as salts of herbs reproduce the likeness of the herb in the test-tube, so salt of human blood can show the image of a man—the true *homunculus* of Paracelsus. He will not stop to dispute with those who have dared to question astrological elections.⁶⁹

Boulton, after his first twelve chapters devoted to the twelve conclusions, proceeds to discuss the things necessary for a physician before he undertakes this part of magnetick cure,—purging, phlebotomy, time of gathering and application, transplantation, the magnet, excrement, urine, sweat, hairs, parings of nails and teeth, blood and pus, and signatures. All this corresponds closely to MS Sloane 1321, fols. 20r-38r.

Turning to less gruesome remedies, we find Joannes Vlacfeld of Haarlem refuting the opinion that drinking cold water is healthier for his countrymen than beer.⁷⁰

Among the numerous attempts in this century to associate the

⁶⁹ *Ibid.*, pp. 145, 164, 109.

⁷⁰ *Galenus Hydropotes . . . sive refutatio . . . opinionis qua frigidae aquae potum etiam illo cervisiae no-*

stratibus salubriorem esse contendit, G. de Haen, Harlemi, 1660, in-4: BM 1038.i.7.

sacred with the scientific or vice versa, may be mentioned one example in the field of medicine, the Octagonal Sacro-medical Mirror of Michel Baldit, an M.D. of Montpellier.⁷¹ After the dedication to the bishop of Mende and addresses to Jesus Christ and the reader, comes a figure of the octagon, hung by its two appendices and with each angle designating a subsequent chapter. Medicine is asserted sacred from its author, is demonstrated to be sacred from its subject, is argued sacred from its goal, is proved sacred from the diseases it cures, is convinced of sanctity by its remedies, is known to be sacred from its effects, is divulged sacred by its professors, and by a series of saintly physicians.⁷² But before we reach these angles, medicine and physicians are freed from calumny, and the necessity, utility and nobility of medicine are affirmed. Incidentally, however, it is noted that Peter of Abano, the Conciliator, writes that perfect physicians are vicious by nature because the cure of disease falls under the evil planet Mars and sign Scorpio, while the conservation of health belongs to Taurus and Venus which inflame the heart to lust.⁷³

Baldit points out that antidotes are plucked not far from poisons, that there are varied virtues in a single plant, that sympathy and antipathy stem from plants, and that there are marvelous plants and portentous remedies from animals.⁷⁴ After his frigid conceit of the octagon, we are mildly surprised to find him excluding from his roster of medical aids those "magical and superstitious remedies" which utilize writings, figures, characters, words and incantations.⁷⁵ He asserts, however, that all agree that there are herbs and drugs which dispel demons by routing the viscid melancholy humors in which demons reside, and that "there is no one who would not call such *antidemonica* sacred."⁷⁶ One is not surprised to find Baldit a friend of Lazarus Meyssonier, whom he calls a most learned

⁷¹ *Speculum sacro-medicum octogonum. In quo medicina octo ex angulis veluti totidem fontibus a primo et in primum salientibus sacra repraesentatur . . . praefixa appendice gemina tamquam vitta speculum aequilibratiter suspensura*, Lugduni, apud Danielelem Gayet, 1666, 363 pp. BN

T²¹, 102. I have not seen Benj. Mussaphia, *Sacro-medicae sententiae*, 1640.

⁷² Baldit, *Speculum*, pp. 87, 109, 125, 137, 154, 186, 203, 234.

⁷³ *Ibid.*, p. 43.

⁷⁴ *Ibid.*, pp. 90-91, 94, 98, 101.

⁷⁵ *Ibid.*, p. 161.

⁷⁶ *Ibid.*, p. 165: "at antidemonica

professor in the medical college of Lyons, and from whom he includes a letter to himself of August 1, 1657.⁷⁷

The experiments with air of the mid-seventeenth century had their repercussions in the fields of physiology and medicine.

Aero Chelinos, or, A Register for the Air, by Nathan Henshaw, M.D., a fellow of the Royal Society, was first printed at Dublin in 1664,⁷⁸ and then at London in 1677, when it was reviewed in *Philosophical Transactions*.⁷⁹ Henshaw inclined to regard the air as the cause of all fermentation. His five chapters were on fermentation, chyfication, respiration, sanguification, and the salubrity of frequent changing of air.

John Mayow (1640-79)⁸⁰ has been regarded as one of the most forward-looking scientific minds of the century, a forerunner of Priestley and Lavoisier. Hoefer said that his untimely death in 1679 "delayed the foundation of modern chemistry for a century."⁸¹ P. J. Hartog wrote in the *Dictionary of National Biography*:

Mayow stands immeasurably above such men as Willis and Sylvius, with their medley of half-digested Cartesianism and iatrochemistry. He must be classed with Hooke and Boyle, possessing the scientific imagination of the one, the tenacity of the other, and succeeding where Boyle failed. He had the genius to perceive exactly the problems which must be solved before any great advance in chemistry or physiology could be made, to guess at and partly to discover their solution; and he showed a critical faculty in theory and experiment, that is not to be met with in those two sciences until we come to Lavoisier.

He held that the air had a nitro-aerial constituent (later to be identified as oxygen) which was consumed in breathing and combustion, produced sulphuric acid and iron rust, and caused fermentation of wine and beer and decay of fruit and meat exposed to the

illa nemo non dixerit sacra." Possibly, however, the double negative is for emphasis and what Baldit means to say is that no one would call them sacred.

⁷⁷ *Ibid.*, pp. 299, 335.

⁷⁸ BM 115.a.45 and 1038.e.5(5.).

⁷⁹ PT XII, 834-35.

⁸⁰ I follow the DNB for the date of his birth. Hoefer, *Hist. de la chimie*, II (1843), 260, gave 1645; the article on him in the EB, 1643.

⁸¹ Hoefer, II (1843), 270.

air. He further described the mechanism of respiration "almost as perfectly as can be done today." Breathing brought the air in contact with the blood, which the heart drove through the lungs and throughout the body, carrying the nitro-aerial constituent which it had received to the muscles, whose motion resulted from a fermentation or chemical reaction. Fresh arterial blood effervesced in a vacuum much more than old blood did, showing that much of the nitrous-aerial substance which the blood received in the lungs from the air was lost in its transit through the body.⁸² Mayow also discovered the double articulation of the ribs with the spine and discussed the function of internal intercostals and the problem of the breathing of the foetus in the womb and in the egg. These and other significant views and experiments were set forth in a slight amount of publication, two tracts on respiration and rickets which first appeared in 1668 and were amplified by three more in 1674.⁸³

Such previous favorable estimates of Mayow were seriously questioned by T. S. Patterson.⁸⁴ He held that Richard Lower (1631-1691) described the mechanism of respiration more perfectly than Mayow, that the latter was more indebted to Hooke and Boyle than had been hitherto recognized, and that modern conceptions had been read into his writings which were not there for his contemporaries. Patterson even went so far as to affirm that

⁸² Hoefer, II, 269.

⁸³ They were reprinted at the Hague in 1681, which is the edition I have used, and at Geneva in 1685, and were published in Dutch translation in 1684. In the edition of five tracts that *De sal-nitro et spiritu nitro-aereo* comes first, *De respiratione* second, *De respiratione foetus in utero et ovo* third, *De motu musculari* fourth, and *De rachitide* last.

⁸⁴ "John Mayow in Contemporary Setting: a Contribution to the History of Respiration and Combustion," *Isis*, XV (1931), 47-96, 504-46. Since I completed this chapter, Henry Guerlac has published a paper on "John Mayow and Aerial Nitre," *Actes du Septième*

Congrès International d'Histoire des Sciences, Jerusalem, 1953, pp. 332-49. Instead of quoting a metaphorical passage of Paracelsus through the dubious medium of A. E. Waite, rather than Sudhoff's critical edition, Guerlac might have found Arnald of Villanova explicitly stating over two centuries before Paracelsus that air through the arteries reaches every member of the human body and alters it and whatever is contained in it. *Opera* (1504), 31a: "Aer etenim per arterias universas omnia membra pertingens suis qualitatibus actualibus alterat ea et quaecumque etiam continentur in eis."

in Mayow's writings "such views as were sound were not Mayow's, whilst those which were Mayow's were not sound."⁸⁵ He further asserted that Mayow's nitro-aerial particles were not "aeriform", although Mayow described them as "subtle, agile, ethereal,"⁸⁶ and as "fixed in the aerial particles themselves," and as constituting "the more active part of them."⁸⁷ Or would Patterson contend that the aerial particles were not aeriform?⁸⁸ Certainly Mayow stated that fire and life were sustained by the same aerial particles.⁸⁹

Although Patterson quotes a contemporary review that Mayow in 1668 made *aerial niter* "necessary to all life" and represented it as mingling with the blood,⁹⁰ he asserts a few pages later on that Lower in 1669 made "the first definitely published use" of the expression, "nitrous spirit of the air," and that Lower attributed the action of the air to it, "not to nitre, as Mayow had done."⁹¹ But it was aerial nitre and nitre inspired that Mayow had discussed, something different from mere nitre and hardly differing except verbally from nitrous spirit of air. Patterson himself quotes Mayow as speaking of "nitro-aerial spirit, or what is the same thing, the aerial part of nitre."⁹²

That Mayow's influence upon his immediate successors was greater than Patterson recognized is suggested by a treatise which he does not mention, published by Barberius of Imola at Bologna in 1680, on the operations of nitro-aerial spirit in the microcosm.⁹³

⁸⁵ *Isis*, XV, 57.

⁸⁶ *Ibid.*, p. 507.

⁸⁷ *Ibid.*, p. 515.

⁸⁸ Patterson also does Mayow an injustice in asserting at p. 81 that Lower "attributes the action of the air, not to nitre as Mayow had done, but to a nitrous spirit of the air." Yet a contemporary review of Mayow's work of 1668 which Patterson quotes at p. 75 speaks of his "Aerial Niter", and again on p. 76 of "the aerial Niter" and "the Niter inspired."

⁸⁹ *Opera* (1681), 95.

⁹⁰ See note 88 above.

⁹¹ *Isis* XV, 861.

⁹² *Isis* XV, 507n. In this note I do not understand the statement that Ma-

yow "does not seem ever to think of nitro-aerial spirit as having the properties of a gas." We have seen that in the seventeenth century all material spirits had the properties of gases, only even more so.

⁹³ L. M. Barberius, *Spiritus nitro-aerei operationes in microcosmo*: BM 780.a.19. Cius. Cervetto, *Di Giambattista da Monte e della medicina italiana nel xvi secolo*, 1839, p. 116, spoke of it in terms of exaggerated praise: "parlo dell'ossigeno e della di lui influenza nella ossidazione dei metalli e nella respirazione degli animali con esattezza mirabile e che gran fatto non si scosta da quella che poti usarne un secolo dopo Lavoisier."

Two years later Emanuel König, in the preface to *Regnum animale*, another book unknown to Patterson, named Mayow before Willis and Lower in listing Harvey's English successors,⁹⁴ and in the subsequent text cited both his *De respiratione* and *De spiritu nitro-aereo*.⁹⁵ In another passage, without citing Mayow, König speaks of the blood as "crammed with nitro-aerial particles taken from the air, of animal spirits being formed from these, and of the sensitive soul being endowed with "an aura and radiant texture of nitro-aerial spirits."⁹⁶ In yet another place König speaks of nitro-aerial particles from the nerves and sulphurous-saline ones from the blood-vessels, "as Mayow *Op. Med. Phys.*, p. 363, ingeniously deduces from his hypotheses."⁹⁷

A work by a third contemporary of Mayow who is unmentioned by Patterson is William Clarke's *Natural History of Nitre*, first printed at London in 1670,⁹⁸ and republished in Latin at Frankfurt and Hamburg in 1675, which treats at length of nitre in the air and discusses whether in houses, walls and earthen floors nitre is generated or separated from the air by the heat and dryness of the places. Clarke further calls the life of animals a burning sulphur kindled by the nitrous air which is received into the lungs and communicated to the heart. "This universal spirit" performs a like service to plants, and air is the life of fire.

Herfelt, in a work published in 1687, spoke of nitro-aerial particles in the air which were salt and of various sorts, citing Mayow, *de sale nitri*, p. 4.⁹⁹

For our particular purpose, however, it is of no great importance whether Mayow originated as much as used to be held, or whether he utilized current conceptions and phrases. Certainly he gave an emphasis to "nitro-aerial spirit" which single passages in Hooke and Lower had not supplied, when he put it in the title of a treatise

⁹⁴ *Op. cit.*, Basel, 1682, fol. 4v (the pages of the Preface are unnumbered): "Post Harvaeum ex Anglis clarent in primis Mayovv egregiis de nitro sale illo catholico hypothesibus, ac Willisius Cerebri & Nervorum Anatome...; Lovverus item qui ea quae Harvaeo circa motum sanguinis & cordis accuratius posthac ex multis observationi-

bus palam facienda restabant addidit; Charleton in *Oeconomia Animalis*..."

⁹⁵ *Ibid.*, pp. 19, 43, 47, 85, etc.

⁹⁶ *Ibid.*, pp. 22-23.

⁹⁷ *Ibid.*, p. 31.

⁹⁸ BM 987.a.12; in-8, 93 pp.

⁹⁹ *Henr. Ger. Herfelt, Philosophicum hominis de corporis humani machina*..., Leyden, 1687, p. 28.

of some 230 pages,¹⁰⁰ and immediately followed it by his earlier treatise on respiration. He was doubtless too daring and speculative in suggesting the participation of this nitro-aerial spirit in a wealth of phenomena, but this only shows the stress which he laid upon it. I am quite ready to take it as a sign of the times rather than an indication that he was in advance of his time. But the fact remains that he erected a sign-board or sign-post which was more likely to strike the eye of future historians than scattered passages in the writings of Lower, Hooke and Boyle—and that that sign-post pointed in the direction of the discovery of oxygen.

Mayow was not such a patient and long-suffering performer of experiments or so modest a disclaimer of general theories and hypotheses as Boyle. He was rather a bold young thinker—he lived only 39 years—who recognized the possibilities of nitro-aerial spirit and tried to trace it in varied natural phenomena. He did not prove the existence of oxygen, but I still think, despite Patterson, that he suggests it. He was a path-finder, not a road-builder.

What we have to note further, however, is that this man of superior intelligence and far-reaching outlook, with original notions concerning yet other matters such as waterspouts and thunderbolts, light and colors, and the mineral springs at Bath, was also tied to a certain extent to ideas which were of a somewhat magical order and relationship, and would no longer be considered as scientific. He still accepted to some extent the influence of the stars. Thus he says that nothing is more probable than that pure earth is sulphur and fixed salt in closest union, from which they can be separated only by long fermentation caused "by the air and the stars."¹⁰¹ Or in discussing diseases of the brain such as melancholy and mania, he thinks it probable that they arise not so much from a vitiated condition of the animal spirits as from the movement of these spirits being perturbed. For since the animal spirits consist

¹⁰⁰ "De sal-nitro et spiritu nitro-aereo," in *Tractatus quinque*, Oxford, 1674, and *Opera* (1681), 7-234.

¹⁰¹ *Opera*, 1681, p. 7 (same wording in Oxford, 1674 edition, p. 8): "Nimirum verisimile est terram puram putam nihil aliud esse quam sulphur et sal

fixum arctissime foederis nexu invicem combinata, quorum utraque mutuis amplexibus adeo figuntur, ut non nisi fermentatione diuturna ab aere astrisque excitata ad vigorem eveniantur, de qua infra fusius disquiretur."

of ethereal matter, they simply cannot undergo change.¹⁰² A relic of the old belief that the heavens are eternal and incorruptible! Incidentally he affirms that he has more than once seen the spit of persons taken by fits and convulsions burst into flame like oil poured on fire or like a funeral pyre.¹⁰³ Spontaneous combustion?

We have just heard Mayow speak of animal spirits. He also called his nitro-aerial constituent of the air *spiritus nitro-aereus*, although his modern interpreters are prone to call it nitro-aerian particles. Hartog, however, recognizes that Mayow identified these nitro-aerian particles "with the animal spirits of his contemporaries." They are separated from the blood in the brain, whence they travel along the nerves to the muscles. In the *Tractatus quartus de motu musculari* Mayow holds that the *spiritus nitro-aereus* contributes to *motus animalis*, which Willis in his *Exercitatio de motu musculari* ascribed to animal spirits. After asserting that muscular contraction is performed partly by animal spirits, partly by particles from the blood, Mayow goes on to contend that the animal spirits on which muscular contraction depends consist of nitro-aerial particles. If saline-sulphurous particles invade the brain, they stir up the nitro-aerial particles there (i.e., the animal spirits) to inordinate movements, as in the case of drunkenness, epilepsy, and the mental disorders mentioned. Mayow is less favorable to the notion of a vital flame which heats the blood and excites light, by whose rays, transmitted to the brain, the sensitive soul is supposed to be affected.¹⁰⁴ The many little bubbles thrown off by recent arterial blood in a vacuum corresponded to so many aerial particles. So perhaps it is justifiable to speak in terms of his nitro-aerian particles, although he himself put *spiritu nitro-aereo* in his title and further talked of *spiritus nitri acidus*. In describing actual experiments, he was more likely

¹⁰² *Opera*, 1681, p. 355: "... non tam a spirituum animalium diatesi vitata quam ab eorum motu perturbato aut etiam defectu oriri verisimile est; siquidem cum spiritus animales e materia aetherea constant, iidem mutationem subire prorsus nequeunt."

¹⁰³ *Ibid.*, 354-55: "Hic spectat observatio haud semel a me facta. Nem-

pe quosdam noveram paroxymis veluti maniacis et insuper convulsionibus corripit silotos quorum sputum dum istiusmodi paroxymis laborarunt igni immissum instar olei seu potius pyril ritu in flammam prorumperet."

¹⁰⁴ *Opera*, 1681, p. 138, "... a cuius radiis ad cerebrum transmissis Anima Sensitiva conflari supponitur."

to speak in terms of particles. But the point that should not be lost sight of is that, while he was influenced by and working toward the corpuscular philosophy of Robert Boyle, he had not yet by any means completely broken away from the habit which we have seen in Telesio, Francis Bacon and many others of explaining much in nature and man by the action of spirits. Anyway, in their thought, too, the spirits were very minute and subtle particles. And we have seen, or shall see, many others combine the hypothesis of material spirits with the corpuscular philosophy. Nor was the mind of Mayow entirely free from half-digested and uncritical ideas.

Mayow's treatment compares very favorably with that of Mariotte, who in his discussion of the nature of air in 1676, also used the expression "nitro-aerial spirit of the air,"¹⁰⁵ and admitted that air was necessary to support combustion, but denied that it changed into fire or gave up a nitro-aerial matter to support it, arguing that the flame depended rather upon the amount of air pressure. He further denied that air was the cause of the rotting of fruit and deterioration of wine, and said nothing of iron rusting. He thought that the air was blue in color, and held that it was not necessary to conclude that air mingled with the blood in the lungs during respiration, since there was also aerial matter in the blood in the veins, and the livelier color of arterial blood could be otherwise explained.¹⁰⁶ He denied that the tendency of adjacent bodies to cling together was an effect of air pressure, since it was equally true in a vacuum.¹⁰⁷

The prominence of nitre in the thought of the time is shown by the fact that even in an exposition of the philosophy of Aristotle by

¹⁰⁵ *Discours de la nature de l'air*..., Paris, 1923 (in *Les maîtres de la pensée scientifique*), p. 58, "...l'esprit nitro-aérien de l'air comme quelques chimistes le nomment."

¹⁰⁶ *Ibid.*, 60-62. There follow in the same volume *De la végétation des plantes*, treated in our chapter on Botany, and only the first of Mariotte's three letters of *Nouvelle découverte touchant la vue*. The excuse given is

that whereas it sets forth the experiment proving the existence of the blind spot, the other two maintain the thesis that the choroid and not the retina produces luminous perception, which is recognized today as wholly erroneous. Hence "it was useless to reproduce the text where it is defended." What a way to disguise the history of science!

¹⁰⁷ *Ibid.*, 43-44.

a Jesuit, nitre was adduced to explain why it almost never rained but sometimes sleeted in Egypt. The good father, however, also touched upon sign language and secret writing and entitled his work *Philosophia curiosa* as well as *Universa Aristotelis philosophia juxta communes sententias exposita*.¹⁰⁸ Also we have heard Nicolas de Locques before Mayow glorify nitre as an almost transcendental source of life, present in the other three elements as well as the air, and even in the heavens, indeed composed in part of light.

From theory as to the constituents of air in general, and its effects upon respiration and life, we turn to a work upon the air of a particular place.

A dissertation which Giambatista Juanini or Giovanini (1636–1691) completed at Madrid on July 13, 1679, is concerned chiefly with the air of that city.¹⁰⁹ It states how the air can charge itself with salts, what fermentation is, and that the earth's surface at Madrid is full of salts. Such recent authors as Willis, Du Hamel and Becher are cited. The air of Madrid contributes to the production of herbs that grow on its roofs and can injure the health of those breathing it. It gives rise to crudities and wind in the stomach, is capable of coagulating the blood, and causes syncopal fevers. It thins the blood more than the air of any other country. No nation endures phlebotomy more readily, because the Spaniards breathe in air impregnated with nitre which converts their blood into spirits. But for the same reason they cannot stand large sweats, which increase the fermentation of the blood, make it more volatile, and so dissipate the spirits. The air of Spain rarefies the blood and gives the Spaniards subtlety and penetration, although they have difficulty in applying themselves. Juanini goes on to explain why syncopal fevers occur only in Spain and to set forth the admirable virtues of quinine. By way of digression he has said that the tides are slight in the Mediterranean Sea because it is not so salt as the ocean—whereas the opposite is true, and to cite Cabeo as

¹⁰⁸ By Adalbertus Tylkowschius (Tylkowski), 1681, 8 vols. in-12: JS X (1682), 92-96.

¹⁰⁹ The original was in Spanish. I have used a French translation of 1685, *Dissertation physique ou l'on montre*

les mouvements de la fermentation, les effets des matieres nitreuses dans les corps sublunaires, et les causes qui alterent la pureté de l'air de Madrid, Toulouse, in-12, vi, 102 pp. BN R. 54911.

attributing the tides to the great force of sulphurous and nitrous spirits in the ocean. He himself believes that the moon contributes a great deal but could not produce the tides without some matter which ferments and so elevates the water.¹¹⁰ Other works ascribed to Juanini are *Varied Secrets*, dedicated to Charles II of Spain (1665-1700) and a *New Idea Physical Natural Demonstrative*.¹¹¹

In connection with the air of Madrid it may not be amiss to quote a passage from Robert Boyle's *The General History of the Air*, Title XXVII:

I inquired of my lord of Sandwich and a couple of gentlemen that accompanied him, whether it be true, which is reported of the purity of the air at Madrid, that though they have no houses of office, but every night throw out their excrements into the streets, yet by the next morning there remains no more smell of them. To which I was answered that it was true the excrements were so disposed of, but that Madrid is the stinkiest town they ever came into; yet that it was difficult to discern in the morning any peculiar smell of what had been cast into the street by night: but they jointly affirmed that the place, where the ambassador's numerous family resorted to make water in, did not smell of piss; and that they often observed the dogs and cats, that lay dead in the streets, were deprived of stench: and his lordship supposed, that the stench of a dead mule would in few hours vanish.¹¹²

When Thomas Burnet, also author of *The Sacred Theory of the Earth*, issued his *Thesaurus of medical practice* in 1672, he not only collected from 117 writers, ancient and modern, passages anent 410 varieties of disease arranged in alphabetical order, but included a discussion of ruminating men.¹¹³ Nor were these limited to the biblical case of Nebuchadnezzar, who is not mentioned in the review of Burnet's volume in *Philosophical Transactions*, whereas we are told that post-mortems performed on such persons have shown either the esophagus "everywhere fleshy like a muscle or their stomach very rough and large." Also one of such ruminating men, when sick, did not chew the cud at all, abstaining as oxen and cows do, when they are not well.

¹¹⁰ *Ibid.*, pp. 41-42.

¹¹² *Works*, 1772, V, 716-17.

¹¹¹ Corte, *Notizie storiche intorno a' medici scrittori milanesi*, (1718), 193-95.

¹¹³ *Thesaurus medicinae practicae*, London, 1672: reviewed, PT VII, 5105-6.

Years later in the *Philosophical Transactions*, Frederick Slare, M.D., contributed an account of a young laboring man at Bristol, "of tolerable sense and reason," who ruminated. After a quarter of an hour or more had elapsed, he would begin to chew his food over again, and chew for about an hour and a half, "the taste being somewhat more pleasant than at first." He was about twenty and had ruminated as long as he could remember. His father did so sometimes in small quantities, "but nothing like this." Dr. Slare goes on to say that very few such cases are recorded in history. Fabricius ab Aqua Pendente mentions a monk of Padua and a noble of that city whom he dissected "and found only one large but very rugous ventricle." Sennert notes one case, as do Salmuth and Velschius, but they give no details. Ludovici's instance ruminated with aversion, and the two examples offered by Pierus "were boorish and foolish, and lived with beasts as calves and sheep."¹¹⁴

Peyer in his careful work on ruminating animals and the organs employed,¹¹⁵ included some ten instances of ruminating men, of whom some were observed by himself. He was inclined to attribute it to the imagination of the mother while pregnant.

The Five Centuries of Medical Observations and Cures by Binninger of Mömpelgard or Montbéliard¹¹⁶ express his belief in the possibility of the transmutation of metals,¹¹⁷ and comprise such items as the vomiting of live millepedes, an infant who was neither male nor female, a wounded person predicting weather change because the spirits and humors in the congested veins and arteries of the healed or healing wound sense it more keenly, and the violent spontaneous death of hypochondriacs.¹¹⁸ He also tells of a magnet a foot and a half square and six or more fingers thick attached to a beam, to which iron of corresponding size was so tightly attached that heavy weights would not dislodge it, and which raised him into the air when he tried to detach it.¹¹⁹

¹¹⁴ PT XVII (1691), 525-27.

¹¹⁵ Joh. Conr. Peyerus, *Merycologia seu de ruminantibus et ruminatione commentarius*, Basel, 1685, in-4.

¹¹⁶ Joh. Nicolai Binningeri . . . *Observationum et curationum medicina-*

lium centuriae quinque . . . Montbelgardi, 1673, in-8, 622 pp. BNTd³⁴.155.

¹¹⁷ *Ibid.*, p. 28.

¹¹⁸ *Ibid.*, pp. 303, 357, 380, 408.

¹¹⁹ *Ibid.*, p. 27.

In 1673 Hermann Grube published a book on Arcana of Medical Men which are no Arcana, in which he attacked the belief in a universal medicine, weapon ointment or sympathetic unguent, the transplantation of diseases, the doctrine of signatures in plants, the gathering of herbs under certain constellations, and the use of letters, words and characters. But the effect of his questioning the transplantation of diseases was at least neutralized by the fact that there was prefixed to his work a long letter by Thomas Bartholinus, whom Grube repeatedly praised in the body of the text and represented as the discoverer of the lymphatic vessels, on the transplantation of diseases which was quite favorable thereto.¹²⁰ Thomas's "epistolary dissertation" filled sixty-four pages, to which he added a postscript, as we have said, of fifteen or sixteen pages more extracted from Tentzel's *Medicina Diastatica*.

Grube had contended that both weapon ointment and transplantation required action at a distance. He quoted a page in German on a method of transplanting gout repeated by Timaeus von Gueldenklee from a manuscript of Wechner but concluded that the notion of transplantation of disease was absurd, and again quoted Gueldenklee against it as superstitious and magical.¹²¹

Bartholinus, on the contrary, held that because of the credulity of the vulgar, amulets, transplantation and other arcana which Grube denied, worked for them. Also many things hidden from us were manifest to nature. He adduced Burggrav's lamp; the antipathy between cats and mice from some occult principle, so that, if a granary were sprinkled with the ashes of cremated cats, mice would not enter it; and the fact, as he supposed, that hazel wood collected under a certain position of the stars would stay the flow of blood, even if it did not touch the part affected. Once he was told of the deformity of a hunch-back being transferred to a tree, and when he was in Calabria the natives informed him that it was not

¹²⁰ *De arcanis medicorum non arcanis commentatio . . . cui praefixa Thomae Bartholini de transplantatione morborum epistola*, Copenhagen, 1673.

¹²¹ *Ibid.*, pp. 45-46, 51, quoting Timaeus von Gueldenklee, *Epistolae*

medicinales, V, 8. The pest tract of Timaeus appeared in German in 1630; his *Casus medicinales*, based on 36 years of practice, in 1662; while his *Responsa medica et Dietetica* was published posthumously in 1668.

uncommon there for diseases to be transferred to the leaves of trees. Haemorrhoids could be cured in early spring by touching them with the herb chondrilla or suspending it from the neck or back or the patient. Peter Castellus of Messina said that if the chondrilla dried up, the haemorrhoids would too; but that if it rotted, they would. Transplantation of disease to solid bodies such as stones and metals was rare and difficult to explain, but he gave some instances of it. He cited de Boodt that a turquoise would break, if its bearer fell, and quoted Burggrav at length as to the transfer of a disease to a dog or pig by inserting blood of the patient in an egg. Or, if the urine of a sufferer from quartan fever were mixed with flour and spread on trees, as birds ate the paste, the fever would gradually disappear. Or, if an egg were boiled in urine of the patient voided at the moment of the paroxysm until all the humidity was consumed, and were then shelled and thrown into the latrine, the fever would cease as soon as the ants consumed it.

Perhaps because he was dissatisfied with this presentation of the subject by Bartholinus, Grube the next year issued *A New Analysis of the Transplantation of Diseases* of his own.¹²² In it he cited the letter of Bartholinus only once, although he also cited a communication by him to the German Ephemerides, and in both cases called him "the incomparable Bartholinus."¹²³ He admits that in dealing with cases of melancholy words may be more effective than herbs, and use of craft and ridicule than employment of strong measures. But he refuses to accept magnetic action in medicine, and rejects the transplantation of disease as requiring it. Even in blood transfusion he sees difficulties, but "this surgical method of cure" is supported by so many celebrated experiments, that he will merely ask, Is that new surgery a proof of magnetic transplantation as commonly understood? And many persons make many incredible assertions as to the force of stones as amulets.¹²⁴

Five years later, in a treatise on the bite of the tarantula, Grube again asked what possible affinity or relationship there could be

¹²² *De transplantatione morborum analysis nova*, Hamburg, 1674.

¹²³ *Ibid.*, pp. 34, 36-37.

¹²⁴ *Ibid.*, pp. 8, 10, 13, 52-53, 86.

between the human patient and the blood of a cow thrown into the fire.¹²⁵

In the preface to the same treatise, Grube censured those who restricted the scope and importance of natural science by attributing natural phenomena to God or demons or the power of imagination, and those, on the other hand, who stretched the bounds of natural science too far to include idle superstition or magic. At the same time it must be admitted that these border line subjects had a very considerable attraction for him. In the preface to *De transplantatione* he referred to the salamander and was planning a work on amber (*Succinologia*); in that to *De ictu tarantulae* he is meditating a commentary *De fascino*.

On the other hand, he was convinced that medicine in his time was making real progress, and that the genuine arcana were not a universal medicine or weapon ointment or transplantation, but Harvey's enunciation of the circulation of the blood, Thomas Bartholinus's discovery of the lymphatic vessels, Sylvius's tracing the origin of intermittent fevers to obstruction of the pancreatic ducts by pituita, and Willis's associating them with fermentation of the blood and disorders of the juice in the nerves. The discovery of Bartholinus threw much light upon dropsy and its cure, and showed that the neck was the most convenient place to apply vesicatories or other medicaments for catarrh.¹²⁶ In intermittent fevers clysters are now a singular arcanum, and Sylvius attributed hysteria and hypochondria to the pancreatic juice.¹²⁷

We have seen that material spirits in the human and other bodies were employed to explain anything and everything in nature that could not be accounted for otherwise from Telesio to Francis Bacon and on through the seventeenth century. One further example not hitherto noted is Letters concerning animal spirits, which Tobias Ludwig Kohlans had written privately to Johann Daniel Horst, but which were divulged at the request of other friends and printed in 1658.¹²⁸ On the other hand, Steno,

¹²⁵ *De ictu tarantulae et vi musices in eius curatione*, Frankfurt, 1679, p. 18.

¹²⁶ *De arcanis*, pp. 171, 195-96,

179-80.

¹²⁷ *Ibid.*, 200, 206, "Arcana ex inventis Willisianis," 218 et seq.

¹²⁸ LR 1029b.

during his stay in Paris in 1664–1665, in a discourse on the brain before Thévenot's circle, had called the very existence of animal spirits into question.¹²⁹

Despite all this, Sebastian Wirdig (1613–1687), a pupil of Senner and professor at Rostock and called *clarissimus* by Paschius,¹³⁰ in a book published at Hamburg in 1673, professed to set forth a "New Medicine of the Spirits, a curious science and doctrine hitherto unanimously neglected and properly cultivated by no one."¹³¹ While the human soul was immaterial, indivisible and immortal, the spirits were most subtle bodies, round, hot, humid, mobile, divisible, and mortal. They constituted a medium between soul and body; could be generated, dissipated and resolved; upon them depended health and disease, life and death. When in a crude vegetative or brutish state, not yet sufficiently elaborated nor sufficiently impregnated by the spirit of the air and stars and specifically adapted to the human body, they were called natural spirits. When perfused, impregnated and vivified by the occult food of the air and astral fire, and further ventilated, elaborated and perfected in heart and arteries, they became vital spirits. When further sublimated, extenuated, exalted and rectified in brain and nerves, they became animal spirits, while genial spirits were those which worked for generation in the spermatic vessels. But from the conflux and combination of them all arose one complex of spirits—one spirit. For just as the spirits, rays and influences of the stars mingle and flow together to constitute one spirit of the world and universe, so in the microcosm the natural, vital and animal spirits form one spirit.

Wirdig did not rely merely on spirits, however, but also on the powers of phantasy, the influence of the stars, magnetism, sympathy and antipathy, and occult qualities. Indeed, some of his tenets bordered so closely upon the magical, that they were condemned by the theological and medical faculties of Wittenberg

¹²⁹ *Nicolai Stenonis Opera philosophica*, ed. Vilhelm Maar, Copenhagen, I (1910), vi, xx. The *Discours de M. Stenon sur l'anatomie du cerveau* was printed in 1669 and reviewed in JS II (Feb. 10, 1670), 585–87.

¹³⁰ *De novis inventis*, 1700, pp. 353–59, with quotations from Wirdig's book. See also the summary in Stolle (1731), 295–97.

¹³¹ For the full Latin title see note 133 below.

and Rostock. According to this censure, he held that fascination was performed not merely by the power and *praestigia* of immaterial spirits and strong phantasy, but also by other means and natural remedies, and so fascination might be natural. Wirdig further contended that all magic, even diabolical, which is performed by natural means, is natural. We resist such fascination by animosity and by combustion by fire, which consumes and annihilates the instruments of fascination, and frees the spirits which have been bound. The first imbuition and infusion of astral influences is the basis of talismans or astrological images. In repeated infusion by fire a metal loses certain spirits which are not fixed, and in their place succeed other spirits from the planet active at that time. Talismans should be fabricated under certain constellations, and when the planet concerned is dominant. Van Helmont, however, would have the virtues of talismans flow from the microcosmic heaven (i.e., presumably from human imagination), and in consequence they are little used in medicine today and are suspected by many.¹³²

Such is the impression of Wirdig's book that we get from Paschius and Stolle. For further detail, let us turn to the work itself.¹³³

The sensitive soul is nothing but a congeries of spirits. God forbade eating the blood of animals, because their soul, that is, spirits, are in the blood. The forms or souls of brutes, vegetable souls, heavens, stars, air, are all spirit. Fire and light are spirit. All bodies are congealed by spirits, and cold is spirit. The moon is the fount of cold; darkness is spirit; ideas are spirit or spiritual

¹³² Theses V, VI, and VII, *Censurae theologico-medicae*, given by Paschius, *De novis inventis*, 1700, pp. 356-57, from Michael Siricius, *Victrix Veritas*, 1684.

¹³³ *Nova Medicina Spirituum, curiosa scientia et doctrina unanimiter hucusque neglecta et a nemine merito exculsa, medicis tamen et physicis utilissima, in qua primo spirituum naturalis constitutio vita sanitas temperamenta ingenia calidum innatum phantasiae vires ideae astrorum influentiae,*

metempsychosis rerum magnetismi sympathiae et antipathiae qualitates hactenus occultae sensibus tamen manifestae aliaeque caeteroquin abstrusa et paradoxa. Dehinc spirituum praeternaturalis seu morbosa dispositio, causae, curationes per naturam per dietam per arcana majora palingeniam magnetismum seu sympathieismum transplantationes amuleta . . . demonstrantur, Hamburg, 1673, in-12. BM 784.a.25.

substances, which Wirdig regards as a paradox hitherto unheard of. Air is a principal ingredient of spirits and is impregnated with astral rays and spirits.

The expression, Nature, is used in different meanings: sometimes for God, sometimes for all creatures, sometimes for their virtues, sometimes for that regular law divinely inspired and involving magnetism and sympathy and antipathy, sometimes for strength and weakness of spirits; sometimes for morals.

The human soul is not subject to manifest qualities nor to the influence of the stars. The speech of genii and separate souls is mere thought, revolution of ideas, fluctuation of things once heard and seen. Since the soul is spiritual light, it is no wonder if in suffering and strong phantasy it radiates in an instant and so to speak lightens and by its strong radiation often works marvels. The phantasy of lust renders the seed prolific, prints moles on the embryo, sometimes produces a monster. The idea of sunlight impressed on the eye lasts after it has been closed. The spirits of epileptic boys are so profoundly impressed by terror, that the disease becomes hereditary, even unto the third generation. Ideas stamped on the spirits by the senses recur in dreams. Morbid ideas generate epilepsy and hydrophobia. Allergy to cheese, butter, apples, roses, is passed on hereditarily. Wirdig misrepresents Redi¹³⁴ as having shown by his observations at Florence that vipers are not venomous, and agrees with Charas¹³⁵ that their poison is irate spirits. Helmont extinguished and obliterated ideas by submersion in water, as the desire of a hen to sit on eggs is overcome. Kircher's *Ars magnetica* is quoted for a page, and Roger Bacon on the secret works of art and nature for another page.

The air is continuous with the sky—there is no wall between, and the stars scatter active heat, rays and spirits. Wirdig does not understand how anyone can deny virtue and operation to other stars than the sun and moon. They are of the same material and have light. He believes in a wonderful harmony between the heavenly bodies and our spirits. He defends astrologers for erecting their *thema genethliaca* at the moment of birth rather than at that

¹³⁴ Spelled Thedo; corrected in the *Errata* to Rhedo.

¹³⁵ Or rather, says that Charas seems to agree with him.

of conception, for the child then first receives the celestial rays and spirits.

And this, in my judgment, is the basis and reason, hidden from many, of fabricating talismans.

The expression, spirit of the universe has two meanings today: one, for the rays, influences and spirits of the heavens, sun and stars; the other, for the spirit of the volatile salt of earth, employed by Borellus to dissolve gold.

Magnetism and sympathy are explained by consensus of spirits. Incidentally Wirdig accepts the Copernican movement of the earth but still insists on the consensus of superiors and inferiors. Occult qualities are also due to spirits. Fascination is explained by the fact that the spirit of one man may command the spirits of another. This may be through voice, song, gazing with strong intent, contact, hurling javelins, shooting arrows, beating, and many other illicit methods employed by witches, by illusions formed by demons in the air, by human *mumia*, herbs, parts of animals, corpses, bones and cast-off garments. But all these enumerated fascinations Wirdig pronounces natural, and says that demons are not allowed to employ supernatural methods but only to use or abuse natural means.

In the second book we come to the causes and cures of disease and begin with the preternatural or morbid disposition of the spirits. Acidity is the cause of all diseases, fevers are diseases of the spirits, and so on. Then we come to chemical remedies. Wirdig admits that he has been only partially succesful in following a prescription of Helmont and in attempting the resuscitation of plants.¹³⁶ He accepts the transplantation or magic transfer of disease, and affirms that multiple experience has taught that amulets are efficacious. Talismans are today less used and by many suspected, but Wirdig again cites Kircher and quotes Roger Bacon for nearly a page.

Nine years later a member of the Congregation of St. Maur attempted to demonstrate a circulation of the animal spirits, analogous to that of the blood. From the brain they moved through the nerves to their extremities, returning by the lymphatic vessels to the

¹³⁶ *Nova medicina spirituum*, II, 25; pp. 228-29.

subclavian vein and heart, thence through the carotid arteries and chorioid plexus to the pineal gland and three anterior ventricles of the brain.¹³⁷

The New and Mechanical Explanation of the actions of animals by Daniel Duncan, M.D. of Montpellier,¹³⁸ explains that the odor of some delicate morsel makes the mouth water because the fifth pair of nerves sends one branch to the olfactory nerve and another to the optic nerve, and that the spirits in these nerves cannot be stirred up much without the disturbance passing to the mouth and causing the saliva to flow.¹³⁹ A musical note is correctly repeated, because the sound heard is communicated to the spirits in the auditory nerve, which pass from the ear to the larynx and impress it upon the muscles there and make them vibrate almost the same as the cords of the instrument which produced the sound.¹⁴⁰ But how does the animal repeat the sound after a lapse of time? It must be that the spirits, by virtue of having been pushed by certain sounds, have opened up certain passages in the cerebellum, in which they cannot re-enter without having to go to the vocal muscles in the same way that they have been struck by the sound in the first instance.¹⁴¹

Imagination, too, is for Duncan entirely a matter of movement of the spirits. If the conduits in the brain surface are very narrow, they contain only a minimum of spirits, and the undulations there are consequently so slight that they are imperceptible to the soul, which can then have only a very sterile and imperfect imagination. Women, who have softer brains than men, have livelier and more penetrating imaginations when they engage in belles lettres. But they must have plenty of spirits, too. Impediment of the conduits causes chimerical and monstrous imaginings. Persons with too subtle spirits do not imagine so well as others, but because of the great mobility of their spirits they imagine more in one hour than others do in four. Those whose spirits have more consistence have

¹³⁷ *De circulatione spirituum animalium tractatus*, Paris, 1682, in-12. *Acta eruditorum*, III (1684), 311-13.

¹³⁸ *Explication nouvelle et mécanique des actions animales . . . etc. . .*, Paris, 1678, in-8, xvi, 449 pp. BN

8°Tb7.20.

¹³⁹ *Ibid.*, p. 251, in cap. 17, "Du mouvement sympathique."

¹⁴⁰ *Ibid.*, p. 257.

¹⁴¹ *Ibid.*, p. 258.

clearer and more distinct images, because they hold their form longer, and the soul has time to examine all their particularities. The air we inhale by mingling with the blood affects the spirits, so that Italians who live in clear air have finer imaginations than northerners whose air is thickened by fog and cold.¹⁴²

Duncan still retained the conception of macrocosm and microcosm, saying that as the sun and moon were in the one, so in the other the two great stars were the brain and the cerebellum.¹⁴³ In another work a few years later he stated that Nature both in microcosm and macrocosm followed the rules of chemistry exactly.¹⁴⁴

Giovanni Alfonso Borelli (1608–1679), in his posthumous work on the movement of animals,¹⁴⁵ ascribed muscular movement, as Mayow and Willis had done, to the fermentation of animal spirits and blood within the fleshy fibres. He denied, however, that the torpedo fish poisoned, or that the porcupine shot its quills.

In eleven discourses on the human head delivered before a learned audience and printed in 1680, Isaac Schoch inquired whether a head separated from the body could utter words without a miracle, why the human head was spherical in shape, why women could carry heavier loads on their heads than men, and why there were persons in Persia without sutures in the cranium.¹⁴⁶

From three decades of medical experiments in the years 1679, 1680 and 1681, "which advise the reader of most secret preparations,"¹⁴⁷ by Daniel Meno Matthiae, the *Journal des Sçavans* repeated two or three "of the most singular for the benefit of the curious."¹⁴⁸ One will suffice for us. A woman with a swelling in

¹⁴² *Ibid.*, pp. 349, 351, 354, 358–61.

¹⁴³ *Ibid.*, pp. 90–91.

¹⁴⁴ *La chimie naturelle ou l'explication chimique et mécanique de la nourriture de l'animal*, Montpellier, 1681, in-8.

¹⁴⁵ *De motu animalium, Pars prima*, Rome, 1680; *pars altera*, Rome, 1681.

¹⁴⁶ *Isaaci Schochii Disquisitiones historico-politico-medicae curiosae de capite humano coram multis rerum naturalium amatoribus tractatae et variis proloquiis ac permultis observati-*

onibus enodatas, Francofurti ad Viadrum, 1680. JS IX (1681), 126–27.

¹⁴⁷ LR 234 gives the title as *Experimentorum medico-chymicorum decades III in annum 1679, 1680, 1681, quae lectori communicant arcanissimas . . . praeparationes . . . Cui accedit Pharmacopaea Cracoviensis*, Francofurti, 1683, in-12. But JS XI (1684), 335, has *Experimentorum Medico-Physicorum Decades tres*.

¹⁴⁸ *Idem*, 335–36.

the right arm-pit was finally cured by a man who gave her nine grains of henbane seed in her soup. On the fourth day the pus came out of the tumor through nine openings corresponding in number to the grains of henbane.

Théophile Bonet was said to have planned a vast medical corpus of the law of nature to parallel the corpus of the Civil Law. His Northern Medicine, published at Geneva,¹⁴⁹ aimed to show how much improvement medicine owed to English, German and Danish physicians like Paracelsus, Helmont, Harvey, Lower, Bartholinus, Wharton, Willis, Betts, Schneider, Steno and Sylvius.¹⁵⁰ But it would appear that much of this progress was associated with monsters. The volume contains plates of monstrosities; the first of its three parts, dealing with diseases of the head, takes up monstrous births without brains or without heads, with too many heads, and with misshapen heads; while part two, on diseases of the mouth and breast, contains an account of a faceless monster which breathed through the neck. Other passages that impressed the English reviewer of the volume as deserving repetition were the case of the senator's wife who caught consumption from wearing the muff of his first wife who had died of that disease over a year before, Lower's experiment by dissection of making a dog breathe like a broken-winded horse, and "famous Historyes of men swallowing odde substances." About the only indication of real progress is in the following passage:

The famous experiment of restoring the humours of the eyes was at last resolved into their natural restitution from the same humours being replenisht those ways they are constantly nourished, and not from their being repaired by the injections of Burrhus or any other pretender.¹⁵¹

¹⁴⁹ Theophilus Bonetus, *Medicina septentrionalis collatitia s. rei medicae nuperis annis a medicis Anglis, Germanis et Danis emissae sylloge et syntaxis*, Geneva, 1685; reviewed, PT XV, 866-69; JS XII, 264-66.

¹⁵⁰ Malpighi is also listed, perhaps because of his contributions to the English *Philosophical Transactions*.

Three days before his death, which occurred on November 25, 1694, he signed with his own hand a volume which he ordered to be delivered to his colleagues of the Royal Society by whom it was published posthumously: PT XIX, 469, 545-60.

¹⁵¹ PT XV, 867.

The French review in *Journal de Sçavans* told of the woman of Leipzig who lost a tooth whenever she gave birth to a child, and who could predict with certainty from the state of her teeth as to her children's sickness or death. It further repeated the case of a man who had been dumb for some time and recovered the use of his tongue, but only for an hour from noon to one P.M.¹⁵²

In a work published at about the same time Theodoor Jansson van Almelveen argued that most of the recent anatomical discoveries had already been known to the ancients.¹⁵³ Similarly a royal physician and doctor of Padua, following the lead of the *Hippocrates chimicus* of Tachenius, tried to trace the distinction of acid and alkali back to Galen and Hippocrates.¹⁵⁴

Gustavus Daniel Lipstorp offered a dissertation on the pores of the human body at the University of Frankfurt on the Oder in 1685, and engaged in a disputation for the doctorate on animalcules generated in the human body at Leyden in 1687.¹⁵⁵

In 1687 appeared a work by Heinrich Gerhard Herfelt on the machine of the human body and the noble center, seat or leash of the mind according to the anatomical observations of Willis, Bartholinus, Malpighi, Fracassati, Harvey and others—we have heard him cite Mayow—and the method of Descartes.¹⁵⁶ In the opening chapter he combined the three elements of Descartes with the three *principia* of the chemists. He thought the conformation of the head a basis for physiognomy, but held that the soul was united with the purest and most subtle spirits in the body rather than with the pineal gland of Descartes, and associated the mind with the purest part of the blood, which again amounted to spirits. He delighted

¹⁵² JS XII, 265.

¹⁵³ *Theod. Janssonii ab Almelveen Inventa Nov-antiqua, i.e., brevis enarratio ortus et progressus artis medicae ac precipue de inventis vulgo novis aut nuperrime in ea repertis*, Amsterdam, 1684, in-8.

¹⁵⁴ François Aignan, *L'ancienne médecine à la mode, ou le sentiment uniforme d'Hippocrate & de Galien sur les acides & les alkalis*, Paris, 1693, in-12.

¹⁵⁵ *Diss. . . de poris humani corporis praeside D. Bernhardo Albino*, in-4, 72 pp., BM 1179.k.5(17); *Disp. . . de animalculis in humano corpore genitis*, in-4, BM B.426(17.).

¹⁵⁶ *Philosophicum hominis de corporis humani machina deque centro nobili sede seu vinculo mentis tractans confirmatum observationibus anatomicis . . . Willisii Bartholini Malpighii Fracassati Harvaei aliorumque methodo illustrissimi D. Cartesii concinnatum*. Leyden, 1687. BN R. 38436.

in the discussion of such questions as why Ethiopians have dark skins, why hair comes later and lasts longer on the chin and groin of man than on his head, why brutes are hairy all over, why epilepsy is contracted more from brushing the teeth too much than from cutting the nails too much, why infants at teething time are so subject to fevers, convulsions and diarrhoea, and why women not giving milk remain more beautiful. The matter of the tongue was mostly from the brain, and the *membrum virile* could be bewitched.

Francis Zype of Louvain and Brussels composed a book on the foundations of reformed medicine.¹⁵⁷ In the preface to the reader he took a very rosy view of "the happy age in which we live," with chemists toiling untiringly, physicists disputing interminably, and all intent on snatching nature's arcana from her within a few years. He further spoke of "the marvelous variation and illumination of medicine." Many things that were once held true had become ridiculous. Reason prevailed over authority. Many useless things had been eliminated. Naked truth was sought after. Zype wrote to reflect this great progress, but he hardly succeeded in doing so in detail. He rather preferred the three elements of Descartes to the four of Aristotle or three of the chemists. But medical men were not especially concerned as to the number of elements. It was enough for them to know that our body consists of particles which vary greatly in size and figure. There was only one spirit in the body, although it might be given different names as it performed different functions. But that in sadness the vital spirit was recalled to the heart was false.¹⁵⁸

Georg Wolfgang Wedel appears to have been one of the first to employ the word, physiology, in its present restricted sense. In his *Physiologia reformata* of 1688,¹⁵⁹ he favored a chemical outlook, but held that the first and second matter of the schoolmen and the elements of Aristotle and Descartes could be interpreted in chemical terms. He talked of ferment, balsamic and sulphuric, and

¹⁵⁷ *Fundamenta medicinae reformatae physico-anatomica*, editio secunda . . . aucta, Bruxellis, 1687, in-8, 524 pp. BM 544.c.26. Zedler lists the first edition of Brussels, 1683, in-8, reviewed in *Acta eruditorum* (1683),

p. 536, and others at Lyons, 1692 and Brussels, 1693, but not this second edition of 1687.

¹⁵⁸ *Ibid.*, pp. 6-12, 9, 138, 143.

¹⁵⁹ Jena, apud Joh. Bielkium, in-4.

archeus, but did not think that all life could be explained by interaction of acid and alkali.¹⁶⁰ He also rejected Descartes' emphasis upon the pineal gland. The vital spirits circulated with the blood, but the animal spirits with the lymph. He did not accept the current theory that from the air nitrous-aerial particles or spirits were brought into the blood. On the one hand, he represented the human body as a machine which followed hydraulic, pneumonic, chemical and mechanical laws. On the other hand, he held that the foetus was formed "from the actual actuation of ideas," and not from Leeuwenhoek's little worm in the semen of the male. Moreover, he spoke of arcana of the microcosm, identified the sensitive soul with light, and believed that the temperament of the individual was determined by the stars, especially the sun and moon. But he abandoned the view that life progressed or declined by groups of seven or nine years. There were climacteric years, but they varied with each individual.¹⁶¹

When Pierre Petit of the medical faculty of Montpellier passed away on December 12, 1687, he was known primarily as a poet and secondarily as an Aristotelian. He had practiced medicine little and had published little in that field.¹⁶² But among his papers were found more than forty unpublished or unfinished works, of which seven or eight were religious, nine philosophical, five physiological, five biological, three psychological. Five more dealt with scientific topics: the eternity of the world, elements and mixed, colors, caverns, and notes on the *Exercitationes* of Scaliger against Cardan, while two others were on the occult causes of human nature and the power of the celestial bodies and the force which they exert upon sublunar bodies.¹⁶³ Also he had already published a work on the sibyl in 1686. We have noticed his reply of 1663 to Isaac Voss on the nature of fire and light in an earlier chapter.

Writing in 1699, Bertini said that a few years ago medical men

¹⁶⁰ In this same year, 1688, however, was translated into Latin with the title, *Fundamenta Medica*, a work written in Flemish by Cornelius Bontekoe in 1683, in which he had made the five chemical principles Acid, Alkali, water, fat and *caput mortuum*.

Acta eruditorum, II, 355; VII, 616-17.

¹⁶¹ *Acta eruditorum*, VII (1688), pp. 531-36.

¹⁶² JS XV, 198-200. "Eloge de Monsieur Petit."

¹⁶³ JS XVII, 254-57.

talked of nothing but ferments, but now had turned to other topics. Perhaps one of the last works on ferments was the *Diatriba* of Melchior F. Geuder in 1689.¹⁶⁴

Whereas Thomas Burnet had listed 410 varieties of disease, Johann Bernhard Gladbach in 1694 reduced all diseases to four cardinal complaints: fever, scurvy, indisposition (*cachexia*) and catarrh.¹⁶⁵ Incidentally he commended the oriental bezoar as far more efficacious than vulgar precipitants.

Although the notion that acid was the cause of all disease, and that all remedies were alkaline, had already been confuted by many most learned men, John Colbatch undertook to show specifically that the causes of many diseases were alkaline and that to employ alkaline remedies for these was very injurious.¹⁶⁶ In small pox, for example, testaceous powders and other diaphoretics broke up the globules of the blood, producing purple spots on the skin which were a sure sign of death, impeding the movement of the animal spirits through the nerves, and causing delirium. He offered a better method which he had tested on more than five hundred patients. In the first place, if the stomach was full of viscid matter, he administered a mild emetic, and then a syrup of poppy-seed or other opiate. To check the inordinate motion of the blood and strengthen its texture, he gave a julep of sugar, barley water, water of cinnamon, and orange or lemon juice. If the patient was already delirious, he bled him and administered stronger acids such as volatile spirit of vitriol, nitre, sulphur, mixed with barley water and water of cinnamon and duly sweetened with sugar or syrup. If the spirits of the patient were languid, he gave cordials, and, after the pustules had disappeared, he prescribed gentle purgatives five or six times, and finally corroboratives.

In the case of scurvy, too, chemical analysis showed that the blood contained more volatile alkaline particles than when in a

¹⁶⁴ *Diatriba de fermentis variarum corporis animalis partium . . . cui sub-jicitur dissertatio de ortu animalium*, Amsterdam, 1689, in-8. BM 784.c.20.

¹⁶⁵ *Praxeos medicae idea novissima . . .*, Herborn, 1694, in-8. See

Acta eruditorum, XIII, 359-63, for full title and summary of contents.

¹⁶⁶ *A Physico-Medical Essay concerning Alkali and Acid*, London, 1696; reviewed in *Acta eruditorum*, XVI (1697), 554-57. BM 7441.a.4(2.). is the second edition of 1698.

state of health, and some fixed lixivious alkali which is totally lacking in normal blood. Also experience proved that sailors who have scurvy are relieved by eating apples, oranges and lemons. Colbatch also highly recommended for it Glauber's tincture of antimony in a decoction of grains of juniper.

Nor was gout due to acid, since the matter extracted from the joints was manifestly alkaline. Rhine wine was not bad for the gouty because it was acidulous, but because it contained more spirituous particles than other wine. The blood of rheumatic persons also had more alkaline particles than that of healthy persons, and contained no acid. Colbatch therefore prescribed acid remedies for it such as tincture of antimony or Willis's preparation of steel.

Colbatch further told of a girl of ten who was cured of dropsy by being submerged in cold sea water, and granted that there were specific medicines which were neither acid nor alkaline. He urged medical men to give more attention to such specifics and to communicate them to the public.

In 1696 appeared a volume entitled *The Progress of Medicine*. Of its seven parts, one told of a child which remained for six or seven years attached to the womb; another dealt with a cist in the uterus; a third was on a mule which foaled last July near Nîmes; while a fourth explained the pyramidical shape of ears of corn, shoots of plants, and the flame of a candle.¹⁶⁷

Bartholomaeus de Moor, in *Thoughts on the Improvement of Medicine*, opposed the notion that there was a single disease, such as scurvy, and held that diseases were complicated and that there might be different species of the same disease. On the other hand, he thought that the blood might become too abundant and that venesection was then advisable. It was very helpful at the beginning of pleurisy but not later on. Prolongation of life depended chiefly upon preservation in good conditions of the animal spirits.¹⁶⁸

¹⁶⁷ *Le progrès de la Medecine . . .*, Paris, 1696, in-12. Reviewed: JS XXIV, 137-38.

¹⁶⁸ *Cogitationum de instauratione*

medicinae ad sanitatis tutelam morbos profligandos necnon vitam prorogandam libri tres, Amsterdam, 1695: *Acta eruditorum*, XI (1696), 370-75.

CHAPTER XXXV

PHYSIOGNOMY

Interest in physiognomy in the early century—Reasons for it—Polemon translated—Aldoriso on divination from laughter and reading character from handwriting—Scipio Chiaramonte—Camillo Baldi—Settala on moles—Ghiradelli—J. C. Frey—Adamantius and Melampus translated—Finella—Mascardus, Vecchius, Otto—Nicquet—Sanders—Works on chiromancy—Pompeius—Elsholtz, *Anthropometria*—Spadon—La Bellière—Philip Mey or Meijens—Helvetius—François Bayle, ten Ryne, Gwither—Works in manuscript—The close of the century.

*There's no art
To find the mind's construction in the face.*
—MACBETH

Interest in physiognomy in the early seventeenth century was shown in Spain by repeated editions of the work of Cortés.¹ In Germany, where the Chiromantic Aphorisms of Rodolphus Coclenius the Younger had already appeared in print in 1597,² there were further editions of works by him upon such subjects.³ Clemens Timpler published at Hanover not only a system of physics or natural philosophy, and a system of optics, but two books on the art of

¹ Gerónimo Cortés, *Phisonomia y varios secretos de naturaleza*, 1601, 1603, 1609, 1610, 1614, etc. See the Index of T VI, where the work has been treated more fully. Luis Fernandez, *Physiognomia*, 1602, seems to have had only that one edition, which I have not seen.

² *Aphorismorum chiromanticorum tractatus compendiosus ex ipsius certis fundamentis desumptus*, Lichæ, 1597. BM 1141.b.6.(2.). A MS *Trattato di chiromanzia di Rudolfo Coclenio* is contained in Accad. de'Concordi di Rovigo 8.3.17. Presumably it is the same as a brief chiromancy in Italian by

Redolfo (sic) Coclenio, printed in 1641: *Trattato di chiromantia*, Amsterdam, 1641, in-8: BM 8632.a.1. This edition has only 48 short pages but is divided into 24 chapters. It relates the lines of the hand and the mountains of the palm to the seven planets.

³ *Uranoscopia, chirosocopia et metoposcopia*, 1603, 1608, 1618; *Physiognomica et chiromantica specialia*, 1621, 1661, 1692. Samuel Fuschius, *Metoposcopia et ophthalmoscopia*, Strasburg, 1615, in-8, and Christian Moldenarius, *Exercitationes physiognomicæ*, Wittenberg, 1616, appear not to have been reprinted.

human physiognomy, which appeared in 1617 both separately and with the system of optics.⁴ In Italy by 1655 there are said to have been twenty-one editions of Porta's work on human physiognomy, first published in 1586, while his *Celestial Physiognomy* came out in 1603.⁵ *Ciro Spontone's La metoposcopia overa commensuratione delle linee delle fronte*, first printed at Venice in 1626, was re-issued in 1629, 1637, 1642, and 1654. Physiognomy, chiromancy and metoposcopy were treated in French by Taxil in 1614,⁶ by Belot in 1619, and by Froger in 1622, although the work of the last-named remained unprinted.⁷

The popularity of physiognomy is to be accounted for by the fact that, while other forms of divination, including for many even judicial astrology, were condemned as superstitious, it was regarded as having a natural basis. Even those who objected to the prediction of future events by its means, could employ it with a clear conscience to read the character and personality of other men or their own. There was a tendency to elaborate it too far and to extend its scope not only from the general features of the face and body to the lines of the forehead in metoposcopy, and the lines and *montes* of the hand in chiromancy, but even to nails on the hands and feet and to moles on the forehead and body. Such artificial extensions, like the attempts to link it with astrology, tended to associate it with divination in general, and we may not be able to keep our treatment of the two completely separate and distinct.

A Latin and Italian translation of the ancient Greek work of Polemon on physiognomy by Carolus Montecuccolus or Montecuccoli seems to have first appeared in print in 1612 together with his *Introduction to the Cabala*.⁸ The British Museum has four subsequent Italian editions of 1623, 1627, 1644 and 1652.

In 1611 Prospero Aldorizio published at Naples treatises on

⁴ For the Latin titles consult the BM catalogue.

⁵ T VI, 162-64.

⁶ T VI, 169-70.

⁷ T VI, 507-10.

⁸ *In Cabalam Introductio*, Modena, Julianus Cassianus, 1612; followed by *Polemonis Phsygnomia e graeco in*

latinum versa per Carolum Montecuccolum et cum translatione eiusdem Phsygnomiae in Italicam orationem conscripta; and by *Oratio . . . de laudibus D. Hyacinthi*, Modena, Jo. Maria de Verdia, 1612, in-4, pp. 40, 106, 80, 105.

Gelotoscopia or divination from laughter and on reading character from handwriting,⁹ the latter dedicated to the doge and senate of Venice. He asserted that he was offering something brand new in both cases: concerning laughter, "a new art, new method, new doctrine"; as to hand-writing, "a completely new and hitherto unthought of kind of science." He also contended that both were parts of natural philosophy. Laughter was a type of motion and closely connected with the spirits in and temperament of the human body. It varied in amount with the expulsion of air from the lungs, and in quality with the prevalence of one of the five vowels in it. For example, those men were most luxurious whose laugh employed the vowel a; next, those who used o in laughing; and least luxurious those employing the vowel i; while those using e and u were not luxurious at all. In his tenth and last part Aldorasio turned to the four ages of man which he associated with the four seasons of the year. Temperaments altered with them. Similarly in the work on handwriting he noted that the elements of the body of the writer altered after a space of seven years, and that the character of his handwriting was likely to undergo a corresponding change. Neither of these treatises seems to have been reprinted, although we shall see that the *Gelotoscopia* evoked a commentary from a Dominican theologian of Sicily, which, however, remained in manuscript. If neither work made much of a hit, this was perhaps less owing to their novelty than to the fact that neither got much beyond generalities.

Scipione Chiaramonte (1565–1653) opposed the Copernican system, in his *Anti-Tychonem* held that comets were sublunar, and wrote on a variety of subjects. His writings include a treatise on reading mind and character from external signs such as voice, movement of the body, care of the person, and from outward circumstances such as the weather, region, education. It is dated at its close October 3, 1620, but was printed in 1625.¹⁰ After some

⁹ *Gelotoscopia* (in Greek letters), 66 pp. BN Rés. V.1339; *Idengraphicus nuntius*, in 72 theses, BN Rés. V.1340. They are bound together.

¹⁰ Scipio Claramontius, *De conjectandis cuiusque moribus et latitantibus*

animi affectibus . . . , Venetiis, 1625, in-4, 448 pp. BM c.83.d.9. The dedication by Ludovicus Zuccolus to the cardinal vice-regent of Sicily is dated July 1, 1625.

consideration of Ptolemy's explanation of human traits and propensities and Plato's ascribing regions to demons distinguished as Saturnine, Jovial, Martial and so forth, Chiaramonte decides to disregard astrology. But he devotes more than a hundred pages to physiognomy.¹¹

Camillo Baldi (c. 1547-1634) in 1621 published at Bologna commentaries on the physiognomy attributed to Aristotle.¹² Eight years later there were edited at the same place by Hippolitus Scaffilionus or Scaffiglione, a doctor of medicine, two treatises upon human propensities¹³ and how to tell them from the person's temperament, and upon natural prediction from inspection of human nails,¹⁴ taken from Baldi's private lectures or other utterances.

The method of procedure in the former treatise is described as follows. First we seek to discover the "complexion" or individual character of the human body of the person concerned. Then from signs with which sense will supply us we learn the nature of the blood in the veins; this known, the spirits are made known to us; and when we know of what sort the spirits are, then the propensities made up from soul and body are revealed.¹⁵ Or, as it is put later, when we know the spirits, we shall have the disposition and matter related to fantasies and thoughts; they induce thoughts, appetites, dispositions and inclinations; these are followed by acts which form

¹¹ *Ibid.*, pp. 174-278. Two works which from their titles would seem to be of the same sort are: Ed. Neuhusius, *Theatrum humani ingenii sive de cognoscenda hominis indole et secretis animi moribus*, Amsterdam, 1633; Herm. Follinus, *Naturae humanae sive mores et temperamenta hominum usque ad intimos animorum secessus cognoscendi modus, methodo Arist.*, ill., 1649.

¹² In *Physiognomica Aristotelis commentarii*, Bononiae, 1621, in folio, 562 pp. Copy seen: BN R.725.

¹³ *De humanarum propensionum ex temperamento praenotionibus tractatus, ex privatis Camilli Baldi Bononiensis philosophi sermonibus olim ab Hippolito Scaffiglione medicinae doc-*

tore excerptus et in lucem editus. Quem dum propriis impensis excuderet moriens Persius Rossius Ludovico Ludovisio cardinali amplissimo S.R.E. vice cancelario, Bononiae archiepiscopo ac principi domino suo colendissimo sacrari mandavit. Bononiae, Apud Haeredes Ioannis Rossi, 1629 superiorum permissu. Copy used: BNR.6007.

¹⁴ *De naturali ex unguum inspectione praesagio comment. ab eodem Hyppolito Scaffilione medicinae doctore ex eiusdem Camilli Baldi Bonon. philosophi sermonibus collectus ac typis mandatus.* Same place, printer and date, and bound with the preceding work in the volume used.

¹⁵ *Op. cit.*, p. 2.

habits and character, from which may be predicted to some extent one's probable fortune, disease, health and length of life. This is not to deny free will or to affirm necessity or assert anything certain as to future contingents, or to call the soul corporeal and educed from matter.¹⁶

There follow in chapters 14-39 statements of the characteristics for each of varied temperaments-hot, cold, moist, dry, melancholic, and more complicated varieties-with classical examples of each and a prediction of the propensities of each. Of the last the following concerning persons of a hot and humid temperament may serve as a fair specimen.

They think that they can accomplish all by words, for we have called them garrulous and vain and boastful. Wherefore they promise that they will do many things and accomplish nothing. And when called to account, they laugh it off, and they laugh even when remonstrating. Consequently they are not punctilious in points of honor. And though they know or suspect that their wives and daughters are not living chastely, yet they do not grieve thereat nor are much upset. Not even if they are held for debt and are dragged off to prison, are they very sad and sorrowful.¹⁷

In the other work on natural presages from the spots on human nails, the author or editor attempts to distinguish it from chiromancy as physical and rational.¹⁸ The chiromancer gives no reason for his conclusions and pretends to predict concerning particular future events. The *Physicus*, as the investigator of spots on nails is called, on the other hand claims no more than to detect natural things and passions dependent on nature. "Nor as I think, is he to be ridiculed, who through nails and spots on nails persuades himself that he can know psychic propensities."¹⁹ But in the beliefs of chiromancer, astrologer, haruspex and magician there is nothing true or probable or verisimilar.

This was the way that the editor, Scaffiglione, had intended to leave the matter, but in a closing chapter²⁰ he tells us that, after he had completed the treatise, he was ordered by those

¹⁶ *Op. cit.*, pp. 22-23.

¹⁷ *Op. cit.*, p. 119.

¹⁸ *Op. cit.*, p. 18.

¹⁹ *Op. cit.*, p. 20.

²⁰ Chapter 25, at pp. 62-70.

whom he dared not disobey to examine the doctrines of chiromancy more exactly and refute them in more detail. He protested that he had said enough on this point in his tenth chapter, but this excuse was not allowed. He therefore affirms that he has always thought and still thinks that the minimum of truth is to be found in the particular responses of astrology, pyromancy, hydromancy, geomancy, necromancy, and all lot-casters who presume to announce anything certain as to particular future contingencies. Of the same sort are the views of chiromancers when they say, for example, that white marks on the nail of the index finger indicate coming honors and dignities; black spots, infamy and depression; that small nails signify a malevolent and contentious personality. Such statements may seem specious, but there is nothing in them that satisfies the intellect and indeed they are not to be believed. The chiromancers say that they are seeking good, and that God makes nothing in vain, but Scaffiglione argues further that future contingents cannot be predicted, and finally against their appeal to astrology and the stars. The general influence of the heavens cannot be gainsaid, but it may be impeded in particular and individual cases.

In a later edition of 1661 there was added to the two foregoing works by Baldi a third treatise by him on epistolary divination. This told how to discern the character of the writer of a letter from the handwriting as well as from the words and phrases which he used, his literary style and the thought expressed.²¹

A work on moles by Ludovico Settala of Milan was printed there with other treatises by him in 1626,²² and separately at Padua two years later.²³ He praised physiognomy and regretted that hitherto the subject of moles had been treated so briefly and ineptly that one might think it was a frivolous and idle form of divination. No one had explained why moles on the face have others scattered over

²¹ Camillus Baldus, *De ratione cognoscendi mores et qualitates scribentis ex ipsius epistola sive divinatione epistolari*, Bologna, 1664, pp. 215-46, of the volume. BN has two copies: R.6745 and V.12625.

²² Ludovicus Septalius, *Analyticarum et animasticarum disertationum*

(sic) libri II. *His accesserunt eiusdem* ... *de naevis* ... , Milan, 1626, in-8. BM c.74.a.15.

²³ *De naevis*, Patavii, 1628, in-8. BM 1169.b.4(2.). It is perhaps by a misprint that J. S. Elsholtz, *Anthropometria*, 1663, gives the date as 1618.

the body in corresponding order. Although God was not willing to disclose internal organs and members to our eyesight, he gave signs by which internal conditions may be known. Man is a microcosm and the parts of the human body match those of the macrocosm. In metoposcopy six straight lines across the forehead are referred to the other six planets and a triangular space to Mercury. Seven apertures of the face also correspond to the planets: eyes to sun and moon, nostrils to Jupiter and Mercury, mouth to Venus, and ears to Saturn and Mars. The moon controls vegetative force; Mercury, fancy and intellect; Venus, lust; the sun, vital force; Mars, wrath; Jupiter, natural actions; Saturn, retentive force. In estimating moles, such measurements are essential as from upper lip to nose, lower lip to tip of chin, the space between the eyes. Also all geometric figures are found in the face. Hand and face are of the same length, and the middle finger equals the distance from the roots of the hair to the tip of the nose. Moreover, the face is a mirror and principle of the entire human body. Some men are ten times as tall as the length of their face, some eight, rarely seven. But the perfect height is nine times the face, with three main divisions paralleling those of the face. Furthermore, the breast corresponds to the forehead, eyebrows to shoulders, cheeks to thighs, eyesockets to armpits, ears to arms; and the moles upon these similarly agree. Settala states the rule of the planets and signs of the zodiac over the parts of the human body, and has earlier related moles scattered over the face to the fixed stars. But he will not go into the astrological significance of such moles in detail, since he has approached the subject as a philosopher and not as an astrologer.

In 1618 Settala had had a controversy with Castiglione regarding some pearls recently brought from India. In 1622 he had published five books on the pest, and in 1627 seven books on *Ragion di Stato*.²⁴ His treatise on moles therefore may not be dismissed as a superstitious work by a mere trifler.

Yet another book on physiognomy was published at Bologna in 1630, the *Cefalogia Fisonomica*²⁵ by Cornelio Ghiradelli of the

²⁴ For the titles see BM catalogue.

²⁵ That the first edition was in 1630, is shown by the dedication, dated

November 10 of that year, from the publishers, "Gli Heredi di Evangelista Dozza & Clemente Ferroni." I have

Academy of Vespertini of that city. It is in Italian, not Latin like the treatise of Settala, and it often cites Baldo, as it calls him, and Scaffiglione. But it bears the Imprimatur of Hieronymus Onuphrius, who taught in the University of Bologna from 1613 to 1639,²⁶ and who here acts for the inquisitor, Paulus de Garrexio. It is a ponderous tome of more than six hundred pages, divided into ten books of ten chapters each. The ten books are on the hair, forehead, eyebrows, eyes, nose, mouth, chin, ears, face and head. Each chapter opens with a picture of the particular type of hair, forehead or other feature that is under consideration. Beneath this is a Latin distich and a sonnet in Italian as to the character signified. The sonnets are signed by various authors, often from other academies or towns, though a few persons contribute more than one. Then follows in each case a longer *Discorso* in prose by Ghiradelli, from which citations of previous authorities are sometimes distinguished under the caption, *Pareri de' Scrittori*. Among those cited are Aristotle (especially for the Physiognomy which was attributed to him), Polemon, Gratarolo, Gaurico, Paolo Pincio,²⁷ Ingegneri,²⁸ Porta, Michael Scot, and Albertus Magnus. But besides writers on physiognomy, poets and men of letters are much quoted, classical literature being ransacked for all possible allusions to the topics under consideration. Nor are such Italian authors forgotten as Tasso and cardinal Paleotti, who, in his book on old age, wrote that in Montefiscone he saw a boy aged seven whose hair had already turned gray.²⁹ Last come Additions made by Ghiradelli's friend and fellow academician, identified only by his academic sobriquet of Inquieto.³⁰ The last chapter of each book is devoted to a feminine type of physiognomy, although "le Donne e Matrone" are also occasionally mentioned in the other chapters. An astrological basis

used a later edition of 1670, by which time the publishers have become "gli Heredi di Evangelista Dozza e Compagni," found in the library of the College of Physicians and Surgeons of Columbia University. Its title page bears a long descriptive title which I will not take the space to reproduce here, but shall cite the volume as

Cefalogia.

²⁶ Dallari, *I rotuli*, II, 314-16.

²⁷ See Paolo Pinzio in T V, 67.

²⁸ T VI, 162.

²⁹ *Cefalogia*, p. 62.

³⁰ Ghiradelli's epithet was Sollevato. Sonnets are contributed by Inquieto, Irresoluto, Avido, etc. See pp. 335, 420, 614.

for physiognomy is sometimes suggested, as when the lines in the forehead are connected with the seven planets,³¹ or, in a supplementary section at the close of the volume,³² various peoples and provinces are grouped under the twelve signs of the zodiac. Each of the ten books has its Proemium, but, preceding them all and their pictures of a hundred different types, is a full page plate of Campeggi, bishop of Sinigaglia (1629-39) and governor of the states of the duke of Urbino, followed by a flattering interpretation thereof as a model of how to put in practice the rules of physiognomy. And before that is a dedication by the publishers to Georg Sigfrid Breuner, free baron in Stibing, Fladnicz, and Rabenstein, and hereditary chamberlain of the archduchy of Austria, followed by poems in his praise. With such political, episcopal, literary, academic and university support and trappings, it is small wonder that the volume passed the censors with colors flying.

We turn from Italy for a moment to take notice of two works which were written by Frenchmen and published at Paris.

Jean Cécile Frey, physician to the queen-mother of France, died in 1631, but his *Compendium medicinae* and opuscula were not published until 1646. But among the opuscula was *Physiognomia, Chiromantia, Oneiromantia ad philosophorum et medicorum mentem*, which had already appeared in print during his lifetime.³³ Stolle, writing in the sceptical Age of Reason, said that no one was any longer interested in this last-named work,³⁴ but we may hazard the guess that it had at least found plenty of readers in the interim. Frey was related to Gaffarel, who composed a panegyric on him.³⁵

Henry de Boyvin du Vaurouy, a boy of twelve, dedicated to cardinal Richelieu his translation from the Greek of tracts on physiognomy by Adamantius and on divination from palpitations attributed to Melampus.³⁶ To Richelieu were also dedicated Tables

³¹ *Cefalogia*, p. 80.

³² *Cefalogia*, p. 625.

³³ Janus Caecilius Frejus, *Omnis homo, item Amor et Amicus, item Physiognomia Chiromantia Oneiromantia*, Paris, 1630, in-8. Not in BN or BM. LR 502.

³⁴ Gottlieb Stolle, *Anleitung zur Historie der medicinischen Gelahrtheit*, Jena, 1731, p. 215.

³⁵ *Lacrymae sacrae in obitum Iani Caecilii Frey medici*, Paris, 1631, in-4. Copy at Bibl. Mazarine, 18729.

³⁶ *La physionomie . . . Le tout tra-*

of Physiognomy by Dominicus de Rubeis, a citizen of Venice,³⁷ which brings us back to Italy again.

Filippo Finella published a work on natural physiognomy and chiromancy at Naples in 1629,³⁸ and another on moles on the skin and their significance,³⁹ at Antwerp in 1633. The dedication to a Spanish grandee⁴⁰ is dated from Naples on June 20, 1632, and there is a portrait of Finella in his forty-eighth year in 1632. He asserts that the book is based upon thirty years of observations in physiognomy and "metroscopia," and their proof from astrological genitures. He alludes not only to his *Natural Physiognomy*⁴¹ but to thirteen books of "Metroscopia" and to a *Physiognomy of the Eyes* and a treatise on seven divine letters apparent on the soles of everyone's feet.⁴²

Finella's scientific calibre and magical propensities may be inferred from the opening sentence of his dedication, in which he affirms that all naturalists say that a stone depicted with colors grows in the eyes of the hyena, which, placed under a man's tongue, enables him to predict the future. The three books of the text treat each of one hundred cases, illustrated by figures of human faces:⁴³ in the first book giving the location of the mole, in the second adding its color, and in the third its accompaniment by a mole elsewhere on the body. For example, a mole on the left forehead just above the eye-brow and below the lunar or lowest line on the forehead, indicates for its owner petulance and lust, and poverty and misery in old age. The corresponding figure in the second book is of a mole on the left forehead at the end of the moon line, and threatens its possessor with flight and persecution on account of homicide. If it is red, he should beware of his own kin. If black,

duit du Grec d'Adamantius et de Melampe, Paris, Louis de Vandosme, 1636, in-8. BN V.21864 is dated 1635. An earlier French translation of *Adamantius* by J. Lebon was printed at Paris in 1556.

³⁷ T VI, 510.

³⁸ F. Finella, *Fisionomia naturale... si contiene la geometria delle membra con un discorso delli segni nelle mani*, Naples, 1629, in-16, 358 pp. Not in

BM and BN catalogues.

³⁹ *Libri tres naevorum*, Antwerp, Plantin, 1633. Col. B158.5 F494. Each book has a separate pagination.

⁴⁰ His titles fill nine lines of text.
⁴¹ Preface to Book I; and see note 38 above.

⁴² In the Preface to Liber II. Also III, 8.

⁴³ The figures are omitted in the third book.

it indicates torture. If there is an accompanying mole on the abdomen to the left of the umbilicum, it indicates for a man bad luck in all his affairs and for a woman a bad husband and short life. In each case Finella further relates the mole to a planet and a fixed star,⁴⁴ and also gives a table relating moles to the signs of the zodiac. If there are several moles on a single face, they correspond to one of forty-eight constellations or to the satellites of a planet, while warts which appear and then disappear are compared by him to comets.⁴⁵ The sun rules the right side of the body; the moon, the left. In the case of persons born by day, moles on their right side have more force of signification, and those on the left side less, while the opposite holds true for those born during the night. "And this rule is infallible." If the person's horoscope was not recorded, you can tell whether he was born by day or night from the attitude of his ears.⁴⁶

Despite all this astrology and divination, Finella affirms that the human will is free and that the stars only indicate and cannot compel. In the case of a person whose mole indicates that he will commit a homicide and be hanged therefor, Finella advises against telling him this, lest he become demoralized and hopeless. Rather tell him that it indicates that he should not carry arms or lethal weapons.⁴⁷

The next year Finella interrupted his thirty years of physiognomical observations long enough to compose in Italian a treatise on the occult virtue of vipers and its relation to the twenty-eight mansions of the moon.⁴⁸ He asserts, like Pliny, that vipers are not venomous in winter, and that the ancients caught vipers by carrying a branch of sage which stupefied the vipers. Besides the virtues of its head, teeth, tongue, blood and skin, especially if removed at the proper astrological time, marvelous stones grow in its head in its old age. After the virtue of the flesh of vipers has been carried through the twelve signs of the zodiac and twenty-eight mansions of the moon, with mention of fifty diseases under Aries alone, we

⁴⁴ See the text for fig. 35 in each of the three books.

⁴⁵ Preface to Liber II.

⁴⁶ Preface to the Reader preceding the text.

⁴⁷ Preface to the Reader.

⁴⁸ *Delle virtù occulte delle vipere per le 28 mansioni delli segni del zodiaco. Con tavole astronomiche...*, Napoli, 1634, in-fol.: BM 718.i.14.

pass from vipers to instructions for blood-letting and taking medicine according to the position of the moon.⁴⁹ Then, with a separate pagination, come lunar astronomical tables.⁵⁰

No further publications by Finella are recorded until, in the years 1648–1650, no fewer than eight volumes and brochures by him came forth from the press, again at Naples and Antwerp. One was a soliloquy on salts. Three others were astrological, dealing with the revolutions of years, two figures of conception and respiration and their connection with the heavens, and a *Speculum astronomicum tripartitum* for physicians, farmers and navigators.⁵¹ The remaining four were all in the field of physiognomy, and one of them was perhaps a reprint or revision of the *Fisionomia naturale* of 1629, but with the added adjective, Planetary.⁵² The other three we shall consider further.

The art or science of metoposcopy—or metroposcopia, as he sometimes spelled it, under the false impression that it could be connected etymologically with the Greek word for measure — dealing with divination from the lines of the forehead, was once more set forth by Finella in works published at Antwerp in 1648⁵³ and 1650,⁵⁴ the first in three books and two volumes, the other in two parts or volumes. In both works the forehead is divided by a row of seven dots placed vertically from just above the nose to the roots of the hair, and the lines passing through these are supposed to provide the chief natural basis for the art. In the first book of 1648, years of life—not to exceed 120 in all—are assigned to each line, and they are related to the chief members of the human body. Finella says that he has examined 1300 human heads in thirty years of experience. One might have thought the years would be more than thirty by 1648. In any case he now gives a hundred figures

⁴⁹ *Ibid.*, pp. 16–20.

⁵⁰ *Delle tavole astronomiche della luna perpetue per anni 19. Libro secondo di Filippo Finella*, Naples, 1634.

⁵¹ For their Latin titles see the catalogues of BM and BN.

⁵² *De . . . planetaria naturali phisionomia*, Neapoli, 1649, in-4, 254 pp.

⁵³ Philippi Finella *De metroposcopia seu methoposcopia naturali liber*

primus . . . etc., Antwerp, 1648, pp. 170, 162, 372. BN V.21895–21896.

⁵⁴ *De methoposcopia astronomica*, 216 pp.; *De duodecim signis celestibus*, 248 pp., Antwerp, 1650. BN V.21897 (1–2). The dating of the dedication from Naples to the governor general of triremes of the kingdom of Naples on May 1, 1656, is presumably a misprint.

of heads in each of the first two books, and 102 in the third, with a brief accompanying text for each. Each of the seven lines of the forehead is associated with a planet. The second book has 45 pages of astrology before the figures of heads are given. The thirty-four chapters of the third book are all astrological and it is entitled *Planetary Methoposcopia*. The heads are also related to the twelve signs of the zodiac, with a separate closing section on those of women.

The emphasis upon astrology continues in both parts of the work added in 1650. In the first part, which, like the work of 1648, is profusely illustrated with cuts of human heads, the forehead is in each divided by the seven dots aforementioned, with horizontal lines sometimes drawn through them. These lines are further described in a brief accompanying paragraph, with some indication of the fate of the person shown, such as riches, death in torment or prison or war, short life, good ability, journeys, honors, several marriages, bad wives, hanging, drowning and public office. In the other part, after four brief preliminary chapters, figures of heads are related, not merely to the signs of the zodiac, as in 1648, but to each of the thirty degrees of each sign. Now however, the accompanying text says nothing of the lines in the forehead, but gives more as to the character, inclination, fate and relation to the planets of the person in question.

Between the publication of these books on metoposcopy Finella issued in 1649 and at Naples a briefer treatise on the four signs which appear in the nails of the hands⁵⁵—white, black, red and ashen for the thumb and each of the four fingers, making twenty chapters in all. A twenty-first chapter is then added relating these marks to the four humors and also to the planets.

Augustinus Mascardus (1591–1640), professor in la Sapienza, Rome, included physiognomy and chiromancy in his *Roman Dissertations of Paris*, 1639, reissued at Milan in 1667, but attacked astrological chiromancy.⁵⁶

⁵⁵ *De quatuor signis quae apparent in unguibus manuum*, Neapoli, Typis Iacobi Gaffari, 1649, 68 pp. Copy used: BN V.21897(3.).

⁵⁶ *Romanae dissertationes de affectibus sive perturbationibus animi earumque characteribus*, Paris, 1639, 234 pp. BM 525.1.16(1.).

The Observations of Every Kind of Erudition on Divine Scripture by Paolo Vecchi were actually limited to two books, of which the first treated of passages of Holy Scripture from the viewpoint of physiognomy, and the second, from that of medicine.⁵⁷ On the other hand, the *Chirologia* of J. Bulwer has nothing to do with chiromancy, although it is sometimes listed under that caption in second-hand book catalogues, but is concerned with gesticulation and finger alphabets.⁵⁸ Andreas Otto, Lutheran professor of theology at Königsberg, published a judgment of man from the external lineaments of his body from top to toe, and both natural and planetary.⁵⁹

In our chapter on Mersenne and Gassendi we have already heard the rector of the Jesuit school at La Flèche advise Mersenne in 1619 that natural, as against astrological, chiromancy was not to be condemned, provided it did not exceed its limits. Now we come to a book on Human Physiognomy composed by Honorat Nicquet (1585–1667) of the Jesuit College at Rome, whence he writes the dedication to the work as printed at Lyons in 1648.⁶⁰ He had entered the Society of Jesus in 1602, taught rhetoric and philosophy, and at Rome had been appointed censor of books and theologian to the *prevôt-général*. Later he was to become head of

⁵⁷ Paulus Vecchius, *Observationes omnigenae eruditionis in Divinam Scripturam carptim universam libri duo: Primus continens observationes physiognomicas sive locos S. Scripturae qui ponderantur juxta physiognomica principia . . . Secundus continens observationes medicas sive locos S. Scripturae qui expenduntur juxta medica principia*, Naples, 1641, in-4. BM 1016.i.9.

⁵⁸ Printed at London in 1644. Copy used: BN Rés. X.1653(1); also in BM 959.a.14.

⁵⁹ *Anthroposcopia*, 1647: BN V. 21924. I was unable to obtain this volume in June, 1951. The work appears to occur anonymously in a MS at the Vatican, Barberini 297, a coarsely written quarto volume, fols. 1r-203r.

On the title page: "Anthroposcopia seu Iudicium hominis de homine ex lineamentis externis a capite usque ad calcem proximum. Ex probatissimis quotquot fere extant Physiognomiae humanae scriptoribus summo cum studio excerptum." The text opens: "Ego scelus esse puto et impietatem negare quae in natura habent causas manifestas quae ita condita sunt ut praesagiant futura . . ." The first of its three books on the head has 39 chapters. The second book covers from the shoulders to the belly, and 28 of its 35 chapters are on chiromancy.

⁶⁰ Honorat Nicquet, S.J., *Physiognomia humana libris io distincta*, Lyons, 1648, in-4, 320 pp. and Index: BM 719.h.31.

several Jesuit colleges in France in turn: Caen, Bourges and Rouen, where he died. All his other writings are theological. He says that he composed this book thirty years ago, which would be about the time that the rector of La Flèche turned to Father Christophe Brossard for information on the subject in order to reply to Mersenne's query. Nicquet adds that he has revised his work as censor and castigator, so that it is now a work at once both new and old to correct the vanities of those who go mad in this curious art and, on the other hand, lead others to some knowledge of the arcana of nature. He follows Aristotle as guide, accepting the Physiognomy attributed to him as a genuine work. Because certain physiognomists have indulged in rash conjecture, this noble discipline is regarded as idle, without any probability, and lacking reason. This wrong estimate he will correct from Sacred Scripture and the authority and reasonings of men of weight. In the second of his four books he takes up the parts of the human body and what can be conjectured from them as to the personality, character and inclination. The third book is on chiromancy, that noble part of physiognomy, but, as in the case of Father Brossard, rejecting astrological chiromancy and attacking the *genethliaci*. The fourth and last book is on such bodily functions as the voice, sleep and laughter, and includes conjectures from the dreams which the different humors of the body produce.

Richard Sanders (or, Saunders) dedicated his book on physiognomy and chiromancy in 1653⁶¹ to Elias Ashmole, whom he called "a real mercurial encyclopedian." The volume also contains a letter to Sanders from his friend and fellow-astrologer, Lilly. In a preface to the reader of thirteen unnumbered pages Sanders sets forth the doctrine of signatures in plants and repeats with some modification and without acknowledgement the distinction of five degrees or kinds of sympathy and antipathy which we heard the son of Goclenius the Younger in 1625 in a posthumous edition of a work by his father quote from one of Melanchthon's Declamations. San-

⁶¹ *Physiognomie and chiromancie, metoposcopie, the symmetrical proportions and signal moles of the body . . . The subject of dreams; divi-native ste-*

ganographical and Lullian sentences, whereunto is added the art of memory. London, 1653, in-fol. BM 719.k.7.

ders then treats of chiromancy in 23 chapters followed by 48 figures of hands.⁶² He discusses the celestial signs, the sacred letters which are found in the hands, how we may know the day of our birth from the lines of our hands, our temperaments, and whom we more resemble, father or mother. Also the changing of the lines of the hands and their significations; how to know the dreams of princes and others through chiromancy and geomancy; of the plain of Mars and mountain of the moon in the palm of the hand; that the nails belong to chiromancy and not to physiognomy; and that the hands are an abridgement wherein are observed the three worlds—elementary, celestial and intellectual—"and certain secrets of astrology and astronomy."

A second book devotes 256 pages to physiognomy, metoposcopy and oneiromancy. Sanders concludes, however, "Few dreams are followed by their events."⁶³ Earlier he had given instructions how to find one's horoscope and nativity from one's physiognomy, and how to discover the physiognomy of any person by geomancy. Following this second book comes *A Treatise of the Moles*, with a new pagination,⁶⁴ and another tract on artificial memory or the art of Raymond Lull.⁶⁵ We have met with other instances of such association of the art of memory with divination or magic in this or previous volumes. Sanders' book had an enlarged second edition,⁶⁶ and in the meantime a separate treatment of Palmistry by him had appeared in 1664.

In the same year that Sanders' work first appeared, a treatment of chiromancy in French was published by Cureau de la Chambre.⁶⁷ It appeared in English translation five years later.⁶⁸ The year after that saw the first of the numerous edition of his book on the art of knowing men.⁶⁹ He also wrote on such subjects as the digestion,

⁶² In all covering 136 pp.

⁶³ *Ibid.*, pp. 235-36.

⁶⁴ *Ibid.*, pp. 1-32.

⁶⁵ *Ibid.*, pp. 33-39.

⁶⁶ At London in 1671-1670: BM G.2517.

⁶⁷ Marin Cureau de la Chambre, *Discours sur les principes de la chiromance*, Paris, P. Rocolet, 1653, in-8, 150 pp. BM 1141.c.15.

⁶⁸ London, 1658, in-8. BM 8630. a.22.

⁶⁹ *L'Art de connoître les hommes*, Paris, 1659. For subsequent editions consult the BM and BN catalogues; also Alexis Bertrand, "L'art de connaître les hommes de Cureau de la Chambre," *Mes vieux médecins*, 1904, pp. 99-139.

rainbow, light and animals.⁷⁰ Ronphile, *La chyromantie naturelle*, appeared in print at Lyons in 1653, and at Paris in 1655. The poet, Rampalle, who signed its dedication as its translator, was perhaps really the author. It so interpreted the word, natural, in its title, as to include rather than exclude astrological chiromancy.⁷¹

Nicolaus Pompeius had been professor of elementary mathematics at Wittenberg, when he delivered in 1653 the lectures on chiromancy, which were preserved in manuscript form for twenty-nine years by "H.S.P." and finally printed by him.⁷² This editor, addressing seventeen students by name, states that many of them, having finished their courses in mathematics, wished "to descend to conjectural" subjects, and that he had accordingly lectured to them on the Astrology of the right reverend Aegidius Strauchius⁷³ and on the chiromancy of Pompeius.

The text itself, after an introduction concerning the lines, "mountains," and marks on the hand,⁷⁴ has a second part on practice of the art in twelve chapters. Of these the first and longest is on life, temperament, genius and character, and closes with the topic of homicides.⁷⁵ The remaining chapters tell how to judge from the hand as to good fortune; cognates, agnates and short journeys; parents; children; corruption of the body, servants and beasts;

⁷⁰ See the dissertation by Robert Doranlo, *La médecine au XVIIe siècle. Marin Cureau de la Chambre, médecin et philosophe, 1594-1669*, Paris, 1939.

⁷¹ Some further titles from Gino Sabattini, *Bio-Bibliografia chiromantica*, Reggio in Emilia, 1946, are: Giovanni Azzi, *L'idea del futuro rappresentato dalle linee della mano*, Lucca, 1655; De la Colombiere, *Traité de la physiognomie*, Paris, 1660, in-8; L. H. Lutz, *Cheirosophia concentrata*, Nürnberg, 1674, 1679; Paul Nagel, *Chiromanthia meganthropi sive signatura microcosmi*, Leipzig, 1611, in-4; *Speculum physionomicum* Ancelmo Petit Douxciel... auctore, Langres, 1648; Adrian Sicler, *La chiromancie royale et nouvelle*, Lyon, 1666, 1667.

On the other hand, Sabattini fails to list the treatments of chiromancy

by Baldi, Otto, Elsholtz, ten Ryne, and Bejot, on which we touch in this chapter.

⁷² *Praecepta chiromantica clarissimi Nicolai Pompei, inferiorum mathematicum in alma Wittebergensium Academia dum vixit professoris celeberrimi, praelecta olim ab ipso anno Christianorum 1653, iam vero recognita descripta figurisque ligno incisis aucta*, Hamburg, 1682: BN R.55281 (2.), 163 pp. followed by various figures of hands.

⁷³ *Astrognesia synoptice et methodice in usum academicum adornata*, Wittebergae, 1659. BM also has the second edition of 1668 and fourth of 1684. Col 520 St 8 is the fifth edition of 1694.

⁷⁴ *Praecepta chiromantica*, pp. 1-24.

⁷⁵ *Ibid.*, pp. 27-73.

marriage; death; long journeys, religion and dreams; mastery and honor; friends; enemies and captivity. The author admits that he is imitating astrology.

Two other handbooks of chiromancy, written in German, which found many readers were by Johann Abraham Jacob Höping. His *Institutiones chiromantiae*, or, *chiromanticae*, which first appeared at Jena in 1673,⁷⁶ reached its fifth edition in 1701,⁷⁷ while his *Chiromantia harmonica* of 1674,⁷⁸ attained its third edition by 1681.⁷⁹

The *Anthropometria*⁸⁰ of Johann Sigismund Elsholtz (1623–1688) was intended to be of use to painters and sculptors as well as to students of medicine and physiognomy, and considered the analogy of the human body with the universe, and what its proper proportions were, and the symmetry of its different parts. But he not only touched upon physiognomy but also on astrological chiromancy and gave figures of the planetary lines in the hand and on the sole of the foot.⁸¹ His final chapter was on moles,⁸² based upon his own experience as well as such previous writers as Melampus, Haly Abenragel, and Ludovico Settala or Septalius of Milan, whose *De naevis* he dated in 1618. But he does not seem to know of Finella.

The book of Elsholtz nevertheless shows wide reading, not only in classical, medical and anatomical works but in miscellaneous authors from Martianus Capella to Bodin. Of recent writers in the field of physiognomy he mentions Scipio Claramontius or Chiaramonte, Dominicus de Rubeis, and Ghiradelli. With reference to the single matter of the posture of the human body when crucified he cites Lipsius *de cruce*, Gretser, Bosius, Nicolaus Fontanus in his Reply to the query put to him, Whether hands transfixed with nails have an equal share in bearing the body hung thence? Which

⁷⁶ BN V.21953. *Institutiones chiromantiae*, is "zu andern Mahl gedruckt," Jena, M. Birekner, 1674, in-8, 103 pp.

⁷⁷ BM 8632.aaa.1. *Institutiones chiromanticae*. Sabattini, Nos. 279-80, lists only two editions of it and none of *Chiromantia harmonica*.

⁷⁸ BN V.21952.

⁷⁹ BM 1141.a.14.(1.). All editions of both works seem to have been at Jena.

⁸⁰ I have used the edition of 1663 at the New York Academy of Medicine: *Anthropometria sive de mutua membrorum corporis humani proportionem et naevorum harmonia*, Francofurti ad Oderam, praelo Andreae Beemani, 1663.

⁸¹ *Ibid.*, pp. 220, 252-3.

⁸² *Ibid.*, pp. 259-66.

question, he adds, has been recently discussed by very prominent men: Salmasius, Calixtus, Niehusius, Dilherrus, Chifletius, and Thomas Bartholinus.⁸³

The original edition was at Padua, while Elsholtz was studying there, with a dedication to the margrave of Brandenburg, to whom in 1656 he became physician and also director of the botanical garden. The Inquisitor at Padua very tactfully entrusted the examination of the work to Fortunio Liceto, who naturally gave it a clean bill of health, reprinted in the edition of 1663. The Berlin bookseller, Rupert Völcker, in a note to the reader on New Year's Day, 1663, says that eight years have slipped by since the book was first published. Copies of it were avidly sought in Italy and France, and the author brought back only a few with him to Germany, so that Völcker has decided on another edition.

In 1663 Elsholtz also issued a catalogue of the plants in the botanical garden. He also composed chemical treatises on phosphorus and distillation with colored liquids.⁸⁴ He was a contributor to the Ephemerides of the *Academia Naturae Curiosorum*, and was interested in infusory surgery and blood transfusion, his *Clysmatica nova* running rapidly through several editions. It is noteworthy that such subjects as astrological chiromancy and the "harmony of moles" should have appealed to a man who was to display such broad medical and scientific interest and experimental tendencies.

The *Studio di curiosita*, "in which are treated Physiognomy, Chiromancy, Metoposcopy," by Nicola Spadon is a small volume in Italian which was published first at Venice in 1662, and had four more editions.⁸⁵ Astrology plays a large part in it. It is held that one

⁸³ *Ibid.*, p. 29; cap. 7.

See Le P. Jacob Gretser, *De cruce Christi rebusque ad eam pertinentibus libri quatuor*, Ingolstadii, 1598-1605, 3 vols., etc.; Giacomo Bosio, *La trionfante e gloriosa Croce...*, Rome, 1610; Nicolaas Fonteyn, *Responsum ad propositam sibi questionem an manus clavus transfixae pares ferendo corpus inde pendulum*, Amsterdam, 1643; Bartoldus Nihusius, *Anticriticus de fabrica Crucis Dominicae incertam G. Calixti... opinionem esse indicans*, Co-

logne, 1644, and *De cruce epistola ad T. Bartholinum*, in T. Bartholinus, *De Cruce Christi hypomnemata* iv, 1670.

⁸⁴ *Destillatoria curiosa*, 1674; *De phosphoris observationes quatuor*, 1676.

⁸⁵ Sabattini, Nos. 505-509, I have used the following edition: *Studio di curiosita nel quale si tratta di Fisonomia, Chiromantia, Metoposcopia*, di Nicola Spadon, dedicato all'illustrissimo Sign. Iseppo Cassetti nobile Veneto, In Venetia MDCLXVII appres-

should prognosticate from the time of conception rather than that of birth;⁸⁶ and that celestial causes concur in the fabric of man's *complexio* or temperament.⁸⁷ Different regions of the world are distributed among different temperaments, planets and signs of the zodiac. For example, England, Cracow, Padua, Bergamo, Florence and Naples are hot and dry, dominated by Aries and Mars.⁸⁸ The lordship of the planets over successive hours of the day, and of the signs over successive periods of the year beginning March 21st, and of the temperaments appropriate to planets, signs, and mansions of the moon are also set forth.⁸⁹ Sleep and dreams, as signs of temperaments and of the future, are also treated.⁹⁰ Besides metoposcopy⁹¹ and chiromancy,⁹² neomancy, or the interpretation of moles and warts, is discussed.⁹³ Specific examples are given outlining for the person in question parentage, conception, birth, native land, residence, the temperament of various parts of the body, education, condition and office, sleep, dreams and disease, astrological influences, lines of hand and forehead, handwriting. Eight temperaments are distinguished. In a briefer second part the probable physical characteristics are listed for each of a number of types, male and female, such as a harlot, scold, witch, good companion, *Mercante interessato* and *Mercante honorato e galante*. But it is of course stated that only inclinations can be predicted and that the stars and physical characteristics do not necessitate events or compel human will.

The Rational Physiognomy of Claude de La Bellière, sieur de la Niolle, appeared in 1664 in both French⁹⁴ and Italian.⁹⁵ It was dedicated to Cardinal Chigi, apostolic legate in France, and approved by two Dominicans and by the royal physician, La Chambre, whose own work on chiromancy of 1653 has been mentioned above.

86 Francesco Ginami, *Con Licenza de'Superiori*. Copy used: Col B158.5 Sp 11.

86 *Ibid.*, p. 24 *et seq.*

87 *Ibid.*, p. 63.

88 *Ibid.*, p. 31.

89 *Ibid.*, pp. 64-71.

90 *Ibid.*, pp. 124-31.

91 *Ibid.*, caps. 46 and 57, at pp. 72-79, 136-42.

92 *Ibid.*, caps. 47, 48, 58, 59, at pp. 79-88, 142-48.

93 *Ibid.*, caps. 50, 60, at pp. 89-91, 148-50.

94 *Physionomie raisonnée . . .*, Paris, 1664, in-12.

95 *La Fisionomia con ragionamenti*, Paris, 1664, in-16. BN R.40185. This is the copy I have seen.

Human passions are detected from the humors, color, parts of the body, including the hand, one's way of speaking, laughing and walking, from stature, visage and nails, with particular mention of hunchbacks and lame persons. After the table of contents come other tables of the signs of this and that. A Latin translation appeared at Lyons in 1666 and again in 1676, and a Spanish version was being prepared, when the Latin was reviewed in the *Journal des Sçavans* of February 7, 1667. Another French edition was printed at Lyons in 1681.

Philipp Mey, Meyens or Mäyens of Coburg dedicated to the margrave and elector of Brandenburg a medical chiromancy in German which he published at The Hague in 1667, with an appendix on the signs on the finger-nails and a tract on medical physiognomy.⁹⁶ The first part dealt in fourteen chapters with the lines and "mountains" of the hand, those for the heart, head, and other parts of the body, the proportion between hand and finger, the table or bowels-line, the triangle or cave of Mars, the Mars line, Venus mountain, conjunction of Saturn and Mars, girdle of Venus, character of Mercury, *rascetta* and *restrictae*,⁹⁷ and eighteen rules for judging. The section on medical physiognomy considers warts and freckles on the face and other parts of the body. In drawing lines across the forehead for the seven planets, Mey differs from the practice of Finella, since only four lines go straight across. That for the sun is over the right eye only; that for the moon, over the left eye; while a perpendicular line between the two eyes is that of Mercury. We have heard Settala refer to yet a third arrangement. From where warts and freckles occur on the face, one can tell where corresponding ones will be found on the body. There are twenty figures of hands at the end of the volume; three, for the

⁹⁶ *Chiromantia medica mit einem anhang von der zeichen auff den Nägeln der Finger. Nebens einem Tractäteln von der Physiognomia medica*, 'Graven-Haag, 1667, in-8, 158 pp. and figures. BM 1141.b.29.

⁹⁷ These expressions are not explained when used at pp. 12 and 36, but at p. 91 we are told that these lines begin under the mountain of Ve-

nus and end under that of the moon. The first of them is called *rascetta*; all the rest, no matter how many, are *restrictae*. If fortunate, they signify not only health and long life, but honor, riches and friendship. When fortunate, they are called the head of the dragon; when unfortunate, the tail of the dragon.

nails, and nine figures for physiognomy, the faces being all female. When another edition was printed in 1691,⁹⁸ the figures were scattered through the text, the dedication was omitted, and another hitherto unprinted chiromancy in German by Mey in twenty-six chapters was added.⁹⁹ Of these the second was on the sisters and conjunctions of the planets, the characters of the planets, divine letters and other signs in the hands; the fourteenth on the matrimonial line; and the fifteenth on the lascivious way. Otherwise the topics of the chapters were similar to those of the earlier chiromancy.

Identical with our Mey or Meyens almost certainly was a Philipp Meijens, a physiognomist of Dresden who conducted a seminar in chiromancy which is recorded partly in Latin, partly in German, in a manuscript now found at the British Museum.¹⁰⁰ Its text is different than, though similar to, the two chiromanices already mentioned.

Amphitheatrum physiognomiae medicum is the misleading Latin title of a work in German by Jan Frederik Schweitzer or Helvetius (1625–1709) which appeared in 1660 and has nothing to do with divination or any part of physiognomy but consists of alphabetical lists of plants arranged under the seven planets.¹⁰¹ We have to wait sixteen years more for his *Microscopium physiognomiae medicum*,¹⁰² and even it should perhaps be regarded as primarily medical. It further is full of astrological doctrine and stresses signatures of herbs, ferments, the three principles of Paracelsus, and even the philosophers' stone.¹⁰³ Croll and Helmont are both cited. Towards the close of the work Helvetius says:

⁹⁸ P. Mäyens *Chiromantia et Physiognomia medica, mit einem Amhange von der Zeichen auff den Nägeln der Finger, item von den Wartzen und Flecken in dem Angesicht, wie auch dessen noch nie in Druck gekommene Chiromantia curiosa*, Dresden and Leipzig, 1691, in-8. BM 7410.de.13.

⁹⁹ *Ibid.*, pp. 138-97.

¹⁰⁰ Sloane MS 1733, fols. 403r-433v, "Collegium chiromanticum a Philippo Meijens Dresd. Physiognomo habitum." Fol. 403v is blank; the text opens on

fol. 404r.

¹⁰¹ Joh. Friedr. Helvetius, *Amphitheatrum physiognomiae medicum*, Heydelberg, 1660, 130 pp. BM 1141. b.19(1.).

¹⁰² *Microscopium physiognomiae medicum: id est, Tractatus de physiognomia*, Amsterdam, 1676, 52 fols., 244 pp. Copies used: BM 46.a.28; BN 8°Td17.2.

¹⁰³ *Ibid.*, p. 186: "Nisi spes fefellerit, sequetur subinde Lapis philosophicus hunc Tractatum."

To you, O curious investigator of natural phenomena and lover of rational medicine, I wished to communicate these observations of true, divine and licit Christian magic, which are all based upon daily experience.¹⁰⁴

The book is dedicated to William III of Orange, whose physician Helvetius was. Before we reach the text proper there are five preliminary discourses: first, the dedication, in Latin, to William; second, a panegyric of that prince, also in Latin; third, a preface in German to the Academy of the Curious concerning Nature; fourth, a dedication to students of medicine; and last, an address to the "benevolent reader." In the course of these preliminaries, a number of illustrations of physiognomy are given from the Bible, and flings are taken against Descartes and Spinoza and in favor of chemical medicine. In the text proper the chief physiognomical feature is the association of certain physical types with the seven planets and illustrating this by portraits of particular personages. Thus Montanus serves as an example of a jovial *complexio*, Crato of a Saturnine, Ficino of a Martial (he hardly looks it), Xenocrates is associated with Venus, Galen with the sun, Cuspinianus (died 1519) with the moon, and Vesalius with Mercury. Each planetary *complexio* has its own appropriate ferment or internal mixture of salt, sulphur and mercury, and there is a harmony of the external lineaments with the internal passion of the soul, with the natural forces of the body, and with disease internal or external, which takes a different form in each planetary *complexio*. The features of one's physiognomy are signatures, as it were, of the other things. The treatment of a disease also varies for each physical type. Thus in curing epilepsy in a patient with a jovial *complexio*, medicine to provoke vomiting should be administered on the seventh day, to move the bowels on the ninth day, and to sweat the glands of the entire body on the eleventh day. Remedial herbs are also classified under the seven planets.

Turning to the more purely chemical and medical side of the work, we find it asserted that all sulphurous odors, tastes and stinks coming from fermentation and volatilization procreate heat, life and health; that all saline odors, tastes and stinks coming from an

¹⁰⁴ *Ibid.*, p. 229.

effervescent and fixating movement suppress native heat, make one sad, and induce disease; and that all mercurial odors, tastes and stinks coming from a putrefying and destructive motion extinguish heat, drive out the spirit of life, and produce death. We are further assured that "it is most certain that every nitrous or bittersweet (*dulcemarus*) taste and odor of vegetables has a universal power of resolving all viscosity and saltiness in the hollows and parts of the human body to restore them again to their pristine ferment."¹⁰⁶ Helvetius then gives a long list of flowers, herbs, roots and fruits which are anodynes and induce sleep in the ventricles of the head by their odors, and appetite in the stomach by their taste. One of the remedies prescribed by him includes jovial bezoartic, fetid oil of hazel, dried eel's gall, spirits of the salt of hartshorn (i.e., of ammonia), sugar of tin sublimate, lilies of the valley dissolved in water, and spiders.

Of six physical dissertations by François Bayle, which were printed at Toulouse in 1677 and at The Hague in 1678,¹⁰⁶ the third was on physiognomy and occupied about one third of the volume.¹⁰⁷ The others were on material substantial form according to Aristotle, on the form of plants explained from the generation of fungi which are the simplest kind of plant, the Cartesian explanation of light, refraction, and the rising of liquors in narrow tubes contrary to gravity. Bayle approaches the subject of physiognomy through the foetus. The brain is the chief seat of reactions (*pathemata*), and the movements of spirits and humors in the foetus can alter the internal structure of the brain. By certain reactions certain parts of the body are nourished and strengthened more than others. The foetus is easily affected by the nervous juice. Other juices, too, excite reactions in the foetus, to which the mores and mode of life of the mother greatly contribute. From such reactions the foetus may resemble some other species of animal in the conformation of some member. It is very difficult to investigate how the imagination of a pregnant woman has such great force on the foetus, but imagination produces stupendous effects through these reactions, so that

¹⁰⁶ *Ibid.*, p. 241.

¹⁰⁶ *Dissertationes physicae*. I have used the edition of Toulouse, 1677, in

BN T³¹.26, where it is bound with his *Problemata physica et medica*.

¹⁰⁷ Pp. 61-120, out of 192 pp. in all.

a human foetus may be changed into a monkey in the womb. It is from the resemblance to brute animals in some part of the body that a man's character is known through physiognomy.¹⁰⁸

In 1683 at London Wilhelm ten Ryne issued a miscellaneous volume containing a dissertation on arthritis and two other treatises and three academic orations dealing respectively with the antiquity and dignity of chemistry and botany, physiognomy, and monsters. He held that gout and many others diseases were caused by internal winds, and in connection with monsters noted the effects of maternal imaginings. He upheld physiognomy but decried chiromancy and astrology and their association with physiognomy.¹⁰⁹

In the last decade of the century, the secretary of the Philosophical Society at Dublin communicated to the Royal Society a Discourse of Physiognomy by a Dr. Gwithier who stated that most men now rejected physiognomy as folly, but that events and emotions left their traces on the countenance, which responded to various, and especially to frequent, images and affections. These acted through the animal spirits which were stored especially in the *medulla* of the brain.¹¹⁰

A few examples may be given of works in manuscript from the seventeenth century on physiognomy and related fields.

Various works, chiefly medical,¹¹¹ by Marcus Aurelius Severinus (1580–1656), professor of medicine and surgery at Naples, were printed. But his medical Physiognomy or *Iatrophysiognomia* of 1612, a long work in two volumes, remained in manuscript.¹¹² In the second volume he considered prognostics of future safety and death.¹¹³

Lectures which Jean Cécile Frey delivered in 1620 at the Collège de Lisieux on physiognomy, chiromancy, divination from dreams, and mnemonic and Lullian art, are preserved in a manuscript at

¹⁰⁸ *Ibid.*, p. 116, "... ex similitudine cum brutis in aliqua corporis parte hominum mores cognoscuntur."

¹⁰⁹ See the account of his book in PT XIII, 222–35.

¹¹⁰ PT XVIII, 118–20.

¹¹¹ For his treatise on the viper see Chapter 24.

¹¹² Rome, Bibl. Lancisiana, MS 2.LXXIV.3, mm.224 x 156, 305, 148 fols. written only on the rectos, "Physiognomia medica cum symbolis alteris..."

¹¹³ P. Giacosa, *Magistri Salernitani nondum editi*, Turin, 1901, pp. 540–42, reproduces the Latin table of contents.

Paris.¹¹⁴ They are probably the basis of, or even identical with, the printed work of 1630 by him which was mentioned earlier in this chapter. In another manuscript of 1653 is the *Physicomantia* of Antoine Bejot,¹¹⁵ while a third codex of 1659 contains the *De physiognomia* of the Jesuit, de la Bourdonnaye.¹¹⁶ A fourth manuscript consists of twenty-seven pages on physiognomy by Jean Baptiste Bachelier, an engineer of 1620.¹¹⁷

A fifth manuscript at Paris contains a commentary by brother Mauritius de Gregorio, a Dominican theologian of Camerino, Sicily,¹¹⁸ on the *Gelotoscopia* or Divination from Laughter, of Prosper Aldorisius,¹¹⁹ which has been described above. The commentary consists of ten books¹²⁰ in which are discussed such questions as whether any new science can be discovered, whether *Gelotoscopia* is a science, whether it is theoretical or practical or both, and whether its theme is laughter? Whether man is the hottest of animals and whether he laughs because he is the hottest? Whether Sardinian parsley induces laughter and death simultaneously, and whether the cause of death from laughing is congregation of heat about the heart or dispersal of the spirits? Whether differences of sound are four, or more or less than four; whether laughing is natural or voluntary; whether expansion comes from moisture and

¹¹⁴ Ste. Geneviève 2234, fols. 174-90. I have not examined it. Note the resemblance to it suggested by the title of Sanders' later work in note 61 above.

¹¹⁵ Ste. Geneviève 2241-2242.

¹¹⁶ Ste. Geneviève 3106.

¹¹⁷ Ste. Geneviève 1038.

¹¹⁸ BN 7340, fols. 71r-133r: "In Gelotoscopium Prosperi Aldorisi Comentariorum sua eiusdem Gelotoscopiae principia et fundamenta rationibus ex philosophia depromptis evidenter probant. Et in quibus quomodo hominum mores et natura ex eorumdem cachinnamentis possint argui clarissime ostenditur. Opus singulare nova et inaudita huc usque philosophis incognita tradens auctore F. Mauritio de Gregorio Siculo Cammerarensi Praed. Ord. Il-

lustrissimi episcopi Galatini theologo." Our work is preceded in the MS by portions of Picatrix (see T II, cap. 66), and followed by the fifteenth century Physiognomy of Roland Scriptoris (T IV, 143).

¹¹⁹ *Gelotoscopia sive Divinatio ex risu*, Naples, 1611; BN Rés. V.1339.

¹²⁰ Only eight are indicated in the table of contents, but in the text at fols. 130v-131v the two questions listed under Book VIII in the Contents are "Libri 9" and at fols. 131v-133r there follows a *Liber decimus* which does not appear in the Contents at all. Book VII is the same in both, but the Contents omit "*Liber octavus. De indagandis ingenii qualitatibus*", which occurs at fols. 129v-130v.

constriction from dryness; whether from the temperament of the spirits and larynx and artery can be deduced the temper of the entire body? Whether from gelotoscopia can be specified the symptoms of or propensity to disease? What is the efficient cause of love, and whether lack of heat alone or of moisture alone causes the desire for conservation and so love? Whether persons given to laughter are long-lived?

Brother Maurizio de Gregorio was also author of *Aphorisms* or *Summae* of all the Councils and Bulls, published at Naples in 1642 (8vo, 943 pp.) and in revised form in 1649.

A manuscript at Milan,¹²¹ which is primarily devoted to tracts on chiromancy, once included early seventeenth century authors on that subject,¹²² such as Fludd and Goclenius the Younger.¹²³ But inasmuch as it also once included sixteenth century authors, Cardan and Tricasso, and still includes Corvo and John of Indagine,¹²⁴ the date of its remaining contents is left in doubt. The opening treatise by Francesco Comenduli¹²⁵ looks back upon Paride Ceresara's prediction of the election of Paul III in 1534,¹²⁶ but from how far is uncertain. There is also a Compendium of Chiromancy by a Master Levi.¹²⁷ The last four leaves of the present manuscript contain an anonymous treatise in six chapters on the influence of the planets upon the human body.¹²⁸

The *Collegium chiromanticum*, held by Philip Meijens at Dresden in 1676, and preserved in a Sloane manuscript, has been mentioned. Such themes seem to have been in vogue at Dresden in that year, for then and there Merbitzius published a work on the variety of the human countenance.¹²⁹ Also in 1676, at Amsterdam,

¹²¹ Ambros. Y.142.sup.

¹²² At present the MS ends at fol. 94v, and does not contain the tracts by Cardan, Fludd, Tricasso and "Cockleinius", which are listed in its table of contents for fol. 95 *et seq.*

¹²³ I take it that "Ludolphi Cockleonii racol. de chiromantia et phisionomia" has reference to the work by him mentioned above in note 2.

¹²⁴ At fols. 23r-39v, "La chiromantia di Andrea Corvo compendiata"; fols. 48r-90r, "Trattato di Chiromantia

di Gio. Endagine."

¹²⁵ At fols. 1r-22r, opening: "La chiromantia altro non e che un arte d'conoscere la fortuna . . ."

¹²⁶ At fol. 9r.

¹²⁷ Fols. 41r-47r, "Compendio della Chiromantia di Maestro Levi."

¹²⁸ Fols. 91r-94v, "Della qualità et natura infusa dá planeti ne corpi humani."

¹²⁹ Johannes Valentinus Merbitzius, *De varietate faciei humanae discursus physicus*, Dresden, 1676.

appeared the *Microscopium physiognomiae medicum* of Helvetius, of which we have already treated. After 1676 less seems to have been written on such subjects during the remainder of the century, although Pompeius's lectures of 1653 were printed only in 1682, while Höping's book of 1673 continued to appear in new editions.

CHAPTER XXXVI

DIVINATION

Works on ancient augury, oracles and sibyls—Montagu, Bulenger and Caudenzio—Divination from dreams—Geomancy: Robert Fludd—Torreblanca on natural divination—Franzsius on human power of divination—Faulhaber's numerical tables—Vates of du Moulin—Masenius on signs—Garibus on prodigies—Favorable attitude to various forms of divination of Osius, Peruchio, Praetorius—Moncaeus on alectromancy—Attacks on divination by Maraviglia, Spencer, Vulteius—The divining rod: de Vallemont, Menestrier—Mortal and sexual presages—Early German and Slavic "idolatry".

Imaginatio non transcendit continuum.

As had previously been the case in the sixteenth century, most arts of divination were no longer living realities nor extensively practised, but possessed only an historical interest as relics of paganism or as classical antiquities. This was particularly true of such subjects as augury, oracles and sibyls, on which nonetheless books and dissertations continued to be written and published.¹

¹ Joan. Ant. Venerius, *De oraculis et divinationibus antiquorum*, Venice, 1624; Basel, 1628; and in Gronovius, *Antiquités grecques*, VII (1697), ii, 325-56.

David Blondel, *Des sibylles célèbres tant par l'antiquité païenne que par les saints Pères*, Paris, 1649, in-4. Crasset is said to have written against Blondel.

Daniel Clasen, *De oraculis Gentilium et in specie de vaticiniis sibyllinis libri tres*, Helmstadii, 1673, in-4. BM 704.d.21.

Magnus P. Comerus, *De oraculis dissertatio*, Copenhagen, 1674, in-4.

Olaus Eriici Odhelius, *De sibyllis dissertatio*, Arosiae, 1678, in-4.

Georg Moebius, *De oraculorum origine, propagatione et duratione*, Leip-

zig, 1657, 1660, 1685, in-4.

Fontenelle, *Histoire des oracles*, Amsterdam, Mortier, 1687, in-12.

Pierre Petit, *De sibylla libri tres*, Lipsiae, 1686, in-8.

Joh. Marckius, *De sibyllinis carminibus disputationes academicae duodecim*, Francker, 1682, in-8.

Thomas Reinesius, *Dissertatio critica de sibyllinis oraculis*, Jena, 1685, in-4.

S. Gallaeus, *Dissertationes de sibyllis earumque oraculis*, Amsterdam, 1688, in-4, 658 pp., 26 chapters.

Joh. Reiskius, *Exercitationes de vaticiniis sibyllinis*, Lipsiae, 1688, in-8.

Andreas Christian Eschenbach, *Disputatio de auguriis veterum*, Altdorf, 1692, 28 pp., has been noted in our Chapter 12.

Henry de Montagu lumped all ancient arts of divination together as diabolical mimicries in the historical development of magic. Asking when and where the first soothsayers of the demon were to be found, he devoted several chapters to Zoroaster and then turned to the early Magi who, following Zoroaster's example, remained in caves feigning sanctity, to the Chaldeans as philosophers and sorcerers of the Assyrians, to the hierophants of Egypt, Pythagoras who imitated Zoroaster in the use of fire, Numa at Rome, and the Druids in Gaul. Not only the first philosophers but also the first poets were sorcerers, as is shown by Orpheus and his orgies. To counteract these diabolical divinings, God had some of the sibyls predict the coming of Christ. On the other hand, the devil aped the divine oracles given in the tabernacle of Moses by the pagan oracles of Dodona and Ammon, and tried to model his temple at Delphi after that of God at Jerusalem. This leads to a discussion of the fiery specters of the temple at Delphi and the species of magic which originated there, such as pyromancy. The Pythia who sat on the tripod was possessed by a ventriloquist demon, and all the other oracles of Apollo were utterances of Satan. Montagu then considers oracles by water and by wine, by blood—and divination from blood, by speaking statues, in writing, from dreams, and from signs and portents. The temple of Serapis in Egypt is then discussed. Oracles ceased at the advent of Christ; some became mute at the preaching of the apostles; the ashes of the martyrs destroyed their temples. After touching somewhat on the scientific equipment of the devil, Montagu turns to his mimicries among the Hindus, Turks and savages, and finally to their recent renewal.²

Claude de Comiers, *Pratique curieuse ou Les oracles des sibyllis sur chaque question proposée*, 1694; BN R.47433. Of this superstitious divination there were further editions in 1695, 1735, 1745 and 1770.

Antonius Van Dale, *De oraculis ethnicorum dissertationes duae*, Amsterdam, 1683, in-12; English translation, 1699; 2nd Amsterdam edition, 1700. In 1696 he published a Latin

dissertation on idolatrous divination of the Jews mentioned in the Old Testament, together with other dissertations on the origin and progress of idolatry and superstition, and on true and false prophecy.

² Henricus a Monte acuto, *Daemonis mimica in magiae progressu tum in sectis errorum*, Paris, 1612, in-12, 410 pp. BN R.44320. Cornell has an edition of 1712.

The attack upon astrology in the work on divination of Julius Caesar Bulenger in his *Opuscula*, printed in 1621, is treated in another chapter. Having disposed of astrology in the first two of its five books, he devoted the third book to necromancy and thirty-seven other kinds of divination, the fourth book to the divination of the sibyls, and the last book to divination from dreams. These three books are much shorter³ than the first two and consist largely of quotation. They were followed by similar brief treatises on oracles, lots, auguries and auspices, omens, and prodigies. All of these were largely motivated by interest in classical antiquity. For example, the third chapter of the book on divination from dreams is on the god Mercury presiding over dreams. This treatise on divination with that on licit and illicit magic which follows it in the *Opuscula* is much the same sort of work as Boissard (1528-1602), *De divinatione et magicis praestigiis*, which belongs to the previous century,⁴ although not printed until 1615. Neither work has any relation to experimental science and they are of very slight importance in the literature of magic.

The short essay of Paganino Gaudenzio, a member of the academy of Umoreisti at Rome and first professor of eloquence at Pisa, on the significance of prodigies, is, like the treatise of Bulenger, more antiquarian and literary than it is superstitious or pseudo-scientific,⁵ and the same may be said of his later opusculum on the Pythagorean transmigration of souls.⁶ Discussing the question, how far prodigies are to be observed by Christians, Gaudenzio says that he neither condemns them outright nor would revive ancient superstition. In inquiring, chiefly through the mouths of ancient writers, why comets are called stars, he implies that they really are not stars. Asking if they are always ominous, he answers that many are. He passes on to other meteorological phenomena, earthquakes, rivers overflowing or drying up, the eruption of Etna, doors opening of their own accord, noises of Manes, whether they go forth from their sepulchers, specters and monstrous images. Importunate birds

³ *Opuscula*, I, 191-225, 226-33, 304.i.16.(2).
234-59.

⁴ T VI, 504.

⁵ *De prodigiorum significatione*, Florentiae, 1638, in-4, 66 pp. BM

⁶ *De pythagoraea animarum transmigratione opusculum*, Pisis, 1641, in-4, 324 pp. (but other works begin at p. 103). BM 519.e.30.

and talking cattle, swarming of bees in houses and temples, dogs and wolves howling, wild beasts entering camps and gardens, are other topics considered as prodigious or portentous. The essay is endorsed by ecclesiastical *Imprimaturs*. The treatment of the transmigration of souls, which is chiefly historical, is accompanied by a discussion whether the year 1640 should be called fortunate. Someone in a public address had declared it "faustissimo", the acme of felicity and ever memorable, but Gaudenzio points to two conjunctions of the evil planets, Mars and Saturn, in July and October, to the turbulence of the Mediterranean and of the ocean off the coast of Holland—the worst since 1597, the prolonged cold winter, and to untoward political happenings in England, and the penalizing of Normandy, especially Rouen, by the French king.⁷

Leaving such primarily antiquarian consideration of divination, we next take up some works on divination from dreams, then geomancy, and after that discussion of natural divination and of human power of divination.

The old medieval Dream Books of Joseph and Solomon were printed at London in 1601 and 1626,⁸ while the *Ὀνειροπολίς* of Josuel Abrech Hunepaeus, printed at Dortmund in 1607, was described as "a marvelous new book."⁹ Soner's oration of 1610 on dreams is discussed in our chapter on Interest in the Occult at German Universities. Although the question of divination from dreams, as having been raised by Aristotle, was apt to be the occasional theme of university disputations and dissertations, there were not many other separate treatments of it, but it was frequently discussed in more general works. Pierre Vattier published a translation of a Dream Book from the Arabic at Paris in 1664.

About 1689 Thomas Tryon published a book on dreams, of which it may suffice to repeat the full title:

A Treatise of Dreams and Visions, wherein the causes, natures and uses of nocturnal representations, and the communications both of good and evil angels, as also departed souls, to mankind, are theosophically unfolded, that is, according to the Word of God. To which

⁷ *Ibid.*, pp. 191-198.

⁸ BM 8630.a.42; 8632.aa.15.

⁹ "Liber novus mirificus," etc.

is added a Discourse of the causes, natures and cure of Phrensie, Madness or Distraction.¹⁰

A second edition appeared in 1695.

Another example of works on divination from dreams was by Marc de Vulson, Sieur de le Colombière, who died in 1658. The book seems to have first appeared in 1646 and to have been reproduced in 1659, 1671, 1690 and 1698.¹¹ Five kinds of dreams are distinguished: *songe*, *vision*, *oracle*, *reverie* and *apparition*. It is stated that few persons have the gift of dreams that come true. After an alphabetical arrangement common to dream-books of the thing dreamed and its signification,¹² various topics are considered, beginning with fire and air. To dream of suffering martyrdom for the Faith and of being beheaded is a sign of great honor and of bliss in Paradise, and to dream of being hanged is an indication of dignity proportionate to the height of the tree or gallows.¹³

A discussion of dreams and interpretation from them occurs in a manuscript of the seventeenth century.¹⁴ After raising such questions as whence inordinate dreams come, whether all men and men only dream, why dreamers seem to themselves to see real things, and why a dream seems to take a longer time than actually elapses, and after a chapter on somnambulists, the author comes to divination by dreams. He now asks whether there is divination by natural dreams, why sleepers seem to themselves to be suffocated by a demon, whether there is divination by "animal and moral dreams," and by dreams caused by the stars, whether the death of or danger to a distant friend can be sensed without revelation, how

¹⁰ London, Andrew Sowle, in-16.

¹¹ I have used the edition of 1690 which bears the title, *Traité des songes et des visions nocturnes avec leurs significations selon la doctrine des anciens*, Paris, s.d., in-12, 96 pp. BM 717.a.55. The edition of 1698 reverted to the original title, *Le palais des curieux* . . . and added a treatise of physiognomy: BM 8632.aaa.4.

¹² *Ibid.*, pp. 14-35.

¹³ *Ibid.*, pp. 74, 89. From p. 88 on smaller type is used.

¹⁴ BN 18508, petit format with 17 lines per page and few words to a line and illegible writing, pp. 3-57, *Tractatus de insomniis et divinatione per somnium*, in 16 chapters; followed, at pp. 61-195, by *De sphaera coelesti* in 7 chapters, including figures of the Ptolemaic, Copernican and Tychoenic systems, otherwise more elementary than the *Sphere* of Sacrobosco. Delisle (BEC XXXI, 1870, 463-565) names Desperières as author of the tract on dreams, but I did not see the name in the MS.

divine and diabolical dreams can be recognized, and why the dreams of melancholy persons are truer. But in the last chapter the interpreters of dreams are refuted.

It has been shown in our previous volumes that the art of geomancy as commonly practised was purely a matter of chance, although it made pretenses to an astrological foundation. Robert Fludd, however, in the early seventeenth century tried to present it as a science of the intellectual soul in which intellectual rays emanated from the mind to mundane affairs and then returned to their center with tidings of the future.¹⁵ In *Prolegomena*, before the four books of the treatise begin, Fludd contends that the science of geomancy is a true act of the intellectual soul, although many regard it as absurd and ridiculous. He discusses how the geomancer should so dispose himself that the intentions of his mind are clearly emitted. The rays of the inner soul must concentrate, and a state of mind be attained akin to ecstasy or rapture. Geomancy is an abstruse and occult science which leads the mind through the universal nature of the macrocosm. In the second chapter of the first book Fludd again instructs as to preparation of the mind of the operator before he casts the points on which the geomantic figures are based.

Meanwhile in the first chapter he has spoken of geomancy as terrestrial astrology and has reminisced concerning his practice of it during a winter at Avignon in the next to the last year of the reign of Queen Elizabeth (i.e., the winter of 1601-1602). When some Jesuits complained to the Vicelegate of Fludd's geomancy, he asked them what Italian cardinal did not have his nativity drawn up by either astrology or geomancy—a sad commentary on the effect of the papal bull of 1586 against judicial astrology. A few days later the Vicelegate invited Fludd to dinner and showed himself well versed in geomancy. The rest of Fludd's four books differs little from other works of geomancy.

In the geomantic collection of 1687 Fludd's treatise is imme-

¹⁵ *Roberti Flud De animas intellectualis scientia seu geomantia hominibus appropriata quorum radii intellectuales extrinsecus, hoc est circa negotia mundana versantes et e centro dissipati*

in centrum recolliguntur, pp. 1-170 of *Fasciculus geomanticus in quo varia variorum opera geomantica continentur*, Verona, (Heidelberg?), 1687, in-8. BN V.21845. BM 1141.a.16.

diately followed by a longer geomancy by H. de Pisis,¹⁶ which I have also read in an earlier edition of 1638.¹⁷ Although the author makes profession of submission to the decrees of the Church of Rome, there is no Imprimatur by ecclesiastical authorities, but at the end of the volume a royal privilege for ten years is dated 1626, and then we read, "achevé d'imprimer le 18 Feurier 1627." No reason is given for the delay in publication. The work is divided into three books devoted respectively to theory, practice and questions taken from previous authors. The theory is largely astrological. Instead of jotting down four rows of dots at random, a wheel with sixteen projections is spun or whirled in order to obtain one of the sixteen geomantic figures.¹⁸ Fludd is cited more than once, also Arabic writers like Geber and Aomar, medieval Latins like Gerard of Cremona and Peter of Abano, and sixteenth century geomancers like Cocles. That the decrees of the church and freedom of the will are observed none too whole-heartedly by H. de Pisis is seen from such predictions as: bitten on the leg by a dog, he will die in December; in peril of his life in waters, he will die in September; pleasure with women, loss of fortune and fame, lascivious adultery; success, wealth, access to the king with honor, advantageous breaking-off of partnership. Or from such questions as: will a lost or stolen article be found? will a debt be recovered? which brother will die first? is it good to build now? will a fugitive slave be caught? will there be war or peace?

Paschius in 1700 still spoke of geomancy as requiring a state of ecstasy and cited Fludd.¹⁹ In the *Fasciculus Geomanticus* of 1687, besides the works of Fludd and H. de Pisis, were Geomantic Questions by the Arab Alfakinus, translated into Latin by Plato (of Tivoli?) and now first printed from an old manuscript of the year 1535. A Geomancy by G. Büchling was published at Jena in 1695.²⁰

Francisco Torreblanca, whose general attitude towards magic has been considered in our eleventh chapter, in his first book of

¹⁶ *Fasciculus geomanticus*, 1687, pp. 171-523.

¹⁷ H. de Pisis, *Opus geomantiae completum in libros III divisum*, Lyons, J. A. Hugvetan, 1638, in-8, 378

pp. BM 1141.b.18.

¹⁸ *Ibid.*, p. 26.

¹⁹ *De novis inventis*, 1700, pp. 598-99.

²⁰ Not in BM and BN catalogues.

1618 or 1623 on divining magic.²¹ held that natural divination was permitted, and assumed the influence of the heavens upon inferiors. Birds, which inhabit the region of air, are more sensitive to this celestial influence as it passes through the air and so sense weather changes and some other future happenings before men do. But natural divination is also possible from inanimate objects. Eclipses of sun and moon announce war, famine and other discomforts of nature. Reference is made to the corpse bleeding at the approach of the murderer. But there is a divine as well as natural disposition in signs of the future. Monsters may come about naturally from superfluity or paucity of matter, but since they are always produced by divine disposal, they are always to be regarded as signs of some evil. There is divination from meteors, including comets, which are prodigious and preternatural, and also prodigious divination from the other elements which often display signs of divine wrath. Torreblanca denies power to words and holds that the Cabala is an invention of the devil, as are the *ars notoria* and *ars Paulina*. Aeromancy is by the apparition of specters; hydromancy by inspection of waters; geomancy by making points on the ground with a stylus. There is no sense and no truth in it.

Torreblanca would grant some power of probable prediction to revolutions, nativities, and elections, if no necessity is assumed, but future contingents do not depend on the stars but on divine predestination which is hidden from man, and the fabrication of astrological images is false. Of interrogations he says nothing. He denies that Abraham or the three Magi were astrologers, and lists various arguments against astrology, many of which would apply equally well to those parts of which he has approved. But in an appendix he reaffirms his middle position, asserts that astrology for farmers, physicians and navigators is permissible, and gives the bull of Sixtus V.

The canons of physiognomy are more certain than the arguments of all judicial astrology, because neither reckoning nor instrument fails, since in each nature are its own instruments corresponding to sign and planet. Thereupon he gives seven planetary types of

²¹ Francisco Torreblanca, *Daemonologia sive de magia naturali* . . . I, *de magia diuinatrice*, Mainz, «1623». BM 719.g.85.

physiognomy, and then, from Cirvelo, signs from the different parts of the body. But he condemns astrological chiromancy and its seven mountains of the hand, holding that there is no natural connection between them and the influence of the heavens, and that only the five lines of the hand and the triangle in the middle of the palm are significant.

As for sortilege, if the outcome is expected from fortune, it is idolatrous; if from fate, heretical. It is licit to observe natural dreams. But since dreams do not come directly from the aspect of the sky but indirectly from its effect upon the body and humors, it is difficult to predict from them, and the advice of Synesius of Cyrene that everyone should observe the outcome of his dreams and compose an art thereby should be thought superstitious. Observance of days and of lucky and unlucky times is vain. Even critical days are not dependent on the stars.

Hieronymus Franzosius, a physician and philosopher of Verona, whose earlier work on divination from dreams and prophecy was noted in my sixth volume,²² in 1646 published at Verona an Exposition of the Paraphrase of Averroes on the book of Aristotle on Dreams.²³ In it he avers that the previous youthful work was printed without his permission, and with omissions and additions.²⁴ Averroes says that there is no man who has not had a dream that announced some coming event, and that, after a man has experienced this many times, he will see that it does not happen by chance but essentially. And Themistius holds that there is almost no dream from which some divination and conjecture or some interpretation cannot be made.²⁵ Franzosius states that Averroes and the Peripatetics generally agreed with the Epicureans in condemning all divining arts, but agreed with the Stoics in maintaining human power of natural divination. Averroes says that memory and cogitation do not act in sleep. Franzosius says that when a man or animal sleeps, there is repulsion of spirits and blood from the brain to the heart, and that in the heart are present all the senses including the imaginative faculty. Also this blood which

²² T VI, 511-14.

1646, 88 pp. BN V.8872.

²³ *Expositio paraphrasis Averrois in librum Aristotelis de somniis*, Verona,

²⁴ *Ibid.*, p. 7.

²⁵ *Ibid.*, pp. 6, 9.

descends from the brain to the heart is turbid and vaporous and brings with it specters and semblances.²⁶

Individual substances have determined causes, even if they are generated from putridity. Individual animals and plants are determined by seed and the active Intelligence; non-generables, by the elements and celestial bodies. It is not unthinkable that the abstract Intelligence gives to the imaginative soul the universal nature of an individual fact, and that the receiving imagination makes it particular. Latin philosophers object that the active Intelligence cannot supply universal species except by the motion of the heavens, and that, while it can produce intelligible things in the mind, it is not joined to phantasms. According to Averroes, however, there are certain particular species in the imagination in which are latent the causes of future things, which, since they are determined, have universal nature and are *per se*. This sort of universal nature, although obscured in particulars, sometimes enlightens the possible Intellect through certain similitudes, albeit obscurely and indistinctly. When the light of the active Intellect is perfectly collected, and all particular and accidental nature laid aside, there is comprehension of the causes of the future.²⁷

Astronomers judge as to the future because they think that they know from the celestial bodies the particular causes of generation of each individual. But Franzosius declares that judicial astrology is not an art or science but an imposture and figment, and that even astrology for farmers, sailors and medical men is dubious, although less reprehensible. Later on, however, he affirms that it is not to be denied that men of melancholy temperament can be born under certain conjunctions of the stars, "by which divine force, together with secondary causes, is diffused in a singular manner to sublunar things, in whose virtue are wrought all things possible in this world."²⁸ Three types of men share the power of divination: those rapt in ecstasy and melancholy; those who are born with a marvelous disposition of the imagination for this, as he has indi-

²⁶ *Ibid.*, pp. 9, 13, 17-18. Franzosius also wrote *De motu cordis et sanguinis in animalibus pro Aristotele et Galeno adversus anatomicos neo-*

tericos, Verona, Typis Merulanis, (1651-1652): BN 4^oTb³⁶.18.

²⁷ *Ibid.*, pp. 34-35, 46, 52.

²⁸ *Ibid.*, pp. 40, 57, 75.

cated, and who foresee the future by aid of the active Intellect and in concourse with other causes work wonders; and a third type not admitted by Averroes or any Peripatetic, namely, those who seem able to acquire speculative sciences while asleep and without medium.²⁹

We next consider, in roughly chronological order, a number of writers on either one phase of divination or several.

The *Magia arcana* of Johann Faulhaber of Ulm in 1613, dedicated to Matthias I, emperor-elect, king of Hungary and Bohemia, archduke of Austria, etc., consists chiefly of numerical tables by means of which one is supposed to be able to predict such future events as the appearance of Gog and Magog, the numerical and cabalistic calculations being based on Biblical texts.³⁰ The work was published at the expense of Johann Remmelin, a physician and mathematician of some reputation. It appeared in both German³¹ and Latin, and the latter is said to have been translated from the French. Fifteen years later Faulhaber issued a treatise entitled *Geheime Kunstammer*, on stratagems of war, other unheard-of secrets, and marvelous machines.³²

The book entitled *Vates*, by the Huguenot theologian, Pierre du Moulin or Molinaeus (1568—1658), on foreknowledge of the future and good and bad prophets, was first published in 1640.³³ It is concerned mainly with the prophecies of the Old and New Testaments, but the third of its five books is devoted to evil prophets, uncertain or fallacious soothsaying, and various arts of Satan. Du Moulin accepts, however, the influence of the stars upon inferior creation, including the human body and appetites, but saving freedom of the will.³⁴ There is no doubt that the demons foresee many things from the aspect of the stars, but they too cannot force the will. Since they perceive the temperaments and internal condition

²⁹ *Ibid.*, pp. 82-84.

³⁰ *Magia arcana coelestis sive cabalisticus novus artificiosus et admirandus computus de gog et magog*, Nürnberg, 1613: BM 719.g.27. The catalogue says, "translated from the French."

³¹ Nürnberg, 1613, BM 8631.bbb. 16.

³² Ulm, 1628, in-4, 28 pp. BN V. 10215.

³³ I have used the edition of 1672: *Petri Molinaei Vates seu de praecognitione futurorum & bonis malisque prophetis libri V*, Gorinchemi ex officina Pauli Vink, bibliop.: Col 156.4 D899.

³⁴ *Ibid.*, p. 99.

of human bodies, they easily foresee imminent diseases, and, although they do not know the precise hour of death for individuals, can set a day beyond which one cannot live.³⁵

Of most arts of divination and magic du Moulin gives the usual traditional account. With reference to lycanthropy, he does not believe that Satan can alter species or turn a man into a beast. But he does hold that the devil can clothe men in a cloud so that they seem to be wolves and deceive the eyes of spectators, and that he can, *deo permittente*, affect the phantasy so that men think themselves wolves and act like them.³⁶ Du Moulin is favorably inclined towards physiognomy within limits and gives a number of probable physiognomic signs.³⁷ But, although he does not question the authenticity of the work on physiognomy attributed to Aristotle, he says that it contains much which is idle and contrary to experience.³⁸ On the other hand, although he states that sure rules cannot be laid down as to the interpretation of dreams, he gives several pages of particular examples, such as that to dream of a heavy knock on the door or that one's ear is pulled, is a sign of impending death or judgment of God, and that to dream of smoking tobacco indicates that one's fortune will soon be dissipated and one's wealth go up in smoke.³⁹

Jacobus Masenius, in his *Mirror of Images of Occult Truth*,⁴⁰ maintained that birds, inanimate objects, and human actions might be signs of the future, but that absolutely certain foreknowledge was not to be had from natural causes.⁴¹ He nonetheless believed in marvelous effects of nature, wonderful force of the imagination in producing monsters, and miracles of nature both in brutes and in the elements.⁴² And monsters were often signs of the future. Dreams offered different images to different persons according to their natural constitutions, and sometimes the same image was interpreted in a different sense. But physicians learned from dreams with certainty; dreams arising from free extrinsic causes often sig-

³⁵ *Ibid.*, pp. 85-86.

³⁶ *Ibid.*, pp. 130-31.

³⁷ *Ibid.*, p. 149 *et seq.*

³⁸ *Ibid.*, p. 155.

³⁹ *Ibid.*, pp. 164-66.

⁴⁰ *Speculum imaginum veritatis occultae*, Coloniae Ubiorum, 1650, in-8. BM 637.d.14.

⁴¹ *Ibid.*, pp. 38-40, 43-44, 46.

⁴² *Ibid.*, pp. 48-54.

nified occult truth; and we can learn from every sort of image seen in dreams.⁴³

Johannes Garibus of Naples published at Venice in 1650–1651⁴⁴ a brief account of ten phenomena seen in the sky during the preceding decade. A picture of each prodigy precedes the account of it, and these are interlarded with interpretations by Leonhard Busserus in his *Meteorology*, book III; Claude Lambert of Burgundy in his *Viridarium astronomicum*; Sancius de Huerta of Valladolid, *Parenesis*, cap. 3 and *Centiloquium*; and Christopher Brahe of Denmark in his *Centiloquium* and *De novis astris*, cap. 35. None of these writers appears either in Beughem's *Bibliographia mathematica* of 1688, or in the printed catalogues of the British Museum and the Bibliothèque Nationale, Paris, except that in the former catalogue the name of Busser appears, but only in connection with Garibus's work. Garibus also lists previous celestial apparitions and says that sometimes they have natural causes, sometimes not.

Two Latin manuscripts in his own hand by a Theodatus Osius of Milan, who seems to have written shortly after 1655, show him to have been hospitable to every form of divination and number mysticism. Two treatises by him are involved, one on Pythagorean numbers,⁴⁵ the other on divination and magic.⁴⁶ Each is found twice repeated in the same manuscript, one copy perhaps representing a first draft.

The treatise on Pythagorean numbers or arithmetic says that

⁴³ *Ibid.*, pp. 64, 73–77.

⁴⁴ According to Beughem, *Bibliographia mathematica*, 1688, p. 51, and Zedler X, 313, citing Toppi, *Biblioteca Napoletana*, 1678: *De phaenomenis ostentis ab anno 1641 ad annum 1650*, Venetiis, 1651, in-4. But according to the catalogue of the Bibliothèque Nationale, Paris, *De phaenomenis ostentis ab anno 1641 ad annum 1650*, Venetiis apud Juntos, 1650, ii-36 pp. Copy used: BN V.7824, in which pp. 33–35 are misplaced at the front.

⁴⁵ Milan, Ambros. D.inf.15, 17c, fols. 62r–104v: "Arythmeticam Pythagoreos. Inscripti hunc librum in quo longissimis contemplationibus specu-

lationibusque et observationibus laboravi... magnitudinem rei ut id quod incertum est sub specie bene chrescat." At fols. 112r–166r the text is repeated. The same is true of what seems a dictionary of Greek mythology at fols. 2r–29v, which is repeated in better writing and with fewer corrections at fols. 30r–53v. On the fly-leaf is written "Reductum theoricæ sive primæ partis arithmeticæ Pythagoræ." At 61r is a letter to Osius from someone whose name I could not make out.

⁴⁶ D.inf.257, 17c, fols. 1r–36v, and again at fols. 47r–78v.

Plato related the composition of the world to arithmetical and geometrical progression. Musical concordances are considered. Later the number zero is used for nothing, one for life, two for motion, three for matter, four for body, five for soul, six for form, seven for status, eight for death, and nine for privation.⁴⁷ The other manuscript and treatise or collection of materials opens with a bit on the importance of the number one in divination and magic.⁴⁸ Three species of the latter are said to be derived from it. There follows a reply to the question whether the voice of the eighth month's child is heard from the womb, the answer being that it is possible and an evil sign.⁴⁹ Then a discussion of chiromancy relates it to physiognomy and metoposcopy, associates the three chief lines in the palm with heart, brain and liver, and the five tumors or mountains at the base of the digits with five planets. Because the middle finger is longest, its mountain is associated with Saturn. Jupiter has the index finger; Mars, the thumb; Venus, the ring finger; and Mercury, the little finger. There follows a Sphere or Wheel of Pythagoras,⁵⁰ a rule for finding the true ascendent and the ruling planet, and various astrological matter including *figurae coeli* for military happenings of 1655 and horoscopes of Philip III of Spain (April 13, 1578) and his second son, Charles (Nov. 17, 1607), then divination from the first twelve days of the year and from the days of the week.⁵¹ Osius says that wise men laugh at the lore of old-wives as superstitious,⁵² but he gives some of it too.

A similar work appeared under the name of Peruchio or de Peruchio at Paris in 1657 and again in 1663.⁵³ It consists of an astrological chiromancy, an astrological physiognomy, and an astrological geomancy. We are told that, while astronomers reckon their 24 hour day from noon to noon, geomancers do so from dawn

⁴⁷ D.inf.15, fol. 75v.

⁴⁸ D.inf.257, fols. 1r-2v.

⁴⁹ *Ibid.*, fols. 2v-4r.

⁵⁰ *Ibid.*, fol. 6v.

⁵¹ *Ibid.*, fols. 25r, 26r.

⁵² *Ibid.*, fol. 32r. An *Arithmetica restituta* by Osius in D.inf.211 is also an autograph. For other MSS by him at Milan see Argellati, *Bibl. scriptorum*

Mediolanensium, 1745, I, ii, 735-36, who spells his name Hosius and dates his death in mid-century.

⁵³ *La chiromance, la physionomie et la géomance. Avec la signification des nombres et l'usage de la roue de Pythagore*, Paris, 1657, in-4. I have used the edition of Paris, 1663, in-4, 343 pp. BM 719.f.15.

to dawn. The first hour represents the planet of the day. Among the questions put are whether the person concerned will come out of prison, whether he'll run the risk of the death penalty, whether he will undergo corporal punishment. The twelve houses of the *figura coeli* are supplemented by three others for two witnesses and a judge, making fifteen in all. There is further added a method of divination by numbers, a key number being obtained by throwing a die four times and adding the four numbers together. By this means such questions are answered as whether a woman is chaste, whether there will be rain this month, whether a usurer will profit or lose by his loan, whether the accused is innocent or guilty. Finally comes a Wheel of Pythagoras or Fortune. It is not merely a wheel of life or death but is surrounded by the 23 letters of the Latin alphabet and as many numbers. You obtain a number, presumably by whirling the wheel; get a second number by taking that on the wheel which is opposite the first letter of the questioner's name; third, the number of the planet of that day; fourth, the number of the day of the month. The four numbers are added together and divided by four. The wheel is presumably whirled again, and the answer is favorable or not as the number is on the upper or lower half.

In the chiromantic section of Peruchio's work are such assertions as that one or more triangles in the plain of Mars in the palm of the hand or below it signify a martial humor and sanguinary and prone to commit murder; and that two connected crescents denote the murderer, while a star promises riches. Other things signified include prison, wounds, favor of princes, an ignominious death, and, for a woman, prostitution.

Johann Praetorius (1630-1680) delighted in treating occult subjects and particularly divination. In 1661 he wrote on chiromancy and metoposcopy;⁵⁴ in 1662 in German on the Silesian Rubin-zalius⁵⁵ or Rubenzagel⁵⁶ or Rübezahl, the name of a mountain

⁵⁴ *Ludicrum chiromanticum Praetorii seu Thesaurus chiromantiae locupletissimus* . . . , bound with *Centifrons idolum Jani hoc est Metoposcopia seu Prosopomantia*, Jena, 1661. BM 1141. c.16. Col 158.5 P88.

⁵⁵ *Daemonologia Rubinzalii Silesii* . . . , Arnstadt, 1662, in-12. BM 1080. b.37.

⁵⁶ *De spectro Rubenzagel*, Magdeburg, 1672, in-8.

demon; in 1665 on German astrology, that is, a new-found geographical astrology;⁵⁷ in 1666–1667 on all sorts of wonderful and monstrous men;⁵⁸ in 1677 on divination by sieves, with some discussion of other methods of divination;⁵⁹ and in 1680 on magic divination with cocks.⁶⁰

The subject of alectryomancy of which Praetorius had treated in 1680 was taken up again only three years later by François de Monceaux who in his *Disquisition on Divining and Operative Magic*,⁶¹ after enumerating sixty-nine species of divination in alphabetical order, singled out alectromancy as the subject of his book. Although in library catalogues he is hardly distinguished from the Franciscus Moncaeus by whom books appeared in 1587, 1593, 1597 and 1606, this cannot be a posthumous work of that author, since it cites publications of 1676, 1677, 1679 and 1680. Indeed, Moncaeus read widely, and I was able to cull a number of unfamiliar titles from his pages. Otherwise it is confusing and tiresome reading.⁶² Perhaps the best thing that can be said for it is that it was found worthy of review in *Philosophical Transactions*, although some may be surprised that attention should be paid there to a work on magic and divination in general, and divination from cocks in particular. The reviewer, however, evidently read the book with interest and care to get as much out of it as he did. And since what he got out of it was what he thought would interest the other members of the Royal Society and the scientific world in general, one can scarcely do better than repeat the substance of his remarks.⁶³

Magic is either human or diabolical; either natural, comprising

⁵⁷ *Astrologia Germanica et Germania, das ist, eine neu-erfundene geographische Astrologie*, Leipzig, 1665. BM 8610.b.75.

⁵⁸ *Anthropodemus Plutonicus, das ist, eine neue Welt-Beschreibung von allerley wunderbaren Menschen*, Magdeburg, 1666-67. BM 8631.c.19. Col 398.4 P88.

⁵⁹ *De coscinomantia, oder vom Sieb-Laufe . . .*, Curiae Variscorum (Stadt-amhof), 1677. BM 8610.b.54.

⁶⁰ *Alectryomantia seu divinatio magica cum gallis gallinaceis peracta*,

Frankfurt and Leipzig, 1680. BM 719.g.34.

⁶¹ Franciscus Moncaeus, *Disquisitio de magia divinatrice et operatrice*, Francof. et Lipsiae, 1683, in-4, 184 pp. BN R.8025. BM 719.g.13.

⁶² This is partially due to the use of several different fonts of type and to poor arrangement, some captions being centered and others not, while points numbered v, vi, vii and viii all occur on page 18, but ix is not reached until page 35.

⁶³ PT, XIV, 706-10.

all the surprising effects of art, or transnatural, under which is put the transmutation of metals. The antipathy of the lion to the cock (if true) may be accounted for by the harsh effect of the cock's crowing upon the lion's ear, or by the circumstance that there are no cocks in Africa and that in Thessaly and Macedonia they do not crow. Auguries from cockcrows vary as they occur A.M. or P.M., to which some add the sign of the zodiac and phase of the moon. Storks do not fly to warmer climates in the winter but hibernate, and they will not build their nests upon a Jew's house. Moncaeus also discusses how swallows and other birds who disappear in winter-time live, why cocks are placed as vanes on towers, and, like Francis Bacon, nineteen kinds of motion. He considers astrologers' explanation of apparent free will as really a mechanical effect of the unequal or incommensurate movements of the stars, and Descartes' explanation of animals as automata. He digresses from alectromancy to coscinomancy and legerdemain. Under movements of Belial he treats of incubus, apparitions and imaginary journeys of witches. Under sympathetic motion he discusses the divining rod, remora, torpedo and heliotrope; under the internal force of words come the Cabala, signatures and talismans.⁶⁴ He ends with reflections on a remark of Marcus Marci in his *Philosophia restituta*, "that all effects, how surprizing soever, are merely natural." Moncaeus was listed by Menestrier among those who favored talismans or astrological images along with Paracelsus, Agrippa, Cardan, Porta, Campanella, Gaffarel, Van Helmont, Fludd, Giuntini, Trithemius and Goclenius.⁶⁵

It may be added that the full Latin title of the book of Moncaeus promises a getting at the heart of the matter which has been rare in previous works, an agreeableness omitted by them especially in treating natural magic, and the covering of a large part of curious physical science.⁶⁶

⁶⁴ There would seem to be no reason for associating the doctrine of signatures in plants or even astronomical images with the power of words, although the latter might be related to characters.

⁶⁵ C. F. Menestrier, *La philosophie*

des images énigmatiques, Lyon, 1694, pp. 258-59.

⁶⁶ *Disquisitio de magia divinatrice et operatrice in qua sobrie ac modeste, non quidem modus ac causae, sed ea quae tam circa materiae difficultatem, in aliis tractatibus ubique obviam,*

It may further be of interest to compare his nine kinds of magic, based upon Deuteronomy 18, 10-11, with the King James version and the Vulgate.⁶⁷

We turn back chronologically to consider one or two attacks upon divination which were made in the decade of the sixties.

The *Pseudomantia* of Giuseppe Maria Maraviglia, professor of moral philosophy at Padua, which was printed at Venice in 1662, is, as its title indicates, unfavorable to arts of divination.⁶⁸ It is divided rather clumsily into five parts which are separately paginated. In the first and longest part⁶⁹ Maraviglia lists and describes all the kinds of divination he can think of, but others occur to him in the subsequent parts. The next three parts are respectively devoted to philosophical, astrological and theological animadversions upon the foregoing,⁷⁰ while in the final part divinations are damned

tam enucleationem, quae semper rara, tam jucunditatem, quae apud alios fere praesertim in Magia naturali quam Sympathia et Antipathia rerum exprimit omitta, expenduntur et proponuntur ita ut magnam partem Physices curiosae repraesentet, auctore Francisco Moncaeo Fridevalliano Atrebatto, Francofurti et Lipsiae sumtibus Joh. Christiani Wohlfarti, anno 1683.

⁶⁷ Moncaeus lists "Lustratores qui liberos suos per ignem transire faciunt; divinatores, scilicet arioli; augures; calculatores; malefici praestigiatore, sortiarum; pythones; scioli; necromantici"

The Vulgate reads: "Nec inveniatur in te qui lustrat filium suum aut filiam ducens per ignem, aut qui ariolos sciscitetur et observet somnia et auguria, nec sit maleficus. Nec incantator, nec qui pythones consulat nec divinos, aut quaerat a mortuis veritatem."

The King James runs: "There shall not be found among you any one who maketh his son or his daughter to pass through the fire, or that useth divination, or an observer of times, or an enchanter, or a witch. Or a charmer,

or a consulter with familiar spirits, or a wizard, or a necromancer."

The *calculatores, sortarii* (lot-casters) and *scioli* of Moncaeus do not correspond to either version, unless the *calculatores* are supposed to be interpreters of dreams.

⁶⁸ *Pseudomantia veterum et recentiorum explosa sive de fide divinationibus adhibenda tractatus absolutissimus ad abolendam falsae divinationis superstitionem cum animadversionibus philosophicis astrologicis et theologicis* . . . , Venet., 1662. BN D.386, in-fol. BM 719.m.13. Hauber, *Bibliotheca... Magica* (1738), I, 319-37, reproduced some of its headings and noted that Maraviglia still believed in the devil, but admitted that he had not read the book through and thought it not worth it.

⁶⁹ *De fide adhibenda divinationibus*, 54 dissertationes in 212 pp.

⁷⁰ Part 2 has 60 Diss. in 96 pp.; Parts 3, 60 Diss. in 88 pp., but pp. 1-8 including the title page were missing in the BN copy; Part 4, 62 Diss. in 112 pp.

from sacred Scripture, sacred Councils, sacred Canons, papal bulls and holy Fathers.⁷¹

A few types of foretelling the future are excepted by Maraviglia from censure. One is weather signs from animals. Another is astrological medicine, but he rejects critical days.⁷² Some inferences as to the future from a study of history are allowed, especially the doctrine of fatal periods for kingdoms and empires. Natural divination from stones is distinguished from the superstitious variety. But Maraviglia warns that, while no one will deny that many marvels are worked in nature by stones, unnatural effects should not be asserted of them, such as that ophthalmium makes men invisible, that the heliotrope obscures the sun, the emerald betrays adultery, and the turquoise prevents injury from a fall.⁷³ Prodigies, even if natural, are very obscure and difficult to predict from, and one should not attempt to infer particular details of the future from them.⁷⁴

The notory art aims by use of certain fasts, prayers, figures and words to attain science and knowledge. Many theologians distinguish it from arts of divination, which try to answer particular questions as to the future, whereas it seeks knowledge of universals, that is, science which may be acquired naturally and by study. Anyway it is a mortal sin, unless ignorance and light-headed curiosity excuse the offender. But, although the attempt to acquire knowledge by such methods is a sin, it is not a sin to use the knowledge which has been thus acquired. The use of words, characters, ceremonial, and even natural objects for ends with which they can have no effective natural connection is illicit, and so are astronomical images, although Cajetan and Vittoria appear to defend them.⁷⁵

The following year the same Maraviglia published a *Vaticinia gloriæ Bavaricæ*,⁷⁶ a title which at first glance might seem inconsistent with the *Pseudomantia*. But it is merely a flattering eulogy of the infant prince of Bavaria, based not upon his horoscope but the eleven names which had been given him. It is followed by an

⁷¹ Part 5 covers 52 pp.

⁷² IV, 70-71; III, 40-41.

⁷³ I, 177.

⁷⁴ IV, 65.

⁷⁵ IV, 77-79.

⁷⁶ BN [M.760, in-fol.

Instruction of the Prince, again from his eleven names.⁷⁷ This frigid conceit is terminated by a Series of Princes from Charlemagne down to the present.⁷⁸

John Spencer, a bachelor of divinity and fellow of Corpus Christi College, Cambridge, held that the "general constancy and harmony of Nature in its operations is not so much removed as commended by . . . prodigious occurrences."⁷⁹ But he denied that such prodigies were omens or signs of the future, whether they were natural prodigies, or preternatural such as strange sights in the air and apparitions of spirits, or even supernatural.

Vultejus or Vultejus (1639–1700) published a dissertation on superstitious divination at Copenhagen in 1668.⁸⁰

To this day many persons not only believe in the efficacy of dowsing and the divining rod in locating water underground, but employ it in practice.⁸¹ In the seventeenth century we have heard even the sceptical Cassendi accept it for finding water and question its validity only in the case of veins of metal. Boyle's attitude was similar, while even Frommann admitted that its successful operation was not necessarily the work of the devil. In the closing decade of the century it was further used in the detection of criminals.

In the *Journal des Sçavans* of January 12, 1693,⁸² appeared an account by Chauvin, a member of the College of Physicians of Lyon, how the murderers of a wine merchant and his wife on July 5, 1692, had been tracked down with the divining rod by Jaques Aimar Ternay, a peasant of Dauphiné. Admitted by the police to the wine cellar where the crime had occurred, his pulse rose to feverish heat, and the rod turned at the two spots where the corpses of the victims had been found. It led to the shop whence their money had been stolen and on out of town to a gardener's

⁷⁷ At pp. 133-218.

⁷⁸ It has a new pagination.

⁷⁹ *A Discourse concerning Prodigious: wherein the vanity of presages by them is reprehended . . .*, 2nd edition, London, 1665, 408 pp. From the Preface, fol. A 2 verso. I own a copy.

⁸⁰ Johannes Vultejus, *De superstitione divinatione dissertatio*, Holmiae, 1668, in-4. Listed by Mollerus, *Swecia*

literata, 1698, p. 250, but not in BM.

⁸¹ See an article on Dowsing by Thomas M. Riddick in the *Proceedings of the American Philosophical Society*, XCVI (1952), 528-34.

Also J. W. Gregory: "Water divining." *Annual Report of the Smithsonian Institution* (for 1928), 1929, pp. 325-48.

⁸² JS XXI, 21-29.

house, where he insisted that the murderers had sat at a table and drunk from one of three bottles towards which the rod turned. Then the two children who had previously denied it for fear of being punished for having left the door open, as their parents had forbidden them to do, described the three men who had entered. Footprints showed where they had embarked on the river, but the rod led under an arch of the bridge of Vienne outside the channel, indicating that they had no boatman and did not know the current. Aimar stopped everywhere along the stream that they had, went straight to their lodgings, the beds where they had slept, the table where they had eaten, the very glasses and dishes which they had used. When he reached the military camp of Sablon in Dauphiné, he became very disturbed and fancied he saw the murderers but did not dare to use the divining rod for fear the soldiers would attack him. He returned to Lyon for credentials, but by the time he got back to Sablon, the murderers had left. He traced them to Beaucaire, whither a fair had attracted them, and, scouring the streets, stopped before the gate of a prison and asserted positively that one of them was there.

Of a dozen or so prisoners who were lined up before him the rod turned to a hunchback who had just been incarcerated for petty larceny; it further indicated that the others had taken a footpath leading to the road to Nîmes. Aimar, however, returned with the hunchback to Lyon but found that he could not walk behind him without insufferable heart spasms. After the hunchback, led back by the route he had come and recognized by his hosts, had confessed and been executed, Aimar, accompanied by archers, returned to Beaucaire to pick up the scent of the other murderers at the footpath. But the rod first led him about the town to the same prison gate, where it was learned that a man who answered to their description had recently come to ask news concerning the hunchback. Aimar pursued them to Toulon to the very hotel where they had dined the day before and then by sea but failed to catch up to them before they had left the limits of the realm.

This pursuit would seem to have been aided by circumstantial evidence other than the divining rod and not to have been quite so

wonderful and inexplicable as it appeared to be to many contemporaries. But it was explained by Dr. Chauvin as the result of corpuscles from the bodies of the murderers entering the pores of the body of Aymar, causing him to feel sick at the scene of the crime and behind the hunchback, a sensation which he did not experience when dowsing for water and which was less when on the river, where the corpuscles which, although very minute, were too heavy to be displaced by winds, but would sink in water, were less in evidence.⁸³ Dr. Chauvin did not ascribe the movement of the divining rod to the corpuscles entering its pores, since it made no difference of what wood it was made, but to the effect of the corpuscles upon the muscles of Aymar's fingers which held the rod.

After the execution of the hunchback, "many experiments were made at Lyon to satisfy the curious," and various persons felt or imagined or pretended that they felt themselves affected as Aymar had been at the spot where the murders had been committed, and that they possessed similar gifts to his. In one case, however, of a man of sixty who was experienced in dowsing, the rod turned only very slightly in the wine cellar at the scene of the crime.⁸⁴

A letter published in the *Journal des Sçavans* of April 27, 1693, states that Monsieur le Prince doubted the virtue attributed to Aymar's divining rod, and had him come to Paris, where it twice failed to indicate the scenes of killings, and that tests made at Versailles and Chantilly had similar results.⁸⁵ In like manner Guyon, in the volume of his Ecclesiastical Library which was devoted to the magic arts, records that when Aymar's discovery of a thief made a great sensation in the Lyonnais and Dauphiné, the prince of Condé had him come to Paris to see the experiment repeated, but Aymar failed several times to do so and likewise before the members of l'Académie des Sciences. Guyon also records that Aymar was said to have discovered forgotten boundaries of fields in Normandy.⁸⁶

⁸³ JS XXI, 98-104.

⁸⁴ JS XXI, 26, 28.

⁸⁵ JS XXI, 277-78.

⁸⁶ Abbé Claude-Marie Guyon, *Bibliothèque ecclésiastique*, VIII (1771),

401-407. Guyon still believed that the divining rod really turned, that it did not do so in the hands of everyone, and that it turned for hidden things as well as underground water. But he

In the same year as the articles in the *Journal des Sçavans* appeared a book on the subject by Le Lorrain de Vallemont,⁸⁷ a priest and doctor of theology, who the year before had published a treatise on the magnet.⁸⁸ Indeed, there were two editions of his book on the divining rod in 1693, and two more in 1696,⁸⁹ while the first edition was promptly accorded a review of nearly eight pages in the *Journal des Sçavans*.⁹⁰ He cited over a hundred authors on the divining rod as well as a great number of experiences, and held that its action was natural, although in Germany some superstitious ceremonies had been added. As the magnet turned towards the pole, so the rod turned toward water or veins of metal or hidden treasure underground, the corpuscles from which were attracted by those of the dowser, whose hands opened up the pores of the rod to admit these, just as the magnet magnetizes a rod of iron. This also served to explain why the divining rod worked only in the hands of certain persons, and not always for the same person. It was only an instrument, but, like the microscope, revealed what had before been invisible. De Vallemont's book continued to be read in the next century, when there were editions of 1709, 1722, 1747, 1752 and 1762.

The Jesuit, Menestrier, in a book which first came out in 1682—1683,⁹¹ had classed as diabolical various forms of divination, such as geomancy, whose operations are arbitrary and have no natural basis,⁹² and the interpretation of dreams. He says that a Christian is not permitted to put faith in dreams, and the church has always

denied that its turning could be caused naturally by vapors from the water or effluvia from hidden metals, and consequently attributed this to the devil, as did Menestrier, whose discussion we are about to consider.

⁸⁷ *La physique occulte, ou Traité de la baguette divinatoire et de son utilité pour la decouverte des sources d'eau, des miniers, des tresors cachez, des coleurs et des meurtriers fugitifs*, Paris, 1693; 2nd ed., Amsterdam,

1693, in-12.

⁸⁸ *Description de l'aimant. Avec plusieurs expériences tres-curieuses...*, Paris, 1692.

⁸⁹ At Paris, in-12, 7 fols., 422 pp., 4 fols. Also at Amsterdam.

⁹⁰ JS XXI, 323-31.

⁹¹ *La philosophie des images*, Paris, 2 vols. I have used the edition of Lyon, 1694, *La philosophie des images énigmatiques*.

⁹² *Ibid.*, pp. 400-401.

regarded the interpretations and conjectures based upon these ambiguous signs as a species of impiety and superstition contrary to God's law.⁹³

Menestrier spends some time on the Prophecy of St. Malachi as to the popes and the Centuries of Nostradamus,⁹⁴ but the part of his work of most interest to us is the discussion of the divining rod in the long concluding chapter⁹⁵ of the edition of 1694, added as a result of the widespread interest which had been aroused by the recent feats of Jaques Aymar, as he spells the name, who by means of the divining rod not only found water and metals underground, but tracked down murderers and thieves and uncovered displaced boundary lines. Others then imitated him and used the rod even to distinguish the quality of cloth, while a lady of Menestrier's acquaintance, when her husband tried to fool her by having a cock killed instead of a murder committed and had the spot where it was done thoroughly cleaned, by means of the rod found first the exact spot, then the buried body of the fowl, and finally the servant who had killed it. Menestrier has no doubt of the truth of these reports. There are so many irreproachable witnesses, ecclesiastical and lay, gentlemen, doctors and magistrates, that one cannot contest the marvelous results obtained by use of the divining rod. He even confesses that he was at first predisposed in its favor, so long as its use was limited to discovering springs of water, hidden metals, and even murderers, since he believed that some natural relationship might be found between these effects and natural causes which we do not yet understand.⁹⁶ But when, instead of a forked fresh hazel branch, any wood, though dry and straight, was employed with equal success, he concluded that what had formerly been thought essential pre-requisites contributed nothing to the result,⁹⁷ which was not natural but diabolical.

One natural explanation which had been offered was that the

⁹³ *Ibid.*, p. 395.

⁹⁴ *Ibid.*, pp. 309 and 385. Guynaud Ecuyer, *La concordance des prophéties de Nostradamus avec l'histoire depuis Henri II jusqu'à Louis le Grand*,

had appeared in 1693 and been reviewed in JS XXI, 247-49.

⁹⁵ *La philosophie*, pp. 417-91.

⁹⁶ *Ibid.*, p. 465.

⁹⁷ *Ibid.*, p. 422.

gift of making such discoveries with the divining rod was due to the individual's horoscope. But this Menestrier condemns as fatalistic, since the action of the divining rod is "une impression necessaire" independent of the human will. He accepts the stars as universal but not as specific causes. Rhubarb may purge better under one constellation than another, but its purging quality is innate, from a specific germ implanted by God at creation.⁹⁸ Similarly all water spaniels go to water, all apes imitate, and from having the same blood there descends in certain families from father to son a natural talent of resetting dislocated and broken bones.⁹⁹ Moreover, it has been said hitherto that one must be born under Aquarius to have the gift of the divining rod. But Jaques Aymar was born in September under Virgo, and others who today exercise the same talent are of all ages; born some in summer, some in winter; some by day and some by night; some under a full moon and others under a new moon.¹⁰⁰

Another attempted natural explanation has recourse to subtle emanations from the spirits in bodies, or effluvia of corpuscles from the same. In the case of assassins and thieves it is supposed that the particles which emanate from their bodies preserve a peculiar configuration which has been imprinted on them by the violent passions of such criminals. But Menestrier questions how long they would conserve such configurations. He grants that the mother while pregnant may impress marks on the embryo which persist in the child through life, such as images of fruit for which she craves while in that condition. But the foetus long remains in close contact with the mother, whereas these emanations are scattered on highways, in places remote, on rivers and by the sea, and are among strange bodies. They are, so to speak, dead, and to act must be excited by some living principle capable of the same impressions. This cannot be the divining rod and so must be its holder, who then has to communicate the effect to the rod. Such a circulation from murderer to atmosphere to the dowser to the rod

⁹⁸ *Ibid.*, pp. 429-34.

⁹⁹ *Ibid.*, pp. 425-27.

¹⁰⁰ *Ibid.*, p. 442.

would be more marvelous, says Menestrier, than that of the blood.¹⁰¹ Also, how can he follow the murderer's traces in a tranquil manner and not become afflicted with like passions from the impression of the corpuscles thrown off by the murderer in the moment of crime?¹⁰² But Menestrier's elaborate refutation shows what a hold the corpuscular theory had then, and that it served to explain, rather than refute, what was closely akin to magic. As de Vallemont had said, it was the philosophy best fitted to explain the marvels of nature.

Although Menestrier had said earlier that the divining rod acted independently of the dowser's will, he now asserts that it is necessary to decide to search for gold or silver, in order that the rod may not turn toward water, and that the concentration required is very tiring.¹⁰³ In any case, he concludes that no natural explanation can be given and that the success of experiments with *la baguette* is due to the devil. He quotes Hosea IV, 12: "My people interrogated its divining rod, and its rod answered it. For the spirit of fornications deceived them."

Johannes Friedrich Stockhausen, in *Marvelous Presages of Death*, classed them as natural, divine, angelic or from the devil. More specifically they might be had from face, nose and hands, from one's nativity, from words from one's own mouth, at a distance, in dreams, and from oracle or magic. The last meant from the devil. Examples were taken from naturalists, Paracelsists, papists, Jews, Turks and heathen.¹⁰⁴

Jean Fonttrailles in his *Traité de physique et de chirurgie* of 1697, professed to teach how to tell if sterility was due to the husband or wife, whether a woman was pregnant, and whether she would give birth to a boy or a girl.¹⁰⁵

The interest in ancient Greek and Roman divination, of which

¹⁰¹ *Ibid.*, pp. 443-52.

¹⁰² *Ibid.*, p. 453.

¹⁰³ *Ibid.*, pp. 461-62.

¹⁰⁴ *Mira praesagia mortis, das ist, Wunderleiche Todes-Vorboten . . .*,

Frankfurt and Leipzig, 1694, in-8. 368 pp. BM 8632.b.16.

¹⁰⁵ JS XXV, 478-79. Newspapers of 1952 announced that this last had at last been discovered.

we spoke in opening this chapter, towards the close of the century extended itself to early German and Slavic "idolatry."¹⁰⁶

¹⁰⁶ A collection of dissertations in BM 703.d.2 (1-10) comprises: Gerhard van Mastricht, Praeses, *Diss. hist. de origine vetutissimi Lippiensis agri Monumenti Hermiensburgk et Hermiensul veterum Saxonum idoli*, Duisburgi ad Rhenum, 1686; Joh. Pet. Ludovicus, Praeses, *Diss. hist. . . . de idolis Slavorum*, Wittenberg, 1692; Geo. Jac. Mellinus et Melchior Voigt, *Suevia Gentilis*, Jena, 1695; C. S. Schurzfleisch, Praeses, *Veterum Instituta Druidum*, Wittenberg, 1697; Amadeus

Schmelz, Praeses, *De idolatria veterum Misniae incolarum*, Lipsiae, 1698; Hermann Becker, Praeses, *Livonia in sacris suis considerata*, Wittenberg, 1700; C. S. Schurzfleisch, Praeses, *Livonia certis propositionibus comprehensa*, Wittenberg, 1700. The other three dissertations are of the eighteenth century, concluding with Gottfr. Christ. Rothius, *De imagunculis Germanorum magicis quas Alrunas vocant*, Helmstadii, 1737.

CHAPTER XXXVII

MENTAL DISEASE AND MAGIC

Magic and melancholy—Sennert on different forms of mental disease—Treatises on melancholy by Guibelet, Du Laurens, Hartmann, Freitag, Marc Duncan, Marcucci, Bausch, Neuhausen—Casaubon on enthusiasm—Deusing on *Man-Schlacht*—Lycanthropy—Schoock on ecstasy—Hysteria and hypochondria, epilepsy—Animal spirits and mental disorders: Highmore, Willis, Nymmann, Du Hamel, Schelhammer—Witchcraft and disease: Drage, Mercklin—Possession by demons: François Bayle, Marius, Henckel—Cally on insanity.

These are they who take the mind captive, who injure the body, who unman man . . . make the wise stupid, the peaceful furious, the cheerful sad.

—J. C. MENTZEL

Melancholy and magic had long been associated closely in the history of ideas. Those who sought a natural explanation for what others regarded as possession by demons found it in an excess of melancholic humor. Melancholy might also be considered as the source of natural divination. Or all the marvels of diabolical magic might be laid at its door, either as illusions or, in part, realities. It produced an abnormal state of mind, which, it was believed, might lead to preternatural effects. A melancholic was certainly an easy prey of demons and medium of magic arts, and might be an active agent of the same.

In the seventeenth century melancholy continued to be regarded in this light, or rather gloom, for it was a dark humor, black bile. We have seen that it was a not infrequent topic of university dissertation and disputation.¹ We encounter repeated reference to it in more general works, and there were also treatises devoted to it

¹ See Chapter 12.

primarily. Edmund Hollyng, who came from England to Ingolstadt in 1588 and died there in 1612, published one at Munich in 1602.² Salando described the case of a melancholy female patient at Verona in 1607.³ Hercules Saxonia published a folio volume on the subject at Venice in 1620, in which he included a discussion of the causes of fascination.⁴ At the request of Gabriel Naudé, Scipione Chiaramonte finally printed a treatise on melancholy insofar as it affected human character, which he had composed back in 1597.⁵ He distinguished between the types of melancholy illustrated by such past personages as Caligula, Cato of Utica, Brutus, Socrates, Tiberius and Alexander the Great. Then he gave remedies to remove the causes, such as sadness and fear in the case of the cold variety, and anger in that of the hot variety.

Early in the century Sennert had distinguished different forms of insanity or mental disease, and his account⁶ seems to have been largely paralleled by subsequent writers. Those who suffer from *typhomania* cannot sleep, see varied absurd specters and images, and become delirious as a result. Or, if they sleep, they have terrible dreams and afterwards think them true, as witches imagine that they have flown through the air to sabbats, when they have been in bed with their husbands all night long. Those who are called ecstatic, in some cases suffer a natural ill, in others diabolical, in others divine ecstasy. *Phrenitis* is perpetual depravation of imagination and reason with fever from inflammation of the membranes of the brain. Melancholy is depravation of the imagination, sometimes but not always of the reason too, without fever but with fear and sadness. Being madly in love is a form of melancholy. Depravation of the imagination and reason accompanied by fury is mania, and lycanthropy is a variety of it. Those afflicted by it either imagine themselves to be wolves but appear human to others, or

² Listed by Anton Maria Kobolt, *Baierisches Gelehrten-Lexicon*, 1795, pp. 338-39.

³ Ferd. Salandus, *De melancholia . . . in magnifica muliere*, Verona, 1607, in-4, 63 pp. BN 4°Td³⁴.78(1.).

⁴ *De melancholia tractatus. Accedit de lue venerea*, Venice, 1620.

⁵ *De atra bile quoad mores attinet*, Paris, 1641.

⁶ *Institutiones medicae*, II, iii, 1, cap. 7; pp. 314a-325a in the edition of 1628: BM 544.f.3. Neither BM nor BN has an older edition. It reprinted prefaces of 1611 and 1620 from earlier editions.

seem wolves to others also by the work of the demon. Finally are listed rabies and hydrophobia.⁷

Returning to the subject of melancholy, we may take note of a discourse by Jourdain Guibelet upon that humor.⁸ Since he regarded the maladies which are caused by it as for the most part strange and incurable, he gave more attention to its supposed relation to natural divination and men of genius. Aristotle and others rejected the Platonic doctrine that the soul was created in possession of universal knowledge, God having engraved upon it species of all things; that these were forgotten after the conjunction of the soul with the body; but that they might be recalled at any moment, so that it would be possible for a melancholic to learn all the arts and sciences instantaneously.⁹ There is more evidence that the soul, if freed from the impediments of the body, has the power to divine and predict the future. Otherwise how are so many auguries, astrological predictions, interpretations of dreams, and oracles to be accounted for? If birds foresee the weather without other instruction than that of nature, why should not man be able to do so? Guibelet repeats notable examples of warning dreams. Ultimately, however, he holds that augurs and astrologers make successful predictions only with demon assistance, and that the only reliable dreams as signs of the future come from God, melancholy having no force and demons being deceitful. No natural exhalation can produce true oracles, and melancholy or other humors cannot explain the acquisition of science without study, or understanding and speaking several languages which were unknown to one before, or speaking articulately with the mouth closed, or predicting the future, divining the thoughts of another person, seeing things absent as present, and levitation. All these, not even excepting ventriloquism, Guibelet pronounces the work of demons.¹⁰ But

⁷ A general history of mental disease from the sixteenth to the nineteenth century is: Laignel-Lavastine et Jean Vinchon, *Les maladies de l'esprit et leurs médecins du XVIe au XIXe siècle*, Paris, 1931, in-4, 320 pp. J. de Nynauld, *De la lycanthropie*, Paris, 1615, has already been mentioned in T VI, 547.

⁸ *Trois discours philosophiques . . . Le III De l'humeur melancholique*, Evreux, 1603. Copy used: BN R.37931.

⁹ *Ibid.*, fol. 271r.

¹⁰ *Ibid.*, fols. 276r, 277v, 279r-v, 282r, 283r-v, 284v-285r. Guibelet's *Examen de l'Examen des esprits*, was printed at Paris, 1631, in-8, 813 pp. BN R.37932; R.37933.

he considers transportation to, and attendance at witches' sabbats as usually imaginary, a mere delusion of the demon.¹¹

One reason that had been given why melancholy persons are ingenious, adroit inventors, and perfect researchers, was that the humor of melancholy had more of earth than any other element in its composition, and that, just as it was a property of earth to seek the center of our globe, so melancholics know how to concentrate and go to the root of problems. This bit of magic logic Guibélet took quite seriously, objecting that the quality is passive in the case of the element earth, but active in the case of melancholy persons.¹²

Among the works of André Du Laurens, who was physician to Henri IV and professor and chancellor of the University of Montpellier, is a treatise on melancholy diseases which he wrote in French and which was translated into Latin by Gui Patin.¹³ Du Laurens remarks that man, although full of divinity, is sometimes so afflicted with almost infinite diseases that he seems reduced to the level of the brutes. Of melancholy there are three varieties: the cold and terrestrial sort makes men slow, stupid and timid; the hot and burned out variety makes them furious and unfit for any work or responsibility; but melancholy mingled a little with blood produces geniuses far excelling other men. Then the brain is neither too soft nor too hard, but dry and with few excrements. The spirits are purer and not easily dissipated. The imagination is both profound and lofty; the memory firmer than usual. And when that humor glows with sanguine vapors, they are carried away by that divine furor called enthusiasm, by whose aid they both philosophize and prophecize. But in the present treatise Du

¹¹ *Trois discours* . . . , fol. 270v.

¹² *Ibid.*, fol. 256r-v.

¹³ Andreas Laurentius, *Opera omnia*, partim iam antea excusa, partim nondum edita, nunc simul collecta et ab infinitis mendis repurgata studio et opere Guidonis Potini, Paris, 1628, vol. II, pp. 49-98 of *Tractatus quatuor*. Copy used: BN 4°T25.1.

I shall not include Du Laurens' treatise claiming a monopoly of the

royal touch for the kings of France (*De mirabili strumas sanandi et solis Galliae regibus christianissimis divinitus concessa liber unus et de strumarum natura differentiis causis* . . . liber alter, Paris, 1609, xvi, 293 pp.), as it is repeatedly cited in the book of Marc Bloch, *Les rois thaumaturges*, 1924.

In the *Opera* of 1628, vol. II, it occupies 79 pp., numbered separately.

Laurens is not concerned with these sane melancholics, but with a diseased melancholic condition.

It may be described as delirium without fever, but accompanied by fear and gloom without any apparent cause. It has its seat especially in the brain, giving rise to horrible dreams and a great diversity of peculiar delirious delusions. Some of these can be explained neither by the patient's physical make-up nor by his life history. Their cause is unknown, mysterious and occult. There seems to be something divine about them, *Θείον τι*, as the ancients held. Rasis and Alexander of Tralles say that they have seen many predict the future; and Avicenna noted that melancholics often produced such marvelous effects, that they were vulgarly believed to be possessed by an evil demon. Du Laurens lists fifteen cases of such peculiar delusions, and suggests cures, then passes on to another species of melancholy which comes from being madly in love. Some remedies of the ancients for this won't do for Christians, being diabolical and prohibited. For instance, Julius Capitolinus tells that when Faustina, the wife of Marcus Aurelius, became so infatuated with a young gladiator that she was almost at death's door, the emperor consulted all his Chaldeans, Magi and philosophers how she might be cured. They advised the emperor to kill the gladiator, give his blood to Faustina to drink, and to lie with her the night immediately following. As a result her libido ceased, but from that night's intercourse was born Commodus, who turned out to be the most cruel of all the Roman emperors and resembled the gladiator rather than Marcus Aurelius. "The infernal demon employs these arts and wiles; by magic of this sort men are deceived."

There remains yet a third type of melancholy, that of hypochondriacs, and of it in turn there are three sub-varieties, hepatic, splenic and mesenteric. Du Laurens declares that he has seen two cases of hypochondriac melancholy which were so marvelous that their like was never seen before or since. But from his descriptions of them they appear to have been purely physical and not mental disease.

Johann Hartmann (1568-1631), often called the first professor of chemistry in a European university—Marburg, regarded the blood

of an ass as a specific in cases of insanity, mania and melancholy, because the ass was a melancholy animal. He had restored a carpenter to his right mind by use of it in the summer of 1615. The blood should be drawn from the veins behind the ears and used in making a water, of which the patient should drink in the morning for three days enough to make him sweat.¹⁴ In the case of madness induced by philters, Hartmann followed Croll in recommending vomitives, holy water, electuary of life, and antimony. For epilepsy in adults he suggested spirit of human brain or a powder, to be compounded only in May, June and July, from the livers of live green frogs.

It can hardly be told how much profit results from this simple remedy. The cure should be begun in June about the time of the solstice, and, if it does not work the first year, repeat it the next. Frederick IV of the Palatinate, who was an epileptic from fifteen to twenty-six, was cured by this remedy.¹⁵

Johann Freitag, court physician at Osnabrück and Tecklenburg, in a work on the abuse of medicine in 1616,¹⁶ opposed those writers, such as Wier, Kirchofius and Godelmann, who argued that witches were merely poor, deceived melancholics.¹⁷ Although melancholy was called "devil's bath," he held that those delirious with melancholy never made pacts with the devil, and when restored to health, recognized their delusions, whereas witches were sly, secretive and stubborn. He grants that the devil can toy with melancholy delirium, but that does not show that all witches were first melancholics. There is no doubt, and the daily observation of physicians attests, that melancholics may imagine that they have attended witches' sabbats, flown through the air, made pacts, spoken strange tongues, and predicted the future. But witches really fly through

¹⁴ *Praxis chymiatrica*, 1633, p. 30; *Opera* (1690), p. 16.

¹⁵ *Praxis*, 1633, pp. 33, 37-38, an amulet follows at p. 39; *Opera* (1690), pp. 17, 19. *Ibid.*, pp. 20-21, for bones behind a pig's ears which are a most excellent specific in epilepsy and on their inner face have an exact signature of a skull.

¹⁶ *Noctes medicae sive de abusu medicinae tractatus quo universum medicorum examen, empiricorum modernorum uberrima annona, uromantes . . . genethliaci . . . pseudo-chymici . . . maga-medicastrum, sagae . . . etc.*, Francof., 1616, in-4. Copy used: BN 4°T21.78.

¹⁷ *Ibid.*, p. 113.

the air to sabbats. And although they cannot stir up storms themselves, they can do so by aid of the devil. On the Baltic you can buy a wind cheap of the Lapps; "I am not speaking fables," Freitag assures us. But he denies that the minds or souls of ecstasies can quit the body.¹⁸ Discussing the question whether the devil without the aid of natural causes can produce hyperphysical diseases and with their aid, natural and usual diseases, Freitag answers in the affirmative. Satan can inflict both natural and supernatural diseases: the former, by abusing natural causes to destroy human health; the latter, by direct application of his own power and forces. Freitag does not say that such diseases are mental, but they certainly could not be physical and natural.¹⁹ He condemns the use of the incantation, "Caspar brings myrrh . . ." etc. against epilepsy as superstitious, and holds that white magic as well as black magic is damned.²⁰ He does not deny occult virtues but attacks Paracelsus's magic and medicine and explanation of disease, denies a fifth essence, a universal medicine, and magnetic cure and weapon ointment. Philters have no natural basis, and the natural limits of life cannot be exceeded.²¹

A doctor of medicine of Saumur named Duncan having suggested that the reputed possession of the nuns of Loudun might be the product of melancholy, Sieur or Monsieur de la Menardiére published at La Flèche in 1635 a treatise on melancholy to show that this could not be the case.²² He was answered in turn by an *Apolo-gie pour M. Duncan* by Marc Duncan,²³ which gives a sufficient impression of the conflict of ideas between them.

Marc Duncan represents Menardiére as having charged Dr. Duncan with being a follower of Pomponazzi, and as having held that

¹⁸ *Ibid.*, pp. 139-47.

¹⁹ *Ibid.*, cap. 37, pp. 182-85.

²⁰ *Ibid.*, p. 192; p. 195, "Tam alba quam nigra Magia damnata est."

²¹ *Ibid.*, caps. 19, 27, 42, 59, 72, 73, 74, 78 and 78 bis.

²² *Traité de la mélancholie, savoir si elle est la cause des effets que l'on remarque dans les possédées de Loudun, tiré des réflexions de M. de la Menardiére sur le discours de M. Dun-*

can, La Flèche, 1635, in-4, but wide margins and only 16 lines per page, 131 pp. Copy used BN 4°Td⁸⁶.13.

²³ *Apolo-gie pour M^r Duncan, docteur en médecine, contre le traité de la Melancholie tiré des réflexions du Sr de la M^{re}*, no date or place, in-4, iv, 295 pp.: BN 4°Td⁸⁶.14. On p. 1 the title is repeated and the name Menardiére is printed in full.

women are not disposed to melancholy, because all melancholy is hot and dry, although hypochondria is very cold. Menardiére further contended that the nuns could not have the type of melancholy which affects the brain, and that the faculty of imagination could not err or be wounded. But that melancholics could divine the future without revelation, and that melancholy was a most dangerous disease, whereas hypochondriacs do themselves no harm.²⁴

In reply Marc cited Hippocrates and various other classical authors, that women as the weaker sex were more given to melancholy than men, while Sennert had devoted a special chapter to the melancholy of women. Men might be more subject to melancholy by their natural complexion, since as a rule it is hotter than that of women. But melancholy by accident was at least as common among women as men; indeed, more so, since they have a greater mass of superfluities, while men exercise more and rid themselves of poisons and impurities through perspiration. Ballonius recorded the case of a woman who was melancholy by nature; and Guinther of Andernach and Leonus agreed that women were worse afflicted in melancholy than were men. For himself, Marc holds that melancholy is sometimes attached to a certain occult quality.²⁵ As for hypochondria, it is the hottest and not the coldest type of melancholy.²⁶ Menardiére represented melancholy as generated in the brain by inflammation thereof, but Galen sought its source in the veins or entrails, while Arnald of Villanova and Sennert thought that it was sometimes due to cold distemper of the brain.²⁷

With regard to the force of imagination, Marc does not agree with Avicenna and Averroes that it can affect external objects and alter the elements, much less with Croll that "imagination can produce whatever we see in the macrocosm." But it can at times cure or make sick or kill. The sight of bitter medicine makes a bitter taste in the month; the imagination of the mother affects the foetus; the fear of pest or small pox may bring on the disease. Long consideration imprints the image of the thing imagined upon the

²⁴ *Ibid.*, pp. 10-12.

²⁶ *Ibid.*, pp. 67-68.

²⁵ *Ibid.*, pp. 43, 46, 75, 80-81, 85-86, 96-97.

²⁷ *Ibid.*, pp. 106, 112, 118-19.

spirits, which spread it all through the body and thus sometimes produce the real species of which they carry the intentional species. The commentators of Coimbra conclude that intentional species combined with imagination may produce real species. Augustine is cited concerning Jacob and the ewes, and quoted that "the will has such power concerning the image impressed on sense that, if it be violent enough, and tougher and more sluggish matter resist not, it changes the visible species and color." Marc also affirms that the faculty of imagination can be impaired.²⁸ He holds that Menardiére ruins his own case in attributing the power to divine the future to melancholics, and that it is a sign of possession by demons. He denies the contention of Menardiére that the fact that the nuns remained in good health showed that they were not melancholic.²⁹

We pass on ten years later to a less controversial and more objective and elaborate presentation of the subject of melancholy by Caspare Marcucci, a noble of Lucca, whose *Quadripartitum melancholicum* was dedicated to the Senate of Lucca on October 1, 1644, and printed at Rome the year following.³⁰ The book takes the form of the consideration of series of questions which deal with the disease of hypochondria, true dreams of melancholics, and the melancholy of lovers, as well as with the disease of melancholy, its essence, causes, differences, prognosis and cure, and with further digression, as we shall see.

Is only the imagination or also the reason injured in melancholy, and can the reason alone be injured? Why the imagination is most injured? Whether there is loss of memory? Whether the brain is always affected in melancholy, and whether as instrumental part or similar part? Is melancholy brought on by gloomy animal spirits, by intemperateness of the animal spirits, by motion of the animal

²⁸ *Ibid.*, pp. 146-51, 154-55, 162-64, 169.

²⁹ *Ibid.*, pp. 212-13, 228. Pages 243-95 are devoted to an "Examen des marges" i.e., a criticism of Menardiére's marginal citations, which Marc argues do not bear out the text.

³⁰ Caspar Marcucci, *Quadripartitum melancholicum quo variae quaes-*

tiones de melancholiae morbo essentia causis differentiis prognosi curatione habentur et plura de morbo hypochondriaco veris melancholicorum somniis et amantium melancholia innotescunt. Omnia philosophicis historicis eruditisque locis referta. Romae ex typographia Andreae Phaei, 1645, in-4, 306 pp.: BN 4°Td⁸⁶.20.

spirits? Can the animal spirits be made gloomy by mere intemperateness, by the air, by the vital spirits? Can melancholy result merely from cold and dry intemperateness or from wet? Does the disease of melancholy result from the nature of the humor melancholy or an occult property? Whether the humor producing melancholy is hot or cold? Whether any other humor, such as phlegm, can induce melancholy? Can melancholy be produced immediately by mental passions? Is an ill-formed head among the causes of melancholy? Can it be brought on by demons?

Aristotle left no place for demons but attributed divination from dreams to nature, various species of madness to *atrabile*, the responses of oracles to vapors from caves, and the quoting of poetry by an illiterate also to *atrabile*. But in this he was in error, for we have daily proof of the existence of demons in the exorcizing of those possessed by them, while today melancholics do not predict unless possessed by demons or by sheer chance. Marcucci believes that demons are an external cause of diseases including melancholy. He also holds that it can be induced by sorcery and incantations, and by philters and poisoned potions without demon aid, citing Cardan and Porta in support of this position. "Nor is it to be denied that there is some power in words or names and also characters to work good or ill." Finally, however, he concludes with Delrio that incantations are idle and superstitious, and that reports of their efficacy are false.³¹

Can men be made melancholy by seals and images? Albertus "in the book of Images" (presumably *Liber II Mineralium*) and Peter of Abano are cited for the affirmative, and Cajetan's favoring arguments are noted, but Marcucci, leaning heavily as before upon Delrio, decides in the negative. Similarly, in answering the question whether melancholy is induced by the stars, he is ready to admit the influence of the stars upon the weather and health, but not that a man's nativity makes him a melancholic.³²

The question whether melancholy can be brought on by the bite of a mad dog or other rabid animal leads to a digression of several chapters. Is the venom in rabid animals dry or moist? Why do their victims fear water? Aromatarius in an elaborate treatise on

³¹ *Ibid.*, I, 25-26, pp. 67-72.

³² *Ibid.*, I, 27-28, pp. 74, 78-79.

contagious rabies³³ has shown by dissection that it is a sort of quinsy in which the larynx or esophagus is choked with phlegm. Why did Avicenna hold that those bitten by a mad dog were not to be despaired of, even if they feared water, provided they recognized themselves in a mirror?³⁴

Returning to melancholy, it is asked if the disease is hereditary and whether one can be melancholy from birth.³⁵ Lycanthropy is classed as a variety of melancholy. Men do not assume the shape of wolves but do take on the manners of wolves, are dejected and timid and walk only by night and rage against mankind. Lycanthropy is at its height in February.³⁶ After some consideration of hypochondria, it is asked why some melancholics are called lunatics, why melancholics are much addicted to study, especially of philosophy, whether they are wise, and whether they predict the future. If so, it is not natural divination but the work of demons. However, they dream more frequently and truly than other persons do. They are almost always constipated and lustful.³⁷

Among the questions of the third book are whether melancholy can be cured, whether those afflicted with it from birth can be cured, why melancholics stammer, why they are often also epileptics, and vice versa, and why melancholy is relieved by haemorrhoids and varicose veins.³⁸ The last book on bleeding, purging and other treatment of melancholy, also inquires if thermal waters and sexual intercourse are beneficial for it.³⁹

J. L. Bausch (1605–1665), municipal physician of Schweinfurt and president and founder of the *Academia Naturae Curiosorum*, prefixed a long *Prooemium Melancholico-Historologicum* to his *Schediasma posthumum de coeruleo et chrysocolla*, printed at Jena in 1668.⁴⁰ In it he gave a copious list of delusions of the melancholy in order to demonstrate their great variety. Some melancholics are

³³ Giuseppe Aromatari (1586–1660), *Disputatio de rabie contagiosa, cui praeposita est epistola de generatione plantarum ex seminibus*, Venice, 1625. Treated above in Chapter 34.

³⁴ *Quadripartitum melancholicum*, I, 29–33, pp. 84–97.

³⁵ *Ibid.*, I, 34–35, pp. 98, 100.

³⁶ *Ibid.*, II, 2–3, pp. 109–12.

³⁷ *Ibid.*, II, 15–20, 25, 27; pp. 131–57, 168, 171.

³⁸ *Ibid.*, III, 1, 2, 11, 16, 21; pp. 177–78, 192, 201, 207.

³⁹ *Ibid.*, IV, 19, 25; pp. 279, 297.

⁴⁰ *Op. cit.*, pp. 1–49.

happy because they think they are kings and the like. Others have lucid intervals, or their disease comes on at certain times, or they may be quite rational in all respects but one. In all of them the memory is constant. If they speak strange tongues and predict the future, this is due to demons' mingling with the melancholic humor. Bauschius then turns in the text proper to *caeruleum*, which he says is one cure for melancholy.

What he and other writers fail to explain is: Why do demons possess melancholy persons rather than the phlegmatic, sanguine or choleric? It would appear that melancholy attracts demons, and that therefore, while they may be the immediate cause of speaking strange languages and predicting the future, melancholy is the remote cause and first cause of that occult phenomenon. The demons are only means which it employs towards those ends. And so, in the last analysis, why is not melancholy alone a sufficient cause of all occult phenomena?

Werner Neuhausen, who, as a Cartesian, held that mind and body communicated only through the pineal gland, distinguished between mental melancholy or prolonged sadness which affected bodily functions, and corporal melancholy or languor of the body produced by external or internal causes. The former was to be cured by finding the source of the sorrow, removing it insofar as possible, and bridling the emotions. The latter was to be remedied by venesection and other medical treatment.⁴¹

Meric Casaubon (1599-1671), son of the classical scholar, Isaac Casaubon, and himself a prebendary of Canterbury, in 1655 published *A Treatise concerning Enthusiasme, as it is an Effect of Nature, but is mistaken by many for either Divine Inspiration or Diabolicall Possession*. A "second edition; revised, and enlarged," appeared in 1656.⁴² He cited Cicero on divination that Aristotle attributed power to foresee the future to melancholics, and thought that Cicero probably had reference to *Problems* (sect. 30, 1) where

⁴¹ Guernerus Neuhausen, Hammonensis, *Homo melancholicus seu Dissertatio philosophico-medica de melancholia intellectuali tum corporali et quatenus objectum est medicinae*, Hammonae Guestphalorum, 1688, in-

12. Reviewed in *Acta eruditorum*, VIII (1689), 226-27.

⁴² G. L. Kittredge, *Witchcraft in Old and New England*, 1929, p. 582. There was also an edition of 1708.

to melancholy are ascribed "distempers of madness and enthusias-ticknesse. Hence also are proceeded the Sibyls and the Bacchicks and all that are truly *ἐνθουσιαι*."⁴³ Casaubon himself accepted such power of prediction as a fact, and asked:

But what should make some ordinary men sometimes to foresee, not the day and hour of their own departure only, but to foretell the period of some other mens lives also, whereof there be divers examples both ancient and late: and not to foretell things only that belong to life and death but sometimes more generally many future things, which have proved true by the event?⁴⁴

He also was confident that the greatest secrets of nature were dependent upon effluvia or "natural unsensible emanations."⁴⁵ He further asserted human love of the marvelous and strange, "whether false or true."⁴⁶ His conception of enthusiasm, however, was not limited to an abnormal or diseased state induced by or akin to melancholy, but included "contemplative and philosophical enthusiasm," a chapter which is really chiefly concerned with cases of supposed religious ecstasy, rhetorical enthusiasm, poetical enthusiasm, and praying enthusiasm.⁴⁷ His preface "To the Reader" contained this fine sentence:

As all men's brains are not of one temper naturally, nor all men equally improved by study, nor all led by one interest, so is it, I think, as impossible by any art or reason of man to reduce all men to one belief.

Casaubon's later writings did not maintain this level. In 1659 he edited from a Cotton manuscript *A true and faithful relation of what passed for many years between Dr. John Dee and some spirits*. In 1668 his *Of Credulity and Incredulity* asserted the existence of demons and witchcraft, and was reprinted in 1672, with the new title-page, *A Treatise Proving Spirits, Witches and Supernatural Operations by Pregnant Instances and Evidences*. Meanwhile in 1670 had been printed its third part: "Of Credulity and Incredulity in Things Divine and Spiritual wherein (among other things) a true and faithful account is given of the Platonick Philos-

⁴³ *A Treatise concerning Enthusiasme*, pp. 39-40.

⁴⁴ *Ibid.*, 45.

⁴⁵ *Ibid.*, 44.

⁴⁶ *Ibid.*, 68.

⁴⁷ *Ibid.*, chapters 3, 4, 5, and 6.

ophy as it hath reference to Christianity: as also the business of Witches and Witchcraft against a late writer fully argued and disputed."⁴⁸

Casaubon now took the stand that those who "deny or will not believe any supernatural operations by witches and magicians are generally . . . atheists."⁴⁹ What he was perhaps really thinking—and it probably made him feel a little uncomfortable—was that atheists did not believe in the witchcraft delusion. So he passed from regarding enthusiasm as natural, to viewing witchcraft as diabolical, and to condemning disbelief in magic as irreligious.

Another indication of Casaubon's own credulity which was already manifest in the book of 1655, was his adducing cases of living without eating or drinking for several years, as attested by divines, physicians and magistrates. In particular he cited Paul Lentulus, M.D., *Historia admiranda et prodigiosa Apolloniae Schreierae*, Berne, 1604, and the History of Thuanus (J. A. de Thou).

In the Netherlands a disease had become prevalent which was popularly known as *Man-Schlacht* and which consisted in a state of agitation which was supposed to have been brought on by the passing of a homicide—a superstition similar to that which attributed the bleeding of a corpse to the presence of the murderer. To the Synod of the district about Groningen, which had been considering this strange complaint, Anton Deusing addressed a treatise on the superstitious origin and cure of certain diseases, especially the disease popularly called *Man-schlacht*.⁵⁰

Deusing says that, besides a thousand kinds of disease subserving divine Providence in chastising and emending the sins of mortals, and which come from natural causes, many other ills are found which, by just judgment of God and permission of the supreme Deity, are induced by causes which transcend the forces of nature. Wherefore very great virtue has been ascribed of old and is still discerned in fascinations, sorceries, incantations, magical actions

⁴⁸ London, Samuel Lownds, 1670, in-8, 208 pp.

⁴⁹ *Ibid.*, p. 171.

⁵⁰ *Dissertatio de morborum quorundam superstitiosa origine et curatione, speciatim de morbo Man-Schlacht vul-*

go dicto, itemque de lycanthropia, necnon de surdis ab ortu mutisque ac illorum cognitione, ubi et de ratione et loquela brutorum animantium, Groningae, 1656, in-12, 227 pp. BN 8°Td⁸⁶.22.

and other similar diabolical arts. Some believe that injury and healing are wrought by power of the eye, but vision is not by extra-mission, and Deusing also denies that imagination can affect another body.⁵¹ He further denies that there is any operative virtue in words and characters.⁵² He admits that contagious disease is spread by effluvia and the action of sympathy and antipathy. He accepts the action of the torpedo fish as well as of the magnet, and even repeats the tale of the girl fed on poison who was offered to Alexander the Great. But he calls inept the opinion of Pomponazzi that men have specific virtues like those of herbs and stones, although it would seem logical enough.⁵³ He puts the *agnus Dei* and the papists' consecration of oil, salt and water in the class of illicit magic.⁵⁴

Turning to *Man-Schlacht* or agitation brought on by the passing of a homicide, he condemns as diabolical magic such ways of curing it as eating a piece of bread cut off, if possible, with the knife with which the crime was committed, or drinking wine or beer which had been stirred with the lethal weapon.⁵⁵

Deusing's treatise is followed by a dissertation on lycanthropy by Elias van der Burgh who distinguishes two varieties: the diabolical and fabulous, and the mental aberration in which men think that they are wolves and act like them.⁵⁶ He also affirms that some years ago in a nunnery at Cologne, Satan infected all the virgins there with his impure magic, for which the majority of them were burned. They made an image of Christ on a crucifix bleed, but were found to have used the blood of a dog. He asserts that many eye-witnesses of this are still living.⁵⁷

Balthazar Timaeus von Gueldenklee among cases from his medical practice of thirty-six years noted one of lycanthropy.⁵⁸ A cow-herd, who had been imprisoned for attacking and mortally wounding another man without cause, stated that ten years ago in 1639 a wolf sprang on his neck but did not wound him so as to draw blood or otherwise injure him at the time. But a year later he suf-

⁵¹ *Ibid.*, pp. 7, 15, 19.

⁵² *Ibid.*, p. 32.

⁵³ *Ibid.*, pp. 57-59.

⁵⁴ *Ibid.*, pp. 37, 41.

⁵⁵ *Ibid.*, pp. 63-65.

⁵⁶ *Ibid.*, pp. 103, 133.

⁵⁷ *Ibid.*, p. 125.

⁵⁸ *Casus medicinalis praxi 36 annorum observati*, Lipsiae, 1662, in-4, pp. 93-96.

ferred great agony of heart, delirium and melancholy and became quite mad, so that he had to be bound lest he harm cattle or men. He felt the same symptoms at Christmas of the present year, 1648, and attacked the aforesaid man. A letter of March 14, 1649, inquired whether the influence of the wolf could operate over so many years. Timaeus, replying on March 17, quoted Fracastoro, Brasavola, Cuaineri and others for a duration of ten, seventeen or eighteen years. That the mere breath or spittle of the wolf was enough to induce lycanthropy without an actual bite, was supported by the authority of Aretaeus, Mattioli, Fernel and Cardan. He doubted, however, whether an attack of lycanthropy would be over so soon as alleged in the present case, for authorities said that this sort of insanity would last in most cases for a month or forty days, unless death intervened.

When Marten Schoock wrote on ecstasy in 1661,⁵⁹ he felt that he was covering untrodden ground.⁶⁰ Voetius⁶¹ cited works by Gravina⁶² and Alvarez, but had not seen them himself, and Schoock could not find them. He had looked at various scholastics and writers of mystic theology, and at the medical works of Santorelli and Paolo Zacchia, but had gotten little or nothing from them. He first treats of natural ecstasy, which he defines as seduction of the mind from certain inferior faculties and its concentrating more profoundly than usual on some particular phantasy. It is especially characteristic of those who are in love, and, if it recurs frequently, is liable to lead to paralysis or apoplexy, if not death. He denies the possibility of levitation in natural ecstasy, though it is related of the Neo-Platonist, Iamblichus. Incidentally he rejects the pineal gland as the organ of phantasy, much less the seat of the rational soul, for the very reason that Costa ben Luca had advanced in its favor, namely, that when we want to meditate profoundly we incline the head and rest it on the hand. The animal spirits are

⁵⁹ *De ecstasi tractatus singularis quo plurima huc pertinentia et ab aliis praeterita non modo tractantur sed et variae quaestiones qua theologicae qua philosophicae et medicae uberius discutuntur*, Groningen, 1661. Copy used: BN R.6567.

⁶⁰ In the preface to the reader, "... me peragrasse loca non trita et vix alterius vestigium exhibente."

⁶¹ *Disputationum*, II, 1056.

⁶² Le P. Domenico Gravina, *Ad discernendas veras a falsis visionibus et revelationibus* . . . , Naples, 1638, in-4, is perhaps meant.

distributed throughout the brain and inclining the head impels them into the anterior part of the brain, whereas the pineal gland is at its center.

Phantasy may be disturbed by disease, not only by mania and frenzy, but by fever, insomnia and good or bad angels. The latter not only give glimpses of the future, but upset the mind by multiple illusions offered to the imagination. Physicians should cure this by appropriate corporeal remedies. When vitiated by disease, the imagination creates absurd and non-existent images or existent but much perverted. Often melancholics are terrified by things that are not terrible at all, if not utterly ridiculous. But unless the brain is greatly upset by ecstasy, memory is not lost. Hard thinking, however, sometimes not merely weakens the memory but takes it way entirely. Thinkers are more apt than others to incur delirium and mania. Suiseth in old age wept because he could no longer understand his *Calculations*, and Schoock ascribes it not to mere old age but to too prolonged and arduous thinking. The same can happen to ecstasies.

Preternatural or morbid ecstasy is a disease different from lethargy, which involves loss of memory, an irresistible drowsiness, and slow continuous fever. Preternatural ecstasy is more akin to mania or frenzy, which are hot diseases, while lethargy is caused by cold. Preternatural ecstasy should not be confused with diabolical ecstasy.

The latter, like divine ecstasy, is supernatural and characterizes those who are possessed by demons. Schoock does not agree with Bodin that the devil can effect a real but temporary separation of soul from body. But the devil can put the senses, both internal and external, to sleep for a time, so that they perceive nothing. Indeed, this happens in some diseases and can be produced by narcotics, which the devil knows how to administer better than any doctor. Whether he can also impede the vital and natural faculties is more doubtful, but perhaps he can make men seem dead by reducing these to a minimum, so that there is no outward indication of breathing or motion of the arteries. This would account for supposed resurrection of the dead by pagans. But when those afflicted with diabolical ecstasy return to their senses, they re-

count things as if they had occurred far off, and this is difficult to explain. For the devil cannot strip corporal objects of their intentional species and bring these to the phantasy of the ecstatic, for accidents, as the philosophers say, do not migrate from subject to subject. He can use their tongues and palates to utter voices, which explains why they often seem to speak languages which are unfamiliar to them. Or he can teach them very rapidly. Some atheists welcome the devil's reputed powers over those in ecstasy to argue that the human soul is not immortal.

Before Schoock, Andreas Probst had treated of the disturbance of phantasy by melancholy.⁶³ Hieronymus Planes in 1634, the year before his death, had published an examination of true and false revelations and the movements of those rapt or ecstatic.⁶⁴

Carolus Piso or Charles Le Pois (1563-1633) classed hysteria among convulsive affections and located it in the brain.⁶⁵ Later in the century Thomas Willis (1621-1675) similarly described it as primarily a convulsive symptom which depended principally on the brain and nerves and a *succus nutritius* in the nerves which was dilated by a violent explosion produced by the mixture of fixed salts with acid.⁶⁶ But Matthieu Chastelain, royal professor of medicine at Montpellier, explained convulsions by fermentation of the spirits in the fibres of the muscles rather than by explosions in the brain and nerves.⁶⁷ Nathaniel Highmore attributed hysteria to the blood rushing too impetuously into the lungs and overfilling them, and held that such an explosion might happen in the blood as well as in the nerves. He also, like other contemporaries, ques-

⁶³ LR 53: *De phantasia eiusque per melancholiam affectione Exercitatio*, Berlin, 1654, in-12.

⁶⁴ *Tractatus de examine verarum et falsarum revelationum et raptuum seu ecstaticarum motionum in libris 4 divisus*, Valentiae, apud Joannis Chrysostomi Garriz viduam, 1634, in-4: no BM-BN.

⁶⁵ *Selectiorum observationum et consiliorum de praetereisis hactenus morbis effectibusque praeter naturam ab aqua seu serosa colluvie et diluvie ortis liber singularis*, 1618, in-4. See

Guy Patin, *Lettres* (1907), p. 49.

⁶⁶ See Nathaniel Highmore, *De hysterica et hypochondriaca passione. Responsio epistolaris ad Doctorem Willis*, London, 1670, in-4; Willis, *Affectionum quae dicuntur hystericarum et hypochondriacarum pathologia spasmodica vindicata contra responsionem epistolarem N. Highmorei*, London, 1670.

⁶⁷ *Traité des convulsions et de mouvements convulsifs qu'on appelle à présent vapeurs*, 1691, in-12. JS XIX, 553-57. BN Td⁸⁵.31.

tioned the existence of Willis's *succus nutritius*. Schoock had quoted Highmore as to odors producing hysteria.⁶⁸

The association, literal and etymological, of a morbid state of depression with the hypochondria or soft parts of the body below the costal cartilages is illustrated in our chapter on Academies by Georg Sebastian Jung's report of a girl who fainted at the sight of calf's head or a head of cabbage because she had birthmarks resembling these upon her hypochondria.⁶⁹ Highmore ascribed hypochondria to weakness and laxity of the stomach and its fibres, whereby were generated corrupt chyle and blood with resulting fermentation which caused trembling and palpitation of the heart, swooning, fear, and sadness. With this view, too, Willis disagreed.⁷⁰ Ten years before Highmore had written that almost all medical men were agreed that the immediate cause of hypochondria was melancholy discharged into the stomach from the spleen.⁷¹ In any case, Willis made hypochondria more of a mental or nervous disease than Highmore did.

The book of Hering on melancholy in general and hypochondria in especial with examples and medicaments from the best authors, had appeared at Bremen in 1638. Hawkins had treated of hypochondriacal melancholy at Heidelberg in 1633. Nicander had published at Paris in 1644, the case history of a female hypochondriac covering six years. Arnisaeus discussed the subject at Copenhagen in 1654. Paolo Zacchia had written in Italian of hypochondriacal ailments, and a Latin translation of his work was issued at Augsburg in 1671.⁷²

⁶⁸ Marten Schoock, *De fermento et fermentatione*, Groningae, 1662, pp. 520-21, from Highmore, *De hysterica passione*, cap. 6, p. 36.

⁶⁹ PT I, 135.

⁷⁰ PT IV, 1089-91.

⁷¹ *Exercitationes duae quarum prior de passione hysterica, altera de affectione hypochondriaca*, Oxford, 1660, p. 99.

⁷² Hon. Heringius, *De melancholia in genere et affectione hypochondriaca in specie*, Bremae, 1638, in-12. Joh. Hawkins, *Discursus de melancholia*

hypochondriaca potissimum ex occasione affectus cuiusdam illustris heroinae habitus, Heidelberg, 1633, in-4. Robert Nicander, *Historia memorabilis foeminae Monteluttanae bis triennio hypochondriis laborantis*, Paris, 1644. Frid. Arnisaeus, *De melancholia hypochondriaca*, Haffniae, 1654, in-4. Paul Zacchias, *De affectionibus hypochondriacis*, Augsburg, 1671. BM 781.d.4 is the second Italian edition: *De'mali hypochondriaci libri tre; in questa seconda impressione . . . accresciuti*, Rome, 1644, in-4.

Yet in 1672 Tomas de Murillo y Velarde, Spanish royal physician, published a work in Latin at Lyons and in Spanish at Zaragoza⁷³ on the cure of hypochondriacal melancholy, which the Latin title represented as most novel. The Latin version is, however, largely a mass of citations and quotations. Seven hypochondria are distinguished: liver, spleen, ventricle, pancreas, caul, meseraic veins, mesentery and other parts joined with these. The whole essence of hypochondriac melancholy is that it is by consensus by the hypochondria and marked especially by fear and gloom which are characteristics of melancholy. Galen distinguished three varieties of hypochondriac melancholy: the first, by the very essence of the brain; the second, by sympathy from the entire body; the third, by connection with the hypochondria, which is hypochondriac melancholy proper and that with which Murillo is concerned. It divides into a spurious and legitimate kind, the former coming from obstructions in the hypochondria but not from melancholic humor depraving the imagination with fear and gloom.⁷⁴ Plato in *Timaeus* says that all diseases from melancholy humor are difficult to cure, and grow worse, the more they are irritated by drugs. Hypochondriac melancholy by consensus, if not continuous, is easily cured in its first stages, but never after it has become inveterate.⁷⁵ Pliny is cited for herbs which induce hypochondriac melancholy and insanity.⁷⁶ The ancients regarded the flesh of a hare as food of demons, and Joannes Bruyerinus, *de lepore*, adds goose to diabolical diet. Hypochondriacs should abstain from cheese and milk-foods. Steel possesses an occult virtue which comes from its specific form and can be learned only by private operations, much practice, and pure experiment without reason.⁷⁷ Acute fever sometimes frees from insanity, quartan cures epilepsy, and so on. The Abderites sent a letter to Hippocrates to come quickly, for Democritus from excessive study had become delirious, insane and a hypochondriac

⁷³ *Novissima verifica et particularis hypochondriacae melancholiae curatio et medela*, Lyon, 1672, in-12: BM 1191.e.2. *Aprobacion de ingenios y curacion de hipochondricos con observaciones y remedios*, Zaragoza, 1672, in-4. I have not examined this but

there is a copy in the BM: 781.d.6.

⁷⁴ Ed. of Lyon, 1672, pp. 9, 12, 39-40.

⁷⁵ *Ibid.*, p. 132.

⁷⁶ *Ibid.*, p. 108, citing *Nat. Hist.*, XXIV, 17.

⁷⁷ *Ibid.*, pp. 160, 164-65, 289.

nigromancer. In a later passage Murillo speaks again of monstrous necromantic hypochondriacs, and in an earlier passage of distorted and monstrous and nigromantic and diabolic imaginations which make men hang themselves over fire, plunge from heights, and jump into wells, as is evidenced by daily experience.⁷⁸

Vinegar is good for melancholics, but pure antimony is poison and its use as a remedy seems an invention of the devil. A bath is bad for hypochondriac melancholy but good for hysterical women, while a bath in sweet water is good for hypochondriacs but one in mineral waters bad. The heart is the member chiefly affected by melancholy, although one might have expected it would be the brain. Too much science is a disease, viper powders are good for hypochondriacs, and a marvelous potion for them when the moon is waning is listed in the Index, but I failed to find it in the text.⁷⁹

Such were the vagaries, magical and otherwise, into which a consideration of hypochondriacal melancholy was likely to lead.

Borrichius, defending the use of chemical and mineral medicines in 1674, held that epilepsy and stubborn hypochondria could be cured only by them, and that volatile spirits of human blood were a better remedy for epilepsy than those made from the blood of other animals.⁸⁰ He had often tested oil of human cranium in nervousness and convulsive movements and in epilepsy of both infants and adults and found it superior to a peony or to swallow-water.⁸¹

In a treatise on vapors, published in French at Paris in 1689, Lange considered not "the vapors which rise continually from each body by the action of the celestial matter which penetrates it," but vapors produced internally in the human body, including melancholy and hysterical ones.⁸² This, he held, was by fermentation of volatile salts in the brain and of fixed salts in the spleen. The

⁷⁸ *Ibid.*, pp. 20, 86-78, 149-50, 51-52; see also p. 37.

⁷⁹ *Ibid.*, pp. 162, 314-15, 298-99, 303-4, 46, Proem., 254 *et seq.*

⁸⁰ PT X, 298-99.

⁸¹ *Hermetis Aegyptiorum et Chemicorum sapientia*, 1674, p. 332.

⁸² *Traité des vapeurs, où leur origine, leurs effets, & leurs remèdes sont mécaniquement expliqués*, Paris, 1689, in-12. No Christian name or initials are given for the author, who is called "Medecin de la société royale départhy à Lizieux." The quotation is from JS XVII, 305.

vapors were spread through the nerves, albeit that these also had to give passage to the animal spirits. Epilepsy was caused by the vapors from the fermentation in the brain; melancholy, by those from the spleen; while hysterics were brought on by seminal ferments. For epilepsy Lange used oil of human cranium and further for specific remedies advised one to consult "le Livre des secrets de Monsieur de Blegny où ils sont fort exactement décrits." He also mentioned the *syrop émetique* and the *pillules hysteriques* of Charas.⁸³

Highmore in 1660 described the animal spirits as atoms or minutest fiery particles, attenuated and rarefied and exalted by heat and fermentation in the heart, and transmitted with the blood through the arteries to the brain, where they were separated from the blood and reserved in its channels and passages for use. But they were so active that they could run through the whole microcosm in a moment's time. In all passion the spirits rush to those parts which are moved by the passion, but these movements do not indicate the same things in all animals. A dog wags its tail when pleased; a lion, when angry. The cat by erecting its tail indicates complacency; the dog, by dropping its, shows fear.⁸⁴ Digby's explanation of the action of the spirits was criticized at some length by Highmore.⁸⁵ He held that the soul directed the spirits and accompanied them to all parts of the body, and that intangible spirits were a fit medium for the soul in acting on tangible parts of the body.⁸⁶

Men are hotter than women and abound more in spirits. Women apprehend objects poorly. Consequently their phantasy and reason are satisfied by weaker arguments, and they are more emotional than men.⁸⁷ Hysteria or suffocation from the womb is an experience familiar to women in which they seem to be suffocated and so to speak strangled.⁸⁸

The account in *Philosophical Transactions* of January 6, 1667-1668 of Thomas Willis's *Pathologiae cerebri & nervosi generis*

⁸³ *Traité des vapeurs*, pp. 273-4, 269, 290.

⁸⁴ *Exercitationes duae*, 1660, pp. 69-70, 73.

⁸⁵ *Ibid.*, pp. 74-77.

⁸⁶ *Ibid.*, pp. 79-80.

⁸⁷ *Ibid.*, pp. 62, 65.

⁸⁸ *Ibid.*, p. 1.

specimen states that he teaches that animal spirits "constitute the being of the corporeal soul," and produce all animal motions by an explosive action, of which convulsions are an extreme instance.⁸⁹ Similarly Sir Michael Foster spoke of Willis's "great discovery" that the corporeal soul consists of two parts: flame or vital spirits in the blood, and light or animal spirits in the brain. Foster believed that Willis's "false fame in large measure rested on Lower's careful unacknowledged work," and that Willis was a rhetorical thinker for whom an illustration was an argument; and an analogy, a proof.⁹⁰

In his own time, however, Willis was highly regarded. In 1701 Burggrafius still ranked him high, although his nervous liquor or juice had been questioned by Highmore and Glisson. He first studied theology, then medicine, and became professor of natural philosophy at Oxford. He won fame by his accurate and new description of the nerves and of convulsive diseases, and his theories concerning fermentation and fevers, fermentation of the blood, and the soul of brutes.⁹¹

For Willis spirits were a most subtle substance, ethereal and particles of diviner aura which the parent of nature had established in this sublunar world as instruments of the life and soul, movement and sense, of every thing. From their motion came the animation of bodies, vegetation of plants. They determined the form and figure of every thing. By their presence they maintained the bonds of mixtures; unlocked these by their departure. They bridled the disorders of sulphur and salt. The perfect state of each thing was attained by abundance and exultation of spirits; decline and fall consisted in their defect and destitution. They were few in minerals, more in vegetation, most in animals.⁹² Animal spirits were formed in the brain,⁹³ and their explosion was the cause of mental disease.⁹⁴

Willis, speaking of the infinite number of ideas stored in memory,

⁸⁹ PT, II, 601.

⁹⁰ *Lectures on the History of Physiology during the Sixteenth, Seventeenth and Eighteenth Centuries*, 1901, pp. 271, 181, 270.

⁹¹ Joh. Phil. Burggrafius, *Libitina ovans . . . de medicae artis ac medico-*

rum praecipuis fati, Francof., 1701, pp. 59-61.

⁹² *Opera* (1676), 3-4.

⁹³ *Ibid.*, 17, 288-90, 337, 340-1.

⁹⁴ *Ibid.*, 446, "Explosiones in spiritibus quomodo contingant."

suggested that they were so many diverse motions conserved in as many diverse particles or connections of the brain. Surely unless they were material, they could not be destroyed by disease, as they were in cases of total loss of memory.⁹⁵

Imagination is a certain undulation or wavering of the animal spirits, begun more inwardly in the middle of the brain, and expanded or stretched out thence on every side towards its circumference. On the contrary, the act of Memory consists in the regurgitation or flowing back of the spirits from the exterior compass of the brain to its middle.⁹⁶

Willis held that the convolutions of the brain were required for the varied acts of imagination and memory, and that the ventricles of the brain, where it was once thought that the animal spirits were stored, were of little importance. The pineal gland was not the seat of the soul—or link between brain and thought, as Descartes had held—because even birds and fish have it and yet not only lack the superior powers of the soul but are almost without imagination and memory.⁹⁷

The rest of the faculties . . . as sense and motion, also the passions and instincts merely natural, though they depend in some measure upon the brain, yet they are properly performed in the oblong marrow and cerebel, or proceed from them.⁹⁸

But there is a private passage, distinct from the common passage of the medulla oblongata into the cerebellum, by which the animal spirits go from the brain to the *praecordia* and viscera, and the natural instincts excited in the *praecordia* and viscera are transmitted to the brain.⁹⁹

Willis held that the prescriptions of the dogmatics were of little or no use for epilepsy. He knew distinguished practitioners who relied upon empirical remedies for it. But, although this sort of practice sometimes succeeded, he felt that it would be more certain to do so, if impediments were first removed by other drugs and the body properly prepared. He advised bridling the animal spirits and preventing explosions by employing such remedies as salt and

⁹⁵ *Ibid.*, 426.

⁹⁶ *Anatomy of the Brain*, chapter 10, p. 91 in English translation of 1681.

⁹⁷ *Ibid.*, pp. 92, 96-97, 106.

⁹⁸ *Ibid.*, p. 91.

⁹⁹ *Ibid.*, p. 108.

oil of amber, spirit of blood, hartshorn, soot and tincture of castor oil, either taken internally or held to the nostrils or rubbed over the entire body. Or specifics such as peony, mistletoe, rue, castor oil, elk's hoof, preparation of human skull, amber and coral, might open up passages in the brain and prevent explosions. Therapeutic method for epilepsy included vomitories, purgatives, specifics, powders, electuaries, pills, elixirs, empiric remedies, amulets, plasters, sneezing powders, distilled waters, juleps, decoctions and *remedia magna*.¹⁰⁰ Some say that the seat of epilepsy is the meninges or thin skin of the brain; others, the pith or middle part of the brain, but Willis holds that the spirits in the middle of the brain are the primary subject of it. The best simple against epilepsy is the root of the male peony. A good compound medicine for it is made up of human skull, mistletoe, counterfeit cinnabar, and elk's hoof. Livers of frogs and eggs of crows and amulets are also listed.¹⁰¹

The bite of the tarantula infects the nervous liquor and the animal spirits. It was not so clear why the painful convulsions produced thereby were immediately calmed down by music and transformed into dancing. Willis rejected the explanation that the tarantula loved music and transferred this penchant to its victim. He suggested rather that the scattered spirits were collected anew by the music, thereby regulating the convulsions and setting both spirits and the victim dancing in regular order until the particles of venom evaporated. St. Vitus dance was ascribed by Willis to unbridled animal spirits.¹⁰²

One more illustration how deeply implanted and taken for granted the hypothesis of spirits in the human body was, is had in the work on apoplexy of Gregorius Nymmann (1594–1638), an M.A., M.D., and professor of anatomy and botany at Wittenberg. He held that the cause of this disease was not so much, as was commonly held, an obstruction of the nerves and interception of the animal spirits, as it was the closing of certain ducts which carried vital spirit to the brain. This treatise was first printed at Wittenberg in 1629, and then again in 1670.

¹⁰⁰ *Opera* (1676), 459-60, 462-65.

English translation, London, 1681, pp. 13-14, 22-23.

¹⁰¹ *An Essay of the Pathology of the Brain and Nervous Stock in which Convulsive Diseases are Treated of,*

¹⁰² *Opera* (1676), 492-94.

Du Hamel in his treatise on the animated body¹⁰³ followed the usual practice of his time of explaining all mental aberrations in terms of the animal spirits. In the case of the dreams of witches and others who, though snug in bed, think that they are moving here and there and doing this or that, the spirits move only the organs of memory and imagination, but the dreams are remembered. In the case of somnambulists, on the contrary, the spirits operate in the motory nerves and move the muscles, so that the sleep walkers sometimes put on their clothes, open doors, and wander into the night. Yet they remain sound asleep and have no recollection of what they did, since in their case the spirits left the imagination and memory untouched.¹⁰⁴ Mental delusion and disease, if of a milder sort and not continuous, is called delirium. It is caused by a tumultuous motion of the animal spirits, which excite and confuse all sorts of imaginations and memories together, resulting in absurd ideas and unexpected movements. But if more serious and continuous, or accompanied by fever, it becomes *phrenitis* and *paraphrenitis*, in which the spirits are not only perturbed but raised to an intense heat and readily inflammable. Or they may have gloom and sadness as an adjunct, and then you have melancholics and hypochondriacs.¹⁰⁵

Schelhammer in 1697 attributed mental disturbance to excessive mobility and bad impression of the spirits.¹⁰⁶ Humors and spirits were out of order which were borne by that vicious impetus. Such too rapid movement of the spirits towards some part of the body customarily resulted in epilepsy of adults, hysterical passions, and the like. It appeared plainly in consumptives and also those afflicted with gout, who were irritated by the mere sight of a fly on the wall. Others were so afraid of small pox or plague or malign fevers that they shuddered at their mere mention. Terrors of this sort often proved deadly and lethal, because mere thought disturbs the mind and sets the humors in motion. The same thing happened to the melancholy and those afflicted with great misfortune. Some

¹⁰³ Joh. Bapt. Du Hamel, *De corpore animato libri quatuor seu promotae per experimenta philosophiae specimen alterum*, Paris, 1673.

¹⁰⁴ *Ibid.*, p. 419.

¹⁰⁵ *Ibid.*, pp. 424-27.

¹⁰⁶ Guntheri Christophori Schelhammeri *Natura sibi et medicis vindicata* . . . , Kiel, 1697, pp. 289-90.

sought an explanation in the *Idea terrifica* of Helmont and Marcus Marci of Bohemia, and employed amulets made from metal fused by thunderbolts or from animals slain when terrified. But Schellhammer rejected the *Archeus furens* of Helmont as the creation of his imagination, prone to ideas and fancies of that kind, and sprung like Pallas from the brain of Jove.¹⁰⁷

William Drage, a physician and philosopher at Hitchin in Hertfordshire, in 1665 put out a book which is sometimes cited as *Daimonomageia*,¹⁰⁸ but whose proper title is "A Physical Nosonomy; or, A new and true description of the Law of God (called Nature) in the Body of Man. To which is added a Treatise of Diseases from Witchcraft."¹⁰⁹ In "A Monitory Proæmium" Drage stresses the influence of the stars, and later says, "We will speak a little here in the vindication of astrology."¹¹⁰ He quotes Sennert that experience shows that the humors are altered by the stars, and the mind by the humors.¹¹¹ But he argues that the planets also operate upon our minds "by raising contingents and intervening accidents," which cause us to change our minds. Of this he gives various examples: for instance, "one man is minded to go a journey, a shower of rain falls and alters his mind."¹¹² He grants that the ancient rules of astrology are often wrong and judgment uncertain, but answers seven objections made against astrology, and presently suggests a "new method or astrologo-physical way" of studying and practising medicine. Yet he is an opponent of compound medicines.¹¹³

¹⁰⁷ *Ibid.*, p. 285.

¹⁰⁸ Notably by Kittredge, *Witchcraft in Old and New England*, 1929.

¹⁰⁹ London, 1665, in-4. Copy used: BM 776.g.3. On p. 2, facing the opening page of text on p. 3, we are informed that, "whereas in the first part of the book mention is made of another work of the author's called *Physiology, Iatrosophy and Pneumatography*," this has not yet been printed. Nor is it found in the British Museum.

¹¹⁰ *Ibid.*, p. 16.

¹¹¹ *Ibid.*, p. 23.

¹¹² *Ibid.*, p. 22.

¹¹³ *Ibid.*, pp. 24, 25-27, 47-58, 40. "A Breife Vindication of Astrology," by Wm. Drage, Apothecary of Herts, in MS Sloane 2279, fols. 35r-39v, at the British Museum, roughly parallels this section of his work and, like it, answers seven objections against astrology. At fols. 63v-68v, is his astrological-physical method of practising medicine; at fol. 118v, "Some few Syllogistical Reasons to proove there be witches . . . Ex W. Drage phys. exp." On fol. 2r the MS is described as "collected and written at several times by Hen. Colby Philomat. Anno 1665, 1666, 1667 etc."

The *Treatise of Diseases from Witchcraft* which accompanied William Drage's *Physical Nosonomy* of 1665 bears on its separate title page the fuller description, *A small treatise of Sicknesses and Diseases from Witchcraft and Supernatural causes, being useful to others besides physicians in that it confutes atheistical, sadducistical and sceptical principles and imaginations*, with the further statement, "Never before, at least in this comprised order and general manner, was the like published." As diagnostic signs of such diseases are listed: "voiding what cannot naturally be bred in the body"; "strange and wonderful convulsions, indomitable and inexpressible torments"; complaint by the patient of a woman or man suspected for a witch; and speaking strange tongues and predicting the future; that, when anything that comes from the patient is burned or harmed, the suspect suffers similarly or comes to the house; and that, after she has so suffered, or been scratched till the blood flows, or been threatened, the patient's condition is manifestly improved. Drage cites "several testimonies" that witches can fly from house to house, or leap many yards, or run up walls feet foremost without holding on. He further asserts that all diseases caused by nature may be duplicated by witchcraft, but that not all those caused by witchcraft can be produced naturally. The witches send their imps or young(!) spirits into some persons in the form of mice or flies. Some bewitch by voice and eyes; others, with ointments and powders; they can transform themselves into various animals.

Seven ways of curing diseases caused by witchcraft are suggested. One is to make the witch suffer, as has been already indicated. Another is to call on God. A third is to use specifics which are antipathetic to demons, "if there be any such" medicines. A fourth is to employ, or force the witch to employ, the appropriate ceremonies for breaking the enchantment. A fifth is to force her to transfer the disease to herself or some dog or other animal. A sixth is to search the house for charms which are causing the disease. Finally, if the witch is put in prison, Satan abandons her and her magic power expires. After citing thirty-six passages of the Bible in support of the existence of witchcraft, noting the occult virtues of herbs and stones, and the existence of monsters and other marvels of nature, and declaring that "thousands more of Nature's aenygmas,

problems and phaenomena's may be produced," Drage closes with "A Relation of Mary Hall of Gadsden, reputed to be possessed of two devils, 1664."

Georg Abraham Mercklin had performed a service of great value to historians of medicine and allied subjects by bringing up to date the bibliography which Van der Linden had published in 1637, 1651 and 1662,¹¹⁴ and printing it under the new title, *Lindenius renovatus* at Nürnberg in 1686. It came somewhat as a shock to find him also the author of a collection of cases commonly ascribed to incantations,¹¹⁵ and the shock increases as one examines the cases themselves.

In a long preface Mercklin reviews the positions of Wier, Bekker, Bodin, Codronchi, Praetorius, Willis, Reinesius and others, and states that he will take middle ground and hold that many of the cases should not be attributed to incantations but not that none are to be so ascribed. Signs of magic diseases are that they transcend the sphere of natural causes, or that they come on suddenly without apparent cause, are unfamiliar to physicians, and incurable by medicine. He is opposed to such tests as pouring the urine into a pot half full of ashes to see if foreign objects appear, or washing the patient with a decoction of vervain and observing whether it changes color or foreign objects appear in it. Willis accepts as signs of magic or demon possession bodily contortions which even an acrobat could not perform and sudden sexual impotence. Other signs of obsession are the gift of tongues, ability to divine the future, sudden knowledge of science or secrets, and abhorrence of the scent of roses. But J. C. Frommann holds that no such signs are infallible.¹¹⁶

The nucleus of Mercklin's book is the strange case of the twelve year old son of a pastor of the church, which had been told him in part by the lad's father, in part by friends at various times. Mercklin at first was going to publish it in the *Ephemerides* of the Academy of the Curious as to Nature, and then decided to print it separately.

¹¹⁴ *De scriptis medicis*, 3rd ed., in-8, 755 pp.

¹¹⁵ *Sylloge physico-medicinalium casuum incantationi vulgo adscribi solitorum*, Nürnberg, 1698, in-4: BN

4°Te¹³⁰.29. Another edition in 1715: Cornell M526.

¹¹⁶ *De fascinatione* (Nürnberg, 1675), III, 8, i-ii.

But the printer said that it was too short, so Mercklin added fifty-nine other cases. But the first case is long enough in all conscience.

On November 30, 1694 the boy became sick and both vomited and excreted many minute worms and fell into epileptic convulsions. He declared that a worm inside him was biting him, and they kept dosing him with medicines, but milk was the only thing that would pacify the worm, which, drawn by it to the boy's jaws, often protruded its head from his mouth, and between times indulged in varied antics within his body. On February 25 an arrogant *medicaster* arrived but, whether despite or because of his ministrations, between March 4 and 26 there came out of the boy's mouth and nostrils, sometimes as many as ten or twenty at once, 162 millepedes, two wood-worms, a white worm with a black head, four swift-running worms with twenty thorny feet, two butterflies, 42 caterpillars and one beetle. Some of them lived for three days afterwards, some for eight, and some for twelve days.

The parents were thanking God for their son's recovery, when on March 26, which was Easter, other children playing in the garden found in a bird's nest a white egg with red figures. They cooked it to eat, but while the albumen was white, the yoke was very black, so they threw it away and washed their hands. In the sight of curious neighbors, who had gathered, a rooster and two hens were killed by it and next day a black powder was noticed where the garden paths intersected. Therefore witchcraft was suspected. The *medicaster* was again consulted and smeared the boy's entire abdomen with unguents and plasters and suffumigated him daily.

From that time on to the end of May, four medium-sized frogs came out of the lad's mouth. One frog had inside it a beetle, a worm and two caterpillars; another, a lot of sperm; and the other two, nothing. After voiding the first frog, the boy was taken to the frog pond in the hope that, if there were other frogs inside him, they would be evoked by their fellows "by force of sympathy." But the result was that his belly swelled, the old worm which had not bitten his insides for some time began to do so again, and the frogs within him imitated the croaking of those in the pool.

The evacuation of the frogs was shortly followed by one of toads

and finally of lizards to the number of twenty-one. Also in June the creature inside him began to bite him again, then came out but could not be found afterwards. During the week of June 17-24 he expectorated nails, half a link of some chain, seven pieces of plates, two big stones, a lock of beautiful hair, fragments of white and red eggshells, the blades of two knives, a piece of a medicine jar, and two large keys. The viper entered his body again but soon came out and bit him on the foot. He again felt it in his belly, and it again came out and bit his hand so that it bled. The parents then decided that a change of scene might do their son good, and he finally recovered.

To his sixty cases Mercklin added cures for witchcraft, including an amulet for insane love, a balsam against all sorcery, candles against all magic diseases, anti-magical and astral herbs, and a sympathetic unguent which was to be prepared under certain specified constellations.¹¹⁷

When some girls who were thought to be possessed by demons were brought to Toulouse to be exorcized, the Parlement ordered that they be examined by two doctors, François Bayle and Henri Grangeron. The symptoms began with upset stomachs, followed in some cases by headaches and later by sudden falls, hiccups, convulsions, faint but fast pulse, extravagant words, vomiting of pins and ribbons, subsequent forgetfulness of what had happened, and all more likely to happen in church than elsewhere. The two physicians accounted for the upset stomachs by bile and melancholy; for the headaches by the sympathy between stomach and brain; and for the hiccups by the ferment produced by the two humors, of which one abounded in acid and the other in alkali. The falls and convulsions were epileptic, but of a sympathetic epilepsy caused by the flow of melancholic juice from the pancreas to the intestines. The numbness which they felt in one of their arms was another indication of epilepsy. Their forgetfulness and weak but fast pulse were due respectively to the action of acid on brain and blood, and their thinness to indigestion. They had swallowed the pins and ribbons unthinkingly when in a state of profound

¹¹⁷ *Sylloge*, etc. 1698, pp. 208, 225, p. 150; the volume, at p. 254. 220, 222, 251. The sixty cases end at

melancholy, as one of them had confessed. Imagination made them imitate one another and suffer attacks in church, where they had heard that the possessed were most tormented, and respond as well to feigned exorcisms as to real ones.¹¹⁸

Bayle had published a treatise on apoplexy at Toulouse in 1676,¹¹⁹ in which he argued that it was caused by melancholy which coagulated the blood, stopping the animal spirits and producing sudden deprivation of all sense and motion except breathing, and that with difficulty. He distinguished four kinds: *fortissima*, *fortissimae proxima*, *fortis*, and *debilis*. *Fortissima*, in which even breathing and pulse suddenly ceased, killed immediately, and even *fortis* was incurable, and a doctor should either refuse to take the case or warn that it was hopeless. But since sudden cessation of breathing and pulse also occurred in cases of syncope, ecstasy and hysteria, it was better to wait for three days after it for fear of burial alive. Galen ascribed apoplexy to obstruction of the anterior ventricle of the brain by thick phlegm, and this view seemed to be supported by a great deal of spittle falling into the jaws of apoplectics and by finding a thick humor like gelatine when the brain was opened. But animal spirits are not generated in the ventricles of the brain, for Malpighi has shown that the fibres of the nerves terminate in the ashy cortex of the brain. Also in some cases the ventricles have been found empty after death from apoplexy. Other suggested causes have been pressure at the base of the brain and beginning of the nerves, obstruction or opening of the arteries, softening of the brain, and inflammation of the brain. But none of these is the true cause, although there is none of them which cannot be joined with the true cause. Epileptics readily fall into apoplexy,

¹¹⁸ *Relation de l'estat de quelques personnes pretendues possedees faite d'autorité du Parlement de Tolose*, par Messieurs Fran. Bayle Doct. Med. & Profess. aux Arts Lib. de l'Univers. de Tolose, & Henri Grangeron Doct. en Medecine, Toulouse, 1682, in-12. JS X (1682), 343-46.

¹¹⁹ Franciscus Bayle, *Tractatus de apoplexia in quo ex nova hypothesi huius affectionis causa penitus in-*

quiritur, omnium vulgo opinionum de hoc morbo absurditas ostenditur, et curatio vera atque succincta proponitur ex doctrina Hippocratis, Tolosae, 1676, in-12. This edition is listed by LR but not found in the printed catalogues of BM and BN.

I have used the *Editio secunda emendatior* of The Hague, 1678, in BN T^{31.27} (2), 137 pp.

and melancholy is the cause of epilepsy. The chief quality of melancholy is acidity and thus it can coagulate the blood. To prevent apoplexy one should take every care against an excess of melancholy. Bayle notes that epileptics are called in Latin *siderati* or star-struck, and makes a weak attempt to show that two aphorisms of Hippocrates confirm his view that melancholy is the cause of apoplexy.

The *Castorologia* of Johann Marius of Ulm was composed about forty years before Johann Francus published it at Augsburg in 1685, overloading it with tiresome *Additamenta* of his own, full of prescriptions of compound medicines. Marius states that he cured a man in Wurtemberg of mania by covering his head with the skin of a beaver which had just been skinned. A Jew told him that he had it from his ancestors, to whom it very likely came down from Solomon, that if anyone wore a cap made of beaver skin and each month anointed his head and spine with drops of castor oil, and took a pound of it internally every year, he would remember everything that he read. But this Francus refuses to believe.¹²⁰

Elias Heinrich Henckel, in a work on how to recognize and cure those possessed by demons,¹²¹ distinguished three chief species of mania.¹²² The first was uterine, to which virgins and viragos were subject. The second was lycanthropy. But a man could not be changed into a wolf by demon aid.¹²³ The third was non-natural and excited by impure spirits. Maniacs possessed great physical strength because of the intense heat of their blood.¹²⁴ Symptoms of the third species were sad and terrible dreams, blasphemous thoughts and unwillingness to attend divine service, speaking foreign tongues never learned or understood before, loss of reason, stupidity with immoderate and untimely laughter, obscenity, inability to speak one's native language, loss of sight and hearing, contortions which if natural would break the bones, going without food, sweating and weeping, a terrible cast of countenance, very bright eyes but eyelids that will hardly open. Obsession was often so intricately

¹²⁰ *Op. cit.*, pp. 25-27.

¹²¹ *Ordo et methodus cognoscendi et curandi energumenos seu a stygio cacodaemone obsessos*, Francof. et

Lipsiae, 1689, 240 pp. BM 719.d.25. Cornell H 504.

¹²² *Ibid.*, pp. 36-37.

¹²³ *Ibid.*, pp. 152-57.

¹²⁴ *Ibid.*, p. 33.

combined with other diseases that it was difficult to tell them apart.¹²⁵

Demons cause the bad dreams by the force of the melancholy temperament. The demons of horrible aspect, which the possessed assert they see, are mostly made of air with enough earth and water to give color and hold the aerial form together. But often they are purely imaginary, especially when the possessed are afflicted with thick and impure blood. While most dreams are not to be trusted, it must be admitted that some are true and reliable.¹²⁶

Henckel has a long digression on the subject of specters or apparitions.¹²⁷ Atheists think that most of them are figments and impostures, but saner philosophers oppose this view and hold that they can neither be explained naturally nor as the product of imagination. Some, however, think that they are natural like meteors, or figments of melancholy delusion. But Henckel holds that they are demons. He goes on to speak of Poltergeister and of gnomes in mines, and to discuss such questions as: at what time do specters appear? why do they appear in lonely and deserted places? why have they become rarer in our time?

Henckel has no sympathy with Thomas Hobbes, saying that the sun never shone on a craftier and more pernicious enemy and mocker of Christian piety.¹²⁸ Spaniards are of melancholy humor and hence are poor at philology but very good at scholastic subtleties and jurisprudence and metaphysics. Parents today, in providing for their sons' education, do not take such temperaments into account as they should.¹²⁹ Henckel's work was briefly noticed in *Acta eruditorum*.¹³⁰

Henckel also composed a work on philters.¹³¹ In it he censures those who resort to witchcraft as an explanation of every puzzling disease, but he equally blames those who deny that there are any

¹²⁵ *Ibid.*, pp. 42-59. For fuller detail the reader is referred to the sacerdotal book of Sammarinus, which I have failed to find.

¹²⁶ *Ibid.*, pp. 68, 78-79, 81, 76. At p. 139 Henckel similarly digresses to discuss oracles.

¹²⁷ *Ibid.*, pp. 83-112.

¹²⁸ *Ibid.*, pp. 39-40.

¹²⁹ *Ibid.*, pp. 123-25.

¹³⁰ IX, 197-98.

¹³¹ *De philtis eorumque efficacia ac remediis*, Francofurti, 1690, viii, 95 pp. BN 8°Te151.1002. But a letter to Henckel concerning the work in the front of the volume is dated Feb. 26, 1679.

diseases from demons. Philters often are followed by vomiting or excreting absurd objects—a sign of demon activity. But he questions whether it is possible to excite love of a particular person. Certain herbs arouse lust but not for only one person, and the same is true of philters. Moreover, in the latter case many of the ingredients are more apt to prove fatal or bring on melancholy and mania than to induce love. Drinking the blood of a criminal who has been beheaded is likely to result in the acquisition of his criminal character and the pursuit of a career of crime. Although Elsholtz in his *Clysmatica nova* dared not affirm anything with certainty as to the conciliation of estranged brothers or married couples by blood transfusion, Martin Weinrich in his book on Monsters tells of an epileptic girl of Warsaw who drank cat's blood and in consequence mewed, jumped and rubbed against one like a cat, and hunted mice. Another, fed on sow's blood, wallowed in mud with delight. Not all menstrual blood is harmful, but it has no force of conciliating love. Cutting characters on the skin of an apple is equally inefficacious. This is about all that Henckel has to say of the relation between magic philters and mental delusions. He goes on to speak in much the usual way of torpedo fish, basilisk, catoblepas and mandrake.

Pierre Cally, royal professor of eloquence and philosophy at the University of Caen, in the first book on the human mind of the section of his four volume Universal Institute of Philosophy which was devoted to Anthropology and published in 1695.¹³² defined a "phanatic" as one who, "deluded by inane specters even while awake, thinks that real which he merely imagines." There are four kinds of phanatics: *phrenetici*, *sagae*, *lemures* and hypochondriacs. The *phrenetici* are insane and their frenzy is attributed to inflammation of those membranes of the brain called *meninges*. René Bary, counselor and historiograph royal, in his Physics in Three Volumes of 1671, stated that fools were most so at the full of the moon, that the English beat them on the fourteenth day of the moon in Nazaret church in London, and that the Mathurins de la Beausse did the same, also stripping them and pinching them and

¹³² *Universa philosophiae institutio*, Caen, 1695, vol. IV, 333-37.

commending them to God.¹³³ Returning to Cally, we find him rather sceptical as to *sagae* or witches, asserting that wherever stories of witchcraft are frequent or rare, there many or few are found who are called *sortilegi*. Some with criminal intent engage in poisoning and ought to be punished. But maybe they should be judged insane and imprisoned for life rather than put to death. He does not entirely deny pacts with demons, however. *Lemures* think themselves wolves, and perhaps Nebuchadnezzar's delusion may be placed in the same category. Hypochondriacs suffer from delusions of grandeur and the like.

¹³³ *La physique divisé en trois tomes*, Paris, 1671, in-12, I, 424-25.

CHAPTER XXXVIII

ILLICIT MAGIC

Introduction—Filesac—Other works, 1608-1612—Fear of the pest—Exorcising: Birette, Olivieri, Pithoys—Sermons of Rudinger—Spee's *Cautio criminalis*—Oregius on angels—Piperno—Inquisition and magic: Carena—Scepticism of Hobbes and Ady—Cases of Timaeus von Gueldenklee—Arndius on superstition—Thumm on witches—*Alexicacon* of the exorcist, Brognolo—Wagstaffe, Casaubon and Glanvill—Jacques d'Autun—Bona on spirits—Reichelt on amulets—Spinoza—Anhorn—Frommann on fascination—John Webster—Menestrier—Decker on specters—Bekker—Burthogge—No defense for the witchcraft delusion.

Illicit magic wraps itself in the other two varieties as in a mantle, while it imitates and pretends to use the force of nature or of art.

—PASCHIUS

Our purpose in this chapter is to consider a few specimens of the literature on illicit magic, or what was commonly called diabolical, including treatises for or against the reality of witchcraft, on the powers of demons, and exorcization of them. Illicit magic, however, may be interpreted more broadly than this. Magic that injures others is unlawful, whether it be sorcery without resort to demons or witchcraft with their aid.¹ Or it may be prohibited as a relic of paganism, or popery, or as heretical and costing the magician his soul through a pact with the devil. Or it may be illicit and condemned because it is unnatural and impossible, an intellectual error and a waste of time practically, in short an imposture and cheat. Use of words and characters, figures and images and amulets, may be classed under this head. But inasmuch, if they do appear

¹ A. Masson, *La sorcellerie et la science des poisons au XVII^e siècle*, Paris, 1904, held that witches were apt to be poisoners and that it was a

good thing that judges executed them. Even so, it would have been preferable to execute them on charges of which they were really guilty.

to be efficacious, this is hard to explain except by supernatural assistance or illusion, this type of magic is apt to be lumped with the diabolical.

In a letter of April 7, 1638, Gui Patin announced the death, on March 27, at the Collège de Sorbonne, of Jean Filesac, "more than an octogenarian, a man of great learning and eminent for many virtues."² He was dean of the faculty of theology at the time of his death and had been rector of the University back in 1586. As such he had been addressed by Giordano Bruno in his *Camoeracensis Acrotismus*, and later served as confessor of Ravaillac, the assassin of Henri IV.³ This extremely learned and virtuous man in 1609 had published a treatise on Idolatrous Magic, in which he asserted that the transportation of witches to nocturnal sabbats had been so thoroughly proved by the most erudite men of the age, that, if anyone any longer cherished any doubt about it, he should be judged not only a wanderer from the Christian faith and religion but as sadly deficient in reason and judgment.⁴ Filesac further affirmed that magicians, sorcerers and witches in his time in the Christian world far surpassed in number all the brothels and houses of ill fame.⁵ These vehement declarations of Filesac were not, however, generally accepted, for he complains that these servants of Satan are held to be innocent and harmless,⁶ that evils for which they are really responsible are attributed to chance or vulgar error, and that some men have become so insane as to deny boldly the existence of demons.⁷ For the rest Filesac's book is largely a collection of quotations from the classics, church fathers, church councils, and so on, with the chief aim of showing the diabolical character of magic.⁸

² *Lettres* (1907), 135. On his activity in the university: Du Boulay, *Hist. Univ. Parisiens.*, VI, 786, 950-1 (where the date of his death is incorrectly given as 1635); Chas. Jourdain, *Hist. de l'Université de Paris au XVIIe et au XVIIIe siècles*, 1862, pp. 46, 48, 69, 71, 75, 76, 86, 112, 128.

³ Bruno, *Opere*, I, i (1879), 56.

⁴ *De idolatria magica*, Paris, 1609, fol. 1v. Copy used: BM 702.b.5 (2.).

⁵ *Ibid.*, fol. 71v.

⁶ *Ibid.*, fol. 73r.

⁷ *Ibid.*, fol. 2.

⁸ The name of Filesac is not found in the copious index of George Lyman Kittredge's *Witchcraft in Old and New England*, 1929. LR lists by him only a *Medicinae Defensio adversus Plinium Majorem*, Paris, 1618, while Triaire, *Lettres de Gui Patin*, 1907, 135, says, "Il a laissé plusieurs inté-

Four other works may be briefly dismissed in chronological order. The *Compendium of Witches* by Guaccius or Guazzo, printed at Milan in 1608,⁹ was well named, since it repeats stories already found in many previous works and offers nothing new of its own.¹⁰ The next year at Lyons appeared *L'Antidemon Historial* by Jude Serclier, "where the sacrileges, thieveries, ruses and frauds of the Prince of Darkness to usurp Divinity are fully treated."¹¹ This book turns out to have almost nothing to do with magic and witchcraft, but to be almost entirely concerned with religion. The first chapters are about the one true God and the polytheism of paganism, then come temples and sacrilege, the devil's imitation of true religion, the gift of prophecy from God, the oracles and lots forged by Satan, and so on. The treatise of Vincent Pons on the power and science of demons, printed at Aix-en-Provence in 1612,¹² is slight and may be passed over, except to note that he believed in the influence of the stars as well as in the power of demons. Demons can predict weather changes and other changes here below which happen from the motion of the superior bodies much better than any astrologer can, and they are able to predict much as to human actions, because, while the celestial bodies cannot directly affect the intellectual part of the soul, they do influence human passions and bodily inclinations, which only the wise few can resist.¹³ *The Anatomie of Sorcerie* by James Mason, London, 1612, is in the form of a commentary upon Acts 19, 11-16.

That fear of the pest and the witchcraft delusion might go together and accentuate each other and further be affected by religious differences, is illustrated by the *Mémoires* of Jacques de Banne,

ressants travaux d'érudition, entre autres un traité des anciens statuts sur l'Origine de la Faculté de Théologie de Paris."

⁹ F. M. Guaccius, *Compendium maleficarum pluribus figuris ac imaginibus perornatum*, Mediolani, 1608, in-8, 245 pp. BM 719.f.29.

¹⁰ See the references to it in the Index to Kittredge.

¹¹ *L'Antidemon Historial où les sacrileges larcins ruses et fraudes du*

Prince des ténèbres pour usurper la Divinité sont amplement traictez, Lyon, 1609, in-8, 552 pp. BN R. 51176 and D.65287. BM 719.d.12. Cornell S561.

¹² Vincentius Pons, *De potentia et scientia daemonum*, Aquis Sextiis, 1612, 160 small pp. with only 21 lines of large type per page. BN D.81469 (2).

¹³ *Ibid.*, pp. 106-7.

canon of Viviers and local historian.¹⁴ He describes the haired comet of 1618, and a rain of black worms in 1622, but the pest is the *leitmotiv* of his work.¹⁵ He attributes its spread into his vicinity to Huguenots from Geneva who brought secretly a bedeviled unguent to Lyons and smeared the door-knockers of houses and the holy water basins in churches with it. Viviers was spared from its ravages, but Jacques was continually haunted by the fear of it, and gave most circumstantial details as to its progress, and a collection of remedies against it, including ones from Italy, Jerusalem, and that employed by the king of Spain. Religious measures were also taken against it, such as processions and prayers to the saints and Virgin.

An amusing instance of exorcizing is recorded, in the opening year of the century, in the procès-verbal of a curé named Grosbal. It began on April 6, 1601, and was not yet completed on September 15. The demon was successively adjured by another curé, Jean Mason of Ecuelles, and by friars from Limoges and Savoy. Finally, on September 10, he was questioned in Spanish by a pilgrim from Spain, in Gaelic by two pilgrims from Scotland, and on September 13, in Breton by a pilgrim from Evreux and a curé from Châtenoy. But the demon did not seem to understand any of these languages.¹⁶

The widespread existence in the diocese of Coutances of the notion that everything said by a demon, when exorcized, was as reliable and true as if it came from the mouth of God, led brother Sanson Birette to write a refutation of it¹⁷ and to cite an opinion of the Sorbonne, pronounced at Paris on July 19, 1615, that demons, when exorcized, often spoke falsely. This does not mean that he did not ascribe great powers to the devil to injure and to deceive by magical illusions.¹⁸ He opposed interpreting the *Canon episcopi* to mean that all sorcery and witchcraft was a mere illusion.¹⁹

¹⁴ Printed by Aug. Le Sourd, *Revue de Vivarais* (1917), xv, 94 pp.

¹⁵ According to Henri Courteault, *BEC* 78 (1917), 359-61.

¹⁶ Marcel Fosseyeux, in *Bulletin de la Société française d'histoire de la médecine*, XXXIII (1939), 29.

¹⁷ *Réfutation de l'erreur du vulgaire touchant les réponses des diables exor-*

cisez, par frère Sanson Birette, Rouen, J. Besogne, 1618, 319 pp. BN D. 65126. The BN has two other copies. Also BM 719.a.28 (1.). Dedicated to the bishop of Coutances.

¹⁸ *Ibid.*, caps. xi, xii; pp. 254- and 274-.

¹⁹ *Ibid.*, p. 289.

In treating of books by exorcists and collections of exorcisms in the closing sixteenth century in our sixth volume, three of the early seventeenth century were also described: an *Antidotarium* against Demons by Porri of 1601, a *Thesaurus Exorcismorum* of 1608, and the *Hammer of Demons* by Albertinus in 1620.²⁰

The literature of exorcisms may be further illustrated by a volume which was put forth in 1618 at Perugia by C. Olivieri, a citizen of Gubbio, Augustinian, canon of the Lateran, and exorcist, with the usual ecclesiastical *Imprimatur*s.²¹ First comes an introductory treatise in twelve chapters on points which the exorcist should note before he enters upon his holy office. Chapter four distinguishes between correct and sinful modes of approach in dealing with demons. In chapter seven, among signs which appear when the priest conjures the possessed, is that some feel a very cold wind through their shoulders and kidneys. The twelfth chapter is on applying remedies against *incubi* and *succubi*. The *Baculus* proper consists of some twenty-five conjurations, followed by exorcisms of hail, water and so forth, and various benedictions. The twenty-fifth conjuration is against demons who impede matrimony, while in the seventh, against obstinate demons, we are told that the exorcist should have three figures of demons with the name of each and three black candles and three stones. When he utters the words, "Maledico, Anathematizo," he should with fury cast one image of a demon with one candle and one stone to the ground, pierce it with a needle, trample on it, and when he says, "Pereant," burn it. "Et ter dicitur haec sententia."

The reverend father Claude Pithoys or Pythois, a Minime of the province of Champagne, in 1621 published a work on how to detect persons who fraudulently posed as possessed by demons, which was approved by theologians of Paris and the Minimes of

²⁰ T VI, 556-59. Other titles are: Jac. Gretser, *De benedictionibus et maledictionibus*, Ingolstadt, 1615; Pietro Locatelli, *Conjuraciones potentissimae et efficaces ad expellendas et fugandas aereas tempestates a daemonibus excitatas*, Piacenza, 1606, 53 pp., Turin, 1619, 72 pp., Brescia, 1628;

H. Nicuesa, *Exorcismarium*, Venice, 1639; Benito Remigio Noydens, *Practica de Exorcistas*, Madrid, 1666.

²¹ *Baculus daemonum*, Perugia, 1618, 563 pp. Copy used: BN E.4650. Index at pp. 551-63.

Champagne.²² He distinguished between insufficient signs of possession and surer indications of diabolical possession. In the former category were great changes in the ordinary disposition of the body, such as being restless and running to and fro, throwing a fit on entering certain places or meeting certain persons, raging against oneself or family or friends, blaspheming; making a great fuss about entering a church, taking holy water, making the sign of the cross, or saying one's prayers; inability to swallow bread and water which had been blessed without one's knowledge, strange visions and seeing the devil. Surer indications in Pithoys' opinion were speaking strange languages, discoursing concerning sciences above one's capacity, acquisition of knowledge without previous instruction, discovery of ruses to catch them that had been mixed in with the exorcisms, recognizing persons without having previously seen or heard of them, discovering secrets, performing unnatural corporal actions beyond human capacity, having a frightful appearance with rolling eyes; and if exorcisms, consecrated hosts, and other holy things produce more notable effects upon them than simulated and supposed sacred words and objects do.

Doctors of medicine and physiognomists of the better sort should examine the person supposed to be possessed. He should be subjected to a strict régime and Christian mortifications within reason, and not allowed to be commiserated with, petted, or given alms. He should be watched. In making invocations in Greek and Hebrew, profane words should be mixed in, to see if the "demon" detects them. Also, if he can tell consecrated from unconsecrated hosts. One should watch their eyes while supposedly possessed and see if they do not sometimes look at you naturally. Father Pithoys warns of the danger that, when exorcised, they may falsely accuse or diffame others. While exorcisms have some power, they do not rank with the sacraments.

There follows a complaint of the author to a friend with regard to his conference with the bishop of Toul concerning the so-called possessed woman of Nancy. When he refused to tell the bishop beforehand by just what particular methods he intended to liberate her from the demon, the bishop said: "Neither your knowledge nor

²² *La découverte des faux possédés, tendue possédée de Nancy, Châlons, avec la conférence touchant la pré-* 1621. BN. D.81469 (1).

your experience nor your revelations nor your magic have satisfied me. Leave, go away, get out." The bishop would not even give him a copy, as had been promised, of the procès-verbal drawn up by a notary. Eleven years later Pithoys became a Protestant.²³

At Jena in 1630 and 1635 were published two volumes containing each ten sermons in German by Johann Rudinger on illicit magic.²⁴ The first Decade asked the questions: who? what? where? by what aids? why? how? when? whether witches should be put to death by the magistracy, which was answered in the affirmative; whether the mischief wrought by them should be cured by their arts, which was answered in the negative; and whether magicians and witches could be saved, which required a distinction. The second decade considered ten varieties of illicit magic: namely, the immolation of children, *ariolatio*, observance of days, auguries, fascination, incantation, interrogation of pythonesses, superstitious announcements from the stars, consultation of the dead, and interpretation of dreams.

The Jesuit, Friedrich Spee, had often visited in prisons those who were accused of witchcraft, and for a time hardly knew what to make of it. He finally decided that there actually were some witches, but that there was no doubt that many innocent persons were punished. In consequence he addressed his *Cautio criminalis* to the princes and magistrates of Germany, questioning whether

²³ Some further titles on the subject of possession are: le Gauffre, *Récit véritable de ce qui s'est passé aux exorcismes de plusieurs Religieuses de la ville de Louviers*, Paris, 1643, in-8; Esprit de Boisroger, Capucin, *La piété affligée, ou Discours historique et théologique de la possession des Religieuses de Louviers*, Rouen, 1652, in-4; François Perrault, *Démonologie, ou Traité des démons et sorciers, de leur puissance et impuissance, ensemble l'anti-Démon de Mascon, ou Histoire véritable de ce qu'un Démon a fait et dit en la maison dudit sr. Perreaud à Mascon*, Geneva, 1653, in-8; Jean de Rhodes, médecin, *Lettre en forme de dissertation au sujet de la prétendue*

possession de Marie Volet, de la paroisse de Pouliac en Bresse, dans laquelle il est traité des causes naturelles de ses accidens et de sa guérison, Lyon, l'anti-Démon de Mascon, ou Histoire des diables de Loudun, ou de la possession des religieuses Ursulines, et de la condamnation et supplice d'Urbain Grandier, curé de la même ville, Amsterdam, 1693; 2nd ed., 1694. English translation, 1703.

²⁴ Joan. Rudingeri, *De magia illicita decas concionum. Zehen gründliche Predigten*, Jehna, 1630, in-4, 405 pp., BN R.8473. *Decas concionum secunda de magia illicita*, Jehna, 1635, in-4, 444 pp., BN R.8474.

they did well to proceed so vigorously against witches and pleading for dispassionate and rational action. The bulk of the book was directed against the use of torture, which he held responsible for the death of the innocent and for "filling our Germany with witches and unheard of crimes." If there were more witches in Germany than elsewhere, it was because of popular ignorance or superstition and ill will towards one's neighbors. There were four classes of persons who urged on the magistracy against witches. First, there were theologians and prelates who speculated at their ease and knew nothing of the squalor of prisons, the weight of shackles, the instruments of torture, and the lamentations of the poor. They included saintly and religious men who were unskilled in affairs and unacquainted with human wickedness. Second, there were lawyers, especially those who noticed how lucrative this department of criminal law could be. Third, was the ignorant and generally envious and malicious populace. Fourth, were those who were witches themselves and wished to avoid suspicion by accusing others. Spee urged that the accused should be allowed counsel and time to plan his defense, rather than be hurried at once to the torture chamber. If he died without having confessed to the crime, his death should be considered natural, unless there was positive evidence to show that he had been strangled by the demon. As for the stigmata or marks of witches, Spee had not yet seen them and would not accept them until he had seen them. He also discussed such questions as how far to believe the denunciations of accomplices, and whether the demon could represent innocent persons as dancing with the others at witches' sabbats. The answer in this latter case was, Yes.

This work by Spee first appeared anonymously at Rinteln in 1631,²⁵ the next year at Frankfurt,²⁶ and in later Latin editions and French²⁷ and German translations.²⁸

²⁵ *Cautio criminalis seu de processibus contra sagas liber ad magistratus Germaniae* . . . , Rintellii, 1631. BM 8632.aaa.57.

²⁶ Copies are: BM 719.b.23; BN F.44677. Kittredge, p. 590, note 125, is inaccurate in calling the edition of

1695 (BM 8631.a.2) the second.

²⁷ *Advis aux criminalistes sur les abus qui se glissent dans les procès de sorcellerie*, Lyon, 1660, in-8. BN E. 7446.

²⁸ Contained in Johann Reichen, *Unterschiedliche Schriften von Unfug*

A work of the other side of the fence was Johann Hofmann's *Defense of Princes* in which he argued for the retention of the death penalty for witches.²⁹

Augustinus Oregius (1577–1635), canon of the Vatican, consultant of the Holy Inquisition, theologian and private secretary of Urban VIII, who in 1634 named him cardinal, in discussing the knowledge possessed by angels (and demons) in his treatise of 1632, held that they did not know corporal things through natural phenomena, since they had no physical senses, but that God from the beginning had implanted concreated species in the angelic intellect by which they know the natures of things. One angel did not foreknow the free acts of another or even the inner thoughts of the human heart, because God willed that free agents should not be impeded by any created agent. Angels can assume bodies in order to speak to men, but another angel would not understand what they say because he has no ears or hearing. Their own locution is immaterial.³⁰

Pietro Piperno was a physician of Benevento whose works were printed at Naples. In 1624 he had published a medical volume which emphasized the importance of air,³¹ its six sections dealing with knowledge of air in general and of that of Benevento, regimen of the air of Benevento, some antidotes, alteration of the air, an annual regimen, swimming in general and concerning the streams of Benevento in particular. In 1634 he dedicated to cardinal

des Hexenprocesses, 1703: Col 156.4 R27.

²⁹ *Apologia principum in qua processus in causa sagarum continetur et malefactorum argumenta refutantur*, Erfurt, 1636, in-4. 2 copies in BN.

³⁰ *Tractatus tertius de angelis*, Rome, 1632, in-4, 216 pp. BN D.9075 (1). Some other seventeenth century works on angels are: Agostino Superbi, *Idea angelica*, Ferrara, 1601; Jean Maldonat, *Traicté des anges et démons*, Paris, 1605; Groscurdten, *Angelus Apocalypticus, Schola enthusiastica, et scriptura coeli*, Brunswick, 1622; C. Stengel, *S. Michael, Gabriel et Rapha-*

el archangeli, Augsburg, 1622, in-12; Thomas Heywood, *The Hierarchie of the blessed Angells* . . . , London, 1635; Steph. Klotz, *Angelolatria*, Rostock, 1636; Jo. Bayer, *An angelorum existentia e solo lumine naturali possit demonstrari?*, Wittenberg, 1638; Cl. le Petit, *De spiritibus creatis, angelis, daemonibus et anima*, Paris, 1641; J. T. Major, *De natura et cultu angelorum*, Jena, 1653, in-4; Theoph. Spizelius, *De vaticiniis quibusdam angelicis*, Augsburg, 1667, in-8.

³¹ *Medicae Petrae . . . divisae in duobus trinis*, Neapoli, 1624, in-8: copy used. BM 1170.f.2(2.).

Agostino Oregio, whom we have just mentioned, a small volume on magic affections or diseases.³² The dedication to the Cardinal is followed by another to the three kings or Magi.

In a prelude concerning demons Piperno says that the existence of angels cannot be known for a certainty by any natural means. Demons, too, are knowable *a priori* only through divine revelation and scripture. But *a posteriori* their existence may be inferred from the effects which they produce,—a position similar to that of Nifo a century earlier. For we see many cases of persons who are naturally ignorant and rude of speech, but who, when they are afflicted by demons, often predict hidden and secret matters or speak in unknown tongues. Piperno accepts the usual orthodox view that demons cannot force human free will, although he notes that some hold that it can be overcome by the stars and images and tyrants as well as by God and demons.

In the first book of the text proper Piperno affirms the existence

³² The British Museum catalogue of printed books lists two editions of Piperno's work. The first is: *De magicis affectibus; horum dignotione, praenotione, curatione medica, stratagemmatica, divina plurisque (sic) curationibus electis et de nuce Beneventana maga, etc.*, 2 pts., Neapoli, 1634, 1635, in-4; shelf-mark, 663.e.6. The other is: *De effectibus (sic) magicis libri sex. Ac de nuce maga Beneventana liber unicus*, Neapoli, 1647, in-4. 2 pts.; shelf-mark, 1141.c.10. The Museum also has: *Della superstittiosa noce di Benevento trattato historico... seconda impressione... emendata*, G. Caffari, Napoli, 1640, 109 pp., in-8; shelf-mark, G.19115. From these data and what follows I infer that *De magicis affectibus* in five books was first printed in 1634, and that bound with it was a supplementary tract on the magic nut-tree of Benevento first printed in Latin in 1635. This tract was published in Italian in a revised and perhaps enlarged form in 1640. Then in 1647 *De magicis affectibus*

was again issued in Latin with an additional sixth book and the nut-tree tract.

I have used an edition in the Columbia University Library (B156.4 P66) which seems a sort of hybrid. The title page is missing; the date 1634 is written in hand on the front cover and first fly leaf; and the volume contains the dedication to the cardinal dated 1634 and opening, "*De magicis affectibus libellum tuo nomine...*" There are only five books and 168 pages, and no tract on the magic nut-tree. But there is a preceding table of contents which would seem to apply rather to the edition of 1647. Pagination for its topics extends only to page 161, but the seven succeeding topics apply to the closing pages of Book V from 162 to 168. Then there is about a column more of the table, beginning "*De mag. capitis dolore L. VI,*" which would seem to mark the opening of the sixth book, and concluding with items concerning the magic nut-tree of Benevento.

of *magi* and of diseases produced by magic. Their division, causes, symptoms and forecasting are discussed. In considering who are most disposed to being thus affected by witchcraft, he suggests the possibility of the stars reducing one's resistance. In the second book on the cure of such magic diseases, Piperno says that he has found no previous author who has considered this from a medical standpoint. He then discusses how to recognize and avoid superstitious remedies, whether it is permitted to seek a remedy from witches, whether weapon ointment is natural and licit—which he decides in the negative, and whether, when the witch dies, the demon ceases to operate the witchcraft. The third book is devoted to natural remedies; the fourth, to the power of imagination, how to cure false imagination by stratagems and fooling the patient, and how to deal with those who feign illness. For example, a merchant who grew melancholy over losses at gambling finally became convinced that he was bewitched. Piperno humored him in this delusion, gave him vomitory medicine, concealing in the vessel a lump which he had made up of hairs, thread, and tar, and then producing it with feigned exclamations of wonder from the by-standers. Whereupon the merchant, thinking that the magical cause of his ailment had been removed, recovered from his illusion.³³

The fifth and last book on divine cures includes amulets as well as exorcisms. We are told that Holy Mother Church in her mercy, to expel demons and their diseases, has found both for preservation and for cure sacred amulets or writing of prayers and divine names, and suspension of holy things about the neck.³⁴

Piperno's book is not as unified as its general plan might suggest, since he is given to digression and side issues. Judging from the table of contents, the sixth book, which was added in 1647, was even more miscellaneous. Like so many other works of its kind, Piperno's is little more than a mass of citations and quotations, a disorderly patch-work pieced together from the past literature of the subject—Grillando, Menghi, Codronchi, Godelmann, and even such extremes as Aquinas and Pomponazzi, while the quotation of Solomon, "O Arctic Manes, O Antarctic, why does the nobility of

³³ *Op. cit.*, pp. 127-28.

³⁴ Cap. 12, De amuleto, p. 143.

so great nature seem to be confined in mineral specific?" is probably taken from Cecco d'Ascoli.³⁵

Dissertations of 1642 on the return and apparition of souls of the dead by Louis Beccasse und his pupil, Guillaume Colombel of Rouen, were once preserved in manuscript at Lyons.³⁶

The attitude of the Inquisition towards magic is indicated in the treatise of Caesar Carena of Cremona, himself an inquisitor, on the Office of the Holy Inquisition, a book first published in 1641 at Cremona and which I have consulted in the Lyons, 1669 edition.³⁷ As to the question whether magic is heretical, Carena takes the position that use of the host, Psalter and the like makes it heretical, while, without these or an express pact with the devil, love charms are not heretical. He contends that use even of an unconsecrated host in *sortilegium*—a word which he employs in the sense of sorcery or magic rather than mere lot-casting—is heretical, although some writers do not agree. But the use of names, characters and unfamiliar signs, and even the invocation of demons, is not necessarily heretical. It may or may not be.³⁸

Indications that persons are *sortilegi* are: if magic instruments or books are found on them, if the name of the devil is often on their lips, if they have a distorted countenance, or other stigmata of the devil—he does not specify what they are, but cites other authors, including Bodin, for such marks of witches. Further suspicious circumstances are: if the suspect is the child of a witch or wizard, if he or she engages in singular acts of religion, if he or she leads a vagabond life, and if he or she has anything to gain by it.³⁹

As for the corpse bleeding in the presence of the murderer, its not bleeding may not be taken as a proof of innocence of those present, and the blood flowing justifies resort to torture, only if it

³⁵ *Op. cit.*, pp. 33-34. See the Commentary of Cecco in my *The Sphere of Sacrobosco and its Commentators*, 1949, p. 397.

³⁶ Lyon 216 and 217: Ant.-Fr. Delandine, *Manuscripts de la bibliothèque de Lyon*, I (1812), 226. The *Cat. gén. des mss. des bibl. publiques de France*, XXX (1900), 66, says of 216-217, "Ce

manuscrit manque aujourd'hui."

³⁷ Between these dates it had appeared in 1649 at Lyons; 1655, Cremona; and 1668, Bologna.

³⁸ *Caesaris Carenæ . . . de officio sanctissimæ Inquisitionis . . .*, Lyons, 1669, pp. 173-77.

³⁹ *Ibid.*, pp. 189-190a.

does so in a quite preternatural manner and if there are other urgent indications.⁴⁰

In notes on the *Praxis inquisitorum* of Franciscus Pegna, which is also included in the edition of 1669, as to the mode of procedure in cases of *sortilegium* and witchcraft, Carena complains that in Spain innocent persons have often been condemned, and that judges proceed to torture, although they are not sure about the *corpus delicti*. He advises seeking a medical opinion, argues that the testimony of demons (obtained via exorcists) should not be accepted, and utters other cautions as to resort to torture.⁴¹

Thomas Hobbes in 1651 argued in *Leviathan* that there was no such thing as incorporeal substance and that it was not found in the Bible. Spirit in common parlance meant a subtle, fluid and invisible body, or a specter which is a mere phantasm or disturbance of the brain. There was no mention of incorporeal substances in the Hebrew scriptures; all that doctrine originated from the Greek philosophers. Nor was there any passage in the New Testament from which it could be proved that angels were permanent and at the same time incorporeal. Its references to the punishment of fallen angels showed that they were corporeal. When Christ said (*Luke* 24, 39) that a spirit does not have flesh and bones, he did not deny them some sort of body, nor when he ordered the demon to leave the man. His being placed on a high mountain by the devil was in a vision, and Paul was rapt to the third heaven "not in the body but in spirit" (*non in corpore sed in spiritu*), which might seem to disprove Hobbes' own contention. The belief in demons arose from misapprehension of images produced by reflection and refraction.⁴²

Hobbes also denied the possibility of magic. When a rod seemed to be a snake, or water to be blood, or any other miracle appeared to be performed through incantations,

unless it be done for the edification of the people of God, neither rod nor water nor anything except the spectator is enchanted. And the whole miracle of the enchanter consists in this, that an impostor deceives man, which is not a miracle.⁴³

⁴⁰ *Ibid.*, pp. 190b-192a, 191b(193).

⁴¹ *Ibid.*, pp. 487-89, 493, 498.

⁴² *Opera*, III (1841), 281, 285, 289, 477-78, 475.

⁴³ *Ibid.*, III, 317.

If this superstitious fear of spirits were taken away, and with it prognostics from dreams, false prophecies, and many other things depending thereon, by which crafty and ambitious persons abuse the simple people, men would be much more fitted than they are for civil obedience. And this ought to be the work of the schools; but they rather nourish such doctrine.⁴⁴

Thomas Ady issued his *A Candle in the Dark; or a treatise concerning the nature of witches and witchcraft* in 1656,⁴⁵ because he felt that the good effect produced upon the minds of magistrates and clergy by Reginald Scot's *The Discoverie of Witchcraft* (1584) had disappeared, and "since that time England hath shamefully fallen from the truth which they began to receive." "Bodinus, Hyperius, Hemingius and other Popish bloud-suckers . . . having defiled the world with their abominable inventions,"⁴⁶ some English writers have followed suit, such as James, bishop of Winton, or James I, Thomas Cooper,⁴⁷ Perkins,⁴⁸ Gaule⁴⁹ and Giffard.⁵⁰ Ady contended that there was no scriptural basis for the present ideas about witches. Under the caption of "A dilemma that cannot be answered by Witchmongers," he asks, Where in the Bible is it stated that witches are murderers? or have distinguishing marks? or form pacts with the devil?⁵¹ And so on. He blames Roman Catholics in general and the pope in particular for the present conception of witchcraft.⁵² Indeed, "the popish religion . . . is altogether upheld by witchcraft" and Mahomet was "another great witch."⁵³

⁴⁴ Quoted by Henry Hallam, *Introduction to the Literature of Europe during the Fifteenth, Sixteenth and Seventeenth Centuries*, II (1847), 106, from *Leviathan*, I, 2, Works, III (1839), 10.

⁴⁵ London, 1656, in-4, 172 pp. BM E.869.(5.). I have used this edition and also that of London, 1661, 172 pp., *A Perfect Discovery of Witches*, BM 8630.f.39.

⁴⁶ Ed. 1656, p. 139; *Ibid.*, 151, 162, 163 and 166 for the following mentions of the works of Cooper, Perkins, Gaule and Giffard.

⁴⁷ Thomas Cooper, *The Mystery of Witchcraft*, 1617.

⁴⁸ William Perkins, *A Discourse of the Damned Art of Witchcraft*, 1608.

⁴⁹ John Gaule, *Select Cases of Conscience Touching Witches and Witchcrafts*, 1646.

⁵⁰ George Giffard, *A Dialogue concerning Witches and Witchcraftes*, 1603.

⁵¹ Ed. of 1656, pp. 6-8.

⁵² His second book is devoted to this.

⁵³ Ed. of 1661, pp. 42-44.

Ady further holds that judicial astrology, "if not abused," is not condemned in the Bible. Indeed, the Bible affirms the influence of the stars. If the star of Bethlehem was a miracle, how could the three Magi tell its significance? The *planetarius* condemned in Deuteronomy 18, 10-11 deified and worshipped the planets.⁵⁴ On the other hand, Ady is sceptical as to the corpse bleeding in the presence of the murderer.⁵⁵ *Praestigium* he defines as a combination of sleight-of-hand, use of confederates, and abuse of natural magic. The feats of Simon Magus were cheating impostures, and Ady explains a number of current magic tricks.⁵⁶

The frequent reporting in the seventeenth century of instances of the voiding from the human body of strange or sharp or solid substances and its acceptance as evidence of magic and witchcraft, because it was hard to see how such things could enter the body otherwise, received further confirmation and illustration from the medical practice of Timaeus von Gueldenkle.

A potter of Tempelburg suffered from perpetual indigestion, stomach-ache, and nausea which reduced him to a state of utter exhaustion. After administration of a clyster and a powder of spices with rhubarb, he excreted four beetles similar to those found in horse manure and called *solares* or *Rosskässer*. He began to feel better and his swollen abdomen partly subsided. But he still felt some pain, so that Timaeus decided to take further steps to kill and expel "these monsters." A worm-killing wine, of which Timaeus lists the ingredients, taken morning and evening, resulted in daily evacuation of two or three more "of those worms, some dead, some so weak that they couldn't move." Finally, pills were given which educated seven more beetles, but all dead. Timaeus told the patient to continue taking the medicated wine for a while, with the pills on alternate days, with the result that he was in the best of health at the time of writing.⁵⁷

In 1625 a learned licentiate of laws returned from travel in France

⁵⁴ Ed. of 1661, pp. 21-22. The word, *planetarius*, does not occur at this point in the Vulgate, nor do I see any equivalent for it in the King James version. See *supra*, Chapter 35, note 67.

⁵⁵ *Ibid.*, 131.

⁵⁶ *Ibid.*, 29, 31.

⁵⁷ Balthazar Timaeus von Gueldenkle, *Casus medicinalis praxi 36 annorum observati*, Lipsiae, 1662, in-4, 434 pp., BM 1165.h.7 (3.), pp. 120b-121b.

and Holland suffering from quartan fever and a noticeable tumor of the left hypochondrium with sharp pains. This went on for three years, until an old-wife, who swore that she would employ only natural means, gave him a hot decoction of herbs morning and evening. After two or three doses he vomited first a great quantity of vicious humors, next black and coagulated blood, then a substance like gypsum and with it fifteen pebbles of varied colors, needles wrapped in moss, and a fragment of a scribe's knife with a piece of the ivory hilt. The tumor went down and he was soon all well again.⁵⁸

In 1653 the daughter of a noble had acute pains in the lower abdomen, which became inflated and distended so that a rupture was feared. This was accompanied by groaning of the guts, nausea, belching, difficulty in breathing, and palpitation of the heart. An enema, clyster and cathartics did no permanent good. Without Timaeus's knowledge, an empiric gave her three pills—of *laudanum opiatum*, he said. She slept; on awaking demanded an emetic; and vomited forth all sorts of objects such as fishhooks bound with a skein of red twine.⁵⁹

In 1655 a student of theology suspected that a girl had given him a philter, as he awoke with a stomach-ache and cholera. After that he contracted various diseases and became melancholy and given to solitude, whereas he had previously been hilarious and facetious and fond of conversation and society. Timaeus's bezoardic water gave only temporary relief. Finally he fell into a swoon, had lockjaw, and seemed about to suffocate, when he began to vomit fetid humors and absurd objects—hairs, bits of wood, pig's bristles and rough pieces of iron. This went on for eight days, and in the opinion of Timaeus such objects must have come from the devil.⁶⁰

In 1634 Timaeus's servants had a lawsuit with an old woman suspected of being a witch. A little later his seven-year old daughter had horrible dreams, especially of being chased by a huge spider, so that she often cried out in the night. But no spider could be found. The dreams continued for a whole semester, until the witch was convicted und burned at the stake. Then she seemed

⁵⁸ *Ibid.*, pp. 328b-329a.

⁶⁰ *Ibid.*, p. 332.

⁵⁹ *Ibid.*, pp. 330-31.

to recover, but her joints were so contorted by witchcraft that she could not grasp objects firmly with her hands or walk freely. But to this day she is safe and unharmed by God's aid and is the solace of Timaeus's old age, and he prays that she may remain immune from all ambushes of the devil and his servants.⁶¹

In 1629 a soldier suddenly lost his sight, although there had been nothing the matter with his head or eyes before. Timaeus questioned him but could find no explanation and inspected his eyes which seemed normal. All sorts of treatments were tried in vain. Finally, without the knowledge of Timaeus, an old witch moistened her finger with saliva, touched his eyelashes and eyes with it, and muttered some words, whereupon he recovered his sight "suddenly and as it were in a moment." But Timaeus quotes Leo and Chrysostom against using diabolical aid.⁶²

The recovery of his wife, however, he ascribed to divine aid. Between eight and nine o'clock on the morning of October 27, 1656, she showed symptoms of pleurisy and he bled her for about seven ounces. But she spit out his antipleuritic concoction, likewise an emulsion of melon seeds, water of scabiosa and other ingredients, and all antipleuritic powders and syrups. When she grew worse, in consternation he tried a medicament of very pleasant taste, among whose ingredients were flowers of wild poppy, violets and ivy, but after taking one or two sips she rejected it too. Then he tried all sorts of external applications. From the third to the fourteenth day she could not sleep but at times was delirious and saw images of terrible things. He gave emulsions of poppy seeds, sleeping waters, electuaries, tinctures and other choice hypnotics, but without success. Because of retention of the spittle, he disliked to risk *laudanum opiatum* but at last put two grains in her nostrils, and she fell into a deep sleep for two days. The pains of the side and other symptoms declined, except for a dry cough with scanty and thin saliva especially towards night, fever, thirst and distaste for any food. On the critical days, twentieth, twenty-seventh and thirty-fourth she seemed worse, and on the fortieth day there were various alarming symptoms. But she gradually recovered.⁶³

⁶¹ *Ibid.*, pp. 329a-330a.

⁶² *Ibid.*, pp. 93a-94b.

⁶³ *Ibid.*, pp. 61b-62a.

Josua Arndius (1626–1686) was a Protestant theologian who was born and died at Güstrow in Mecklenburg, where too in 1664 appeared his treatise on superstition.⁶⁴ It was for the use of pastors and considered superstition only as it pertained to or led to magic.⁶⁵ He saw superstition in the *ars notoria*, amulets, the bleeding corpse doctrine, and canonical purgations with cold water and like ceremonial.⁶⁶ Especially to be guarded against were: 1) incantations to stay the flow of blood in men or horses or cows; 2) the checking by old-wives of other diseases in the feet, eyes and so forth; 3) transfer of disease by means of wax images; 4) so-called transplanations of diseases into the hollows of trees; 5) the supposititious and blasphemous books of magic ascribed to Solomon; 6) plucking the herb of St. John the Baptist shortly before sunrise; 7) wearing the Gospels suspended from the neck; 8) waving a sword against a ghost; and 9) applying molten lead against witchcraft.⁶⁷

Such superstitions found support from astrologers and excessive defenders of occult qualities. Astrology is the key to magic, and Coelius Rhodiginus is quoted that the vanities of all superstitions have flowed from the bosom of astrology.⁶⁸ But "the marvelous efficacy of occult qualities is readily discerned by pious and learned prudence."⁶⁹ It is only unwarranted appeal to them that Arndius censures, and he admits critical days and climacterics in medicine.⁷⁰ But demons are neither affected by corporeal and natural things nor subject to the celestial bodies.⁷¹ As a Protestant Arndius regards ecclesiastical vestments, the doctrine of purgatory, the canonization of saints and use of holy water as all relics of paganism.⁷² His two closing chapters are devoted to the sinfulness of such practices and how they are to be avoided and punished.⁷³

⁶⁴ *Tractatus practicus de superstitione quatenus vulgo vanam exercet observantiam vel alias deducit in magiam in usum pastorum . . .*, Güstrovii, 1664, in-8, 141 pp. BM 1020.i.15.(1.).

⁶⁵ *Ibid.*, p. 7.

⁶⁶ *Ibid.*, p. 24.

⁶⁷ *Ibid.*, p. 33.

⁶⁸ *Ibid.*, pp. 36, 38.

⁶⁹ *Ibid.*, pp. 47-48.

⁷⁰ *Ibid.*, p. 54.

⁷¹ *Ibid.*, p. 37.

⁷² *Ibid.*, pp. 70-71, 76, 78. At p. 80 he quotes Pliny on magic; at 85, Theophrastus on superstition; and at 87, Isaac Casaubon.

⁷³ *Ibid.*, p. 104, cap. 4, "Quid et in quo et quantum peccet? Ubi et legum divinarum verba adducuntur et expendantur;" 121, cap. 5, "Quomodo sit cavenda. Quare quibusve modis ac mediis fugienda. Quam severe . . . puniendi."

Johann Ernst Pfuel, physician to the Elector of Brandenburg, distinguished four varieties of magic: divine, diabolical, vulgar and natural.⁷⁴

Theodor Thumm, doctor of theology and professor at Tübingen, accepted the existence of witches but tried to show that their power of harming was slight and that they were punished too severely.⁷⁵ His position was based partly on his own experience, partly on the statements of others, including the confessions of the accused. He also held that their sins might be remitted. Inquiring whether they were actually transported through the air or merely dreamed it, he replied that either opinion could be defended. But the devil could not have sexual intercourse with them and beget offspring; they could not kill by words or by consuming a wax image of the intended victim before the fire or puncturing it with a needle. Neither they nor the devil could raise storms, but the devil could foresee storms and so make the witches seem to raise them. Nor could men be transformed into beasts. Asking how the hard and solid bodies which are vomited by the sick could have got into the body, Thumm denies that the devil can open and close the pores, which only sweat and vapors can penetrate.

To the question why God permits men to be injured by witchcraft, Thumm responds that he does it for his own sake, for the benefit of men, for the sins of men, on Satan's account—to show his malice and that he can go only so far as God permits, and for the witches' sake. Thumm might have added that it was for his sake as an author and for the entertainment of his readers.

Coming to preventive measures against being bewitched, Thumm classifies as superstitious and ineffective both papal ones such as the sign of the cross and holy water, and popular ones, such as cock-crow, washing the hands in the morning, spitting thrice on such of one's hairs as have been combed out, smashing eggshells thrice with a knife—lest witches employ them against one. True and efficacious measures are faith, prayer, a holy and upright life,

⁷⁴ *Tract. de magia*, Berlin, 1665: not in BM and BN printed catalogues.

⁷⁵ *Tractatus theologicus de sagarum impietate, nocendi imbecillitate, et poenae gravitate, partim ex privata*

experientia, partim veris historiis et relationibus aliorum, Tübingen, 1666, in-4. I have used the second edition of 1667: BM 719.g.17.

attending to one's business, and keeping away from witches. But Thumm does not approve of borrowing or stealing some article from the house of the suspected witch, putting brooms on one's threshold, using threats or force to make the witch relieve one or begging her to do so.

Thumm rejects most of the supposed marks of witches. From various cases which he has examined he concludes that "witches" are of three sorts. First, melancholics who have merely been so fascinated and deceived by the devil that they think they have contracted friendship with him and done this or that, which is all purely imaginary. Secondly, those who have been deceived by the devil into making a pact with him but have done no actual harm. Third, those who have knowingly made an express pact with the devil and by his aid have gravely injured those whom they would not dare to attack openly. Thumm would try to reform the first two kinds and, if they remained obstinate in their delusions, banish them rather than execute them. The third variety should be put to death but not by fire.

Possibly such a halfway book did as much or more to mitigate the rigors of the witchcraft delusion as more extreme volumes against it. Thumm gives the impression that he knows what he is talking about.

We come to a quite interesting book by an exorcist, Candido Brognolo, a Franciscan (*Ordine de' Minori Osservanti Riformati*).⁷⁶ His first volume contains four disputations on as many causes of bewitching, namely, God, the demon, the witches, and natural objects employed. Similarly in the second volume there are four disputations on as many ways of curing the bewitched, namely, diabolical, natural, moral and divine. Brognolo had published a *Manual of Exorcists* at Bergamo in 1651, which was reprinted at Lyons in 1658 and in 1702 at Venice, where the *Alexicacon* (Keeping off ills), with which we are here concerned, was published again in 1714.

One of Brognolo's chief aims was to separate and distinguish the functions of physician and exorcist. The physician should not usurp

⁷⁶ *Alexicacon, hoc est, opus de maleficiis ac morbis maleficis*, Venice,

1668, in-fol., 2 vols. of 285 and 379 double-columned pages.

the office of the exorcist, and the latter should not apply corporeal remedies but leave this to a qualified physician.⁷⁷ Yet he lists unguents against demons and witchcraft, and they include one "composed and tested by the author" and compounded of oils, fats, and tobacco.⁷⁸ He also gives exorcisms to destroy birds, worms and locusts that are devastating the crops.⁷⁹ He shows some signs of professional jealousy towards medical men, and also took it ill that some of them denied that there was any truth in witchcraft. Hippocrates denied that demons send disease and that sorcerers do more than deceive men. Physicians are guilty of atheism when they attribute all disease to nature and none to God.⁸⁰

Brognolo holds that natural entities cannot have any direct action on spirits or demons. Marbod, Thetel, Pliny and others err in attributing the power to expel demons to herbs, stones or compound medicines. Tobias's use of the heart of a fish occasions some difficulty, but Brognolo explains that the operation was really performed by the angel.⁸¹ He denies that cockcrow dissipates witches' Sabbats, for the virtue of the demon is greater than any natural virtue on earth.⁸² He will not grant that all things are animated,⁸³ but makes a sharp distinction between the natural and the spiritual. The most that he will allow is that natural remedies can at least mitigate bodily ills produced by witchcraft.⁸⁴ But sometimes the medical art cannot remove bewitchment brought on by natural causes,⁸⁵ either because it intervenes too late or the patient is too weak to retain the doses administered.⁸⁶ Moreover, there are limits to human science, and philosophers cannot reach a certain and infallible conclusion as to natural causes, effects, and principles.⁸⁷ In consequence, professors of magic, who seemed to penetrate the secrets of nature more subtly, attracted students away from the other philosophers.⁸⁸

Demons, on the other hand, have power over nature. They can impede the action of other agents indirectly by application of

⁷⁷ *Alexicacon*, I, 2-3; II, 240.

⁷⁸ *Ibid.*, II, 101.

⁷⁹ *Ibid.*, II, 357.

⁸⁰ *Ibid.*, I, 3, 158.

⁸¹ *Alexicacon*, II, 96 *et seq.*, 123.

⁸² *Ibid.*, II, 83.

⁸³ *Ibid.*, I, 242.

⁸⁴ *Ibid.*, II, 131.

⁸⁵ I.e., as utilized by the devil.

⁸⁶ *Ibid.*, II, 182.

⁸⁷ *Ibid.*, Prolog. 4.

⁸⁸ *Ibid.*, I, 168, ¶484.

natural causes, moving the air, or moving more quickly. They can cause bodily diseases which are curable by medicines and others which require exorcism.⁸⁹ And witches sometimes employ medicines marvelously prepared by demons which are superior to those compounded by human industry and ingenuity. To excite melancholy, they use simples hot in quality. The human memory is marvelous, but the diabolical is more so.⁹⁰ Many mixed objects are generated in the human body by force of nature, but larger ones by diabolic virtue.⁹¹ There are demons in earth as well as in air, fire and water—in woods, fields, deserts, caves, at crossroads, in houses, and underground.⁹² Although demons are entirely spiritual. Brognolo accepts both incubi and succubi. He has had many cases of confessors bringing their penitents to him in this connection.⁹³ The demon can affect the sight, hearing and other external senses. More than that, he can exist within the human body and affect the internal senses and thus produce hallucinations and infirmities.⁹⁴ And he won't remove a disease, unless the witch transfers it to another person or herself.⁹⁵ Persons who pose as saints by undergoing long periods of fasting are kept alive by the demon either by internal phlegmatic humor or subtle matter from the brain, or externally by drugs such as a Scythian herb or cocoa from the Indies.⁹⁶

But one reason why Brognolo ascribes so much power over nature to demons is that unaided human art and science are able to accomplish so much. What can't the demons do, when chemists perform such wonders as to render gold potable, "than which nothing is more useful for health, nourishment and prolongation of life?" Or multiplying gold by strewing a gold powder on some scrapings, or producing gold from non-gold?

For although this last chemical operation is denied by some, nevertheless they assert that there is no philosophical, or necessary, or even probable reason to show that it is impossible.

And Brognolo argues in favor of it for two more paragraphs.⁹⁷

⁸⁹ *Ibid.*, I, 77; II, 101.

⁹⁰ *Ibid.*, I, 63; II, 125, 182.

⁹¹ *Ibid.*, I, 276.

⁹² *Ibid.*, I, 130-31.

⁹³ *Ibid.*, I, 90, ¶ 279, 277.

⁹⁴ *Ibid.*, II, 170, 175, ¶ 536-38, 549-50.

⁹⁵ *Ibid.*, II, 4, ¶ 13.

⁹⁶ *Ibid.*, I, 89.

⁹⁷ *Ibid.*, I, 77, ¶ 239.

There are other human arts and beliefs than alchemy which may seem to border upon the occult, but which Brognolo declares are not superstitious. Such are the observance of critical days and climacteric years, the belief that the eighth month child dies and that the sixty-third year is especially perilous.⁹⁸ Natural astrology is licit, and even nativities and elections, if they are made only conjecturally. And so are physiognomy, chiromancy and metoposcopy, provided they are only natural. What is illicit is to pretend to predict with certainty what are really future contingents or emanate from free will or divine prescience.⁹⁹ It is proper to collect herbs before or after sunrise, if they are more virtuous then, or at noon on Midsummer Day, if one thinks them better when the sun is at the zenith, and does not believe that it is the feast of St. John which produces such effects. But divination in connection with that day is superstitious.¹⁰⁰ God grants marvelous healing power to certain men and families, such as a seventh son or the kings of France.¹⁰¹ The custom of wearing amulets is not to be scorned.¹⁰² Brognolo will not admit the existence of a good angelic magic as well as bad diabolical magic, although he recognizes that the argument for it is specious, but he does sanction human magic, natural and artificial, by making use of the influence of the stars, occult virtues, and sympathies and antipathies. It may be either divining or operative and is not superstitious.¹⁰³ Observance of dreams which have a natural cause is also not superstitious.¹⁰⁴

On the other hand, the notory art and the Pauline art are from the devil. Brognolo rejects the Cabala for various reasons, but chiefly because it is full of trumpery and nonsense. Of fascination there are two varieties: one physical, exemplified by the basilisk; the other, diabolical. Weapon ointment is superstitious. Some say that the corpse bleeding in the presence of the murderer is due to natural antipathy; others ascribe it to a secret judgment of God. It is not advisable to have recourse to torture on the basis of it, for if it is a natural process, the demon might interfere in it.¹⁰⁵

⁹⁸ *Ibid.*, II, 68-69.

⁹⁹ *Ibid.*, I, 213-14.

¹⁰⁰ *Ibid.*, I, 66.

¹⁰¹ *Ibid.*, II, 74, ¶ 256.

¹⁰² *Ibid.*, II, 313.

¹⁰³ *Ibid.*, I, 9-10, ¶ 27-31.

¹⁰⁴ *Ibid.*, I, 209, ¶ 608.

¹⁰⁵ *Ibid.*, I, 218; II, 266; I, 253; II, 80; II, 77.

A distinction is made between astronomical and necromantic images,¹⁰⁶ and the former are discussed at some length. Cajetan defends their use against particular diseases. For figure *per se* can contribute to action, as is evident in instruments and machines, in which figuration aids nature. Moreover, the conformity of such a figure to a star can help in receiving its influence. But Aquinas says that artificial form cannot receive the virtue of action from the artificer, because it proceeds only from an idea or mental conception which is not active. The celestial figure engraved on the image is a human device and so has no occult influence. Even if the stars exerted some influence on such images, it is incredible that it could be so impressed as to last forever. Brognolo holds that such images are prohibited by the bulls of Sixtus V and Urban VIII against judicial astrology. And that, even if by application of certain seeds under certain constellations a result could be obtained much more quickly than ordinarily, still the whole process is so difficult that those who operate it are often suspected of diabolical cooperation.¹⁰⁷

A number of superstitious practices are recounted by Brognolo. To drive away a disease, one faces east before sunrise with arms outspread to form a cross and says, "Today is that on which the Lord God went to the cross," etc. and recites certain prayers. A ceremony against poison is, when the messenger or patient arrives, to place your right foot over his left foot and give him a cup of water or wine, at the same time reciting a specified prayer. To preserve the hooves of a horse whose shoes have come off on a journey, cross your fingers on its hoof and repeat certain words. To make a horse go, take out a nail and kneeling drive it into the earth while reciting a Paternoster. At the words, "in earth," strike the earth with a hammer or rock, adding certain words and ceremonies.¹⁰⁸ Brognolo also disapproves, in treating a patient, of slight movements which can have no natural effect.¹⁰⁹

Brognolo's natural science is neither advanced nor impressive. He retains the Aristotelian doctrine of comets, and explains that as dry and hot exhalations they may naturally affect kings and great men who eat an abundance of hot and dry foods and spices more

¹⁰⁶ *Ibid.*, I, 275.

¹⁰⁷ *Ibid.*, II, 84-85, ¶ 295, 298-99.

¹⁰⁸ *Ibid.*, II, 63, ¶ 218.

¹⁰⁹ *Idem*, ¶ 217.

than other men. But one must also remember that God often sends prodigies and portents of coming punishments.¹¹⁰ At least since the year 1379, swarms of four-winged ants fly annually from June 24, the feast of St. John, to August 29, the anniversary of his beheading, and enter the church of S. Giovanni delle Formiche near his natal place. Some of them die around the altar but they do not interfere with the celebration of the mass and never enter the house of the monks. This phenomenon is neither natural nor diabolical and so must be divine. There follows a long comparison of ants to John the Baptist.¹¹¹ Brognolo is on firmer ground, when he rejects Menghi's theory that the demon conducts the phantasy of witches to Sabbats, while their bodies remain behind inert, on the ground that the phantasy cannot be separated from the body. Either they are transported entire or merely imagine it.¹¹²

Brognolo sets some limits to exorcizing and to the power of demons. In general he is opposed to the practice of the exorcists' questioning the demon in a possessed person.¹¹³ Nor may the exorcist employ superior demons to expel inferior imps.¹¹⁴ He holds that Samuel and not a demon appeared before the witch of Endor, for the demon cannot prophesy.¹¹⁵ The stigmata of the devil on the bodies of witches cannot eradicate the indelible sacraments.¹¹⁶ But the triple name of the demon indicates his authority over Gentiles, Jews and Christians.¹¹⁷ Of signs of witchcraft and possession by demons Brognolo enumerates a multitude, marking with a cross those which are sure signs. In all there are six from the intellect, two from the will. From the internal senses there are two for the estimative, six for the imaginative, and two for memory. For the exterior senses, eight from sight, five from hearing, nine from taste, ten from speech, two from smell, and two from touch. There are seven from the nutritive powers, two from the augmentative, and five from the generative. From the disposition of the body there are twenty-eight, and eight more in the case of infants.¹¹⁸

All this may seem very fantastic to the modern reader, but for

¹¹⁰ *Ibid.*, II, 71, ¶ 244, 246.

¹¹¹ *Ibid.*, II, 78-79.

¹¹² *Ibid.*, I, 103-4, ¶ 315-22.

¹¹³ *Ibid.*, II, 175.

¹¹⁴ *Ibid.*, I, 125.

¹¹⁵ *Ibid.*, I, 111.

¹¹⁶ *Ibid.*, I, 182.

¹¹⁷ *Ibid.*, I, 167.

¹¹⁸ *Ibid.*, II, 192-98.

Brognolo and his contemporaries it was all too real. Indeed, Brognolo is quite a believer in experimental method. Man grows in practical science by experiments, but the demon even more so, because his experience is surer, more universal, longer, while man's is uncertain, particular and brief.¹¹⁹ And there are superstitious experiments to preserve health and escape ills.¹²⁰ As the students of medicine are learning new secrets of nature from experiments, the devil takes a hand in those practical experiments and, their avidity increasing to know the most occult mysteries, reveals himself more openly, until, pacts having been made openly and voluntarily, he has taught his arts, by means of which his new disciples work wonders in restoring the sick to health to the stupefaction of all. Afterwards, having become masters, they seduce others who are led on by curiosity to learn the same secrets.¹²¹

Brognolo tells stories and recounts cases from Delrio and Sprenger, the *Speculum historiale* of Vincent of Beauvais, Aeneas Sylvius, Binsfeld, Grillando and others, which we shall omit. But he also recounts his own experiences and experiments as an exorcist, and some of these we shall repeat, for he evidently believed that his art had an experimental basis.

His belief in *incubi* and *succubi* was founded on particular cases at Bergamo in 1650, and Venice in 1664, from his own practice, the second case being that of a nun who fasted a great deal but also read about magical transformations, with a speech half a column long by a demon in the form of a beautiful youth.¹²² Another case at Venice in 1664 was that of a girl of fourteen who kept admiring herself in a big mirror, until one day she saw a beautiful youth kissing her in it. He was really a demon who persuaded her to renounce Christianity. Her mother, however, wormed the secret out of her and removed the mirror. But the doctor who was called in tormented her worse than the demon had, until finally Brognolo was summoned and cured her of possession by the demon.¹²³ At Rome in 1647 there was a boy of eight who disputed all sorts of philosophical and theological questions before cardinals and others

¹¹⁹ *Ibid.*, I, 59, ¶ 189.

¹²⁰ *Ibid.*, II, 50, ¶ 181.

¹²¹ *Ibid.*, I, 168b, ¶ 482.

¹²² *Ibid.*, I, 91.

¹²³ *Ibid.*, I, 84.

and was heaped with gifts. Later at Loreto it was noticed that he did not take any holy water or cross himself. When he was introduced into the chapel of the Virgin, the demon possessing him let out cries, and the master who had been with him—and who was perhaps a ventriloquist—fled and committed suicide by jumping from a high tower to escape the Inquisition. The boy, when later cured of the demon, also lost all his former knowledge.¹²⁴ Three *magi* at Bergamo, who tried to get some of a girl's hair in order to sell her soul to the devil and have her for their whore, were given the hairs of a cow by her instead. As they were all dressed up for the ceremony and sacrificing the hairs, the cow broke out of its stable and attacked them and their altar, and the Inquisition deported them to the galleys.¹²⁵ The wife of a tailor at Bergamo who had twenty-four children came to Brognolo and he expelled a demon from her thigh, and thereafter she bore no more twins.¹²⁶

Brognolo was a great advocate of faith in God and said that the Emperor Charles V had been preserved unwounded in cannonades thereby.¹²⁷ While writing his *Manuale exorcistarum* at Padua in 1648 and dwelling on the theme of faith in God, he was tempted to put his right eye out and then have faith in God to restore it. He got so far in this interesting experiment as to touch the eye lightly with his scribe's scalpel, but was saved by the name of Jesus.¹²⁸ A doctor of laws and theology, the sort of person termed worthy of all confidence, told Brognolo of a pact in 1638 with a demon, to whom he was introduced by nine other magicians. After it had been completed, they were carried home through the air in a chariot drawn by four white dromedaries. But when he was brought before the Inquisitor, he confessed that it was all a cock-and-bull story from the pages of Peter of Abano.¹²⁹ A Venetian cobbler in 1647 who had trouble with his eyes, after a physician and an old-wife had failed to cure him, came to Brognolo and was healed.¹³⁰ He

¹²⁴ *Ibid.*, I, 86.

¹²⁵ *Ibid.*, I, 256.

¹²⁶ *Ibid.*, I, 90. The demon might seem to have been fulfilling the Scriptural injunction, "Be fruitful and multiply," and Brognolo to have been

guilty of conniving at birth control.

¹²⁷ *Ibid.*, II, 211.

¹²⁸ *Ibid.*, I, 85.

¹²⁹ *Ibid.*, I, 173-74. Probably from a supposititious work.

¹³⁰ II, 3.

would seem to have moved in a descending rather than ascending scale.

In a book which was first published in 1669 and reprinted in 1671, John Wagstaffe, a master of arts of Oriel College, Oxford, held that belief in witchcraft was of heathen origin and fomented by priests against private persons who imitated their rites.¹³¹ Consequently those who today defended that belief were more guilty of heathenism than those who denied it were of atheism. And those who ascribed such great power over nature to the devil were Manicheans. Biblical passages had been falsely translated to indicate witchcraft, whereas there was no such thing as a witch mentioned in Scripture, and no such thing as a witch at all. There was no satisfactory evidence for the supposed pacts of witches with the devil, and Wagstaffe unfairly blamed the papal inquisition for that notion. The effects attributed to witchcraft were ridiculously absurd, and the poverty of persons reputed to be witches showed that they possessed no such powers. It was impious to say that God permitted witchcraft and let the devil exercise such vast power. If the devil has such power,

no rational man by the light of reason shall be able to tell from the history of the Gospel whether Christ were a witch or no; for let some men think what they please, the holiness of his doctrine is not the thousandth part such a proof of his acting by a divine power as the marvelousness of his works. But alas! what were his miracles, . . . if malicious creatures . . . can make frogs and serpents, raise the dead, give law unto the winds and seas?

Wagstaffe regarded demons as aerial creatures, who might have "more skill, agility and strength" than men, but could only work wonders as men do by application of natural forces, and who had no power in the ethereal and celestial world. Winds, seasons of the year, and the fruits of earth depended not on them but "upon the motions and mutual aspects of the glorious celestial stars."¹³² Thus Wagstaffe, while rejecting witchcraft, clung to the influence of the stars as well as to miracles.

¹³¹ *The Question of Witchcraft debated . . .*, London, 1671, in-8, 148 pp. BM 719.b.24.

¹³² *Ibid.*, pp. 86-87, for passages quoted.

According to Meric Casaubon, who undertook to refute Wagstaffe's work, its author contended that witches were not mentioned in Scripture; that only simple, ignorant and foolish people believed in their existence; that such belief was derogatory to God and His omnipotence; and that it was based on fables "and pollicie."¹³³

A leading argument of Casaubon for belief in witchcraft was that other facts or beliefs were just as strange and occult, such as monsters, natural sympathies and antipathies, occult qualities, celestial influence, chemical remedies—he himself had been cured by one at Oxford when his life was despaired of, the wonders of natural and artificial magic, astronomical clocks, mathematical paradoxes, the unfamiliar phenomena of strange countries and climates, and the belief that the human mind or soul may work miracles by natural confidence, long fasts without any bodily sustenance, solid or liquid, empiric and specific remedies. The consensus of mankind also affirms the reality of witchcraft. Oracles are often true; strange things are foretold by even those forms of divination which may seem the most ridiculous. Augustine said, "Some credible things are false, just as many incredible things are true." The statements of Pliny the Elder are "very often wronged and censured by men through incredulity grounded upon ignorance."¹³⁴ Hence Casaubon arrives at the conclusion, "Then let us account, though strange, yet not prodigious, those things which are known so often to happen," which he proceeds to support by the usual run of witch stories, "but those men not so strange as prodigious" who do not see what all other men see or will not believe it, even when they see it.¹³⁵

The same individual might declare for natural science or modern progress in one book, yet maintain the existence of witches in another. Thus Joseph Glanvill wrote in 1661 *The Vanity of Dogmatizing or Scientific Scepticism* and in 1668 *Plus Ultra, or the Progress and Advancement of Knowledge since the days of Aristotle*. But in the interim he issued *A Philosophical Endeavour towards the Defence of the Being of Witches and Apparitions* (1666),¹³⁶ re-

¹³³ Meric Casaubon, *Of credulity and incredulity*, 1670, p. 171. 154, 61.

¹³⁵ Ed. of 1672, p. 84.

¹³⁴ *Ibid.*, ed. of 1672, pp. 141-42.

¹³⁶ Moody E. Prior, *Joseph Glanvill*,

printed in 1667 as *Some Philosophical Considerations touching the Being of Witches and Witchcraft*, after the previous impression had been almost wholly destroyed in the Great Fire, to which in *A Blow at Modern Sadducism* (1668) he added an account of the demon of Tedmouth, accepting the evidence of a haunted house. The whole was repeatedly published posthumously (1681, 1689, 1700, 1726) as *Saducismus triumphatus, or Full and Plain Evidence concerning Witches and Apparitions*. Similarly George Sinclair was author in 1669 of *Ars nova et magna gravitatis et levitatis*, in 1685 of *Satan's Invisible World Discovered*.

The book of Jacques d'Autun or de Chevoines against learned incredulity and popular credulity on the subject of magicians and sorcerers, with a reply to Naudé's *Apologie pour tous les grands personnages qui ont esté faussement soupçonnés de Magie*,¹²⁷ is a "windy suspiration of forced breath" of over eleven hundred pages addressed to the Parlement of Dijon and written primarily from the legal and judicial standpoint. The title may have been suggested by Meric Casaubon's book of the previous year. In the preface Jacques says that in 1644 most of the towns and villages of Burgundy were so wrought up over reports that sorcerers were affecting the weather, that there was no assurance of safety for even the most innocent person. A young shepherd boy claimed to detect a mark of the devil which was invisible to everyone else by looking into the pupil of the eye of those suspected, and was trusted by the credulous populace, but caused a reaction on the part of some judges in the opposite direction of scepticism which Jacques deplures. Incidentally he holds forth for over one hundred and fifty pages¹²⁸ against the extremes of astrology, while his forty-second Discours is a "Descry universel de l'astrologie iudiciaire et de la Magie."¹²⁹ Coming to ways by which magicians and sorcerers

Witchcraft and Seventeenth Century Science, 1932 (Col 308 Z Box 378) seems more dependable as to the wording of this title than Ferris Greenslet, *Joseph Glanvill, a Study in English Thought and Letters of the Seventeenth Century*, 1900, p. 223 et seq., who had not seen the 1666 edition and gives the 1667 title for it.

¹²⁷ *L'incrédulité sçavante et la crédulité ignorante au sujet des Magiciens et des Sorciers, avec la response à un livre intitulé Apologie . . .*, Lyon, 1671, 4to, 1108 pp. Copy used: BN D.8205.

¹²⁸ *Ibid.*, 186-349.

¹²⁹ *Ibid.*, 361-8.

may be detected,¹⁴⁰ he admits that of all criminals they are the hardest to find out, and discusses how far evil report is to be trusted. He also considers whether curing by words, figures and characters is an indication of sorcery,¹⁴¹ but rejects inability to shed tears as a proof that a person is a witch,¹⁴² and the ordeal of cold water as condemned by both divine and human law.¹⁴³ On the other hand, he holds that the *Canon episcopi* does not apply to sorcery, and that witches can be transported through the air to their sabbats,¹⁴⁴ and that by sleight of the demon men can be changed into wer-wolves so far as accidents and outward appearance are concerned although not substantially.¹⁴⁵ In replying to Naudé, Jacques contends that most of those whom Naudé mentions were justly accused of magic, although Naudé included some great men whom few persons would or did suspect of magic, such as Aquinas, Albertus Magnus, Arnald of Villanova and Raymond Lull.¹⁴⁶

The work of Jean Bona (1609–1674), who became General of the Order of Reformed Cistercians in 1651 and was made a cardinal in 1669, on distinguishing spirits was published at Rome in 1672 and Paris in 1673.¹⁴⁷ It distinguishes three kinds of spirits: human within us, divine and diabolical outside us. It is written from the religious standpoint and is stuffed with quotations. I saw nothing as to magic, the stars, or natural divination, but the last five of its twenty chapters are about dreams, prophetic dreams, intellectual vision, apparitions and revelations.

Another work on spirits, which I have failed to find, was the *Pneumatics* of Georg Meyer, "in which the natural science of spirits—God, angel, separate soul of man—is thoroughly explained."¹⁴⁸

Julius Reichelt, who in 1667 had become professor of mathematics at Strasburg, in his *Exercitatio de amuletis figuris illustrata*¹⁴⁹ took such amulets in the narrow sense of any body marked with

¹⁴⁰ *Ibid.*, 427 et seq.

¹⁴¹ *Ibid.*, 511 et seq.

¹⁴² *Ibid.*, 535 et seq.

¹⁴³ *Ibid.*, 570 et seq.

¹⁴⁴ *Ibid.*, 701-81.

¹⁴⁵ *Ibid.*, 897 et seq.

¹⁴⁶ *Ibid.*, 935 et seq.

¹⁴⁷ *De discretione spirituum liber unus*, Rome, 1672, in-4, 208 pp. in-

cluding the index, BN D.5447; Paris, 1673, in-8, BN D.26318. Not in BM.

¹⁴⁸ *Pneumatica qua scientia spirituum dei angeli animae hominis separatae naturalis solide explicatur*, Wittenberg, 1667, in-8: no BM-BN.

¹⁴⁹ Argentorati, 1673, 4to, 22 pp.: copy used, BN Vp.3557. Other editions followed in 1676 and 1692.

characters, image or figure in order to obtain particular effects by some celestial virtue. Reichelt denied that they could receive any celestial influence or had any relation of sympathy with the heavens. He examined and criticized astrological technique in some detail, citing such writers as Leopold of Austria, Peter of Abano, and Ficino. He concluded that there was no natural cause in such amulets, and that they were therefore superstitious snares of the devil. Henry Cornelius Agrippa, Paracelsus and Gaffarel discussed them, but the last-named had to retract before the Sorbonne. Gnostic gems had been treated by Macarius and in the added notes of his posthumous editor, Chiflet.

In 1674 a correspondent, Hugo Boxel, asked Spinoza's opinion as to apparitions, specters and ghosts, whether they existed, whether they were immortal, material or spiritual, stating that the ancients and present philosophers and theologians believed in them, though disagreeing as to their essence, and that so many instances were recorded in history that it was hard to doubt their reality. In reply Spinoza asked him to cite one reliable account. He disbelieved all ghost stories, and to him they were no more real than gryffins and other imaginary creatures. When the correspondent argued that we cannot demonstrate everything but for much must be content with probable or plausible reasons, and that "No one of moderns denies specters," Spinoza answered that they still seemed mere phantasies to him without any intelligible property. The authority of Plato and others had no weight with him on this point, and it was no wonder that those who accepted occult qualities, intentional species, substantial forms and a thousand other *nugae*, should have invented specters and ghosts and trusted old-wives.¹⁵⁰

On the other hand, Isaac Voss just laughed at the story of a Swiss making gold and was surprised that Spinoza paid any attention to it. But others took more stock in it, and Spinoza himself saw the Swiss, who showed him the gold and the crucible used in making it. He also thought that imagination based on bodily causes could never produce omens of future events but that imagination based

¹⁵⁰ *Epistolae* 55-60, ed. Leipzig, 1876, pp. 156-70; in Wolf's English translation, 51-56. Spinoza also gives

a humorous account of evil spirits in his *Short Treatise*, II, 25.

on the mental constitution might, "because the mind can have a confused presentiment of the future."¹⁵¹ But these two beliefs were more in accord with Spinoza's fundamental principles.

The *Magiologia*, or Christian Warning against Superstition and Magic, of Anhorn, printed at Basel in 1674, is a long work in German of 1107 pages.¹⁵² Superstition is found in prediction of the future, under which caption are considered dreams, ecstasy, visions and new prophets; in observance of days;¹⁵³ and in sign-reading, under which are grouped such signs as the cry of birds, astrology, physiognomy and chiromancy. Magic is pronounced an illicit art and a partnership with the devil. Anhorn does not stop with jugglery and operative magic, but includes magnetic cures, alchemy, snake-charming, and philters.¹⁵⁴ All magic is a shocking sin and a terrible affront to the majesty of God.¹⁵⁵ A final question is whether magicians and witches can ever regain a state of grace and be saved.¹⁵⁶

In 1675 Johann Christian Frommann, provincial physician of Saxe-Coburg, published a long treatise of over a thousand pages on fascination. In its title the book is called "new and unique,"¹⁵⁷ but actually it is very repetitious with frequent citation and quotation of previous writers, largely in Latin but sometimes in German and Greek. The work is in three parts on vulgar, natural, and magical or demoniacal fascination. More space is devoted to the latter than to the two other taken together. The book is especially intended for theologians, lawyers, physicians, and particularly for provincial priests who have to contend with superstition not only in connection with fascination but the verbal cure of disease.

In brief, Frommann denies the possibility either of visual or vocal fascination, and that words or sounds or characters or incantations possess such power. Nor can it be accounted for by the

¹⁵¹ *Ibid.*, Ep. 45, 30; pp. 127, 74.

¹⁵² B. Anhorn, *Magiologia: Christliche Warnung für dem Aberglauben und Zauberey*, Basel, 1674, in-8, 1107 pp. BM 8632.bb.14.

¹⁵³ Treated briefly at pp. 128-37.

¹⁵⁴ The consideration of Zauberey begins at p. 233; of magnetic cures at p. 814; alchemy, at 890; snake-charm-

ing, at 923; philters, at 946.

¹⁵⁵ *Ibid.*, p. 982.

¹⁵⁶ *Ibid.*, p. 1088.

¹⁵⁷ *Tractatus de Fascinatione novus et singularis, in quo fascinatio vulgaris profligatur, naturalis confirmatur, et magica examinatur* . . . , Nürnberg, 1675, in-4, 1067 pp.

influence of the stars or power of the human soul and imagination, which cannot act outside their own body. He grants to amulets some natural action through subtle effluvia which come from them and enter the pores of other bodies. But he limits the scope of natural fascination to little more than antipathy, and holds that magicians and witches of themselves cannot injure by sight or voice or touch or in any other way, but that the effects are entirely diabolical.

Visual fascination has to fall along with the discarded theory of vision by extramission of rays instead of the reception of species. It is false that the ostrich hatches its eggs by merely looking at them. To the old notion that the presence of a menstruating woman clouds a mirror, Frommann replies that menstruating blood is not harmful by nature. The basilisk, which Frommann hesitates to call fabulous, kills not by sight but by its breath, and does not die upon seeing itself in a mirror. It is untrue that a man loses his voice, if a wolf sees him first. Blear-eyes are caused by contagion, not by visual fascination. Envy contributes nothing to the power of fascination.

Frommann denies that the walls of Jericho fell down from the natural virtue of sound alone, or that musical instruments acquire virtue from the material of which they are made. He admits that shouts of an army or the voice of an orator may affect the phantasy and through it the body indirectly. The bite of the tarantula is not relieved directly by music, to which the patients dance, but only accidentally. Willis in his *Pathology of the Brain*, chapter 7, holds that the poison of the tarantula does not completely extinguish the animal spirits but merely dissipates them in disorder, and that the soothing influence of music gradually reassembles them in orderly array. But this fails to explain why it does not have the same effect in the case of even milder poisons. Frommann suggests rather that the patients are affected by the idea of the venom of the tarantula, which makes them want to dance, tarantula-like, when music arouses it. So those bitten by a mad dog are obsessed by its idea and bark and bite; those who drink cat's blood mew and catch mice; those weaned on goat's milk leap and nibble. In the case of those bitten by the tarantula, their protracted dancing makes

them perspire so profusely that the tarantula idea finally exudes with the abundant sweat.¹⁵⁸

It seems extraordinary and extremely inconsistent of Frommann, after denying that imagination or sight or sound can affect a foreign body, and that words, characters and astrological images have operative power, to contend that an operative idea can be transferred in the poisonous bite of an animal, so that it will eventually obsess the victim. It is true that the bite involves physical and material contact. But an ideal element would seem to be far more characteristic of imagination, words, characters and images than of the physical secretions of reptiles and brutes. And if it is an idea that operates, why is any material contact necessary?

One example may be given of popular superstitious usages recorded by Frommann: in this case the placing of an herb (*Sideritis*, *Heraclea*, *Gliederkraut*, *Fussbeerkraut*, *Beruff-Kraut*) on infants' cradles to protect from fascination or witchcraft. Or the herb is cooked and the child washed thrice in the decoction and given a drink of it after each washing. And they religiously observe that the washing be done in a vessel of lead or wood which has been handed down in the family. Then from the presence or absence of impurities left in the vessel they infer the presence or absence of fascination. After the washings the child is not wiped off but is wrapped wet in linen or some man's dirty undershirt and put to bed. If the skin is affected (*Si cutationis successus aegrum destituit*), the child will die or suffer from a very serious occult disease or loss of health from witchcraft ("for the populace knows how to distinguish magic fascination from vulgar").¹⁵⁹

Words of themselves have no operative virtue. The moon cannot be brought down by incantations. Crocodiles, bulls and snakes are charmed not by words but by the aid of the devil. There is no real virtue in words even from the cabalistic viewpoint, and the force of characters is not from the stars. Neither is the venom of poisonous animals, but from their own specific form. The heavens are only a very general, remote and indeterminate cause of things sublunar and do not determine the virtue of each individual. A man cannot be generated by imagination, as Avicenna said, without mother,

¹⁵⁸ *Ibid.*, pp. 240-43.

¹⁵⁹ *Ibid.*, pp. 69-70.

womb and seed. A public record of the Parlement of Grasse in 1637 confirmed a virgin birth, but Gui Patin asserted that the document was a forgery and hoax.¹⁶⁰

Frommann finds it necessary to explain away various passages from the Bible and from classical writers which had been adduced in favor of fascination, and he charges the papists with superstitious practices in benedictions, exorcisms and other connections. He cites various passages from the works of Paracelsus to show that he believed in the power of words and characters, and in employing them, even if they were of the devil. In his pest tract he advised the physician to learn magic, and in his treatise on epilepsy to heal by pure or impure spirits. Frommann also cites Erastus, Sennert, Conring and Libavius for Paracelsus being addicted to magic.¹⁶¹ Frommann further attacks Pomponazzi, Bruno and Vanini, and holds that those who ridicule magic and demons are either magicians themselves or atheists.¹⁶² Both Frommann and Ursinus state that Bruno held that Moses worked his miracles by magic in which he outstripped the Egyptians.¹⁶³ Frommann states more mildly that John Peter Lotichius, "most learned physician and philologer," in his Commentary on Petronius Arbiter, rejected the seals of Paracelsus and Agrippa as impostures, but would not admit that all signatures, words and characters have no natural causes and are diabolical. Urging the existence of natural marvels, the ceremonial use by Christ himself of spittle and gazing heavenward, the signatures in plants, the influence of the stars and the royal touch, Lotichius added: What then prevents that even seals and rings, carved at this or that time under this or that aspect of the sky, should share in the virtues of the constellations? But while Frommann accepts most of the premises, he rejects the conclusion.¹⁶⁴

We have seen that Frommann accepted the existence of occult

¹⁶⁰ *Ibid.*, p. 426, citing Bartholinus, Cent. VI, Hist. 61 for the document and Cent. III, Ep. 83 for Patin's disclaimer.

¹⁶¹ *Ibid.*, pp. 27-28, 183, 279.

¹⁶² *Ibid.*, pp. 57, 327, 510, 508.

¹⁶³ *Ibid.*, p. 510; Joh. Henr. Ursi-

nus, *De Zoroastre Bactriano, Hermete Trismegisto, etc.*, Nürnberg, 1661, p. 5.

¹⁶⁴ *De fascinatione*, pp. 296-97. Frommann's discussion of the royal touch, at pp. 475-78, is not noted by Marc Bloch, *Les rois thaumaturges*, 1924.

virtues and specific forms.¹⁶⁵ He also accepted the bleeding of the corpse in the presence of the murderer and explained it as usually an instance of natural fascination or antipathy.¹⁶⁶ He was also ready to admit that the use of the divining rod was not necessarily diabolical, although some attributed it to chance or fraud.¹⁶⁷

With respect to diabolical fascination or witchcraft Frommann held that witches were more numerous than magicians, that the devil could fascinate but not transform soul and body. The devil frequently fascinated the phantasy. The memory could be fascinated in three ways, and the mind could also receive some intellectual light from the demon. Visible objects could be rendered invisible by diabolical fascination. The feat of the piper of Hameln was the work of diabolical fascination. The demon can inflict diseases, and fascination of the genital faculty is frequent. Those who rise from bed without prayer are more easily fascinated. The demon cannot fascinate the universe and its laws, heavens and stars, nor elements entire, but can affect their parts and raise storms, and can further bewitch works of art such as arms, buildings, mills and ships.¹⁶⁸

Such are a few specimens of the powers ascribed by Frommann to diabolical fascination. He deserves some credit for denying visual and vocal fascination, the power of words and characters, and of imagination on a foreign body. But he still believed in occult virtues, in antipathy in the blood of a dead body, and in an idea, and an operative one at that, in the poison of a spider.

John Webster, whose work of 1671 on Metals has been considered elsewhere, in 1677¹⁶⁹ followed Ady and Wagstaffe, Wier and Scot, in denying that witches were mentioned in the Bible, and argued against Casaubon and Glanvill that

to deny the existence of angels or spirits or the resurrection does not infer denial of the existence of God, nor denying witchcraft infer denial of the existence of angels and spirits.¹⁷⁰

¹⁶⁵ See further p. 409.

¹⁶⁶ *Ibid.*, pp. 399-407.

¹⁶⁷ *Ibid.*, p. 688.

¹⁶⁸ *Ibid.*, pp. 531, 642, 566-67, 580, 588, 602, 615, 629, 638, 643, 652.

¹⁶⁹ Zedler's giving the date of the first edition as 1673 seems a mistake.

¹⁷⁰ *The displaying of supposed witchcraft: wherein is affirmed that there are many sorts of deceivers and impostors, and divers persons under a passive delusion of melancholy and fancy, but that there is a corporeal league made betwixt the devil and the*

He further referred to Casaubon, Glanvill and

the rest of the demonographers and witchmongers that amass and heap together all the lying, vain, improbable and impossible stories that can be scraped forth of any authority, ancient, middle or modern.¹⁷¹

He made the rather damaging admission that many persons were possessed with devils in Christ's time. But that was in order that

there might be fitting subjects for . . . stupendous miracles, and therefore the Father in his providence had prepared and provided lunaticks, demoniacks, those that were born blind, and other strange diseases, that the power of Christ and his Apostles might be manifest in their miraculous cures. But whether or no that devils have at all times the same power over man's bodies is much to be doubted.¹⁷²

Webster's leading line of argument was that the supposed effects of witchcraft were natural and not diabolical. He seized upon Glanvill's statement, "We are ignorant of the extent and bounds of nature's sphere and possibilities," to contend that, if so, it was madness "to attribute those effects to wicked, fallen and degenerated demons," that may be produced "by the course of Nature." Later he made the similar point which goes back at least to Roger Bacon, that ignorance of the power of art and nature has favored belief in witchcraft and the activity of demons.¹⁷³ He believed that frogs might be generated in the human stomach by conveying their eggs into an apple which one eats.

And this kind of witching or secret poysoning we grant to be frequent and common, because those persons commonly accounted witches are extremely malicious and envious and do secretly and by tradition

witch, or that he sucks on the Witches Body, has carnal copulation, or that witches are turned into cats, dogs, raise tempests or the like, is utterly denied and disproved. Wherein also is handled the existence of angels and spirits, the truth of apparitions, the Nature of Astral and Sidereal Spirits, the force of charms and Philters, with other abstruse matter, London, 1677, in fol., 346 pp. BM 719.m.14. Passage

quoted at p. 38.

There was a German translation of Webster's book printed at Halle in 1719. Col 156.4 W.393.

¹⁷¹ *Ibid.*, p. 42.

¹⁷² *Ibid.*, p. 239.

¹⁷³ *Ibid.*, pp. 17-18, 267-80. Later in the book he quoted Bacon's *Epistola de secretis operibus artis et naturae et de nullitate magiae* at length: *ibid.*, pp. 336-38 and 339.

learn strange poysons, philters and receipts whereby they do much hurt and mischief.¹⁷⁴

He further believed that unguents have been used by the malevolent to disseminate plagues, and proceeds to tell stories as improbable as those we heard him denounce, although he finally expresses some doubt and caution as to them.

Turning to Helmont's explanation of *Injecta*, or how foreign substances get into the human body, Webster says:

From these stupendous and almost incredible stories he draweth these conclusions . . . He holdeth that the devil doth only make the things invisible or hides them by his spirit and brings them near to the object into which they are to be injected, and that the witch by the seminal idea of her imagination and the strength of her desire doth inject or thrust them into the body of the person to be hurt or tormented.¹⁷⁵

After stating that Helmont's supporting stories are either all true or all false, and that his argument, that "penetrating of dimensions" is natural, seems convincing, Webster says:

I confess it would rack the judgment even of the most credulous to believe these unparalleled stories, but the author relating them as of his own knowledge and being a person of unquestionable veracity, I cannot conceive how they rationally can be denied, especially finding Mr. Boyle to affirm, that in those experiments (much more relations of matters of fact) that Helmont avouched upon his own knowledge, he durst be his Compurgator.¹⁷⁶

Webster proceeds to argue that Satan is not needed to bring the foreign objects near, "because it is far easier to carry them near the place than to thrust them into the body," but he does not explain how they are kept invisible without demon aid.

Ambrose Paré is quoted that man the microcosm may well have within him all the seeds and elements of the macrocosm, in which case such foreign objects may have been produced internally, and Helmont's theory may be a mere figment. And the vomiting of such objects is often a deception. But, although Fienus, "and the whole rabble of the Schoolmen," deny that the human imagination

¹⁷⁴ *Ibid.*, p. 242.

¹⁷⁶ *Ibid.*, p. 263.

¹⁷⁵ *Ibid.*, pp. 257, 259.

can work upon another body at a distance, Webster accepts it as a certain truth, admitted by all who truly understand the workings of nature. Therefore, if witches do inject such objects, they do it by their own imagination without aid from the devil.¹⁷⁷

Many real creatures, such as satyrs, pygmies, *cynocephali*, mermaids and other marine monsters have been mistaken for spirits and demons. Many apparitions are produced by natural or artificial means and are not the work of demons. "Of visible apparitions of evil angels we scarce have any evidence.. in Scripture," possession by demons ceased with the age of miracles, and souls of the dead cannot return to this world. Ghost stories "are most strangely fabulous." Webster accepts the bleeding of the corpse in the presence of the murderer, and attributes it to the astral spirit or sensitive soul, which after death still hovers about for a time in the air, after the immortal soul has immediately returned to its Maker.¹⁷⁸

Webster asserts that most of the church fathers of the first four centuries regarded demons as corporeal, with which he agrees. But they cannot assume other bodies. They are totally ignorant of many things, and such knowledge as they have is dark and confused. Both in respect to themselves and others they are spurious, erroneous, fallacious, deceitful and delusive. Their power is less than before their fall and is exerted only over sublunars, since they "are chained in this caliginous atmosphere and impure air."¹⁷⁹

In his own medical practice, when patients attributed epilepsy and other diseases to witchcraft or evil spirits, Webster found it advisable to "indulge their fancy" and give them a charm or amulet as well as the medicine proper to eradicate their disease. There was no efficacy in the amulet, but the patient's confidence in it helped to cure him. After quoting Fernel and others for the power of words, Webster concludes, "Notwithstanding all this, for the most part all charms, spells and characters are inefficacious, fallacious, superstitious and groundless."¹⁸⁰ But he quotes Thomas Bartholinus that words framed or enclosed in a certain rhythm may

p. 346.

¹⁷⁸ *Ibid.*, pp. 279-87, 39-40, 288-320.

¹⁷⁹ *Ibid.*, pp. 197-224.

¹⁸⁰ *Ibid.*, pp. 323, 329, etc.

¹⁷⁷ *Ibid.*, pp. 264-66. At p. 321, however, he says: "Neither can we assent fully to those that hold that the force of imagination can work strange things upon other bodies." See also

without any superstition cure epilepsy. The breath alters the air which enters the pores. And the cure of the bite of the tarantula by music convinces him that there is some natural virtue in uttered words and charms. If music has a healing effect, they should have a greater, especially if related to the heavens, as in astrological images.¹⁸¹ Also figure counts for something; thus a circle contains more space than a square of equal perimeter.

If we consider speech or oration which consists of sounds and syllables in relation to the material cause, which is the breath of man by his several organs moving, modulating and figuring the air . . . into diversity of sites, motions, contextures and moods, then we must conclude that words, charms or rhythms . . . are of great force and virtue naturally.

But today there are few or none which are efficacious, and the devil can operate nothing by words and charms.¹⁸²

We may further note that, although Webster rejected witchcraft, he had faith in "that secret and sublime art of the transmutation of metals," in "mystical chemistry," and in a universal medicine or *aurum potabile*. He listed three instances of producing a human phantom by the chemical distillation of blood.¹⁸³ Indeed, he must be classed as a believer in natural magic. For him Agrippa was "that great philosopher and master of natural and lawful magick," while Fludd was "a person of much learning and great sincerity."¹⁸⁴ Since the visible species of bodies operate upon our eyes from afar, and intersect one another in the air without confusion, the imagination too may operate at a great distance, "and so words and charms may from thence have power."¹⁸⁵ For Webster, also, new stars, comets and meteors were portents and prodigies, natural but unusual and marvelous, while "the great power of celestial bodies upon inferior matter was such that it inclined him to believe that astrological images received "most potent virtue."¹⁸⁶

Finally, Webster was hardly in a position to distinguish between the physical and the spiritual. For him demons had bodies, while natural bodies were full of spirit. The intrinsic nature of body was utterly unknown. Reflection in a mirror was "as really a body as

¹⁸¹ *Ibid.*, pp. 341-42.

¹⁸² *Ibid.*, pp. 344-46.

¹⁸³ *Ibid.*, pp. 5-7, 319.

¹⁸⁴ *Ibid.*, pp. 322, 319.

¹⁸⁵ *Ibid.*, p. 322.

¹⁸⁶ *Ibid.*, pp. 288, 341.

any in the universe, though of the greatest purity and fineness of any that we know," and "we cannot tell where spirit must begin, because we do not know where the purest bodies end."¹⁸⁷ In short, he attacked only witchcraft in particular, not magic in general.

Webster had rejected the specter of Tedworth as fraudulent, and Glanvill was further urged to reply to him by Henry More in a letter which held that the feats of Pharaoh's magicians were not illusions and that the witch of Endor made Samuel really appear to Saul. Similarly Glanvill in *Saducismus Triumphatus, or full and plain evidence concerning witches and apparitions*, first published in 1681, the year after his death, held that the human soul, even when separate from the body, had an aerial or ethereal vehicle of its own, namely the form of its body. It was this that Saul saw, not Samuel in the flesh, and it was in this form that witches traveled through the air to their sabbats, or assumed animal shapes. But if they were wounded while in this state, the wound would appear next day upon their flesh, just as the imagination of the mother produces marks upon the foetus.¹⁸⁸

La philosophie des images enigmatiques of the Jesuit Claude François Menestrier, which first appeared in 1682–1683,¹⁸⁹ is a deceptive title, since the book was written from a literary and theological standpoint, and since its main contention is that there is no such occult philosophy, or natural magic. Also it might be thought that it deals primarily with magic or astrological images, whereas only a part of the text is concerned with them. In the preface the author affirms that "all our religion is an enigmatic religion," full of mysteries; that all our sciences are but obscure nights; that *caligo* is a fitting anagram for *logica*; that history is an unreliable puzzle; while magic, lot-casting, divination, oracles and predictions have assumed a mask of the occult and mysterious in order to conceal their real character. There are three kinds of enigmas: licit, suspect and condemned. He will combat the last with the maxims of theology and the authority of religion rather

¹⁸⁷ *Ibid.*, pp. 203–4. I have failed to find Georg Schulken, *De materia illicitae Magiae*, Lipsiae, 1677 (the same year as Webster's work).

¹⁸⁸ *Acta eruditorum*, II (1683), 317–

20.

¹⁸⁹ *La philosophie des images*, Paris, 2 vols. I have used a later edition, *La philosophie des images enigmatiques*, Lyon, 1694.

than with the captious reasoning of the new philosophy, which is often based on false or dubious and suspicious experience and experimentation. Thus magic and experimental method are attacked simultaneously.

After dealing with such enigmas as hieroglyphs, ciphers and figurative representations—often in a historical, literary or trifling manner—in the first half of the book, Menestrier comes to enigmas which are suspect, discredited and dangerous. Magic is clearly bad; judicial astrology, dangerous; the divining rod and chiromancy, suspect; while augury, the inspection of entrails, talismans and characters are universally decried. Menestrier leaves to writers like Delrio to deal with magic which is clearly diabolical. Nor will he stop to treat of judicial astrology, whose extravagances so many theologians have pointed out, and whose principles and systems so many philosophers have overthrown by solid reasoning.¹⁹⁰ He will turn to those occult arts which are disguised under a pretense of natural secrets, occult virtue, physical causes, and “recognized experiences, authorized and approved by the examples of the saints and by the practice of persons of . . . known probity.”¹⁹¹ They use the sign of the cross, words of Scripture, prayers of the church, invoke angels, and say that these secrets are from heaven. Deceiving alchemists have put on this sort of language and unintelligible terminology. Although he had before represented talismans as universally decried, and now identifies astrological images with them, he nevertheless says that astrological images have the support of such writers as Paracelsus, Agrippa, Cardan, Porta, Campanella, Gaffarel, Van Helmont, Fludd, Junctinus, Trithemius, Goclenius and Moncaeus.¹⁹² It is true that some surprising effects in nature, such as the figures imprinted naturally in stones, the power of the magnet, and the sympathy and antipathy existent between plants and animals, have given some color to these illusions. But art cannot implant the same virtues as nature does; it can only imitate in color, figure and movement.¹⁹³

¹⁹⁰ He has occasion, however, later to discuss the extent of the influence of the stars.

¹⁹¹ *Ibid.*, 251-52.

¹⁹² Franciscus Moncaeus, *Disqui-*

sitio de magia divinatrice et operatrice, Francofurti, 1683, in-4: BM 719.g.13. Discussed above in Chapter 36.

¹⁹³ Menestrier, 258-59.

Menestrier's book might seem of little importance for our investigation, since in general much of it is historical, literary or simply trifling. But the fact that, after its first appearance at Paris in 1682-1683,¹⁹⁴ there was another French edition at Lyons in 1694,¹⁹⁵ and then a Latin translation at Amsterdam in 1695,¹⁹⁶ and also an English translation,¹⁹⁷ shows that, despite the repeated condemnation of talismans or astrological and magic images as either inoperative or diabolical, there was still a good deal of interest in them at the close of the century.

Another illustration of the late survival of this sort of interest is the defense of the casting of persons suspected of witchcraft into cold water as a method of proof by Jacob Rick, which was first published in 1597,¹⁹⁸ and was reprinted at Frankfurt and Leipzig almost a century later in 1686.¹⁹⁹ Yet the employment of this ordeal had been forbidden by the Parlement of Paris in the first year of the century.²⁰⁰

Johann Heinrich Decker of Hamburg conceded that the power of imagination was great, especially in melancholy persons, but held that specters were nothing but a sport of Satan. Spirits properly speaking were invisible, but specters were bodies assumed by demons.²⁰¹ They were rarely seen in Holland and England, so that the inhabitants of those countries doubted their existence. But in Holstein, Iceland, Lapland and the New World they were often seen.²⁰² There were also other specters which wandered about houses at night, and were called *nigri, lemures*, or lares and penates in Latin, Poltergeister in German. They were very obsequious to

¹⁹⁴ With the title, *La philosophie des images*. BM 89.k.18.

¹⁹⁵ With the altered title, *La philosophie des images enigmatiques*. Copy used: Col 156.4. M524.

¹⁹⁶ *Philosophia imaginum*. Copies in both BM and BN.

¹⁹⁷ Not in the printed catalogues of BM or BN.

¹⁹⁸ *Defensio compendiosa probae aquae frigidae*, 1597; cited by Kit-tredge, p. 536. BM 719.b.18; BN Rés. R.2441.

¹⁹⁹ *De examine sagarum super a-*

quam frigidam projectarum, or, Defensio probae aquae frigidae, Francof. et Lipsiae, 1686, in-4, 92 pp. BM 719.g.12.

²⁰⁰ Louis Servin, *Arrêt du Parlement portant défense de faire preuve par eau en accusant de sortilege, du 1 Decembre 1601 avec la plaidoyé*, Paris, 1602, in-8.

²⁰¹ *Spectrologia*, Hamburg, 1690, in-12, 197 pp. and a long bibliography. BM has two copies. Pp. 36, 85, 112, 147 et seq.

²⁰² *Ibid.*, pp. 145-46.

mankind, setting everything in the house in order by night, cleaning dirty dishes, bringing water, and the like. Nor were they always seen, but their presence was inferred from their labor, for which food was set out as their reward. Much was said of them by Luther, Simon Majolus in *Dies caniculares*, and Petrus Gregorius of Toulouse.²⁰³ Resemblances will be noted between Decker's account of specters and the long digression on them in Henckel's work of the year before described in our previous chapter.

Sermons which he had preached on biblical texts concerning the magicians of Nebuchadnezzar and Pharaoh, the witch of Endor, and so on, were developed by Balthasar Bekker into a book entitled, *The Enchanted World*.²⁰⁴ Inasmuch as Bekker went so far as to deny Satan any activity in this world since the fall of Adam, he was expelled from the Dutch Reformed Church. More convincing than his effort to prove that the Bible gave no support to the existence of diabolical magic was his argument that there was no basis in the Bible for the existence of pacts between the devil and witches. And in his last book he took up and exposed in detail various cases of supposed witchcraft known to him, especially at Franeker, and other noted impostures such as that of the Ursulines at Loudun which resulted in the burning to death of an innocent man, Grandier, whom they accused.²⁰⁵

A few years before Bekker's book there had appeared the *Pan-daemonium* of Richard Bovet.²⁰⁶ The first part in seven chapters came from the fall of the angels down through idolatry to witchcraft and alleged confederacies of several popes and Roman priests with the devil. Part II dealt with Relations of Witchcraft,²⁰⁷ such as Troubles that happened in the house of Peter Pain, a shoemaker living in Mary Poel Street in the city of Bristol, from a letter of June 25, 1683. But the events reported were supposed to have

²⁰³ *Ibid.*, p. 143. On Majolus see Chapter V, note 93.

²⁰⁴ *De Betoverde Weereld*, 1691, 1693; *Le monde enchanté*, Amsterdam, 1694.

²⁰⁵ For a fuller summary of the four books of Bekker's work see G. L. Kittedge, *Witchcraft in Old and New*

England, 1929, pp. 351-56. Also W. P. C. Knuttel, *Balthasar Bekker de Bestrijder van het Bijgeloof*, 1906.

²⁰⁶ London, 1684. Copy used: BN R.29888.

²⁰⁷ *Ibid.*, pp. 162-239.

occured forty-five years before. The evidence for the other stories is of like order.

Richard Burthogge (c. 1638–94) had a large medical practice and had acquired considerable property by marriage. Yet his published works were mainly on religious subjects: for infant baptism²⁰⁸ and toleration,²⁰⁹ and against atheism.²¹⁰ But he also published an *Organum Vetus et Novum*; or a Discourse of Reason and Truth in 1678, and in the year of his death, 1694, he dedicated to Locke *An Essay upon Reason and the Nature of Spirits*,²¹¹ with which we shall be concerned here. This treatise displays originality, keen and clear reasoning, and common sense, yet retains interests and beliefs which were characteristic of the age, such as the emphasis upon monsters in nature,²¹² or which were already being discarded, such as the notion of sympathy and the belief in spontaneous generation.

For example, Burthogge says that when Enthusiasts think they understand one another, "it must be reckoned an effect of Sympathy and not of Intellectual Apprehension."²¹³ He goes on to illustrate sympathy by the case of twins. "If Nicholas were sick or grieved, Andrew felt the like pain, though far distant and . . . without any intelligence given to either." And, "if Andrew were merry, Nicholas was likewise."²¹⁴ Some think that ghosts are formed or rather, "frame their vehicles, out of the moisture of their own deserted bodies, this being a matter that is believed more congenial to them and more sympathetical."²¹⁵ But Burthogge objects that ghosts appear too long after death for this explanation to be acceptable.

Burthogge might seem to be approaching the theory of evolution when he speaks of the

²⁰⁸ *An Argument for Infant Baptism*, London, 1683; *Vindiciae Paedo-Baptismi*, London, 1685.

²⁰⁹ *Prudential Reasons for repealing the Penal Laws against all Recusants and for a general Toleration*, London, 1687.

²¹⁰ *Tayaθov, or Divine Goodness explicated and vindicated from the Exception of the Atheist*, London, 1672; *Causa Dei or an Apology for God*, 1675.

²¹¹ London, 1694. Copy used: BN 8° R.9557.

²¹² *Op. cit.*, p. 261, the aberrations of nature in monsters; 264–66, instances of monsters (Siamese twins).

²¹³ *Ibid.*, p. 44.

²¹⁴ *Ibid.*, pp. 45–46, quoting *Remarkable Antiquities of the City of Exeter*, 42–43, and *England's Worthies in Church and State*, London, 1684, p. 165.

²¹⁵ *Burthogge* (1694), pp. 225–27.

sensible analogy and correspondence not only between the several species of animals (which is very manifest in comparative anatomy), but also in a good degree between plants and animals, and minerals and plants . . . There are no vacuities or gaps in nature in respect of species, no jumps or leaps, but all in orderly gradation . . . Minerals and vegetables are joined by *Lithodendra* or stone plants such as coral and the like; Vegetables and animals by Zoophytes or plant-animals such as the sensible plant, the Scythian lamb, and the like . . . Plants as well as animals are produced by semination, and even minerals and metals have their matrices,

and something analogous to seed in their production.²¹⁶ But this passage is written to support an argument for one world soul, and Burthogge goes on to speak of easy transmutation, as "the animation of horse-hairs that fall into pools in the summertime," the spontaneous generation of barnacle geese, and the animation of the branches of certain trees.²¹⁷

Burthogge believed that there were invisible as well as visible animals. Such were angels good and bad who were ethereal and "Genii which are aerial animals."²¹⁸ But

the laws of the spiritual world (for laws there must be which do confine and regulate the motions of spirits) . . . perhaps are only known unto God

and "Not one relation of a hundred holds true."²¹⁹ Yet Burthogge is impressed when Pliny the Younger "tells of his own knowledge" of a slave's hair being cut in his sleep. Or Burthogge writes:

Wherefore I will only desire the Anti-pneumatist to resolve me how these dead men's candles come to be lighted, and how to be directed to go so right from the house of the person whose death they do presage to the church or churchyard where he is to be lodged, without the influence of spirits.²²⁰

As we have heard in the case of ghosts, he prefers, like Glanvill, to speak of spirits' assuming "vehicles" rather than bodies, when

²¹⁶ *Ibid.*, 248.

²¹⁷ *Ibid.*, 249. Burthogge's *Of the Soul of the World and of Particular Souls* appeared posthumously in 1699.

²¹⁸ Burthogge (1694), p. 161.

²¹⁹ *Ibid.*, p. 233. He has, however, recounted a number of cock-and-bull witch stories at pp. 177-222.

²²⁰ *Ibid.*, pp. 215, 210.

they appear to us. And he is inclined to believe that they "appear by condensation of their vehicles and disappear by attenuating them."²²¹ But that even

the angelical vehicle should be obnoxious to the impressions of heat and cold . . . seems somewhat a gross conception; nor can I see how the spissitude or the tenuity of the air should signifie much, either to further or to hinder the making a body of air by a spirit . . . if a spirit be conceived (as he must) to work magically and not mecannically in it.²²²

And he holds that spirits of the dead do not appear to the external sense but affect the imagination, which serves to explain why sometimes they appear to only one person of several or many in a room.²²³ And he defines enthusiasm as "a false conceit of being inspired."²²⁴ Furthermore, "A soul is a system of faculties," or "A means only of conveying the vital influence into the body from the original mind" or world soul, which he suggests as the source of all particular souls.²²⁵

It has been argued that the defenders of the reality of witchcraft and of diabolical interference with the course of nature, considering their seventeenth century background, their belief in the literal interpretation of the Bible and in the existence of spiritual beings, were more justified and logical in their opinion than were those who then opposed it. I cannot subscribe to this thesis. They may have been more logical in a narrow-minded sense, but they were less enlightened. They had no right to interpret the Bible literally. It had often been otherwise interpreted in previous centuries, and it was otherwise interpreted in their own time.

The details of the system of witchcraft and diabolical magic were extremely fantastic and poorly put together, an outrageous pot-pourri of superstition and riff-raff. The evidence for the existence of witches was very unsatisfactory. It found well-nigh no support in Aristotle, natural philosophy, recent experimental science, or from medicine. Demons were admittedly invisible and spiritual; their existence could be inferred only from their supposed effects.

²²¹ *Ibid.*, p. 225.

²²² *Ibid.*, pp. 230-31.

²²³ *Ibid.*, pp. 227-29.

²²⁴ *Ibid.*, p. 40.

²²⁵ *Ibid.*, pp. 241, 244, 247.

On the one hand, it was said that only they could perform the marvels of magic, which was preternatural and superhuman. On the other hand, it was stated that they worked their magic by availing themselves of forces of nature—which man, too, might control.

Practically all reported cases of witchcraft were incredible cock-and-bull stories, or the imagined effects could be explained naturally or psychologically. The legal evidence on which convictions were based was obtained chiefly through confessions extorted by torture, a procedure rendered more unfair and cruel by the assumption that witches could endure torments better than other persons.²²⁶ How often was evil sorcery actually attempted? Even when it was, there would be only criminal intent without fatal result.

As for Biblical authority, it might easily have been side-tracked by taking the attitude that the age of witchcraft was past and gone, just as Protestants held that the age of miracles had ceased. Why hold, as the Premonstratensian, François Placet, did, that Christ's coming had delivered the world from the tyranny of the devil, but that sorcerers still kept it in his power? Most educated men in the seventeenth century were satisfied with the position that God could interfere in the course of nature, if He wished, but that in actual practice He did not, or restricted Himself to an occasional warning and prodigy, such as a comet, and a few special providences. Why should they attribute to the devil such frequent and highly irregular action in the material world? Why relinquish divine miracle in the present, yet cling to diabolical magic as a daily occurrence? This was not logical. It was a delusion, an aberration, a wrong-headedness that was almost sinful and criminal.

²²⁶ See Bouvet, prévôt général des armées du Roi, *Les manières admirables pour découvrir toutes sortes de crimes et sortilèges*, 1659. Chapter XX, at p. 192 *et seq.*, concerns criminals

who have taken drugs or *sortilèges* to protect them from torments, and what to do to make them suffer and confess their crimes.

CHAPTER XXXIX

SIR ISAAC NEWTON

The published and the private Newton—"The last of the magicians"—His alchemy and secrecy—Gravitation and occult attraction—His conception of nature—Of the ether—Animal spirits—Reception of the *Principia* on the continent—His interest in alchemy again—His medicine—Newton and Hooke—The triumph of a single magic formula.

No other quality more deserves the name of occult than gravity.

—CASPAR BARTHOLINUS

If the experiments, which I urge, be defective, it cannot be difficult to show the defects; but if valid, then by proving the theory they must render all objections invalid.

—NEWTON

Within the realm of science, leaving aside his credulity as to early history and biblical chronology, Newton was careful not to publish anything which was not firmly supported by experimental proofs and geometrical demonstrations, of which he did not feel certain, and which he felt should promptly convince everyone else. As his recent biographer has well said, Newton "made public a very small body of work, but each portion was an imperishable monument to his genius."¹ Undoubtedly it is upon these accomplishments that the chief emphasis should be laid rather than upon writings which he never saw fit to put into print, beliefs which he may have laid aside, passing views which he may have expressed in letters, or medical activity which was minor, or more prolonged chemical experimentation which got nowhere. Possibly therefore there has been too much stress laid recently upon his manuscript

¹ Louis Trenchard More, *Isaac Newton*, 1934, 97; hereafter cited as "More (1934)." I have made extensive

use of this book for quotation from documents inaccessible to me.

remains—over a million words in his own handwriting. This has led to a re-appraisal of his personality from the idealized portrait of him drawn by previous biographers, and to a broader survey of all his mental interests and occupations. The former does not much concern our present investigation; the latter is extremely germane to it. To suggest the familiar antithesis of Dr. Jekyll and Mr. Hyde would be too strong. But as the noble sage whom foreigners visited in London has been replaced by an irritable neurotic, “of the most fearful, cautious and suspicious temper that I ever knew,” as his contemporary and professorial successor, Whiston, said,² so the impeccable mathematical thinker and experimental scientist has been shown to have been something of an alchemist, an amateur physician and theologian, and an inferior historical critic. Indeed, we are assured that “his great interest in theology . . . was the most prominent passion of his life.”³

And Lord Keynes, who pored over all the Portsmouth Papers, in a brilliant contribution to the *Newton Tercentenary Celebrations*, has not so much taken the words out of my mouth—for I would not have ventured to utter them, as he has brought grist to my mill, the *History of Magic and Experimental Science*, by representing the supreme figure of the experimental science of the seventeenth century as “the last of the magicians,” and “the last wonder-child to whom the Magi could do sincere and appropriate homage.”⁴ In seven years of his early life, he made his first calculation of the attraction of the moon, added important findings in the solution of problems by the new method of infinite series, discovered the binomial theorem, invented fluxional calculus, worked hard on the subject of light, prepared his course of Lucasian lectures, and edited the *Algebra* of Kinkhuysen and the *Geography* of Varenus, enough accomplishment, says More, for a whole lifetime.⁵

Indeed, there seems to be no end to the list of Newton's achievements. The polar coordinate system, which has usually been ascribed to Jacques Bernouilli (in *Acta eruditorum* of 1691 and

² Quoted by Lord Keynes in the Royal Society's *Newton Tercentenary Celebrations*, 1947, p. 28.

³ R. J. Forbes, “Was Newton an

Alchemist?” *Chymia*, II (1949), 27.

⁴ *Newton Tercentenary Celebrations*, 1947, p. 27.

⁵ More (1934), 288, 296.

1694) has recently been shown to date back to Newton's *Method of Fluxions*, composed by 1671, although not published until after his death in 1736.⁶

Keynes called Newton a magician because the discovery of secrets of nature was his aim. The million words and more that have come down in his manuscripts⁷ are of "no substantial value." Yet they "were nearly all composed during the same twenty-five years of his mathematical studies," and "are just as sane as the *Principia*, if their whole matter and purpose were not magical."⁸ A large alchemical section consisting of translations and notes taken from other books and manuscripts, but also containing the record of many experiments, is devoted primarily to the subjects of the transmutation of metals, the philosophers' stone, and the elixir of life. "The scope and character of these papers have been hushed up," wrote Lord Keynes, "or at least minimized, by nearly all those who have inspected them." His own conclusion was that "Newton was clearly an unbridled addict."

I have glanced through a great quantity of this—at least 100,000 words, I should say. It is utterly impossible to deny that it is wholly magical and wholly devoid of scientific value; and also impossible not to admit that Newton devoted years of work to it.⁹

It is also possible, although Lord Keynes does not directly say so, that Newton's secret alchemical activity as well as his secret Anti-Trinitarianism contributed to his "fearful, cautious and suspicious temper." "His deepest instincts were occult, esoteric, semantic—with profound shrinking from the world . . . a wrapt, consecrated solitary, pursuing his studies by intense introspection, with a mental endurance perhaps never equalled."⁹ He furthermore tried to find the secrets of the universe in apocalyptic writings like the book of Revelations or mystic interpretation of the measurements of Solo-

⁶ C. B. Boyer, "Newton as an Originator of Polar Coördinates," *American Mathematical Monthly*, LVI (1949), 73-78.

⁷ For yet other materials by and concerning Newton which keep coming to light, see G. Findlay Shirras in

Actes du VI^e Congrès International d'Histoire des Sciences, Amsterdam, 14-21 Août, 1950, I, 212-25.

⁸ *Newton Tercentenary Celebrations*, 29-30.

⁹ *Ibid.*, 31-32, 28.

mon's temple. But Lord Keynes believed that there was something magical about even his scientific thought and not merely his occult vocations or avocations, that he solved a problem intuitively and dressed it up in proofs afterwards.

Certainly there can be no doubt that the peculiar geometrical form in which the exposition of the *Principia* is dressed up bears no resemblance at all to the mental processes by which Newton actually arrived at his conclusions. His experiments were always, I suspect, a means, not of discovery, but always of verifying what he knew already.¹⁰

One might even go farther than Lord Keynes has done and compare Newton's frame of mind after some great mental effort of discovery to that of a medium coming out of a trance: those "intervals of despondency during which it was laid aside for trifling reasons,"¹¹ or, as he wrote to Flamsteed regarding his work on the theory of the moon, "when I have done it once, I would have done with it forever."¹² But let us come back to Lord Keynes' picture of him once more:

And when the turn of his life came, and he put his books of magic back into the box, it was easy for him to drop the seventeenth century behind him and to evolve into the eighteenth-century figure which is the traditional Newton... Magic was quite forgotten. He has become the Sage and Monarch of the Age of Reason.¹³

But in the nineteenth century he impressed William Wordsworth in somewhat the same way that he was to impress Lord Keynes in the twentieth:

... With his prism and silent face,
The marble index of a mind, for ever
Voyaging through strange seas of thought alone.¹⁴

Except for the two very important differences that it could be applied successfully mathematically and was quantitative rather than qualitative, and that it applied alike to terrestrial and celestial

¹⁰ *Ibid.*, 29.

¹¹ More (1934), 416.

¹² Letter of April 23, 1695; More (1934), 427.

¹³ *Newton Tercentenary Celebra-*

tions, 1947, 33.

¹⁴ Prelude, Book III, Residence at Cambridge, lines 61-63. The last two lines were not in the original version of 1805-6.

bodies, Newton's universal law of gravitation might seem to require an action of attraction from a distance which was as occult as the influence of the stars which had been maintained by the astrologers. And, after all, this latter influence could be passed on to terrestrial bodies too in the occult virtues of herbs, animals and minerals. At an earlier period in his life Newton once expressed himself as not unfavorable to such an occult influence. In 1675 he made the tentative suggestion that sun and planets

were kept apart by 'some secret principle of unsociableness in the ethers of their vortices,' similar to the principle which prevented the mixing of oil and water.¹⁵

But after the publication of the *Principia* he wrote to Bentley:

That gravity should be innate, inherent and essential to matter, so that one body may act upon another at a distance through a *vacuum*, without the mediation of any thing else, by and through which their action and force may be conveyed from one to another,

seemed to him an utter absurdity.

Gravity must be caused by an agent acting constantly according to certain laws; but whether this agent be material or immaterial, I have left to the consideration of my readers.¹⁶

If material, this agent or medium would be an ether,¹⁷ of which more anon.

For the ordinary run of Newton's contemporaries, however, there was little difference between gravitation and attraction. Thomas Baker wrote in 1700 of Newton's accomplishment:

another incomparable person, who has added mathematical skill to his observation upon nature, after the nicest enquiry seems to resolve all into Attraction, which, tho' it may be true and pious withal, perhaps will not be thought so philosophical.

¹⁵ Louise Diehl Patterson, in *Istis*, 41 (1950), 32.

¹⁶ More (1934), 379.

¹⁷ More (1934), 211: Newton's "discovery of an universal law of gravitation had forced on him the dilemma of

either assuming for bodies an occult property of attracting at a distance, or of postulating a gaseous medium which caused these attractions by its pressure."

The truth of it is, we may as well rest there, for after all Gravitation was never yet solved and possibly never may <be>, and after men have spent a thousand years longer in these enquiries they may perhaps sit down at last under Attraction, or may be content to resolve all into the power or providence of God.¹⁸

In a letter to Henry More of 1685, J. C. Sturm examined the demonstration sought from the phenomenon of gravity for a spirit of nature or hylarchic principle.¹⁹

Newton himself as late as 1717 showed belief in attraction in sublunar substances, for he appended to the second edition of his *Opticks* the query:

When *Aqua fortis* dissolves silver and not gold, and *Aqua regia* dissolves gold and not silver; may it not be said, that *Aqua fortis* is subtile enough to penetrate gold as well as silver, but wants the Attractive force to give it entrance . . . ?²⁰

For Caspar Bartholinus in his *Specimen of Natural Philosophy*, published at Amsterdam in 1697 ten years after Newton's *Principia*, there was no other quality which more deserved the name of occult than did gravity.²¹

The tendency to personify or idealize nature, which we have had occasion to note in so many other scientists of the seventeenth century, was still strong in Newton. He normally spelled the word, Nature, with a capital and regarded it as a Being second only to God, or at least as a wonderful universal mechanism. In his *Optics* he pictures Nature as delighted with the transmutation of metals,²² or assures us in Baconian vocables that, "Nature is very consonant and conformable to herself," and that, "thus Nature will be very conformable to herself, and very simple," soon adding, "And therefore that Nature may be lasting."²³ A paper submitted by him to

¹⁸ *Reflection upon Learning*, 1700, p. 85.

¹⁹ *Ad . . . Henricum Morum . . . Epistola . . .*, Nürnberg, 1685, p. 17.

²⁰ Quoted by Thomas S. Kuhn, "Newton's '31st Query' and the Degradation of Gold," *Isis* 42 (1951), 296.

²¹ *Specimen philosophiae naturalis praecipua Physices capita exponens in gratiam iuventutis academicae*, Am-

sterdam, 1697, p. 109: "Non alia magis qualitas occultae nomen meretur quam gravitas."

²² *Optics*, Query 30; cited by L. T. More (1934), 163. *Opera* IV (1782), 241.

²³ *Optics*, Query 31; More (1934), 164-65. *Opera*, IV (1782), 242, 258, 260.

the Royal Society on December 9, 1675 contains the following passage:

Nature is a perpetual circulatory worker, generating fluids out of solids and solids out of fluids, fixed things out of volatile and volatile out of fixed, subtile out of gross and gross out of subtile, some things to ascend and make the upper terrestrial juices, rivers and the atmosphere, and by consequence others to descend for a requital to the former. And as the earth, so perhaps may the sun imbibe this spirit copiously, to conserve his shining and keep the planets from receding further from him.²⁴

Here nature becomes the marvelous mechanism and the personification is transferred to the sun, while the circulatory ascent and descent on earth remind us of Kepler. Or, in a letter to Oldenburg, Newton expressed his conception of God as

creator and governor of this mechanistic universe, who first created the fermental aether and its principles of action, and then assigned to a lesser power, Nature, the duty of forming and operating the perceptible mechanical universe.²⁵

Such a remark was, of course, a pious commonplace of the time. Thus Robert Hooke affirmed concerning matter and motion:

Both these Powers I take to be the immediate Product of the Omnipotent Creator, and immutable in themselves, without a like Command of the same Power.²⁶

In any case, it was not surprising that Halley should regard the third book of the *Principia* as a revelation of "the abstrusest secrets of nature."²⁷ In the same year Varignon wrote in like tone in dedicating his *Project of a New Mechanics* to the members of l'Académie Royale des Sciences:

Nature, so stingy of its treasures to others, so reserved in its secrets, has failed to defend itself against your intellectual penetration and subtle researches.²⁸

²⁴ More (1934), 181, quoting Brewster, I, 390.

²⁵ More (1934), 182.

²⁶ Quoted *Isis*, 38 (1948), 151, by Louise D. Patterson from Hooke's

Posthumous Works (1705).

²⁷ Letter to Newton of April 5, 1687; More (1934), 315.

²⁸ *Projet d'une nouvelle mécanique* . . . , Paris, 1687.

The passages quoted above from Newton further indicate his hypothesis of a fermental ether and spirit which nourished the sun and from which "perhaps may all things be originated."²⁹ Or, as summarized by Louise Diehl Patterson, Newton in 1675

explained the attraction of the earth for a falling body as due to a circulating ether, condensed when it converged upon the earth, which bore down upon any objects in its path with a force proportional to the areas of their parts, descended to the center of the earth for replenishment by a process like fermentation or coagulation, turned into atmosphere as it rose out of the earth, and eventually receded into outer space, whence it returned again as the gravitational ether.³⁰

Like most men of the closing seventeenth century, Newton still believed in the existence of animal spirits in the human body. He described them as of an ethereal nature and "subtle enough to pervade the animal juices as freely as the electric, and perhaps magnetic, effluvia do glass." He thought of these animal spirits as generated in the heart by fermentation and conducted thence to the brain. "All the motions we see in animals" were produced by the soul impelling this ethereal spirit into the motor nerves and moving the muscles by its inspiration.³¹

At times, however, Newton preferred the hypothesis of hard particles of matter moved by mutual mechanical action or attraction as a possible explanation of all physical, chemical, and even vital phenomena.³² Huygens held that the ether was composed of very tiny particles which were very hard and exceedingly elastic, but he balked at the very rare matter with which Newton would fill the celestial spaces.³³

Finally, in the General Scholium which was added to the 1713 edition of the *Principia*, Newton said that, if an occult substance were preferred to an occult cause, he might go on to speak of a subtle spirit pervading all bodies and causing gravitation, electrical energy, light, heat, sensation and nervous stimuli.

But these are things that cannot be explained in a few words, nor are we furnished with that sufficiency of experiments which is required

²⁹ More (1934), 182.

³⁰ *Isis*, 41 (1950), 32-33.

³¹ More (1934), 181.

³² *Optics*, Queries 30-31; More (1934), 163-64.

³³ *Opera reliqua*, I (1728), 123.

to an accurate determination and demonstration of the laws by which this electric and elastic Spirit operates.³⁴

Thus a mechanistic and mathematical universe might have its spirit too. Dear spirits, to parallel a remark in an earlier volume, what a treasured legacy from animism to mechanism!

The conception of a material ether was not much more satisfactory. After Olaus Roemer in 1676 had demonstrated that the velocity of light was some seven hundred thousand times that of sound, it became necessary to regard the ether as a fluid which was seven hundred thousand times more rigid than air but with only one seven hundred thousandth of the density of air. It must be so rare as not to retard the planets appreciably and at the same time "immensely more rigid than steel," while in the early nineteenth century it became necessary to give it "the impossible attributes" of being at once "the rarest of gases and the most rigid of solids."³⁵ Copernicus, Tycho Brahe and others are often depicted as rejecting the conception of solid spheres by which the celestial bodies were moved. Now the entire ether was solid.

The vortices of Descartes might well seem to many more befitting a material and mechanical universe, and it is small wonder that the textbook of Rohault (1620-1675) had so many editions in the eighteenth century, even including three of an English translation of it which had been first printed as late as 1723.³⁶ However, it was made from the Latin edition of 1710 and 1719, which embodied amplifications "from the philosophy of Isaac Newton" by Samuel Clarke.

Newton's great work received a review of only one and a half duodecimo pages in the *Journal des Sçavans*. It was granted that it was not possible to make demonstrations more precise or exact than those which he gave in the first two books on gravity, elasticity, the resistance of fluids, and "attractive and impulsive forces." But his attempt in the third book to explain the system of the world was held to rest upon hypotheses which were for the most part arbitrary, such as the principle that all the planets exert gravity

³⁴ More (1934), 554.

³⁵ More (1934), 118, 120.

³⁶ George Sarton, "The Study of Early Scientific Textbooks," *Isis*, 38 (1948), 137-48, especially 144-45.

reciprocally upon each other, and the explanation of the tides based upon it. The reviewer concluded:

So to make the most perfect work possible, Mr. Newton has only to give us a physics as exact as his mechanics. He will have done this, when he shall have substituted true movements in place of those which he has conjectured.³⁷

In *Acta eruditorum*, on the other hand, the *Principia* received a review of a dozen pages.³⁸

Newton's interest in chemistry and alchemy dated from his schooldays at Grantham, where he had lodgings with an apothecary who introduced him to such pursuits.³⁹ Later his expense accounts itemize expenditures for purposes of books, apparatus and chemicals.⁴⁰ A list of 119 titles of alchemical books in his own handwriting was recently offered for sale. He spent much time in his laboratory and upon experiments of which the transmutation of metals was the prime object.⁴¹ He was curious concerning reported transmutations elsewhere.⁴² He employed such current chemical jargon as "pores," "ferment" and "menstruum."⁴³ He wrote to Boyle that by continual fermentations in the bowels of the earth aerial (i.e. gaseous) substances were raised by the action of acid menstrooms out of all kinds of bodies to compose the atmosphere. Of these the metallic were the most permanent and constituted the air we breathe, since as the heaviest they remained next to the earth's surface, above them being lighter vapors.

The air also is the most gross unactive part of the atmosphere, affording living things no nourishment, if deprived of the more tender exhalations and spirits that float in it; and what more unactive and remote from nourishment than metallic bodies?⁴⁴

In the same letter he argued that chemical action depended on the size of the particles and whether they were "sociable" or "unsociable."

Newton's recent biographer well asked, "Why should Newton

³⁷ JS XVI, 237-38.

³⁸ VII (1688), 303-315.

³⁹ More (1934), 10.

⁴⁰ See, for example, More (1934),

54.

⁴¹ More (1934), 247-48, 249, "the

transmuting of metals being his chief design."

⁴² More (1934), 50-51.

⁴³ *Ibid.*, 212, 214. Forbes in *Chymia*, II (1949), 34-35.

⁴⁴ Quoted More (1934), 215.

not be an alchemist? All his contemporaries, even Boyle, Locke and Hooke, were . . ."⁴⁵ However, none of his contemporaries wrote the *Principia*. More was further of the opinion that in his later years Newton

seems to have lost his faith in the practicability of transmutation. At least, in his letters to Locke, he expressed a doubt that Boyle had found an alchemical recipe and had kept it a secret for twenty years.⁴⁶

I am afraid that this is not quite the inference to be drawn from the letters to Locke. No sooner had Boyle died than Newton wrote to Locke:

I understand Mr. Boyle communicated his process about the red earth and mercury to you as well as to me, and before his death procured some of that earth for his friends.

Within a month he wrote again:

Mr. Pawling told me, you had writ for some of Mr. Boyle's red earth, and by that I knew you had the receipt.

In a third letter, later in the year, he expressed the opinion that Boyle's being already in possession of this recipe was the reason why he procured the repeal of the Act of Parliament against Multipliers, and also was the basis of his publishing "many years ago" a paper concerning "such mercuries as would grow hot with gold." Therefore the recipe had been known to Boyle sixteen or twenty years since, and yet had not resulted in successful transmutation. Newton thinks that by it the color and properties of mercury may be altered, but not gold multiplied. He heard some years ago of a company who tried it unsuccessfully and lost money in the attempt. Boyle admitted to Newton that the recipe had gotten abroad "among several chemists, and therefore I intend to stay till I hear that it succeeds with some of them." Newton adds that Boyle did not reveal the secret in its entirety to him, and so he could not make it work, even if he tried.⁴⁷

⁴⁵ *Ibid.*, 159. See also R. J. Forbes, "Newton als Alchemist," a paper read at the session of *Genootschap voor geschiedenis der Geneeskunde, Wiskunde en Natuurwetenschappen*, at

Haarlem, 6-7 Nov., 1948, and "Was Newton an Alchemist?" *Chymia*, II (1949), 27-36.

⁴⁶ More (1934), 161.

⁴⁷ See the selections from the letters

All this may indicate growing scepticism on Newton's part, but it also may indicate the cautious advances and withdrawals of one desirous of penetrating to an alchemical secret, especially on the part of so secretive, suspicious and timid a nature as Newton's.

On the other hand, Newton's interest in alchemy and transmutation may be viewed as but one phase of his broader effort to solve the secrets of Nature, combining terrestrial chemistry with ethereal astronomy. This breadth of interest is further illustrated by his buying in 1663 at Stourbridge Fair a book on judicial astrology.⁴⁸ It is seen also in his younger contemporary, Sir Hans Sloane, secretary of the Royal Society and Newton's successor as its president, whose collections, which formed the nucleus of the British Museum, are rich in both alchemical and astrological manuscripts.

Professor Forbes has argued that Newton was "not intent on gold-making but seeking a theory of the structure of matter."⁴⁹ If so, I can only say that he neither got very far, nor displayed much originality in his thought on the problem. His particles "of the first composition," "of the second composition," and "of the last composition," would seem obviously to have been suggested by Descartes' three varieties of matter, although differing somewhat from them. His pores are akin to Descartes' interstices. Also particles were a commonplace of Boyle's corpuscular philosophy—not to mention its earlier exponents—just as cusps and pores were trite chemical concepts.

Newton's medicine was less nasty and magical than that of Boyle and Bacon, but, like many of his contemporaries, he "both doctored himself during his minor ailments and suggested simple remedies to his friends."⁵⁰

His breakfast was orange-peel boiled in water, which he drank as tea, sweetened with sugar, and with bread and butter. He thinks this dissolves phlegm.⁵¹

He sometimes took Leucatello's Balsam, of which the chief ingredient was Venetian turpentine. He recommended

in More (1934), 369-70, 372-3.

⁴⁸ More (1934), 32.

⁴⁹ *Chymia*, II (1949), 36 *et supra*.
See also S. I. Vavilov, "Newton and

the Atomic Theory," *Newton Tercentenary Celebrations*, 1947, pp. 43-55.

⁵⁰ More (1934), 128.

⁵¹ *Ibid.*, 207, quoting Dr. Stukeley.

For the measell, plague, or small-pox, a half an ounce in a little broth. Take it warm, and sweat after it. And against poison and the biting of a mad dog; for the last you must dip lint and lay it upon the wound, besides taking it internally. There are other virtues of it; for wind, cholic, anoint the stomach, and so for bruises.⁵²

An autograph medical manuscript of five leaves recently offered for sale shows his interest in iatrochemistry, including a method of using tincture of Sol (gold), and how to extract tincture of coral and fixed salt of amber, as well as a medicine to clear the eyesight,

Of late Newton has been chided for seldom indicating the previous literature and experimentation on the subject in hand, and those from whom he may have received suggestion. This, if true, is probably another magical trait in him, continuing the method of secrecy and exaggeration of one's own feats and performances. Already in his lifetime the charge of plagiarism was brought against him by Hooke, Aubrey and Hearne,⁵³ and was bandied back and forth between himself and Leibniz with reference to the differential calculus. Professor Patterson tries to show that Hooke's inchoate gravitation theory did influence Newton, or writes:

Hooke had proposed as early as 1678 that the oval shape of the planet Mercury was due to its "vertiginous motion;" his writings contain numerous references to the same theory as regards the earth. Newton seems clearly to have borrowed in this instance.⁵⁴

Similarly Louis Trenchard More said:

Newton devotes the third book of his *Optics* to the phenomena of colours produced by successive reflections and refractions in thin transparent plates. While it may have been the custom of the day to refer only casually to the work of others, Newton unfortunately gives the impression that the whole subject, excepting its bare discovery, was the result of his own labour. Hooke's name is not even mentioned,

⁵² *Ibid.*, 206.

⁵³ Louise Diehl Patterson, "Hooke's Gravitation Theory and its Influence on Newton," *Isis*, 40 (1949), 327-41; 41 (1950), 32-45; p. 328. See also Koyré's note, *Isis* 41 (1950), 195-96, and Miss Patterson's reply, *Ibid.*, 304-5.

⁵⁴ *Ibid.*, 336. See also Philip E. B. Jourdain, "Robert Hooke as a Precursor of Newton," *The Monist*, 23 (1913), 359; and A. R. Hall, "Two Unpublished Lectures of Robert Hooke," *Isis*, 42 (1951), 219-30, who is less favorable to Hooke's claims.

and no one would suppose that he had described all the essential phenomena of these colours in his *Micrographia* almost a half century earlier, or that he had been the source from which Newton had derived his composite-wave hypothesis.⁵⁵

It may be that the noble *virtuosi* of the Royal Society were a little inclined to look upon Hooke as a sort of handy man and mechanic, not to say servant or menial, whose function it was to supply them with ideas as well as to regale them with experiments.⁵⁶ But after all the *Micrographia* was a well known work which people had been reading for years, and Newton hardly needed to tell them what was in it. He could almost take it for granted that they knew already.

As for gravitation, the whole problem had been raised ever since Copernicus had suggested that the earth was not the immobile center of the universe, towards which heavy bodies naturally tended, and that the other planets were not superior bodies which naturally stayed aloft where they were. Then the situation became complicated by Kepler's discovery that the planet Mars moved in an elliptical orbit, with neither earth nor sun at the center but with the sun at one of the foci. The members of the Royal Society may have puzzled over this but they did not get very far. As Koyré has noted, the difficulty of deducing elliptical orbits from attraction inversely proportional to the square of the distance rendered the efforts of Wren, Hooke and Halley vain, and checked even Newton for fifteen years.⁵⁷ In 1669–1670 *Philosophical Transactions* took a quite primitive view of the problem, saying concerning a recent work by Wallis:

he doth not think fit to explicate the Physical Cause of Gravity, whether it proceed from an innate quality in the heavy body itself, or an universal tendency of circumambient bodies to the center, or a magnetical power in the earth.⁵⁸

⁵⁵ More (1934), 116.

⁵⁶ C. E. Raven in his life of John Ray (edition of 1942, p. 145) remarks that Hooke "was unable to keep the *virtuosi* of the Royal Society "permanently amused."

⁵⁷ *Actes du VIe Congrès International d'Histoire des Sciences*, I, 206, note 22.

⁵⁸ PT IV, 1087, reviewing, John Wallis (1616-1703), *Mechanica sive de motu tractatus geometricus*.

Koyré agrees with Professor Patterson that Hooke "did not receive from the historians of science of the 19th and 20th centuries the fair and unprejudiced treatment to which he was entitled."⁵⁹ He holds that since 1674 Hooke was "in full possession of a scheme of the system of the universe almost identical with that of Newton," and believed that all the celestial bodies not only drew their own parts towards their centers but exerted a reciprocal attraction on one another which varied with their distance apart, and that all moving bodies continued to move in a straight line unless deflected by some other force. Newton failed to point out to Hooke an error in the latter's letter of January 6, 1680, to him, yet was stirred by that letter to complete the solution of the problem.⁶⁰

Newton solved the problem in more complete and thorough fashion than Hooke or anyone else had done or perhaps even contemplated doing. He got and keeps the credit for it. And, despite all that his predecessors may have done to pave the way for its acceptance, it was a long time before his solution was generally accepted.

In 1695, the author of a project for a treatise of physics, to be called *A Natural History*,⁶¹ although he regarded the universe as a machine, whose movement was called Nature, felt that he must go back to the time when that machine was first set in motion and base the principles of physics upon the story of creation. He reduced these principles to nine; of which the first was that God first made matter which had no form; the second, that the first form was motion; the third, that the second form was the division produced by fire in the rest of matter. On the basis of these principles he promised to explain what he evidently still considered to be unsolved problems and important scientific questions, such as the tides, the influence of the stars, experiments with the magnet, and the breaking of tears of glass (Prince Rupert's drops), as well as explosives and all mechanics.

Newton's solution was until our own times the solution. Not

⁵⁹ *Isis*, 41 (1950), 195.

⁶⁰ *Actes du VIe Congrès International d'Histoire des Sciences*, I, 207-210.

⁶¹ *Projet d'un traité de Physique*,

qui aura pour titre: *Histoire de la nature*, Marseille, 1695, in-4. Reviewed: JS XXIV, 59-60.

merely was he "the last of the magicians." He was the discoverer of a single magical formula, the universal law of gravitation, which, like the universal medicine of the alchemists and iatro-chemists, cured or was thought to cure all diseases and to iron out all difficulties in the physical world. When its mathematical ingredients were put to the test, they were found to hold true, to work. Men no longer had to worry about occult influence or action at a distance, or resort to effluvia or vortices or ferments. Mass and momentum took their place. One rejected all occult influence and all action at a distance which could not be accounted for in Newtonian terms. On the other hand, so long as reputed phenomena could be accounted for on those terms, one insisted that there was nothing occult or magical about them, that they belonged integrally to experimental science and mathematical method—let some cynics

and body, which continued to be a fruitful seed-ground of magic, except for biology and medicine and psychiatry and human relations, which were still open fields, a dividing line had been drawn between science and superstition which was sharper and more satisfactory than any that had been previously attempted. Not all of nature's secrets had been solved, but many questionable beliefs and practices were dropped and declared, or tacitly assumed, to be unnatural. A *modus vivendi* or *modus sciendi* had been arrived at, and, for the time being at least, the boundaries of natural and experimental science seemed to be more distinctly defined than they ever had been before. They had been so drawn as to lie outside of theology as well as of magic, and to exclude miracles, demons and diabolical or spiritual action as well as other forms of the occult.

Despite its many new discoveries and rapid progress, the seventeenth century had been in certain respects a time of growing scepticism and increasing scientific uncertainty. Aristotelian physics and natural philosophy had been attacked and in large measure overthrown; Galenic medicine had been questioned by iatrochemists. The once universal law of nature of the rule of inferior creation by the superior heavenly bodies had been rocked on its foundation. Men were losing faith not only in astrology but even in the regularity of the courses of the heavenly bodies. Huygens made mechanical clocks keep better time, but he doubted whether the periods of the stars could be bound to certain laws and perpetual Tables, or that they forever kept the same course.⁶² The brilliant hypotheses of Descartes might charm for a time. Effluvia, corpuscles and pores might satisfy the inquiring mind temporarily. Incorrect notions and practices such as animal spirits and phlebotomy still held their own, but Halley's identification of the comets of 1531, 1607 and 1682 had to wait until 1758 for verification. Newton's formula eventually restored the old faith in the regularity of the movements of the heavenly bodies, reinforced the Cartesian and Galilean faith in a mechanistic world of nature, and created a new faith in natural Science, and in the application thereto of mathematical method.

⁶² *Oeuvres*, I (1888), 307.

CHAPTER XL

THE LAST DECADE

Introduction—General textbooks: Sperlette, Cally, Pourchot, Caspar Bartholinus, Regis—The physics of Leclerc—Menestrier's objection to the new physics—Progress of chemistry: Barchusen, Wotton, Baker—Medicine reviewed by Bertini and Barchusen—Wolf on amulets—Schelhammer and Martius on natural magic—Connor and Lami on miracles—Garmann on miracles of the dead—Conclusion.

For that which moves towards an end involves all things necessary to that end, whether they be precedent or consequent or concomitant.

—POMPONAZZI

It may seem in the nature of an anti-climax not to terminate this volume with the chapter on Newton. But, while we have already carried certain subjects to the end of the century, there remain a number of books printed or written between 1687, when the *Principia* appeared, and 1700, which may be combined with others which look back upon and review the literature or accomplishment of the century, to afford a final glimpse of the state of thought with regard to magic and experimental science at the close of the seventeenth century. We first present several general textbooks in philosophy to illustrate to what extent the *cursus philosophiae* and teaching of natural science had altered, and what the general information as to nature and the attitude towards experimental and occult science of the average university graduate was likely to be. Then, turning to more specialized fields, we treat of the Physics of Jean Leclerc and an objection to the new physics by Menestrier. Barchusen's *Pyrosophia* will serve as an example of chemistry, with the varying comments on chemical progress of Wotton and Baker. Bertini and Barchusen will review the state of medicine for us. As to magic, we note the work of Wolf on amulets, that of Schelhammer

against natural magic, and that of Martius in favor of it. Regarding miracles we shall consider Connor on suspending the physical laws of nature, temper this by the Physical Conjectures of Father Lami, and conclude with Garmann on miracles of the dead. Of these writers six were French, one a Dane, one Dutch, one Italian, three English and five German.

When Johann Sperlette, professor of philosophy at Halle, composed a New Physics or Philosophy of Nature for student use, he judged it advisable to adhere to the scholastic method of presentation and instruction and divided his book into four parts containing two or three disputations each, concerned with those questions which are customarily taken up in the schools, and still following the commentators of Coimbra where the opinion of Aristotle was involved. The disputations were on principles and elements, matter, form, the universe, the heavens, meteors, man, brutes and plants, and comprised such usual sub-topics as vacuum, rarefaction and condensation, reflection and refraction, tides and origin of springs, internal and external senses, imagination, memory and reminiscence. The influences of the stars were still discussed and one marvelous effect of fire, namely, glass. On the other hand, the circulation of the blood was touched on, and it was argued that all the actions of brutes can be explained mechanically.¹

Pierre Cally, royal professor of eloquence and philosophy and "gymnasiarch of arts" in the university of Caen, published there in 1695 a general textbook of philosophy in four volumes devoted respectively to philosophy in general and logic, metaphysics, physics, and anthropology and theology.² The section on physics begins with nature, the principles of natural body, matter and form, but adopts the three Cartesian elements. "There is no vacuum in

¹ *Physica nova seu philosophia naturae ad usum academicae juventutis secundum methodum hactenus in scholis receptam tradita, in qua omnes naturae effectus, quantum fieri potest, mechanice seu per inviolabiles motuum leges explicantur* . . . , Berlin, 1694, in-4: *Acta eruditorum*, XIII, 390-93. The Compendium of Natural Science of Johann Murralt, published

in German at Zurich in 1694, was very briefly noted in the same journal, XIV, 183. He had previously opened an anatomical *Collegium* at Zurich on Jan. 5, 1686, with lectures in the vernacular.

² *Universa philosophiae institutio*, Caen, 1695, 4 vols. in-4. BN R.2018-2021. Reviewed in JS 24, 92-99.

nature." To speak of the spirit of the world does not mean that the universe is a big animal, but refers to Descartes' first element. Mixed body is successively considered as hot, cold and tepid; liquid, hard and soft; light, heavy and elastic. The old four causes are enumerated and both Ptolemaic and Copernican systems are set forth, also that of Tycho Brahe. Cally says that the Roman church no longer enforces the decree of 1616 against the movement of the earth. Although he had accepted the Cartesian elements, he does not give the Cartesian system of vortices. He employs the term, geology, for terrestrial phenomena, just as he uses the word, anthropology, for his discussion of the human mind or soul. Under Geology he includes geography, fire—including earthquakes, glass and gunpowder, magnet and iron, salts, oils, and other bodies found underground. Turning from earth to water, he treats of hydrography, the tides, and the origin of springs. Despite the argument of "a recent French writer"³ (Mariotte?) that precipitation is the source, he still thinks that some come from the sea. He notes the weight and elasticity of air, but his much longer treatment of meteors remains largely Aristotelian.⁴ Of comets, however, he speaks under the heavens. He does not regard them as new divine creations, with no pre-existing material, to terrify men, for God, once the world was made, abstained from creating. Someone who wanted to prove that comets portend good or ill for men might point to the fifteen years of war which have followed the comet of 1680. But such an argument would be sophistical. He grants that the moon affects the tides, if not shellfish. But he contends that the heavens do not influence unless by their motion, which, however, includes their light, and that they are not the sole cause.

In his anthropological section he presents the circulation of the blood, but still distinguishes three kinds of spirits from liver, heart and brain; and four kinds of dreams, divine, diabolical, natural and animal.⁵ This last classification we met with in 1625 in Caspar Bartholinus the Elder.

Another textbook of philosophy in four volumes was put out the same year, 1695, by Edme or Edmund Pourchot (1651–1734), once

³ *Ibid.*, III, 294–96.

⁵ *Ibid.*, IV, 222, 248, 231, 332.

⁴ *Ibid.*, III, 311–84.

professor, rector and syndic of the University of Paris.⁶ But both its second and third volumes were on physics, logic and metaphysics being combined in the first tome, and the fourth dealing with moral philosophy. Similarly the *Cours* of Sylvanus in 1690 had devoted twice as much space to physics as to logic, metaphysics and morals combined. Another feature of Pourchot's book was that the views of ancient and modern philosophers were compared. Thus in setting forth the primary and insensible principles of natural bodies, those of Pythagoras, Plato and the Peripatetics which are commonly called metaphysical are first considered, then matter according to Aristotle, substantial form according to the Peripatetics, the principles of Democritus and the Epicureans past and present which are wont to be called mechanical, and the principles of Descartes.⁷ In taking up the sensible and secondary principles of natural body and of mixed bodies, Pourchot first asks what and how manifold is a sensible element, then treats of fire—though not an element, air, water and earth, the three principles of the chemists, mixture and resolution of the mixed. Under the qualities and affections of simple natural body are considered size and divisibility, figure and position, motion and rest, time and place, motion, gravity and so on to the secondary and composite affections of bodies.

Pourchot declares that so-called manifest qualities, such as heat, are really just as occult as those which are commonly so designated, and that these, together with sympathy and antipathy can all be explained mechanically, from sympathetic powder, antipathy of lamb and wolf, action of torpedo and tarantula and basilisk (if true), through amulets to magical or sympathetic inks.⁸

The Aristotelian doctrine of comets is stated but rejected, and it is recognized that the orbit of Mars is elliptical. Judicial astrology is rejected, as we have noted in a previous chapter. So are divination

⁶ *Institutio philosophica ad faciliorem veterum ac recentiorum philosophorum lectionem comparata*, Paris, 1695, 4 vols. in-12. BN R.9923-9926. Reviewed in JS 24, 155-61, which calls him "ancien professeur, recteur et syndic." According to Zedler and Mi-

chaud, he taught at Paris in Collège des Grassins and Collège Mazarin for 26 years, 1677-1703.

⁷ *Ibid.*, II, 46-93.

⁸ *Ibid.*, II, 411-17; ed. of 1711, II, 481-86.

from the letters of one's name, chiromancy and geomancy. There is some truth in physiognomy and metoposcopy, yet in many respects they are found wanting.⁹

Descending to our globe of earth and water, Pourchot considers its division and parts, the tides, saltness of the sea, origin of springs, and subterranean fires, earthquakes, and mineral baths. Almost all now agree that tides are due to the moon; Descartes' version of this is repeated as the best. Aristotle's explanation of the origin of springs is repeated, and the view that they come from the sea, but precipitation is accepted as the correct explanation. The treatment of fossils (i.e., minerals) divides into five chapters on salts, oily juices, stones—their virtues are omitted as uncertain and often false, the magnet, and metals. Astrologers and alchemists say that it is better to work in silver on Monday, in Mercury on Wednesday. But transmutation and potable gold are opposed by Pourchot.¹⁰

Plants possess many and great medicinal virtues; it is a shame how few are commonly used. The old view that imperfect animals are generated from putrefaction is opposed, and Redi is cited. It seems likely that animal spirits are prepared in the cortex or ashy part of the brain from arterial blood and are perfected in the medulla or callous part, which furthermore is perhaps the seat of the internal senses. Descartes was wrong about the pineal gland. Sleep and waking are ascribed to the animal spirits.¹¹ The heart is a muscle and its movement does not come from fermentation or ebullition of the blood but from the impulsion of the animal spirits, as happens in other muscles, as Harvey teaches. In 1665, Lower transfused the blood of one dog to another, but an attempt with human beings at Paris had an unhappy outcome. The blood of a young man, instead of restoring or rejuvenating that of the old, acted like new wine in old bottles and rotted. In consequence Parlement wisely decreed on January 2, 1670, that no one henceforth should dare to perform an experiment so pernicious and full of danger to human society.¹²

In an earlier chapter we have considered the Physical Handbook of Caspar Bartholinus the Elder, printed in 1625.

⁹ *Ibid.*, III (1695), 99.

¹⁰ *Ibid.*, III, 229, 234-35.

¹¹ *Ibid.*, III, 263-64, 295-99, 318-23.

¹² *Ibid.*, III, 416, 419, 428.

The *Specimen of Natural Philosophy* of Caspar Bartholinus (1655–1738) first appeared in 1690–1692, when it was further described in its title as “illustrated by the newest reasons and experiments.”¹³ In the edition of 1697, which concerns us here, the title was otherwise worded as setting forth the main topics of physics for the sake of academic youth.¹⁴ In the preface to the reader Bartholinus emphasized the great progress which natural science had made “in our age,” but regarded as most pitiable every investigator of nature who did not recognize the Author of nature. True it was that natural phenomena were best explained by mechanical consideration of matter. But every machine has to have a maker and mover.

In the first chapter Bartholinus argues that hypotheses are necessary in natural science, because we perceive only externals and cannot penetrate to the heart of things. Also the same effect may have different causes, as in the case of rarefaction, which may be produced both by heat and cold. Even false hypotheses may be useful, as the history of astronomy has shown, but no hypothesis should be admitted, unless it squares with reason and experience, and unless we perceive it clearly and distinctly. Descartes’ own mistakes show, however, that this last criterion is not always dependable. Caspar thinks nevertheless that the human mind cannot devise an absolute chimera.

Turning in the second chapter to principles, Bartholinus rejects privation but retains form and matter. All difference in forms, however, arises from motion, magnitude and figure. The rational soul is the only form which can exist *per se* without matter. Inseparable from matter are extension and divisibility, place and time. Motion is the measure of time, rather than time the measure of motion. Mariotte corrected Descartes as to motion by various experiments and showed that the laws of motion varied as bodies were endowed with greater or less elasticity. On motion depend

¹³ *Specimen philosophiae naturalis novissimis rationibus et experimentis illustrata disputationes* I–V, 1690–1692, in-4, 150 pp. BM 538.f.21 (1.).

¹⁴ *Specimen philosophiae naturalis praecipua Physices capita exponens in*

gratiam iuventutis academicae. Accedit de fontium fluviorumque origine ex pluviis Diss. physice, Amsterdam, Apud Henricum Wetstenium, 1697. 285 pp. BN R.13005.

all changes and qualities which are produced in nature by secondary causes. Descartes held that the quantity of motion had remained unchanged from the beginning until today, but Bartholinus regards this as uncertain. He recognizes the law of inertia, that bodies, whether in movement or at rest, never change that state unless they are impelled to movement by another body or are stopped. Once some philosophers explained by avoidance of a vacuum all those movements which moderns more correctly account for by the weight and gravity of the air. Boyle's air pump is mentioned, and the fact that water will rise only 32 feet.

From the fourth chapter on motion we turn to successive chapters on heat and cold; fluid and solid, rare and dense; light and color; sound, taste and odor. It is credible that heat is nothing but the agitation of insensible particles produced by the very subtle ethereal matter which fills the pores of all bodies. And it may be safely asserted that cold is nothing but absence and diminution of heat, despite Du Hamel's frigoric effluvia. Light is the motion of an ethereal substance, and its rays are real bodies. Descartes thought that the diffusion of light was instantaneous, but Roemer has proved from the eclipses of the satellites of Jupiter that it takes time. Newton is not mentioned in connection with color, and it is discussed whether white and black should be called colors. Sound consists in a tremulous movement produced by the collision of two bodies, communicated to the air, and so brought to the ears. Tastes consist in a certain magnitude and figuration of particles, from which all their variety arises. Odors consist in the substantial but very subtle effluvia of particles.

The ninth chapter is on gravity and magnetic force. Gravity is the quality by which bodies seek the center of the earth, and its action cannot be impeded by the interposition of any body thus far known to us. No other quality more deserves the name of occult than gravity. Newton's law of gravitation and application of it to the celestial bodies is not noticed, but Descartes' vortices and Huygens' centrifugal force are mentioned. The properties of the magnet are commonly called occult qualities. The magnet neither attracts nor is attracted, but there is impulsion by some intermediate body so subtle that it eludes our senses. It is highly probable that

from the earth itself, especially its interior, as from a magnet, there are continual streams from north to south and vice versa.

In the tenth chapter on the elements, they are defined as minutest and insensible particles of matter. The Aristotelian and Cartesian elements are also described, and the chemists' compounds.

The eleventh chapter is on the system of the world and the heavenly bodies. The Ptolemaic system is rejected as contrary to the phenomena. It is almost a toss-up between those of Tycho, Copernicus and Longomontanus, but the Copernican seems simpler and more suited to easy comprehension of particulars. From the movement of the sunspots, which undoubtedly come from the sun itself, recent astronomers calculate that the sun revolves about its own axis in 26 or 27 days. It is not the center of the universe, but only of its own vortex. Comets are celestial bodies which migrate from one vortex to another, and the same one might recur. That the moon has no atmosphere distinct from the ether, is demonstrated from the occultations of stars by the moon. The vanity of astrology is shown by the fact that the illustrious scientific societies of the seventeenth century neglect it, although occupied with astronomy, cosmography, geography, navigation, chronology and physics.

Descending to the air and meteors, Bartholinus estimates the earth's atmosphere as hardly a mile in height, although he has said that its weight raises water 32 feet, although he later holds that the precipitation from it will supply all springs and rivers, and although he still speaks of three regions of air. He attributes the rusting of iron and other metals to saline and nitrous exhalations from the earth, but regards respiration as necessary for the circulation of the blood and life. Air is also taken in through the pores of the human body, and the experiments of Sanctorius proved that as much is evacuated through the pores in one day as through the bowels in fifteen days. Incidentally the wrinkles of fingers and hand are called the stumbling-block of chiromancy.

The thirteenth chapter is on the globe of earth and water. Three parts are distinguished: exterior, *media* containing minerals and metals, and interior, "which is unknown to us but plausibly supposed by some to be fiery and of magnetic nature." When he adds that that globe consists chiefly of terrestrial, watery and fiery particles,

he appears to retain—with air—the old four elements. He speaks of the earth's crust and of strata composing it which are probably sediments deposited by inundations and are subject to rupture. There are traces of the sea on the highest mountains, and in many places new-made land, either deposited by rivers or uncovered by recession of the sea. Mountains, rivers and islands have altered in the course of time. Springs come from rain, the water percolating through the strata, and from the springs rivers which flow into the sea. One third of the rainfall would suffice for all the rivers. The old question, why the sea is salt, is not forgotten, but almost all now agree that tides are controlled by the moon. Stones and metals do not grow as animate bodies do. There is no vegetation in them, no seeds analogous to the eggs of animals. Animate bodies grow by the internal apposition of particles; stones and metals increase by the external apposition of parts. Bartholinus thinks that gems and stones have been produced from fluid matter. He believes that fossil shellfish and the like were parts of animals.

The fourteenth and last chapter is on the functions of animated body. Humors are now reduced to three: chyle, blood and humors secreted from the blood. What used to be called spirits are the subtler part of the blood. What old writers said about innate heat and *humidum radicale* should all be referred to the blood. Once there was great controversy as to the distribution of chyle, but it has recently been discovered that those vessels which, a few hours after eating, are found turgid with it, all tend to the lumbar receptacle and thence to the thoracic duct. The chief function of the heart is as a muscle to propel the blood, which returns to the heart through the capillaries of the veins. Bartholinus tells how fish breathe, but is uncertain how the egg is fertilized by the male semen. He rejects Descartes' selection of the pineal gland as the seat of the soul, and the spontaneous generation of plants and insects.

The supplementary dissertation elaborates the argument for the origin of springs and rivers from precipitation.¹⁵

There are several close resemblances between the texts of Bartholinus and Pourchot, hardly sufficient to justify a charge of direct

¹⁵ *Ibid.*, pp. 247-85.

borrowing, but certainly indicating an increasing standardization of scientific opinion and instruction along new lines.

In 1690, or earlier, since he states that publication had been delayed for ten years or more, Pierre Silvain Regis (1632-1707),¹⁶ assuming that nature always follows the simplest course, attempted a single system of philosophy based largely on Descartes.¹⁷ This, however, did not mean that he limited himself to a single hypothesis, for he explained the universe both on the supposition that the earth was immobile and on the supposition that it revolved about the sun. He still accepted three regions of air, and that springs come from the sea. In other respects his views were more progressive. He laid much stress upon fermentation and represented the earth as full of pores, of which, however, there were only four species. These served as moulds in which particles of matter took on the forms of the four fundamental mixed bodies—water, air, salt and oil.

Jean Leclerc proceeded upon a quite different assumption.¹⁸ His five books concerning corporeal things treated of the universe and heavens, land and sea, air and meteors, plants and animals, and

¹⁶ Locke alluded to him on March 22 and August 1, 1676, in the two following passages (*Travels in France*, ed. by John Lough, 1953):

p. 60,

If one take the ashes of Sarments and put them in water about a day and half before the Aequinox, he shall finde them rise to the top of the water the very instant of the Aequinox. This was told Monsieur Regius for a certain experiment, but he found it not Succeed upon Triall;

p. 107,

M. Regius was stung in the night in one eyelid by a Scorpion. It swelled as big as an egg by morning, but with no great pain. He only anointed it with oil of Scorpions which took it down and cured it quite without anything else.

¹⁷ *Système de philosophie, contenant la logique, la métaphysique, la physique, et la morale*, Paris, 1690, 3

vols. in-4. Reviewed in JS XVIII, 644-56. In the edition of Amsterdam, 1691, the title became *Cours entier de philosophie ou Système général selon les principes de M. Descartes*: BM 51.h.1. Reviewed at length in *Acta eruditorum* XI, 135-44, 179-87. Regis had taught Cartesianism at Toulouse, Aigues-Mortes and Montpellier before returning to Paris.

¹⁸ *Physica, sive de rebus corporeis libri quinque, in quibus praemissis potissimis corporearum naturarum phaenomenis et proprietatibus veterum et recentiorum, de eorum causis celeberrimae conjecturae traduntur*, Amstelodami, G. Gallet, 1696. The dedication to his brother is dated August 1, 1695. I have used the edition of 1700, *Physica sive de rebus corporeis libri quinque*, ed. novissima, Cambridge; also the text as contained in his *Opera philosophica*, 1700, vols. III-IV.

body in general. In the preface he held that general principles could not be found, and advocated instead an analytical method from particulars. Thomas Baker said of it:

It is very remarkable that the very last author that has given us a system of physics, after all the discoveries that have been talked of and improvements that have been made in nature, has been forced to proceed in an analytical method for want of principles to go upon,

and then added, "His Physics are, like his other works, faulty enough."¹⁹ Leclerc's book is an odd jumble of authorities, citing Newton as to comets and tides but not colors, Lansberg, Huygens, Cassini and Wallis,²⁰ yet still quoting Pliny for pages as to gold, silver and salts,²¹ and continuing to quote him after having said that he is wrong on many points and is shown by experience to have inverted the order of generation.²² Leclerc keeps speaking, like Descartes, of the solar vortex, but also, unlike Descartes, of its empty spaces.²³ The statement that the north pole of one magnet repels the north pole of another—and the south pole, the south pole—because the matter which goes out by the north pole cannot enter by the same pole because of its figure and motion, is Cartesian.²⁴ But although Leclerc expounds Descartes' explanation of brutes as automata and their cries and movements as mechanical reactions of their animal spirits, he does not accept it, but says that "those seem to philosophize better who attribute some ratiocination to brutes."²⁵ The circulation of the blood is said to have been unknown to the ancients and invented by Harvey, and the lymphatic vessels are described, but capillaries do not appear to be mentioned.²⁶

Experimental method receives considerable attention. Spontaneous generation is said to have been disproved experimentally.²⁷

¹⁹ T. Baker, *Reflections upon Learning*, 2nd ed., London, 1700, p. 86.

²⁰ *Opera*, III, 88, 90, 222-23; IV, 291-302. Ed. Cambridge, 1700, pp. 41-43, for Newton and Huygens that the earth is not a perfect sphere, with their estimates and those of Cassini and Lansberg as to the distance of the sun from the earth.

²¹ *Opera*, III, 139-42, 147-48, 160-62.

²² *Opera*, IV, 89.

²³ *Opera*, III, 84, 87.

²⁴ *Opera*, III, 187.

²⁵ *Opera*, IV, 205-10. Ed. Cambridge, 1700, pp. 350-56.

²⁶ *Opera*, IV, 139, 144-45.

²⁷ *Opera*, IV, 44.

The Florentine experiment is recounted of filling a silver sphere with water and sealing it, then hammering it out of its spherical shape and consequently decreasing its cubical content and condensing the water. But some little drops sweat through the silver and finally from the opened globe the water spurts out with great force.²⁸ From the experiments of the chemists it is clear that, from various mixtures of particulars, various bodies are born and an incredible diversity produced from their varied disposition.²⁹ Once it was generally held that a lump of lead hanging from a thread would point directly to the center of the earth. But at Paris there is a declination of five minutes and fifty-four seconds.³⁰

The affirmation of chemical change is rather in contradiction to other passages which imply a purely quantitative and mechanical viewpoint, as when it is asked, Who knows how tenuous even solid bodies can be made? or when it is said that sulphur and bitumen are full of pores and so inflammable.³¹

A few further specific examples may be offered of the character of the work. The old arguments pro and con for the origin of fountains and rivers from the sea or from rain are repeated, but the suggestion is added that they come from snow which falls heavily on mountains and covers them all the year round.³² The chapter on reptiles is mostly taken up with the controversy over vipers of Redi and Charas, and the whale, seal and dolphin are included in the chapter on fish. "Although lungs are not discerned in many fish which do not breathe pure air, yet many have lungs like whales, seals, dolphins and others." But they always stay near the surface to take in air.³³ But it is said that if we consider only the bodies of men and of brutes, there is no greater difference between them than between various species of brutes. Indeed, some brutes resemble man physically more than they resemble other animals. But this evolutionary suggestion is capped with a line from an ancient poet:

*Simia quam similis turpissima bestia nobis.*³⁴

²⁸ *Opera*, III, 200.

²⁹ Ed. Cambridge, 1700, p. 390.

³⁰ *Ibid.*, p. 41.

³¹ *Opera*, III, 99, 114.

³² *Opera*, III, 202-205.

³³ Liber iv, caps. 4-5; *Opera*, IV, 60-, 73-, 81.

³⁴ *Opera*, IV, 204.

The ventricles of the brain are still regarded as the receptacles of the animal spirits and are often found full of phlegm. The animal spirits are thought of as acting through the nerves in sensation and motion.³⁵

Leclerc objects to having recourse to sympathy and antipathy in discussing the magnet and its properties, which he would explain instead by pores and cusps.³⁶ He prefers a mechanical explanation of the action of the moon on the tides to occult influence, and attributes it like Descartes to pressure exerted by the moon.³⁷ But, although he abandons substantial forms as well as occult influence and sympathy and antipathy, he has to admit that concerning the figure, magnitude and situation of the most tenuous parts of which bodies are constructed, and from whose contexture all corporeal variations seem to arise, "we have found out practically nothing."³⁸ Derivative qualities like color, taste and odor are known to us, but primitive qualities are not.³⁹ So we come back to occult qualities after all.

But on the whole, although Leclerc may have failed to sketch a complete and consistent system or to discover fundamental principles of physical science, he does provide a not unfair reflection and retrospect of the ups and downs, the change and confusion, the back currents and the stream of progress, in the scientific thought of the seventeenth century.

The new views in physics and chemistry which gained ascendancy during the seventeenth century were regarded by their adherents and have commonly been accepted by subsequent historians of science as a marked improvement in clarity, mechanical precision, and scientific character over scholastic natural philosophy with its occult virtues, substantial forms, and animistic tendencies. That this was not always the attitude of contemporaries, however, is shown by a passage in *La philosophie des images énigmatiques* of the Jesuit, Cl. François Menestrier, published at Lyons in 1694. He objects that the new Physics has a sort of jargon which closely resembles that of the ancient oracles which gave their responses

³⁵ Ed. Cambridge, 1700, pp. 288, 333-35.

³⁶ *Opera*, III, 184, 186.

³⁷ *Opera*, III, 219.

³⁸ Ed. Cambridge, 1700, p. 387.

³⁹ *Ibid.*, p. 388.

only in vague and general terms. "It talks about corpuscles, spirits, ferments, volatile salts, subtle matter, irradiations, impressions . . ."⁴⁰

Although Johann Conrad Barchusen or Barkhausen entitled the book which he published at Leyden in 1698, *Pyrosophia*⁴¹ and declared that fire and air are the principal instruments of the chemist, he was still an iatro-chemist and regarded the restoration of health as the primary aim of chemistry. The curious scrutiny of natural phenomena by the aid of fire was its secondary object. The *Pyrosophia* divides into three parts: medical, metallurgical, and dealing with transmutation, for Barchusen thought that the transmutation of metals was possible. But he would seem to have abandoned belief in astrology and the influence of the stars, since he affirms that, under God, the sun is universal cause in sublunars. He still, however, observed the division of nature into three kingdoms, animal, vegetable and mineral. These were compounds. As for elements or principles, he distinguished four rather than three or five. Of these salt and oil were active, earth passive, and water neuter, that is, sometimes active and sometimes passive. None of the four was found in a state of absolute purity, but oil was a simpler substance than sulphur, while fire was a congeries of varied particles, especially of oil, in a commotion which burst into flame when exposed to the air (*accedente aere liberiore*). Acids and alkalis were semi-salts, which, when mixed to the saturation point, reverted to pure salt. They exerted a secret friendship or magnetism upon each other, and effervesced when brought together, as did spirit of nitre and butter of antimony. Barchusen laid stress upon human medicines derived from mercury, but, as we have seen, neither it nor sulphur was any longer one of his Principles.

Barchusen denied most of the medical virtues attributed to stones in the past⁴² but still had faith in the healing properties of coral,

⁴⁰ *Op. cit.*, p. 463.

⁴¹ I first learned of Barchusen's *Pyrosophia* from a long notice of it in L. Neocoro, *Bibliotheca librorum novorum*, I (1697), 542-55. The name of Barchusen does not appear in the indexes of such works as Hoefer, II (1843), Ernst von Meyer, *Geschichte der Chemie*, 4th ed., 1914, or Hélène

Metzger, *Les doctrines chimiques en France du début du XVIIe à la fin du XVIIIe siècle*, 1923, although in the last-named there are numerous references to Boerhaave. However, the *Pyrosophia* is found both in BN Te¹³¹.140, which I have consulted, and BM 458.a.21.

⁴² *Pyrosophia*, 1698, p. 255.

pearls, the blood-stone, talc and amber. He classed amber and coral as minerals, yet believed that most varieties of coral were soft under water. From the animal kingdom he included elk's hooves as well as sal ammoniac. Elk's hooves were employed medically chiefly in external applications, but spirit of ants (formic acid?) was not infrequently administered internally in cases of apoplexy, and some believed that it would make a man magnanimous.⁴³ The *Pyrosophia* includes a picture of Barchusen's laboratory at Utrecht as well as plates illustrating chemical apparatus, and at its close gives five programs of laboratory courses for as many semesters, 1695-1697. The book was issued in an enlarged edition as *Elementa chimiae* in 1718, and most of Barchusen's works belong to the eighteenth century,⁴⁴ when he is said to have been an opponent of Boerhaave,⁴⁵ and to have discovered succinic acid.⁴⁶

William Wotton in his *Reflections upon Ancient and Modern Learning*, published in 1694, in summing up the progress in chemistry during the past century or so, said in effect that it was now certain that five distinct and tolerably uniform substances might be drawn from most vegetable and animal substances by means of fire: namely, phlegm, fixed salt, oil, earth and spirit (or volatile salt dissolved in phlegm). To the present day reader or chemist this may not seem such astounding progress or an advance in quite the right direction. But for Wotton it was sufficient foundation for a triumphant conclusion to one phase of his controversy with Sir William Temple⁴⁷ as to the relative merits of the ancients and the moderns. "So that here is a new field of knowledge of which the ancients had no sort of notion."⁴⁸

A different estimate of chemistry than Wotton's was given in other *Reflections upon Learning* by Thomas Baker. Complaining that the virtues of herbs were not yet known, he went on:

⁴³ *Ibid.*, p. 378: "Credunt et aliqui nescio quam vim hominem magnanimum faciendi huiusmodi bestiolis esse."

⁴⁴ Such as *Acroamata . . . complura ad iatrochemiam atque physicam spectantia*, Utrecht, 1703; and *Historia medicinae*, Amsterdam, 1710.

⁴⁵ Boerhaave (1668-1738) was professor at Leyden from 1701 to 1729.

⁴⁶ Hirsch, *Biog. Lexikon*, I, 293.

⁴⁷ Whose *Ancient and Modern Learning* appeared in 1692.

⁴⁸ Wm. Wotton, *Reflections upon Ancient and Modern Learning*, London, 1694, p. 193.

It is not enough to say, their natures may be known by being chymically resolved, for their effects are often very disproportionable to the principles and parts that result from the analysis. There are other parts more subtle and yet most active and vigorous in their operation, as the grosser part do upon the blood and humors, and those the subtlest chymists and the most exquisite analysis will not be able to reach.

Baker presently remarked anent chemical remedies:

all those fine medicines do not always answer in the application, nor have they been found so sovereign in our bodies as they are in our books.

Moreover, chemical and medical beliefs and usage were ever fluctuating.

In one age alkalies are in fashion, and in the next acids begin to recover credit; antimony at one time is next to poyson and again the most innocent thing in the world, if duly prepared; bleeding is practis'd in one nation and condemned by their neighbours.⁴⁹

Whereas Wotton wrote to uphold modern learning, Baker's object was to show the superiority of revelation to any learning,⁵⁰ so that his criticisms must be discounted accordingly. However, they sometimes display a considerable insight and pungency. It is to be further noted that of his nineteen chapters only three deal with science and medicine, and that he has no chapter on mathematics. His work had a number of editions after 1700, including a French translation.⁵¹

A valuable review of the state of medicine at the close of the century was published at Lucca in 1699 by Anton Francesco Bertini (1658—1726).⁵² While the book was written in Italian by an Italian, the participants in its dialogue are represented as a Spaniard, Frenchman and German. And although the title suggest controversy

⁴⁹ *Reflections upon Learning*, 2nd ed., London, 1700, pp. 183-86. The Bodleian has a copy of the first edition of 1699.

⁵⁰ *Reflections upon Learning wherein is shewn the insufficiency thereof in its severall particulars, in order to evince the usefulness and necessity of*

Revelation.

⁵¹ *Traité de l'incertitude des sciences*, Paris, P. Miquelin, 1714.

⁵² *La medicina difesa dalle calumnie degli uomini volgari e dalle opposizioni de' dotti, divisa in due dialoghi*, in-4, 353 pp., Lucca, 1699. Copy used: BN T²¹.121.

and polemic, and the mode of presentation is popular and discursive, the actual discussion, aside from mild satire, is sane, impartial and broad-minded. It is recognized that medical opinion undergoes many metamorphoses, and that posterity may reject doctrines and practices which are now esteemed or restore others from present neglect.⁵³ A few years ago physicians talked of nothing but ferments; now they have relegated these to bakers and have turned to other topics: mechanical architecture, animal economy, and Borelli's doctrine of configurations. Bertini, however, himself continues to speak of fermentation, for in pointing out seventeenth century improvement in the theory of fevers, he states that heat is not the essence but the effect of fever and is produced by fermentation of the blood which is the cause of fever.⁵⁴

Besides such discoveries with regard to the generation of diseases, Bertini regards the chief advances in medicine made during the past century as chemical medicine, which he considers as great an improvement as the compass was in navigation,⁵⁵ anatomical discoveries as to the structure of parts of the body, especially the circulation of the blood,⁵⁶ the use of the microscope, which, however, has also given rise to many doubts and conflicting opinions,⁵⁷ experimentation with animals especially in the infusion and transfusion of blood,⁵⁸ and such progress in surgery as the plastic surgery of Tagliacozio, who had rediscovered how to regenerate the missing parts, and Borri's restoring the lost humors of the eye.⁵⁹

Recent medical works which will immortalize their authors are Mercuriale's *De arte gymnastica*, Santorio's *De statica medicina*—although Ippolito Obizi tried to lower his glory by his *Staticomastige*—and Prospero Alpino's *De medicina Aegyptiorum*.⁶⁰ But Bertini also lists medical writers of the century preceding the

⁵³ *Ibid.*, pp. 28, 74.

⁵⁴ *Ibid.*, p. 816.

⁵⁵ *Ibid.*, pp. 349-50.

⁵⁶ *Ibid.*, pp. 73, 245.

⁵⁷ *Ibid.*, pp. 47-49.

⁵⁸ *Ibid.*, pp. 248-9.

⁵⁹ *Ibid.*, p. 163. Bertini was probably unaware of fifteenth century plastic surgery. "Cirugia . . . arriva a fare molte belle opere che da se non puo

far la natura . . . Tagliacozio Bolognese ritrovatore della maniera di regenerare le parti mancanti alle labbra alle orecchie etc. ne esserci mancato in questo secolo un' inventore di rimetter gli umori nell' occhio uscite fuori per qualche accidente, il quale per quanto ne ha divulgata la fama è stato il Borri."

⁶⁰ *Ibid.*, p. 72.

discovery of the circulation of the blood who, he believes, will ever be held in great esteem, and also anatomists and surgeons before Harvey.⁶¹

The chief faults of the recent age, in Bertini's mind, are the printing of too many books, which confuse rather than instruct men's intellects,⁶² and the multitude of remedies which do the patient more harm than good.⁶³ Also the assumption of surgical functions by barbers, whereas a surgeon should have a long preparation and be acquainted with anatomy and Latin.⁶⁴

Bertini says nothing of astrological medicine nor of any confusion of magic and medicine. The closest approach that he makes to superstitious medicine is an apparently favorable reference to Croll's doctrine of signatures in plants as a feature of recent medicine.⁶⁵ On the other hand, he affirms that tyriac is not a cure for all poisons, and is bad for arsenic poisoning.⁶⁶ He says that the Copernican system is justly condemned by the Sacred Congregation and rejected by many philosophers,⁶⁷ and he repeats from Giorgio Paschi the story of Columbus and the egg.⁶⁸

The History of Medicine published in 1710 by Barchusen, of whose chemical *Pyrosophia* of 1698 we have already given some account, provides interesting retrospects upon the seventeenth century. The attitude towards astrology, although for the most part unfavorable, is still vacillating. As the book is in dialogue form, contradictory viewpoints can be given. If one interlocutor doubts the influence of stars other than sun and moon because of their great distance, another replies that if our earth was influenced only by sun and moon, there would not be such great variations of seasons and weather from year to year. If the opponent shifts his attack to genethliology and remarks the difficulty of determining the exact

⁶¹ *Ibid.*, pp. 73-74.

⁶² *Ibid.*, p. 258.

⁶³ *Ibid.*, p. 288.

⁶⁴ *Ibid.*, p. 161.

⁶⁵ *Ibid.*, p. 272.

⁶⁶ *Ibid.*, p. 273. The *Journal des Savans* devoted its issue of February 28, 1684, to theriac.

⁶⁷ *Ibid.*, p. 201.

⁶⁸ *Ibid.*, p. 259, "secondo il racconto di Giorgio Paschi in scedias. d. curios. huius seculi inventis, p. 105," Bertini evidently used G. Paschi . . . *Schediasma de curiosis huius seculi inventis quorum accuratiori cultui facem prae-tulit antiquitas*, Kiel, 1695, in-8. BM 56.a.20. Better known is the second edition of Leipzig, 1700, entitled *De novis inventis* . . . etc.

time of birth or conception, the defendant ripostes that many physicians deem the science of the stars necessary. Firmicus is often cited, and the relation supposed to exist between the signs of the zodiac and the human body is set forth. But it is held that the names of the constellations have no justification or significance. The final speaker agrees in the denial of a peculiar influence of the stars on individual bodies, but will not give up their general influence.⁶⁹

As for magic, it once had and still has commerce with medicine, but whereas this formerly held true of men of erudition, it is now only the uneducated who resort to magical remedies, which are partly superstitious, partly ridiculous.⁷⁰ Later on, Barchusen through the mouth of Wagtendorp decries the magnetic cure by unguent or sympathetic powder, and transplantation of disease to brute or tree.⁷¹ On the other hand, blood transfusion, of which Daniel Major in his *Chirurgia infusoria* is represented as the inventor, is questioned on the erroneous ground that the soul of brutes resides in their blood, and that consequently, if blood of this sort is directly transmitted into the veins of man, it is to be feared that his nature will become brutish.⁷²

Of mediæval medical authors Barchusen notices Constantinus Africanus⁷³ but passes over Roger and Roland, Arnald of Villanova, Peter of Abano, Gentile da Foligno, Bernard Gordon, Guaineri and Savonarola. He devotes over thirty pages to Chinese medicine,⁷⁴ but then turns to the moderns from Paracelsus on.⁷⁵ He and Severinus are the only sixteenth century authors treated; the remaining 160 pages⁷⁶ are devoted to writers of the last century: Croll, Scheunemann, Helmont, Tackenius, Sylvius and Willis, Andry de Mon and Stahl, chiefly iatrochemists. However, the debt of medicine to anatomists and mechanical physicists is recognized,⁷⁷ and the influence of Descartes.⁷⁸

⁶⁹ J. C. Barchusen, *Historia medicinæ* . . . , Amsterdam, 1710, Dialogus XI, De astrologia, pp. 233-47.

⁷⁰ *Ibid.*, pp. 123-26 in Dialogus VI.

⁷¹ *Ibid.*, p. 488.

⁷² *Ibid.*, p. 489.

⁷³ *Ibid.*, pp. 364-65.

⁷⁴ *Ibid.*, pp. 368-401.

⁷⁵ *Ibid.*, Dialogus XV, De doctrina Paracelsi, pp. 401-41.

⁷⁶ *Ibid.*, pp. 451-610.

⁷⁷ *Ibid.*, pp. 485-87.

⁷⁸ *Ibid.*, p. 524 et seq.

Jacob or J. W. Wolff (1642–1694) was a physician and member of the German Academy of the Curious as to Nature. In 1690 he became professor of medicine at Jena and in the same year published his *Scrutiny of Amulets*,⁷⁹ a book which shows that faith in this relic of magic persisted at the close of the seventeenth century. Furthermore, it was reviewed at length in *Acta eruditorum*.⁸⁰ Over four hundred quarto pages are devoted to an alphabetical catalogue of "amulets which occur more frequently" from those preventing abortion to those consolidating wounds,⁸¹ with almost a hundred pages on amulets against the pest alone.⁸² How they work is then considered; by means of effluvia being the favored explanation. Illicit ones are distinguished from licit, and the book closes with praise of the latter. Such authors as Delrio, Andreas Laurentius,⁸³ Cnoeffel,⁸⁴ Mylius,⁸⁵ Betts⁸⁶ and Boyle⁸⁷ are cited in their favor. Beast are said to employ them.⁸⁸ If applied over veins and arteries, their healing virtue may be disseminated by the circulation of the blood.⁸⁹ Boyle argues that they work quicker and better than do medicines taken internally, which are liable to lose their virtue in the alimentary canal before they reach the ailing part of the body.⁹⁰ His treatise on the virtue of gems is cited as to the efficacy of the bloodstone against haemorrhages.⁹¹

Schelhammer, in his *Vindication of Nature and Medicine* of 1697, argued against use of the expression, Natural Magic. It originated from the fact that many things hidden in nature which seem to be marvelous are not so in themselves. If natural magic has commerce with demons or observes times, numbers, ceremonies, figures, characters and the like, it ceases to be natural.

⁷⁹ *Scrutinium amuletorum medicum*, Leipzig and Jena, 1690, in-4, 688 pp. Copy used: BM 1141.c.17. *Curiosus amuletorum scrutator. Cui accessit Julii Reichelti Exercitatio de amulets*, Francof. et Lipsiae, 1692, in-4. BM 7461.F.

⁸⁰ IX, 161-69.

⁸¹ *Scrutinium*, pp. 30, "Abortum inhibentia," to 462, "Vulnera consolidantia."

⁸² *Ibid.*, pp. 276-373.

⁸³ *Operum therapeut.*, tract. de

strumarum sanat., lib. I, cap. 5, f. 12.

⁸⁴ *Misc. Acad. Leopold. Caes.*, Dec. I, Ann. 6-7, Appendix.

⁸⁵ *Antidot. medic. chymia*, I, 6, p. 66.

⁸⁶ *De ortu et natura sanguinis*, ¶ 15, p. 156.

⁸⁷ *Scrutinium*, pp. 683, 685-86.

⁸⁸ *Ibid.*, p. 679.

⁸⁹ *Ibid.*, p. 682.

⁹⁰ *De specif. medic.*, pp. 26, 37, 90, etc.

⁹¹ *De virtute gemmarum*, p. 198.

For the influence of the stars, if anyone is tempted to take refuge in it, has long since been exiled from the boundaries of true wisdom.

On the other hand, if it duly acts upon bodies offered to it, it does not deserve the name of magic but of natural science applying itself to art and practice.⁹²

A last word in the seventeenth century on magic was said by Johann N. Martius in a Dissertation concerning natural magic and its use in medicine in curing magic and magically.⁹³ He divided magic into three kinds: natural, artificial or mathematical, and diabolical.⁹⁴ He accepted various legendary instances of artificial or mathematical magic such as Archimedes and Laurentius Florentinus fabricating self-moving spheres, Drebbel displaying the whole work of creation in a glass globe, and Albertus Magnus constructing a speaking head. On the other hand, he despaired of the aeronautical art's ever succeeding.⁹⁵ He approved of the cabbala, but regarded geomancy as without any natural foundation. On necromancy and theurgy there were still many books current.⁹⁶ Almost all magicians affirmed the influence of the stars, but many modern writers like Carolus de la Font in his pest tract and Caspar Schott in his course of mathematics had tried to destroy it by varied arguments.⁹⁷ Martius felt that it was necessary to build up a new astrology based on experience, although he did not have much hope that this would come about.⁹⁸ But he did not doubt that the human soul had power to leave its body and join itself with other things.⁹⁹

Martius admitted that many operations were assigned to natural magic for which no manifest cause could be designated, but only the occult or specific virtues of natural bodies. It was hard to

⁹² J. C. Schelhammer, *Natura sibi et medicis vindicata*, Kiel, 1697, pp. 152-53.

⁹³ Joh. N. Martius, *Dissertatio de magia naturali eiusque usu medico ad magice et magica curandum*, Erfurt, 1700, 44 pp. Copy used: BM 1185. c.17 (7).

⁹⁴ *Ibid.*, 4.

⁹⁵ *Ibid.*, 6-7. "Huc spectat ars aeronautica cuius nullum specimen curio-

sis adhuc est exhibitum, num vero in posterum tale quid sit sperandum dubito."

⁹⁶ *Ibid.*, 10.

⁹⁷ *Ibid.*, 21.

⁹⁸ *Ibid.*, 23, "quamvis illa optanda magis sit quam speranda."

⁹⁹ *Ibid.*, 20: "Caeterum non dubitandum spiritus hominis potentiam habere extra corpus suum divagandi seque cum aliis rebus coniungendi."

know these well, but he put no little faith in signatures as a means toward that end, citing works of Croll, Thurneisser, Maxwell and a German philosopher on that subject.¹⁰⁰ He believed that cures were wrought by words and characters, where other medicines had failed, citing cases from Borellus, Fernel and Marcellus, and he did not think that a pact with demons was necessarily implied in such instances, citing one to the contrary in a cure of haemorrhage by use of the six letters OIPULU from the *Small Surgery* of John Agricola. But he agreed with van Helmont that the virtue of words was more to be admired than applied, and, although great and prolix volumes had been written on characters, as one could find in brief in Paracelsus, Agrippa and Caesar Longinus, he himself did not employ them in order to avoid giving offence.¹⁰¹ He repeats, however, from Maxwell six methods of magic transfer of disease by taking some of the patient's blood or hair or sweat or nails and mixing this with earth in which seeds are planted (*inseminatio*), or in which the herb or root itself is planted (*implantatio*), or inserting it in the stem of a plant or trunk of a tree (*impositio*), or by manuring the plant or tree with it (*irroratio*), or giving it to some animal to eat (*inescatio*) or by applying some herb or animal directly to the sick body (*adproximatio*). Martius later gives many amusingly absurd actual cases where these methods were employed to transfer the disease from the patient to an herb or animal. He also believes that the touch of a dead hand cures warts.¹⁰²

It is said that ash wood cures wounds by contact and that its pith contracts them. Some prepare a rod from the said wood, when sun and moon are joined in Aries, by whose mere touch they boast that any haemorrhage can be stopped. The rod called *das Wundholz*, which is believed to cure fractures, dislocations and contusions, is made in this wise: a hazel branch as thick at least as a finger is cut from one knot to another at one blow as the sun enters Aries, sealed with Spanish wax at both ends to prevent its spirits and forces from oozing out, and kept for use.¹⁰³

In the fifth and last chapter¹⁰⁴ Martius comes to magical diseases

¹⁰⁰ *Ibid.*, 24-25.

¹⁰³ *Ibid.*, 36.

¹⁰¹ *Ibid.*, 25-27.

¹⁰⁴ Beginning at p. 37.

¹⁰² *Ibid.*, 33.

which are not from natural causes but the work of malicious witches. They are produced, however, by effluvia from the eyes and entire body, use of natural objects of the three kingdoms—animal, vegetable and mineral—and by the work of the devil. Although Martius no longer believes in vision by extramission of visual rays, he does believe that effluvia emanate from the eye, and he notes that surgeons know better than to let every man look at a wound. Since it is human nature to have recourse to witches, when doctors fail to cure, a physician ought conversely, when ordinary methods fail, to suspect strongly that the disease has been inflicted by witchcraft, and especially so if any old woman has been near the patient. Even such diabolical diseases can be cured, because the demons have used natural means to inflict them. Both prayers and medicaments are of avail. Surgery is of not much use, but pharmacy supplies drugs which by their specific virtue counteract fascination and witchcraft. A list of herbs is given to use against diabolical magic with the instruction that they are all to be collected before sunrise. Van Helmont denied diabolical cooperation even in cases where the witch makes an image of her victim and sticks needles into it, ascribing the effects to a certain ideal ens or to strong imagination of the witch, and also tried to explain how witches were able to insert needles, keys, hairs and the like into various parts of their victim's body without breaking the skin or the victims feeling it. And in a brief epilogue Martius concludes that the matter is an arduous one and by many persons utterly rejected and discredited. But his discussion as a whole shows that it was still very much alive. A German version of his work was published in the next century.¹⁰⁵

In substantial consonance with Baker's preferring revelation to learning was Bernard Connor's accounting for miracles by suspension of the laws of nature.¹⁰⁶ Yet he was a fellow both of the

¹⁰⁵ J. N. Martius, *Unterricht von der wunderbaren Magie und derselben medizinischen Gebrauch, auch von zauberischen und miraculösen Dingen, Sympathie, Spagyrik, Astrologie, etc. Welchem beigelegt ein neu eröffnetes Kunst-Cabinet in 178 Artikeln*

und Antonii Mizaldi 100 curieuse Kunst-Stücke, Francofurti, 1719, Neudruck. 12mo.

¹⁰⁶ *Evangelium medici seu medicina mystica; de suspensis naturae legibus sive de miraculis . . .*, London, 1697; Amsterdam, 1699.

Royal Society and of the Royal College of Physicians. He begins by proposing to treat of a supernatural or miraculous state of the human body: how not to be burned in fire, to walk on water, to generate without male or female, to resurrect that which has been reduced to dust. He describes matter as made up of particles which differ in mass, figure and motion, and distinguishes mixed bodies as inorganic and organic. Man consists of spirit, soul and body. But for him what is usually called the rational soul is spirit, while the soul is the blood and animal spirits. The four elements in the human body are earth, water, salt and sulphur, and their particles form molecules. In diseases of the blood it is too thick or its motion of fermentation or circulation is retarded. In a thick condition of the blood, its saline and fixed sulphuric principles are crass, its molecules are larger, being aggravated by much tartar and fixed acid salt. If thus becomes too prickly and not only lacerates the texture of tender flesh but even erodes solid bones. But all this preliminary pretext of atomic science and corpuscular theory of disease turns out to be quite beside the point.

There are three laws of motion; namely, that when a body moves, it is moved by some other body; that, once put in motion, it communicates it to other bodies which it meets; and that it will keep moving until it has thus exhausted its motion. But God is really the sole Mover; he can suspend these three laws; and their suspension will account for all possible miracles. This is about all there is to the book, except for a conclusion that the resurrected human body will not be the same in quantity, and an account of a wood-boy captured in Poland in 1694 among a flock of bears, and a similar case in 1669.

A different attitude from that of Connor had been shown a few years before by a Benedictine of the Congregation of St. Maur. When a column of vapor similar to a waterspout appeared in August in fine weather, the people were so frightened that one youth became speechless and died a few days later, while more than a score of persons whom Father Lami questioned said that they had seen in the column angels going up and down a ladder, or a crucifix, or snakes and demons. The Benedictine, on the other hand, not only found a natural explanation of it in a cyclone, but

believed that the column which guided the children of Israel for forty years was of the same sort. For although miracles cost God nothing, He ordinarily employs simpler and more natural methods.¹⁰⁷

The thick tome of Christian Friedrich Garmann (1640–1708) on miracles of the dead, which his son published posthumously in 1709,¹⁰⁸ constantly digresses beyond the strict limits of its theme and becomes a repertory, collected from extensive reading, of much of the magic and pseudo-science of the past century. The father had printed its first book in 1670, and this was cited in 1672 by Schwimmer. There was another edition in 1687, but of only 112 pages.¹⁰⁹ Born at Merseburg, Garmann became a licentiate in medicine and municipal physician of Chemnitz. In a shorter work on man from the egg in 1672 he had also discussed whether conception could take place outside the womb, and concerning the chemical *homunculus* of Paracelsus.¹¹⁰ Another treatise by him was on wholesome breathing of boys and girls. Heinrich Kornmann, as we have seen, had published a briefer work with the same title, *Miracles of the Dead*, back in 1610. It was more strictly limited to biblical miracles and other divine miracles recorded in ecclesiastical and profane history, whereas Garmann included wonders of almost any sort. Although he lived until 1708, and his complete work was not published until 1709, it would seem that we are justified in considering it as a product of the closing seventeenth century.

¹⁰⁷ *Conjectures physiques sur quelques colonnes de nuë qui ont paru depuis quelques années, & sur les plus extraordinaires effets du tonnerre, avec une explication de tout ce qui s'est dit jusques ici des trombes de mer*, Paris, 1689, in-12. JS XVII, 708-712.

¹⁰⁸ Chr. Fr. Garmann, *De miraculis mortuorum libri tres quibus praemissa dissertatio de cadavere et miraculis in genere. Opus physico-medicum editum a Immanuele H. Garmanno*, Dresdae et Lipsiae, 1709, 160, 1244 pp., in-4. BN 4°Tb78.8A. In citing this text, the pagination of the briefer preliminary dissertation will be distin-

guished by prefixing "Diss." to the page number.

¹⁰⁹ A copy is BN 4°Tb78.8. The topics treated in this edition are: i, de capillorum augmento; ii, de nasi insititii sympathia; iii, Schnezzende Tode, or, cadavera glotientia; iv, de faciei mutatione; v, mira quaedam circa faciem et os; vi, dentium singulalia; vii, de cordis augmento et in igne duratione; viii, de abdominis crepatura et viscerum egestionem; ix, de partu cadaverum; x, de unguium cornuum et ossium augmento; xi, de penis erectione.

¹¹⁰ PT VII, 5049.

Some instances of direct mention of magic may first be noticed. Among things that prevent the flow of blood are listed magic characters and the words of enchanters. By murmuring incantations an Arab ate or annihilated the inside of a cucumber without cutting it open. Birds won't touch the corpses of magicians. Why witches won't sink in water? How demons can keep one from being burned in fire. Divers have a peculiar pact with the demon. Why magicians draw down the moon from the sky by incantations? Whether there are ventriloquists without the aid of the devil?¹¹¹ There is a magic which is fabled to move the stars by utterance of words.¹¹²

Divination does not appear in the index to Garmann's work, but it discusses the variety called Chaomancy, also that from palpitatio of the limbs, from the movement of parts of corpses, and the faculty of vaticination in general.¹¹³ What kind of dreams come to those who sleep covered with the skin of a glutton (i.e., wolverene) is quoted from Helmont.¹¹⁴

It is asked whether man can affect the stars by his imagination, and whether the stars confer a soul on insects and are responsible for the corpse's bleeding at the approach of the murderer.¹¹⁵ Bicker in *Hermes redivivus*¹¹⁶ attributes sounds emitted by corpses to necromantic stars, and Reys de Fontacha holds that dead bodies which do not decay owe this to the influence of the constellations prevailing at the moment of death. But Caspar à Rejes turns thumbs down on this idea. Bede says that the bodies of those who are born on January 27 or February 13 will remain uncorrupted till the day of judgment. A more recent writer¹¹⁷ alters the days in question to February 1 and 2.¹¹⁸

A few examples of the effects of sympathy and antipathy may next be noted. Can thought be communicated at a long distance by sympathy? The blood of a crow and an owl, or of an eagle and

¹¹¹ *De miraculis mortuorum*, 1709, pp. 547, 131-32, Diss. 105, 390, 220, Diss. 44; II, x, ¶ 86; p. 405.

¹¹² *Ibid.*, p. 576.

¹¹³ *Ibid.*, pp. 115, 468, 491, 752.

¹¹⁴ *Ibid.*, Diss. 101.

¹¹⁵ *Ibid.*, pp. 616, 928, 576, 603.

¹¹⁶ Liber III, cap. vii, p. 410.

¹¹⁷ Anton. Palcan. *caten. Tempor. Annul.*, p. 53.

¹¹⁸ *De miraculis mortuorum*, pp. 114, 965. The citation, "Bede de nat. infl." is probably meant for the spurious tract, *De nativitate infantium*."

a dragon, will not mix. Why do the windows open when someone in the house dies?—a question which goes unanswered. The fiercest bull is quiet under a fig tree, whereas wolf dung hid in the stable disturbs the cattle, and swine shun marjoram. Eating an herb from a cemetery makes the teeth fall out. The sea is tranquil, when the vessel carries a corpse. Zwingli's heart could not be burned, and the hearts of those who have heartburn are said to be incombustible. Cataleptics die standing.¹¹⁹

A number of the questions discussed by Garmann were suggested by the Bible, such as why Adam lived so long, whether he had teeth and an umbilicus before the fall, how the blood of Abel cried from the ground, and whether this was a case of the corpse bleeding in the presence of the murderer.¹²⁰ And in connection with the question whether, when Saint Catherine was beheaded, milk flowed instead of blood, he notes that Augustine and Chrysostom tell the same of the Apostle Paul.¹²¹

In view of the title of his book, it is a natural consequence that many of Garmann's marvels are concerned with human beings. He asks whether baptism takes away the stench of the Jews, why Capuchin monks do not sweat when they die and why, when dead, their skin dulls the edge of a knife. Egyptians do not grow bald. A candle of human fat discovers hidden treasure, and the brain is large in those who do not indulge in sexual intercourse. Ecstasy and levitation go together. Do the corpses of women decay more quickly than those of men? Absence of spleen is an advantage to divers; Muscovites eat the hearts of infants; and the reason why so many Italians wear eyeglasses is that they indulge too much in sexual intercourse. We are told of a boy who was bearded when six months, and virile in his seventh year, and of the golden thigh of Pythagoras. Boys are so given to nosebleed because their brains are so moist. Can anyone utter words with his head off?¹²²

An ethereal body unites soul and body, and the souls of sages

¹¹⁹ *De miraculis mortuorum*, pp. 94, 101, Diss. 103, 359, 854, Diss. 105, 638-39, Diss. 122, 1045, 220, 225, 231, 435, 438.

¹²⁰ *De miraculis mortuorum*, pp.

214, 1242, 566, 585, 598.

¹²¹ *Ibid.*, p. 623.

¹²² *Ibid.*, pp. 643, 502, 972, Diss. 123, 28, Diss. 26, 846 and 964, Diss. 45, 128, 148, 38-39, 694, 541, 480.

are sublimated to the ether.¹²³ Augustus Caesar was born of a woman and serpent, and the same has been said of Luther and Scipio Africanus.¹²⁴ A rainbow of the microcosm may be produced by opposing blood from the veins to the sun's rays.¹²⁵ Drinking coffee is bad for the teeth.¹²⁶

It is not strange that light and even flames appear on corpses and in cemeteries, for they also are seen in the living. The face of the Apostle Matthew lit up when he was chosen by lot, and St Lawrence as a child sucked not milk but flames from the breasts, signifying his flaming spirit which faced kings and pontiffs undaunted. But there is fire in other men than saints, and in other living bodies than those of human beings. Melanchthon defined the vital spirit as a flame kindled in the heart from purest blood. On the 26th of January, 1555, there was a flaming birth, and Borelli tells of a woman who vomited flame at death. Thomas Bartholinus records a post mortem at which a great flame burst forth from a woman's body, perhaps as the result of drinking spirits of wine and inflammatory waters. Many have held that the souls of brutes were fiery. Fish have light, and flames appear on ship's yards and from the mouths and intestines of animals. Garmann does not believe in presages from the appearance of unusual light on meat, but coruscations before one's eyes are usually a symptom of disease.¹²⁷

Despite the title, marvels of other animals than man are often discussed. Asses with their heads cut off are brought to life. One should abstain from the sight of mad brutes. The flesh of birds does not putrefy, but a basilisk, even when dead, cannot be touched without injury. Why do not toads petrify in petrifying water or when enclosed in rocks? The blood and brain of the sparrow is a remedy for impotence. Will the dead tarantula revive at the sound of music? Ostriches swallow but do not digest iron, which is still found in the bird's crop. The tortoise lives for six months after its head has been cut off and makes a noise for half an hour thereafter. After the head of a viper has been amputated, the head will

¹²³ *Ibid.*, pp. 60, 764.

¹²⁴ *Ibid.*, p. 913.

¹²⁵ *Ibid.*, p. 703.

¹²⁶ *Ibid.*, p. 205.

¹²⁷ *Ibid.*, "De luce cadaverum," which begins at p. 674; see especially pp. 678-79, 682-84, 687, 703, 708, 713-14, 721.

still bite and injure—even Redi says for half an hour. On the authority of Scaliger's *Exoteric Exercises* it is asserted that the hyena eats only human flesh.¹²⁸ The interest is obviously in the sensational and the miraculous, not in the scientific.

Plants receive little attention; mineral and metals, more. It is asked whether drinking gold will produce golden hair, and whether eating gold will make the flesh lucid. Goldsmiths won't sink in mineral baths but have discolored teeth because they work with quicksilver. Liquid gold is useful in perpetual lamps, to further discussion of which a dozen paragraphs or so are devoted. Flint can be changed into water, and a stone from the liver of a cock quenches thirst. The saltpeter from cemeteries is useful for various diseases. The sky is said to be composed of stones, because they fall onto the earth occasionally.¹²⁹

Some, not to say much, of the magical and pseudo-scientific lore which Garmann accumulates is not put forward by him as true. The story of the nose that putrefied when the man from whose flesh it had been grafted died, is pronounced by him a ridiculous fable. He points out that the evidence for it is insufficient, and that spirits of human blood will keep in an uncorrupted condition after the man whose blood has been used for them dies.¹³⁰ But he has not merely repeated it; he has made "Concerning the sympathy of the grafted nose"¹³¹ the caption under which he has first discussed the grafting of flesh and plastic surgery for some ten pages. Then he has quoted such advocates of natural magic as Campanella, Helmont, Digby, Rattray and Burggrav, although characterizing the last named's *Biolychnium* as ridiculous, and has mentioned the practice of communication at a distance by friends who mix their blood before parting.

Hermes Trismegistus never existed. That the mandrake grows from the urine of an innocent man who has been hanged is a fable. Garmann venerates divine miracles, sees the hand of God in those of the prophets and apostles, and will not reject those ascribed to

¹²⁸ *Ibid.*, pp. 1229, 375, 961-62, 1180, 382, 588, 493, 1157, 462, 464, 123.

¹²⁹ *Ibid.*, pp. 59, 701, 405, 205, 809 et seq., 1144, 1127, Diss. 122, 1187.

¹³⁰ *De miraculis mortuorum*, pp. 94, 96, 99.

¹³¹ *Ibid.*, Lib. I, Tit. ii, "De nasi insititii sympathia," pp. 87-105.

the saints. Those from the slimy and putrid ocean of monkish fables and old-wives' tales he leaves to the reader's judgment. But he alludes to the fraud of the papists in fabricating specters.¹³² That pygmies make fossil pots underground is a popular superstition.¹³³

Specters can also be fabricated by chemical experiment, as when a plant is reproduced in a phial from its ashes. Petrus Borellus says that by a licit necromancy one can similarly represent in a phial one's father, grandfather or all one's ancestors, or ancient Romans or Hebrews, provided one has preserved their bones or ashes, "and other more important things which I think should not yet be revealed." Fludd and others record such an experiment at Paris. When they broke the phial, they found something like a cranium in the debris. Which shows why specters appear frequently in cemeteries.¹³⁴

Miracles of the dead! If Newton was really the last of the magicians, they were all that was left. Thus endeth the seventeenth century.

Yet its substitutions for the magic and astrology of the past were not always so radical as they have been thought. Sometimes they almost seem like ghosts of the departed. Animism had been replaced by mechanism; qualities and occult virtue, by quantity and extension. The notion that the celestial bodies were a fifth essence, distinct from and superior to the elementary world, had been abandoned. But in its stead a new ethereal matter had been coined. Radiations of influence from celestial bodies had been given up in favor of insensible effluvia from all sorts of objects. Characters and images were spurned, but figuration and pores were cherished. Attraction and occult virtue were eschewed, but only at the price of impulse from an invisible body.

In investigating the seventeenth century we have considered more authors, works and topics than we did in the sixteenth or any previous century or period.¹³⁵ The treatment of such subjects as

¹³² *Ibid.*, Diss. 98, 458, Diss. 159, 190.

¹³³ *Ibid.*, pp. 284, 1063.

¹³⁴ *Ibid.*, p. 782.

¹³⁵ The following chart of topics indexed is reproduced from T VI, 589, with figures for the two present volumes added.

air, atom, nitre, pore and material spirits has become much fuller. So has that of balsam, chemical remedies, elixir, philosophers' stone and philter, and of ecstasy and epilepsy. These indications of a growing interest in problems of physics, chemistry and psychiatry are confirmed by noting topics that appear in the Index for the first time. In the physical realm may be mentioned Cartesianism, cold, corpuscular theory, effluvia, fluid, mass in a physical sense, inertia, liquid and solid, micrometer, momentum, pendulum, percussion, Prince Rupert's drops, Royal Society, and thermometer. In the domain of alchemy and chemistry we encounter for the first time alkahest, ferment, *homunculus*, *magnale*, mastery, *regulus*, and resuscitation of plants. In the biological sphere new names are duct, entomology, Jardin des Plantes, pancreas, swordfish and tobacco. Medical and mental novelties are enthusiasm, hypochondria, *Mannschlacht*, specifics (here only the use as a noun rather than adjective is new, and the word rather than the idea), and spiritualism.

Volume	I	II	III	IV	V-VI	VII-VIII
Animal	173	141	74	80	151	233
Vegetable	126	78	52	64	188	307
Mineral	76	54	53	44	97	143
Human body	80	68	52	59	99	179
Disease	56	50	45	45	78	112
Medicine	51	40	34	36	53	98
Celestial	25	20	25	26	37	74
Nature	60	51	63	50	75	185
Alchemy and Chemical	15	16	46	28	51	150
Technical	87	67	36	47	88	132
Mathematics and Time	35	27	30	21	32	68
Linguistic, Literary	45	35	28	42	74	66
Intellectual	94	92	108	115	169	172
Occult	122	94	119	108	174	252
Religion	119	93	67	100	139	143
Political	12	13	13	16	38	35
Crime and Penal	13	9	9	14	16	21
Occupations	18	13	10	14	34	24
Other human life	85	65	60	71	115	52
Total	1292	1026	924	980	1708	2446

In the present volumes some 1600 authors and men of learning of the seventeenth century have been mentioned as against 1200 of the sixteenth and early seventeenth century in volumes five and six.

On the other hand, some points receive less attention than in the sixteenth century, such as censorship and eloquence, or humanism and nobility. Fewer references to augury and auspices, hydromancy and pyromancy, planetary conjunctions and astrological elections, might seem signs that divination and superstition are on the decline. But there are more mentions of the aspects of the planets than in previous volumes; Helmont's *injecta* and other fanciful new creations appear for the first time on the scene; and action at a distance, although a conception present in previous thought and concealed in the Indices under other captions, now first emerges as a distinct topic.

On the whole, however, our Index, and perhaps our text, gives an impression of the continuity of thought and continuance of tradition rather than of modern progress. But Descartes, stimulated by the discoveries of Galileo, Kepler and Harvey, and by his association with Beeckman, had thought out a new Cosmos for himself and had encouraged other men to do likewise. Huygens, Grew, Ray, Malpighi, Swammerdam and others had proved the value of intensive observation. Galileo, Torricelli, von Guericke, Boyle and others had extended the sphere of experimental method, and, as we have said, no manacles of creeds and devils were fastened to its flying feet. Finally Newton, employing mathematical method, had demolished the distinction between superiors and inferiors, heavens and earth, and drawn what seemed a hard and fast line between physical and occult science.

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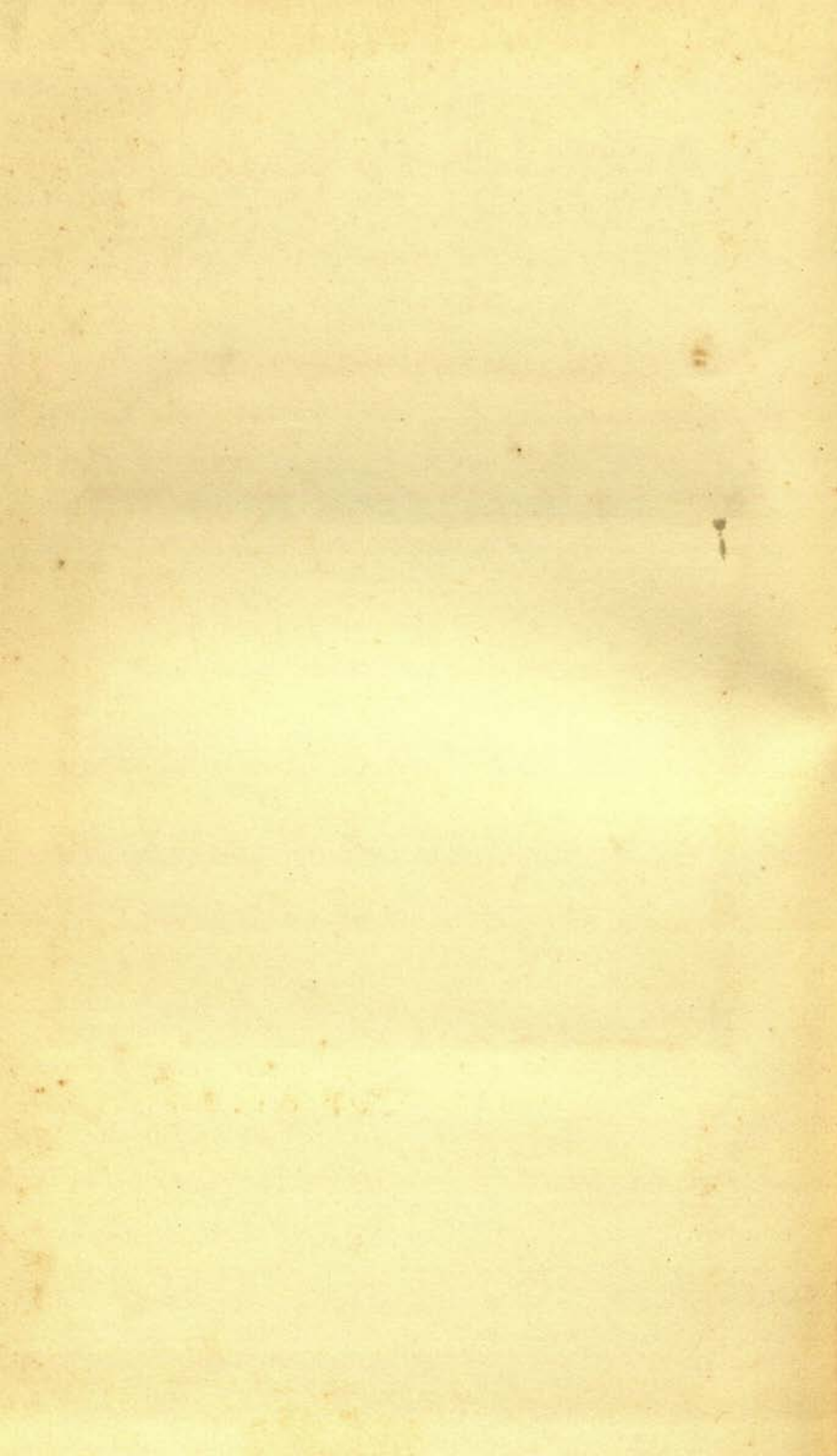
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