THE AMERICAN PHILOSOPHICAL SOCIETY

HELD AT PHILADELPHIA
FOR PROMOTING USEFUL KNOWLEDGE

YEAR BOOK 1939

JANUARY 1, 1939 – DECEMBER 31, 1939

THE AMERICAN PHILOSOPHICAL SOCIETY
INDEPENDENCE SQUARE
PHILADELPHIA
1940

LANCASTER PRESS, INC., LANCASTER, PA.

53790
American Philosophical Society
Year book—1939

CONTENTS

I

CHARTER *

STATUTES AT LARGE OF PENNSYLVANIA

CHAPTER DCCCXCIV.

AN ACT

for incorporating the American Philosophical Society held at Philadelphia for promoting useful knowledge.

L.S.

Whereas the cultivation of useful knowledge, and the advancement of the liberal arts and sciences in any Country, have the most direct tendency towards the improvement of agriculture, the enlargement of trade, the ease and comfort of life, the ornament of society, and the encrease and happiness of mankind; **And whereas** this country of North America, which the goodness of Providence hath given us to inherit, from the vastness of its extent, the variety of its climate, the fertility of its soil, the yet unexplored treasures of its bowels, the multitude of its rivers, lakes, bays, inlets, and other conveniences of navigation, offers to these United States one of the richest subjcts of cultivation, ever presented to any people upon earth; **And whereas** the experience of ages shows that improvements of a public nature, are best carried on by societies of liberal and ingenious men, uniting their labours, without regard to nation, sect or party, in one grand pursuit, alike interesting to all, whereby mutual prejudices are worn off, a humane and philosophical spirit is cherished, and youth are stimulated to a laudable diligence and emulation in the pursuit of wisdom; **And whereas**, upon these principles,

* Original Charter, Granted in 1780. Articles of Amendment added 1935.

divers public-spirited gentlemen of Pennsylvania and other American States did heretofore unite themselves, under certain regulations, into one voluntary Society, by the name of "The American Philosophical Society held at Philadelphia, for promoting useful knowledge," and by their successful labours and investigations, to the great credit of America, have extended their reputation so far, that men of the first eminence in the republic of letters in the most civilized nations of Europe have done honour to their publications, and desired to be enrolled among their members; **And whereas** the said Society, after having been long interrupted in their laudable pursuits by the calamities of war, and the distresses of our Country, have found means to revive their design, in hopes of being able to prosecute the same with their former success, and being further encouraged therein by the public, for which purpose they have prayed us, "the Representatives of the Freemen of the Commonwealth of Pennsylvania," that they may be created One Body Politic and Corporate forever, with such powers, privileges, and immunities, as may be necessary for answering the valuable purposes which the said Society had originally in view.

Wherefore, in order to encourage the said Society in the prosecution and advancement of all useful branches of knowledge, for the benefit of their country and mankind.

[SECTION I.] **Be it enacted, and it is hereby enacted by the Representatives of the Freemen of the Commonwealth of Pennsylvania, in General Assembly met, and by the authority of the same,** That the Members of the said American Philosophical Society heretofore voluntarily associated for promoting useful knowledge, and such other persons as have been duly elected Members and Officers of the same, agreeably to the fundamental laws and regulations of the said Society, comprized in twelve sections, prefixed to their first volume of transactions, published in Philadelphia by William and Thomas Bradford in the year of our Lord one thousand seven hundred and seventy-one, and who shall in all respects conform themselves to the said laws and regulations, and such other laws, regulations and ordinances, as shall hereafter be duly made and enacted by the said Society, according to the tenor hereof, be and forever hereafter shall be, One Body Corporate and Politic in Deed, by the name and style of "The American Philosophical Society held at Philadelphia, for promoting useful knowledge," and by the same name they are hereby constituted and confirmed One Body Corporate and Politic, to have perpetual succession, and by the same name they and their successors are hereby declared and made able and capable in law, to have, hold, receive, and enjoy lands, tenements, rents, franchises, hereditaments, gifts, and bequests of what nature so ever, in fee simple or for term of life, lives, years or otherwise, and also to give, grant, let, sell, alien, or assign the same lands, tenements, hereditaments, goods, chattels, and premises, according to the nature of the respective gifts, grants, and bequests, made to them the said Society, and of their estate therein. **Provided**, that the amount of the clear yearly value of such real estate do not exceed the value of ten thousand bushels of good merchantable wheat.

[Section II.] **And be it further enacted by the authority aforesaid**, That the said Society be, and shall be for ever hereafter able and capable in law to sue, and be sued, plead and be impleaded, answer and be answered unto, defend and be defended in all or any of the courts or other places, and before any Judges, Justices, and other person or persons, in all manner of actions, suits, complaints, pleas, causes, and matters, of what nature or kind so ever, within this Commonwealth; and that it shall and may be lawfull to and for the said Society, for ever hereafter to have and use one common seal in their affairs, and the same at their will and pleasure to break, change, alter and renew.

[Section III.] **And be it further enacted by the authority aforesaid**, That for the well governing of the said Society, and ordering their affairs, they shall have the following officers, that is to say, one Patron, who shall be his

Excellency the President of the Supreme Executive Council * of this Commonwealth, for the time being, and likewise one President, three Vice Presidents, four Secretaries, three Curators, one Treasurer, together with a Council of twelve members; and that on the first Friday of January next, between the hours of two and five in the afternoon, as many of the members of the said Society as shall have paid up their arrears due to the Society, and shall declare their willingness to conform to the laws, regulations and ordinances of the Society then duly in force, according to the tenor hereof, by subscribing the same, and who shall attend in the Hall or place of meeting of the said Society, within the time aforesaid, shall chuse by ballot, agreeable to the fundamental laws and regulations herein before referred to, one President, three Vice Presidents, four Secretaries, three Curators, and one Treasurer, and at the same time and place, the members met and qualified as aforesaid shall in like manner chuse four members for the Council, to hold their offices for one year, four more members for the Council to hold their offices for two years, and four more members for the Council, to hold their offices for three years. And on the first Friday in January, which shall be in the year of our Lord one thousand seven hundred and eighty-two, and so likewise on the first Friday of January, yearly and every year thereafter, between the hours of two and five in the afternoon, the Members of the said Society met and qualified as aforesaid, shall chuse one President, three Vice Presidents, four Secretaries, three Curators and one Treasurer, to hold their respective offices for one year, and four Council Men to hold their offices for three years; *Provided* that no person residing within the United States shall be capable of being President, Vice President, Secretary, Curator, Treasurer, or member of the Council, or of electing to any of the said offices, who is not capable of electing and being elected to civil offices within the State in which he resides. *Provided also*, that nothing herein

* [Now His Excellency the Governor of this Commonwealth.]

contained shall be considered as intended to exclude any of the said Officers or Councillors, whose times shall be expired, from being re-elected, according to the pleasure of the said Society; and of the day, hours and place of all such elections, due notice shall be given by the Secretaries, or some one of them, in one or more of the public newspapers of this State, agreeable to the said fundamental laws and regulations before referred to.

[SECTION IV.] **And be it further enacted by the authority aforesaid**, That the Officers and Council of the said Society shall be capable of exercising such power for the well governing and ordering the affairs of the Society, and of holding such occasional meetings for that purpose, as shall be described, fixed, and determined by the statutes, laws, regulations and ordinances of the said Society, hereafter to be made. *Provided always*, that no statute, law, regulation or ordinance shall ever be made or passed by the said Society, or be binding upon the members thereof, or any of them, unless the same hath been duly proposed, and fairly drawn up in writing, at one stated meeting of the Society, and enacted or passed at a subsequent meeting at least the space of fourteen days after the former meeting, and upon due notice in some of the public newspapers, that the enacting of statutes and laws, or the making and passing ordinances and regulations, will be part of the business of such meeting; nor shall any statute, law, regulation or ordinance be then or at any time enacted or passed, unless thirteen members of the said Society, or such greater number of members as may be afterwards fixed by the rules of the Society, be present, besides such quorum of the Officers and Council, as the laws of the Society for the time being may require, and unless the same be voted by two-thirds of the whole body then present; all which statutes, laws, ordinances and regulations, so as aforesaid duly made, enacted and passed, shall be binding upon every member of the said Society, and be from time to time inviolably observed, according to the tenor and effect thereof; provided they be not repugnant or contrary to the laws of this Commonwealth, for the time being in force and effect.

And whereas nations truly civilized (however unhappily at variance on other accounts) will never wage war with the Arts and Sciences, and the common Interests of humanity:

[SECTION V.] **Be it further enacted by the authority aforesaid,** That it shall and may be lawful for the said Society by their proper officers, at all times, whether in peace or war, to correspond with learned Societies, as well as individual learned men, of any nation or country, upon matters merely belonging to the business of the said Society, such as the mutual communication of their discoveries and proceedings in Philosophy and Science; the procuring books, apparatus, natural curiosities, and such other articles and intelligence as are usually exchanged between learned bodies, for furthering their common pursuits; **Provided always,** That such correspondence of the said Society be at all times open to the inspection of the Supreme Executive Council of this Commonwealth.

[Signed] *JOHN BAYARD,*
Speaker.

Enacted into a Law at Philadelphia on Wednesday the fifteenth day of March anno Domini one thousand seven hundred and eighty.

[Signed] *THOMAS PAINE,*
Clerk of the General Assembly.

COMMISSION FOR THE COMPILATION OF THE LAWS OF PENNSYLVANIA PRIOR TO 1800.

CLERK'S OFFICE,
1211 BETZ BUILDING.

JAMES T. MITCHELL, HENRY FLANDERS, } *Commissioners.* CHAS. R. HILDEBURN, *Clerk.*

PHILADELPHIA, March 12, 1898.

Compared, revised and found to be a correct copy of the original enrollment in the archives of the Commonwealth, by me the custodian of the said original as clerk of the commissioners appointed under the act of May 19, 1887, entitled, AN ACT FOR THE COMPILATION AND PUBLICATION OF THE LAWS OF THE PROVINCE AND COMMONWEALTH OF PENNSYLVANIA PRIOR TO THE YEAR ONE THOUSAND EIGHT HUNDRED, P.L. 1887, pp. 129 and 130.

CHAS. R. HILDEBURN,
Clerk of the Commissioners.

Witness as to Chas. R. Hildeburn:

WM. NEWBOLD ELY,
JULIUS F. SACHSE.

SEAL Sworn to and subscribed before me this 19th day of May, 1898.

JAMES P. STERRETT,
Chief Justice of the Supreme Court of Pennsylvania.

ARTICLES OF AMENDMENT

Article I

Notwithstanding the Proviso at the end of the first paragraph following the preamble of this Charter, or any other proviso thereof, the Society shall have the capacity and authority without limitation by this Charter to purchase, take, receive, lease as lessee, take by gift, devise or bequest, or otherwise acquire, and to own, hold, use, and otherwise deal with any and all real or personal property, or any interest therein, wherever situated.

Article II

Any provisions of this Charter which are purely administrative in their nature, including those concerning the officers, the members of the council, and the date and time of meetings, may be altered by a law, regulation or ordinance of the Society duly adopted and not repugnant or contrary to the laws of this Commonwealth.

CERTIFICATE OF ACCEPTANCE

1. The name of the accepting corporation is The American Philosophical Society held at Philadelphia for promoting useful knowledge.
2. The American Philosophical Society was created by the Act of Assembly approved March 15, 1780, L.B. No. 1, 363.
3. The American Philosophical Society herewith accepts the Constitution of Pennsylvania and the provisions of the Nonprofit Corporation Law.
4. The acceptance made herewith was duly authorized by a meeting of the members called for that purpose, held in Philadelphia on the 6th day of December, 1935.

Roland S. Morris
President

C. F. Skinker
Assistant Secretary

SEAL

Filed this 12th day of
December, 1935

J. Warren Mickle
Deputy Secretary of the Commonwealth

Recorded in
Miscellaneous Corporation
Record Book 210, P. 125

II

LAWS

(As Amended April 24, 1936, April 22, November 19, 1938, and November 18, 1939)

CHAPTER I

Of the Members both resident and foreign: their classification, nomination, and election; suspension and forfeiture of membership.

ART. 1. The resident members of the Society are elected from among citizens or residents of the United States who have achieved distinction in the sciences or humanities, in letters, in the practice of the arts or of the learned professions, or in the administration of affairs. Their number may not exceed five hundred, nor may more than thirty be elected in any one year.

ART. 2. The foreign members of the Society are elected from among persons who are neither citizens nor residents of the United States, and who are of the greatest eminence for their attainments in science, letters, or the liberal arts. Their number may not exceed sixty, nor may more than eight be elected in any one year.

ART. 3. Every member, whether resident or foreign, shall be classified according to his expressed wishes, or in accordance with his principal activities or contributions to knowledge, in one of the following four classes: *

* In accordance with general usage, the following more or less clearly defined fields of science and learning within the four classes have been recognized by the Society in recent years: Class I. Mathematics; Astronomy; Physics; Chemistry; Engineering. Class II. Geology, Paleontology, Geography; Zoology, Anatomy; Botany, Bacteriology; Anthropology, Psychology; Physiology, Pathology; Medicine, Pharmacology, Surgery. Class III. Political Science, Economics and Statistics; Modern History; Jurisprudence; Administration, Government; Affairs. Class IV. Philosophy, Education; Ancient, Medieval and Cultural History; Archaeology; Philology and Languages; Literature, Fine Arts.

Class I. Mathematical and Physical Sciences
Class II. Geological and Biological Sciences
Class III. Social Sciences
Class IV. Humanities

Art. 4. In each of the four classes of members there shall be a Committee on Membership consisting of a Chairman and four others members, appointed by the President.

Art. 5. Nominations to membership shall be made in writing by the Committees on Membership, or they may be made by any five members of the Society. These nominations shall be known respectively as "Committee nominees," and "Member nominees," and shall be so listed in the *preliminary ballot*. These nominations must be in the Executive Office before December first. Nominations shall be on blank forms provided for that purpose and shall specify the qualifications and principal activities or fields of learning of the nominees. In case of non-election nominations may be continued by the written endorsement of three of the proposers filed in the Executive Office before November first following and shall be listed as "Continued nominations" in the *preliminary ballot;* these nominations may be continued a second time in similar manner, after which the names of the unsuccessful candidates will be dropped and all papers relating thereto destroyed. Such candidates may be considered again only by entirely new nominations.

Art. 6. Immediately before December first in each year the Chairman of each Committee on Membership shall submit to the members of his class a list of all the nominations in the class and shall request them to use this list as a *preliminary ballot* and to check on it the names of those persons, not more than twelve in number, whom they prefer for resident members, and not more than five whom they prefer for foreign members, and to sign and return this ballot to the Executive Office before January first.

Art. 7. Before February first each Committee on Membership shall select from among those nominees having a high number of votes in the *preliminary ballot* not more than twelve for resident membership and not more than five for foreign membership in each class, due regard being given to a proper representation of the various subjects within the class.

Art. 8. Before February first, the Council may nominate not more than three persons in each year whose names shall be presented to the Society in the *preference ballot* as "Council nominees" together with their qualifications. These nominations shall be on the regular blank forms provided for that purpose.

Art. 9. It shall be the duty of each Committee on Membership to prepare, with such outside assistance as it may choose, a brief biographical sketch of each of the nominees so selected, listing his profession, position, qualifications, and important publications or contributions to science, literature, art or affairs. The names of these nominees, together with the biographical sketch of each, shall then be printed in alphabetical order under each class, and shall be sent confidentially to all members of the Society not later than March first. Members shall be invited to return to the Executive Office before April first a *preference ballot* on which they have checked the names of not more than thirty nominees for resident membership and of not more than eight for foreign membership.

Art. 10. The Council at the meeting next preceding the General Meeting of the Society in the month of April, notice of which shall be given at least two weeks in advance, shall select by ballot from the list of nominees residing within the United States a number not exceeding thirty, and of non-residents of the United States a number not exceeding eight, to be recommended to the Society for election. In this selection special weight shall be given to the votes of members in the preference ballot. The names of the nominees so chosen, arranged alphabetically in classes, shall be reported to the Society at its next ensuing session.

Art. 11. Election to membership, both resident and foreign, shall be by ballot at the General Meeting of the Society in the month of April. A two-thirds vote of those present and voting shall be necessary to elect.

Art. 12. The members are mutually pledged not to mention to non-members of the Society the name of any nominee proposed, or of any withdrawn or unsuccessful nominee.

Art. 13. Every person who is elected a resident or foreign member shall signify his acceptance in writing within one year after the mailing of notification of such election. In default of such acceptance the election shall be void.

Art. 14. The formal admission of a member into the Society shall be at his first attendance at a meeting of the Society after his election and in the manner and form following: He shall subscribe the Laws in the Roll Book and be introduced to the President, who, taking him by the hand, shall say:

"By the authority and in the name of the American Philosophical Society held at Philadelphia for Promoting Useful Knowledge, I do admit you a Member thereof."

Art. 15. The Society may from time to time assess membership dues in accordance with its needs and policies. Any person who shall refuse or neglect to pay such assessment for two years, after two or more notifications from the Treasurer, shall be reported to the Society as delinquent and his name shall be stricken from the roll of members.

Art. 16. The membership of any resident or foreign member may, for good and sufficient cause, and upon recommendation by the Council, be terminated by the Society at a General Meeting by a vote of two-thirds of the members attending, provided, however, that the total number of members so attending shall be not less than thirty.

Chapter II

Of the Patron and Elective Officers; qualifications, nominations and elections, terms of office, suspension or removal, vacancies.

Art. 1. The Governor of Pennsylvania shall be ex-officio the Patron of the Society.

Art. 2. The elective Officers of the Society shall be a President, three Vice-presidents, two Secretaries, a Curator, a Treasurer, and twelve Councillors.

Art. 3. No person save the Treasurer, who may be a Corporation, shall be capable of holding any elective office as defined above, who is not a citizen of the United States.

Art. 4. Nominations to the elective offices of the Society are made by the Committee on Nominations as hereinafter provided, and may also be made by petition signed by not less than twenty members, in such manner as may be prescribed by the Committee on Nominations and approved by the Council.

Art. 5. The election of Officers shall be held at the General Meeting in the month of April at a time duly announced in the program. The election shall be by ballot, a majority of all ballots cast being requisite for election. In the event that no candidate for a given office shall receive such a majority, a second ballot shall be taken and election shall be by plurality of votes cast.

Art. 6. The terms of all elective Officers, except Councillors, are of one year, commencing upon the close of the General Meeting at which they are elected. They shall serve until the election and acceptance of their successors and are eligible for reelection.

Art. 7. The terms of Councillors are of three years, commencing upon the close of the General Meeting at which they are elected. They shall serve until the election and acceptance of their successors, but are ineligible for reelection until one year after the expiration of their terms of office.

Art. 8. Any elective Officer may be suspended or removed from office, for good and sufficient cause, at a meeting of the Council, by a vote of two-thirds of all its members.

Art. 9. A vacancy occurring in any elective office may be filled for the unexpired term by vote of a majority of the Council.

Chapter III

Of the Officers and their duties

Art. 1. The President shall preside at the meetings of the Society and Council; he shall appoint all committees, and designate their chairmen, except as otherwise provided in the Laws, and shall be ex-officio a member of all committees except the Committee on Nominations.

Art. 2. The Vice-presidents shall preside at meetings of the Society and Council, in the absence of the President, in rotation in order of seniority of continuous service. In the event of the death or disability of the President, the senior Vice-president shall act as President until the vacancy shall be filled.

Art. 3. The Secretaries shall have the custody of the Seal of the Society, shall record the proceedings of the Society and the Council, shall notify all acts of the Society and the Council to those concerned, shall conduct the correspondence of the Society and Council, shall maintain the authentic list of resident and foreign members, and shall have the custody of the Society's files and records. The Secretaries shall arrange among themselves each year as to the distribution and performance of their duties, and shall report such arrangement to the Council; they shall also have power to delegate the performance of their duties to the Assistant Secretary or Executive Officer.

Art. 4. The Curator shall have charge of the Cabinet, and shall supervise the maintenance, exhibit, and use of the Society's collections, and shall advise the Council with respect to their increase, disposal, or temporary loan. He shall be ex-officio a member of the Committee on the Hall.

Art. 5. The Treasurer may be a person, as defined in Chap. II, Art. 3, or a trust company or other suitable financial corporation of the State of Pennsylvania. He shall collect and receive all moneys due or payable to the Society or entrusted to its care, and all gifts and bequests made to it. He shall pay all bills due by the Society when properly approved, in accordance with appropriations authorized by the Society or the Council, or in accordance with the terms of trust funds established for specific purposes. He shall deposit the funds and securities of the Society in its name with such banks or trust companies in the State of Pennsylvania as may be approved by the Committee on Finance.

Art. 6. The Treasurer shall keep accounts in good and regular order of all receipts and expenditures and of all moneys or other property in his hands, and shall report them, and present them for audit, as may be required by the Committee on Finance.

Art. 7. The Treasurer may, if authorized by vote of the Committee on Finance, employ an assistant treasurer or a trust company or other suitable financial corporation of the State of Pennsylvania, approved by the Committee on Finance, for the performance of such duties as may be delegated to such agent.

Art. 8. The Treasurer shall give bond, at the expense of the Society, for the faithful execution of all his trusts, in such amount as may be required by the Committee on Finance.

Art. 9. The Treasurer shall, upon the expiration of his term of office, deliver over to the Committee on Finance, for transmittal to his successor, the books, papers, moneys, and property remaining in his hands.

Chapter IV

Of the Council and the Annual Budget

Art. 1. The Council shall consist of the Officers, the twelve Councillors, and the Chairmen of the Committees on Finance, Research, Publications, Library and Hall.

Art. 2. The Council shall hold at least two meetings a year, and nine members shall constitute a quorum at any meeting, provided, however, that for the adoption of the budget a vote of a majority of all the members shall be requisite. Minutes of the proceedings and acts of the Council shall be regularly kept.

Art. 3. The Council shall make recommendations for membership in the Society as provided in Chap. I, Art. 9, of the Laws, and elect members of the Committees on Research and Publications as provided in Chap. 5, Arts. 5 and 8.

Art. 4. The Council shall, at such time as they may fix, ask all Committees to submit estimates of their needs for the ensuing fiscal year which, together with the report of receipts and expenditures by the Committee on Finance, shall be made the basis for the annual budget to be submitted by the Council to the Society for its approval at the General Meeting in April or November.

Art. 5. The Council shall have power to take action for the Society in legal matters, to manage its affairs, and to assume its administration, to make contracts or to authorize them to be made in the name of the Society, except as otherwise provided.

Art. 6. The Council shall require reports to be presented to it at least once a year by such officers, committees, and employees of the Society as they may designate, or as may be required by the Laws to present such reports, and shall, through the President, present an annual report to the Society on the state of its affairs.

Art. 7. The Council shall have power to appoint an administrative executive officer, and to fix his term of service, duties and compensation.

Chapter V

Of the Committees of the Society

Art. 1. There shall be four Committees on Membership, one in each class, each composed of five members whose appointment and duties are prescribed in Chap. I, Arts. 4–8.

Art. 2. There shall be a Committee on Finance, consisting of the President and Treasurer, ex-officio, and not fewer than five other members who shall be nominated by the President and elected by the Society at the General Meeting in April. A majority of the Committee shall constitute a quorum at any meeting. The Committee shall keep a record of all its acts and proceedings, which shall be communicated to the Council.

Art. 3. The Committee on Finance shall have the general superintendence of the financial concerns of the Society. It shall have the custody and control of all the securities and investments of the Society, both real and personal, with full power and authority to buy and to sell, and to invest and reinvest the same; including the power to purchase and to sell real estate and to make leases thereof, to satisfy mortgages and extinguish ground rents, and to direct the placing of all such insurances as it may deem necessary; as well as to borrow on the credit of the assets of the Society, to create mortgages thereon, and to make such improvements, repairs and alterations to real estate as it may deem necessary. It shall have power to authorize the proper Officers of the Society to execute the necessary papers to effect all purchases, sales and assignments of property, both real and personal; to execute and to satisfy mortgages, to extinguish ground rents and to transfer registered securities; to subscribe to bond-holders' agreements to plans of reorganization involving any securities held by the Society or in which it has an interest, and to do all such acts as are necessary in pursuance of the foregoing powers.

Art. 4. The Committee on Finance shall always have access to the Treasurer's books, accounts, and vouchers, and shall cause an audit of such accounts to be made at least once a year. It shall require from the Treasurer an annual report of all the operations of the treasury, which it shall present to the Council with an annual statement of estimates of receipts and expenditures. With the approval of the Council it shall determine the fiscal year of the Society and, in case of emergency needs, authorize appropriations over and above the annual budget.

ART. 5. There shall be a COMMITTEE ON RESEARCH, consisting of the President, ex-officio, and of not fewer than six other members, representative of the four classes, who shall serve for three years and who shall be nominated by the President and elected by the Council. A majority of the Committee shall constitute a quorum at any meeting, and shall be requisite for any vote disposing of funds that may be allotted to the Committee. The Chairman, or a member designated by the Chairman, of the Committee on Publications, and of the Committee on Meetings, may sit with the Committee on Research but shall not vote.

ART. 6. The Committee on Research shall, with the approval of the Council, prescribe regulations for receiving and considering proposals for the advancement of knowledge through investigation. It may take such action as it shall see fit with respect to proposals received by it, and may, with the approval of the Council, itself initiate and cause to be executed investigations for the advancement of knowledge. It shall certify to the Treasurer all disbursements to be made from funds appropriated to it by the Council, and may allot therefrom such sums as it may see fit, on such conditions as it may prescribe, for the investigations approved by it. It shall require reports of the expenditures of all sums so allotted, and of the progress of all investigations aided thereby. It may withhold assistance in the event that the said reports are judged unsatisfactory.

ART. 7. The Committee on Research shall report all its acts to the Council, and from time to time submit reports to the Society on the progress of the investigations aided by it, and on the contributions to the advancement of knowledge made by them.

ART. 8. There shall be a COMMITTEE ON PUBLICATIONS, consisting of the President, ex-officio, and of not fewer than six other members, representative of the four classes, who shall serve for three years, and who shall be nominated by the President and elected by the Council. A majority of the Committee shall constitute a quorum at any meeting, and shall be requisite for any vote disposing of funds that may be allotted to the Committee. The Chairman, or a member designated by the Chairman, of the Committee on Research and of the Committee on Meetings, may sit with the Committee on Publications but shall not vote.

ART. 9. The Committee on Publications shall supervise the contents, editing, printing, publication, distribution, and sale of all publications issued by the Society or in its name. It shall have power to employ necessary editorial assistance, and, with the approval of the Council, to appoint an Editor and to determine his duties and fix his compensation. It shall cause the necessary contracts for the manufacture of the Society's publications to be drawn up and executed. It shall certify to the Treasurer all bills which it shall have examined and approved for expenses attending the publications, as well as all disbursements to be made from funds appropriated to the Committee by the Council.

ART. 10. The Committee on Publications shall, with the approval of the Council, prescribe regulations for receiving and considering proposals for publication, and may take such action as it shall see fit with respect to proposals so received, including the allotment of funds appropriated to the Committee by the Council. The Committee shall have power to appoint referees or special sub-committees to assist it in the examination of material presented to it for publication and, in its discretion, to give honoraria for services so rendered. It shall report all its acts to the Council.

ART. 11. There shall be a COMMITTEE ON MEETINGS, consisting of the President, ex-officio, and of not fewer than four other members representative of the four classes. The Committee shall be appointed by the President and shall have power to add to its numbers. A majority of the Committee shall constitute a quorum at any meeting and shall be requisite for any vote disposing of funds that may be allotted to the Committee. The Chairman, or a member designated by the Chairman, of the Committee on Research and of the Committee on Publications, may sit with the Committee on Meetings but shall not vote.

ART. 12. The Committee on Meetings shall be charged with the preparation of the scientific and scholarly programs of all meetings of the Society, and of all meetings held under its auspices, and with the organization of discussions, symposia, and conferences. It shall have power to name special sub-committees to assist it, and to invite suitable persons, whether members of the Society or not, to participate in such programs, discussions, symposia, etc. The Committee shall have power to use such funds as may be appropriated to it by the Council for defraying the expenses of the programs, discussions, etc., organized by it, and shall certify to the Treasurer all disbursements to be made from such funds.

ART. 13. The Committee on Meetings shall transmit to the Committee on Publications all papers, communications, reports, and other materials which it may recommend for publication.

ART. 14. There shall be a COMMITTEE ON LIBRARY, consisting of the President, ex-officio, and of not fewer than six other members, representative of the four classes, who shall serve for three years and who shall be appointed by the President.

ART. 15. The Committee on Library shall supervise the administration of the Library, and shall, with the approval of the Council, prescribe regulations for its government and use. The Committee shall have power, with the approval of the Council, to employ a Librarian, determine his duties, and fix his compensation. It shall have charge of the exchange of publications, and shall have power to expend income of trust funds established specifically for purposes of the Library. The Committee shall prepare estimates of expenditures for the maintenance and increase of the Library, and shall certify to the Treasurer all bills properly payable and all disbursements to be made from funds appropriated by the Council for the purposes of the Library.

ART. 16. There shall be a COMMITTEE ON HALL, consisting of the President and Curator, ex-officio, and such other members as may be appointed by the President. They shall serve for three years and shall have charge of the Hall of the Society and of its furniture and fixtures and shall direct all necessary repairs.

ART. 17. There shall be a COMMITTEE ON NOMINATION OF OFFICERS consisting of five members,—a Chairman, appointed by the President, and the four Councillors who are entering the third year of their term of service.

ART. 18. The Committee shall, not later than December first, invite all members of the Society to submit to it informal suggestions for nominations to all offices to be filled by election at the next General Meeting.

ART. 19. The Committee shall then communicate to all members of the Society, not later than February first, a report presenting one nomination to each office to be filled by election at the next General Meeting. Nominations may also be made by petition if signed by twenty or more members and submitted to the Chairman not later than March first. Notice of such nomination must be sent to all members by April first.

ART. 20. The Committee shall prepare for use in the elections at the General Meeting a ballot in which shall be included, under each position to be filled by election, the name of the Committee's nominee, and the names, in alphabetical order, of any nominees included in petitions duly received in accordance with the Laws.

Chapter VI

On the Meetings of the Society

Art. 1. The Annual General Meeting shall be held in the month of April on days designated by vote of the Council, adopted at least three months before the date fixed therefor, at which it shall be lawful to transact all business not in contravention of the Laws.

Art. 2. The Autumn General Meeting shall be held on days designated by vote of the Council, usually in the month of November, at which it shall be lawful to transact all business not in contravention of the Laws.

Art. 3. Special meetings may be called at any time by order of the President, or, in his absence or disability, by order of a Vice-president, or by vote of the Council, for the consideration of matters of scientific or scholarly interest or for the transaction of such business as shall be specified in the order or vote calling the meeting.

Chapter VII

Of the Publications of the Society

Art. 1. The publications of the Society shall consist of Proceedings, Transactions, Memoirs, Year Book, and of such other serial or separate publications as may be authorized by the Council upon recommendation by the Committee on Publications.

Art. 2. The Proceedings shall contain papers that are read before the Society at its meetings and that have been approved by the Committee on Publications. Other papers from whatever source may also be published in the Proceedings if approved by this Committee. The Proceedings will be distributed without charge, as issued, to the members who request it.

Art. 3. The Transactions shall consist of contributions in the form of monographs, treatises, collections of documents, and other materials, approved by the Committee on Publications. The Transactions shall be issued in complete parts, one or more of which may constitute a volume.

They may be supplied to any member on such conditions or terms as may be prescribed by the Committee on Publications.

Art. 4. The Memoirs shall consist of works approved by the Committee on Publications. They shall be issued in such form as shall make possible their assembly in volumes according to subject matter, or to fields of knowledge. They may be supplied to any member on such conditions or terms as may be prescribed by the Committee on Publications.

Art. 5. The Year Book shall contain, among other items, the Charter and Laws, list of Officers and Committees, the annual report of the President and Officers, important acts of the Society and Council, reports of all standing Committees, a catalogue of prizes, premiums and lectureships, lists of all members together with those elected and those deceased during the year, and obituaries of deceased members. It shall be published as soon as possible after the close of each calendar year and shall be sent gratis to all members of the Society.

Chapter VIII

Of the Laws of the Society and their Amendment

Art. 1. No amendment or supplement to these laws, nor any new law shall be made or passed by the Society, unless the same has been duly proposed in writing at a Stated Meeting of the Society and enacted at the subsequent General Meeting; due notice of the proposed law or amendment having been sent by mail at least fourteen days before the said General Meeting to the members qualified to vote thereon.

Art. 2. At the General Meeting no amendment or supplement to these laws shall be made, nor shall any new law be made, unless there be present a quorum of at least twenty members, of whom not fewer than five shall be members of the Council, and the same be voted by two-thirds of the whole body present.

III

OFFICERS AND STANDING COMMITTEES

1939–1940

OFFICERS

PATRON

The Governor of Pennsylvania

PRESIDENT

Roland S. Morris

VICE-PRESIDENTS

Edwin G. Conklin   Robert A. Millikan   Cyrus Adler

SECRETARIES

John A. Miller   William E. Lingelbach

CURATOR

Albert P. Brubaker

TREASURER

Fidelity-Philadelphia Trust Company

EXECUTIVE OFFICER

Edwin G. Conklin

COUNCILLORS

Elected in 1937	Elected in 1938	Elected in 1939
Edward Capps	William F. Albright	Albert F. Blakeslee
Luther P. Eisenhart	Arthur L. Day	Waldo G. Leland
Alfred N. Richards	Frank A. Fetter	Harold G. Moulton
John M. Scott	Harold C. Urey	W. F. G. Swann

STANDING COMMITTEES

The President is ex-officio a member of all committees except the Committee on Nomination of Officers. The first member named in each committee is Chairman. The Executive Officer sits with all committees but does not vote unless regularly a member.

FINANCE

(For one year, 1939–40)

Marshall S. Morgan
Thomas S. Gates
Nathan Hayward
John S. Jenks
George W. Norris
Charles J. Rhoads
J. Henry Scattergood

HALL

(For three years, 1939–42)

J. Bertram Lippincott †
Paul P. Cret
Marshall S. Morgan
Lawrence J. Morris
J. Rodman Paul
John M. Scott
Albert P. Brubaker, Curator

RESEARCH

(For three years)

Edwin G. Conklin (1939–42)
William F. Albright (1939–42)
Detlev W. Bronk (1939–42)
Arthur F. Buddington (1937–40)
Edward P. Cheyney (1938–41)
Gilbert Chinard (1938–41)
John A. Miller (1939–42)
Alfred N. Richards (1939–42)
Harlow Shapley (1939–42)
W. F. G. Swann (1939–42)
Hugh S. Taylor (1939–42)

† Deceased January 19, 1940.

PUBLICATIONS

(For three years)

Cyrus Adler (1939–42)
Frank Aydelotte (1939–42)
Edwin G. Conklin (1939–42)
Franklin Edgerton (1939–42)
Benjamin D. Meritt (1939–42)
John A. Miller (1939–42)
Ernest M. Patterson (1938–41)
Conyers Read (1939–42)
Jacob R. Schramm (1938–41)
Harold C. Urey (1938–41)
James T. Young (1939–42)
Arthur W. Goodspeed, Editor

MEETINGS

(For one year, 1939–40)

Edwin G. Conklin (1939–40)
Frank Aydelotte (1939–40)
Karl K. Darrow (1939–40)
Merkel H. Jacobs (1939–40)
Horace H. F. Jayne (1939–40)
Waldo G. Leland (1939–40)
Phoebus A. Levene (1939–40)
William E. Lingelbach (1939–40)
John A. Miller (1939–40)
David W. Tennent (1939–40)

LIBRARY

(For three years)

St. George L. Sioussat (1939–42)
George A. Barton (1939–42)
Rhys Carpenter (1937–40)
John S. Jenks (1939–42)
Waldo G. Leland (1939–42)
William E. Lingelbach (1939–42)
Horace C. Richards (1939–42)
A. S. W. Rosenbach (1938–41)

COMMITTEES ON MEMBERSHIP

(For one year, 1939–40)

CLASS I. MATHEMATICAL AND PHYSICAL SCIENCES

W. F. G. Swann
Luther P. Eisenhart
Frank B. Jewett
Irving Langmuir
Harlow Shapley

CLASS II. GEOLOGICAL AND BIOLOGICAL SCIENCES

Detlev W. Bronk
Edward W. Berry
Ralph E. Cleland
Ross G. Harrison
Karl S. Lashley

CLASS III. SOCIAL SCIENCES

Ernest M. Patterson
Edward P. Cheyney
Edward S. Corwin
Jesse S. Reeves
Charles J. Rhoads

CLASS IV. HUMANITIES

Gilbert Chinard
William F. Albright
William S. Ferguson
Arthur O. Lovejoy
John C. Rolfe

COMMITTEE ON NOMINATION OF OFFICERS

(For one year, 1939–40)

Thomas S. Gates, Chairman

Edward Capps
Luther P. Eisenhart
Alfred N. Richards
John M. Scott
} Retiring Councillors

CALENDAR FOR 1939–1940

STATED MEETINGS OF THE SOCIETY

1939

November 17–18. Autumn General Meeting.

November 17, 10 A.M.–1 P.M. Open Session for Reading of Papers and Reports of Research aided by Grants.

2–4 P.M. Symposium on "The Totalitarian State from the Standpoints of History, Political Science, Economics and Sociology." Followed by General Discussion.

4 P.M. Stated Meeting of Council.

8:15 P.M. Public Lecture followed by Reception.

November 18, 9:30–10:30 A.M. Executive Session.

10:30 A.M.–1 P.M., 2–4 P.M. Open Sessions for Reading of Papers and Reports of Research aided by Grants.

1940

February 23–24. Mid-winter Meeting

February 23, 10 A.M.–1 P.M., 2–4 P.M. Centennial Celebration of the Wilkes Exploring Expedition of the United States Navy, 1838–1840, and Symposium on American Polar Exploration.

8:15 P.M. Public Lecture on Polar Exploration followed by Reception.

February 24, 9:30 A.M.–1 P.M. Open Session for Papers on Polar Exploration.

April 18–20. Annual General Meeting.

April 18, 10 A.M.–1 P.M., 2–4 P.M. Open Sessions for Reading of Papers.

6:30 P.M. Annual Meeting of Council.

8:15 P.M. Special Lecture and Exhibition followed by Reception.

April 19, 9 A.M. Executive Session and Annual Election.

10:30 A.M.–1 P.M., 2–4 P.M. Symposium on "Characteristics of American Culture and its Place in General Culture."

8:15 P.M. Penrose Memorial Lecture followed by Reception.

April 20, 10 A.M. Open Session for Reading of Papers.

2 P.M. Excursion.

7:30 P.M. The Annual Dinner.

IV

MINUTES OF THE EXECUTIVE SESSIONS

1. Annual General Meeting

Friday, April 21, 10 A.M.

EXECUTIVE SESSION

ROLAND S. MORRIS, President, in the Chair

ANNUAL REPORT OF THE PRESIDENT

In submitting a report on our stewardship on behalf of the Officers and Council of the Society since the last Annual Meeting, I am happy to report that the general financial condition of the Society is sound and encouraging.

The total principal funds of the Society, at book value, amount to $7,209,302.39, which have, as of December 31, 1938, a market value of $7,325,438.94. During the year we received additions to our principal of $391,740.86, which included the net principal estate of Judson Daland of $219,953.90; cash received from the estate of Walter Wood, $101,743.42, and income from our various funds transferred to principal $69,294.91, together with a small item for stock dividends received.

I think I can safely assure you that the portfolio of our securities is a sound and conservative one and, apart from a considerable holding of real estate and unliquidated mortgages, our general funds are in a satisfactory and fairly liquid condition, so that we could take advantage of any improvement in the investment market.

The same sound condition is reflected in our summary of income and expenditure for the year. We kept well within our budget and were able to transfer, as previously stated, out of the funds to principal the satisfactory reserve of $69,294.91. This addition of income to our principal would seem to be more than justified by the uncertain conditions prevailing in the investment markets.

That I can make such an excellent report to you of the financial condition of the Society I feel is wholly due to the fine judgment and devotion of our Finance Committee. I sometimes wonder if the Society realizes the wealth of experience and judgment which is being given so generously to the Society by the members of the Finance Committee.

We suffered a severe loss during the year in the death of our Chairman, Mr. William P. Gest, who had taken such a deep, personal interest in the activities of the Society. He brought to us more than half a century of experience as a lawyer, trust officer, President of the Philadelphia Clearing House, and for many years President and Chairman of the Board of the Fidelity-Philadelphia Trust Company. It was under his leadership that during the past six years the Society has pursued such a conservative course in the handling of its investments. I know I speak for every member of the Society when I place upon the records a statement of our deep appreciation of all he did for our Society and the deep sense of loss which we feel in his death.

We have remaining with us as successor to the Presidency of the Fidelity-Philadelphia Trust Company, Mr. Marshall S. Morgan, who has succeeded him as Chairman of both the Finance and Building Committees; Mr. Thomas S. Gates, President of the University of Pennsylvania and for many years a partner in the firm of Morgan & Drexel; Mr. J. Henry Scattergood, who is the Treasurer of both Haverford and Bryn Mawr Colleges, where he has had many years of experience in the handling of endowments; Mr. Charles J. Rhoads, a former Vice-president of the Girard Trust Company and a former Governor of the Federal Reserve Bank; Mr. John S. Jenks, a director of many of our largest Philadelphia institutions; and Mr. George W. Norris, one of our new members, who has only recently retired from the Governorship of the Federal Reserve Bank in the Philadelphia District. It shows a fine spirit that these men, so important in the financial life of Philadelphia, should give so much of their time and study to the financial welfare of our historic Society.

In this connection, I venture once more to call to the attention of the Society the need of having available a few more of the younger leaders in business affairs who, as members of the Society, may be prepared to succeed those who are now serving on the Finance Committee. It has been our policy, for many generations, to elect as members men of scholarly tastes, easily available, and experienced in the management of money and investments.

At present, under our class system of nomination, it has been perhaps an unfair burden to impose on the social science Committee on Membership the responsibility of nominating possibly one, two, or three men from time to time to carry on this particular tradition in the Society. It tends to limit the opportunity which that Committee has to recognize strictly scholarly work within the field of the social sciences. An amendment to our Laws has been suggested, which is submitted with the approval of the Council for your consideration, which would give to the Council of the Society the right merely to nominate three candidates at large, not classified as men of affairs. This proposed amendment would, in effect, simply provide another very small group called "Council Nominees." They might belong to Class I, II, III or IV. The Council might nominate any great scholar or man of affairs but would be limited to three. The names of these "Council Nominees" would be sent out to members together with the nominations of the Committees on Membership for their approval.

We owe to our Executive Vice-president and to the Hall Committee many improvements in our Hall and equipment. If you will look over the building at your convenience, you will see that the basement floor has been greatly improved and made available for additional offices; that the top floor of the building now contains an adequate kitchen, in addition to the one on the basement floor; that a system for broadcasting throughout the building has been installed, thus to enlarge our general meeting-room by carrying the speaker's voice to all parts of the building in case of overflow attendance. You will also observe that many of our valuable portraits have been repaired, properly identified and marked, and that the general interior of the building has been improved. This summer we shall build a brick wall around the south area, as provided for at the previous meeting, and make some minor changes in the exterior of the building. We thus have a building of historic value and prefectly adapted to our present administrative needs.

As I reported last year, we have acquired additional space in the Drexel Building, and I am bold to hope that the members attending this general meeting will take occasion to look over the Library and its present equipment. I think I express the conviction of those in close touch with the Society in stating that the present library facilities have proved adequate for our needs, that it is protected by watchmen, cared for by janitors, and reasonably fireproof, all for the very reasonable rental of $8,700 a year.

This brings me to the suggestion which has been made that the former Philadelphia Custom House building might be available to be used as a library building for the American Philosophical Society. The members of the Society will recall that at the last Annual Meeting a resolution was passed appropriating a sum not to exceed $5,000 for the purpose of obtaining tentative plans and estimates as to what the cost would be of reconditioning the Custom House building and rendering it available for a library of the Society.

It was further resolved that the Library Committee should submit a report on what the Committee deemed to be necessary for adequate library facilities for the Society, and that this report should be submitted to architects and engineers for the purpose of obtaining a plan and an estimate on such plan of the cost involved. In compliance with these instructions, and after a very careful investigation, the Library Committee submitted a report, in October of last year, which is entitled "Report on the Needs of a New Library Building," and which will be appended to this report.[1] This report concludes with the following words:

As before stated, "the needs are presented, and it is not in the province of this communication to decide for or against leasing or purchasing the old Custom House building. It does attempt to show the necessity of competent professional engineering advice on the subject."

Upon receipt of this report from the Library Committee, and in accordance with the further provisions of the resolution of the Society, the Finance Committee, after consideration, employed the United Engineers and Constructors, Inc., requesting that this well-known designing and building company should study the present construction of the Custom House and advise the Finance Committee whether it could be fitted up in such a way as to meet the requirements as given by the Library Committee and to make a rough estimate of the possible cost of such changes and improvements as might be required. The Company, through its President, Edwin M. Chance, then filed with the Finance Committee a very exhaustive report outlining what would be required to fit the Custom House for a library, and estimated that the total cost, not including commissions and other incidentals, would amount to $275,000. In addition, the Company reported that the cost of

[1] See p. 41.

maintenance of the property after it had been improved would be approximately $20,000 a year. This would include heating, hot water, electricity, gas, cleaning and maintaining exterior marble, insurance and public liability, automatic fire alarm, carpentering, painting, and other continuing repairs, supplies for the building, and salaries of a supervising mechanic and possibly three watchmen, each on an 8 hour schedule, for the general protection of the building.

If to these expenses you add the interest on the money expended on the alterations and repairs—$12,000—the total cost of the use and maintenance of the building as a library would represent a yearly expenditure of $32,000, which might be deemed the minimum rental for the building, assuming that the Government would consent to lease the building to us on a long-term lease at a merely nominal rental or, which seems more likely, would retain title to the property and permit us to use it for library purposes, with some provision for cancellation. This total would not include any amount for amortization of the $300,000 expended on improvements.

This sum may be contrasted with the amount we are now paying for the library facilities in the Drexel Building of $8,700, and raises the question of whether, under present conditions, the Society would be justified in assuming the additional burden involved over a period of years. In this connection it might be of interest to the Society to review the actual cost of the Library apart from such rental figures. Reference to the Society's financial statement for the year 1938 shows that, apart from the rental charges, the Library requires fixed yearly expenses as follows:

Books, binding, and general expenses	$10,979.20
Librarian's salaries	9,892.50
Special library funds	5,170.78

or a total of $26,042.48 for administration and books.

This total does not include furniture and additional equipment for the Library, but merely the normal administration expenses. It would thus seem that should the Society undertake to improve the Custom House and to operate it as a library building under some arrangement with the United States Government, it would call for a total expenditure yearly of $58,042, which may well be contrasted to the present cost of the Library of $34,700. These figures and estimates were carefully studied by the members of the Finance Committee in the light of the general purposes of the Society, the future development of the Library, and the business judgment of expending such a substantial sum of money at this time and under present conditions, including an additional yearly expense of some $16,000, perhaps as much as $20,000. It was the unanimous judgment of the Finance Committee that it would be inadvisable for the Society to assume this burden at present, which would mean cutting down our expenditures to that extent in other fields.

The members of the Finance Committee also studied the present condition of our available building funds. We have the Wood bequest which would be available for building purposes, and which has an appraised net value of $577,827, but, unfortunately, practically all of this net value is in unsalable real estate, completely frozen at the present time and, therefore, unavailable for use. In addition, the building fund proper now amounts to $617,149.90, but of this amount over $355,000 is in real estate and mortgages which cannot, at this time, be liquidated, so that the only balance of cash available for any building purpose would be the $261,717, or considerably less than the amount required for the improvements on the Custom House. It, therefore, seemed to the members of the Committee inadvisable at a time when values are so uncertain to expend such a large sum on improvements.

Further, the Committee, in cooperation with the executive officers of the Society, studied the actual use of the Library at the present time, as it would seem essential to consider any large additional expenditure in the light of the use to which it can be put. It appears from the report of the Librarian, covering the year 1938, that the Library had been used by a total of 398 persons; 19 books were borrowed by members; 93 manuscripts have been consulted, and 129 books have been sent from the Library in exchange with other libraries.

We feel that these figures of use should be considered in the light of the present operation in Philadelphia of the Union Catalogue, to the creation of which our Society contributed some $21,000, and which will have the ultimate effect of driving the various libraries to special fields rather than to continue a general collection of books. This may well result in a limitation of our future purchases and a greater specialization in the Society's library policy. It is this subject which is set for discussion[1] by the Society on Saturday afternoon.

It is in this connection that the suggestion has been made that it might be well at this time for the Society to undertake a rather careful survey of the future uses of the Library, and it might be wise to authorize the Council of the Society to appoint a committee of expert library students to make such a survey and report at a later date. It is the conviction of the Finance Committee that, pending such an investigation, it would be most unwise to undertake now the additional expenses enumerated above, or to consider the use of the Custom House for a library.

Finally, it must be borne in mind that we are now under the obligations of a lease dated March 8, 1938, and which has approximately four more years to run. It might well require a considerable additional expenditure to be released from the obligation of this lease. For these reasons, it is the conclusion of the Finance Committee that it would be inadvisable to inaugurate any negotiations with the United States Government at this time, with a view to assuming the additional burden of the Custom House property.

Discussing generally our new equipment leads me to refer, at this point, to the new activity which will now be concentrated in the offices on the basement floor, to which I referred above. The members of the Society will recall that at the last general meeting of the Society the proposal of the Carnegie Corporation that the Society should supervise an intensive study, in the Philadelphia metropolitan area, of amateur education in science, was approved in principle and that the President was authorized to appoint a committee with power to set up an organization for such survey. The Carnegie Corporation undertook to meet all the expenses of such an organization.

In pursuance of this authority, I appointed a Committee with Dr. Conklin, our Executive Vice-president, as Chairman, and consisting of the following distinguished scientists—all members of the Society—

Anton J. Carlson	Harlow Shapley
Edwin G. Conklin, *Chairman*	George G. Simpson
Karl K. Darrow	W. F. G. Swann
Luther P. Eisenhart	Rodney H. True
C. E. Kenneth Mees	Harold C. Urey

[1] See p. 64.

After the appointment of the Committee, the Carnegie Corporation deposited with us, for present expenses, the sum of $15,740, which has been placed in a special account as a first payment on the expenses which will be involved in this survey.

The Committee has held several meetings and has asked the President to act as Chairman of the Executive Staff, and has appointed Mr. W. Stephen Thomas as Executive Secretary, who will give his full time to the work, using the new offices in our building as his headquarters. His salary will be $4,000 a year. We are grateful to the Academy of Natural Sciences of Philadelphia for granting Mr. Thomas an indefinite leave of absence from his work there, in order to give his entire time to this project. Mr. Thomas has had considerable experience in promoting adult education in Philadelphia and its outlying districts, and has already made a preliminary survey of the work now being done and the possibilities of enlarging it. It is hoped by the Carnegie Corporation that an enlarged enterprise in adult education in science may be established which would set a standard for such work throughout the United States. I am sure that the members will cooperate in this most interesting experiment.[1]

Turning now from equipment and plans of organization, may I say just a few words on the vital activities of the Society in the promotion of useful knowledge? As you know, these activities are four-fold. First, grants for the support of research in all fields of knowledge; second, publication of studies and papers, monographs and memoirs; third, the maintenance of a library, which I have already discussed at some length; and fourth, the conduct of meetings for the discussion of contemporary problems in the field of scholarship.

I need not dwell on the details of these activities, as you have in the Year Book now in your hands the story of what has been done and is being done in all these fields. The outlines in the Year Book will be commented on in the reports from Dr. Edwin G. Conklin, *Chairman*, on behalf of the Committee on Research; Dr. Cyrus Adler, *Chairman*, on behalf of the Committee on Publications; Dr. St. George L. Sioussat, *Chairman*, on behalf of the Committee on Library, and Dr. Edwin G. Conklin, *Chairman*, on behalf of the Committee on Meetings.

It is only necessary for me to make one comment in passing.

[1] See p. 353.

Each one of the committees has studied earnestly whether we are at present operating wisely in these several fields. I need not point out, as I have before, the great opportunity which this Society has, due to the generosity of those who have contributed to the large endowment which we now possess and the fine tradition of scholarship which we have inherited from those who have preceded us in the two centuries of the Society's existence. It seemed to the Committee on Meetings that it might be wise for the Society as a whole to subject itself to a rigid self-examination, that the several committees might have the benefit of comment and suggestion from the members as to how we could enlarge or improve our usefulness. This is the reason that you will find the program on Saturday afternoon set aside for a general open forum discussion[1] of our objectives and how they can best be attained in this bewildering modern life of ours. This Saturday afternoon forum, which I hope as many as possible of our members will attend, is not a formal meeting of the Society and is not empowered to take action, but it may well develop suggestions which could be considered by the committees and subsequently submitted to the Society for approval. In such a forum it would seem that we could have a freer discussion and I am sure that the participation of all of you will be appreciated not only by the Officers and the Council, but also by the committees involved.

Revised Draft of the
REPORT OF THE NEEDS OF A NEW LIBRARY BUILDING
for the American Philosophical Society

The following information represents an attempt to formulate briefly the needs of a new library building, not only for the present time, but to cover the needs until some time in the remote future. This makes it largely a speculative problem and the figures can be only tentative. Herewith are given statistics on the cost of the erection of a few library buildings:

Historical Society of Pennsylvania, Philadelphia, Pa.

Erected 1910	
Cost of erection	$213,300
Including ground	$339,501

Henry E. Huntington Library, San Marino, California.

Erected 1920	
Cost of erection (approximate)	$950,000

[1] See p. 55.

William L. Clements Library, Ann Arbor, Michigan.

Erected 1923
Cost of erection $203,669

Girard College Library, Philadelphia, Pa.

Erected 1933
Cost of erection including furniture $405,037

Agnes Scott College Library, Decatur, Georgia.

Erected 1936
Cost of erection $230,000

Rhode Island State College Library, Kingston, R. I.

Erected 1937
Cost of erection: Grant from PWA of .... $ 65,000
Loan by state of $168,000

Brooklyn College Library, Brooklyn, N. Y.

Erected 1937
Cost of erection $800,000

The present holdings of the Society's Library are approximately as follows:

Volumes in library	85,000
Pamphlets	50,000
Maps	6,000
Manuscripts (single pieces)	30,000

During the past four years the accessions have averaged annually slighly over 2,000 bound volumes, of which an average of 1,100 were serial publications; 500 pamphlets, and 75 maps. At this same rate of increase at the end of one hundred years, there would be in the library approximately 300,000 volumes; 100,000 pamphlets; 13,500 maps.

It is only natural to suppose that with the years, the Society will acquire more bequests and as it grows richer, the library accessions will increase, and therefore the figures given above are conservative, and the figures listed below are probably none too high.

It is important that a site sufficiently large should be selected for a building, in order that units may be added to the original as needs develop and that the building should be so designed as to allow such additions without marring the original architectural design.

Extensive space must be provided for the storing of the Society's publications. A large room with built-in bins would be the more economical method as to space, but the stack shelves would be the more convenient method.

Scientific methods of air conditioning should be considered. It is especially essential in the stacks for the preservation of the books. If air conditioning is not possible, some system of adequate ventilation of the stacks should be installed.

SITE:

This should be of sufficient size to provide space for a building planned not only to suit the needs of the present, but capable of expansion as needs may develop.

Plans for building must be adequate for provision of sufficient space for users of the library, for the administrative and work rooms of the library staff and for the shelving of the books.

Uniform floor levels are most important, and should be uniform with stack floors.

STACKS:

The American Philosophical Society Library should plan for stack room to accommodate a maximum of 500,000 volumes. (While many libraries count eight books to a running foot of shelving, this library should not count more than six or six and one-half at most.)

VAULTS:

There should be 10,000 cu. ft. allotted for vault space, which should be fire-proof and burglar-proof. This space could be made into one large vault or divided into three smaller ones, as is deemed best by the architect and engineers. If divided into three, one could be used for the Franklin manuscripts, one for miscellaneous manuscripts, and the third for rare printed material.

Here in the Drexel Building the two vaults together contain approximately 1,400 cu. ft.

ROOMS REQUIRED:

Main Reading Room: 40′ × 60′—2400 sq. ft.

It would be well if this room could be so constructed that it could be used as a lecture room for the Society. Using our present Lecture Room at 104 South Fifth Street as a basis of measurement, a room 40′ × 60′ would accommodate between 400 and 500 persons. The present Lecture Room accommodates 200 or even 220 if crowded and it measures about 45′ × 25′ or 1,125 sq. ft.

Exhibition Room: 20′ × 35′—700 sq. ft.

Map Room: 30′ × 40′—1,200 sq. ft.

Plan for 15,000 maps.

Metal cases containing shallow drawers, measuring 48″ × 36″ and not more than 2″ deep, are the most satisfactory. Large tables for using maps are necessary.

Committee Room: 18′ × 25′—455 sq. ft.

Study Rooms: Five— 8′ × 8′—320 sq. ft.

If cubicles in the stacks should be used for study rooms, less space would be required, perhaps 6′ × 6′, as shelving in the stacks would hold the books. Each study room requires a chair and table.

Store Room for Society's Publications:
With built-in bins—5,000 cu. ft. or make provision in stacks for these publications.

Rest Rooms for Staff:
Two—one for men and one for women, 12′ × 14′ each, with lavatory and toilet adjoining each.

In addition to above, provision should be made for
Two public lavatories and toilets
Cloak room
Kitchen and catering facilities (provided building is fireproof throughout).

Janitor's quarters.

Elevators:
One passenger elevator from basement to floors used by public
Freight elevator to all floors
Book and passenger elevator to all floors of stacks.

Administrative and Work Rooms:

Librarian's office:	12′ × 16′—192 sq. ft.
Secretarial office:	10′ × 14′—140 sq. ft.
Cataloguers' room:	18′ × 24′—450 sq. ft.
Work room: Accessioning, preparation of books for binding, etc.	18′ × 22′—396 sq. ft.
Store room for supplies:	10′ × 12′—120 sq. ft.
Room for research worker:	12′ × 15′—180 sq. ft.
Room for repairing manuscripts (facing north)	12′ × 15′—180 sq. ft.

Photographic Section: 3 rooms each 10′ × 12′—360 sq. ft.
For efficient work three rooms are necessary, including the dark room proper. The dark room must have running water and electrical outlets. It should be so located that water leakage could not possibly injure the books in the library, and also so as to reduce to a minimum any possible danger of fire caused by crossed wires, chemicals, etc. . . .

It would be wise to have about 500 sq. ft. in reserve for future needs.

The compilation of this list is the result of much thought and painstaking investigation. Expert authorities have been consulted on the various phases of our requirements. This has been done through personal contact, correspondence, and in studying authoritative literature on the several subjects. We have been in correspondence with Dr. Max Farrand and Mr. Thomas M. Iiams of the Henry E. Huntington Library; Dr. Randolph G. Adams, Director of the William L. Clements Library; Dr. Lawrence C. Wroth, Librarian of the John Carter Brown Library; Dr. Merle M. Odgers, President of Girard College; and Dr. Julian P. Boyd, Librarian of the Historical Society of Pennsylvania; and from their valuable experience, we have obtained data on plans, equipment, cost statistics, etc. We also have gleaned valuable information from James Thayer Gerould's book, *The College Library Building, Its Planning and Equipment*, and many worthwhile recent articles in the *Library Journal* (see bibliography at end of report).

The Librarian has herewith given what she considers the essential needs of the present and future library building, and the Chairman presents these requisites to the President for consideration of the Finance Committee, the engineers and the architects. It is for them to determine whether the old Custom House can be made to care for these needs. We especially wish to emphasize the fact that the building must be made to fit our needs and not our needs made to fit the building.

We have not gone into the problem of foundations, heating, lighting, and ventilation, as yet, but if the report from the engineers is favorable, these questions then must be taken up and carefully considered as they are most important factors in the efficiency and comfort of the patrons of the library, of the library staff, and of the books themselves.

As before stated, the needs are presented, and it is not in the province of this communication to decide for or against leasing or purchasing the old Custom House building. It does attempt to show the necessity of competent professional engineering advice on the subject.

St. George L. Sioussat,
Chairman, Committee on Library.

November 22, 1938.

APPENDIX

LIBRARY BUILDING—BIBLIOGRAPHY

William L. Clements Library
For description see letter from Mr. Randolph G. Adams. Introduction to the Dedication of the W. L. C. Library (026.973: M58j).
American Architect October 10, 1923, for *Plans* of Library.

John Carter Brown Library
For description see letter from Mr. Lawrence C. Wroth, also chapter on the building of the J. C. B. Library in Winship's *History of the Library*.

Girard College Library
Detailed statistics of cost of erection of building, equipment, etc. (Plans of the building lent for inspection.)

Henry E. Huntington Library
Letter from Thomas M. Iiams, containing small plan of library.
Letter from Dr. Leslie E. Bliss giving dimensions and cost (confidential).

Harvard University
Letter from C. E. Walton gives description and prices of exhibition cases used by Harvard.

Historical Society of Pennsylvania
Letter from Mr. Julian P. Boyd and Mr. B. R. Johnstone giving statistics on cost and maintenance.

The College Library Building, Its Planning and Equipment by James Thayer Gerould. 1932.

Public Library Buildings by D. G. McComb. Los Angeles, 1935.

Library and Its Home by G. M. Drury. New York, 1935.

Art Metal Construction Company
Detailed statistics on our present stack equipment.

The Library Journal
The Rochester Public Library, by John Adams Lowe. January 15, 1937.
Library Step-Children—The Bookstacks, by Seymour Robb. April 1, 1937.
The Agnes Scott College Library, by Edna Ruth Hanley. April 15, 1937.
New College Library Buildings: Brooklyn College; Rhode Island College; Linfield College. October 15, 1937.
New Library Buildings: Denison University Library; University of Oregon Library; Syracuse University Libraries; Wellsville, N. Y., Public Library. December 15, 1937 .
New Friedsam Library of St. Bonaventure College, by Rev. I. J. Herscher. May 1, 1938.
Notes on Library Lighting. May 1, 1938.

Friday, April 21, 1939

Roland S. Morris, President, in the Chair.

MINUTES OF THE BUSINESS MEETING

The recommendation of the President, the Committee on Finance and the Council that it would be inadvisable for the Society to undertake to convert the old Custom House into a library building was considered by the Society and the Council's recommendation was, on motion, approved.

The President asked Dr. Frederick P. Keppel, President of the Carnegie Corporation of New York, to indicate the policy of the Carnegie Corporation in requesting the American Philosophical Society to make a survey of opportunities for adult education in science in the Philadelphia area.

MR. KEPPEL: "I remember at one of our Board meetings a banker member was moved to say that money was distributed through his bank down town but always on the basis of security; then he would come up in the afternoon to our Board meeting and he would vote for the distribution of substantial sums, and the question of security never seemed to be mentioned. But after the fashion of this particular member, he then proceeded to turn to the other side of the question and said, 'Perhaps if the Carnegie Corporation would limit its activities to bodies that have a reputation to lose, that might be regarded as an adequate form of security.' And it is for that reason and for the great reputation the American Philosophical Society has to lose, that our Trust was particularly pleased and proud to find that in this enterprise, which is a part of a nation-wide interest in the problems of education for adults, it could count upon the cooperation of the American Philosophical Society.

"I can't say very much about the future; the only thing for us to do is to be on our way. But it is a curious fact at the present time with all the excitement and activity in this field of adult education, that scientists have thus far been pretty close to the tail of the procession. One estimate that was made indicated that so far as you can tell from formal opportunities in extension classes and forums and similar activities, that you can account for only about six per cent of the total as definitely dedicated to science.

"I think, speaking as a member of the Society, we can look forward with great interest and confidence to long-time results of this inquiry. Nowhere in the United States is there a better region than this one of Philadelphia as a center, and so far as we know, the willingness to cooperate on the part of the various institutions of this region is something we can really rely on."

Proposed amendments to the Laws were carefully considered and after being discussed at some length by Drs. Leland, Conklin, H. S. Morris, Aydelotte, Emory R. Johnson, and Russell, they were corrected and approved as follows:

Chapter I, Article 5 reads: "Nominations to membership shall be made in writing by the Committees on Membership, or they may be made by any five members of the Society and addressed to the Secretaries before November first in each year. Nominations shall be on blank forms provided for that purpose and shall specify the qualifications and principal activities or fields of learning of the nominees. In case of non-election nominations may be continued by the written endorsement of three of the proposers filed with the Secretaries before November first following; these nominations may be continued a second time in similar manner, after which the names of the unsuccessful candidates will be dropped and all papers relating thereto destroyed. Such candidates may be considered again only by entirely new nominations."

Amend to read:

Article 5. "Nominations to membership shall be made in writing by the Committees on Membership, or they may be made by any five members of the Society. These nominations shall be known respectively as 'Committee nominees,' and 'Member nominees,' and shall be so listed in the *preliminary ballot*. These nominations must be in the Executive Office before December first. Nominations shall be on blank forms provided for that purpose and shall specify the qualifications and principal activities or fields of learning of the nominees. In case of non-election nominations may be continued by the written endorsement of three of the proposers filed in the Executive Office before November first following and shall be listed as 'Continued nominations' in the *preliminary ballot;* these nominations may be continued a second time in similar manner, after which the names of the unsuccessful candidates will be dropped and all papers relating thereto destroyed. Such candidates may be considered again only by entirely new nominations."

CHAPTER I, ARTICLE 6 reads: "Before December first in each year the Chairman of each Committee on Membership shall submit to the members of his class a list of all the nominations in the class and shall request them to use this list as a *preliminary ballot* and to check on it the names of those persons, not more than twelve in number, whom they prefer for resident members, and not more than five whom they prefer for foreign members, and to sign and return this ballot to the Secretaries before January first."

Amend as follows:

Substitute "Immediately after" in place of "Before" in the first line and "Executive Office" in place of "Secretaries" in the last line.

Insert new Article as follows:

CHAPTER I, ARTICLE 8. "Before February first, the Council may nominate not more than three persons in each year whose names shall be presented to the Society in the *preference ballot* as 'Council nominees' together with their qualifications. These nominations shall be on the regular blank forms provided for that purpose."

The numbering of each of the following Articles in this Chapter, namely Articles 8, 9, 10, 11, 12, 13, 14 and 15, to be changed owing to intercalation of the new Article 8.

CHAPTER IV, ARTICLE 2 reads: "The Council shall hold at least three meetings a year, and nine members shall constitute a quorum at any meeting, provided, however, that for the adoption of the budget a vote of a majority of all the members shall be requisite. Minutes of the proceedings and acts of the Council shall be regularly kept."

Amend as follows:

Substitute "two" instead of "three" in second line.

CHAPTER IV, ARTICLE 4 reads: "The Council shall, at such times as they may fix, ask all Committees to submit estimates of their needs for the ensuing fiscal year which, together with the report of receipts and expenditures by the Committee on Finance, shall be made the basis for the annual budget to be submitted by the Council to the Society for its approval at the General Meeting in April."

Amend as follows:
Add "or November" after "April" in the last line.

It was the sense of the meeting that copies of these amendments be sent to each member of the Society and that they be presented for final action at the General Meeting in November in accordance with the Laws.

The President stated that a letter had been received from Mr. Irwin D. Wolf, Chairman of the Buildings and Exhibits Committee of the New York World Fair requesting the Society to loan for exhibition in the Pennsylvania Building at the Fair certain books, manuscripts and articles. President Morris stated that we should send copies of any documents but that no original manuscripts should be sent for exhibition at the Fair. After some discussion by Drs. Conklin, Russell and Sioussat it was voted not to send any original documents, but to entrust to the Executive Officer the sending of any other items.

The following Committee on Finance was nominated by the President and elected by the Society for the year 1939–40:

Marshall S. Morgan, *Chairman,*	Roland S. Morris,
Thomas S. Gates,	George W. Norris,
Nathan Hayward,	Charles J. Rhoads,
John S. Jenks,	J. Henry Scattergood.

The Committee on Finance was appointed to serve as the Society's Committee on Building Fund.

The Election by Council of the Committees on Research, Publications, and Library for 1939–42, and the appointment by the President of the Committees on Hall and Meetings for 1939–40 was unanimously approved.[1]

Mr. Morgan, Acting Chairman of the Committee on Finance, presented the Treasurer's report together with the Auditor's report.[2]

[1] See p. 30.
[2] YEAR BOOK, Amer. Philos. Soc. for 1938: 268–290.

The budget for the year 1939 as submitted and approved at the November meeting was again approved in accordance with the Laws.

The Council's recommendation that an extra appropriation of $25,000 for the use of the Committee on Research during the year 1939 was unanimously approved.

Dr. Conklin, Chairman of the Committee on Research, gave an account of the work of the Committee during the year and stated that a complete account of the Committee's activities together with reports from recipients of grants would be found in the Year Book.[1]

Dr. Adler, Chairman of the Committee on Publications, presented his report.[2]

Dr. Sioussat, Chairman of the Committee on Library, stated that a complete account of the Library's accessions, exhibitions and activities during the year 1938 would be found in the printed report,[3] and added the following comments:

"In the first place, the report of the Committee follows the usual norm of the last five years. I am sure that when you read it, you will skip some of the statistical matter: I hope that you will at least read the acquisitions of books, each in your own field, and see what we have been acquiring. I want to speak particularly of one of the last acquisitions. Mrs. Henry H. Donaldson has presented to the Library in the last few weeks a most interesting series of small diaries kept by Dr. Donaldson in which the American Philosophical Society figures very largely. I am sure that I speak the sentiment not only of the Chairman but of the Committee on Library, and I hope of the Society, in saying that those will be greatly treasured: and I hope that example will be followed by many of our members.

"In the second place, this Society has acquired two or three interesting groups of papers relating to Franklin. One of these is part of a collection that was dissipated by sale at auction, and represents a good deal of material that has not been printed. We have also picked up a couple of other very interesting little groups of Franklin items,—nothing to compare with the great purchase bought for $75,000 by Society funds some years ago from Mr. Franklin Bache, because all of these purchases have come out of funds of the Committee without any appeal to the Society as a whole.

"The Committee has also carried on the work of getting the Bache papers ready for publication. It is completing the work of

[1] Year Book, Amer. Philos. Soc. for 1938: 119–267.
[2] Ibid.: 82–118.
[3] Ibid.: 59–81.

classifying the Society's archives as distinct from the collections in the Library, that is the records that pertain to the activities of the Society itself, from the time of its foundation down to the present time. That is approaching a very definite point. The Committee has cooperated in various activities. It has lent some support to the publication, *Writings in American History*, as other groups have done to *Biological Abstracts*, but within the Committee's funds. It was called upon to send a delegate to the conference in New York called by Mr. Lawrence C. Wroth and by Mr. Harry M. Lydenberg of the New York Public Library for the preparation of a list of American imprints in the Eighteenth Century, and it was my pleasure to attend that meeting. The Librarian and the Assistant Librarian also were present. I observe that this is not recorded in the YEAR BOOK of the Society, probably because the meeting was not a celebration of any sort, but merely one looking toward a plan for a future activity.

"The Committee's part in connection with the Custom House has been sufficiently described by the President, and the conclusion reached by the Committee on Finance was unanimously accepted by the Council last night, and by this meeting.

"This is to be the topic of the discussion [1] principally on Saturday afternoon, in the forum on the activities of the Society. I do not want to anticipate that; but because of this full attendance, there are one or two considerations I would like to present to you. I accept with the utmost agreement the proposition laid down by the Committee on Finance that at this time and particularly because of the absorption of so much of the Society's funds in real estate, it is inadvisable to consider the proposition of the Custom House. I have no dissent or failure to acquiesce in that agreement, please understand that. But I ask where that leaves you as an alternative? One, the prospective tenancy for a number of years of the quarters in the Drexel Building; because, as has already been brought out, undoubtedly this lease can be indefinitely renewed. Secondly, the building of another library building. And a third proposition suggested, though not developed, in the President's report, of some change in the Library by which we probably might not need a building, or at least a building of such important size.

"I want to say that I welcome and am delighted to have the proposed investigation by a group who shall look at the Library more from the outside than the Librarian, or the Chairman of the Committee on Library, or the Committee on Library as a whole can do, and I shall be most happy to cooperate with that investigation. It will not hurt the cause, but aid it, for the great thing that the Library needs, with the liberality of the appropriations which have been made in the last few years, is publicity. It has been too

[1] See p. 55.

modest, and not very successful, perhaps, in regard to acquainting the world with its possibilities and its resources.

"In connection with the President's report, some of the statistics which he cited, I think, might be put another way. For example, in respect to the cost of the Library, a little more emphasis might be laid on the fact that part of the salaries of the staff of the Library are of no expense to the Society. These have been provided for by a grant from the Carnegie Corporation of New York. Secondly, a large part of the total sum which was stated has been provided by benefactors in the past, or by some financial arrangement resulting from the sale of certain volumes or otherwise, which has resulted in invested funds that do not cost the Society anything because they were established for the special purposes of the Society.

"When the appeal was made for the building on the Parkway a few years ago, and subscriptions were invited, the valuable possessions of the Society were one of the principal features. Nothing has been done so far as I know to improve the character of the building with regard to fire protection. I have to enter my dissent to the statement that the situation in the Drexel Building is permanently satisfactory. It is undoubtedly much better than it was here because that is a slow-burning building. Nobody claims it to be fireproof."

The President then stated that Council had recommended the appointment of a special committee to study the relations of the Library of the American Philosophical Society to other libraries in Philadelphia and also the future policy of the Library administration in the light of present conditions, and suggested that Dr. Max Farrand and the Chairman of the Committee on Library, Dr. St. George L. Sioussat, should be named by the Society with power to increase the committee after they have consulted together as to the types of library experts that might be helpful in making this study.

On motion, Council's recommendation was adopted and the following committee was appointed:

Max Farrand
St. George L. Sioussat

JOHN F. LEWIS PRIZE

The Council's recommendation was unanimously approved that the John F. Lewis Prize for 1939 be awarded to Henry Norris Russell of Princeton University Observatory for his paper on

"Stellar Energy" (Read February 17, 1939. Proc. Amer. Philos. Soc., 81: 295–307).

Before proceeding to the annual election the President requested those present to stand while the names of the members[1] who had died since the last meeting were read by the Secretary.

ANNUAL ELECTION

The Society proceeded to the election of officers and members. Harrison S. Morris and Edward P. Cheyney acted as Judges and Ernest M. Patterson as Clerk of election.

The tellers subsequently reported that the following officers and members had been duly elected:

OFFICERS

President

Roland S. Morris

Vice-presidents

Edwin G. Conklin
Robert A. Millikan
Cyrus Adler

Secretaries

John A. Miller
William E. Lingelbach

Curator

Albert P. Brubaker

Treasurer

Fidelity-Philadelphia Trust Company

Councillors

(To serve for three years)

W. F. G. Swann, *Class I*
Albert F. Blakeslee, *Class II*
Harold G. Moulton, *Class III*
Waldo G. Leland, *Class IV*

[1] See p. 430.

MEMBERS

CLASS I—MATHEMATICAL AND PHYSICAL SCIENCES

Resident

Jesse Wakefield Beams, University, Va.
William Mansfield Clark, Baltimore, Md.
Arthur Byron Coble, Urbana, Ill.
Enrico Fermi, New York, N. Y.
Charles August Kraus, Providence, R. I.
Paul Willard Merrill, Pasadena, Calif.
Stephen P. Timoshenko, Stanford University, Calif.
John Hasbrouck Van Vleck, Cambridge, Mass.

Foreign

Prince Louis Victor de Broglie, Paris, France
Godfrey Harold Hardy, Cambridge, England

CLASS II—GEOLOGICAL AND BIOLOGICAL SCIENCES

Resident

Eliot Blackwelder, Stanford University, Calif.
William Bosworth Castle, Boston, Mass.
Wolfgang Köhler, Swarthmore, Pa.
William de Berniere MacNider, Chapel Hill, N. C.
Theophilus Shickel Painter, Austin, Texas
Peyton Rous, New York, N. Y.
Edmund Ware Sinnott, New York, N. Y.

Foreign

Sir Henry Hallett Dale, London, England
Johan Hjort, Oslo, Norway

CLASS III—SOCIAL SCIENCES

Resident

Samuel S. Fels, Philadelphia, Pa.
Guy Stanton Ford, Minneapolis, Minn.
Felix Frankfurter, Washington, D. C.
Philip C. Jessup, New York, N. Y.
Charles Seymour, New Haven, Conn.
Harlan Fiske Stone, Washington, D. C.
Charles Warren, Washington, D. C.

Foreign

Eduard Beneš, Formerly Prague, Czechoslovakia
George Peabody Gooch, London, England

CLASS IV—HUMANITIES

Resident

Van Wyck Brooks, Westport, Conn.
Walter Johannes Damrosch, New York, N. Y.
Harry Miller Lydenberg, Scarsdale, N. Y.
Ralph Barton Perry, Cambridge, Mass.
Theodore Leslie Shear, Princeton, N. J.
Edgar Howard Sturtevant, New Haven, Conn.
Lynn Thorndike, New York, N. Y.
Herbert Eustis Winlock, New York, N. Y.

Foreign

Martin P. Nilsson, Lund, Sweden
Sir Aurel Stein, Srinagar, Kashmir

Saturday, April 22, 2 P.M.

Roland S. Morris, President, in the Chair

FORUM ON THE ACTIVITIES OF THE SOCIETY

THE MEETINGS

Waldo G. Leland

The meetings of the American Philosophical Society constitute its oldest and most consistently sustained activity, and, during the greater part of its life time, have been its chief function. Even the Society's publications have been largely a by-product of its meetings.

Meetings, however, have the limitation of being confined to the place in which they are held and, although the radio may now increase their audience, and their results may be perpetuated and disseminated by means of publication, they must remain localized manifestations of the Society's life.

For a century and a half the Society's meetings were held semi-monthly, during the autumn, winter, and spring; the general meetting, held in April, which for many members furnishes the only occasion of participating in the Society's life, was inaugurated in 1906. From 1911 to 1935, the semi-monthly meetings were reduced to monthly meetings, but continued to be almost exclusively local affairs. The present schedule, to which we have already become accustomed, was inaugurated only in 1936. It includes a general meeting, in April, lasting three days, a second general meeting, in November, lasting two days, and a meeting in February, lasting a day or a day and a half and devoted to conferences and discussions.

In addition to these three meetings, there are sometimes held special meetings, inspired by such occasions as the meetings of the American Association for the Advancement of Science, in January, 1936, and the anniversary of the Constitution of the United States, in 1937, or by the opportunity to listen to an address by some distinguished authority. The normal annual schedule, however, is of three meetings: in April, November, and February, each of these meetings being of sufficient duration, interest, and importance to attract a fair, or even a large, number of the Society's members from beyond the Philadelphia region. Unquestionably this arrangement has resulted in substantially increasing the active participation in the life of the Society by a greater number of its members; it has tended to increase their interest in its affairs; and it has been instrumental in giving to the meetings of the Society a national character.

While the obvious reasons for holding meetings are to read and listen to papers, to discuss problems of scientific import, and to transact the business of the Society, it is equally obvious that the pleasure and advantage of association and communion with kindred spirits are powerful motives of attendance. It is the whole occasion, in all its aspects, that brings us, and often our wives as well, to this ancient and beloved house in this hospitable city, where we feel that we have indeed a spiritual home.

A discussion of all the aspects of our meetings would engage our attention for many hours, instead of for the few minutes allotted to the purpose, and would lead it in many directions. It seems best, therefore, to devote our attention chiefly to the meetings as a scientific activity and to inquire how they may best be organized for the advancement of our scientific interests. But a few preliminary observations are in order.

In the first place, we find it desirable and even necessary to give more time in our meetings to the consideration of the Society's affairs and policies. While we have every confidence in the Council and Administration of the Society, it is only right that we should recognize our obligation to participate fully, according to our statutes, in the Society's government and in the determination of its policies. The setting aside of a half-day session for the transaction of business, and, occasionally, of another half-day session for the discussion of policies, is a suitable recognition of such obligation, which has become all the greater as our resources have increased.

A comment, however, is pertinent. Some of the most important business of the year is transacted by the Council in an evening session, after a sumptuous dinner. Members of the Society have the right, even the duty, to inquire if this time-hallowed custom is in the best interests of the Society. Should not the Council, without depriving itself of the sumptuous dinner so generously offered by a hospitable host, find some other occasion for the consideration of at least the more serious items of its agenda, such as the election of new members? And members may also ask if, during the evening when the Council is engaged in feasting, some suitable and even useful occupation might not also be found for them—perhaps an instructive lecture or the exhibit of scientific but interesting films, or a *conversazione*, or even a *bier-abend?* At the worst, a session of papers might be organized.

After all, a three-day meeting has only nine parts: three mornings, three afternoons, and three evenings. None of these parts should be wasted. During the present meetings, one part has been devoted to the business meeting, one part to the discussion of policies, one part to the Penrose Lecture, one part to the banquet, and one part to the Council meeting, leaving only four parts, or 44 per cent of the available time, for the reading of papers.

The scientific elements of the programs of our meetings are as follows: papers, symposia, discussion conferences, and lectures. It has become customary to devote the April meeting to papers and to the Penrose Lecture; the November meeting to papers, with emphasis on reports on projects assisted by the Society's grants-in-aid, and to symposia; and the February meeting to discussion conferences or symposia.

Since 1934, six symposia have been organized, on the following subjects:

Community planning
Problems of business recovery
Viruses and virus diseases
Geophysical exploration of the ocean bottom
Factors in American population growth
Progress in astrophysics

Several of these symposia have been organized with the cooperation of other societies, and the relation of our Society to them has been chiefly that of host.

Two discussion conferences have been held: the first, in February, 1937, on the administration of grants-in-aid of research, and on methods of promoting research; the second, in February, 1938, on the publication of the results of research.

The number of papers read before the Society, exclusive of special lectures and addresses and of papers forming parts of symposia, was 51 in 1938, and 59 in 1937. Of these 110 papers, 42 were by recipients of grants and were in the nature of reports on the work so aided. Forty-five of the papers were presented by non-members, many of whom were recipients of grants. Sixty-five of the papers were by fifty members.

While these figures indicate a commendable hospitality to non-members, they indicate that a surprisingly small number of members (25 a year) presented papers in the general sessions. This confirms the impression of the Committee on Meetings that it is difficult to compose a program if depending upon voluntary contributions by members. Of these fifty members, 10 were in Class I, 24 in Class II, 6 in Class III, and 10 in Class IV. Since the strength of the classes varies considerably, 133 in Class I, 163 in Class II, 74 in Class III, and 63 in Class IV (at the end of 1937) the relative effort of each class is not indicated by the number of participants it furnishes. The percentage of participants in each class is: Class I, 7.5 per cent, Class II, 14.7 per cent, Class III, 8.1 per cent, Class IV, 15.5 per cent. Thus Class IV, with 63 members, furnished 10 participants, as did also Class I with 133 members, but the relative effort of Class IV was more than twice that of Class I.

The cost of the meetings ranges from \$5,000 to \$7,000 a year, most of which is for entertainment in the form of luncheons in the Society's Hall, the hotel expenses of attending members, and the annual banquet; as compared with the amounts expended for the other scientific activities of the Society, this sum is relatively small. In 1938, for example, the expenditures for the Library were approximately \$26,000; for grants-in-aid of research, \$97,000; and for publication, \$21,750, while \$6,700 was devoted to meetings including the special session for the anniversary of the Constitution.

With this brief exposition of the system of meetings that has been in operation since 1935, let us enquire as to how it may be made to operate more effectively for the promotion of useful knowledge.

In the first place, we may well feel that the present system is, in general, a great improvement over any previous system, and that in its principal features it should be maintained long enough to develop its possibilities. No radical changes, for the present, at least, are proposed.

In considering possible improvements, we may discuss in order the principal elements of our program: the lectures, the conferences, the symposia, and the papers.

The lectures undoubtedly add to the luster of the meetings; especially is this true of the Penrose Lecture, to which an entire evening of the April meeting is devoted. Such a lecture may be, and should be, an important scientific event; several of our Penrose Lectures have been of that character, and it is clearly the desire of the Society that all lectures should be of the utmost distinction. But it must not be forgotten that each lecture displaces a session of papers or a symposium. Would it be worthwhile to consider the possibility of making the Penrose Lecture an independent event, unconnected with the general meetings? In that case, however, attendance would not, of course, be practicable for many members of the Society, apart from those in the Philadelphia region.

To offset this disadvantage, might not the Society organize a series of Penrose or other lectures, to be given in centers where there are numerous members of the Society, as in Washington, New York, Boston, and Chicago? Such an arrangement would extend the reputation of the Society and would reach many members who seldom, if ever, attend the general meetings. And time would be gained in the meetings for exercises of perhaps greater scientific value.

In the organization of discussions and conferences, the Society has an unusual opportunity to furnish a forum for the consideration of various problems of scholarship. The two discussions already held, devoted to grants-in-aid of research and to problems of publication, were participated in by a large number of persons especially qualified by experience to make useful contributions. The organization of a successful conference is not an easy task; it requires long and careful preparation and judicious selection of leaders. Also it is true that in the short period of the February meeting there is hardly time to deal with all the aspects of the problem under consideration, and to reach satisfactory conclusions. Preparation, however, can do much to assure the success of even a short conference, if there is agreement at the outset as to the nature of the problem to be discussed and as to its analysis. The discussion of grants-in-aid of research illustrated the necessity of agreement on the nature of the problem, for while some participants discussed grants-in-aid, others wanted to discuss fellowships, and at times there was considerable confusion as to just what subject really was under consideration.

Many important problems call for such attention as they would receive from a conference organized by the Society. To mention a few: the place and use of fellowships in the discovery and development of superior research and teaching personnel; editorial management and scientific standards of learned journals; the organization and maintenance of bibliographical and abstracting services; the development and application of technological or scientific aids to research and instruction; the interpretation of the results of research for purposes of adult education. Such problems, as well as countless others, very much concern us, and their careful consideration amounts to an obligation.

Symposia differ from conferences in that the former are groups of related papers bearing upon selected subjects, while the latter are round table discussions. We have had six symposia in recent years, most of which have been reasonably successful. Like conferences, however, symposia must be carefully prepared. The subjects selected must be capable of illumination from different points of view; they must be carefully analyzed; competent participants must be selected, and each must understand clearly just what his part is, and how it is related to the other parts. A poorly focused symposium becomes a meaningless blur. The most appropriate subjects for symposia organized by our Society are those that are of interest to a number of disciplines—not merely to several specialized phases of a single discipline. An introductory paper or printed statement should explain the significance of the subject and the method of treatment; a concluding paper should summarize the results of the symposium.

Finally we come to the papers. Although the program of every meeting includes papers of great excellence, on the whole the sessions of papers are disappointing. This is due in part—perhaps chiefly—to the fact that the Committee on Meetings depends chiefly upon voluntary offerings, and it is hard to work these into any sort of a balanced program. It is also due in part to the failure of our members to conceive of the meetings of the Society as an opportunity to explain the significance of their investigations in terms intelligible to all. President Merriam has pointed out that increasing specialization has had much the same effect as the unfortunate experiment of the Tower of Babel. It has broken up the learned world into groups, each of which uses a language that is not intelligible to the others. Now the American Philosophical Society, above all other organizations, must demonstrate the unity of science and learning. There are, in abundance, specialized societies where highly technical papers may be read, understood, and appreciated. The papers read before the American Philosophical Society should deal with matters that have significance for more than a single group of specialists, and that significance should be clearly explained in comprehensible and literate language. After listening to many papers in the meetings of many societies over many years one is tempted also to insist that they should be well organized, read audibly and even with animation, and kept within the limits of time that have been imposed and accepted. A session of papers should attract all members, because of the opportunity it affords them to learn of the work of other scholars, even in fields far removed from their own, to understand why that work is significant, to appreciate the methods by which the work is carried on, and to comprehend the bearing of the results upon knowledge as a whole. Papers should be written to achieve this result, and with a general audience of scientists and scholars in mind.

The responsibility for organizing sessions of such papers rests with the Committee on Meetings, whose members should endeavor diligently to attend its few sessions. The Committee desires to conceive of its task as a work of creation and interpretation, not merely of arrangement. Members known to be engaged in research of special importance should be urged to participate in the sessions; new members should early be brought into the programs; a balance among the many fields represented in the Society should be maintained, and each session should be so composed and organized that no member of the Society will willingly miss any of it.

DISCUSSION

CHAIRMAN: "I would like to ask whether the Society can offer any suggestions for our future meetings."

MR. RUSSELL: "I feel, after a moderate number of years' experience in this Society, that our meetings are getting even better than they were before. I have never attended better sessions than the last two of this meeting. I think we are already succeeding splendidly in this. We need to do very little more than go on. The leader of our discussion said something about the proper selecting of the program by a committee. I think the idea is a good one, and it is already being done. We do not need a large number of sessions for papers. Two sessions for papers in one day are all that human nature can stand, and we have that. Moreover, from my many years of experience, I feel that perhaps the most precious portion of our meeting was the informal session held across the hall. There we had a chance to escape, to get together with our friends and talk about everything in general. I have seen in my own particular field some very good things started in informal discussions of two or three men. There are many other meetings—scientific, scholarly, technical—but I think I can say that by common consent the meetings of the American Philosophical Society are the best learned meetings in the United States. The reason is not that we have so much discipline here, but that we have time to get together and talk things over.

"Let me also say that I should deeply regret having the Penrose Lecture moved away from the Annual Meeting. It is a priceless feature of this meeting. The social traditions of this Society are unique in this country. We live in a home, not a mausoleum. I want to keep the meetings of our Society here. I would hate to see a series of lectures, even Penrose Lectures, given under the auspices of our Society, held in other places. It would not be the American Philosophical Society if the meetings were not held in Philadelphia."

MR. H. S. MORRIS: "I would like to suggest that we have a discussion on literature."

Mr. Swann: "I am very much interested in the suggestion that we have a session on literature. I will go a little further and suggest that we have a symposium on what I will call 'The Philosophy of Thought.' It is a striking fact that when you take learned men in different fields, and they get really down to talking to one another intimately, their lines of thought are much the same but in slightly different forms of language."

Mr. Aydelotte: "A great many of the lectures on literature are so dry and so dull as to be unworthy of the name of literature. It seems to me that research in literature and the modern languages ought not to be dull. If the lecture is dull, it is unworthy of its subject. I think a symposium on the subject engaged in by students of literature and history and philosophy, if it did justice to the subject, would be a thing that all you men would be interested in."

Mr. Emory R. Johnson: "It seems to me that one thing we have not done, as a Society, as well as we might have done it, is to concern ourselves with the most fundamental public questions. That would have the added advantage of enabling the Society to contribute something to useful knowledge, that people outside our own membership would understand. I think one limitation of our influence is that much of the work of our Society is but scantily understood by its own members.

"I was interested in some of the things that Dr. Leland said. It seems to me that those who make statements here ought to make them in language understood by the members. And I think we ought to deal with subjects of much wider interest than that of our own membership.

"We have in our membership men of business affairs, prominent men; we have eminent members of the Supreme Court, and other men who are thoroughly competent to deal with public questions. I suggest that we have at least every other year a symposium dealing with some fundamental public question."

Mr. Huntington: "May I add one word to what Dr. Russell said a few moments ago to the effect that these meetings are good? I would like to add one item of goodness, and I can do that with better grace since I come from a New England institution which is characterized as being somewhat impecunious in its nature; I would like to say that we appreciate the hospitality of the Society in inviting members to stop at the Benjamin Franklin Hotel."

Many valuable suggestions were also offered by Messrs. H. S. Morris, Parker, Leland, Humphreys and Davenport.

Mr. Conklin: "I have to prepare the calendar for each year soon after this General Meeting, and distribute it if possible by the first of July. One of the serious difficulties is the question as to what the principal topic is to be at each of the three meetings.

"I should welcome any help that the members of this body and of the entire membership can offer to the Committee on Meetings in the organizing of future meetings. We cannot, of course, take at once all the suggestions that are offered, but we can scatter them along throughout the coming meetings and take them up seriatim, dealing with them in plenty of time so that they can be properly organized."

THE LIBRARY

ROLAND S. MORRIS

I have said a good deal about the Library in my annual address,[1] if you will recall, and we had some discussion at that time, and I was authorized to appoint a Committee with power to study the relations of the Library of the American Philosophical Society to other libraries in Philadelphia and also the future policy of the Library administration. I appointed a Committee of Two, Dr. St. George L. Sioussat, Chairman of our Committee on Library, and Dr. Max Farrand of the Huntington Library and Art Gallery. What I am going to do is to surprise Dr. Farrand by asking him if he will state to the membership what he considers the problem to be in connection with his Library. If we have a committee appointed to make a report, we hope that within a year or so, possibly a year and a half, we will have a report on our own Library. Dr. Farrand, will you please tell us what you conceive to be the problem that we face.

DISCUSSION

MR. FARRAND: "I have not taken the time to formulate carefully what the problem is, beyond this fact, that the American Philosophical Society is already in possession of extremely valuable material, both printed and in manuscript. That material, from the very first observation, appears not to be used very much by the members of this Society. We are not then dealing with the problem that is affecting directly this Society. This Society has an obligation to this community and to the country at large in the promotion of knowledge, and the way in which this institution, this organization, this American Philosophical Society, can function to the best of its ability, in so far as the Library is concerned, is the fundamental problem.

"The care of the material which we have leaves much to be desired. And the Society at the present time must continue its library activities in some form. What form it should take, of course, I am not prepared to discuss.

[1] See p. 33.

"Since this question just came up, less than two days ago, I have been much interested in talking to the representatives of a number of libraries and associations in this city. I had heard before, of course, of the Union Library Catalogue which reveals a perfectly extraordinary work that is being done in this community. If this work is carried out successfully, I am confident that it is going to affect every library community, every community in which there is more than one library—a series of libraries, in this whole country, and I think even beyond this country. I was enormously interested, as those plans are working out, to find in connection with this Union Catalogue that this Society stepped in at the critical moment with the necessary funds that made it possible to bring it to a conclusion. They are grateful for that. More than that, this Society has cooperated more whole-heartedly in carrying it out than any other organization. And in the half dozen libraries and societies that I have already discussed this general problem with, it has been tremendously gratifying to find the position which the American Philosophical Society holds in this community. There is, I may say, greater confidence in our Society than in any other organization because, apparently, we have no ax to grind, and any suggestion which comes from this Society is received with respect, not because they think there is money back of it, but because they think that the suggestion is being made for the benefit of the community and for the promotion of knowledge, that we are not seeking simply our own interest.

"I am trying to gather from just as many persons as I can who are familiar with the Library as it now exists the possibilities of the various forms our activities might take. But I do want to say, Mr. President, that coming from where we are so particular, not only with the care which we give to all of our material, but also in making it accessible to competent students, I was somewhat shocked at the condition of some of the valuable material. Some of this choice material must be kept in air conditioned stacks. It must not be left out. I found some of the old sets left out in the steam heat, and although they have some method of dampening the air to some extent, it will not do to let this valuable material remain for any great length of time exposed to the steam heat.

"I want to make just one suggestion to show you the possibilities that are under consideration. It was mentioned to me this morning—as yet it is only a dream—that there may be in this city a bibliographical center for the carrying out of this same project, the unifying of the libraries, so that there may be a central clearing house so that each may know what the other is doing in order to prevent duplication. That is one of the dreams, and it has come to several of those men, that there should be a bibliographical center, where the information regarding all the material in all of the libraries in this whole community can be found, and at some place outside, where it would not occupy the valuable space within the city, there should be built a storage warehouse, library building—call it what you will—in which these various collections can be properly stored and cared for, in which case, if that were followed out, and the American Philosophical Society were cooperating, we would have a section in the storehouse for the care and preservation of our material. As yet it is only a dream. If it is carried through, it is going to set an example for the whole United States and for the world at large.

"I want to say that Mr. Sioussat has been helping out in all of this work for a cooperative movement in this community, which I am confident is going to achieve very noteworthy results."

Chairman: "I think Dr. Farrand has expressed so much better than I could what has been in my mind, that there is going on a great change in the making available to scholars these materials that have been scattered in so many places, both in regard to the material itself, and also in regard to the catalogues which contain references to it. Dr. Farrand tells me they are considering getting some of the leading men in this field to join with us in our work. We hope the work will lead to what might be a radical movement in the development of making more available the immense stores of material in the United States.

"I think the time is not now ripe to discuss the work in detail, because we would want our committee's report before us, and I am happy that the Society has paused in any plans of its own until it can look the field over broadly and determine what we ought to do, and what leadership we can give in the doing of it."

RESEARCH

Edwin G. Conklin

I wish to call your attention to a number of things which I have emphasized in the report of the Committee on Research.[1] You will see there a list of the grants which we have made, and their distribution as to subjects. There has been the feeling on the part of some members of the Society that Classes III and IV have been neglected in the distribution of the research funds, and that I and II have received the lion's share. Assuming that this is true, the question arises, what is the cause of this? Mr. Morris, who represents Class III on the Committee on Research, as well as all classes, will bear me out when I say that we consider all of these applications impartially and irrespective of where they may be classified. Our grants are in no sense to be considered as gifts or charities to be distributed equally to all classes but as investments in men and

[1] Year Book, Amer. Philos. Soc. for 1938: 119–267.

projects from which we expect returns. They are investments of the Society, and we look upon them in that sense, and so far as I am concerned, I am sure there has been no conscious prejudice in favor of one class rather than another.

It was said by one of the members of Class III who was at the last meeting of the Committee on Research that he did hope that we would have more worthy applications from Class III in the future. I hope so, too. I really hope that we will have applications of such a sort that we can grant them. I may say that one of the very first grants the Society made was to Class III, and for the largest sum that we have ever given in any single grant. We are ready to give to Class III if we can convince ourselves that the projects are worthy ones to invest money in, and that the applicants are competent to carry them through.

We have been more generous to Class IV, as you will see, because we have given substantial sums there, and in previous years, in 1937 for instance, the largest sum given to any one subject was for archaeology, $13,500.

We have in addition to the Penrose Fund two other funds from which the Committee on Research is authorized to make grants; one of them is the Johnson Fund of $500,000, the income from which, for the current year, was somewhat more than $12,000. Mr. Johnson's son indicated to President Morris that he thought it would please his father if it should be the judgment of the Society that it is worthwhile to make grants to workers in the Academy of Natural Sciences of Philadelphia, in the Eldridge Reeves Johnson Foundation for Medical Physics of the University of Pennsylvania and in the University Museum of the University of Pennsylvania. We have so far given the income from the Johnson Fund to workers in these three institutions, and so long as the applications from such persons measure up to the requirements from other applicants, it is understood that they occupy a preferred position in the distribution of the income from the Johnson Fund.

We have another research fund, established by the bequest of Dr. Judson Daland, which was given exclusively for research work in clinical medicine. By vote of the Society, grants from the income of this fund are administered by the Committee on Research, but the donor requested that the work of the Philadelphia Institute for Medical Research, of which he had been President, should be supported as long as it was felt by this Society that the work was worthy of such support.

In order to show what is being done under our grants we have published abstracts of the results in the YEAR BOOK.[1] More than one hundred pages of this are given to these abstracts, showing the principal points that have been achieved in the various researches. Following each abstract there is a bibliography of papers that have been published as the result of the grants that were given. You can see by looking this over what has been done.

During 1938 our grants averaged $960 each. Some ran as high as $3,000 or $4,000, but I think for the funds we have to distribute, we probably cannot do better than to give relatively small grants to persons who otherwise would be unable to go on with their work.

DISCUSSION

CHAIRMAN: "I hope that Dr. Keppel will make some comment on our research program. He has had a wide experience in studying applications."

MR. KEPPEL: "May I comment on one point in this matter? Of course, there are a great number of sources for grants. Offhand it would look as if here in this country we ought to be able to be far more efficient than we are. We ought to be able to exchange information and pool our resources and fit them into the gaps. Up to a certain point that can be done, but it is not wise to develop a restraint of trade in the matter. The individual has the right to go to each party and state his case. If all these various sources are too much in 'cahoots,' and if A knows that B has already considered the matter and found it wanting, it is not quite fair to the proponent. So we can go a certain distance in regard to efficiency of organization, but we must not go too far. I think we must remember that."

CHAIRMAN: "I want to ask you one question: Do you feel from your experience that our making grants of about this size to individuals who are pursuing a specific form of research that appeals to us is filling a need in that general field of the promotion of knowledge? Should we keep that up?"

MR. KEPPEL: "It certainly is filling a need, and I see nothing on the horizon that would carry out the purpose of this Society better, within the proportion of our total resources, that is devoted to this particular end."

MR. CHEYNEY: "I have no desire to make any defense for the Committee. I think everything Dr. Conklin said was true. However, I would like to say a word of defense for Class III. It is true

[1] YEAR BOOK, Amer. Philos. Soc. for 1938: 130–266.

that history is a very large subject, and some of the things which masquerade as investigations in other fields might just as well be considered as subjects in history. However, I do feel that applications for grants in Class III should be be much greater.''

MR. Y. HENDERSON: ''Dr. Keppel said there should not be too much organization, so as to shut off applications. On the other hand, I know that there are a certain number of laboratories run by collecting a little here, and a little there. Could we require that the applicant state what other applications he is making elsewhere and how many other grants have been made to him over the previous five years? I think that would be helpful.''

MR. CONKLIN: ''That is one of our requirements. The application forms require the applicant to answer the question, among others, as to the amount and nature of institutional contributions towards his work, other grants received for his work, or other applications for grants impending. We ask the applicant to give us references. We write to the referees he indicates as well as to others whom we choose. All of this voluminous material is mimeographed and sent at least two weeks before the meeting to every one of the ten members of the Committee on Research. They are asked to study the material before coming to the meeting. We have a full day devoted to this subject at each of the meetings, and there are five meetings a year at the present time.''

The research activities were further discussed by Messrs. Parker, Shapley, D. C. Jackson, Humphreys and Conklin.

PUBLICATIONS

JAMES T. YOUNG

The efforts of the Committee on Publications are directed to three main objectives:

To secure a steadily improving and rising standard of material.

To publish this material more quickly and in a more attractive form.

To distribute it in circles where it will be of greater scientific service.

The Committee feels that it can greatly improve its work in all three of these points.

It has been fortunate for the Committee that during a year or more there has been in the Society an intermittent but at times active discussion of publication policy which has shed much light on the future problems of the Committee's work. This discussion, which is to continue this afternoon, has ranged over such questions as:

Shall the Society use its publication funds to subsidize worthy but financially embarrassed scientific journals?

Shall we publish one or more specialized journals?

Shall we increase our editorial force by employing additional assistance, perhaps one for each of the four groups of membership?

Since all of these may come up in today's discussion and may be handled in some detail by other speakers, it seems best to give attention for the moment to certain other allied problems of the Committee's work.

Cost.—The Committee assumes that our publication work will be greatly expanded by the natural increase in meritorious manuscripts and by changes in policy. The item of cost therefore assumes prime importance. In a symposium on publication conducted last year, Dr. Schramm gave us a detailed and highly valuable analysis of scientific magazine costs with conclusions which seemed apropos of our own series. The President of the Society has therefore appointed a special committee to make full and detailed recommendations on methods of applying Dr. Schramm's principles to the Society's various series of PROCEEDINGS, MEMOIRS and TRANSACTIONS.

Speed.—An equally important problem is greater speed in the preparation and issuance of the manuscripts selected. The Committee feels that a vast improvement along this line is not only feasible but imperative. Delays occur especially in the PROCEEDINGS. This series covers the shorter papers read at our meetings and other manuscripts offered to the Society. There have been repeated requests for the earlier appearance of these materials.

Dr. Goodspeed, the Editor, keeps a card record of every manuscript approved by the Committee, from the time of its approval down to its final publication. These card records seem to show beyond peradventure that the one man who can contribute most to a speedier publication is the author himself. For example, we find on the cards the case of that author who, after much urging, finally sent in his script, but to the wrong address. After due exchange of correspondence and telegrams, Dr. Goodspeed finally traced the package down, in the wrong post office. A clerk, learning that the address was wrong, had inquired of another clerk about Dr. Goodspeed and had been told that it was thought he had died. Whereupon there was solemnly entered against his name on the package the word "deceased" and the bundle was then allowed to lie peacefully at rest. But all this cost several weeks of valuable time.

Next we have the symposium conducted by the Society, February 16 last, in the field of astrophysics. After much negotiation, urging, pleading, and nagging, the manuscripts are now all in, that is, all but one, which is a key paper. The author has just promised to try to mail it today. February 16–April 22—surely this could hardly be called unseemly haste. Finally there is that number of our TRANSACTIONS the manuscript for which was returned to the author by the Editor in October, 1936, with a number of valuable suggestions, one of them being that it should be put in shape for the printer. Thereupon at various times and with lengthy interruptions the author, with the constant aid, encouragement and forceful stimulation of the Editor, re-wrote much of the manuscript, submitted it, it was passed by the Editor, sent to the printer, and put in galley proof. At this point the author suffered serious qualms leading him to re-write large sections of it in the galley. Eventually the paper appeared in March, 1938. October, 1936–March, 1938. The paper has received much favorable comment.

From all of the above it appears that the first step towards the greater speed upon which the Committee is now bent must come from the author.

But is the Committee itself entirely free from possibility of improvement? We think not. It is believed that several important steps are worthy of immediate consideration. First of these is that the Committee shall not hold up papers pending any future changes in format. This has been done in order to give the papers themselves the benefit of a few changes recently made. On the whole such delays have been brief and infrequent, but unnecessary. Second, the Committee can short-circuit the printing process by freeing the author from page-proof corrections. Only in a few subjects is a second correction by the author necessary. In the more usual run of materials the author's corrections on galley proof, if checked by the Editor in the page, would be sufficient and would immensely help the speed of publication.

A third possibility is an insistence by the Committee that anything read before the Society for publication shall within a two weeks' deadline be in final form for the printer, especially in symposia. It is highly unfair to the other members of a group discussion to hold up their papers indefinitely while one speaker gets around to the task of placing his statement in final form. If a change in Committee policy on this point can be secured, it would in many cases save a month in time.

Interest and Attractiveness.—Our third and last problem is, what can the Committee do to make our publications more interesting and attractive? As this verges closely upon the problems to be raised immediately in the general discussion, we may concentrate upon two suggestions. One is that a much greater attention in the future shall be given to the symposium, both in the meetings and publications of the Society. Several members have already suggested this. It would undoubtedly give to the otherwise scattered offerings of our members and of outside scientists a greater cohesion and unity and would immensely strengthen the interest of each issue of our PROCEEDINGS for a definite group of readers. This need in no wise interfere with the present practice of holding sessions to which any member may voluntarily contribute in his field. It is directed rather toward the holding of special meetings for the consideration of selected groups of problems.

And the second suggestion is closely connected with it. There should be a much more intimate cooperation between the Committee on Publications and that on Meetings. Such a cooperation would enable us to plan a well-rounded and complete series of subjects each dealing with a broad list of sub-topics. Would not such a readjustment aid both in raising the standard of material and in grouping it along clearer lines of definite interest? It is a pleasure to report that the Committee on Publications at its last meeting placed upon its agenda for immediate consideration the items which I have just mentioned—cost, speed, cooperation with the Committee on Meetings for planned programs of publication.

DISCUSSION

MR. SHAPLEY: "I think there is some danger in making our members subject to such a discipline as you propose. As soon as you require a man, who is going to make a scientific talk, to turn in his paper at once, you are going to get dead science, not the live discussion. As soon as you make it a requirement that the speaker produce his paper at once, you are going to have men declining who could bring us live knowledge. I know half a dozen men who would say: 'I won't accept an invitation to take part in the symposium if it means preparing a manuscript.'

"One way of meeting our difficulty, it seems to me, is to make our publication a periodical. Publish it quarterly, bi-monthly, monthly, and do not attempt to publish the papers as a complete symposium. Publish the ones that you have, and let the others come in some time during the following decade when the authors get ready. At the present time our publication has no bibliographical standing, because it is only an occasional thing. I believe we shall have more bibliographical standing if we make our PROCEEDINGS a periodical."

MR. UREY: "I think most of the articles that appear in our publications are not particularly alive. People working in the various scientific fields represented by Class I send their articles to other magazines if they are interested in having them published promptly and circulated widely. The good papers do not come to us at all.

"If you turn to the question of what can be done about it, I must confess that I see very little that can be done. I, myself, would not propose a separate journal for that section. But there are several things wrong with the present setup. In the first place, if I am not a member of the Society myself I will not publish my papers in the journal of that Society. I have a little stubborn pride on that subject. If I am not good enough for the Society, neither is my work. And I think a great many of our colleagues will take exactly that attitude. One hundred and forty members in Class I cannot support a separate journal for that Class.

"Now then, one turns to what else might be done with a fair proportion of this $25,000 that is spent for publication. The only useful thing I can think of is to use it to subsidize existing journals that are doing good work in their respective fields when and if they need it. *Biological Abstracts* has been supported by the Society. I suppose that is one of the most important subsidies in recent years. I understand that there is a mathematical abstract journal that is practically being discontinued abroad, and it looks as though more and more of the intellectual activities of the world must be supported in the United States. The way things are going it seems as though it would be a good thing to move that journal to the United States. It seems to me that there would be nothing more useful we could do in Class I than to support that journal.

"There are many in the Society who feel that the imprint of the Society should always go on our publications. I myself say this, if we honestly attempt to do the best thing for the science that we know how to do, there will be abundant credit come to the American Philosophical Society, a credit which can be earned in no other way.

"I am not so much concerned about that, but I think it is well to do what we think is best at the present time with our funds, and let the credit come if we deserve it. But there is a possibility that such a journal as that might be very well taken over by the Society if financially it looks as though it could be arranged. That might be an alternative. And I think from time to time there will be other journals belonging to Class I that could be supported in this way with great value to the science, for example, the American Institute of Physics, which has had its page charge of $3.00 per page underwritten, I believe, by the Rockefeller Foundation. This page charge is supposed to be paid by the university or institution that supports the research. If the institution does not pay it, the sponsor merely takes the bill and pays it. Such a support as that can prove invaluable."

Mr. Lefschetz: "I understand that the Carnegie Corporation is proposing to back this mathematical abstract journal to the tune of something like $60,000 provided the Mathematical Society will take it over. There is a good deal of hesitation on the part of the Mathematical Society about taking the journal over. They feel that they may have funds for five years, but after that it might be embarrassing. The Mathematical Society is a very large organization with a varied membership, and it is not so well equipped, perhaps, for taking over something like this which requires rapid initiative. I am glad to know that the American Philosophical Society is considering the possibility of backing this journal. I am sure that the Carnegie Corporation will not object to being backed by the American Philosophical Society. I am extremely eager to see this abstract journal continued. It is important to the whole world that it be continued. In view of the present conditions in Europe, I do not see any possibility of its being carried through anywhere else but in this country. I hope that the Mathematical Society will consent to do it. If we do back them with funds, it will make it very much easier for them to do so."

Mr. Blakeslee: "At the discussion here two months ago, I pointed out that, from the standpoint of the investigator, there are two things of paramount importance. One is the rapidity of publication. The examples that have been given by the leader of the discussion seem to me to be personal matters, that is, if the author does not get his manuscript in, there is no reason for complaint if it is not published on time. As far as my experience has gone, a report [1] on the Library which I gave in February, 1938, just came out yesterday.

Mr. Conklin: "That report was part of a discussion of the publication program of this Society and as business of the Society

[1] Year Book, Amer. Philos. Soc. for 1938: 96–105.

it appears in the YEAR BOOK for 1938, and it could not go to press until the close of 1938. The YEAR BOOK is an annual publication."

MR. BLAKESLEE: "For that reason people in our group would hesitate to publish in the annals of our Society if they can get their papers published anywhere else. It is better to have your work published soon after it comes out.

"The *American Journal of Botany* had the same problem. Their manuscripts were coming out two years late. They studied the situation, and within a year the manuscripts were coming out with regularity three months after they were submitted, some of them sooner. And in doing that, the standard of the manuscripts was raised. We instituted a method of review and revision. Every manuscript was passed upon by three individuals, sometimes members of the editorial committee and sometimes not. Even with all that, it was possible to get the manuscripts out within three months. I think a study of that kind would alleviate our difficulty.

"The next problem of importance is the adequate distribution of the articles."

MEMBER: "It is important for the investigator to get his material into the hands of the workers in his own field. I will not attempt to reread my paper here, but I do make a suggestion that I think might be of service along this line and still retain the honor of the Society in publishing the articles. My suggestion is that to an extent which could be determined by the policies of the Committee the Society should publish some of its articles in accredited journals. It could have a note to the effect that this particular article was supported by the Society. Then the articles would go to the people most interested in reading them. And the article would have the advantage of the editorial supervision of the particular group which is especially qualified to judge in regard to its merits. This also could be made, I feel, a very effective method of raising the standards of certain journals. The Society, naturally, would not care to make this arrangement with journals that were not of a high standard."

MR. RUSSELL: "It seems to me that two or three altogether different things have been advocated. I, myself, would like to second what Dr. Shapley has said about having our journal come out at regular intervals. I think it would be well to print the articles as we get them and not hold them in order to present the symposium as a unit. I think if we adopt that idea that we shall do far better and our publications will be better."

CHAIRMAN: "Is there any further discussion? This is a serious question, this question of subsidizing these special journals. We have subsidized one—*Biological Abstracts*."

MEMBER: "Technical scientific papers are much better presented in specialized technical journals. I, myself, would not be interested in publishing detailed results in such a publication as ours, but I wonder if there is not a field for some journal to present papers which describe scientific research in such terminology and in such a way that it would be generally interesting to a body of scholars such as that represented by our membership. This, it seems to me, is an important need at the present time. I raise the question as to whether there are enough papers of that sort which would warrant the development of our journal along those lines. I, myself, for instance, would be very much interested in a paper in the field of political science, also one in the field of astronomy, these subjects being treated in a more general way than they are usually treated in specialized journals on these subjects."

MR. CONKLIN: "That is precisely what we have had in mind in connection with the symposium idea. We think that the subjects would be presented in a way so that they would be generally understood by the members of the Society. The papers presented, while they would come from authors of distinction who were themselves contributors to knowledge, would be fitted for people who had no special knowledge in that particular field. That is one of the things which most members of this Society prize highly. I have talked with many of them. Many people who gather here say: 'We enjoy hearing papers in fields other than our own.' The scientists want to hear papers in literature and music. That is precisely the thing that makes the Society so attractive.

"I think we should not attempt the impossible task of dealing with specialized journals in all the twenty or more fields that are represented in our membership.

"I want to add that for nine years I was a member, as were Drs. Day, Pearl and Veblen, of the committee of the National Academy of Sciences for the distribution of funds for publication. The Rockefeller Foundation provided $25,000 a year, and we spent every cent of it and had calls for more. That was entirely in the field covered by Classes I and II of our Society. None of it went into the fields known as Classes III and IV of our Society; $25,000 a year was not enough to meet these needs, and that was one reason why the Rockefeller Foundation grew weary. Finally they stopped attempting to fill the bottomless hole. I feel if we, as a Society, should undertake to meet the needs of the suffering and deserving publications we should have an impossible task on our hands, one that would exhaust the funds of this Society. For that reason I hesitate to see the Society go into anything like that."

MR. LEFSCHETZ: "I have complete sympathy with what you say; however, I would like to point out that the mathematical abstract journal has played a vital rôle in the history of mathematics over the last ten years, and this journal is likely to disappear. We are not in 1922, 1923, or 1924. We are in the times of emergency. Perhaps these times will not last, but I feel that if the United

States does not share in such things, no one will. It is either we or nobody. A certain amount could perhaps be put aside for that —not a large sum. Whatever could be done, I should be happy to see done."

Mr. Emory R. Johnson: "Something was said earlier in our discussion about the desirability of having more of the papers presented in terms which would be understood by those of us who are in utterly different fields. Then we could understand the substance of the researches and their value, and we could appreciate what our distinguished colleagues in other fields are trying to do. It seems to me that, if there were such a cooperation with the Committee on Meetings and the Committee on Publications, we could have a deliberate effort to cultivate that aspect of our publication and it would be worthwhile. I think we should urge those who are presenting accounts of their scientific and literary projects, and other subjects, to present them in terms that will stress the fundamental achievements and their value and yet will be free from the technicality of the special language which these same men would use when writing for specialized journals. Then, if our publication would come out quarterly, or at some regular interval, we could present those papers in that form instead of in the technical form. For instance, take yesterday afternoon's program. If I had a quarterly journal coming which contained Professor Meritt's discussion on 'Restoration of Greek Inscriptions,' and Professor Sanders' 'A Soldier's Marriage Certificate in Diploma Form,' Professor Corwin's 'The Posthumous Career of James Madison as Lawyer,' and 'Some Notes on Shakespeare' by William Lyon Phelps, I would await the coming of that journal with a great deal more eagerness than I do the present publication."

Mr. Urey: "I am very curious to know whether the work of our publications for the other classes is regarded as satisfactory by men in those classes."

Chairman: "Suppose we start with Class II."

Mr. Conklin: "I can say that I have published half a dozen of my researches in the Proceedings of the American Philosophical Society, and I have bought as many reprints as I could afford and have distributed them throughout the world to be sure that they might reach the people that I thought would be interested in them. The American Philosophical Society is pretty generous with reprints.

"I do not regard the publications of the American Philosophical Society as a proper place for the publication of brief technical reports of progress, which must appear frequently to insure priority of discovery. On the other hand, our Transactions and Memoirs are well suited for large monographic works, and the Proceedings is quite ideal for the publication of symposia and reviews of a general and philosophic nature, such as those which are presented in our meetings. There is also a great demand for means of publishing papers that are too long for most of the journals, and this demand is being well met by our PROCEEDINGS, as a glance at recent numbers will demonstrate.

"I have the feeling, which I am glad to know is shared by other members, that monographic work representing the cumulative results of research into which years of labor have gone, is likely to have a more lasting value than the day by day reports of progress, or the multiplication of brief papers according to the formula, 'one idea, one paper.'"

MR. GRAVES: "May I make an observation with reference to the printing of papers? It may be that others are circumstanced like myself. I had supposed that, although one might voluntarily offer to read a paper before the Society, the offer accepted, the paper read, the manuscript was not to be submitted for publication unless it was asked for. Perhaps I had no reason to assume anything of that sort, but I have read papers at other meetings of societies, and once in a while a paper of mine has been asked for, but I have never volunteered one for publication; therefore, I have never volunteered a manuscript of mine for the PROCEEDINGS of this Society. I take it that others proceeded on the same assumption. Perhaps some of the papers in Class III may not have appeared in print because other members of this class, like myself, did not know the good customs of this venerable organization."

CHAIRMAN: "In the announcements of meetings there is always the statement that arrangements will be made for publication in the PROCEEDINGS of papers accepted by the Committee on Publications.

"I think this discussion has been very helpful. I know it has been to me. I have gathered that the thought of the Society is running toward a periodic publication, making it in the nature of a quarterly. That should be seriously considered by the Committee on Publications.

"Second, I have gathered that you believe our papers ought not be highly technical, scientific papers, but interpretations for the benefit of men in other fields of knowledge, that we should make it an interpretation journal in a common language, and that we ought to develop that largely through these forum discussions.

"I think that will be seriously considered by the Committee on Publications, and also the question of the critical condition of this abstract journal that has been before us. I think you will all agree that if we did anything in this connection it would be an exception and not expressive of any policy for the future. We are not subsidizing technical journals as a general rule. We have made only one exception that I know of—*Biological Abstracts*.

"I hope you have felt that this forum has been worthwhile; it has been for your officers. I hope this discussion will inspire you to keep in as close touch as you have time for with the administration of the Society. If you have any idea or any criticism, do write to us and tell us about it. I think of this Society as a brotherhood of man, interested in the promotion of knowledge, and something more than merely a technical, scientific society. It has its social and personal aspects of friendship as well as a devotion to the ideal of the promotion of knowledge which its founder exemplified all through his life."

2. Autumn General Meeting

Saturday, November 18, 9:30 A.M.

EXECUTIVE SESSION

ROLAND S. MORRIS, President, in the Chair

MINUTES OF THE BUSINESS MEETING

President Morris gave an account of the work of the Committee on Finance and of the Treasurer.

Copies of the Treasurer's Report were distributed and, on motion, the Report was approved.

The following resolution recommended by the Committee on Finance was approved:

Resolved: That all of the property, including timber and mineral rights, received by the American Philosophical Society from the Estate of Walter Wood and located in Dade and Walker Counties, Georgia, be sold for the sum of Six Thousand Five Hundred Dollars ($6,500) cash;

And Be It further Resolved, That Roland S. Morris, President, or Dr. Edwin G. Conklin, Executive Officer, and Dr. William E. Lingelbach or Dr. John A. Miller, Secretaries, be authorized to execute the necessary papers and Deeds to effect this sale.

The budget for the year 1940 as recommended by the Committee on Finance and Council was unanimously approved.

AMENDMENTS TO THE LAWS

The amendments to the Laws proposed at the General Meeting in April were on motion, duly seconded, approved as follows:

CHAPTER I, ARTICLE 5 reads: "Nominations to membership shall be made in writing by the Committees on Membership, or they may be made by any five members of the Society and addressed to the Secretaries before November first in each year. Nominations shall be on blank forms provided for that purpose and shall specify the qualifications and principal activities or fields of learning of the nominees. In case of non-election nominations may be continued by the written endorsement of three of the proposers filed with the Secretaries before November first following; these nominations may be continued a second time in similar manner, after which the names of the unsuccessful candidates will be dropped and all papers relating thereto destroyed. Such candidates may be considered again only by entirely new nominations."

Amended to read:

ARTICLE 5. "Nominations to membership shall be made in writing by the Committees on Membership, or they may be made by any five members of the Society. These nominations shall be known respectively as 'Committee nominees,' and 'Member nominees,' and shall be so listed in the *preliminary ballot*. These nominations must be in the Executive Office before December first. Nominations shall be on blank forms provided for that purpose and shall specify the qualifications and principal activities or fields of learning of the nominees. In case of non-election, nominations may be continued by the written endorsement of three of the proposers filed in the Executive Office before November first following and shall be listed as 'Continued nominations' in the *preliminary ballot;* these nominations may be continued a second time in similar manner, after which the names of the unsuccessful candidates will be dropped and all papers relating thereto destroyed. Such candidates may be considered again only by entirely new nominations."

CHAPTER I, ARTICLE 6 reads: "Before December first in each year the Chairman of each Committee on Membership shall submit to the members of his class a list of all the nominations in the class and shall request them to use this list as a *preliminary ballot* and to check on it the names of those persons, not more than twelve in number, whom they prefer for resident members, and not more than five whom they prefer for foreign members, and to sign and return this ballot to the Secretaries before January first."

Amended as follows:

Substitute "Immediately after" in place of "Before" in the first line and "Executive Office" in place of "Secretaries" in the last line.

Insert the following new Article:

CHAPTER I, ARTICLE 8. "Before February first, the Council may nominate not more than three persons in each year whose names shall be presented to the Society in the *preference ballot* as 'Council nominees' together with their qualifications. These nominations shall be on the regular blank forms provided for that purpose."

Change the numbering of each of the following Articles in this Chapter, namely Articles 8, 9, 10, 11, 12, 13, 14 and 15, owing to intercalation of the new Article 8.

CHAPTER IV, ARTICLE 2 reads: "The Council shall hold at least three meetings a year, and nine members shall constitute a quorum at any meeting, provided, however, that for the adoption of the budget a vote of a majority of all the members shall be requisite. Minutes of the proceedings and acts of the Council shall be regularly kept."

Amended as follows:

Substitute "two" instead of "three" in second line.

CHAPTER IV, ARTICLE 4 reads: "The Council shall, at such times as they may fix, ask all Committees to submit estimates of their needs for the ensuing fiscal year which, together with the report of receipts and expenditures by the Committee on Finance, shall be made the basis for the annual budget to be submitted by the Council to the Society for its approval at the General Meeting in April."

Amended as follows:

Add "or November" after "April" in the last line.

The report of the subcommittee of the Committee on Publications [1] concerning the establishment of *Mathematical Reviews* and the advisability of the Society's making a contribution towards the support of this journal were considered. The following resolution recommended by the Committee on Publications was approved with the proviso that this action was not to be considered as establishing a precedent:

> *Resolved,* That the Committee on Publications recommend to the Society that an appropriation of $3,000 for one year be approved for *Mathematical Reviews.*

Dr. Harold C. Urey informed the Society that the Committee on Publications had not approved the suggestion of the subcom-

[1] See p. 142.

mittee that the title page of the journal shall include a statement: "Sponsored by the American Philosophical Society," and that he had been requested to confer with the editors of the new journal with a view to formulating a statement to be used for the cover of *Mathematical Reviews*. After some consideration and discussion, it was moved that the name of the American Philosophical Society should not be officially mentioned as sponsor of *Mathematical Reviews* but that mention of the Society's contribution might be noted in a less conspicuous manner.[1] It was the sense of the meeting that the editors of this journal be notified of the Society's action.

The Secretary announced the donation by Mr. Arthur Bloch of Mechanicsville, Pa., of an engraving of Peter S. DuPonceau by J. Sartain, after the painting of T. Sully.

The names of the members[2] who had died since the last meeting were read.

[1] See p. 146.
[2] See p. 430.

V

REPORTS OF STANDING COMMITTEES

1. REPORT OF THE COMMITTEE ON MEETINGS

The Committee members who were continued for the year were Roland S. Morris, *President*, Edwin G. Conklin, *Chairman*, Karl K. Darrow, Merkel H. Jacobs, Waldo G. Leland, William E. Lingelbach, and John A. Miller. Frank Aydelotte, Horace H. F. Jayne, Phoebus A. Levene and David H. Tennent were added as new members in the places of Cyrus Adler, Ralph E. Cleland, Jesse S. Reeves and Harlow Shapley, retired. It is desirable so far as possible to have as members of all committees persons who live sufficiently near Philadelphia so that they can attend committee meetings without undue expense of time and money. During 1939 meetings of this Committee were held on March 15, May 17, October 9 and December 11. The Laws (Chap. V, Arts. 12 and 13) prescribe: "The Committee on Meetings shall be charged with the preparation of the scientific and scholarly programs of all meetings of the Society and of all meetings held under its auspices, and with the organization of discussions, symposia and conferences." It ". . . shall transmit to the Committee on Publications all papers, communications, reports and other materials which it may recommend for publication." With these duties it is necessary to prepare the program well in advance of the meetings, to decide upon topics for symposia and conferences and to select participants in these, to choose the Penrose and other lecturers, to select for public presentation papers resulting from research grants, and to pass upon papers that are offered for the meetings by members or non-members. Our programs, therefore, consist in the main of invited communications and all are approved by the Committee in advance of the meetings. It is largely owing to this fact that our meetings are generally said to be more interesting than those of societies where the program consists largely or entirely of volunteered papers. The Committee always welcomes suggestions from others, whether members of the Society or not, of speakers, papers, and themes for symposia.

In view of the fact that the scientific and scholarly programs are arranged by the Committee on Meetings, it seems appropriate that these programs should be listed in the annual report of this Committee instead of in the "Abstracts from the Minutes" as heretofore. This will also permit a more complete report of the business of the Executive Sessions of the Society in the "Abstracts of Minutes."

PROGRAMS OF THE MEETINGS DURING 1939

(1) MEETING IN COMMEMORATION OF THE LIFE AND WORK OF ELIHU THOMSON

Under the auspices of
The American Philosophical Society
The Franklin Institute of Pennsylvania
Central High School of Philadelphia
Massachusetts Institute of Technology
General Electric Company

Thursday, February 16, 2 P.M.

Hall of the American Philosophical Society

ROLAND S. MORRIS, President, in the Chair

The following papers were read by the persons named:

Vannevar Bush, President, Carnegie Institution of Washington. "Elihu Thomson, as Educator." (Read by Dr. W. F. G. Swann.)

William D. Coolidge, Director, Research Laboratories of the General Electric Company. "His Interest in Research."

Dugald C. Jackson, Professor Emeritus of Electrical Engineering, Massachusetts Institute of Technology. "Electrical Engineer."

Albert G. Davis, Lawyer; Formerly Manager, Patent Department, General Electric Company. "Inventor of 700 Patents." (Read by Dr. E. G. Conklin.)

Harlan T. Stetson, Research Associate, Massachusetts Institute of Technology. "His Interest in Astronomy."

Albert L. Rohrer, Advisory Engineer (retired), General Electric Company. "His Love of Nature."

At the close of the session tea was served in the reception room.

Thursday, February 16, 8:15 P.M.,

Hall of the Franklin Institute

PHILIP C. STAPLES, President of the Franklin Institute, in the Chair

The following addresses were made by the persons named:

John L. Haney, President, Central High School of Philadelphia. "The Philadelphia Period in the Life of Professor Thomson."

Roland S. Morris, President, American Philosophical Society. "Elihu Thomson and the American Philosophical Society."

Karl T. Compton, President, Massachusetts Institute of Technology. "Elihu Thomson, the Scientist."

A moving picture film was shown of Professor Thomson in conversation with E. W. Rice, Jr., late President of the General Electric Company. Apparatus invented by Professor Thomson was on exhibition.

(2) JOINT MEETING WITH THE FRANKLIN INSTITUTE OF THE STATE OF PENNSYLVANIA

SYMPOSIUM ON "PROGRESS IN ASTROPHYSICS"[1]

Friday, February 17, 10 A.M.

Hall of the American Philosophical Society

HARLOW SHAPLEY, Director, Harvard College Observatory, in the Chair.

The following papers were read by the persons named:

Donald H. Menzel, Associate Professor of Astrophysics, Harvard College Observatory. "Problems of the Solar Atmosphere."

Charlotte M. Sitterly, Princeton University Observatory. "The Composition of the Sun."

Rupert Wildt, Princeton University Observatory. "The Constitution of the Planets."

S. Chandrasekhar, Yerkes Observatory, University of Chicago. "The Internal Constitution of the Stars."

[1] Published in full in PROC. Amer. Philos. Soc. 81: 107–307.

Friday, February 17, 2 P.M.

W. F. G. Swann, Director, Bartol Research Foundation of the Franklin Institute, in the Chair

The following papers were read by the persons named:

Cecilia Payne-Gaposchkin, Astronomer, Harvard College Observatory. "Variable Stars."

Otto Struve, Director, Yerkes Observatory, University of Chicago. "Stars with Extended Atmospheres."

Fred L. Whipple, Harvard College Observatory. "On the Physical Characteristics and Origin of the Supernovae."

Dorrit Hoffleit, Harvard College Observatory. "Observations of Supernovae."

Theodore Dunham, Jr., Astronomer, Mount Wilson Observatory, Carnegie Institution of Washington. "Matter in Interstellar Space."

Friday, February 17, 8:15 P.M.

Hall of the Franklin Institute

Roland S. Morris, President of the American Philosophical Society, in the Chair

Henry Norris Russell, Professor of Astronomy and Director, Princeton University Observatory: "Stellar Energy and the Evolution of Atoms." [1]

(3) ANNUAL GENERAL MEETING, APRIL 20, 21, 22, 1939

Thursday, April 20, 10:30 A.M.

Edwin G. Conklin, Vice-president, in the Chair.

Campbell Bonner and Carl D. Buck, recently elected members, subscribed the Laws and were admitted into the Society.

The following papers were read by the persons named:

Charles B. Davenport, Research Associate, Carnegie Institution of Washington, Cold Spring Harbor. "The Living Skull."

Barbara Burks, Research Associate, Carnegie Institution of Washington, Cold Spring Harbor. (Introduced by Dr. Davenport.) "Mental and Physical Developmental Patterns of Identical Twins in Relation to Organismic Growth Theory."

[1] This address was also published in the *Journal of the Franklin Institute* **228**: 143–157.

Eliot Chappel, Instructor in Anthropology, Harvard University. (Introduced by Dr. Hooton.) "The Measurement of Human Interaction."

George Howard Parker, Professor Emeritus of Zoology, Harvard University. "The Prolonged Activity of Severed Chromatophoral Nerves."

Merkel H. Jacobs, Professor of General Physiology, University of Pennsylvania. "Distinctive Physiological Characters of Certain Types of Vertebrate Blood."

Arthur K. Parpart, Assistant Professor of Biology, Princeton University. (Introduced by Dr. Harvey.) "Ionic Permeability of the Red Blood Cell."

Elmer G. Butler, Professor of Biology, Princeton University. (Introduced by Dr. Conklin.) "Effects of X-rays on Tissue Regeneration."

Edward W. Berry, Professor of Paleontology, Johns Hopkins University. "The Geology and Paleontology of Lake Tacarigua." (Read by title.)

Ermine C. Case, Professor of Geology, University of Michigan. "The Mastodons of Borobudur (Bârâboedaer) in Java."

Samuel Eliot Morison, Professor of History, Harvard University. "Navidad, the First European Settlement in the New World."

Thursday, April 20, 2 P.M.

Liberty Hyde Bailey, in the Chair.

The following papers were read by the persons named:

George D. Birkhoff, Professor of Mathematics, Harvard University. "The Four Color Problem."

Gilbert A. Bliss, Professor of Mathematics, University of Chicago. "The General Analysis of E. H. Moore."

William Henry Brown,* Lecturer in Botany, Johns Hopkins University. (Introduced by Professor Berry.) "The Bearing of Nectaries on the Origin of Anemophily."

Burton E. Livingston, Director, Laboratory of Plant Physiology, Johns Hopkins University. "Total Sunlight Intensity Automatically Integrated for Convenient Periods by Means of Radio-atmometer and Integrating Thermopile Solarimeter."

Burton E. Livingston, Director, Laboratory of Plant Physiology, Johns Hopkins University, and Stuart B. LeCompte, Jr. "Soil-moisture Fluctuations Indicated by

* Recipient of Grant from the Penrose Fund.

Means of Porous-porcelain Auto-irrigator Cones Permanently Installed in Open Ground."

Benjamin M. Dugger,* Professor of Plant Physiology and Economic Botany, University of Wisconsin, and Wayne E. Moore. "Further Studies on Quantum Efficiency of Photosynthesis in Chlorella."

Daniel T. MacDougal, Director (ret.), Desert Laboratory, Carnegie Institution of Washington. "Growth Control in Trees." (Read by title.)

George H. Shull, Professor of Botany and Genetics, Princeton University. "The Repeated Occurrence of a New Gene Mutation Oenothera mut. clusa, and its Genetical Behavior."

Albert F. Blakeslee, Director, Department of Genetics, Carnegie Institution of Washington, Cold Spring Harbor, and Sophia Satina and Marie E. Conklin. "Effect of Colchicine on Lower Plants."

Friday, April 21, 10:30 A.M.

EXECUTIVE SESSION [1]

Friday, April 21, 2 P.M.

Cyrus Adler, Vice-president, in the Chair

Evarts B. Greene, Benjamin D. Meritt, Charles H. McIlwain and Carl D. Anderson, recently elected members, subscribed the Laws and were admitted into the Society.

The following papers were read by the persons named:

Campbell Bonner, Professor of the Greek Language and Literature, University of Michigan. "An Ikon of St. Demetrius in Ann Arbor."

Benjamin D. Meritt, Professor of Greek Epigraphy, Institute for Advanced Study. "Restoration of Greek Inscriptions."

Carl D. Buck, Professor Emeritus of Comparative Philology, University of Chicago. "History of Some Words Denoting Emotions or Their Physical Expression."

Henry A. Sanders, Professor of Latin, University of Michigan. "A Soldier's Marriage Certificate in Diploma Form."

Edward S. Corwin, Professor of Jurisprudence, Princeton University. "The Posthumous Career of James Madison as Lawyer."

Richard Krautheimer,* Professor of Art, Vassar College. (Introduced by Dr. Morey.) "Some New Discoveries in Early Christian Architecture in Rome."

[1] See Minutes, p. 33.

William Lyon Phelps, Professor Emeritus of English Literature, Yale University. "Some Notes on Shakespeare."

Alfred J. Swan,* Associate Professor of Music, Swarthmore and Haverford Colleges. (Introduced by Dr. Aydelotte.) "Russian Folk-lore in the Pskoff Region and its Collection."

Friday, April 21, 8:15 P.M.

Roland S. Morris, President, in the Chair

Eduard Beneš, newly elected member, subscribed the Laws and was admitted into the Society.

THE R. A. F. PENROSE, JR., MEMORIAL LECTURE

Eduard Beneš, Former President of Czechoslovakia: "Politics as Art and Science."

The lecture was followed by a reception.

Saturday, April 22, 10 A.M.

Robert A. Millikan, Vice-president, in the Chair

Herman A. Spoehr, Victor G. Heiser, C. F. Tucker Brooke, John von Neumann and Eliot Blackwelder, recently elected members, subscribed the Laws and were admitted into the Society.

The following papers were read by the persons named:

Robert A. Millikan, Director, Norman Bridge Laboratory of Physics, California Institute of Technology, and H. V. Neher. "Energy Distribution of Incoming Cosmic Rays."

William V. Houston, Professor of Physics, California Institute of Technology. (Introduced by Dr. Millikan.) "Electrons in Metals."

J. D. Williams, Princeton University Observatory. (Introduced by Dr. Russell.) "Systematic Biases of Meteor Directions."

Horace W. Babcock, Assistant in the Lick Observatory, University of California. (Introduced by Dr. W. H. Wright.) "The Rotation of the Andromeda Nebula."

Arthur H. Compton,* Professor of Physics, University of Chicago. "Production of Mesotrons in the High Atmosphere."

Floyd K. Richtmyer,* Professor of Physics, Cornell University, and R. E. Shrader. "Double Ionization of Atoms and the Auger Effect."

Karl K. Darrow, Research Physicist, Bell Telephone Laboratories. "Status of the Theory of Solids."

Percy W. Bridgman, Professor of Mathematics and Natural Philosophy, Harvard University. "Compressibility of Simple Cubic Compounds."

Saturday, April 22, 2 P.M.

FORUM ON THE ACTIVITIES OF THE SOCIETY [1]

Saturday, April 22, 7:30 P.M.

The annual dinner was held at the Bellevue-Stratford Hotel, President Morris presiding.

Dr. Harlow Shapley presented Dr. Henry Norris Russell, of Princeton University, for the John F. Lewis Prize.[2] The prize, consisting of a check for three hundred dollars and a diploma, was then awarded to Dr. Russell who made a gracious response in accepting this honor.

The following after dinner addresses were made:

Jesse S. Reeves, Professor of Political Science, University of Michigan. "Neutrality."

Victor G. Heiser, President, International Leprosy Association. "Nutrition and Personality."

Vannevar Bush, President, Carnegie Institution of Washington. "Research Aspects of National Defense."

(4) AUTUMN GENERAL MEETING, NOVEMBER 17, 18, 1939

Friday, November 17, 10 A.M.

ROLAND S. MORRIS, President, in the Chair

President Morris called attention to the fact that the first meeting held in this building was on November 13, 1789, and that the one hundred and fiftieth anniversary of the opening of this building is being observed in connection with this meeting.[3]

[1] See p. 55.
[2] See p. 52.
[3] See p. 99.

The following papers were read by the persons named:

William B. Scott,* Professor Emeritus of Geology, Princeton University. "White River Fauna."

Helmut deTerra,* Formerly Research Associate, Academy of Natural Sciences of Philadelphia. "Results of the American Southeast Asiatic Exploration for Early Man."

Ronald L. Ives,* Research Geologist. "A Re-exploration of the Colorado Headwaters."

Harold Sellers Colton,* Director, Museum of Northern Arizona. "A Remarkable Twelfth Century Burial Found Near Flagstaff, Arizona."

Linton Satterthwaite, Jr.,* Assistant Curator, University Museum, University of Pennsylvania. "Fundamental Components of Maya Temples at Piedras Negras."

John Franklin Daniel, Member, The Cyprus Expedition of the University Museum, University of Pennsylvania. (Introduced by Dr. Jayne.) "Kourion in the Late Bronze Age."

M. F. Ashley-Montagu,* Associate Professor of Anatomy, Hahnemann Medical College. "The Author of the First Comparative Anatomy of an Ape and Man: Edward Tyson, 1650–1708."

E. Newton Harvey, Professor of Biology, Princeton University. "Benjamin Franklin's Views on the Phosphorescence of the Sea."

Josiah Cox Russell,* Assistant Professor of History, University of North Carolina. "The Effects of Some Rapid and Continuous Population Changes."

George A. Barton, Professor Emeritus of Semitic Languages, University of Pennsylvania. "The Palaeolithic Beginnings of Religion—an Interpretation." (Read by title.)

Friday, November 17, 2 P.M.

Ernest Minor Patterson, in the Chair

Jesse Wakefield Beams, Frederick Gardner Cottrell, Harry Miller Lydenberg, Gerrit Miller, Jr., Ralph Barton Perry and Herbert Eustis Winlock, recently elected members, subscribed the Laws and were admitted into the Society.

The following papers in a Symposium[1] on The Totalitarian State from the Standpoints of History, Political Science, Economics and Sociology were presented by the persons named:

* Recipient of Grant from The Penrose Fund.

[1] Proc. Amer. Philos. Soc. 82: 1–102.

Fritz Morstein Marx, Associate Professor of Political Science, Queens College. "Totalitarian Politics."

Walter Thomas Woody, Professor of Education, University of Pennsylvania. "Principles of Totalitarian Education."

Moritz J. Bonn, Lecturer, London School of Economics. "The Economics of Totalitarianism."

C. R. Whittlesey, Professor of Economics, Princeton University. "The Relation of Totalitarianism to International Trade and Finance."

Herbert Heaton, Visiting Professor of Economics, Princeton University. "Discussion of Totalitarianism."

Friday, November 17, 8:15 P.M.

Roland S. Morris, President, in the Chair

AUTUMN LECTURE

Carlton J. H. Hayes, Seth Low Professor of History, Columbia University: "The Novelty of Totalitarianism in the History of Western Civilization."

The lecture was followed by a reception.

Saturday, November 18, 9:30 A.M.

EXECUTIVE SESSION [1]

Saturday, November 18, 10 A.M.

Detlev W. Bronk, in the Chair

Van Wyck Brooks, recently elected member, subscribed the Laws and was admitted into the Society.

The following papers were read by the persons named:

A. M. Banta,* Professor of Biology, Brown University, and Thelma R. Wood. "Cytoplasmic Effects in Inheritance in Daphnia."

T. M. Sonneborn,* Associate Professor of Zoology, Indiana University. "Genetic Evidence of Autogamy in Paramecium aurelia, and its Significance."

George Crile, Director, Cleveland Clinic Foundation, and D. P. Quiring. "Comparison of the Energy Organs of the White Whale and the Thoroughbred Horse 'Equipoise.'"

[1] See p. 79.

Thomas Hale Ham,* Instructor, Department of Medicine, Harvard Medical School, and William B. Castle. "Studies on the Destruction of Red Blood Cells."

William C. Stadie,* Associate Professor of Research Medicine, University of Pennsylvania, and John A. Zapp and Francis D. W. Lukens, "The Effect of Insulin Upon Ketone Formation by the Liver of the Normal and Diabetic Cat."

Jean Broadhurst,* Professor of Bacteriology, Teachers College, Columbia University. "Embryo Chick Cultivation of a Virus from Scarlet Fever Patients."

Francis Harper,* Research Associate, John Bartram Association. "Retracing the Routes of John and William Bartram in the Southeast."

Merritt L. Fernald,* Professor of Natural History and Director, Gray Herbarium, Harvard University. "Discoveries in the Flora of Tidewater Virginia."

Saturday, November 18, 2 P.M.

HENRY NORRIS RUSSELL, in the Chair

William B. Castle, Samuel Fels and Hermann Weyl, recently elected members, subscribed the Laws and were admitted into the Society.

The following papers were read by the persons named:

Carl C. Speidel,* Professor of Anatomy, University of Virginia. "Effects of Metrazol on Tissues of Frog Tadpoles with Special Reference to the Injury and Recovery of Individual Nerve Fibres."

A. M. Skellett, Physicist, Bell Telephone Laboratories. (Introduced by Dr. Cook.) "The Coronaviser, a New Astronomical Instrument."

Karl F. Herzfeld,* Professor of Physics and Head, Department of Physics, Catholic University of America. "Theory of Light Absorption in Simple Aromatic Compounds."

James Franck, Professor of Physical Chemistry, University of Chicago. "A Contribution to the General Theory of Photosynthesis."

Robley D. Evans,* Associate Professor of Physics, Massachusetts Institute of Technology. "New Work on International Standards of Radioactivity."

J. W. Beams, Professor of Physics, University of Virginia. "A High Resolving Power Ultracentrifuge."

Karl K. Darrow, Research Physicist, Bell Telephone Laboratories. "Status of Nuclear Theory."

W. F. G. Swann, Director, Bartol Research Foundation of the Franklin Institute. "Showers Produced by Penetrating Rays."

Allan C. G. Mitchell,* Professor of Physics, Indiana University. "The Relation Between the Emission of Beta and Gamma Rays in Radioactive Substances."

At the close of the session tea was served in the Reception Room for members and guests.

MEETINGS OF OTHER ORGANIZATIONS

In addition to the meetings of the Society, the following meetings were held by other organizations in the Hall of the Society:

(5) THE JAYNE MEMORIAL LECTURES

January 26, February 2 and 7, 8:15 P.M.

A series of three lectures on "The Rise and Fall of American Indian Civilizations" was presented by Alfred Vincent Kidder, Chairman, Division of Historical Research, Carnegie Institution of Washington, on the following subjects:

January 26. "Early American Man and His Cultural Beginnings: The Southwest."

February 2. "High Cultures in the Andes and Central America: The Maya; Decline; The Conquest."

February 7. "New World Civilizations. Man: his Culture, Archaeology and History; The Future."

(6) MEETING OF THE ARCHAEOLOGICAL INSTITUTE OF AMERICA

November 15, 8:15 P.M.

The Archaeological Institute of America, Philadelphia Society, was granted the privilege of holding its three meetings for the year 1939–40 in the Hall of the Society, and on November 15 the first of these meetings was held with an illustrated lecture by Professor Richard Stillwell of Princeton University on "Byzantine Church Architecture in Greece."

(7) MEETING OF THE DELAWARE VALLEY NATURALISTS UNION

November 25

A meeting of the Delaware Valley Naturalists Union was held in the Hall of the Society under the auspices of the Committee on Education and Participation in Science.[1] At 2:30 P.M., a sight-seeing tour was arranged to sites of historic and scientific interest in the vicinity of the Hall of the American Philosophical Society. At 4 P.M. Charles E. Mohr, Director of Education, Academy of Natural Sciences of Philadelphia, spoke on "The Fauna of Caves." At 8:15 P.M., W. Stephen Thomas, Executive Secretary of the Committee on Education and Participation in Science of the American Philosophical Society, spoke on "Early Scientific Work of the American Philosophical Society."[2]

[1] See p. 355.
[2] See p. 356.

2. REPORT OF THE COMMITTEE ON HALL

The membership of the Committee on Hall consists of the following persons:

J. Bertram Lippincott,† *Chairman*
Paul P. Cret
Marshall S. Morgan
Lawrence J. Morris
J. Rodman Paul
John M. Scott

and *ex officio*

Roland S. Morris, *President*
Albert P. Brubaker, *Curator*
Edwin G. Conklin, *Executive Officer.*

A number of alterations and repairs in the building and its surroundings were made during the year, and as in recent years the costs were charged to the Building Fund, with the approval of the Committee on that Fund.

The southeast basement rooms in the Hall of the Society were assigned for the uses of the Executive Staff of the Committee on Education and Participation in Science.[1]

The most important alterations or repairs of the year are the following:

1. A kitchen was installed on the third floor in an alcove of the old library, previously occupied by a stairway and wash basin. The alcove was rendered as nearly fireproof as conditions permitted and a sink with cold and hot water from the basement, a gas range, cupboards and tables were installed. This kitchen is convenient to the Reception Room and Members' Room on the second floor where luncheons are served during meetings and receptions. The former kitchen in the basement was remote from the rooms where food is served and waiters had to pass through crowded halls and up two flights of stairs to reach those rooms. There was no possibility of installing a dumb-waiter without seriously marring

† Deceased January 19, 1940.
[1] See p. 353.

the rooms on the first floor. Furthermore the basement was objectionable because the smell of cooking permeated the meeting rooms. All these difficulties and objections have been overcome by the installation of this third floor kitchen.

2. Ventilation of the Lecture Hall has always been unsatisfactory, and when the room was crowded it became very bad. By the installation of two forced draft window ventilators, one on the Fifth Street side of the room, the other on the Independence Square side, this trouble has been entirely overcome.

3. The Lecture Hall will seat comfortably only about 200 persons, but on special occasions we may have two or three times that number of persons wishing to hear the lecturer. Instead of hiring a hall at some distant place in the city it was decided to install a microphone at the lecturer's desk and loud speakers in the Reception and Members' Rooms on the second floor. These can be turned on or off as desired and the listeners outside the Lecture Hall may enjoy a freedom in conversation, smoking or repose not possible in the Lecture Hall; thus we can maintain the respect for a lecturer and the dignity of a formal meeting in the Lecture Hall, with the freedom of conversation in the second floor rooms.

4. All windows on the first floor were put in order at the time of the reoccupation and restoration of those rooms in 1934, but windows in the basement and second floor, 27 in number, were very loose, rattled in the wind and let in currents of air while the sash cords, pulleys and weights were in bad order. All sashes have been reset in the frames, fitted with bronze weather strips and provided with new chains, pulleys and in some cases new weights.

5. The old wooden fence around the south area yard has long been an eyesore and was falling to pieces. Two years ago the Committee recommended that it be replaced by a brick wall similar to that which surrounds Independence Square. An architect was employed to prepare plans and specifications and during the year bids were received and the contract let for the work. This wall has now been built and it harmonizes well with the wall around the Square. A gate on the Fifth Street side opens into the area, thus providing for the first time a service entrance into the building.

6. When the first floor rooms were rented and the door into Independence Square closed a small window adjoining this door was inserted for ventilation of a lavatory which was placed in the

entrance hall. With the removal of this room and the opening of the door into the Square the window was no longer needed. It has now been removed and the front of the building on the Square restored to its original condition.

7. The wall of the building, especially on the south side, bore marks of crude patching where openings had been closed or bricks replaced. These patches have been replaced by neat brick work and all open joints in the basement and first floor walls have been repointed.

8. During the past summer a serious flood of ground water came into the basement of the building near the northwest corner. An examination by the United Engineers and Constructors, Inc., indicated that this was due to a loose fill around the boiler room under the old Supreme Court building adjoining the Hall of the Society. This fill was removed and replaced by clay well packed down and the flagstones in the walk at that point were laid in concrete and the joints well sealed. This seems to have completely remedied this rather serious trouble. The property is now in excellent condition and the Hall serves all the needs of the Society, except for the Library which is well housed in the Drexel Building, on the opposite side of Fifth Street.

9. Visitors to the buildings on Independence Square frequently come into the Hall of the American Philosophical Society thinking that it is one of the public buildings. The Executive Staff is always glad to show visitors who are interested in the Society through the building, but many have no interest in it when they learn that it is not one of the public buildings. For the information of the general public it was decided two years ago that an appropriate bronze tablet should be placed on the outer wall of the building adjoining the entrances on Fifth Street and on Independence Square. Several forms of tablets were prepared by the Executive Officer and one of these was approved by the Committee and Mr. Edwin H. Fetterolf was commissioned to prepare blueprints and specifications to be submitted to the Art Jury of Philadelphia. The Jury objected to the size of the tablet and to the number of words on it and requested that both be reduced to a minimum. Consequently no mention on the tablet was possible of the union in 1769 of the American Philosophical Society and the American Society, nor of the origin of the latter from the Junto established in 1727. Yet it was necessary to give the significant dates of the founding of the American Philosophical Society and of the Junto,

since the Society had for 170 years dated its origin from 1743 and only on May 1, 1914, had voted to accept the report of a committee on the date of origin as 1727 instead of 1743. The wording of the tablet is designed to perpetuate both of these dates, although it was

THE
AMERICAN PHILOSOPHICAL SOCIETY
~ FOUNDED BY ~
BENJAMIN FRANKLIN
·1743·

Outgrowth of The Junto. 1727 : Reorganized. 1769
THE FIRST LEARNED SOCIETY IN
THE BRITISH PLANTATIONS IN AMERICA

This Building was Erected 1786-1789

not possible in the limited space allowed to offer explanations. Mr. Fetterolf prepared blueprints of the present tablet, here illustrated, and this was approved by the Art Jury. The tablet is a beautiful work of art, simple, plain and chaste as befits the building. The two tablets were made and set securely on the walls by Mr. John M. Doyle.

Location and Construction of the Hall of the American Philosophical Society

In this connection it is fitting to recall that the Autumn General Meeting of the Society on November 17 and 18, 1939, coincided very nearly with the sesquicentennial of the completion and occupation of the Hall of the Society, and it seems appropriate at this time and place to record some of the outstanding events in the location and construction of this historic building.[1] No Minutes of meetings of the American Philosophical Society prior to 1768 have been preserved. In 1768 the Society held most of its meetings in the

[1] The following account has been compiled from the Early Minutes of the Society, Proc., 22, pt. 3, 1884.

Council Chamber "at the State House"; after its union with the American Society on January 2, 1769, meetings were held for a year "at the College" [University on Fourth Street]. On March 16, 1770, it is recorded that the Society had rented the Church Schoolhouse on Second Street for the meetings of the Society at £12 per annum and a committee was appointed "to provide Candles, Firewood, Benches, Tables and other necessary Furniture at as moderate a rate as they can." Thereafter until 1780 whenever the meeting place is mentioned this is called "Society Hall," except on one occasion, viz., February 5, 1773, when the meeting was held in the "Council Chamber in the State House" and an address to the House of Assembly was drawn up "acknowledging the kind assistance of the Assembly to the Society and praying for further Help to enable us to discharge the heavy Debts still due for our first Publication" [TRANSACTIONS, Vol. I]; and on March 5, 1779, when the meeting was "at the College." On February 17, 1780, the Minutes record that, "the Society finding it necessary to have a regular place of meeting it was moved and seconded that a Committee be appointed to enquire where a proper lot could be obtained for building a Hall for the Society, or whether any house or lot already appropriated for public purposes similar to those of this Society could be obtained; Dr. Bond, Mr. Wilson and Dr. Smith were appointed a Committee to make the necessary enquiries on this subject and to report as soon as they can."

The Act of Incorporation was passed by the General Assembly on March 15, 1780[1] and on April 7, 1780, "The Committee on Room was directed to apply for the use of the Library room in Carpenters' Hall;" on June 16, "the Curators were requested to move the Society's effects from the University to Carpenters' Hall." At a meeting on April 11, 1780, "It was proposed to build in company with the City Library. It was proposed to join with the Library in purchasing Carpenters' Hall,—Widow Stell's lot,—Dr. Franklin's lot in Arch Street,—State House yard,—Hamilton's lot in Third Street."

April 10, 1783. "Mr. Hopkinson reported that he had examined a house in Fifth Street suitable to receive the Library and Cabinet. Committee of two to review said house and enquire of the Trustees of the University at what rent it may be had." . . . "Resolved that the said gentlemen (Hopkinson and Rittenhouse

[1] See p. 5.

and Hazard) be directed and empowered to sell a building[1] in the State House yard belonging to this Society."

July 19, 1783. "Lot in Fifth Street near Arch, 40′ × 48′; Committee to confer with the owners about a purchase." September 26, 1783, "Committee reported the price of the desired lot too high. The Committee on Sale of House in State House yard reported an offer of Eighteen pounds (£18).—Sale ordered. Committee appointed to enquire of Mr. Willing whether he will let the Society have [his lot in Third Street] upon ground rent and upon what terms. If unsuccessful they are desired to endeavor to find some other which will be suitable for the Society's purposes." November 21, 1783, "Committee on Lot reported one in 5th Street belonging to Mr. Jno. Dunlap, to be got for $1000."

December 5, 1783. "Mr. Hopkinson offers to sell to the Society a Lot of Ground on Arch Street near the Observatory 40 feet front and 100 feet deep, clear of Incumbrances for the sum of one thousand dollars." December 19, 1783, "Hopkinson offers *the whole* lot on 5th Street, 40′ × 306′, for £600[2] ($1000 down; the rest on interest)."

February 6, 1784. Committee on revising the Constitution and Laws reported recommending among other things:

> "4. That measures be immediately taken for erecting a suitable building . . . if a lot were purchased, it would not be difficult to raise by subscription funds to build . . . at least it ought to be vigorously attempted without delay . . . and one of the offered lots forthwith determined upon.
>
> "5. A subscription immediately opened . . . and an application to the Legislature for aid . . . as soon as £1000 shall be subscribed, a committee be appointed to plan a suitable Edifice to be laid before the Society for appropriation and to superintend the Building."

The fourth recommendation (4) ". . . resulted in a resolution to purchase the Hopkinson Lot next the Observatory in Arch Street (40′ × 306′) for £600, half down, half on interest for five years." February 20, 1784, "The deed of the Hopkinson lot was produced and deposited with Mr. Rittenhouse. A bond and mortgage was ordered to be sealed."

March 5, 1784. "Ordered Mr. S. Vaughan, Mr. Rittenhouse and Mr. Hopkinson be a Committee to consider the most eligible means of providing the Society with a suitable Building."

1 [Evidently a small structure with no lot.]
2 [Pennsylvania currency, £1 = $2.66⅔.]

March 19, 1784. "The Building Committee reported conference with the Directors of the Library Co. of Philadelphia and the presentation of a joint petition to the General Assembly for two Lots of ground on the East and West sides of the State House square. Highly approved."

June 19, 1784. "Botanical garden ordered to be planted on 200 feet of the Arch Street lot next to the Observatory."

November 12, 1784. "Com. of 3 to draft a petition to the Assembly for a lot of ground in the State House square for the purpose of erecting thereon a suitable building."

December 9, 1784. "Petition to the Assembly for two lots. Draft presented and read and amended so as to submit the particular appropriation of said lots entirely to the good pleasure of the Assembly. . . . Ordered that if the Library Company shall think proper to adopt the above amendment the petition be immediately presented; but if the said Library Company shall decline this, that the Committee be directed to present a similar petition in name of this Society alone." December 17, 1784, "The Library Company having declined to join in the [amended joint] petition Mr. Vaughan reported that he had presented a sole petition."

On March 28, 1785, an Act was passed by the General Assembly entitled: "An Act for vesting in the American Philosophical Society, held at Philadelphia, for promoting useful knowledge, a certain lot of ground, being part of the State-house square:

"By this act a lot of ground, being a part of the State-house square, was vested in the American Philosophical Society, with a proviso, that it should be applied to no other use but that of erecting buildings for the accommodation of the Society; but they were vested with power to lease the premises, under some qualifications, by an act of the 17th of March, 1786." (Laws, Commonwealth of Pennsylvania, II: 311, 1810.)

The Minutes of the meeting of the Society on April 1, 1785, read: "Agreed on motion that a subscription be opened immediately to enable this Society with all the expedition practicable to erect a proper building in which they may hold their meetings and conduct their transactions on the lot granted by the General Assembly in the State House Yard."

On April 15, a form of subscription was adopted, reciting the purposes of the American Philosophical Society, its need of a suitable building, the Act of the General Assembly in granting a lot of ground on the east side of State House square, and closing with this form of subscription:

"Therefore, we the Subscribers, desirious, with all practicable expedition to enable a Committee which is appointed for the purpose to construct a neat, sufficient building on the ground aforesaid, do hereby promise to pay, within three months after the Date hereof, into the hands of the Treasurer of the American Philosophical Society, or to any person authorized by them to receive the same, the Sums annexed to the Subscription of our respective Names."

June 17, 1785. "Plan of building presented by Mr. Vaughan for consideration was approved:

"Passage (Central Hall)	12 feet by 47
Hall or largest room on S. side	27 feet by 47
Room on N.E. side	27 feet by 23
Room on N.W. side	27 feet by 23
Height of the 1st floor	14 feet
Height of the 2nd floor	10 feet
Cellars to be	7 feet high
Vaults under them	of equal height.

"*Resolved* that the Committee already appointed are authorized and impowered to begin this work immediately, or to defer it some time longer—as they may judge most expedient."

[No plans or specifications are extant, but it is evident that the second floor was like the first, and probably the stair was at the Fifth Street end of the "Passage."]

From Minutes of November 18, 1785: "Robert's account for proping [sic] the State house Wall [sic] and securing it against the influence of the frost, on one side of the Society's cellar, ordered to be paid; said account including plank and scantling amounting to £3..16..6." [This must refer to the wall running around the State House yard, a jog in which must have been made to let in the Society's building.]

June 16, 1786. "Building Committee reported. It was then

"*Resolved*, as the building of vaults & cellars thereon would be very expensive: that cellars only may be built, and to be raised two feet in the clear, above the State House garden [sic] in order to have windows to give light and a thorough air thro' the cellar.

"*Resolved*, that as the intended Hall will, for the most part, be used after sunset; that it may be built on the North side; and that the two Rooms may be built on the South side, for the advantage of having light and air." [This change of plan was carried out.]

August 18, 1786. "Building Committee directed to take proper measure for securing the work against the weather."

September 15, 1786. "Building bill: for boards and covering the walls £12..18..2. Ordered to be paid."

October 6, 1786. "Vaughan's bill 'for having an area round the Society's Hall' £2..5..0; passed. Ordered that the Treasurer be directed to pay to Mr. Vaughan out of the money subscribed towards carrying on the building . . . £365..10..4."

October 20, 1786. "The Committee to carry on the building in the State House yard reporting itself not 'able to concur' it was discharged and another appointed; viz., S. Vaughan, T. Clifford and T. Parke."

November 17, 1786. "Building Committee authorized to collect subscriptions."

February 2, 1787. "The Committee on Subscriptions were invested with power to carry on the building, being accountable for the expenses; the accounts to be first passed on by the Society."

April 20, 1787. "S. Vaughan, Dr. Morris and Dr. Hutchinson were appointed to issue proposals for leasing the cellar in Fifth Street for a term of years."

May 18, 1787. "Subscriptions ordered to be opened for £400, towards carrying on the building in Fifth Street, on the following conditions:

"1. Subscriptions for one or more shares of £5 each.
2. A lease of the cellars to be made to the subscribers, when £400 were subscribed, for 20 years (to commence when the cellars were fit for use), 'subject to restrictions with advertized conditions.'
3. Possession of cellars to continue after 20 years until the refunding of the £400.

"Agreed that in case the subscription list be not filled up in the course of one week the Committee should be at liberty 'to make the offer to any person they choose.'"

July 20, 1787. "Committee to inquire about the Library Company's proposals relative to the Society's lot and intended hall in the State House yard."

August 17, 1787. "Letter from Henry Laurens, of South Carolina, thanking the Society for his election, and giving £50 for the Building. John Vaughan announces a donation for the Building of 10 guineas from his brother, Wm. Vaughan, of London.

"The Committee on the Lot & cellars near the State House reported a conference with the Directors of the Library Company, to whom they had proposed a joint finishing and occupying of the building on terms of equality and mutual convenience; or, a sale to the company at the price of past expenditures for the cellars and value of the privilege of occupying the ground. The Directors required time for deliberation.

"It was resolved to inform the Company that the Society could not tell the exact cost of the cellars, nor was prepared for any definite agreement; and that the Building Committee should make up its accounts."

September 7, 1787. "Hutchinson's motion for a Committee with power to treat, sell and transfer to the Library Company, was, on motion of Dr. Magaw, postponed to be a special order for September 14, and the Building Committee was requested again to hand in their accounts." [There are no Minutes of any meeting on September 14.]

September 18, 1787. "Mr. Vaughan produced his account of subscriptions [no details—nor any sum mentioned]. Hutchinson's motion of September 7th was argued and negatived. Dr. Ruston added to the Building Committee, *vice* Dr. Parke, resigned. Building Committee ordered 'to proceed with all convenient despatch to have the walls carried up & covered in.'"

November 2, 1787. "Franklin's second subscription of £100, and offer of a 'loan of what money may be requisite to raise & cover the building upon legal interest'—reported, the thanks of the Society voted, and the offer accepted, by the appointment of Dr. White and Samuel Vaughan, as a Committee to confer with Franklin on the 'proper mode of giving security for his advances.'

"After the interview with the President [who was apparently in another room of his house], the Committee reported, & it was resolved to give Franklin a Bond not exceeding £500, payable in one year, with legal interest; and a Mortgage on the lot of land bought by the Society of Fra. Hopkinson, Esq.; also of the rent of the cellars & such part of the building as may be let by the Society: until the said advance & interest be fully paid; and, meanwhile, a signed & sealed copy of the resolutions delivered to Franklin."

January 18, 1788. "Committee to let such parts of the Philosophical Hall as the Society can spare:—Clifford, Hutchinson, J. Vaughan. Committee for carrying on the building: Hutchinson and J. Vaughan added to it. The said Committee . . . to consider of the objections . . . mentioned in a letter . . . from the Street Commissioners, respecting the stone steps in the front of the hall, and to take such order as . . . advisable." July 18, 1788. "The Building Committee were instructed to inform the Street Commissioners that the Society was willing to enter an amicable suit, concerning the Fifth street front door steps, *presumed* by the Commissioners to rise too high."

October 17, 1788. "The Building Committee were ordered to confer with the Masonic Body in this City, or their Representatives, concerning their occupying, for a term of years, such part . . . as the Philos. Soc. can conveniently spare. . . ." November 7, 1788. "Committee to confer with the Masons were ordered to inform them that the Act of Assembly would not permit any part of building to be occupied in the manner that the Masonic Gentlemen have proposed. Hutchinson and Rittenhouse were made a Committee to sell the lot in Arch street."

November 21, 1788. "Building Committee authorized to treat with the Library Company of Philadelphia about leasing a part of the building to the Library Company."

January 16, 1789. "Arch Street Lot Committee reported that they had agreed finally with Ogleby and Sadler, who agree to pay £525, or do carpenters work in the building on the State House Square to the amount . . . at their opinion; the Society . . . to indemnify them for all encumbrances on the said Lot & to convey it to them. Messrs. Clifford, Rittenhouse, and Fox and Drs. Ruston and Hutchinson were then appointed a Committee to treat with the Directors of the Library Company about renting part of the building. The President was requested to inform the Directors by letters that the Committee have full powers . . . to receive any proposals . . . and finally to agree with them on the subject."

February 6, 1789. "The Building Committee reported a contract made with gentlemen for supplying the necessary scantling for the building . . . at 12 months' credit."

February 20, 1789. "An extract from the minutes of the Directors of the Library Company was read. The Company had considered a letter from Franklin, and appointed a Committee to wait on him and thank him for his friendly attentions. They request him to inform the Committee of the Philosophical Society that they are sensible of their friendly overtures; but it would not be convenient to remove the Library from the building which they occupy at present."

March 11, 1789. "Report of Committees of the Society and of the University read, particularly considered and agreed to:

"Dr. James Hutchinson, Mr. Kuhl, & General Irvine, Committee on the part of the University; Messrs. Vaughan, Fox & Barton, Committee on the part of the American Philosophical Society met at the University [in 4th Street] & the Univ. Com. proposed to lease the Society's Hall, (except two south rooms on the Second floor,) with free use of the Stairs, passages & cellars, for five years, at an annual rent of £85; the University to provide those materials which the Phil. Soc. have not already contracted for . . . to complete the building & to make it tenantable: the same to be allowed for to the Trustees out of the rent as it becomes due; the rent to commence as soon as the house is in tenantable order; the house to be delivered up, at the expiration of the lease, in like order as received, reasonable wear & tear excepted.

"Preparation of such a lease was then ordered under the inspection of the Committees."

April 3, 1789. "The Committee's lease was read, considered, and the Seal of this Corporation ordered to be affixed."

May 1, 1789. "Hopkinson requested part payment of his bond. The Building Committee (Mr. Clifford) wrote that no funds had been provided to pay for contracts made on materials and workmanship."

August 21, 1789. "*Resolved*, That the future meetings of the Society shall be in the Philosophical Hall, unless on occasions, when the President's health may [not] allow him to be present; then they shall be held in his house. [No meeting in new Hall until November 13.]

"Committee of the Building, ordered to take legal and efficient steps towards collecting the present outstanding sums that were subscribed to carry on that work . . . in consequence of Mr. Clifford's representations . . . now repeated. Dr. Wistar's request was granted to be permitted to fix a Rain Gauge on the top of the Philosophical Hall, and to communicate from time to time the results."

Finally at long last after twenty years of planning the Officers and Councillors of the Society met in the new building on November 13, 1789, and on November 21, the first regular meeting of the Society was held in the new building. The present Members' Room on the second floor, south side, was then divided into two rooms and was the only portion of the building reserved for the uses of the Society, the rest being rented at first to the University, later to Peale's Museum, the College of Physicians, the Municipal Court and finally to brokers and insurance agents. The Members' Room has been occupied continuously by the Society for one hundred and fifty years.

3. REPORT OF THE COMMITTEE ON THE LIBRARY

The Committee on the Library has the honor to present the following report for the calendar year 1939.

I. Report of the Librarian

Holdings of the Library.

The Report of the Library Committee for 1899 stated that for fifteen or twenty years previous to that date the number of volumes in the Library had been reported to the United States Bureau of Education and to other gatherers of library statistics to be from 50,000 to 60,000 volumes. As far as could be determined those figures were not based on an actual count, but were merely estimates. An accurate count was made, therefore, in that year and the number of volumes in the Library was found to be 32,848. The archives of the Society have not revealed thus far the explanation for the considerable discrepancy between the estimated figures and the actual ones; nor can it be determined whether that total represented pamphlets as well as volumes. There is, moreover, no conclusive evidence that these figures were used as the basis on which subsequent accessions were reckoned. There seems to have been also a lack of uniformity in the manner of entering accessions.

In order to obtain again an accurate record of the Library's holdings a new count has been made during the past year of all books and pamphlets. As a result, it is now possible to state the number of volumes (other than serials), bound and unbound; the number of serial publications, bound and unbound; the total of these two groups; and the number of pamphlets, bound and unbound.[1] An improved method of keeping accession records has been worked out which, it is hoped, will obviate the necessity for future total counts of the Library's holdings. This examination, conducted with great care, has consumed much of the time of the Library staff.

The statements just made afford the explanation for the obvious fact that the statistics for 1939 do not correspond with the

[1] The count shows also the holdings in each class, viz: archaeology, bibliography, history, physics, etc.

figures of previous years, and necessitate the following correction in the 1938 Report:

1938 Report: Total number of volumes in the Library is 82,369, of pamphlets 49,834, of maps 5,557.[1]
Correction: 29,850 volumes (other than serials), 66,550 serials,[2] giving a total of 96,409 volumes; and 36,071 pamphlets.

In accordance with this new count the holdings of the Library at the close of 1939 are: 30,322 volumes (other than serials), 67,782 serials, giving a total of 98,104 volumes; 36,553 pamphlets; and 5,645 maps.

Additions to the Library.

During 1939 there have been added to the Library 1,695 volumes, of which 1,223 were serials; 482 pamphlets; 88 maps; 67 manuscripts (exclusive of the addition to the Elihu Thomson Papers mentioned elsewhere); 83 photostats; 2 broadsides; and 1 microfilm. Of these there have been acquired by gift or exchange 842 volumes, of which 735 were serials; 397 pamphlets; 88 maps; 49 manuscripts; 1 photostat; and 1 broadside.

The purchases have been on account of the following:

Funds	Purpose	Vol. (other than ser.)	Pam.	Photostats	Mss.	Broadsides	Microfilms	Serial titles
General	Unrestricted	93	50	79	17	1		95
Balch	Intern. Law							2
Boyé	Chemistry and Geology							3
Carlier	Unrestricted	106	11					7
Franklin	Unrestricted	13		3	1		1	3
Jefferson	Unrestricted							2
Magellanic	Navigation, Astronomy, Natural Philosophy							7
Michaux	Forestry, Botany, Agriculture	22	2					53
Norris	Unrestricted	12	1					3
Phillips	Archaeology, Philology	109	21					120
Proud	Unrestricted	10						5
Seybert	Unrestricted							3
Tilghman	Unrestricted							3

[1] A recount of the maps was not made in this survey.

[2] For purposes of simplification incomplete back volumes of serials were counted as complete unbound volumes; incomplete and unbound current ones are not counted as additions until they are complete and bound.

Donations to the Library.

The following members of the Society have contributed generously to the Library: Percy W. Bridgman, T. D. A. Cockerell, Edwin G. Conklin, Reginald A. Daly, Arthur W. Goodspeed, William K. Gregory, Aleš Hrdlička, John Story Jenks, Emmanuel de Margerie, Benjamin D. Meritt, Samuel E. Morison, Roland S. Morris, John D. Rockefeller, Jr., A. S. W. Rosenbach, and T. J. J. See.

Many non-members also have contributed, among whom are the following:

W. P. Anderson
E. C. O. Beatty
Marcel Blancheteau
J. Jijon y Coamano
Howard Comfort
Mrs. Henry H. Donaldson
Henry R. Evans
William B. Evans
Mrs. William P. Gest
Richmond C. Holcomb
Alban W. Hoopes
Charles F. Jenkins
Lawrence Lewis
Burt M. McConnell
Walton Brooks McDaniel, 2nd
J. Francis McDermott
Fred C. Miller
J. Bennett Nolan
Helen C. Palmatary
Mr. and Mrs. A. D. Pardee
Edgar L. Pennington
Stefan Przeworski
Horace G. Rashkopf
Thomas L. Rhoads
Frank E. Ross
A. W. Sijthoff
Felix Soron
Alfonso Strafile
Carl Troll
Carl Van Doren
Charles Warren
Gabriel Wells
George B. Wood
Charles N. Young

Books, pamphlets, maps, etc., also have been contributed by various learned societies, institutions, universities and by the Federal and State Governments. To all of these, the Committee on the Library extends its sincere thanks.

Important Purchases Made by the Library.

Selected titles in the respective classes are here given:

Bibliography.

De Puy, Henry Farr. A bibliography of the English colonial treaties with the American Indians . . . New York, Printed for the Lenox Club, 1917.

Growoll, Adolf. Book trade bibliography in the United States in the nineteenth century . . . reprinted MCMXXXIX. New York, Brick Row Book Shop [1939].

Jones, Herschel Vespasian. Adventures in Americana, 1492–1897 . . . a selection of books from the library of Herschel V. Jones . . . with a preface by Dr. Wilberforce Eames. New York, Rudge, 1928. 2v.

Jones, Herschel Vespasian. Americana collection of Herschel V. Jones; a check-list [1473–1926] comp. by Wilberforce Eames. New York, Rudge's Sons, 1938.

Lehmann-Haupt, Hellmut. The book in America; a history of the making, the selling, and the collecting of books in the United States, by Hellmut Lehmann-Haupt . . . in collaboration with Ruth S. Granniss . . . and Lawrence C. Wroth. New York, Bowker, 1939.

McMurtrie, Douglas Crawford. Eighteenth century North Carolina imprints, 1749–1800. Chapel Hill, University of North Carolina Press, 1938.

Peddie, Robert Alexander. Subject index of books published up to and including 1880; second series, A–Z. London, Grafton, 1935. —Third series, A–Z. London, Grafton, 1939.

Reid, Charles F., ed. Bibliography of the island of Guam . . . New York, Wilson, 1939.

University of Texas. Library. Guide to the Latin American manuscripts in the University of Texas library, ed. . . . by Carlos E. Castañeda and Jack A. Dabbs. Cambridge, Harvard University Press, 1939.

Webber, Winslow Lewis. Books about books . . . Boston, Hale, Cushman & Flint, 1937.

Wroth, Lawrence Counselman. An American bookshelf, 1755. Philadelphia, University of Pennsylvania Press . . . 1934.

Early Scientific Works before 1800.

Accolti, Pietro. Lo Inganno degl'occhi, prospettiva pratica . . . trattato in acconcio della pittvra. In Firenze, Appresso Pietro Cecconcelli, MDC.XXV.

Agricola, Georg. De la generatione de le cose, che sotto la terra sono, e de le cause de'loro effetti e nature, lib. V. De la natura di quelle cose, che da la terra scorreno, lib. IIII. De la natura de le cose fossili, e che sotto la terra si cauano, lib. X. De le minere antiche e moderne, lib. II. Il Bermanno, ò de le cose metallice, dialogo . . . (Colophon) In Vinegia, Per Michele Tramezzino, M D L.

d'Alembert, Jean Lerond. Traité de l'équilibre et du mouvement des fluides; pour servir de suite au Traité de dynamique. A Paris, Chez David . . . MDCCXLIV.

Apianus, Petrus. Horoscopion Apiani generale dignoscendis horis cvivscvmqve generis aptissimum . . . (Colophon) Excusum Ingolstadij, Anno Curr. 1533.

Arnold, Christoph. Wahrhaftige Beschreibungen dreyer mächtigen Königreiche, Japan, Siam, und Corea . . . denen noch beygefüget Johann Jacob Merkleins . . . Ost-Indianische Reise . . . Nürnberg, In Verlegung Michael und John. Friederich Endters, M. DC. LXXII.

Baker, Humphrey. The well-spring of sciences; which teacheth the perfect worke and practise of arithmeticke, both in whole numbers, and fractions . . . At London, Printed by Thomas Purfoot, An: Dom. 1612.

Bammacarus, Nicolaus. Tentamen de vi electrica ejusque phaenomenis, in quo aeris cum corporibus universi aequilibrium proponitur . . . Neapoli, Apud Alexium Pellecchia, Anno MDCCXLVIII.

Baranzano, Giovanni Antonio. Vranoscopia, sev de coelo; in qva vniversa coelorum doctrina clarè, dilucidè & breuiter traditur . . . [Genève] Apud Petrum & Iacobum Chouët, Anno M. DC. XVII.

[**Barin**, Théodore.] Le monde naissant, ou la création du monde . . . A Utrecht, Pour la Compagnie des Libraires, CIↃIↃCLXXXVI.

Barozzi, Francesco. Cosmographia in qvatvor libros distribvta . . . Venetijs, Ex Officina Gratiosi Perchacini, M D LXXXV.

Boeckler, Georg Andreas. Theatrum machinarvm novvm, exhibens aqvarias, alatas, ivmentarias, manuarias; pedibus, ac ponderibus versatiles, plures, et diversas molas . . . ex Germaniâ in Latium recens translatum operâ R. D. Henrici Schmitz. Coloniae Agrippinae, Sumptibus Pauli Principis . . . Anno M. DC. LXII.

Buccaferreus, Camillus Antonius. De barometro disputatio. (Colophon) Pisis, Ex Typographia Francisci Bindi . . . M.DCC.XXIV.

Castel, Louis Bertrand. L'optique des couleurs . . . A Paris, Chez Briasson . . . M. DCC. XL.

Collins, John. The sector on a quadrant . . . also an appendix touching reflected dyalling from a glass placed at any reclination. London, Printed by F. M. for George Hurlock . . . 1659.

[**Dasypodius**, Conrad.] Hypotyposes orbium coelestium, quas appellant theoricas planetarum . . . Argentorati, Excudebat Theodosius Rihelius [1568].

Fontana, Francesco. Novae coelestivm, terrestrivmque rervm observationes . . . Neapoli, Superiorum Permissu, Apud Gaffarum, M.DC.LXVI.

Gallucci, Giovanni Paolo. De fabrica, et vsv cvivsdam instrumenti ad omnia horarum genera describenda, ad omnem latitudinem peropportuni . . . Venetiis, Apud Io. Baptistam Ciottum, Senensem, Ad Signum Mineruae, M D XCII.

Gallucci, Giovanni Paolo. De fabrica, et vsv novi horologij solaris, lunaris, & sideralis, in parua quadam pixide conscripti . . . Venetiis, Apud Io. Baptistam Ciottum, Senensem, Ad Signum Mineruae, M D XCII.

[**Gil**, Alexander.] The new starr of the north, shining vpon the victorious king of Sweden. London, Printed by Avgvstine Mathewes for Robert Milbovrne . . . 1632.

Goubert. Description et usage des barometres, thermometres et autres instrumens météorologiques . . . seconde édition. A Dijon, Chez J. B. Capel . . . M. DCC. LXXXV.

Goubert. Recherches sur les différences qui existent entre les thermomètres de mercure et ceux d'esprit-de-vin, et sur les moyens d'y remédier . . . A Paris, Chez Merigot le Jeune . . . M. DCC. LXXXIX.

Grazia, Vincenzio di. Considerazioni . . . sopra'l discorso di Galileo Galilei intorno alle cose che stanno su l'acqua, e che in quella si muouono. In Firenze, Presso Zanobi Pignonj, MDCXIII.

Horrebow, Peder. Operum mathematico-physicorum. Havniae, Sumtibus Jacobi Preussii, CIϽIϽCCXL–CIϽIϽCCXLI. 3v. in 1.

Hulsius, Levinus. Tractatus primus [. . . tertius] instrvmentorvm mechanicorvm. Francofvrti ad Moenvm, Ex Officina Typogr. Wolfgangi Richteri . . . M. D C. V. 3v. in 1.

Magini, Giovanni Antonio. Breve instrvttione sopra l'apparenze et mirabili effetti dello specchio concauo sferico. In Bologna, Presso Clemente Ferroni, M.DC.XXVIII.

Magini, Giovanni Antonio. Novae coelestivm orbivm theoricae congruentes cum obseruationibus N. Copernici. Venetiis, Ex Officina Damiani Zenarij, MDLXXXIX.

Müller, Johann, of Königsberg. Tabule directionū profectionūque famosissimi viri Magistri Joannis Germani de Regiomonte . . . (Colophon) Venetiis Ingenio ac impensa Petri Liechtensteyn . . . Anno . . . 1504.

Pagan, Blaise François. Les tables astronomiqves . . . A Paris, Chez Iean Henavlt . . . M. DC. LVIII.

Porta, Giambattista della. De aeris transmvtationibvs libri IV. Romae, Apud Bartholomaeum Zannettum, M.DC.X.

Rauwolf, Leonhard. Aigentliche Beschreibung der Raiss, so er vor diser Zeit gegen Auffgang inn die Morgenländer, fürnemlich Syriam, Judaeam, Arabiam, Mesopotamiam, Babyloniam, Assyriam, Armeniam . . . [Laugingen, Durch Leonhart Reinmichel] In Costen und Verlag Georgen Willers, 1583.

Savonarola, Girolamo. Opvs eximivm, adversvs dininatricem astronomiam . . . interprete F. Thoma Boninsignio . . . Florentiae, Apud Georgium Marescotum, M D L XXXII.

Sfortunati, Giovanni. Nvovo lvme, libro de arithmetica . . . (Colophon) Stampata in Venegia per Bernardino de Bindoni, Milanese Anno domini, M. D. XLV.

Zahn, Johann. Pro practico construendo et elaborando oculo artificiali telediotrico, sive telescopio, fundamentum III. practico-mechanicum . . . Herbipoli, Sumptibus Quirini Heyl . . . Anno M DC LXXXVI.

Botany.

Bardswell, Mrs. Frances Anne. The herb-garden . . . 2nd ed. London, Black, 1930.

Degener, Otto. Flora Hawaiiensis . . . Pt. 2. [Honolulu, 1933–1935.]

Glimpses of the historic gardens in Kyoto and its outskirts. Kyoto, Yamada Unsō-do, Teramachi, Nijo, n.d.

Hansen, Adolph. Die Vegetation der Ostfriesischen Inseln . . . Darmstadt, Bergsträsser, 1901.

Linnaeus, Carolus. Supplementum plantarum systematis vegetabilium, editionis decimae tertiae . . . Brunsvigae, Impensis Orphanotrophei, 1781. [Facsimile reprint, Tokyo, Shokubutsu Bunken Kanko-Kai, 1938.]

Meyer, Arthur. Das Chlorophyllkorn in chemischer, morphologischer und biologischer Beziehung . . . Leipzig, Felix, 1883.

Niwa, Teizō. Chrysanthemums of Japan. London, Allen & Unwin, c1937.

Piggott, Sir Francis Taylor. The garden of Japan; a year's diary of its flowers . . . 2nd ed. London, Allen, 1896.

Siebold, Philipp Franz von. [Einer Monographie der Gattung Hydrangea.] Tokyo, Shokubutsu-Bunken-Kankokai, 1938. [Reproduction of Siebold's manuscript, written in Dezima Nagasaki, 1825, and of the printed book published in Bonn, 1826, with a pamphlet of commentary in Japanese by T. Nakai. 3v.]

Tansley, Arthur George. The British islands and their vegetation. Cambridge, University Press, 1939.

Taylour, Mrs. Harriet (Osgood). Japanese gardens . . . 2nd ed. London, Methuen, 1928.

Thunberg, Karl Peter. Icones plantarum japonicarum, insulis japonicis annis 1775 et 1776. Upsaliae, Edman, 1794–1805. [Facsimile reprint, Tokyo, Shokubutsu Bunken Kanko-Kai, 1935.]

Thunberg, Karl Peter. Miscellaneous papers regarding Japanese plants. Tokyo, Shokubutsu Bunken Kanko-Kai, 1935.

Art and Archaeology.

Andrae, Walter. Das wiedererstandene Assur. Leipzig, Hinrichs, 1938.

Bahr, A. W. Early Chinese paintings from A. W. Bahr collection, by Osvald Sirén. London, Chiswick Press, 1938.

British Museum. Dept. of Egyptian and Assyrian antiquities. Assyrian sculptures in the British museum, from Shalmaneser III to Sennacherib. London, British Museum, 1938.

British Museum. Dept. of Egyptian and Assyrian antiquities. Catalogue of Egyptian religious papyri in the British museum. V. 1 +. London, British Museum, 1938 +.

Cadoux, Cecil John. Ancient Smyrna; a history of the city from the earliest times to 324 A.D. Oxford, Blackwell, 1938.

Carter, Howard. The tomb of Tut-ankh-Amen, discovered by the late Earl of Carnarvon and Howard Carter; by Howard Carter and A. C. Mace. London, Cassell, c1927–1933. 3v.

Copenhagen. Nationalmuseet. Inscriptions hieroglyphiques du Musée national de Copenhague, par Maria Mogensen. Copenhague, Höst, 1918.

Dunham, Dows. Naga-ed-Dêr stelae of the first intermediate period. London, Pub. for the Museum of Fine Arts, Boston, by the Oxford University Press . . . 1937.

Evers, Hans Gerhard. Staat aus dem Stein, Denkmäler, Geschichte und Bedeutung der ägyptischen Plastik während des mittleren Reichs. München, Bruckmann [1929]. 2v.

Falkenstein, Adam. Archaische Texte aus Uruk. Berlin, Deutsche Forschungsgemeinschaft, 1936.

Firth, Cecil Mallaby. Excavations at Saqqara; the Step pyramid, by Cecil M. Firth and J. E. Quibell . . . Le Caire, Impr. de l'Institut Français d'Archéologie Orientale, 1935. 2v.

Hayes, William Christopher. Royal sarcophagi of the XVIII dynasty. Princeton, Princeton University Press . . . 1935.

Hetherington, A. L. Chinese ceramic glazes. Cambridge [Eng.], University Press, 1937.

Howells, John Mead. Lost examples of colonial architecture . . . with an introdvction by Fiske Kimball. New York, Helbvrn, 1931.

Institut Biblique Pontifical, Rome. Teleilât Ghassûl I; compte rendu des fouilles de l'Institut biblique pontifical, 1929–1932, par Alexis Mallon, Robert Koeppel, [et] René Neuville. Rome [Scuola Tipografica Pio X], 1934.

[**Joint Expedition** of the British School of Archaeology in Jerusalem and the American School of Prehistoric Research, 1929–1934.] The stone age of Mount Carmel . . . V. 1–2. Oxford, Clarendon Press, 1937–1939.

Mi, Fu. Mi Fu on ink-stones, tr. by R. H. van Gulik. Peking, Vetch, 1938.

Milne, Herbert John Mansfield. Scribes and correctors of the Codex sinaiticus, by H. J. M. Milne and T. C. Skeat . . . [London] British Museum, Printed by Order of the Trustees, 1938.

Morey, Charles Rufus. The mosaics of Antioch. London . . . Longmans, Green, 1938.

Musée du Louvre. La sculpture égyptienne au Musée du Louvre, [par] Charles Boreux. Paris, Librairie des Arts Décoratifs, n.d.

New Orient Society of America. Oriental art in America; recent accessions in American museums. Chicago, New Orient Society of America, c1937.

Otto, Walter Gustav Albrecht, ed. Handbuch der Archäologie . . . Lief. 1 +. München, Beck [1938 +].

Rawlinson, Sir Henry Creswicke. A selection from the historical inscriptions of Chaldaea, Assyria, & Babylonia, prepared for publication, by . . . H. C. Rawlinson, assisted by Edwin Norris. London, Lithographed by R. E. Bowler, 1861–1891. 6v.

Rostovtsev, Mikhail Ivanovich. Dura-Europos and its art. Oxford, Clarendon Press, 1938.

Salmony, Alfred. Carved jade of ancient China. Berkeley, Calif., Gillick Press, 1938.

Saville, Marshall Howard. The antiquities of Manabi, Ecuador . . . New York, 1907–1910. 2v. (Contributions to South American archaeology—George G. Heye Expedition. V. 1–2.)

Thureau-Dangin, François. Textes mathématiques Babyloniens. Leiden, Brill, 1938.

Werbrouck, Marcelle. Les pleureuses dans l'Égypte ancienne. Bruxelles, Éditions de la Fondation Égyptologique Reine Élisabeth, 1938.

Winkler, Hans A. Rock-drawings of southern upper Egypt . . . Sir Robert Mond desert expedition, season 1936/1937–1937/1938; preliminary report. V. 1–2. London, Egypt Exploration Society, 1938–1939.

Biography.

Arthur, Stanley Clisby. Audubon, an intimate life of the American woodsman. New Orleans, Harmanson, 1937.

Herrick, Francis Hobart. Audubon the naturalist . . . 2nd ed. New York . . . Appleton-Century, 1938. 2v. in 1.

Gipson, Lawrence Henry. Lewis Evans . . . to which is added Evans' A brief account of Pennsylvania . . . Philadelphia, Historical Society of Pennsylvania, 1939.

Adams, Randolph Greenfield. Three Americanists: Henry Harrisse, bibliographer; George Brinley, book collector; Thomas Jefferson, librarian. Philadelphia, University of Pennsylvania Press, 1939.

McPike, Eugene Fairfield. Hevelius, Flamsteed and Halley; three contemporary astronomers and their mutual relations. London, Taylor and Francis, 1937.

Hooke, Robert. The diary of Robert Hooke . . . 1672–1680, transcribed from the original in the possession of the Corporation of the city of London . . . ed. by Henry W. Robinson . . . and Walter Adams . . . London, Taylor & Francis, 1935.

Gottschalk, Louis Reichenthal. Lady-in-waiting; the romance of Lafayette and Aglaé de Hunolstein. Baltimore, Johns Hopkins Press, 1939.

Lowell, Abbott Lawrence. Biography of Percival Lowell. New York, Macmillan, 1935.

Rives, William Cabell. History of the life and times of James Madison. Boston, Little, Brown, 1868–1873. 3v.

Morris, Gouverneur. A diary of the French revolution . . . 1752–1816 . . . ed. by Beatrix C. Davenport. Boston, Houghton Mifflin, 1939. 2v.

Stukeley, William. Memoirs of Sir Isaac Newton's life . . . 1752 . . . ed. by A. Hastings White. London, Taylor and Francis, 1936.

Sellers, Charles Coleman. The artist of the Revolution; the early life of Charles Willson Peale. Hebron, Conn., Feather and Good, 1939.

Phelps, William Lyon. Autobiography, with letters. New York . . . Oxford University Press, 1939.

Jessup, Philip Caryl. Elihu Root. New York, Dodd, Mead, 1938. 2v.

Scott, William Berryman. Some memories of a palaeontologist. Princeton, Princeton University Press, 1939.

Sparks, Jared. The life and writings of Jared Sparks . . . by Herbert B. Adams. Boston . . . Houghton, Mifflin, 1893. 2v.

History and Travel.

Bodley, Temple. Our first great west, in revolutionary war, diplomacy and politics . . . Louisville, Ky., Morton, 1938.

Burlingame, Roger. March of the iron men, a social history of union through invention. New York, Scribner's Sons . . . 1938.

Cárdenas, Juan de. Primera parte de los problemas y secretos marauillosos de las Indias . . . 2nd ed. México, Imp. del Museo n. de Arqueología, Historia, y Etnología, 1913.

Duflot de Mofras, Eugène. Duflot de Mofras' travels on the Pacific coast . . . tr. . . . by Marguerite Eyer Wilbur . . . Santa Ana, Calif., Fine Arts Press, 1937. 2v.

Heine, William. Japan; Beiträge zur Kenntniss des Landes und seiner Bewohner. Berlin, Bette [1875?].

Siebold, Philipp Franz von. Atlas von Land- und Seekarten vom Japanischen Reiche . . . Berlin, Schropp . . . 1851.

—Geschichte der Entdeckungen im Seegebiete von Japan, nebst Erklärung des Atlas von Land- und See-Kartun vom Japanischen Reiche . . . zweite Auf. Berlin, Schropp . . . 1853.

Smathers, George Henry. The history of land titles in western North Carolina. Asheville, N. C., Miller, 1938.

Tabeau, Pierre Antoine. Tabeau's narrative of Loisel's expedition to the upper Missouri, ed. by Annie Heloise Abel, tr. from the French by R. A. Wright. Norman, University of Oklahoma Press, 1939.

Troncoso, Francisco P. Las guerras con las tribus Yaqui y Mayo del estado de Sonora . . . Mexico, Tipografia del Departamento de Estado Mayor, 1905.

U. S. Constitution Sesquicentennial Commission. Broadsides relating to the ratification of the constitution and the formation of the government of the United States . . . Washington [1938]. (Photostats.)

Washburn, Louis Cope, comp. Christ church, Philadelphia . . . Philadelphia, Macrae Smith, c1925.

Wissler, Clark. Indian cavalcade; or, Life on the old-time Indian reservations. New York, Sheridan House, c1938.

Frankliniana.

Paul Leicester Ford's *Franklin Bibliography*[1] lists one hundred and ten editions of what he terms the "'chap-book' edition of Franklin's Life and Writings" which was published first in London in 1793 under the title *Works of the late Doctor Benjamin Franklin: Consisting of His Life Written by Himself, together with Essays, Humorous, Moral, & Literary, Chiefly in the Manner of The Spectator . . .* Seven American editions have been added to the Library's file bringing its total of *Works* up to forty-eight, four of which are not listed in Ford. Other items of Frankliniana, exclusive of manuscripts, which have been acquired are Robert Fridenberg's *Catalogue of the Engraved Portraits of Franklin* (3v., photostats), and a microfilm of a complete run of the Poor Richard Almanacs from 1733 to 1766 inclusive. This will supplement the Library's set of originals which contains twenty-three numbers for the period covered.

[1] Brooklyn, N. Y., 1899.

Mr. Carl Van Doren presented an autographed copy of the three volume de luxe edition of his *Benjamin Franklin*.[1] From the *Rotarian* came a copy of the August 1939 issue containing an article by Mr. Van Doren, "Franklin Almost Invented Rotary." Mr. J. Bennett Nolan presented two items from his own pen—*The Only Franklin in Franklin's College*,[2] a brochure on William Temple Franklin, grandson of Benjamin, and his studies at the University of Pennsylvania; and *Printer Strahan's Book Account*,[3] which concerns a debt owing by James Read, relative of B. Franklin, to William Strahan, London printer and bookseller, and which, according to Mr. Nolan's Foreword, "reveal[s] Poor Richard in the grotesque rôle of the collector of a doubtful account—a dun—as the harassed object of his importunities may well have termed him."

Acquisition of Serials.

This Library maintains an exchange of publications with 700 learned societies, universities, institutions, etc., from which it has received 1,168 serial titles during the past year; 308 titles have been received as gifts, and 306 by purchase. The last are credited to the various funds as stated above. Sixty-four new serials have been added during the year. Among them are the following:

By Purchase.

American Geographical Society. Current geographical publications. V. 1 +. New York, 1938 +.

American Numismatic Society. Numismatic studies. No. 1 +. New York, 1938 +.

American School of Oriental Research in Jerusalem. Publications—Archaeology. V. 1 +. New Haven, 1937 +.

Quarterly journal of inter-American relations. V. 1, no. 2 +. [Cambridge] 1939 +.

Society of Antiquaries of Newcastle-upon-Tyne. Proceedings. Ser. 4, V. 8, no. 8 +. Newcastle-upon-Tyne, 1939 +.

In addition to the above, the Library has acquired complete sets of the following serials which are not found in any other library in Philadelphia:

Archaeologia aeliana; or, Miscellaneous tracts relating to antiquity. V. 1 +. Newcastle-upon-Tyne, Society of Antiquaries of Newcastle-upon-Type, 1822 +.

[1] New York, Viking, 1938.
[2] Philadelphia Graphic Arts Forum, 1939.
[3] Reading, Pa., 1939.

Raccolta d'opuscoli scientifici e filologici. T. 1–51. Venezia, Zane, 1728–1757. Continued as

Nuova raccolta d'opuscoli scientifici e filologici. T. 1–42. Venezia, Occhi, 1755–1787.

By Exchange.

Academia Sinica, China. National Research Institute of Geology. Monograph. Ser. B. V. 1 +. [Peiping] 1934 +.

Academy of Natural Sciences of Philadelphia. Notulae naturae. No. 1 +. Philadelphia, 1939 +.

Gesellschaft der Wissenschaften zu Göttingen. Nachrichten . . . philologisch-historische Klasse. Fachgruppe V—Religionswissenschaft. N.F. Bd. 1 +. Göttingen, 1936 +.

Journal of mathematics and physics. V. 18 +. [Cambridge] Massachusetts Institute of Technology, 1939 +.

Lloydia; a quarterly journal of biological science (Lloyd Library of Natural History). V. 1 +. Menasha, Banta, 1938 +.

Oregon. State College. Oregon state monographs. Studies in botany. No. 1 +. Corvallis, 1939 +.

Société de Géographie Finlandaise. Terra. Årg. 50, n:o 4 +. [Helsingfors] 1938 +.

University of Colorado. Studies. Ser. B.—Studies in the humanities. V. 1 +. Boulder, 1939 +.

—— Studies. Ser. C.—Studies in the social sciences. V. 1 +. Boulder, 1939 +.

University of Indiana. Publications—Humanities series. No. 1 +. Bloomington, 1939 +.

University of Oregon. Monographs—Studies in literature and philology. No. 1 +. Eugene, 1939 +.

Zoological Society of London. Agenda and abstracts of the scientific meetings. No. 1 +. London, 1939 +.

By Gift.

Institut des Sciences de Roumanie. Comptes rendus des séances. T. 3 +. Bucuresti, 1939 +.

Moscow. Universitet. Bulletin—Section A—Mathématiques et mécanique. Sér. internationale. V. 1 +. Moscou, 1937 +.

Files Completed.

Through purchase, the following files have been completed:

Yale Oriental series: Babylonian texts. V. 2–7.

Yale Oriental series: Researches. V. 3; 4, pt. 1–2; 5, pt. 2–3; 6; 8; 13, pt. 1.

(For manuscript accessions see Part II of this report.)

Binding, Cataloguing, etc.

During 1939, 1,097 books have been bound. There have been catalogued 484 books in 808 volumes, 364 pamphlets, 13 maps, 62 manuscripts, 47 autographs, 7 bookplates, 56 photostats, and 80 broadsides. Of serials analyzed 1,165 titles have been brought out; 7,602 cards have been added to the catalogue, of which 2,214 were typewritten and 5,388 were Library of Congress cards to which changes and additions were made to adapt them to our catalogue.

Calendaring of Manuscripts.

The calendaring of the Bache Collection of Franklin Papers has been practically completed except for that part of the index pertaining to subjects and persons mentioned. The index of persons writing and receiving the letters is completed and has been consulted by a number of persons throughout the year.

About 500 items have been added to the Elihu Thomson Papers. These are in process of being filed with the original gift presented in 1937.

Care and Repair of Books and Manuscripts.

Owing to the fact that it became necessary for Mrs. Carolyn Price Horton to take up her residence in New Haven, she was obliged to sever her connections with this Library on October first of this year. For the past five years she has been repairing and restoring our rare books and manuscripts. Since the acquisition of the Bache Collection of Franklin Papers, her work has been confined largely, though not entirely, to that collection, and with the exception of the account books, the restoration on these papers has been completed. The manuscripts now are ready to be arranged, mounted and bound in volumes similar to those which contain the original collection of Franklin Papers.

In-Use and Out-Use of the Library.

During the year 1939, the total number of recorded readers in the Library was 475. They consulted 740 [1] printed items and 627 [1] manuscript items. In addition, replies were made to 101 inquiries

[1] Of these, 124 printed items and 261 manuscript items were used by workers of the Historical Records Survey and other W.P.A. projects.

received through correspondence, exclusive of requests for photo-duplication service. Forty-nine volumes were lent to members of the Society, 104 volumes to the staff, and 100 volumes upon interlibrary loan; 10 volumes were borrowed upon interlibrary loan.

Manuscripts Consulted.

Among the manuscripts most frequently consulted are:

American Philosophical Society. Manuscript Communications.
American Philosophical Society. Memoirs of Deceased Members.
The Burd-Shippen Papers.
William Dunbar. Journal of a Voyage . . . to the Mouth of the Red River.
Andrew Ellicott. Astronomical Observations.
George Fox. Letter Book.
The Franklin Papers.
The Greene Papers.
The Horsfield Papers.
Thomas Jefferson. Letters.
B. A. Konkle. Life and Writings of James Wilson.
The Lewis and Clark Journals.
André Michaux. Botanical Journal in North America.
G. H. E. Mühlenberg. Botanical Journals.
John Ordway. Journal of the Lewis and Clark Expedition.
William Penn. Cash Book.
Philadelphia. Record of Indentures of Redemptioners, 1771–1773.
The Weedon Papers.

Interlibrary Loan.

The following libraries have borrowed material upon interlibrary loan:

Bryn Mawr College, Bryn Mawr, Pennsylvania.
Bucknell University, Lewisburg, Pennsylvania.
Colorado School of Mines, Denver, Colorado.
Curtis Publishing Company, Philadelphia.
E. I. DuPont Company, Wilmington, Delaware.
Franklin Institute, Philadelphia.
General Electric Company, Schenectady, New York.
Grolier Club, New York City.
Harvard University, Cambridge, Massachusetts.
Haverford College, Haverford, Pennsylvania.
National Research Project (W.P.A.), Philadelphia.
Philadelphia Museum of Art, Philadelphia.
Princeton University, Princeton, New Jersey.
Sharp and Dohme, Philadelphia.
University of Michigan, Ann Arbor, Michigan.

University of Pennsylvania, Philadelphia.
University of Wisconsin, Madison, Wisconsin.
Vanderbilt University, Nashville, Tennessee.
Wistar Institute of Anatomy and Biology, Philadelphia.

The American Philosophical Society has borrowed material upon interlibrary loan from the following:

The Free Library of Philadelphia, Philadelphia.
Historical Society of Pennsylvania, Philadelphia.
Library of Congress, Washington, D. C.
Mercantile Library, Philadelphia.
Philadelphia City Institute, Philadelphia.
Spring Garden Institute, Philadelphia.
University of Pennsylvania, Philadelphia.

Exhibits of the Books and Manuscripts from the Library.

Exhibition in Honor of Franklin's Birthday Celebration, January 16–26, 1939.

Collection of books from Franklin's library.

Jayne Memorial Lectures, Delivered by Dr. Alfred Vincent Kidder on the Rise and Fall of American Indian Civilizations, January 26, February 2 and February 9, 1939.

Material pertaining to the American Indian.

Mid-winter Meeting, February 16–17, 1939—Elihu Thomson Memorial Meeting, February 16.

Letters, articles, patents, etc., from the Elihu Thomson Papers.

Annual General Meeting, April 20–22, 1939.

Recent acquisitions in the field of archaeology; scientific works from Franklin's library.

Autumn General Meeting, November 17–18, 1939.

Material pertaining to the American Philosophical Society and the early development of science; collection of books on eighteenth century American travel.

Financial Statement.

Books and Binding and General Expenses.

Carried forward from 1938	$ 607.00
Appropriation for 1939	10,000.00
	$10,607.00
Expended during 1939	7,755.59[1]
Balance 12/31/39	$ 2,851.41

Special Library Funds.

Balances 1/1/39	Income	Expended	Transferred Principal	Balances 12/31/39
$6,294.00	$7,927.77	$3,115.03	$870.40	$10,236.34

Salaries.

For 1939	$ 9,773.17

[1] Includes $600 for salary of photographer.

Staff of the Library.

The Library staff comprises Miss Laura E. Hanson, *Librarian*, Mrs. Gertrude D. Hess, *Assistant Librarian*, Mrs. Ruth A. Duncan, and Mrs. Mary C. Dothard. In addition to the regular staff, Dr. Alban W. Hoopes is engaged on special archival work, Dr. John J. Heilemann on the photoduplication service, and Mrs. Carolyn Price Horton on the restoration of manuscripts.[1]

II. Report of the Chairman of the Committee on the Library

The Library Committee: Personnel, Meetings and Policy.

Four regular meetings of the Committee on the Library were held at two o'clock on the afternoons of March 15, May 17, October 18, and December 20, 1939.

The membership of the Committee consists of St. George L. Sioussat, *Chairman*, George A. Barton, Rhys Carpenter, John Story Jenks, Waldo G. Leland, William E. Lingelbach, Horace C. Richards, A. S. W. Rosenbach, and Roland S. Morris, *President;* Edwin G. Conklin, *Executive Officer*, sits with the Committee. At his own request, Dr. Harlow Shapley was not reappointed. The President appointed Mr. John Story Jenks to fill this vacancy.

The usual matters of routine have come before the Committee, and the results of its deliberations have already been noted in the report of the Librarian.

Mexican Materials.

The request for the return to the National Museum of Mexico City of the "tribute roll of Montezuma," mentioned in the Report for 1938 (pp. 73–74), having received favorable action on the part of the Committee on the Library was referred to the President of the Society. The Committee's recommendation was approved unanimously by the Council and the Society at the General Meeting in April 1939.

The Archives of the Society.[2]

The most important work of the past year has been the establishment of a twofold division of all material into *manuscript collections* and *archives*. In the course of the summer of 1939 a

[1] Mrs. Horton resigned October 1, 1939.
[2] From a report submitted by Dr. Alban W. Hoopes.

large group of miscellaneous letters was taken as a convenient point of departure for this dual classification. Letters from 1744 to 1830 have been regrouped, in what it is hoped may prove to be a final arrangement. The catalogue cards covering this period have been rearranged in accordance with modern library practice. Thus each piece has a minimum of three cards, viz: one for a chronological file, and two (one under the name of the sender, and one under the name of the recipient) for an alphabetical file. Extra cards (e.g: cross-reference cards and enclosure cards) have been added where necessary. This work already has proved of great utility in finding material. It is to be continued until every item is so classified, thus furnishing a quick and efficient reference catalogue for all heretofore unclassified material.

A marked increase in the number of letters appears between 1815 and 1819, which is due, in large part, to the organization of the Historical and Literary Committee. Although foreshadowed as early as 1811,[1] this Committee was not actually organized until 1815.[2] Its influence in the affairs of the Society was closely tied up with the work of Redmond Conyngham in the files at Harrisburg,[3] and even more closely with the historical interests of Peter S. DuPonceau. The death of the latter in 1844 would appear to have terminated the active career of the Committee.

The bulk of the miscellaneous letters is found in the middle decades of the nineteenth century, roughly from 1830 to 1850. Three men contributed most to this correspondence—John Vaughan, Peter S. DuPonceau and George Ord. The first of these was Librarian of the Society for the last thirty-eight years of his life (1803–41). Most illuminating is the correspondence with his brother William, in London, and with D. B. Warden [4] in Paris. Much information about books, and many suggestions as to purchases, came from these sources.

One senses that while Vaughan's interests were ubiquitous—

[1] Plan for organizing a committee for making researches into and collecting materials for the history of the United States, [Philadelphia] July 5, 1811. Archives, MS. Committee Reports.

[2] Resolutions concerning Historical and Literary Committee, [Philadelphia] June 16, 1815. Archives, MS. Committee Reports.

[3] Cf., Conyngham to R. M. Patterson, Nov. 6, 1815; Conyngham to Peter S. DuPonceau, Dec. 9, 1815; Conyngham to John Vaughan, March 25, 1816. Archives, Misc. Letters.

[4] Warden is first referred to in the Minutes under date of Sept. 18, 1807, at which time he donated a number of foreign books to the American Philosophical Society.

taking in the entire range of the Society's activities—DuPonceau's were more limited and more scholarly. There can be no reasonable doubt that DuPonceau was the soul of the Historical and Literary Committee. As its Corresponding Secretary his efforts to obtain rare or interesting documents were unremitting.[1] His correspondence with the famous missionary to the Delaware Indians—J. G. E. Heckewelder—is of permanent value to all students of American history.[2]

DuPonceau was seventh President of the Society, holding that office from 1828 until his death sixteen years later. A period free from war, these years were marked by notable scientific advance.[3] DuPonceau's letters, although by no means as numerous as Vaughan's, are none the less of importance. His activities become more apparent upon a study of the Minutes and of the various committee reports that he signed.[4]

George Ord filled many offices during his membership in the American Philosophical Society. He was Secretary from 1820 to 1831; Vice-President, 1832–35; Treasurer, 1842–47; and Librarian, 1842–48, succeeding John Vaughan in both of the latter positions. Despite these activities, and despite his undoubted distinction as

[1] Joseph Hopkinson to DuPonceau, Dec. 11, 1815; Alexander Graydon to DuPonceau, March 12, 1816; William Graham to DuPonceau, April 2, 1816; David Hosack to DuPonceau, April 25, 1816; Caesar A. Rodney to DuPonceau, Aug. 6, 1818; John Franklin to DuPonceau, April 6, 1819; Levett Harris to DuPonceau, May 28, 1819. Archives, Misc. Letters.

[2] The Original Letters written by the Revd John Heckewelder from the 3d of April 1816 to the 5th of May 1822, on the Indian languages, etc. Collected & presented to the American Philosophical Society by Peter S. DuPonceau. 1840. Now among the manuscript possessions of the Society.

[3] Much of the work of many eminent scientists falls within this period. Benjamin Silliman, the chemist, founder and first editor of *The American Journal of Science and Arts*, became a member of the American Philosophical Society, Jan. 18, 1805. His *Elements of Chemistry* appeared in two volumes in 1830–31. Thomas Nuttall, the botanist, became a member, Oct. 17, 1817. *The Genera of North American Plants* appeared the following year. The ornithologist, John James Audubon, whose membership dated from July 15, 1831, published his monumental *Birds of America* in 1838. Joseph Henry, the physicist and first secretary of the Smithsonian Institution, published an article on magnetism in *The American Journal of Science* in January 1831. He was elected to membership in the American Philosophical Society, Jan. 2, 1835.

[4] There is a certain humor in the fact that one of the first committee reports signed by DuPonceau, June 22, 1804, was the Report of committee appointed to consider additional rules for the preservation of order at the meetings of the board of officers. Archives, MS. Committee Reports. His connection with the Historical and Literary Committee has received notice. He also served on the Committee on the Library, as is evidenced by his signature to its reports of Dec. 1, 1820, March 14, 1822 and April 2, 1824.

a naturalist,[1] George Ord's place in the history of the Society has never received as full recognition as has been accorded to that of Vaughan and that of DuPonceau. Ord's was an irascible nature, which may have militated against his friendships during life and detracted from his memory after death.

His trip abroad between 1829 and 1831 gave rise to a number of interesting letters to Vaughan, regarding the purchase of books for the Society.[2] Authorized at first to spend up to \$150,[3] a committee later made an additional appropriation of \$200 for the purpose.[4] Thus many valuable books were obtained in London and Paris, whence they were sent to the Society. The American Philosophical Society must ever remain deeply in his debt.

Brief as it is, the foregoing review may give some conception of the importance of one group of material—the miscellaneous letters. Were the study continued other figures would come to the fore: Titian R. Peale (1799–1885), the close friend of Ord, a naturalist and artist who accompanied Captain Wilkes on the United States Exploring Expedition to the South Sea; Elisha Kent Kane (1820–57), the arctic explorer; Elias Durand (1794–1873), the pharmacist who served under Napoleon and was taken prisoner at Hanau, a man whose adventures stand in sharp contrast to his quiet, scholarly nature;[5] Daniel Garrison Brinton (1837–99), who served as a medical doctor in the Federal army during the Civil War, being present at both Chancellorsville and Gettysburg, and who, the war over, became one of the foremost ethnologists in the United States. The list might be greatly expanded, but enough has been given to demonstrate the essential importance of the miscellaneous letters to a more full and accurate knowledge of the history of the American Philosophical Society.

Another group worthy of mention is the communications. Com-

[1] It will be recalled that Ord edited Alexander Wilson's *American Ornithology*, in addition to writing the text for volume IX of that work after its author's death. Cf., *Dictionary of American Biography*, XIV, 49.

[2] Ord to Vaughan, Jan. 29, 1829; Feb. 11, 1829; Feb. 12, 1829; March 5, 1829; March 10, 1829; May 18, 1829; June 23, 1829; July 27, 1829; Aug. 27, 1829; March 17, 1830; March 18, 1830; April 24, 1830; May 8, 1830; Jan. 28, 1831; June 14, 1831; Aug. 13, 1831. Archives, Library material.

[3] Ord to Vaughan, Jan. 29, 1829. Archives, Library material.

[4] Report of committee upon best use of \$200 to be placed at the disposal of George Ord for the purchase of books in Paris. April 1, 1831. Archives, MS. Committee Reports.

[5] Harshberger, J. W. *The Botanists of Philadelphia and Their Work*, (Philadelphia, 1899) 174–178.

munications are usually longer than letters, and usually deal in a more or less thoughtful manner with a particular topic. Frequently they are the basis of articles in the PROCEEDINGS and TRANSACTIONS.

In their origins the communications go back to the earliest days of the Society. At the Friday evening meetings of the Junto and the American Society, it was customary for members to discuss previously determined queries—to communicate their views thereon to their fellow members. The queries and their answers were entered in detail in the Minute Book.[1] The transition from this procedure to the more formal practice of submitting written communications was natural and, in view of the increasing membership of the Society, inevitable. The number of written communications increased between 1756 and 1771; after the latter year written communications became the rule rather than the exception.[2]

It was on November 17, 1837, on a motion of J. K. Kane, that it was

> *Resolved* that the Secretaries be instructed, to cause the Records and Documents, connected with the History and Transactions of the Society, to be properly arranged and bound, and that they be authorized to provide suitable cases for their preservation.[3]

Three and a half years later, on March 5, 1841,

> The Secretaries, as a Committee to cause the records and documents of the Society to be bound etc. reported in full accompanying their re-report by a letter from J. Francis Fisher Esqr. one of the Secretaries at the time of the appointment of the Committee, containing a complete list of the volumes of records and documents, comprising 18 quarto and 2 folio volumes . . . .[4]

[1] Junto and American Society for Promoting Useful Knowledge, MS. Minute Book. The following entries may be taken as typical: Sept. 22, 1758, "How may the phenomina of Vapours be explained?" Oct. 20, 1758, "Are any of our affections disinterested?" Feb. 15, 1760, "Whether we may place pointed Rods on our Houses to guard them from Lightening without being guilty of Presumption?" Aug. 26, 1760, "Is it consistent with the Principles of Liberty in a free Government to Punish a Man as a Libeller when what he writes is true?"

[2] Two volumes of the bound communications, and the series of unbound communications begin in 1771.

[3] MS. Minute Book, 1834–1839, entry for Nov. 17, 1837.

[4] MS. Minute Book, 1840–1842, entry for March 5, 1841.

Of the twenty volumes thus bound, eleven contained manuscript communications, divided on a basis of subject matter, as follows:

1. Mathematics and Astronomy	2 v.	1756–1835	125	pieces
2. Natural History	2 v.	1715–1835	91	"
3. Natural Philosophy	2 v.	1753–1838	101	"
4. Medicine, Anatomy and Physiology	1 v.	1781–1833	58	"
5. Mechanics, Machinery and Engineering	1 v.	1784–1837	63	"
6. Trade, Navigation, Manufactures, Agriculture, Economics	1 v.	1771–1835	67	"
7. Philology, Literature, Antiquities, Geography, Education	2 v.	1771–1833	70	"
	11 v.		575	"

In addition to the above bound communications, there are approximately 200 unbound communications, covering the period from 1771 to 1873. As the nature of the material is essentially the same as that of the bound volumes, and as some of it is of equal antiquity, it is difficult to say why some items were bound and others were not.

The bound communications are most numerous during the first two decades of the nineteenth century—that is, during the presidencies of Thomas Jefferson (1797–1815) and Caspar Wistar (1815–18)—thinning out in the late eighteen-twenties and eighteen-thirties. On the other hand, the unbound communications are considerably swollen by the Centennial Celebration of the Society of 1843.

A few other items deserve mention. A group of about twenty Joseph Priestley letters, held for some time for repair, now have been incorporated in the manuscript collections. Written to John Vaughan between 1794 and 1839, these letters are, for the most part, of a personal nature, typical of the correspondence between two friends. A group of about the same number, from Christian Denke to Henry Mühlenberg, has also been incorporated in the manuscript collections. These letters are dated in 1798 and 1799, and are written in German. Containing lists of plants, they may prove of some interest to botanists.

The coming exhibition of material relating to the United States Exploring Expedition under the command of Captain Wilkes has proved of considerable interest. The American Philosophical Society does not possess a large collection in this field—perhaps nineteen or twenty pieces in all—but, such as it is, some of the items are of very real interest. This is particularly true of some of the Titian R. Peale letters of the 1840's, which throw a personal light upon the Wilkes-Peale controversy. Some George Ord-Titian R. Peale letters in the possession of the Historical Society of Pennsylvania are now being microfilmed to add to our collection.

It has long been known that the Historical Society of Pennsylvania has much material of interest to the American Philosophical Society. By examining manuscripts written to or by members of the latter Society, in the possession of the former, a beginning has been made toward an accurate knowledge of the extent and importance of the files of the Historical Society. Notes of this material have been placed upon catalogue cards and filed.

The Photoduplication Service.[1]

During 1939 the Photoduplication Service filled 60 orders for users of the Library in addition to doing work for the Library. This work comprised 3,846 frames of microfilm, 956 enlargement prints and 56 lantern slides. The Library has some 900 frames of microfilm from the Sparks Collection at Harvard; 356 of these have been enlarged to 8″ × 10″ prints and prepared for loose-leaf binding. Six volumes of the Franklin Papers and the entire Weedon Correspondence have been microfilmed, comprising some 2,000 frames.

Experiments have been carried on with the purpose of improving the quality of the work. The film which is now being used has a higher resolving power than that used previously; a newly developed enlarger has been acquired; and the Photorecord camera has been modernized by the addition of an improved lens and shutter assembly. An arm for turning the camera through ninety degrees has proved useful in copying large bound volumes. The acquisition of an electric refrigerator has made possible satisfactory work during warm weather.

While microfilm is unique in its own field, it is not the most efficient method for reproducing small quantities of material, e.g: one or two book pages or a single page or two of manuscript. A process which involves only a single operation is desirable for such work; the apparatus which is available commercially is either too bulky and expensive or not sufficiently flexible. Preliminary experiments were made with the idea of meeting this need, and the

[1] From a report submitted by Dr. John J. Heilemann.

results were shown at the October meeting of the Committee on the Library. The method consists simply in using a copying camera in which bromide (enlargement) paper is used as the sensitive material; a prism before the camera lens reverses the image so that an unreversed legible negative results. Positives may be made by rephotographing the negatives. An additional advantage of this arrangement is the fact that the camera may be used for ordinary photography by simply removing the prism.

In collaboration with Mrs. Hess, of the Library staff, the Photoduplication Service established a system for numbering orders and films for record and cataloguing purposes by assigning numbers for film orders, and photographing these numbers in a conspicuous place on the first frame of the film. The fact that a manuscript has been filmed is noted with the item in the manuscript calendar. A record of each filming is thus kept in three places: (1) the original order, filed alphabetically according to the year and the name of the person ordering, (2) a card briefly describing the nature of the material and the name of the person ordering, and (3) the entry in the general Library catalogue or in the manuscript calendar.

In accordance with modern practice non-inflammable "safety film" is used exclusively. The films are stored in metal cartridges marked with the film number, and these cartridges are placed in cardboard boxes 8½" × 1½".

During 1939 the photographic equipment was expanded and improved, with a consequent betterment in the quality of the work.

The Old Custom House and the Library.

In the Report of last year (pp. 76–77) mention was made of the proposal that the Society acquire for the housing of the Library the old Custom House, the building originally constructed for the Second Bank of the United States; and there was noted the statement of the Librarian on the requirements that would attach to any new building. The President and the Finance Committee, after considering this statement, employed the services of the United Engineers and Constructors, Inc. Upon the report of this Corporation as to the probable cost of reconditioning the Custom House, and the charges which the maintenance of that building, if restored, would involve, the Council and the Society, respectively, at the April meeting voted against the further pursuit of this proposal. This action was formally reported to the Committee on the

Library by the Chairman, at the meeting of the Committee held May 17, 1939.

Acquisition of Manuscript Material.

In *Books and Bidders*,[1] Dr. A. S. W. Rosenbach tells the fascinating story of his acquisition of "Work-Book No. 2" kept by the printing firm of Benjamin Franklin and David Hall for the period 1759–66. A further description of the book, by Mr. George Simpson Eddy, appeared in the *Bulletin* of the New York Public Library[2] a short time after it had been presented to that Library by Mr. Edward S. Harkness.

This year the Library of the American Philosophical Society has been fortunate in securing a companion piece to the "Work-Book." It is a fragment of a ledger index with pages numbered from five to seventy-nine, many of which are missing, labeled simply, "Franklin & Hall No. 1." It appears to be a summary of the work carried on throughout the entire period of the Franklin-Hall partnership, 1748–66. The book is divided into four sections—the number of advertisements printed in issues No. 1178–1927 [of the *Pennsylvania Gazette*] with amounts received, from July 11, 1751, to November 28, 1765, covering pages 5–20; names of persons for whom advertisements and ephemeral pieces, such as playbills, *etc.*, were printed, with amounts charged, from June 3, 1748, to January 28, 1766, covering pages 23–60; an "Account of Money received by David Hall for printing Work done by Franklin and Hall and charged in the Leidgers commencing Jany. 21st 1748. From the Old Leidger No. 1 [and] From New Leidger No. 2," covering pages 61–77; and an "Invoice of Books, etc., left in my Hands by Mr. Franklin taken January 23d 1748."

Under the dates of June 13, August 22, 1765, January 17 and February 1, 1766, J[ames]Parker affixed his signature as having examined the previous entries. This was in compliance with Franklin's request that Mr. Parker, another printer friend and partner of Woodbridge, N. J., act as his representative at the dissolution of the firm of Franklin and Hall. One learns from the Society's Franklin Papers that the audit of the firm's account began as early as February 1765. Reports of its progress were sent to Franklin in England from time to time coinciding with the dates

[1] Boston, Little, Brown, 1927.
[2] Vol. 34, pp. 575–589, 1930.

of Parker's examinations. The final account of the settlement was sent on February 3, 1766. This letter, owned by the American Type Founders Company of Jersey City, is printed in full in John Clyde Oswald's *Benjamin Franklin, Printer.*[1] Although a thorough search made by the previous owner of the fragment for the missing leaves has been thus far unsuccessful, it is our hope that some future discovery may complete this part of the record of the Franklin-Hall partnership.

Along with this Franklin item was purchased another shop book covering the period from April 29, 1767, to February 22, 1769, containing principally accounts of books and stationery sold. It is presumably that of David Hall and William Sellars who were in partnership from 1766, after Franklin's retirement, until Hall's death in 1772. Nine times during the period covered, Benjamin Franklin, although still in England, was charged with the purchase of paper, books, etc. Another interesting entry is that under date of January 29, 1768, at which time Dr. Thomas Bond was charged on "account of the Philosothick [Philosophical?] Society" for a blank book. This was a period of rejuvenation in the old Philosophical Society, of which Dr. Bond was one of the most active members, in the year that preceded the union of that Society with the American Society, to form the present American Philosophical Society.

Among other manuscript acquisitions that have associations with Franklin may be mentioned a letter from Franklin to Messrs. Wharton and Trent, dated July 3, 1769; a bankruptcy petition against Charles Young, signed by B. Franklin, as President of the Supreme Executive Council of the State of Pennsylvania, March 2, 1787; a deed granting a plot of ground No. 82 in Westmoreland County, Pennsylvania, to Franklin, November 1, 1787; a letter from Thomas Ruston to Franklin, as President of the American Philosophical Society, dated January 12, 1786, on smoky chimneys; a letter from Elbridge Gerry to James Winthrop, and its reply, pertaining to lightning rods and Franklin's use of a certain type thereof. Three William Temple Franklin items were purchased: letters to Thomas Ruston, May 2, 1785, and Henry Drinker, November 1, 1790; and a certification that Pierre Des-champs was his servant, dated 9 Thermidor, An 4.

Unusual is the organization founded in the eighteenth century

[1] Doubleday, Page, 1917.

which has no cause to regret incomplete archival files. This Society is no exception. Although the American Philosophical Society was founded in 1743, and united with the American Society (a revival of Franklin's 1727 Junto) in 1769, there was no permanent meeting place until the present building on Independence Square was completed in 1789. During the previous twenty years, after the union of the two societies, papers for publication in the TRANSACTIONS and donations for the Library and Cabinet were received, but owing to this lack of a permanent housing place it is presumed that various members took these items to their homes for safe-keeping, and, in some instances, failed to return them. Occasionally opportunities to regain some of these lost archival papers come to our notice. This year three such items have been acquired, viz: a letter from Christian Meyer, astronomer to the Elector Palatine, acknowledging election to membership in the Society and presenting some of his astronomical observations, April 24, 1778, which was published in the Society's TRANSACTIONS, Vol. 2, p. 217; a letter from John Page to David Rittenhouse, December 4, 1779, pertaining to a meteor which was seen in Virginia on October 31, 1779, published in the TRANSACTIONS, Vol. 2, p. 173; and the afore-mentioned letter from Thomas Ruston to B. Franklin, on smoky chimneys, which was likewise printed in the TRANSACTIONS, Vol. 2, p. 231. There was purchased also the engraved certificate of membership which was issued to Joseph Hopkinson, author of *Hail Columbia*, and grandson of Thomas Hopkinson, the first President of the American Philosophical Society in 1743. Mr. Hopkinson was made a member in 1815 during the presidency of Caspar Wistar, and held the office of Councillor from 1829 to 1831, and that of Vice-president from 1831 until his death in 1842.

The manuscript of Burton Alva Konkle's unpublished work, "David Lloyd, and the First Half-Century of Pennsylvania," was acquired by the Society.

Among the outstanding gifts of the year is the collection of diaries kept by the late Dr. Henry H. Donaldson, covering the years 1890–1938, which was presented by Mrs. Donaldson. Dr. Donaldson had been a member of the Society since 1906, having served four terms as Councillor and was a Vice-president at the time of his death in January 1938. Owing to the frequent mention of persons still living, the diaries will not be available for public use for some time to come.

Mrs. John L. Younger has deposited with the Society three letters which are subject to her withdrawal. Two of these are from Pierre Eugène Du Simitière, Philadelphia artist and antiquary, to Evert Bancker, Jr., of New York, dated March 27 and 31, 1771, and mention, among other news, the publication of the first volume of the TRANSACTIONS of the American Philosophical Society. The other letter was written from the Hall of the Society, April 15, 1825, and is a notification to Charles N. Bancker of his election to membership. The Society has permission to make photocopies of these papers.

Cooperative Activities.

Upon the recommendation of Dr. Rodney H. True and Mr. Lawrence J. Morris, a contribution from our Michaux Fund was made to the Philadelphia Society for Promoting Agriculture to aid in the publication of its *Memoir*, Volume 6, which gives a short sketch of the history of the Society by Dr. True and the proceedings of its 150th Anniversary Celebration, held in 1935. In speaking of this grant, Dr. True said in part, "It seems to me fitting that this request be granted since the American Philosophical Society and the old Agricultural Society were close neighbors for more than one hundred years, in fact sharing the same rooms part of the time, and also due to the fact that the membership list was to a considerable extent interlocked." Letters of thanks and appreciation were received from the Treasurer and Directors of the Society.

The Grolier Club, New York City, held an exhibition of Frankliniana, March 17–April 16, 1939, and asked if this Library would contribute by lending eight books on travel which had been originally in Franklin's library. These formed in part, illustrative material for Mr. George Simpson Eddy's opening address on "Franklin's Travels." The titles of these books are as follows:

[**Bancroft**, Edward.] An essay on the natural history of Guiana, in South America . . . London, Printed for T. Becket and P. A. De Hondt . . . MDCCLXIX.

Born, Ignace, Baron de. Travels through the Bannat of Temeswar, Transylvania, and Hungary, in the year 1770 . . . translated from the German . . . by R. E. Raspe. London, Printed by J. Miller . . . MDCCLXXVII.

de Bougainville, Louis Antoine. Voyage autour du monde, par la frégate du roi La Boudeuse, et la flûte L'Étoile; en 1766, 1767, 1768 & 1769. Paris, Chez Saillant & Nyon . . . M. DCC. LXXI.

Chabert, Joseph Bernard, Marquis de. Voyage fait . . . en 1750 et 1751, dans l'Amérique Septentrionale . . . Paris, De l'Imprimerie Royale, M. DCCLIII.

Courtanvaux, François César Le Tellier, Marquis de. Journal du voyage . . . sur la frégate l'Aurore, pour essayer par ordre de l'Académie, plusieurs instrumens relatifs à la longitude . . . Paris, De l'Imprimerie Royale, M. DCCLXVIII.

de La Condamine, Charles Marie. Journal du voyage fait par ordre du roi, a l'équateur . . . Paris, De l'Imprimerie Royale, M. DCCLI.

Phipps, Constantine John, 2nd Baron Mulgrave. A voyage towards the north pole . . . London, Printed by W. Bowyer and J. Nichols . . . MDCCLXXIV.

Rogers, Robert. Journals of Major Robert Rogers. London, Printed for the Author . . . MDCCLXV.

In addition to the books, the Grolier Club also asked for several of our Passy imprints. Permission was granted to send these books and three Passy imprints to the Grolier Club for its exhibition, under proper protection and insurance. The imprints selected were:

Numb. 705. Supplement to the Boston Independent Chronicle. First edition. Single sheet, printed on one side only. 1782. (Livingston 17.)

Receipt for papers relating to prize ships. In French. Single sheet, printed on one side only. (Livingston 24.)

Instructions to captains of private armed vessels. Dated, In Congress, May 2, 1780. Single sheet, printed on both sides. (Livingston 29.)

Letters of appreciation for the cooperation of this Society were received from Miss Ruth S. Granniss and Mr. F. B. Adams, Committee on Arrangements.

4. REPORT OF THE COMMITTEE ON PUBLICATIONS

The Laws of the Society provide "that there shall be a Committee on Publications, consisting of the President, *ex-officio*, and of not fewer than six other members, representative of the four Classes, who shall serve for three years, and who shall be nominated by the President and elected by the Council" (Chap. V, Art. 8). While election to the Committee is for a three-year term there is no provision against reelection or appointment of persons to fill out the terms of those who resign or cease to be members. The members of the Committee for 1939–40 and the dates of their first appointments are as follows: Cyrus Adler, 1932, *Chairman*, 1938; Frank Aydelotte, 1936; Edwin G. Conklin, 1932; Franklin Edgerton, 1939; Benjamin D. Meritt, 1939; John A. Miller, 1925; Ernest M. Patterson, 1938; Conyers Read, 1939; Jacob R. Schramm, 1938; Harold C. Urey, 1938; James T. Young, 1933; Roland S. Morris, *President*, and Arthur W. Goodspeed, *Editor*.

The Committee held six regular meetings during the year, namely, on February 13, April 10, May 8, June 12, October 9 and December 11, and one special meeting on October 30. It accepted for publication in the

PROCEEDINGS	35 papers
TRANSACTIONS	2 monographs
MEMOIRS	4 volumes

During the year the following contributions were published:

TRANSACTIONS:

Volume XXXI, Pt. 1. February, 1939.

William H. Hobbs. The Early Discoveries of Antarctica as Revealed by Newly Found Maps and Documents. 71 pp., 31 pls.

Pt. 2. February, 1939.

Herbert Fox. Chronic Arthritis in Wild Mammals. 77 pp., 12 pls.

PROCEEDINGS:

Volume 80, No. 1. January, 1939.

J. R. Schramm. Cost Analysis of Scholarly Periodical Printing. pp. 1–24.

Dumas Malone. The Scholar and the Public. pp. 25–36.

Donald Bean. The Riddle in Research. pp. 37–47.

A. E. Parr. On the Possibility of a Biological Mechanism Controlling the Occurrence of the Oxygen Minimum Layer in the Sea. pp. 49–56.

Thomas Tileston Waterman. English Antecedents of Virginia Architecture. pp. 57–63. 4 pls.

Anna R. Whiting. Mutant Body Colors in the Parasitic Wasp Habrobracon juglandis (Ashm.) and Their Behavior in Multiple Recessives and in Mosaics. pp. 65–85. 9 pls. in colors.

Charles T. Berry. More Complete Remains of Ophiura marylandica. pp. 87–94. 1 pl.

William Bell Dinsmoor. Archaeology and Astronomy. pp. 95–173.

No. 2. January, 1939.

Charles Benedict Davenport. Post-Natal Development of the Human Outer Nose. pp. 175–355. 19 pls.

No. 3. February, 1939.

Edwin B. Wilson, Constance Bennett, Margaret Allen and Jane Worcester. Measles and Scarlet Fever in Providence, R. I., 1929–1934, with Respect to Age and Size of Family. pp. 357–476.

No. 4. February, 1939.

Symposium: Intrinsic and environmental factors in American Population growth.

Conrad Taeuber. Agriculture and Current Population Trends. pp. 477–489.

Warren S. Thompson. The Social Environment as a Factor in Population Growth. pp. 491–498.

Frank W. Notestein. Intrinsic Factors in Population Growth. pp. 499–511.

John C. Flanagan. A Study of Psychological Factors Related to Fertility. pp. 513–523.

Clyde V. Kiser. Voluntary and Involuntary Aspects of Childlessness. pp. 525–539.

Mortimer Spiegelman. Mortality in Relation to Widowhood. pp. 541–558.

Waldemar B. Kaempffert. Technological Advance in Relation to Population Trends. pp. 559–568.

No. 3. August, 1939.

William K. Gregory and Milo Hellman. On the Evolution and Major Classification of the Civets (Viverridae) and Allied Fossil and Recent Carnivora: A Phylogenetic Study of the Skull and Dentition. pp. 309–392. 6 pls. 1 folder.

Curtis L. Newcombe and Andrew G. Lang. The Distribution of Phosphates in the Chesapeake Bay. pp. 393–420.

D. T. MacDougal. Features of Growth-Control in Trees. pp. 421–445.

Roberts Rugh. Developmental Effects Resulting from Exposure to X-Rays. pp. 447–471. 6 pls.

No. 4. September, 1939.

Fletcher Watson. A Study of Fireball Radiant Positions. pp. 473–479.

Fletcher Watson. Apparent Distribution of Meteroid Orbits. pp. 481–491.

Fletcher Watson. A Study of Telescopic Meteors. pp. 493–504.

J. D. Williams. Binocular Observations of 718 Meteors. pp. 505–520.

J. D. Williams. Systematic Biases of Meteor Directions. pp. 521–524.

W. V. Houston. Electrons in Metals. pp. 525–532.

Dorrit Hoffleit. On the Necessity for Spectral Sub-classification, with a Discussion of Preliminary Results for 1300 Southern Stars. pp. 533–545.

Edward W. Berry. Geology and Paleontology of Lake Tacarigua, Venezuela. pp. 547–568. 7 pls.

E. C. Case. The Mastodons of Båråboedaer. pp. 569–572. 2 pls.

William Lyon Phelps. Notes on Shakespeare. pp. 573–579.

Henry A. Sanders. A Soldier's Marriage Certificate in Diploma Form. pp. 581–590. 2 pls.

No. 5. December, 1939.

Charles Wendell David (Editor). Narratio de Itinere Navali Peregrinorum Hierosolymam Tendentium et Silviam Capientium, A.D. 1189. pp. 591–676. 1 pl. 2 maps.

MEMOIRS:

Volume I, Part 2. February, 1939.

Eliakim Hastings Moore (with the cooperation of Raymond Walter Barnard). General Analysis, Part 2, The Fundamental Notions of General Analysis. 255 pp.

Volume X. March, 1939.
Felix M. Keesing. The Menomini Indians of Wisconsin. 261 pp. 8 pls.

Volume XI. November, 1939.
Earle Radcliffe Caley. The Composition of Ancient Greek Bronze Coins. 203 pp. 4 pls.

Volume XII. December, 1939.
The Letters of John Chamberlain. Edited by Norman Egbert McClure. (In 2 vols. bound) Vol. 1, 627 pp.; Vol. 2, 694 pp.

Volume XIII. December, 1939.
Ann M. H. Ehrich. Early Pottery of the Jebeleh Region. 129 pp. 24 pls.

YEAR BOOK for 1938. 407 pp. April, 1939.

COST OF PUBLICATIONS DURING 1939

PROCEEDINGS,			
Vol. 80, No. 1.	173 pp., 14 pls.	$1,914.53	
No. 2.	180 pp., 19 pls.	1,175.63	
No. 3.	119 pp.	718.65	
No. 4.	149 pp.	667.47	
Vol. 81, No. 1.	106 pp.	594.27	
No. 2.	200 pp., 4 pls.	1,179.15	
No. 3.	162 pp., 12 pls.	1,190.69	
No. 4.	117 pp., 11 pls.	887.01	
No. 5.	85 pp., 1 pl.	604.39	
			$8,931.79
TRANSACTIONS,			
Vol. 31, Part 1.	71 pp., 31 pls.	928.98	
Part 2.	77 pp., 12 pls.	715.59	
			$1,644.57
MEMOIRS,			
Vol. I, Part 2.	255 pp.	1,555.95	
Vol. X,	261 pp., 8 pls.	847.71	
Vol. XI,	203 pp., 4 pls.	832.94	
Vol. XII,	1,321 pp., 2 pls. (bound, 2 vols.)	3,658.89	
Vol. XIII,	129 pp., 24 pls.	856.23	
			$7,751.72
YEAR BOOK for 1938.	407 pp. (bound)		$ 1,766.18
Total			$20,094.26

The total return from sales of publications during 1939 was $1,894.95.

The question of distribution of the publications of the Society has been considered by the Committee on Publications. It has been customary to send gratis to the members who request it copies of the PROCEEDINGS as issued. These contained, in addition to papers in the various fields of learning and reports of symposia, abstracts of the Minutes of the meetings, obituaries of deceased members and reports of some of the Committees. Since the establishment of the YEAR BOOK this latter material has been transferred from the PROCEEDINGS to the YEAR BOOK and it has been thought that, since the YEAR BOOK is sent to all members gratis, some might prefer not to receive the PROCEEDINGS. Therefore in September the following letter, enclosing a return post-card, was sent to the members of the Society:

To the Members of the
American Philosophical Society

Before the establishment of the YEAR BOOK of the American Philosophical Society all the business of the Society, Minutes of meetings, obituaries of deceased members, etc., were published in the PROCEEDINGS. All this material is now transferred to the YEAR BOOK and the PROCEEDINGS is devoted to the publication of research papers in various fields of learning and to reports of symposia which are presented in the meetings of the Society.

The YEAR BOOK in bound form will be sent to all members, but it is thought that some members may not be interested in nor have room for the storage of the PROCEEDINGS and if they give their copies away it will in some instances interfere with their sale by the Society. Consequently, this note is being addressed to each member with the request that he indicate on the enclosed card whether he desires to receive the PROCEEDINGS; if this is his desire the PROCEEDINGS will be forwarded as issued. *If no reply is received from a member before December 30, it will be understood that he does not desire to have the* PROCEEDINGS *sent to him.*

EDWIN G. CONKLIN,
Executive Officer

In response to this letter 239 members of the Society requested that the PROCEEDINGS be sent to them, while 209 did not reply to the notice and 24 wrote requesting that their names be removed.

At the Forum [1] on the Activities of the Society on Saturday, April 22, during the Annual General Meeting the publication program of the Society was again considered and Dr. James T. Young, a member of the Committee on Publications, informed the Society

[1] See p. 69.

that the efforts of the Committee are directed to three main objectives: To secure a steadily improving and rising standard of material; to publish this material quickly and in an attractive form and to distribute it in circles where it will be of greater scientific service.

At the meeting of the Committee held on October 9 a letter was read from Griffith C. Evans, President of the American Mathematical Society, requesting the Society to join with them in sponsoring a new journal to be called *Mathematical Reviews*. A Subcommittee consisting of George D. Birkhoff, Oswald Veblen and Harold C. Urey was appointed to consider this matter.

On October 30 a Special Meeting of the Committee was called to consider the report of the Subcommittee on *Mathematical Reviews* and the advisability of the Society making a contribution towards the support of this journal.

The following Report of the Subcommittee was read:

Report of the Subcommittee of *Mathematical Reviews*

I. *Description*

Mathematical Reviews is to be a journal which summarizes and coordinates the mathematical research literature of the world. It will cover not only pure mathematics but the many phases of applied mathematics in so far as they are of definite mathematical interest. It will appear monthly in a large double column format somewhat like that of *Chemical Abstracts*. The editorial direction has been entrusted to Professors Otto Neugebauer and J. D. Tamarkin of Brown University, who have brought together a group of over three hundred collaborators who will write the actual reviews. The collaborators have been chosen from all nations of the world and include leading specialists in all the most important fields of mathematical science.

The journal differs from previous periodicals of similar intent in two important features. (1) The subscription rate has been set very low in the hope of extending its influence into all parts of the world, and, in particular, of reaching the many isolated workers in the United States who cannot afford expensive periodicals. (2) It has associated with it a microfilm service so that a subscriber may obtain for a nominal cost a microfilm copy of any of the original articles reviewed.

The new journal has met an immediate enthusiastic response from the mathematicians. Already 426 subscriptions have been received in advance of any solicitation. It is widely felt that it will be not only an indispensable tool for the research worker, but also a powerful means of spreading general mathematical culture and an integrating influence of a sort which is much needed in these days of specialization.

II. *Cost and Sources of Support*

A journal of this type is necessarily very expensive. A detailed study which has extended over the better part of a year and made use of the experience of other similar enterprises, has led to an estimate of $17,000 as the annual cost of production. This includes a small salary for a technical assistant and the cost of clerical assistance as well as the cost of printing, mailing, etc. The editors themselves receive no salary.

The income to be expected from subscriptions is purely a matter of speculation, the one substantial fact being the 426 subscriptions already received. The subscription price has been set at $13 a year, but members of sponsoring societies are charged only $6.50 a year. A sponsoring society is expected to make either an annual subvention or to guarantee a minimum number of subscriptions from its membership. The present sponsoring societies are the American Mathematical Society and the Mathematical Association of America. The American Mathematical Society makes a cash contribution of $1,000 a year and contributes other services which are doubtless worth at least $2,000 a year. The Mathematical Association of America has made a subvention of $1,000 for the first year and will probably continue this support in the future.

The Carnegie Corporation has made an appropriation of $60,000 toward the founding of the journal and its support during its initial period. The Rockefeller Foundation has made a direct grant of $12,000 and has contributed indirect support by providing microfilm and library facilities at Brown University. The latter university is contributing the necessary office space and the services of the two editors.

The support now guaranteed is ample to carry the enterprise for at least five years, and probably longer in view of the decrease in mathematical literature which is certain to result from the

European war. The ultimate success of the journal, however, must depend upon enlisting the interest and cooperation of individuals and scholarly groups in all parts of the world. It is planned to seek the support of foreign mathematical societies and also of some of the more important general learned societies such as the Royal Society in Great Britain and the American Philosophical Society in the United States. It is hoped that the financial support needed will ultimately be reduced to a very small amount and perhaps actually to zero.

III. *The Special Position of Mathematics*

When this project is laid before such an organization as the American Philosophical Society, or the Royal Society, the question will of course immediately be asked, why give support to a single field like that of mathematics? The answer is in part that the journal actually will be of interest not only to mathematicians but to theoretical physicists, astronomers, chemists, economists, and biologists. But there is a much more fundamental reason why any organization with a truly broad and basic interest in science ought to recognize the special position of mathematics. Advances in mathematical knowledge and technique have for their ultimate field of significant application the whole range of quantitative science. It can be effectively argued that progress in all of the analytical and quantitative branches of science depends in a fundamental and limiting way upon advances in mathematics.

This fact is not always given the recognition it deserves, because the work of the mathematician is a highly technical activity which receives very little, if any, direct public attention. Just because the mathematicians need no expensive apparatus and no research materials more expensive than pencil and paper, it is easy to forget their modest but definite material needs.

The problem for the Committee on Publications to consider is whether the special basic nature of mathematics is not a reason for giving it at least a modest place in the broad scientific program of the Society.

IV. *Relation to the Publications Problem of the American Philosophical Society*

At the present time, Class I of the membership of the American Philosophical Society is very strong both in the number and in the distinction of its members, but it makes very little use of the publication facilities of the Society. Apparently this is because there is very little demand on the part of physics and chemistry. There would thus seem to be an opportunity to give attention for a few years to the needs of the mathematicians who are at present engaged in a critically important and difficult enterprise. After this enterprise is launched and going forward on an even keel, the amount of financial support needed should become very small. When that time comes there may well be needs in the sister sciences, and the support which is now given to mathematics can then be turned in one or another of these other directions.

V. *Recommendation*

The Subcommittee recommends that the American Philosophical Society become a sponsoring society of *Mathematical Reviews* and contribute $3,000 a year to its support for a period of five years.

The Committee suggests that the title page of the journal shall include a statement: Sponsored by the American Philosophical Society.

H. C. UREY,
G. D. BIRKHOFF,
OSWALD VEBLEN

October 28, 1939

The report was carefully considered and discussed by the Committee on Publications and the Committee recommended to the Society that an appropriation of $3,000 for one year be approved for *Mathematical Reviews*. The question was raised as to how this contribution would be acknowledged and it was suggested that the following statement appear on the cover of *Mathematical Reviews:*

Sponsored by The American Philosophical Society
The American Mathematical Society
The Mathematical Association.

This sponsorship was not approved by the Society at the meeting on November 18, 1939, but a grant of $3,000 for one year was voted.[1]

At the meeting of the Committee on Publications held on December 11, a letter was read from Oswald Veblen concerning the acknowledgment to be made of the Society's support of *Mathematical Reviews* and after some consideration the Committee approved the following statement to be inserted in the publication:

"This publication was made possible in part by funds granted by the Carnegie Corporation of New York, the Rockefeller Foundation, and the American Philosophical Society held at Philadelphia for Promoting Useful Knowledge. These organizations are not, however, the authors, owners, publishers, or proprietors of this publication, and are not to be understood as approving by virtue of their grants any of the statements made or views expressed therein."

[1] See p. 81.

5. REPORT OF THE COMMITTEE ON RESEARCH

The Laws (Chap. V, Art. 4) specify that the Committee on Research shall consist of the President, *ex officio*, and of not fewer than six other members, representative of the four Classes, who shall serve for three years and who shall be nominated by the President and elected by the Council. In practice it has been found desirable to have more than six elected members in order to obtain wider representation of subjects. While regular election to the Committee is for a term of three years, several persons so elected have found it necessary to resign and others have been appointed to fill out their terms. There is no provision in the Laws against the reelection of a person to serve on this Committee.

The members of the Committee for 1939–40, the subjects they represent and the dates of their last election are listed herewith:

- Albright, William F. (Classical Archaeology), 1939.
- Bronk, Detlev W. (Biophysics), 1939.
- Buddington, Arthur F. (Geology), 1937.
- Cheyney, Edward P. (Modern History), 1938.
- Chinard, Gilbert (Philology and Languages), 1938.
- Conklin, Edwin G., *Chairman* (Biology), 1939.
- Miller, John A. (Astronomy), 1939.
- Richards, Alfred N. (Physiology and Medicine), 1939.
- Shapley, Harlow (Astronomy), 1939.
- Swann, W. F. G. (Physics), 1939.
- Taylor, Hugh S. (Chemistry), 1939.
- Morris, Roland S., *President* (Jurisprudence and Administration).

The Committee held five meetings during the year 1939, viz., on February 10, April 14, June 9, October 13, and December 8. All applications and supporting letters are manifolded and sent to the members of the Committee about ten days in advance of the meeting; in many cases members consult by correspondence or in person with applicants, or with persons conversant with the applicants or their projects. This work requires considerable time and labor and it has been done faithfully and without compensation.

At the Forum[1] on the Activities of the Society held on Saturday, April 22, during the Annual General Meeting, Dr. Conklin, *Chairman* of the Committee on Research, led the discussion on the research program of the Society which was participated in by ten members. It was the general opinion that, with the funds at the Society's disposal, it could not undertake the support of fellowships or professorships and that its most important service in promoting knowledge lies in making relatively small grants to initiate promising research, or to complete projects that might otherwise be lost.

The budget for 1939 assigned \$50,000 from the Penrose Fund for the support of research during the calendar year. At the Annual General Meeting in April an additional appropriation of \$25,000 was recommended by the Society to the Committee on Finance for this purpose. A balance of \$93.29 was carried over from 1938; however, seven grants amounting to \$4,850.00 were awarded in December 1938 to be drawn from the 1939 budget, and in addition to this \$2,000 had been committed from the 1939 budget for a grant made in 1937. Therefore, the total amount available for grants to be made during the year 1939 was \$68,243.29 plus \$530.37 refunded to the Society, or \$68,773.66. During the year the following 106 grants were awarded of a total sum of \$68,265.00 leaving a balance of \$508.66 to be carried over to the 1940 budget:

1939, February 10

Grant No. 275a. Eliot R. Clark, University of Pennsylvania, for technical assistance and supplies to be used in the continuation of his study of the growth and behavior of various cells, tissues and organs, as observed microscopically in the living mammal, with the aid of permanently installed transparent chambers and windows (third grant, extension of Preliminary Grant No. 275, \$300, 1938). \$1,000

Grant No. 290. Millar Burrows and Nelson Glueck, American Schools of Oriental Research, for the expenses for six weeks in the completion of the excavation of Tell el-Kheleifeh (Biblical Ezion-geber) on the Gulf of Aqabah (second grant). 1,600

Grant No. 291. Francis Harper, John Bartram Association, for the preparation for publication, with annotations, of John Bartram's manuscript diary of his journey through the Carolinas, Georgia and Florida in 1765–66; of William Bartram's manuscript report to Dr. John Fothergill on his travels in the Carolinas, Georgia and Florida in 1773–74; and of a new edition of William Bartram's "Travels" (1791). 500

[1] See p. 66.

Grant No. 292. H. H. Hess, Princeton University, and M. Ewing, Lehigh University, for traveling expenses in the continuation of a gravity survey of the Caribbean area and the correlation of the gravity field with the geologic structure. 1,000

Grant No. 293. Davenport Hooker, University of Pittsburgh, for technical assistance and supplies in the continuation of physiological and morphological studies of human prenatal development (third grant). 500

Grant No. 294. Allan C. G. Mitchell, Indiana University, for the rental for one year of a radium-beryllium source of neutrons to be used in the continuation of his study of neutron scattering cross-section as a function of energy; study of the radioactivity of antimony, its beta rays, gamma rays and neutron resonance levels; study of resonance levels in non-activated substances (third grant). 800

Grant No. 295. J. Percy Moore and Olin Nelsen, University of Pennsylvania, for the purchase of a micro-manipulator with a warm chamber to be used in connection with experimental studies on the free uterine eggs and blastocysts of the opossum to test the existence of embryonic organizers and the mutual interrelation of parts, and related problems. 300

Grant No. 296. W. B. Redmond, Emory University, for the purchase of canaries, bands and chemicals to be used in connection with the study of active immunization of birds to malaria without infection (second grant). 200

Grant No. 297. Solomon Leon Skoss, Dropsie College, for editorial and research assistance in connection with the edition and publication of Volume 2 of *David ben Abraham al-Fāsi's Hebrew-Arabic Dictionary of the Bible*, of the 10th Century. 600

Grant No. 298. Harvey Harlow Nininger, American Meteorite Laboratory, for field work in the search for and laboratory investigations of meteorites. 500

Grant No. 299. Emil W. Haury, University of Arizona, for a part of the expenses of the excavation of a prehistoric village on Forestdale Creek, Fort Apache Indian Reservation, Arizona, occupying the area of direct contact between the Mogollon and Anasazi cultures. 500

Grant No. 300. Research Council on Problems of Alcohol, for technical assistance, chemicals, animals and apparatus, to be used in connection with the study of the toxic factors in alcoholism. 1,500

Grant No. 301. Ralph A. Beebe, Amherst College, for a research assistant for the measurement of heats of adsorption of gases on active charcoal at low temperatures and the adaptation of the present calorimeter to heat measurements at high temperatures (200–400° C.) (second grant). 1,000

Grant No. 302. L. S. Cressman, University of Oregon, for field work in connection with archaeological exploration and excavation in southeastern Oregon 600

Grant No. 303. Samuel King Allison, University of Chicago, for part payment of a research assistant in making a precise measurement of the energies of short range particles produced in nuclear disintegrations. 500

Grant No. 304. James A. Shannon, New York University, for part payment for technical assistance in the study of the relationship between the renal tubular reabsorption of water and the rôle of the antidiuretic principle of the posterior pituitary; and the effect of the composition of the body fluids upon the latter variable. 600

Grant No. 305. P. W. Whiting, University of Pennsylvania, for a research assistant in his studies on sex-determination in Habrobracon: genetic analysis of the sex-linked group of genes to determine whether multiple factors or multiple alleles are involved (third grant). 1,200

Grant No. 306. Richard Offner, Institute of Fine Arts, New York University, for photography in connection with the study of origins and artistic environment of Giotto. 750

1939, April 14

Grant No. 307. Richard Krautheimer, Vassar College, for an architectural collaborator in Rome, photographs and other expenses in connection with his studies of the early Christian basilicas in Rome, covering the period from 300–850 A.D. including a complete architectural analysis of the buildings (second grant). 1,000

Grant No. 308. Francis Owen Rice, Catholic University of America, for technical assistants in connection with his studies on the synthesis of polynuclear ring systems by a method of thermal polymerization. 1,000

Grant No. 309. Laurence Irving, Swarthmore College, for technical assistance, travel and transportation of equipment in connection with his examination of the oxygen dissociation curves of blood of the Atlantic salmon while living in salt and in fresh water (second grant). 550

Grant No. 310. Merritt L. Fernald, Harvard University, for traveling expenses for himself and two assistants, equipment, etc., in connection with the collection of plants in eastern Virginia and the Carolinas. 1,500

Grant No. 311. Rupert Taylor, Clemson College, for the fees of solicitors and a searcher in London to examine documents relating to the Manor of Packwood in an attempt to discover the exact ancestry and family relationships of William Shakespeare in the hope that they will lead to discovery of other details of his life and career. 100

Grant No. 312. Carl C. Speidel, University of Virginia, for photographic equipment to be used in investigations of the histological changes exhibited by cells and tissues as these are subjected to various experimental procedures, and to record the changes by cinephotomicrography. 400

Grant No. 313. Margaret Lantis, University of California, for travel and other expenses in Alaska involved in making an ethnographic study, through the complete seasonal round of the year, of the Eskimos of Nunivak Island, Alaska, as the culturally best preserved group of the important but little known Alaskan Eskimos south of Bering Strait. 950

Grant No. 314. Robert W. Pennak, University of Colorado, for apparatus to be used in making a study of the comparative limnology of north central Colorado. 350

Grant No. 315. Thomas Hale Ham, Boston City Hospital, for the continuation of his study on the destruction of red blood cells in the normal individual and in patients with hemolytic anemia such as congenital hemolytic jaundice, sickle cell anemia, paroxysmal nocturnal hemoglobinuria and allied conditions (second grant). 1,500

Grant No. 316. Rodney H. True, University of Pennsylvania, for traveling expenses and assistance in making investigations of materials and personalities of significance alluded to in Thomas Jefferson's manuscript book on his garden operations at Shadwell and Monticello, Va. 750

Grant No. 317. Louis W. Chappell, West Virginia University, for traveling expenses and equipment for the collection and preservation of folk-lore in West Virginia: folk-songs, folk-tales, legends, riddles, proverbs, superstitions, animal and plant lore, etc. 500

Grant No. 318. Karl Sax, Harvard University, for a technical assistant in studying the effect of radiation on chromosome structure. 600

Grant No. 319. Arthur C. Cope, Bryn Mawr College, for a technical assistant in the study of three-carbon tautomerism between 1-alkenyl and alkylidene malonic and cyanoacetic esters. 600

Grant No. 320. William C. Stadie, University of Pennsylvania, for a research assistant in his study of the chemical action of insulin upon the intermediary metabolism of isolated surviving tissues of normal and pathological animals (second grant). 1,500

Grant No. 321. Adam G. Böving, Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, for expenses in making an anatomical investigation of the taxonomically important structures of the larvae of the beetles of the genus Phyllophaga. 800

Grant No. 322. Marie Farnsworth, American School of Classical Studies, for field work and traveling expenses in connection with a technological study of the Agora pottery; analysis of unknown and doubtful substances which appear in the course of excavating and development of methods of cleaning and preserving the objects found; preparation of exhibits for the Agora Museum. 750

Grant No. 323. Paul Weiss, University of Chicago, for apparatus, technical assistance, etc., in connection with his study of the "resonance" principle of neuro-muscular coordination in mammals, studied by nerve crossing and muscle transplantation, using motion pictures and electrical action potentials as indicators. 350

1939, June 9

Grant No. 324. Charles B. Davenport, Department of Genetics, Carnegie Institution of Washington, for a statistical assistant in the study of postnatal development of the extremities in Homo. 500

Grant No. 325. Henry Alexander Grubbs, Princeton University, for traveling expenses in connection with the preparation of a definitive study of the life and works of Jean-Baptiste Rousseau (1671–1741), French poet. 200

Grant No. 326. Dorothy K. Hill, Walters Art Gallery, Baltimore, for laborers, photographer and architect in connection with the study of the Etruscan remains at Castel Campanile (between Cervetri and Rome). 300

Grant No. 327. Raphael Levy, University of Baltimore, for traveling expenses in connection with the preparation of a commentary on 815 Old French glosses in order to explain properly their importance in French lexicography and in mediaeval culture. 250

Grant No. 328. Richard H. Shryock, University of Pennsylvania, for traveling expenses in connection with the study of the modern history of irregular medical practice in Europe (medical sects, folk medicine, and quackery) with particular reference to Great Britain, France and Germany and the influence exerted by developments therein upon the United States since the late 18th Century. 250

Grant No. 329. B. Edwin Blaisdell, Massachusetts Institute of Technology, to hire a computer for the numerical integration of Laplace's differential equation for the equilibrium meridian of a fluid drop of axial symmetry. 250

Grant No. 330. Herbert S. Harned and Gosta C. Akerlof, Yale University, for construction of apparatus for making vapor pressure measurements of high precision for solutions with one volatile component. 1,000

Grant No. 331. Horace W. Babcock, Astrophysical Observatory, California Institute of Technology, for supplies, travel, etc., in connection with the systematic measurement of the spectrum of the night sky and of its integrated intensity, to discover the most favorable spectral region and the type of photographic emulsion to reduce the effect of this light to a minimum. 1,000

Grant No. 332. William Henry Brown,† Johns Hopkins University, for an artist and typist in connection with the continuation of

† Deceased November 9, 1939.

the investigation on the phylogeny and classification of flowering plants (second grant). .... 1,948[1]

Grant No. 333. Harry B. Friedgood, Harvard Medical School, for technical assistance, chemicals, etc., for the biochemical study of hirsutism and virilism in women. 500

Grant No. 334. Roy Winfield Jones, Central State College, Oklahoma, for technical assistance, purchase of fish and equipment in determining the effect of growth promoting substances, such as auxilin (indolebutyric acid), on the early differentiation of fish embryos as expressed by the rates of cell division in such embryos. 275

Grant No. 335. Martin Kilpatrick, University of Pennsylvania, for a research assistant and materials for the determination of relative acid strengths in non-aqueous solutions (second grant). 750

Grant No. 336. Roberts Rugh, New York University, for animals, equipment, technical assistance, etc., for the study of the effect on the embryo of x-radiation of the gametes (frog); developing technique for artificial insemination in mouse or rat in anticipation of comparable x-ray studies on mammals (second grant). 600

Grant No. 337. John T. Buchholz, University of Illinois, for technical assistants for the study of pollen-tube growth in crosses between the tetraploid and diploid plants of ten species of Datura (second grant). 300

Grant No. 338. M. Bruce Fisher, Rhode Island State College, for equipment and machinist's labor in connection with the determination of the relation between the critical fusion frequency of flicker at the fovea of the human eye and the size, brightness, and position of the surrounding field. 125

Grant No. 339. Henry Dexter Learned, Temple University, for the preparation of the vocabulary of French as used in England from the Conquest to the death of Chaucer. 200

Grant No. 340. Lloyd P. Smith, Cornell University, for a technical assistant and apparatus in connection with the electrical separation of the isotopes of calcium, phosphorus and boron in sufficient quantities for biological, medical and nuclear investigations respectively. 1,500

Grant No. 341. Guy S. Lowman, Jr., Brown Unversity, Field Investigator for Linguistic Atlas of United States and Canada, for field work in making a survey of the speech of Pennsylvania. 1,000

Grant No. 342. F. K. Richtmyer,[†] Cornell University, for a research assistant in the completion of a series of investigations in the general field of double ionization of the inner electron shells of atoms (third grant). .... 600[2]

[1] Owing to the death of Dr. Brown, an unexpended balance of $253 was returned.

[†] Deceased November 7, 1939.

[2] To be continued by L. G. Parrot and J. W. Trischka.

Grant No. 343. Robert Gaunt, New York University, for technical assistance and supplies for the study of the rôle of steroid hormones in carbohydrate metabolism; adrenal insufficiency in the ferret and its response to cortical and other steroid hormones (compared to other species); and related investigations (second grant).	500
Grant No. 344. Dwight L. Hopkins, Mundelein College, Chicago, for laboratory space, chemicals and supplies for further studies of the adaptation of amoebae to changing concentration and the regulation of the water content of the protoplasm.	250
Grant No. 344a. Dwight L. Hopkins. (December 8, extension of Grant No. 344.)	487
Grant No. 345. John Francis McDermott, Washington University, for traveling expenses in connection with the study of the life of August Pierre Chouteau (1786–1838), a member of one of the principal pioneer families of St. Louis and an important figure in the fur trade of the southwest.	400
Grant No. 346. Malcolm F. Farley, Chicago, for stenographic help, travel, etc., in connection with the preparation for publication of a study of the history of Fukien and the South China Coast.	500
Grant No. 347. Elizabeth Lowndes Moore, St. Lawrence University, Canton, N. Y., for traveling expenses in connection with the study of the French settlers in northern New York State.	500
Grant No. 348. Frederick A. Saunders, Harvard University, to purchase a special camera to be used in the investigation of the mechanical action of old and new violins.	500
Grant No. 349. Benjamin R. Coonfield, Brooklyn College, for laboratory fees, supplies and traveling expenses in connection with an investigation on the problems of regeneration in the ctenophores and color change in embryo fishes.	300
Grant No. 350. Paul R. Stewart and B. K. Stewart, Waynesburg College, Penna., for excavation, travel, slides, etc., in connection with a paleontological survey of the 1100 $\pm$ ft. above the Monongahela formation in southwestern Pennsylvania.	500
Grant No. 351. Hugh O'Neill Hencken, Harvard University, for technical assistance in the preparation of illustrations for report of the Harvard Archaeological Expedition in Ireland (1932–6).	500
Grant No. 352. James Harvey Gaul, Harvard University and Sofia, Bulgaria, for travel and field work for the study of the interrelations of prehistoric Bulgaria with the Aegean world, during the Neolithic, Bronze and Iron Ages.	500
Grant No. 353. E. G. Anderson, California Institute of Technology, for a cytological technician to assist in the genetic and cytological analysis of the chromosomes of maize.	300
Grant No. 354. Irvin M. Korr, New York University College of Medicine, for part payment of apparatus to be used in the	

study of the relation between cellular activity and cellular respiration in mammalian tissues, with particular attention to changes in rate, foodstuffs burned, and catalysts involved as the tissues are made to pass from the resting to the active state. 400

Grant No. 355. Harold W. Landin, Ohio State University, for traveling expenses in connection with the study of the political and cultural influence of the French Revolution on Sweden, with special reference to the activities of the Jacobin clubs which were organized in Sweden after 1791. 600

Grant No. 356. Curtis L. Newcombe, University of Maryland, for technical assistance and apparatus in connection with a physical, chemical and biological investigation of the layer of low oxygen content in the deeper waters of the Chesapeake Bay (second grant). 600

Grant No. 357. Dorothy M. Spencer, University of Pennsylvania, for traveling expenses, equipment, informants, etc., in connection with an intensive study of one group among the Munda-speaking peoples of Central India. 1,500

1939, October 13

Grant No. 358. William R. Amberson, University of Maryland, for equipment, animals, etc., for further studies in blood substitution (third grant). 600

Grant No. 359. E. W. Berry, Johns Hopkins University, for photographs or drawings for the study of the paleobotany of Middle and South America. 100

Grant No. 360. Richard C. de Bodo, New York University, for animals, chemicals, materials, etc., for the study of the cause and mechanism of the loss of hypersensitivity to insulin and the return of gluconeogenesis to a normal level. 850

Grant No. 361. Leslie Lyle Campbell, Washington and Lee University, for apparatus, etc., for the continuation of investigations into the Hall and allied effects in metals. 350

Grant No. 362. Morris H. Harnly and Ruth B. Howland, Washington Square College, New York University, for care of stocks, preparation of slides, and technical assistance, in the analysis of the effect of the vestigial locus during the embryological and larval periods of Drosophila. 500

Grant No. 363. Serge A. Korff, Bartol Research Foundation of the Franklin Institute, to purchase a ten milligram radium-beryllium neutron source for the investigation of the disruption of the nuclei in the upper atmosphere by cosmic radiation. 325

Grant No. 364. Isaac Starr, University of Pennsylvania, for an assistant in ascertaining and defining the clinical utility of the ballistocardiogram, an instrument which records the heart's recoil and the blood's impact in man. 480

Grant No. 365. Eugene Pacsu, Princeton University, for technical assistance, chemicals and apparatus for the physico-chemical investigation of polypeptides and proteins produced synthetically. 1,500

Grant No. 366. Willis L. Tressler, University of Buffalo, for apparatus to be used in the limnological study of New York Lakes. 250

Grant No. 367. Peter van de Kamp, Swarthmore College, for a technical assistant, in making an accurate measurement of relative positions of close double star components by interferometer methods with special reference to close binaries with rapid orbital motion. 500

Grant No. 368. Frances G. Wick, Vassar College, for a technical assistant, in making an investigation of the effect of neutrons as source of luminescence excitation and a study of the relation of luminescence to changes in physical state and changes in crystal structure. 500

Grant No. 369. J. A. Bearden, Johns Hopkins University, for technical assistants and travel in connection with the study of electronic energy levels of solids by x-ray absorption measurements (second grant). 1,000

Grant No. 370. Carl A. Hoppert and Harrison R. Hunt, Michigan State College, for expenses in connection with the study of inherited differences in rats with respect to susceptibility to dental caries, and if such differences are found, to discover, if possible, the number of genes involved. 425

Grant No. 371. Fred E. D'Amour, University of Denver, for technical assistance, chemicals, etc., for (*a*) the continuation of the study concerning the hormonal control of ovulation by means of urine analysis, and (*b*) psycho-galvanometric and skin temperature studies on same subjects (third grant) 500

Grant No. 371a. Fred E. D'Amour (December 8, extension of Grant No. 371). 250

Grant No. 372. Hudson Hoagland, Clark University, for an assistant in the investigation of the controlling chemical pacemakers (master reactions) involved in respiration of different brain centers. 600

Grant No. 373. Robley D. Evans, Massachusetts Institute of Technology, for technical assistance in the completion of the international interchecking project on radioactivity (third grant). 1,500

Grant No. 374. J. F. McClendon, Hahnemann Medical College, for the purchase of rats, chemicals, etc., in connection with the determination of the relation of the fluorine content of certain diets to the incidence of dental caries in experimental animals. 300

Grant No. 375. Russell W. H. Gillespie, University of South Dakota, for equipment for an attempt to determine the nature and identity of the metabolite or metabolites in cultures of aerobacillus species responsible for the establishment of oxidation-reduction potentials at different levels. 300

Grant No. 376. S. C. Brooks, University of California, for technical assistance in the continuation of investigations of the intake and exit of ions in living cells, particularly Nitella and eggs of marine invertebrates (second grant). 600

1939, December 8

Grant No. 377. Robert T. Clausen, Cornell University, for field work and travel in making field studies of Sedum and Gentians in western North America. 400

Grant No. 378. Harry Richard Seiwell, Woods Hole Oceanographic Institution, for technical assistance in the investigation of internal waves in the North Atlantic Ocean (second grant). 750

Grant No. 379. George Kreezer, Cornell University, for technical assistance and travel, for the study of the electro-encephalogram (E.E.G.) as an index of cerebral conditions associated with mental deficiency of different levels and types (second grant). 1,000

Grant No. 380. John Ernst Weaver, University of Nebraska, for technical assistance, travel, etc., in connection with the study of destruction caused by drought, adjustment of grasslands to those losses, and the methods and rate by which prairie is being reestablished (second grant). 600

Grant No. 381. Harald H. Nielsen, Ohio State University, for apparatus for the measurement of the infra-red absorption band spectra of polyatomic molecules under high dispersion. 500

Grant No. 382. Homer Garner Barnett, University of Oregon, for travel, interpreters, etc., in making a study of the Mexican Kickapoo Indians from the standpoint of an analysis of the process of culture change. 500

Grant No. 383. Grace Medes, Lankenau Hospital Research Institute, for technical assistance in connection with the purification and characterization of enzymes which act on organic sulphur. 600

Grant No. 384. Thomas Hume Bissonnette, Trinity College, Hartford, for assistance, animals, etc., in connection with the study of photoperiodicity in animals (second grant). 500

Grant No. 385. Willard VanOrman Quine, Harvard University, for technical assistance in the completion of a treatise entitled "Mathematical Logic." 200

Grant No. 386. *Journal of the History of Ideas*, for supplementary support to initiate and promote publication. 500

Grant No. 387. Edward Jay Schremp, Washington University, for apparatus to survey the directional distribution of intensity of cosmic rays at St. Louis and to ascertain the complete form of the fine structure pattern in the sky predicted theoretically by the applicant. 500

Grant No. 388. Frank Cummings Hibben, University of New Mexico, for technical assistance, equipment and labor to be used in the continuation of excavations in the Sandia Cave, Sandia Mountains, New Mexico. 750

Grant. No. 389. Albert V. Stoesser, University of Minnesota, for technical assistance, in the study of water and electrolyte metabolism in intractible bronchial asthma. 500

Grant No. 390. American School of Prehistoric Research, for an expedition to the Paleolithic caves of Bulgaria. 1,000

Grant No. 391. Bailey Willis, Stanford University, for an assistant, drafting, photographic work, etc. in compiling a new geologic map of the North American Continent on the base of the one published by the U. S. G. S. in 1911; scale 1: 5,000,000. 1,000

Grant No. 392. Edith Von Porada, New York, for expenses in connection with the publication of 450 interesting cylinder seals in the Pierpont Morgan Library. 800

The distribution of these grants to various subjects is shown in the following table:

		Grants	Amount
Class I.	Mathematics	1	$ 200
	Astronomy	3	2,000
	Physics	13	8,825
	Chemistry	6	5,850
	Biochemistry	1	600
Class II.	Geophysics	1	1,000
	Paleontology	2	600
	Geology	1	1,000
	Oceanography	1	750
	Ecology	3	1,200
	Zoology	14	6,687
	Biology	1	600
	Anatomy	1	1,000
	Genetics	3	1,100
	Histology	1	400
	Botany	5	5,048
	Bacteriology	1	300
	Anthropology	3	2,950
	Psychology	2	1,125
	Physiology	12	7,130
	Pathology	3	3,500
Class III.	American and Modern History	3	1,150
	History of Science	1	750
Class IV.	Philosophy	1	500
	Ancient, Medieval and Cultural History	4	1,700
	Archaeology	9	6,500
	Ethnology	1	500
	Languages	4	2,050
	Literature	2	700
	Art	2	1,550
	Architecture	1	1,000
	Total	106	$68,265

Tabular summary of the number of applications and grants and the sums granted during the seven years of the activities of the Committee on Research:

	Available for grants	No. of applications	For total sum of	No. of grants made	For total sum of
1933	$20,000	16	$ 21,075*	2	$ 3,500
1934	63,302	83	242,586*	33	59,600
1935	71,754	92	200,442	48	70,350
1936	51,382	95	230,435	36	50,882
1937	76,019	122	305,467	74	76,245
1938	72,793	169	288,969	90	77,550
1939	68,774	206	272,413	106	68,265
TOTAL	424,024	783	1,561,387*	389	406,392

* Total amount not included here since 4 applications in 1934 and 11 applications in 1933 were received which did not specify sums desired.

REPORTS FROM RECIPIENTS OF GRANTS FROM THE PENROSE FUND

(ALPHABETICALLY ARRANGED)

ERNST C. ABBE, University of Minnesota

Grant No. 228 (1938). A study of the flora of the Richmond Gulf area (east coast of Hudson Bay).

Our knowledge of the flora of the east coast of Hudson Bay is strictly limited as compared with that of other portions of the subarctic of eastern North America. Botanical information concerning this region is badly needed both to test current phytogeographical theories and to provide a basis for checking the delimitation of boreal taxonomic entities. The Richmond Gulf area was chosen for field study because it presents a wide diversity of environmental conditions and is in the transition region from forest to tundra.

In order that an effective season's work might be accomplished during the summer of 1939 it was found that the greater part of the expedition's ton and a half of supplies would have to be sent in by boat to the Hudson's Bay Company Post at Great Whale River at the end of the summer of 1938, and then be transported by dog team to Richmond Gulf before the "break-up" of early spring 1939. This was accomplished satisfactorily due to the efficient assistance of the Hudson's Bay Company personnel. Our supplies were therefore awaiting us when we arrived by plane at the Richmond Gulf outpost of the Hudson's Bay Company on the 26th of June, 1939. The trip to Richmond Gulf was made by chartered plane, leaving the railroad at Senneterre, P. Q., June 25th. The importance of this mode of transportation in the exploration of the North cannot be over-emphasized. In this particular instance approach to Richmond Gulf by boat would have been impossible for another ten days because of ice conditions, while travel by canoe from Moose Factory would have taken at least until the beginning of August. As it was, we were able to collect on the islands and shores of Richmond Gulf from June 27th to August 13th. During this time we made a series of trips to the southern, southeastern, western and southwestern shores of the Gulf. We thus sampled the flora from sea-level to the tops of the 800 to 1,400 foot hills in areas composed of various combinations of Archaen granites, Huronian (?) sedimentaries, and diabase trap, and from both forested and treeless areas.

The 13th of August we left Richmond Gulf and traveled down the coast of Hudson Bay to Great Whale River, some 80 miles to the south. At Great Whale River we awaited the arrival of the Hudson's Bay Company supply boat upon which we were to return to the railroad at Moosonee. The delayed arrival of the supply boat permitted us to make an extensive series of collections from the vicinity of Great Whale River as well as from nearby Manitounuck Sound. The opportunity was taken to accompany the supply boat on its annual visit to the Belcher Islands and thus compare the more arctic flora of these little known islands of Hudson Bay with the flora of the mainland. The return trip to Moosonee was finally completed September 11th, further collections being made at Cape Smith on the way south.

Over 1,400 numbers (about 8,000 sheets) of flowering plants were collected by the party during the summer, as well as about 400 numbers of mosses and lichens. Mr. John Marr also collected about 250 borings and sections from 80 trees for a study of tree growth climatic correlations.

The party consisted of the writer, Mrs. Lucy B. Abbe, Mr. John Marr (a graduate student at the University of Minnesota), and a local Eskimo guide and camp helper, Jacob Oriarlik. It might be mentioned that the Eskimo turned out to be an unexpectedly useful addition because of the skill which he quickly developed in the preparation of the specimens.

The expedition was supported with grants from the Penrose Fund of the American Philosophical Society, the Graduate School of the University of Minnesota, the Bache Fund of the National Academy of Sciences, the American Academy of Arts and Sciences, the Smithsonian Institution, the Arnold Arboretum of Harvard University, the Minnesota Academy of Sciences, and private donations.

Abbe, Ernst C., 1939. The Expedition to Hudson Bay of the University of Minnesota. Science, N. S. 90: 458–459.

SAMUEL K. ALLISON, University of Chicago

Grant No. 303 (1939). The precise measurement of the energies of short-range particles produced in nuclear disintegrations.

The University of Chicago has matched the grant with an equal sum and the money is being used to pay for a research assistant during the spring and autumn quarters, 1939, the winter quarter, and one month of the spring quarter, 1940.

At the time of making the grant, our group had made precise measurements of the energies released in the reactions

$$Be^9 + H^1 \rightarrow Li^6 + He^4 + Q_1$$

and

$$Be^9 + H^1 \rightarrow Be^8 + D^2 + Q_2,$$

but conclusions of comparable accuracy concerning the masses of Li^6, Be^8, Be^9, could not be made without measuring more reactions. Aided by the grant, we have measured the energy released in the reactions

$$Li^7 + H^1 \rightarrow 2He^4 + Q_3$$

and

$$Li^6 + D^2 \rightarrow 2He^4 + Q_4.$$

From these four equations, we have solved for the masses of the heavier atoms involved, and published the values:

$$\begin{aligned} Li^6 &= 6.01682 \pm 0.00011, \\ Li^7 &= 7.01784 \pm 0.00009, \\ Be^8 &= 8.00766 \pm 0.00015, \\ Be^9 &= 9.01486 \pm 0.00013. \end{aligned}$$

These values are consistent with the following masses of the lightest atoms:

$$\begin{aligned} H^1 &= 1.00813 \pm 0.00002, \\ D^2 &= 2.01473 \pm 0.00006, \\ He^4 &= 4.00386 \pm 0.00006. \end{aligned}$$

We believe that this set represents the most reliable values for the masses of these 7 light atoms at the present time.

In continuing our work we have been investigating the reaction

$$Be^9 + D^2 \rightarrow Li^7 + He^4 + Q_5.$$

Since all the atoms in this reaction are included in the set given above, we are able to predict the exact value of the energy release Q_5. An accurate measurement of Q_5 will serve to test the reliability of the masses we have thus far obtained. We have, however, found a new and interesting phenomenon in connection with this reaction, namely, that the alpha particles are emitted in two distinct energy groups, of about equal intensity. We are investigating this new effect at the present time before giving an accurate experimental value for Q_5.

ALLISON, SAMUEL K., 1939 (with SKAGGS, L. S. and SMITH, N. M., JR.). Re-Measurement of The Energies Released in the Reactions Li^7 (p, α) He^4 and Li^6 (d, α) He^4. Phys. Rev. 56: 288.

—— 1940 (with SKAGGS, L. S. and GRAVES, E. R.). Alpha-Particle Groups from the Disintegration of Beryllium by Deuterons. Phys. Rev. 57: 158.

SMITH, NICHOLAS M., JR., 1939. The Energies Released in the Reactions Li^7 (p, α) He^4 and Li^6 (d, α) He^4, and the Masses of the Light Atoms. Phys. Rev. 56: 548–555.

DONALD H. ANDREWS, Johns Hopkins University

Grant No. 206 (1938). Heat capacity studies of organic compounds at low temperatures.

During 1939 our efforts have been devoted to the development of the apparatus for the new method for heat capacity measurements of films of organic compounds reported last year. This method employs a film of super-conducting metal as a thermometer, which is consequently of extremely low heat capacity and high sensitivity. As a detector of small quantities of energy, the advantages of such a film appear to be very significant as compared with any other method at present available. Preliminary experiments carried out on May 5, 1939 demonstrated that films of the requisite thinness can be made superconducting. Because of the breakdown of our hydrogen liquefier it has not been possible to continue experimental measurements during the fall, but a new and larger liquefier will be completed in 1940 making possible more extensive experiments.

In addition to the calorimetric studies this research gives promise of making possible a number of new types of measurement.

1. These metallic films are transparent and have a continuous and nearly uniform absorption spectrum. When light of varying wave lengths falls on the super-imposed organic layer, the electrical

resistance of the metallic film will be a function of the intensity of the light adsorbed. In this way it should be possible to observe the spectrum of a unimolecular layer with increased sharpness of the bands due to the low temperature. By the same method it may even be possible to study changes in the surface of the metallic film itself due to oxidation or adsorption.

2. One may calculate that with liquid helium it is possible to obtain high vacua of the order of 10^{-15} mm. or better. By using superconducting films to measure the heat conductivity in such a vacuum one should be able to determine the pressure and study the properties of molecules and surfaces under these extreme contions.

3. If amounts of energy of the order of 10^{-9} ergs can be measured it will be possible to detect the impact of a single molecule of high molecular weight such as a protein. This suggests the use of the films as "molecular Geiger counters" for extremely attenuated particle beams and the determination of high molecular weights by actually counting the number of particles involved and measuring the energy contained therein.

The films may be useful as detectors of radiation of all kinds, particularly weak radioactive emanations and infra-red spectra. The use as radiometers was suggested independently last summer by Goetz (*Phys. Rev.*, **55**, 12, 1270–1, 1939). There is some indication that individual photons can be detected in the ultra-violet. The investigation of the use of the films as radiometers has been undertaken with the help of a grant from the Research Corporation.

ANDREWS, DONALD H., 1939. Report of Progress, Yr. Bk. Amer. Philos. Soc. for 1938: 132.

M. F. ASHLEY-MONTAGU, Hahnemann Medical College and Hospital

Grant No. 259 (1938). The development of the interest in the comparative anatomy of the primates as illustrated by the life and work of Edward Tyson (1650–1708).

In the hope of discovering new materials relating to the life and work of Edward Tyson, and with the purpose of studying and recording those already known to exist, the period from 22 May to 5 July 1939 was spent in England in the location and investigation of such materials. The value of the material investigated during this period far exceeded the investigator's most sanguine expectations.

The greater part of the time was spent in the study of the Tyson manuscripts and drawings in the collection of the Royal College of Physicians at London. This material had never previously been studied. A catalogue and description was made of the many drawings representing natural history and anatomical specimens and other objects, and photographs of some of these drawings were also made. Copies were made of all the manuscripts. The manuscripts have never been published, and contain material of the utmost value for the proper study of Edward Tyson and his times. To Dr. Arnold Chaplin, Harveian Librarian of the Royal College of Physicians the investigator is greatly indebted for the facilities and the many courtesies offered him during his investigations in the Library of the College. Early in June this investigator reported the results of his study to that date in a lecture delivered before The Historical Section of the Royal Society of Medicine of London.

With the completion of the work at The Royal College of Physicians work was begun on the Copy Books, Letter Books, Register Books, and Council Books in the collection of the Royal Society in London. Every page of these manuscript volumes was scanned for relevant references to Tyson. In this manner much hitherto unknown material relating to Tyson was discovered and copied. To Miss Carruthers, Archivist to the Library of the Royal Society, many thanks are due for her numerous courtesies during the execution of this work.

In the British Museum Library the investigator discovered an hitherto unknown poem addressed to Tyson, and there also examined the contribution, in the form of original drawings, *inter alia*, by Tyson to Samuel Collins' "System of Anatomy," London, 1685. As a result it was found that Tyson's contribution to that work was more considerable than either Collins or Tyson ever acknowledged.

Owing to the removal from London of the manuscript collection in the possession of the Barber Surgeons of London it was not possible to examine these manuscripts. This is greatly to be regretted since it was expected to find among them materials which would throw much light on Tyson's activities as a teacher.

It was also found that materials at Oxford and Cambridge had become unavailable owing to the necessity of taking precautions against damage resulting from aerial bombardment.

A very fruitful visit was paid to Professor J. F. Cole at Reading where the investigator had the opportunity of inspecting Professor Cole's unrivalled collection of early works on Natural History.

The investigator is now in process of preparing his materials so that he may write the first draft of his book, which it is expected will be completed by the Fall of 1940.

E. B. Babcock, University of California

Grant No. 274 (1938). Cytogenetic investigations in the Cichorieae and their bearing on taxonomy, phylogeny and evolution of higher plants.

The original purpose of the project was to investigate the genus Crepis with reference to the chromosomes of the species, the geographic distribution of the species, the cytogenetics of interspecific hybrids, and the bearing of these three lines of evidence on the taxonomy, phylogeny, and evolution of the genus.

The last published report on the chromosomes of Crepis is that of Babcock and Cameron [1] which treats of 108 species. At least thirteen additional species have been acquired and examined and these, together with a revised list of all the species studied cytologically, will be reported in a forthcoming paper. In the genus as at present delimited (excluding Youngia, Soroseris, Dubyaea, and Aetheorrhiza) the following diploid numbers occur: 6, 8, 10, 12, 14; also among the Old World group there are several tetraploid species with $2n = 16$ ($x = 4$), two octoploid species with $2n = 40$ ($x = 5$), and possibly a decaploid species with $2n = 40$ ($x = 4?$); whereas in the native American species (except nana and elegans with $2n = 14$) only the base number 11 occurs and the following somatic numbers are found: 22, 33, 44, 55, 66, 77, 88. This unique situation in the native American species, as compared with the rest of the genus, is fully discussed in relation to geographic distribution, polyploidy, and apomixis in the monograph by Babcock and Stebbins [2] and a paper by Stebbins and Jenkins.[3]

The geographic distribution of the Old World species of Crepis

[1] Babcock, E. B. (with Cameron, D. R.). Univ. Calif. Publ. Agr. Sci. **6**: 287–324. 1934.

[2] Babcock, E. B. (with Stebbins, G. L., Jr.). Carnegie Inst. Wash. Pub. No. **504**: 1–199. 1938.

[3] Stebbins, G. L., Jr. (with Jenkins, J. A.). Genetica **21**: 191–224. 1939.

has been discussed in "The Origin of Crepis and Related Genera."[4] The general conclusion regarding Crepis is that the center of origin was in southwestern Asia, and that migration from this center occurred toward the west into Europe and Africa, and toward the northeast throughout Asia and eventually into western North America. In the essay just cited there was suggested a working hypothesis concerning the phylogenetic relations between Crepis and three large closely related genera, Hieracium, Lactuca, and Prenanthes, based on the concept that 10 is the most primitive number of chromosomes in this group of genera. It should be pointed out, however, that the comparative morphology of *existing* species is not wholly consistent with this hypothesis, and that a broader survey of the chromosome numbers in the tribe Cichorieae as a whole may necessitate the adoption of a different hypothesis.

Cytogenetic studies on eleven interspecific hybrids, made by several different investigators, have been reviewed recently.[5] This evidence supports the evidence from comparative morphology and geographic distribution which indicates that Crepis, as delimited above, is a natural group of closely related species. Although several major subgeneric groups are recognized as providing a convenient basis for systematic classification, yet the species thus classified are more or less closely related, i.e., their genic complements are more or less homologous. This generalization is supported by more recent studies on groups of very closely related species[6] as well as by other work on interspecific hybrids in Crepis.[7]

The bearing of all these investigations on the phylogeny and evolution of Crepis has been summarized by Babcock and Navashin[8] and Babcock and Cameron.[1] This evidence is invaluable in working out a natural taxonomic treatment of the genus, and it is hoped that when the general monograph is completed it will

[4] Babcock, E. B. In Essays in Geobotany in Honor of William Albert Setchell. Univ. Calif. Press. 1936.

[5] Babcock, E. B. (with Emsweller, S. L.). Univ. Calif. Publ. Agr. Sci. 6: 325–368. 1936.

[6] Babcock, E. B. (with Cave, M. L.). Ztschr. ind. Abst. Vererb. 75: 124–160. 1938; Jenkins, J. A. Univ. Calif. Publ. Agr. Sci. 6: 369–400. 1939.

[7] Collins, J. L. (with Hollingshead, L. and Avery, P.). Genetics 14: 305–320. 1929; Poole, C. F. Univ. Calif. Publ. Agr. Sci. 6: 169–200. 1931; ibid., 231–255. 1932.

[8] Babcock, E. B. (with Navashin, M.). Bibliographia Genetica 6: 1–90. 1930.

also prove of practical value for purposes of identification and classification in this genus.

Other genera of the Crepidinae to which special attention has been given during these investigations are Youngia,[9] Prenanthes, Dubyaea, Lactuca, and Ixeris;[10] Soroseris (unpublished); Aetheorrhiza (unpublished). Furthermore, preliminary taxonomic and cytologic studies have been made in some forty to fifty other genera mostly in other subtribes than the Crepidinae. This survey of the whole tribe Cichorieae has been undertaken because the subtribe Crepidinae as heretofore constituted can hardly be considered a natural group of genera, whereas the Cichorieae as a whole can be so considered. Hence there is reason to expect that this broader survey will throw considerable light on the phylogenetic relations of the Crepidinae. It is hoped eventually to publish a generic revision of the Cichorieae.

Horace W. Babcock, California Institute of Technology (now at Yerkes Observatory, University of Chicago)

Grant No. 331 (1939). A photometric study of the light of the night sky.

Spectro-photometric comparisons of the light of the night sky and of the central portion of the Andromeda Nebula (Messier 31) have been carried out at Palomar Mountain, the site of the 200-inch telescope. All plates were made with the same spectrograph and 12-inch aluminized reflecting telescope, and were calibrated for intensity by means of a standard lamp. Intensity plots of the spectra were made with the aid of the recording microphotometer of the Mount Wilson Observatory, through the courtesy of Director W. S. Adams.

Results indicate that the radiations of the night sky that interfere most seriously with the direct photography and photometry of nebulae, i.e., the radiations of greatest relative intensity, are the violet and ultra-violet bands below about $\lambda 4200$, and the well-known "green auroral line" of [O I] at $\lambda 5577$. It is possible that seasonal variations of the red lines, $\lambda\lambda 6300$, 6360, might cause them to become sufficiently strong to be troublesome. It appears that a

[9] Babcock, E. B. (with Stebbins, G. L., Jr.). Carnegie Inst. Wash. Publ. No. 484: 1–106. 1937.

[10] Babcock, E. B. (with Stebbins, G. L., Jr. and Jenkins, J. A.). Cytologia, Fujii Jubilee Vol.: 188–210. 1937.

panchromatic emulsion, in combination with a color filter to eliminate wave lengths shorter than about λ4200, should be most efficient for making direct photographs of faint nebulae having colors similar to that of M31. No suitable filter for eliminating the light of the strong night sky line at λ5577 is known to the authors.

With the same spectrograph, and using plates calibrated as above, systematic exposures on the night sky are being continued, with the object of investigating the intensity variations that are known to occur in its spectrum. Both the short period variations occurring within a single night, and longer seasonal variations are being studied, mainly from the utilitarian standpoint of improving the efficiency of direct photography with telescopes of large relative aperture.

This investigation is being carried out with the cooperation of the Observatory Council of the California Institute of Technology. To date, none of the results have been published.

Personnel: Horace W. Babcock and Josef J. Johnson.

Carl Bachman and D. Wright Wilson, University of Pennsylvania

Grant No. 182 (1937). A cooperative study of sex hormones.

(a) The Gonadotropic Hormone of Urine of Pregnancy.

Many attempts have been made previously to purify the gonadotropic hormone of pregnancy urine. Progress has been slow because of lack of dependable methods for its purification. The compound is unstable and is excreted in very low concentration in urine. However, it has recently been shown that its concentration may be many times greater between the 60th and 80th days than at other periods of pregnancy. With the excellent collaboration of Dr. Samuel Gurin, we have developed a simple, inexpensive and well standardized method for obtaining highly active preparations of gonadotropin in good yield from early pregnancy urine.

After adsorption with benzoic acid, the active material is recovered by dissolving out the benzoic acid with acetone. The resulting product is extracted with 50 per cent ethanol at pH 6.0. The insoluble material is removed by centrifugation and the active principle precipitated with 2 volumes of ethanol. The precipitate is extracted with 50 per cent ethanol at pH 4.8 and the active material again thrown out by 1 volume of ethanol. The resulting precipitate has an activity of 1,000–3,000 m.e.d. (minimal effective doses for ovulation in the post partum rabbit) per milligram.

Treatment with iodine in potassium iodide, tannic acid or dialysis following removal of traces of protein by shaking with chloroform has yielded preparations containing 4,000 m.e.d. per milligram.

The best products appear to be glycoprotein. They respond to several protein color tests but tryptophane is absent. The material contains 15 per cent reducing sugar of which ⅓ is a hexosamine and ⅔ is galactose. Thus, it is possible that the hormone contains a carbohydrate having one hexosamine and two galactose groups. Galactose has been proven to be present by the response of the hormone to the colorimetric methods of Sörensen and Haugaard and of Dische.

GURIN, S., 1938 (with BACHMAN, C. and WILSON, D. W.). The Gonadotropic Hormone of Pregnancy Urine. Proc. Am. Soc. Biol. Chem., Jour. Biol. Chem. 123: xlix.

—— 1939. The Nature of the Carbohydrate in the Gonadotropic Substance of Pregnancy Urine. Science 89: 62–63.

—— 1939. The Gonadotropic Hormone of Urine of Pregnancy I. A Simple Method of Extraction and Purification. Jour. Biol. Chem. 128: 525–536.

(b) Urinary Excretion of Pregnandiol and Estrogen During Pregnancy in the Human.

The excretion of pregnandiol glucuronidate has been followed at weekly intervals for 7–8 months during 10 normal pregnancies, utilizing the method of Venning and Browne for the quantitative recovery of this substance from urine. The results obtained have confirmed in every particular those which have been reported by Browne, Henry and Venning. In addition, new data have been obtained concerning the output of this substance in the puerperium and during multiple and abnormal pregnancies.

In the case of the estrogens it was found that the results obtained on examination of urine extracts by available colorimetric methods were unsatisfactory. As a consequence the methods themselves have been restudied. In the course of this work certain improvements have been introduced into the technique of the original Kober color reaction for estrogens, and a new color reaction for estriol has been developed.

BACHMAN, CARL, 1939. Photometric Determination of Estrogens I. A Modified Kober Reaction for Determining the Total Estrogens in a Mixture of Estrogenic Steroids. Jour. Biol. Chem. 131: 455–462.

—— 1939. Photometric Determination of Estrogens II. A New Color Reaction for Estriol. Jour. Biol. Chem. 131: 463–468.

A. M. BANTA, Brown University

Grant No. 277 (1938). Cytoplasmic effects in uniparental inheritance in Daphnia.

In biparental inheritance reciprocal crosses between stocks of Daphnia longispina possessing either of the mutant characters studied, excavated head or sex intergradedness, it was found that when eggs came from the mutant-bearing stock and the sperm from the normal (non-mutant-bearing) stock, the sexually produced offspring, about 50 per cent of which carried the character, produced a higher average manifestation of the character involved than when the cross was made in the reverse direction. These differences in reciprocal crosses appeared conclusive. Such a result may find explanation in that the factors for the mutant characters affect the cytoplasm of the egg previous to fertilization.

Inasmuch as parthenogenesis in Daphnia is diploid, there theoretically being no opportunity for genic segregation during the one non-reductional maturation division of the eggs, all the parthenogenetic descendants of an individual should be genetically identical, except as a mutation occurs. However with the two mutant characters studied, both of which are highly variable in their manifestation, there was strong presumptive evidence that even among parthenogenetically produced clutch mates, a mother phenotypically low for the character produced uniparental, diploid offspring with a slightly lower manifestation of the character than did her clutch mates which themselves were phenotypically higher for the character involved. Only cytoplasmic influences would seem to account for such a result.

In an attempt to get critical evidence concerning such cytoplasmic effects experiments were set up as follows: clutch sisters having different grades of manifestation of the mutant character were reared in individual bottles of the same culture medium under as nearly identical conditions as could be provided. As many parthenogenetic young as possible were obtained from each mother. The offspring from each mother were graded with reference to the manifestation of the character. An average grade for all the offspring from each mother, in many cases 150 to more than 300 per mother, was thus obtained. The general average grade of offspring from mothers which were phenotypically of one grade of expression of the character was then compared with averages for offspring from mothers having other grades of expression of the character studied. The data thus obtained for the excavated head character revealed no evidence for a cytoplasmic effect in the inheritance of this character in parthenogenesis.

On the other hand extensive data for the sex integrade character appear to confirm the earlier evidence which suggested cytoplasmic effects in inheritance in parthenogenesis. Most of the differences between the average grade of offspring from groups of low mothers and from mothers with a higher grade of expression of the sex intergrade character were statistically highly significant.

Two difficulties were encountered in these extensive experiments involving the careful grading of more than 15,000 offspring. Our temperature control was not adequate and temperature influences the grade of expression of the sex intergrade character. Since, however, all of a given series were reared under the same temperature conditions it is highly improbable that temperature had a differential effect. The second difficulty while more serious does not invalidate the results. A few of the mothers utilized in the experiments proved to be mutants. Eliminating from the summaries data for offspring from all mothers which showed any suggestion of possible mutation the summarized data produced averages still suggesting that lower mothers produce parthenogenetic offspring with a lower expression of sex intergradedness than do their genetically identical sisters which are phenotypically higher in the expression of the character. Thus the results with the sex intergrade character appear to confirm the earlier suggestions of a cytoplasmic influence of the mother's phenotype upon the expression of this variable character in her parthenogenetic offspring.

The grant from the Penrose Fund was utilized in payment of salary of Dr. Thelma R. Wood whose time was devoted exclusively to this study. The work is being continued on a limited scale.

Banta, A. M., 1939. Studies on the Physiology, Genetics and Evolution of some Cladocera. Carnegie Institution of Washington, Publication No. 513.

Biological Abstracts

George W. Hunter, III, Chairman, Board of Trustees

Grant No. 235 (1938). Supplementary emergency support for the publication of abstracts from biological journals of the world.

An emergency supplementary grant was requested from the American Philosophical Society in the Spring of 1938 in order to realize the minimum budget of $40,000 necessary to continue the publication of *Biological Abstracts*. Through the cooperation of biologists throughout the world, the subsidizing educational institutions, and the American Philosophical Society, over 16,300 abstracts appeared in ten issues between May and December, 1938, followed by the index some months later.

The American Philosophical Society grant was utilized to defray the expenses of printing the index to Volume 12. This index, appearing by July 1939, carried the following expression of appreciation on its cover: "Grateful acknowledgment is made to the American Philosophical Society for their grant defraying the cost of publication of this issue."

Directly or indirectly, this grant was instrumental in facilitating a number of significant advances in:

(1) The number of journals covered. The year started with 385 journals being abstracted in January 1938, and had increased to 575 by October of that year. Further increases during 1939 have extended the list to about 1,150 journals.

(2) Abstracts have been published promptly. For example, the lag in one journal, picked at random, dropping from an average of 505 days between the appearance of the article and the abstract in 1928 to 88 days in 1938.

(3) Subscriptions have increased from about 1,931 in 1938 to 2,812 in December, 1939.

Thomas Hume Bissonnette, Trinity College, Hartford

Grant No. 268 (1938). Sexual photoperiodicity in animals and related phenomena.

Burger, J. Wendell, 1939. Some Experiments on the Relation of the External Environment to the Spermatogenetic Cycle of Fundulus heteroclitus (L.). Biol. Bull. 77 (1): 96–103.

—— 1939. Some Further Experiments on the Relation of the External Environment to the Spermatogenetic Cycle of Fundulus heteroclitus. Bull. Mt. Desert Isl. Marine Biol. Lab. (to be published).

Since there exists at present very little information about the factors which control the sexual cycle of cold water fish, a series of experiments were performed on the male killifish, Fundulus heteroclitus. Light which is an important factor in the periodicity of the sexual cycle of many warm-blooded vertebrates was not able to alter the velocity of the sexual cycle at any phase of the fish's cycle. The temperature of the water even in the almost complete absence of light was found to modify the cycle. Sexually inactive fish quickly formed large quantities of sperm when kept in water whose temperature was between 14–20° C. Fish kept at 6–10° C. remained sexually inactive. Similarly the testicular involution following the breeding season proceeded normally when fish were kept at temperatures normal for that season of the year (17–29° C.), but this involution was delayed by lower temperatures (11–17° C.). These experiments lead to the conclusion that the factor of external environment affecting velocity of sexual cycle of the male Fundulus is the annual cycle of water temperatures. Matthews[1] simultaneously with us published a like conclusion.

BURGER, J. WENDELL, 1939. On the Relative Rôles of Increased and Constant Periods of Illumination in the Sexual Photoperiodic Activation of the Male Starling. Jour. Exp. Zool. 80: 249–257.

—— 1939. Some Aspects of the Rôles of Light Intensity and the Daily Length of Exposure to Light in the Sexual Photoperiodic Activation of the Male Starling. Jour. Exp. Zool. 81: 333–341.

A study was begun with the purpose of defining the external conditions whereby light causes testicular activation in the male starling. It was shown that the sexually inactive starling is only affected by light manipulations when the individual lengths are greater than 9 hours. The present experiments seek to find whether or not sexual photoperiodic activation could be expressed as a product of duration of lighting × intensity of light as has been reported for the ferret. Sexually inactive birds were given 10½ hours of light daily (an exposure which merely initiates spermatogenetic activity). Control birds were given light from a 60 watt lamp. Another group of birds had the intensity of light received gradually increased from that coming from a 25 watt lamp to that coming from a 500 watt lamp. Neither group showed any significant spermatogenetic advancement. Birds given 15

[1] Matthews, S. A. The effects of light and temperature on the male sexual cycle in Fundulus. Biol. Bull. 77: 92–95. 1939.

hours of light daily showed synezesis stages in 15 days. Both the total number of hours of exposure to light and the total illumination was less for these latter birds than for the birds which failed to show spermatogenesis under gradually increased intensity of light. It is clear that sexual activation depends primarily on the daily length of illumination. Increased amounts of illumination can not be substituted for proper daily length of exposure to light. Other data relevant to the more general problem outlined in the first sentence were also secured, and further experiments are in progress.

BISSONNETTE, T. H., 1939 (with WILSON, E.). Shortening Daylight Periods Between May 15 and September 12 and the Pelt Cycle of the Mink. Science 89: 418–419.

A very crudely and irregularly carried out experiment on shortening the daily period of exposure to light for Mink (Luteola or Mustela vison) by curtaining the windows of a cellar during part of the day was carried out from May 15 to October 24. It led to shedding of summer coat and assumption of winter coat, prime except for reddish color due to summer diet of red meat, by six of sixteen animals before August 17 and September 18. Three other animals changed coat incompletely before October and others merely shed a few hairs in September and October and failed to change coat completely at the normal time with controls. They did so later in the winter. Controls, on normal days outside, changed coat at normal time in October to be "prime" during or after the first week of November. With them the reddish color was prevented by a diet of fish instead of red meat.

It is indicated that the assumption of prime winter pelt by mink is conditioned by length of day and may be induced in summer in spite of relatively high temperature or hastened in autumn by shortening the daily period of exposure to light. Reduced temperature in a refrigerator for short periods every second day may have helped one animal but certainly did not help another to make the change. Light control may, therefore, help fur-farmers to control their times of "pelting" older animals but can hardly be effective on young animals from spring litters.

BISSONNETTE, T. H., 1939 (with CSECH, A. G.). Modified Sexual Photoperiodicity in Cotton-tail Rabbits. Biol. Bull. 77: 364–367.

Cottontail rabbits were night-lighted from October 10 onward with periods increasing from one hour each night to eight by one hour each ten days and then maintained at eight hours until February and in one case into April. All pens were outside without heating, except a little from the light bulb. Replacements were made without altering the original schedule, when animals killed each other. Sex organs of unlighted controls were obtained on December 8 and January 25 for comparison with those of a lighted male killed by his mate on January 12 after night-lighting for eight hours each night from December 20.

The original objective, induction of winter litters, was not attained, because, after varying times of lighting, one member of each pair killed the other and replacements were made on schedule. Sex organs of males were modified to complete sperm formation in twenty-three days in the period between December 20 and January 12 and mating libido reached, accompanied by breeding condition of the epididymis. Controls showed mating libido slightly later in time but no sperm formation or epididymal activation. Lighted females mated and made nests, in one case lined with fur for the reception of young that never came. Control females mated but made no nests. No pregnancies occurred in any females, controls or experimentals, until April.

The induced changes indicate that these rabbits can be brought into breeding condition in winter by increased lighting; but modification of the method used and provision of warmed nest-boxes are necessary for successful winter breeding and rearing of these animals.

BISSONNETTE, T. H., 1939. Sexual Photoperiodicity in the Blue Jay (Cyanocitta cristata). Wilson Bull. 51: 227–232.

The Blue Jay (Cyanocitta cristata) was tested for sexual photoperiodic response in December. Males responded to added lighting by almost, if not quite complete spermatogenesis and activation of the epididymis to breeding condition in twenty-eight days. Females also responded but more slowly and less completely, with oviducts much increased in size and activity in most lighted birds. Exact uniformity of stages of germ-cells was not found in males taken from the wild within ten minutes of each other in

March, nor in experimentally activated birds in December. Ovaries exhibited similar variation. Blue Jays are better suited than starlings for experimental work because of hardiness, good temperament, and larger germ-cells and nuclei in smaller testes. They are very easily fed in captivity.

BISSONNETTE, T. H., 1940. The "Mule" Pheasant: Sex-invert or Intersex? Jour. of Hered. 31: (In press).

A study was made of plumage of one and sexual organs of two sex-inverted or intersexual pheasants, called by pheasant breeders and sportsmen "mule" pheasants, as compared with those of the normal hen pheasant in January. One of these "mules" was sent to us in the skinned condition two days after it died on October 3, the other was taken alive with a normal hen pheasant on January 20, and properly killed and fixed for histological study.

The plumage of the "mule" pheasant is mixed male and female, with the ring on the neck only partly formed and the tail mostly male in type of feathers. Its size is that of the hen pheasant. Right gonad rudiments were not identified in either the hen or the "mules" and therefore no evidence of their activation was found. The left gonad or "ovary" of the "mules" is without egg follicles or eggs, either lost or never developed, and the one killed in January possessed sex-cords and tubules of the male type in which Sertoli cells give signs of an early stage of activation. Certain regions in the left "ovaries" of both "mules" studied may permit interpretation as having resulted from regression or degeneration of previously existing ovarian follicles or as cysts or pus pockets undergoing resorption. Both the "mules" and the normal hen pheasant possess homologues of left epidymis and vas deferens. The shape of the left gonad of the two "mules" studied was that of an incompletely developed ovary, not that of a testis.

Some features of these birds in relation to the problem of intersexuality or sex-inversion in birds and mammals are pointed out and discussed.

FRANCIS BITTER, Massachusetts Institute of Technology

Grant No. 126 (1937). Experiments on the production of intense magnetic fields, and their effect on matter; operation of the new electromagnets at Massachusetts Institute of Technology.

The magnet laboratory has been operating satisfactorily for over a year and preliminary results have been published in the papers referred to below. Work is continuing on these lines, and is being extended to include investigations at low temperatures under the direction of Prof. F. G. Keyes.

Bitter, F., 1939. The Design of Powerful Electromagnets, Part IV, The New Magnet Laboratory at M. I. T.; R. S. I. 10: 373–381.
—— 1939 (with Kaufmann, A. R.). Magnetic Studies of Solid Solutions, Part I, Methods of Observation and Preliminary Results on the Precipitation of Iron from Copper. Phys. Rev. 56: 1044–1051.
—— 1940 (with Harrison, G. R.). Zeeman Effects in Fields up to 100,000 Gauss. Phys. Rev. 57: 15–20.

B. Edwin Blaisdell, Massachusetts Institute of Technology

Grant No. 329 (1939). Numerical integration of Laplace's differential equation for the equilibrium meridian of a fluid drop of axial symmetry.

In this laboratory an experimental study of the thermodynamic temperature scale has been under way for some years. The thermodynamic scale has been realized in the range 0° to 450° C. by the use of constant volume gas thermometers, and the experimental technique has been refined to such an extent that at the higher temperatures the uncertainty in the capillary depression and the meniscus volume of mercury is a relatively large source of error. For this work we wish to know the capillary depression to 2 per cent and the meniscus volume to 0.2 per cent for tubes of about 20 mm. diameter; these quantities to be given in terms of the readily measurable variables: tube diameter, meniscus height and capillary constant, where the capillary constant is to be deduced from simple measurements made upon the meniscus *in situ*. Such information is not at present available.

This lack has been filled by numerical integration of Laplace's differential equation for the equilibrium meridian of a fluid drop of axial symmetry in a gravitational field. The integration has been carried out in dimensionless form, all lengths being expressed in terms of the capillary constant as a unit.

From the above work tables have been prepared giving to five significant figures the slope and radial coordinate in terms of the height coordinate and the radius of curvature at the crown of the drop. These tables permit the evaluation of the capillary constant from X-ray photographs of the mercury meniscus.

Further, tables have been prepared giving to five significant figures the capillary depression and meniscus volume as functions of meniscus height and tube diameter.

The tables already prepared cover tube diameters from 20 mm. to 10 mm. Receipt of the grant is enabling their extension, by recalculation of the results of Bashforth and Adams, to tube diameters from 10 to 1.5 mm. The first part has been accepted for publication in the *Journal of Mathematics and Physics* for July, 1940.

ADAM G. BÖVING, Smithsonian Institution

Grant No. 321 (1939). Morphological investigation of the taxonomically important structures of the larvae of the beetles of the genus Phyllophaga.

In May, 1939, the committee on research of the American Philosophical Society and the National Academy of Sciences jointly sponsored a two years' morphological investigation of the taxonomically important structures of the larvae of the genus Phyllophaga. The work of the first year has been made possible by a generous grant from the Penrose Fund.

The plan for the investigation as originally presented included the accumulation of a large amount of well preserved, reared material of the larvae of as many as possible of the more than 100 North American species of the genus.

Prior to July, 1939, when the investigation sponsored by the American Philosophical Society began, larvae of 52 species were available for study in the collection of the National Museum. Since this date, more and better material of these 52 species has been collected, and reared larvae of eight more species have been added.

The larvae of each of these 60 species have been dissected, the parts mounted permanently in Canada Balsam on slides, and, because many minute and easily overlooked structures are of great taxonomic value, an elaborate new terminology has been worked out to facilitate their precise observation and description.

It has been considered a problem of primary importance to find out whether the larvae of the species would form groups within the genus corresponding to the 18 groups in which the species are arranged according to the old, but not yet revised classification of the adults, by Geo. Horn (*Trans. Amer. Ent. Soc.*, Vol. XIV, 1887, 209–296). The answer may now be given as affirmative.

In general, the classification of the larvae approximates the customary classification of the adults, and it would almost coincide with it if the old arrangements by Horn were revised in accordance with the ideas of the modern taxonomists who have made thorough studies of the divergent patterns of the genitalia in the various species.

In the proposed classification of the larvae the species fall into twelve groups. Each of the groups is diagnosed by a number of characters, but particularly by a single indicative character by which any of its members is easily distinguished from the larvae of the other groups.

A comparison of the arrangement of the species in the Horn classification and in the present larval classification reveals two essential differences.

In the first place, Horn established his groups XII to XVI for several species which, in the opinion of modern taxonomists, should have been placed in the beginning of the system, because they have symmetrical male genitalia like the species in his groups I to VII, while the species in his groups VIII to XI generally have asymmetrical and complicated male genitalia. The larvae of the species placed by Horn in his groups XII to XVI are listed in the groups 1 and 2 of the present larval classification. Consequently, if Horn's five groups, XII to XVI, were placed before his group I, his classification and the present larval classification would appear more similar than they do now.

The second essential difference between the present classification and that of Horn concerns the many species listed in the latter's group IX. Horn has frankly admitted (p. 265) that he joined a great number of unrelated species to form this group. It was done solely because he had been unable either to segregate them into separate groups or to associate them properly with species in established groups.

However, according to the larval classification, these species are readily arranged as follows: (1) Six closely related species are the only ones which remain in group 8 which partly corresponds to Horn's original group IX. (2) A single species, luctuosa, belongs definitely in larval group 10, connected with the species calceata for which alone Horn created his group VIII. (3) Six species forming the larval group 11 are closely related to all the species included in Horn's group XI. (4) Three species form the well-defined larval group 12. (5) Finally, two species are placed in the larval groups 7 and 9.

This radical rearrangement of the species in Horn's group IX would almost coincide with a rearrangement of the same species if made according to the development of the genital organs in the adults.

JEAN BROADHURST, Teachers College, Columbia University

Grant No. 250 (1938). Preliminary investigation in the use of a scarlet fever virus for testing susceptibility or immunity.

The work so far conducted under this grant of the American Philosophical Society is divided into two phases: (1) the experimental testing of 48 laboratory animals (mainly chicks and rabbits) with scarlet fever blood and with cultivated virus; and (2) a method of securing adequate amounts of virus developed in tissues possessing greater resistance than would be met in the isolated tissue present in tissue cultures.

The first phase, the experimental tests on laboratory animals, has not yet given consistent results (skin effects, blood pictures) and a report on this part of the work must be deferred until more work is completed.

In the meantime, we can report for the second phase that the virus present in the blood of scarlet fever patients can be cultivated by inoculating the chorio-allantoic membrane of chick embryos, a method now used in many places for the propagation of the smallpox and certain other viruses.

Judging from our results with chick embryo inoculations, the virus present in scarlet fever blood does not readily adapt itself to the conditions found in the developing chick, for our first efforts with eight different specimens of blood from "uncomplicated scarlet fever cases" taken the second or third days of the attack, were not successful, although we used chick embryos of various incubation ages (7 to 15 days) and employed various amounts of filtered and unfiltered scarlet fever blood. A wide variation was also tried for the incubation period following inoculation—from three to eight days.

The satisfactory virus character of the blood used was assured by the fact that, later, when parallel inoculations of the scarlet fever filtrate (Jena glass filter, 5 over 3) were made into tissue cultures and into chick embryos, the virus multiplied in the tissue cultures even though no evidence of virus growth was noted in the chick embryos. When, however, an established tissue culture virus preparation was used to inoculate the chick embryos, growth was obtained. The eighth serial transfer in tissue culture was so used to inoculate the chorio-allantoic membrane and numerous inclusion bodies, indicative of this virus, developed in the inoculated membrane. To date, the virus has been carried through six serial transfers in multiple sets of chick embryos with heavy infection of the inoculated membranes. The embryos were, for the most part, inoculated after 7 to 10 days of incubation and re-incubated for 4 or 5 days before examination.

The filtrable character of this virus is further supported by filtration of the material used to inoculate the chick embryos in the third serial transfer and the development of the characteristic inclusion bodies in it and all later inoculations in the series.

The full report of this chick embryo work, with illustrations, will appear later in the PROCEEDINGS of the American Philosophical Society.

MARY BUTLER, University Museum, University of Pennsylvania

Grant No. 181 (1937). Study of Maya archaeological material, chiefly pottery, from Chamá, Alta Verapaz, Guatemala.

The archaeological importance of the North Guatemala department of Alta Verapaz lies not only in its long occupation by Maya peoples but also in its strategic location between the great stone Old Empire Maya cities of the low-lying Peten-Usumacinta region to the north and the Highland Maya country to the south. Archaeology, Spanish Colonial history, and contemporary economics bear witness to the enduring importance of north and south trade routes through the Verapaz. The purpose of Grant No. 181 was to work out, through analysis of available archaeological material and through field work, a chronological sequence for the Maya prehistory of this area that would not only fill a gap in the archaeological picture but help to date related parts of the Maya area and clarify their interrelations.

A study was made from September 1938 to January 1939 of the only relevant archaeological material in this country, a carefully annotated collection in the University of Pennsylvania Museum, consisting of pottery and associated objects, largely tomb material, from Chamá on the western edge of the Alta Verapaz and Chipal and related sites to the west of Chamá. On the basis of stratigraphy and association, three main periods were established, called, from the river drainage on which all the sites lie, Chixoy I (Black Ware), Chixoy II (Decorated Cylinder Jar), and Chixoy III (Plumbate-Fine Orange).

While this Chixoy sequence was corroborated in its main points by those already worked out in other parts of the Maya area, it was based on a relatively small group of selected objects. I hoped, therefore, in going into the field, to check it by work at Chamá and nearby sites, but when local conditions made this inadvisable, concentrated on the Cobán-Carchá area, about twenty miles southeast of Chamá. Here excavation of a hill-top temple site and a hill-top tomb, and testing of mound complexes, during the three months of the dry season (February 15 to May 15, 1939), established three main periods, related to and showing contact with those of Chamá, but defining in the Alta Verapaz another ceramic sub-area with marked local characteristics. The earliest of these periods shows in its lowest level a possible connection with the "Archaic" culture that in the Maya area as in Mexico is the earliest that we know.

The picture that is beginning to emerge may take a totally different emphasis as more work is done. At present, the earliest pottery in these Highland valleys seems to be localized in feeling, material that shows no connection with the so-called "classic" Maya tradition of fine representational art. This tradition appears in the second period in a wave of influence that in the Alta Verapaz expresses itself in fine polychrome, carved, incised, and effigy, pottery vessels. The last general period shows a logical development from the preceding one in the conventionalization of cut, and the degeneration of painted, technique. Sherds of Usumacinta-Highland carved Fine Orange bowls, a final flicker of the old style, serve as a common denominator for this period; Plumbate Ware, consisting of lead glaze vessels apparently made in Salvador, appears in the western sites, implying a trade contact in that area lacking in the east. Translation of these shifts and changes into their human terms of migrations, trade, and conquest, must unfortunately wait until much more digging has been done.

The work done so far in the Alta Verapaz has found no fine stone carvings, but has noted architectural developments of a fairly complex nature, though lacking the large dressed-stone structures of famous Maya ruins. It has, through study of pottery and its associations, established three main periods in Alta Verapaz prehistory and identified two ceramic sub-areas, Chamá and Carchá, in the Kekchí-speaking, western part of this department, with another ceramic group, represented by Chipal, on its western border in the department of Quiché.

During a visit in February to the department of Suchitepequez, an archaeological survey was begun of the region just north and west of Patulul, on the trade route from Lake Atitlán to the Pacific. The pottery from three small sites was homogeneous enough to be considered typical of the last pre-Columbian period in that area. Its most interesting feature was the prevalence of textile-impressed sherds, probably fragments of tortilla griddles. Plain-cloth, duck, and gauze weaves, plain and in striped patterns, can be identified from the impressions, which assume real importance in the light of the almost complete destruction by damp soil of pre-Columbian Maya fabrics.

Further field work will be carried on during the season of February to May, 1940.

Edwin F. Carpenter, University of Arizona

Grant No. 216 (1938). The distribution of color-index in the extra-galactic nebulae.

During the year 1939 further observational material was obtained photographically with the 36-inch reflecting telescope, and progress was made in establishing photographic and photovisual magnitude sequences around the program nebulae.

With the tracing densitometer, a portion of which was obtained with the aid of this grant, the faint blue isophotes have been constructed for a number of nebulae of representative types. From the material at hand, especially with reference to nebulae which we see from their equatorial planes, it seems to be a general feature of the elliptical nebulae that the larger and fainter isophotes are less elliptical than the intermediate ones which give the nebulae their apparent forms. The effect is judged to be not uncommon in the early and possibly in the intermediate types of spiral nebulae as well, but it has not yet been found in any of the late types. These large rounded isophotes appear to arise from a voluminous but rarified system of stars which extends far beyond the conventionally regarded boundary of the nebula and which is subject to a much slower rotation.

E. F. Castetter, University of New Mexico

Grant No. 194 (1937). Comparative study of primitive cultivated plants among the Indians of the American Southwest.

This grant was made to cover a two-year period, and the work done during the first year was essentially exploratory in nature. This was done in order to delimit the field of investigation, define the problem as specifically as possible, make necessary contacts, and to locate the most promising places for study, as well as to ascertain where it would not be profitable to pursue further inquiry. Although a considerable amount of definite information was secured during the first year of study, the period was regarded, nevertheless, as one of exploring and defining the field.

The second year of the two-year period—1939—was devoted to intensive study of a few selected places. During the first part of the year, the data gathered on the extensive trip to the Pima-Papago, Maricopa, and Colorado River tribes in November, 1938, were digested and carefully integrated.

Only a relatively few trips were made in 1939, but each was made only after assembling as much material as possible from our own field notes as well as from the literature. This was done for the purpose of conserving the financial resources as much as possible.

The trip from November 4 to 29, 1939, to the Pima and Papago Indians was made only after four solid months of study of everything available on the agriculture and ethnology of these tribes. It was believed that with this preparation it would be possible on this trip to finish the work on these tribes. To our gratification we feel that we have thus entirely finished the study of these tribes, with the exception of a few possible controversial points which may arise during the writing of the paper on the Papago-Pima. These points can be cleared up readily by a few hours' visit to these tribes en route to the Colorado River tribes. We firmly believe this method to be more productive and much less expensive than making two or more trips with less adequate preparation.

On this Papago-Pima trip we followed a plan which we had hitherto not used. On all preceding trips Dr. Bell and I worked together using a single informant and an interpreter. This was done for the purpose of working out our technique, checking and having a common understanding as to the method to be followed and the objectives to be attained. On this last trip we worked separately, each working with different informants and different interpreters. With the accepted technique worked up on previous trips, we found this new method to work very satisfactorily. We accomplished fully twice as much as if we had worked together and both feel that the quality of the results obtained was just as high as if we had worked together. Our plan in all our future undertakings is to work separately. We believe that we can get the job done at much less cost than if we were to work together.

The plan for our future investigations is to work each tribe intensively without further exploratory work. We believe we have surveyed the field sufficiently that now we have the whole matter well enough in hand to be able to proceed directly with intensive study of the several tribes.

In addition to the above-mentioned trips made during 1939, we also made fifteen trips to pueblos located near Albuquerque. As these involved no large amount of travel, no charges were made against the project but the expenses were defrayed personally. A considerable amount of contact work and creating of good will among the Pueblo Indians has, as always, been necessary.

We recently have encountered a very fortunate situation from the standpoint of the project. One of the outstanding Indians from San Felipe Pueblo has been confined in the Indian hospital at Albuquerque for a persistent but not serious ailment. We had made contact with him before he came to the hospital. While here in Albuquerque I have visited him three times a week and on each occasion have used him for two hours as informant on San Felipe agriculture. He speaks English well so that no interpreter is necessary. The importance of our good fortune can scarcely be overestimated, for Pueblo Indians are very reluctant to impart information when in the pueblo, but sometimes talk freely when they are away from home and away from the watchful eye of their own officials.

Our investigations during the past year have constituted intensive studies of such main topics as:

1. Former home or location.
2. Field location and selection.
3. Ownership and inheritance of land and crop.
4. Primitive agricultural implements.
5. Clearing new land.
6. Annual cycle—seasonal life.
7. Planting—time, method, etc., for each crop.
   Ritual of planting.
8. Cultivation.
   - *a.* Irrigation.
   - *b.* Cultivation—methods and times.
     Rotation of crops, fertilizing soil.
   - *c.* Ritual of cultivation.
9. Harvest.
   - *a.* Time.
   - *b.* Methods.
   - *c.* Ritual of harvest.
10. Storage.
    - *a.* Method.
    - *b.* Place.
    - *c.* Ritual of storage.
11. Seed selection and knowledge of inheritance.
    - *a.* Ritual of seed selection.
    - *b.* Methods of seed selection.
12. Crop utilization.
13. Kinds of crops grown anciently.
    - *a.* Semi-cultivation of certain plants.
    - *b.* Crops grown, in order of importance.
14. Detailed consideration of the growing of each crop.
15. Consideration of important wild food plants.

A considerable number of the crop specimens gathered were grown on a one acre plot of ground in the Rio Grande Valley near Albuquerque in the summer of 1938 and again in the summer of 1939. This was done at no cost to the project. These crops were grown for the purpose of observing them under practical field conditions, to make variety determinations, and also to make certain genetic studies, particularly in corn.

Dr. E. A. Anderson, Geneticist of the California Institute of Technology, has grown for us a number of our maize specimens with a view to making certain genetic studies on them.

All tobacco specimens secured have been or are being grown by Dr. T. H. Goodspeed, of the Department of Botany of the University of California, for varietal and genetic determinations.

Cotton samples secured are being grown by Dr. Kearney of the U.S.D.A. at Sacaton, Arizona, with a view to determining varieties.

All bean samples secured have been sent to Dr. W. W. Mackie, Agronomist at the University of California, who has determined the varieties.

CASTETTER, E. F., 1939. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1938: 150–151.

LOUIS W. CHAPPELL, West Virginia University

Grant No. 317 (1939). To aid in making disk-recordings of folk-songs in West Virginia.

The project of recording folk-songs in West Virginia has been under way three summers, other seasons of the year not being suitable for field work off the main highways. I record all types of folk-songs in oral circulation in the state, our indigenous songs, creations outright and by adaptation, and local survivals from Europe, mostly English, Scotch, and Irish. Whether native or foreign as to matters of origin and early history, they all belong to our cultural heritage.

I have been using the "Sounscriber," the recording machine employed in making *The American Dialect Atlas*, with highly satisfactory results. The media I use are aluminum and cellulose "acetate" disks.

These records, after the songs are transcribed for the purpose of publication, are preserved for voice and speech study.

ELIOT R. CLARK, University of Pennsylvania

Grant No. 275 (1938–39). Growth and behavior of cells and tissues as observed microscopically in the living mammal, with the aid of transparent chambers and windows.

The extension of a grant from the American Philosophical Society, made for 1937–1938, to cover the time from October 1938 to July 1939 has made possible the uninterrupted study of a number of problems already in progress (see Report of Committee on Research 1938). The research activities during the period of October 1938 to July 1939, made possible by this grant, are briefly as follows:

Dr. E. R. Clark and Mrs. E. L. Clark have continued microscopic observations of living cells in transparent chambers installed in the ears of rabbits adding new data to previous observations on the behavior of blood vessels, lymphatic capillaries and macrophages. A study on the extra-endothelial cells of living blood vessels and another on the new formation of fat have been completed and prepared for publication.

Dr. R. G. Williams continued his microscopic studies on living functioning thyroid follicles transplanted to the ear chamber and carried out a number of experiments on the behavior of the follicles following the administration of sodium iodide and thyreotropic hormone, some of which have been published during the year.

Dr. R. G. Abell continued work on a number of problems using the "moat" chamber in which chemicals can be installed and removed without mechanical injury to the tissues. By means of a new modification of the method he carried out quantitative studies on the rate of passage of nitrogenous substances through the walls of growing capillaries as compared with differentiated capillaries. He continued observations with Dr. Clark on permeability of capillaries and on their reaction to histamine. He has also studied the reaction of the vessels and cells to a disinfectant (metaphen).

Dr. Mary L. Stearns, holding a Finney-Howell Fellowship, completed and prepared for publication two studies on the growth, differentiation and behavior of connective tissue in transparent chambers and continued observations on the reaction of cells to carcinogenic substances.

Dr. Max Samter, Guest Fellow, carried out preliminary experiments with the purpose of finding out if possible, with the aid of vital dyes, the cells which are involved in certain phases of the anaphylactic reaction.

Mr. Darrow Haagensen, recipient of a fellowship from the Air Hygiene Foundation, commenced a study of the reaction of living cells to silica installed in the transparent chambers. He recently made a preliminary report of his experiments at the meeting of the Air Hygiene Foundation in Pittsburgh.

Dr. H. A. Zintel and Mr. J. A. McClenahan have made progress in their experiments for installing an observation window in the thorax for observation of the living lung.

Mr. Talbot has continued his attempts to devise and install a chamber for observations of the liver.

CLARK, ELIOT R., 1938 (with WENTSLER, N. E.). Pial Circulation Studied by Long-continued Direct Observation. Proc. Assoc. for Res. in Nervous and Mental Dis. 18: 219–228.

—— 1939 (with CLARK, ELEANOR LINTON). Microscopic Observations on the Growth of Blood Capillaries in the Living Mammal. Amer. Jour. Anat. 64: 251–301.

—— 1940 (with CLARK, ELEANOR LINTON). Microscopic Observations on the Extra-endothelial Cells of Living Mammalian Blood Vessels. Amer. Jour. Anat. 6: 1–49.

—— 1939. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1938: 153–155.

WILLIAMS, ROY G., 1939. Observations on the Formation of New Follicles in Living Grafts of the Thyroid Gland of Rabbits. Anat. Rec. 73: 307–317.

—— 1939. Further Observations on the Microscopic Appearance and Behavior of Living Thyroid Follicles in the Rabbit. Jour. Morph. 65: 17–51.

ABELL, RICHARD G., 1939 (with CLARK, E. R.). Studies on Intercellular Substance. Proc. Amer. Assoc. Anat., Anat. Rec., Suppl. 73.

—— 1939. Quantitative Studies of the Rate of Passage of Nitrogenous Substances Through the Walls of Growing and Differentiated Mammalian Blood Capillaries. Biol. Bull. 77, October.

STEARNS, MARY L., 1939. Growth and Differentiation of Connective Tissues as Observed Microscopically in the Living Rabbit. Proc. Amer. Assoc. Anat. 73, March; also Proc. Physiol. Soc. of Phila., Amer. Jour. Med. Sc., May.

—— 1940. Studies in the Development of Connective Tissue in Transparent Chambers in the Rabbit's Ear. Amer. Jour. Anat. 66: 133–176. (A second paper in press, Amer. Jour. Anat.)

RALPH E. CLELAND, Indiana University

Grant No. 202 (1938). Continuation of work on cytogenetics and phylogeny of Onagra (evening primrose).

Considerable progress was made during the year 1938–39 on the phylogenetic analysis of Oenothera, sub-genus Onagra. Previous to this year, very few complexes had been analyzed completely from the standpoint of their segmental arrangements. During the year, over twenty complexes were reduced to a single possibility, or at the most, to two possibilities. It is now clear what type of segmental arrangement each complex has, and on the basis of this information, plus other criteria, it is found that the forms so far analyzed belong to certain cyto-genetically rather well defined groups of races, which may be tentatively called the hookeri, irrigua, strigosa, biennis and grandiflora groups. Each of these groups is characterized by a distinctive type of association between complexes. For example, biennis forms have thus far been shown to have egg (or α) complexes which produce biennis characters and which are segmentally similar to the hookeri complexes; and pollen (or β) complexes which produce narrow-leaved hybrids and which are segmentally much less closely related to the hookeri.

The work thus begun is being carried on with the aid of the Rockefeller Foundation and it is hoped that the story of phylogenetic relationships in Onagra will be complete in its essentials within another five years.

During the year, preliminary work was started on the cytogenetics of certain other sub-genera of Oenthera which have not hitherto been studied. Already interesting results are being obtained.

A summary of the work carried out during the year was presented before the 7th International Genetics Congress in August, 1939. This will be published in expanded form as soon as another paper presenting detailed findings has been printed.

Cleland, Ralph E., 1938–39. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1937: 142–146; for 1938: 155–157.

Benjamin R. Coonfield, Brooklyn College

Grant No. 349 (1939). Investigation on the problems of regeneration in the ctenophores and color change in embryo fishes.

1. The Pigment in the Skin of Myxine glutinosa.

Adult specimens of Myxine glutinosa collected from Passamaquoddy Bay were studied to determine their responses in color to backgrounds and to other stimulations. It was found that this animal changes in tint of coloration very slowly. It becomes dark when kept over a black background, pale when subjected to a white background, very slightly pale when in total darkness, and pale when injected with adrenalin. These changes in degree of paleness or darkness are believed to be accomplished by a disappearance of melanin or by a reappearance of this pigment. It is believed that a humoral agent acts in a coordinating capacity in these responses of this cyclostome.

(To appear in the *Transactions* of the American Microscopical Society.)

2. The Chromatophore Reactions of Embryos and Larvae of Pomacentrus leucostictus.

The young of Pomacentrus in stages of development from their very beginning up to three or four days after hatching were studied. The chromatophore responses of these young fish were observed as these animals were being subjected to backgrounds and to other experiments. Attention was given to the melanophore reaction especially during these experiments. The melanophore picture of the developing embryos up to a few hours before hatching is described as their being in the stellate state. During this time these embryos did not change in tint when they were kept over a black background or over a white background, or when they were kept in total darkness. These melanophores did contract, however, during this time in development of the embryos when these animals were subjected to cold temperature and when their bodies were stimulated by pressure (contact). Just before hatching and for a period lasting a few hours after the larvae were hatched they responded by a change in tint of color to background stimulations and to the absence of light. They became pale when kept in total darkness, dark when kept over a black background, and pale when kept over a white background. Older larvae failed to give any conclusive response in color change to the experiments just cited herein. Both the normal and eyeless embryos and larvae gave exactly the same reactions to these experiments. The reactions of these fish signified by their responses to stimulations during the period of time which begins just before hatching and lasts to a few hours after they have hatched are believed to be due to the release of a humoral agent within the capsule which surrounds the developing embryo. The early response of the melanophores is believed to be the direct method of response and does not involve an intervening agency.

(This manuscript is being written and is to be published by Carnegie Institution of Washington.)

WILLIAM STEEL CREIGHTON, College of the City of New York

Grant No. 239 (1938). Completion of a handbook of North American ants begun in collaboration with the late Dr. W. M. Wheeler.

The grant was used to secure the service of an artist who prepared illustrations for a handbook on North American ants.

Two years before his death Dr. W. M. Wheeler suggested that the writer collaborate with him in preparing a handbook of North American ants. The work was begun and has been continued by the writer since Dr. Wheeler's death. During the past year good progress was made. A sabbatical leave permitted full time work on the project and greatly facilitated study on the ants in the collections of the American Museum of Natural History and the Museum of Comparative Zoology at Harvard. As a result the volume is well toward completion.

At an early date it was agreed that as many illustrations as possible should be included. This phase of preparation was a troublesome one since it entailed consumption of time needed for other studies. The grant made by the Society has been of particular value not only because of the results which it brought about but because it freed the writer for other work.

The illustrations for the handbook were made by Mrs. Shirley Risser. Through the courtesy of the American Museum Mrs. Risser was given the use of a laboratory and access to their ant collection. The high quality of the drawings could thus be supported by the authentic material from which they were drawn. Each of the fifty-seven genera which occur in America north of Mexico was illustrated by figures showing the characters of all known castes. This work in itself is of no small value since there is no illustrated generic key to our ants at present. In conjunction with the handbook these illustrations will be of great service in reducing the necessity for extensive generic description. As planned at present the handbook will include full bibliographic citations covering original descriptions and redescriptions, keys to genera and species, zoogeographical data, the location of type material and condensed ecological notes. The literature which covers this field is in large part unavailable to most students and it seems certain that a single source-book will be very useful. No definite plans for publication have been made but several people have expressed a desire to publish the volume. The material is at present in process of final typing.

LUTHER SHEELEIGH CRESSMAN, University of Oregon

Grant No. 302 (1939). Early man and culture in south central Oregon.

During the field season of 1939, we carried out further examination of the Paisley-Summer Lake region since we had excellently stratified sites there with occupation evidently beginning shortly after the recession of the water from the high-terrace Pleistocene level. Following this, we planned to carry out reconnaissance in the Pleistocene Lake Lahontan Basin in southeastern Oregon first to discover, if possible, productive archaeological sites and second, if such sites existed to examine the possibility of tying them in with sites of historic culture from the Snake River drainage of the Owyhee River region, which lay just north across the Great Basin-Pacific divide by the way of the Snake River drainage, in other words, to establish a continuity from the known to the unknown. Following the completion of this work we planned to carry our reconnaissance west to Alvord Valley which lies between the Lahontan area and Catlow Valley where previous work had been done. Alvord was a Pleistocene lake the west shoreline of which was formed by the rugged Steens Mountain and that on the east by the high, forbidding buttes and mesas running westward from the Lahontan area in Oregon. Our objectives here were essentially the same as in the Lahontan area.

I shall report on this work in the following order of regions: Lahontan, Alvord, and Paisley.

Our work in the Lahontan basin in Oregon was unexpectedly negative. A careful examination of several hundred square miles failed to show occupied caves or terrace camp sites. The amazing thing was the lack of even historic sites. Probably marked geological changes between an earlier period of high water and the latest through uplift, folding and faulting made the area at the last period of flooding unfavorable for human habitation. Water appears to have been shallow and no terraces were cut.

The few caves in the area failed to show signs of habitation.

The Lahontan area in Oregon is to be written off as an archaeological asset.

In the Alvord Valley we examined that part south of the Alvord Desert because it is the area where lake water would have lasted longest; it was just over the Pass from Catlow Valley and there was a good exposure of caves in the East Rim. The East Rim is devoid of springs and creeks so that any permanent habitation would have been dependent on lake water for drinking purposes.

Some ten caves were examined in the East Rim and two of these showed occupation on the gravels. In one of these the gravel was near the surface but without distinctive artifacts it lacks chronological significance.

Another cave showed the high beach gravels at a depth of 1.3 meters below the surface. On the gravels was a fire lens containing a few bones of waterfowl. About 10 cms. of fine soil, possibly aeolian, rested on the gravel. Above this was badly decomposed roof debris. The gravels were rotten and broke readily. The deposit was very damp, causing organic material to rot, and the only sign of human occupation was the fire lens on the gravel bed. This was, however, evidence of ancient occupation.

In the Paisley (Summer Lake) sites we completed the excavation of two caves partially worked in 1938 and dug a test pit in a third. The work in the first two caves verified the conclusions drawn as a result of the 1938 work and clarified some points not clear at the close of the 1938 season.

The third cave was of particular importance. At a depth of about six feet from the surface, after passing through recent occupational materials, pumice (Crater Lake) and sterile fine dust in this order from the top, we discovered a camp fire site on the old shore line containing many partially mineralized bones. These have been identified by Dr. Chester Stock who wrote me under date of July 22, 1939, as follows:

> "The bird bones included in the collection represent pintail, teal, duck, hawk, and sagehen. The mammals represent bison, mountain sheep, camel (possibly Camelops), horse, a large dog (wolf), a fox (perhaps red fox) and probably bear. Among these mammals are two genera, namely horse and camel, that we generally regard as more characteristic of the Pleistocene than of the Recent epoch. Some of the remaining forms do not range in the region where the cave is located at the present time. The avifauna suggests the presence of water."

The Paisley No. 3 Cave, which will be completely excavated during the 1940 field season, is convincing evidence of the presence of man with the Pleistocene or Early Recent horse and camel in south central Oregon. The Alvord caves are of little use because of the unfavorable conditions for preservation of specimens, and the Lahontan area is negative. In the immediate future, work will be concentrated in the dry lake regions of the South Central part of the State.

CRESSMAN, L. S., 1939. Carnegie Institution of Washington, Yr. Bk. for 1938–1939, 38: 314–317.

—— 1939. Early Man in South Central Oregon. *Pacific Science Congress, Stanford University.* Paper to be published in Proc. Pac. Sci. Congress.

FRED E. D'AMOUR, University of Denver

Grant No. 273 (1938). Study of the hormonal balance during the menstrual cycle, in its relation to ovulation, and an investigation of indirect methods to determine the time of ovulation.

This study falls into three divisions:

1. An attempt to identify the gonadotropic substance appearing at the presumed time of ovulation with some other, better known, hormone. The results of a number of qualitative tests indicate that this substance is probably identical with that produced during the menopause. The latter is believed to be of hypophyseal origin. From this fact, plus findings mentioned under 2, *b*, a tentative explanation of the hormonal mechanism of human ovulation is advanced.

2. An intensive study, in one subject, of the urinary output of sex hormones and an attempt to correlate subjective symptoms and mental tests with the urinary findings.

Eighteen menstrual cycles were assayed for gonadotropin and the last nine for estrin as well. Vaginal temperatures were taken during the last nine cycles. Mental tests (word association and reaction time) were administered for three cycles. Throughout the period of investigation, the subject kept careful note of subjective incidents which might make recognition of ovulation possible. The results were as follows: (*a*) More than one gonadotropic peak occurred in a number of cycles. (*b*) Estrin excretion occurred in two waves, usually preceding the gonadotropic peaks. (*c*) Vaginal temperatures were inconclusive. (*d*) Association and reaction times could not be correlated with hormone fluctuations. (*e*) Nothing in the sex life of the subject, nor in her physical or mental state could be correlated with hormone findings.

3. An attempt to develop a method whereby the same urine might be assayed for gonadotropin, estrogen and progestin (pregnandiol). The difficulty lies with the latter and no satisfactory

method has been worked out. This investigation is being continued under Grant No. 371 (1939).

D'Amour, Fred E., 1939 (with Funk, D., and Liverman, H.). Daily Gonadotropic Hormone Tests during Fifty Complete Menstrual Cycles. Am. Jour. Obst. and Gynec. 37: 940–946.

—— 1939. A Qualitative Study of Normal Gonadotropin. Amer. Jour. Physiol. 127: 649–653.

—— 1939. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1938: 159–160.

D. S. Davidson, University of Pennsylvania

Grant No. 193 (1937). Investigation of native tribes and archaeological remains in Western Australia, with reference to continental, historical and ethnological problems.

The purpose of this project has been the gathering of data on a number of continental ethnological and archaeological problems of Australia through activities in Western Australia. This state, which occupies the western third of the continent and embraces almost 1,000,000 square miles, heretofore has been entirely unknown archaeologically and has been investigated ethnologically only in certain districts, principally those where the natives are still relatively numerous. For over half the state the aboriginal population was found to be on the verge of physical extinction or faced with complete loss of native culture and since it is mainly from this region that very little information was available it seemed imperative that special attention be given this extensive area. The urgency of the situation can be understood when it is realized that in less than a decade there probably will be no natives who actually have lived under tribal conditions south and west of a line drawn from Northwest Cape to the border of South Australia at Eucla. Indeed, if we may judge by the steady decline in full blood children, who in many areas have virtually disappeared, the fatal susceptibility of the natives to common European diseases, and the rapid tempo of unorganized acculturation, it seems not unlikely that in less than a generation there will be few aborigines north and east of this line except in a few secluded districts in the Kimberleys and on the desert.

Over 20,000 miles were traversed in the southern, western and northern portions of the state. In all areas surface archaeology was investigated and excavations conducted on open sites and in rock shelters but sites prolific in other than extremely crude chips of stone employed at adze points or in "death" spears were not found nor were stratified deposits located. This poverty seems to be typical of Western Australia in decided contrast to certain eastern localities and is explainable in historic terms, for such prominent types of artifacts as polished stone axes and certain specialized blades have been diffusing westward toward the region in question. The basic lithic industry in Western Australia therefore can be considered as one of the most primitive of which we have record. Skeletal remains without associated cultural objects were excavated in a limestone cave at Yanchep under conditions indicating a minimum antiquity of several hundred years and a maximum antiquity of possibly several thousand years if certain geological factors could be satisfactorily determined. Rock paintings and carvings heretofore reported from only a few localities were found to be widely distributed throughout the state except along the southern and southwestern coasts.

Ethnological data on a number of questions were collected over extensive areas. These throw important light upon the history of aboriginal culture on the continent for it is now possible to define more accurately the distributions of many prominent aboriginal institutions and to indicate the routes of their diffusions, most of which are still going on or were continuing within the memory of living informants.

The results of these investigations are being prepared but none has been published as yet.

Helmut deTerra, Academy of Natural Sciences of Philadelphia

Grant No. 170 (1937). Geological and archeological studies on early man in Southeastern Asia.

In working out the observations and collections of the American Southeast Asiatic Expedition for Early Man it appeared that the results of these studies lend new aspects to the study of early human environments in Asia. One of these pertains to a new method of Pleistocene stratigraphy which, generally speaking, is based on the glacial cycle. The latter had previously been studied in some detail in Northwestern India where glacial chronology was instrumental in recognizing a sequence of Old Stone Age cultures. As

Burma is much further removed from the glaciated highlands than are the plains of northern India, it was a matter of special importance to have come across the same number of Pleistocene stages as in the case of India. The four glaciations correspond here to four alluviations in the valleys of Upper Burma, each of which is represented by gravels or terraces, or both. Such deposits are separated from each other by erosion intervals in very much the same manner as interglacial phases in the glaciated highlands. This observation makes it possible to subdivide the Pleistocene into seven stages instead of the usual three which had been based on paleontological records. The advantages of such a new system both for geological and archeological correlations is obvious.

Another new aspect is provided by soil geology. The soil samples collected in Upper Burma were studied by Dr. P. D. Krynine of the Pennsylvania State College soil laboratory. He has found interesting data to corroborate the geological observations on climatic changes which took place during the Ice Age in the northern tropical belt of Asia. Certain soil types, such as concretionary silts or laterite, make for reliable indicators of interpluvial and pluvial stages which were recorded in the Pleistocene column.

The studies are as yet not completed but it is hoped that such will be the case by the spring of 1940. Dr. Edwin H. Colbert, Associate Curator of Vertebrate Paleontology at the Academy of Natural Sciences at Philadelphia, is in charge of the study on the vertebrate fossils collected by the expedition. Dr. H. L. Movius, of the Peabody Museum of Harvard University, has undertaken the description and analysis of Stone Age artifacts collected in Burma and Java. These studies will help to clarify many of the puzzles which the distribution of Stone Age races in Southern Asia present.

H. deTerra, 1939. The Quaternary Terrace System of Southern Asia and the Age of Man. Geog. Rev., No. 1.

—— 1939 (with Paterson, T. T.). Studies on the Ice Age in India and Associated Human Cultures. Carnegie Inst. Publ. No. 493.

—— 1939. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1938: 130–131.

Malcolm Dole, Northwestern University

Grant No. 266 (1938). The influence of negative ions on the glass electrode.

With the aid of the grant the assistance of Dr. Richard M. Roberts was engaged from Dec. 1, 1938 to June 1, 1939, during which time the glass electrode e.m.f. measuring apparatus was completely overhauled and improved. The behavior of the glass electrode in solutions of sodium acetate and fluoride at several concentrations was studied and some preliminary experiments in solutions of potassium acetate and fluoride carried out. Beginning with the present academic year the study of the influence of fluoride ions and hydrogen fluoride on the glass electrode has been completed by the author and additional investigations of the effect of chloride and borate ions finished. A study of silicate solutions, which will complete the investigation, is now being undertaken.

At the present time the data indicate no general influence of negative ions, in agreement with previous conclusions of the author, but demonstrate that the glass electrode must not be immersed in 1 N fluoride solutions below pH 6.8 if the electrode is to function without abnormal behavior. The more acid the fluoride solution is the more the hydrogen electrode function of the glass surface is impaired.

Frank G. Dunnington, Rutgers University

Grant No. 198 (1937). A precision determination of the ratio of Planck's constant to the charge of the electron, that is, of h/e.

During the past summer and through the fall semester intensive work has been done on the h/e problem. In the report of last year mention was made that if the originally conceived method did not, in a short time, give indication of yielding satisfactory results, a newly conceived and certainly superior method would be used in its place. Further work did indicate the desirability of changing to this new method. Most of the reconstruction has been completed except for the machine shop work. It is anticipated that the latter will be finished within a month, and probably that the final measurements will be taken next summer.

The primary objective of this problem is to obtain information that will aid in the resolution of the existing discrepancy in the basic atomic constants. Since the initiation of this present work, no new work on h/e has been published, and the need of such information continues to be outstanding.

W. J. Eckert, Secretary, Astronomical Hollerith-Computing Bureau

Grant No. 262 (1938). A punched card catalogue of data for the stars in the Boss General Catalogue.

The stars contained in the Boss General Catalogue will form the basis of many observing programs and statistical studies. It is with the view of facilitating these researches that a card catalogue has been prepared and is now available to astronomers. The expense of preparing the catalogue has been defrayed by the grant from the Penrose Fund of the American Philosophical Society.

The card catalogue will be available to astronomers through the facilities of the Thomas J. Watson Astronomical Computing Bureau (formerly the Astronomical Hollerith-Computing Bureau). The catalogue will be kept at the Bureau where it may be used in connection with the various machines to furnish any information desired by an investigator.

The following uses of the cards are suggested:

(*a*) Statistical studies of the data on the cards. The customary operations of sorting, counting, taking means, and computing correlations are done most efficiently on the machines.

(*b*) The formation of duplicate sets of cards for use elsewhere. Such a set may be used in connection with a sorter which is available in many universities, or as an ordinary printed card catalogue. For this latter purpose the data punched on the cards may be automatically interpreted in type at the top of the cards.

(*c*) The transcription onto a printed sheet of selected portions of the information on the cards.

(*d*) The computation of additional quantities by means of the machines.

Robley D. Evans, Massachusetts Institute of Technology

Grants No. 276 (1938) and 373 (1939). International interchecking project on radioactivity.

Substantially all measurements in the field of radioactivity are relative rather than absolute in character. In order to place these measurements on an absolute foundation, it is necessary to have accurate radioactive standards available. For many years the U. S. Bureau of Standards has certified radioactive preparations whose strength was one milligram or greater. Such quantities of radioactivity are used mainly in therapeutic work. For the vast body of scientific investigations in radioactivity, no official and authoritative standards have existed.

The stimulus for the formal organization of an international program of calibration and standardization came from the interest and support of the American Philosophical Society. A committee of active workers in the field of radioactivity was formed under the Division of Physics of the National Research Council. The membership of this committee is as follows:

Robley D. Evans, Massachusetts Institute of Technology, *Chairman*.
L. F. Curtiss, National Bureau of Standards, *Vice-Chairman*.
Clark Goodman, Massachusetts Institute of Technology, Secretary.
Alois F. Kovarik, Yale University.
C. S. Piggot, Geophysical Laboratory of the Carnegie Institution of Washington.
S. C. Lind, University of Minnesota.

This committee is directing the preparation of national substandards of radioactivity which will be properly certified and made available for distribution through the National Bureau of Standards to all scientific workers in this country and abroad. Radium standards in varying strengths down to 10^{-11} grams of radium element, as well as thorium standards in the range of activities met in practical problems in radioactivity (down to 10^{-5} grams of thorium element), are being prepared.

A set of 12 certified standard rock samples have been prepared. These working standards are being used for intercalibration purposes among all active laboratories in the fields embracing terrestrial radioactivity. Results so far obtained indicate that major revisions will be required in re-evaluating the published work from some laboratories.

Due to the great importance of artificial radioactivity, which involves accurate β-ray measurements, several types of β-ray standards are also being prepared. These will have application in many fields of applied radioactivity as well as in pure nuclear physics where they are of value in many problems, such as in the determination of absolute yields from nuclear disintegrations, and hence in the calculation of nuclear cross sections.

MALCOLM F. FARLEY, Field Museum, Chicago (formerly of Fukien Christian University, Foochow, China)

Grant No. 346 (1939) Studies in the archaeology of China, and particularly of Fukien and the South China Coast.

The province of Fukien occupies the south central part of the China Coast and lies between 24° and 28° N. L. In prehistoric times it was the meeting place between the peoples from the north and the south in their various inroads. In later historical times it was during successive centuries the seat of important military and political activities. It was for centuries the very center of China's great international trade, particularly with the Arab countries of the Near East, and in more modern times it was the chief seat of the important clipper-ship tea trade. It is one of the most interesting and important and at the same time one of the least known historically, archaeologically, ethnologically, linguistically, and from the point of view of natural history of all the more important areas of China.

For almost seventeen years, from 1922 to 1939, as a member of the faculty of Fukien Christian University in Foochow, China, I devoted my spare time to a study of Chinese archaeology, and particularly to the archaeology, history and culture of Fukien and the South China coastal areas. This is a virgin field of research and one heretofore almost entirely uninvestigated.

In this field I have had during the years three main objectives. (1) To push back the history of Fukien as far as possible and determine her cultural contacts with the regions to the north, south, and west. (2) To reconstruct the history of the arts and crafts of Fukien, especially her greatest art, the art of ceramics, from the earliest times down to the present. (3) To determine the part played by Fukien ports, Fukien potters, and Fukien merchants in China's great international ceramic trade, especially that with the Near East from the days of early Arab supremacy down to much later times.

A further objective has been to make a comprehensive collection of the folk literature and music of the Fukienese before these important expressions of folk art should have become extinct.

Up to the time of my leaving China for furlough in July, 1937, extensive progress had been made along the line of each of these various objectives. I had travelled quite extensively up and down the South China Coast from Foochow to Hong Kong and Canton, and beyond to Manila, carrying on archaeological reconnaissance. I had searched much of this area for ancient dwelling dumps and kiln-sites and had discovered and excavated on many scores of them. In addition, hundreds of ancient grave sites—opened incidental to road building and other kinds of construction—had been carefully investigated. These investigations have yielded not only many new discoveries and facts, all important and some of real note, but they have enabled me to build up an outstanding and unique collection of archaeological material to serve as the basis for extensive future studies of Fukien and South China culture.

The furlough year of 1937–1938 was spent in Europe, America, and the Near East, particularly investigating the early ceramic trade between the South China Coast and the Arab countries of the Near East from about 850 A.D. down to modern times. Returning to the United States in the fall of 1938 I expected to return shortly or at once to China with my family. The war situation made it impossible for me to do so and kept me in this country, at the same time depriving me of my position and with it my support. The authorities of Field Museum, Chicago, very generously offered me a place and every facility to work. The American Philosophical Society with equal generosity made me a grant-in-aid from the Penrose Fund to enable me to continue my researches and writing at Field Museum during the summer and fall months of 1939.

In my work at Field Museum it has been my purpose to prepare a series of studies in the field of Chinese archaeology and particularly the history and culture of Fukien and the South China Coast, based upon my long years of field work, for the most part as yet unpublished. On this project I have been working since the Penrose Grant in June. I have now, December, 1939, completed two studies. The first, "A Study of Some Mirrors of Supposed Pre-Han Date," has been accepted by the Harvard-Yenching Institute and is scheduled for publication in the *Harvard Journal of Asiatic Studies* during 1940. The second, "Contribution to the Archaeology of the South China Coast, the Excavation of An Early Fukien Necropolis," has not been submitted to any editor for publication but will be so during 1940.

I should like to give a brief indication of the nature and contents of these two studies. The second, longer article will be given fuller treatment in a later report to this Society, presumably after it has received publication.

In the field of Chinese archaeology the study of early bronzes has for centuries played a most important part. Among these bronzes none have commanded greater interest than bronze mirrors. They have furnished within narrow limits an accurate guide to the evolution and development of styles in Chinese art, and technique in working the metal of the Chinese artist-craftsman's first choice, namely bronze. Add to these two the fact that mirrors are frequently inscribed and sometimes dated, and we have a series of master documents for the specialist in Chinese archaeology and history.

During the past score of years Japanese researchers in particular have developed this study to the point of a science and through it have made a notable contribution to Chinese archaeology. Chinese and European scholars have also made important contributions to it. In America, on the other hand, no considerable study has appeared since 1906.

Following a critical survey of the more important works in Chinese, Japanese, and European languages bearing on the subject, the present article discusses many matters of casting technique, styles of decoration, chronology, etc., from early pre-Han times (before 206 B.C.–220 A.D.) down to the Sung Dynasty (960–1280 A.D), but is particularly devoted to a study of a group of mirrors of supposed pre-Han date, based upon specimens in the Boston Museum of Fine Arts and the Fogg Museum of Art. Of these the Boston Museum specimen has been known for more than thirty years and considered as pre-Han. Indeed, of a very rare type, it has become "classic" as perhaps the first Chinese mirror in the West to be designated as pre-Han. The writer believes it to be T'ang, that is about a thousand years later than this date, and thus raises an extremely important question in Chinese mirror and bronze chronology and consequently in the matter of style evolution and influences, all of which problems are here treated in detail.

The writer's second study, which he expects to have published during the year, is a first account of the excavation of an extensive Fukien necropolis and a large number of graves and dumps of contemporary date in Fukien. The necropolis site is the first ancient cemetery of such extent to be excavated in Fukien or anywhere in the extensive coastal area from Hangchow Bay south to Hong Kong. The scores of graves of early Han to Sung date (206 B.C.–1280 A.D.) have yielded the largest body of material yet available bearing on the early culture of this important area, the center of the ancient coastal Kingdom of Yüeh.

The account of the excavation finds is followed by a study of cultural elements of the China coastal areas, and a first attempt to indicate a series of burial objects which seem to be common to centers from as far north as Hangchow Bay and south to Indo-China. These objects in the distinctive forms in which they here occur may be peculiar to the Yüeh peoples and culture, and may have been invented by them. (Fuller report to follow after publication.)

Finally, a third article, a summary report of some of the results of the writer's years of field activity, has been recently published in the Asia archaeological series in *Asia* for November, 1939. Though this article was completed before the writer received the grant from the Penrose Fund, since it has so recently been published, in it he has given full expression of his indebtedness to the American Philosophical Society.

FARLEY, MALCOLM F., 1939. Fukien—China's Rich New Field for Archaeology. A Summary Report of Sixteen Years of Archaeological Exploration and Discovery in Fukien, China, and Along the South China Coast. Asia, November, 1939; 640–646.

—— 1940. A Study of Some Supposed Pre-Han Mirrors Based Upon Specimens in the Boston Museum of Fine Arts and the Fogg Museum. Harvard Jour. of Asiatic Studies (in press).

—— Contribution to the Archaeology of the South China Coast, The Excavation of An Early Fukien Necropolis. In manuscript, 71 pp.

MARIE FARNSWORTH, American School of Classical Studies, Greece

Grant No. 322 (1939). Continuation of work in the field laboratory of the Agora Excavations, Athens, Greece, and a technological study of Greek pottery.

Besides the large amount of daily work involved in cleaning and identification in the field laboratory during the 1939 season (February–June), a beginning was made in the proposed technological study of Greek pottery. The black Attic glaze was found to be magnetic, thus making possible its separation from the clay pot in pure form. Its magnetic properties also disprove the commonly accepted statement that the black coloring matter is ferrous oxide. A fair amount of the glaze has been separated and spectrographic, magnetic, and x-ray investigations are being made. The study also includes the shiny and dull black protogeometric glaze.

Of the miscellaneous finds, the most interesting was a sheet of zinc of the fourth century B.C. A study of the literature shows this to be the first well authenticated find of this metal of such an early date. A spectrographic analysis showed the sample to be quite pure with traces of lead and copper and a very small trace of silver. A metallographic study of this specimen is now being made.

MERRITT L. FERNALD, Harvard University

Grant No. 310 (1939). Collection of plants in eastern Virginia and the Carolinas.

The field-work in eastern Virginia and the Carolinas was in continuation of work already in progress. These regions are classic ground in American botany, because many hundreds of types of North American plants collected by Catesby, Banister, Clayton and other colonial explorers were from the area between Chesapeake Bay and southeastern South Carolina. These and the later types from South Carolina of Thomas Walter (1788), from the two Carolinas of Bosc (18th century), and the types from Virginia and the Carolinas of André Michaux (1803) are all preserved in European herbaria and, therefore relatively inaccessible. Furthermore, the several hundred types of Stephen Elliott (early 19th century), from South Carolina and Georgia, stored for more than half a century in a musty basement at Charleston, are largely destroyed, although the recognizable remnants are now well housed at the Charleston Museum. One purpose of the summer's work was to secure as many species as possible from the areas known to Walter and Elliott in South Carolina; the other continuation of the analysis of the surprisingly complex components of the flora of the coastal plain of Virginia.

The intensive collecting in South Carolina was entrusted to Mr. Robert K. Godfrey, formerly of the University of North Carolina, who had successfully carried on botanical exploration in that state. Mr. Godfrey was accompanied by Mr. Rolla M. Tryon, Jr. Greatly aided by introductions to land owners by the Director of the Charleston Museum and with the cooperation of federal officers of the Santee Power project, they worked intensively from Georgetown southward and westward, chiefly in the lower Santee Valley, where the type-stations of Walter will soon be submerged. They were in the field continuously from mid-June to late September, securing more than 16,000 sheets of fine specimens in duplicating sets, so that the principal herbaria of the world will eventually receive a series of topotypes of Walter's species. The elucidation of this series is now in progress but it is too soon to report the final results.

My own work, in continuation of intensive study of the flora of the coastal plain of Virginia, was prosecuted in periods of two to three weeks each from June to the killing frosts of October. In this work I had the invaluable cooperation of Mr. Bayard Long of the Academy of Natural Sciences of Philadelphia. The object was not great numbers of specimens, but a highly selective collection of significant plants. Nevertheless we secured for critical study nearly 7,000 sheets which are entered in the accessions of the Gray Herbarium as "rarest plants of southeastern Virginia." Study of this material now in progress reveals fully 130 species never before recognized as growing in the state, about 30 quite new to science, several (about 20) not known since the old collections of Clayton or of Michaux, and a notable series of species with isolation on the geologically youthful coastal plain from the high Blue Ridge or other areas of the geologically ancient Appalachian Upland; from which, during Tertiary uplifts of the upland, they must have migrated out to the newly available younger territory: in one case a species characteristic of altitudes of 4,000–6,000 feet in the Blue Ridge, in another a famously rare plant of the mountains of Alabama and western Georgia isolated by 400 miles in pinelands of Prince George County, Virginia. These and scores of other isolations will be considered in the report now in preparation.

Study of the tidal estuaries of the James, the Chickahominy, the Pamunky and other rivers opened a new field of study, as yet merely begun. Here, in a habitat as ancient as vascular plants, though its geographic positions have been subject to many fluctuations, is concentrated an extraordinary flora of cooler pantropical and semi-cosmopolitan relationship: some species known wherever fresh tidal flats are found, in warm-temperate to tropical Asia, Africa, Australia, Polynesia, South America, the Atlantic Islands and southern North America; another heretofore known only from eastern and southern Asia; another heretofore known from the estuaries of La Plata River in South America and estuaries from Louisiana to South Carolina; others characteristic of the estuary of the St. Lawrence and those of New England; still others of the lower Delaware; and others, of world-wide relationship, now quite restricted (endemic) to the estuaries confluent with Chesapeake Bay or Albemarle Sound. These species, intolerant of salt water, are evidently relics of former geographic connections, when they could migrate in fresh water.

The detailed report upon this work must await further intensive study. Such results as became quickly available were included in the following paper, which reports chiefly upon explorations in Virginia immediately preceding the receipt of the grant.

FERNALD, M. L. Last Survivors in the Flora of Tidewater Virginia. Rhodora 41: 465–504, 529–559, 564–574. (Contributions from the Gray Herbarium of Harvard University, CXXVII.)

SIMON FREED, University of Chicago

Grant No. 287 (1938). The symmetries of the electrical fields about ions in solution and their relation to chemical thermodynamics.

I. FREED, SIMON, 1939 (with WEISSMAN, S. I., FORTESS, FRED E., and JACOBSON, H. F.). Ions of Europium Distributed between Different Configurations in Homogeneous Solutions. Jour. Chem. Phys., 7, 9, 824–828.

Here it was shown that not only do the electrical fields about a positive ion in solution differ in orientation and intensity depending upon the negative ions present but when different kinds of negative ions are in the solution, the positive ions distribute themselves between fields of different configurations at the same time. For example, when potassium nitrate was added to a dilute aqueous solution of europium chloride, the absorption spectrum consisted not only of the patterns characteristic of the original solution ($EuCl_3$ in water) but it contained also the spectrum of europium nitrate in water. Increasing the concentration of potassium nitrate strengthened the "nitrate spectrum" at the expense of the "chloride spectrum." These changes occurred at a concentration of europium chloride which produces a freezing point lowering about three or more times what the same concentration of an un-ionized substance would produce.

The distribution of europium ions (Eu^{+++}) between several configurations was also brought about by mixing solvents. Anhydrous europium chloride when dissolved in absolute alcohol possesses an absorption spectrum differing from the spectrum which arises from a solution of the chloride in water. Upon adding a little water to the alcoholic solution, the spectrum of the "hydrate" immediately appears besides that of the "alcoholate." The distribution of the europium ions favors the "hydrate." The absorption spectrum of the salt in the mixed solvent was, in the scale of wavelengths, accurately the superposition of the spectra of the salt in the separate pure solvents.

However, such was not the case with anhydrous europium nitrate dissolved in absolute alcohol. When water was added, the wavelengths of the lines of both "hydrate" and "alcoholate" were shifted somewhat from the positions they held in the spectra of the salt in the separate pure solvents. *They remained sharp*, however, not appearing as a blurr between the positions in the spectra from the salt in the single solvents. The actual position of the lines is a function of the relative amounts of alcohol and water in the solvent. Both the "alcoholate" and "hydrate" configurations appear to respond sharply to some average in the macroscopic properties of the pure solvents. This behavior has considerable bearing on the many investigations which have been undertaken with mixed solvents to discover the effect of the dielectric constant, for example, of a solvent on the colligative properties and to compare it with expectations from the inter-ionic attraction theory of electrolytes.

II. ——, 1940 (with WEISSMAN, S. I.). Lattice Vibrations of Crystals and the Corresponding Vibrations of their Solutions. Jour. Chem. Phys. 8, 2, 227–228.

Crystals of hydrated europium chloride possess structures in their absorption spectrum which are faint but accurate repetitions of the intense patterns arising from electronic transitions in the europium ions. These repetitions occur on both sides of the intense patterns at intervals which are ascribed to thermally as well as optically excited oscillations of the lattice.

The spectra of aqueous solutions of europium chloride and also of europium nitrate closely parallel the structures in the spectrum of the crystals. In the region where the crystals absorb, the solutions absorb also. The structures in the spectra of the solutions are somewhat more diffuse than the corresponding structures in the spectra of the crystals. Especially is this true for the structures at the intervals corresponding to lattice vibrations.

III. —— 1940 (with WEISSMAN, S. I., and ROTARIU, G. J.). Zeeman Effect from Liquids, Solutions of Salts of Europium.

The spectra of the solutions we are investigating are so sharp that the Zeeman Effect has been obtained (for the first time from liquids) and the effect of the magnetic field is considerable. The resulting spectral pattern is polarized. The transverse effect is as yet the only one studied.

IV.

Europium acetylacetonates possess spectral lines of extreme sharpness. In concentrated solutions in such solvents as benzene, they exist as dimer while they are monomer in dilute solutions. The spectra of these forms are distinctly different and the rate of dimerization as well as the reverse processes is slow and is easily followed by the spectra. This work was undertaken to investigate the range of the electric fields which are effective in decomposing the energy levels of the europium ions, that is, whether only the first coordination sphere is completely accountable or whether more remote coordination spheres must be taken into account. This work is not yet finished.

V.

The study of the correlation of our spectra with chemical thermodynamics has awaited the construction of a sensitive apparatus for measuring intensities of spectral lines. This has been successfully finished but time has not as yet permitted the actual commencement of the measurements.

CHRISTINA HALLOWELL GARRETT, Boston, Mass.

Grant No. 286 (1939). Origins of Elizabethan Puritanism.

The recurring threat of war during 1938–9 made necessary an intensive search for manuscript material of the Tudor period with which to complete a second volume on the origins of Puritanism to serve as an expansion of the thesis already advanced in "The Marian Exiles, 1553–9." The search has been amply rewarded:

First at Antwerp, where corroborative evidence was discovered in the city's archives to connect the English exiles with the company of "Merchant Adventurers" whose headquarters, known as the "English House," is found to have served as an asylum and distributing center for the refugees.

Secondly at Douai in northern France, the former home of the "English College," where in the Municipal Library the comparatively unknown "Registrum Expeditionum" of Cardinal Pole, being his legatine register in manuscript for the years 1554–7, yielded invaluable information in support of a revision of older interpretations of the policy of Stephen Gardiner toward English heretics. Further confirmation for this revised estimate was also forthcoming in the still unpublished Tyler Transcripts at the Public Record Office in London.

Finally, a rather spectacular discovery of Anglo-Savoyard documents at Turin provided unexpected support for the theory first set forth in "The Marian Exiles," that the English movement to the Continent in 1554 was that of an embryo political party possessed of a foreign as well as of a religious programme which a large section of the English merchant class financed. Among these Turin archives a series of letters from London, written in 1554 by the ambassador Stroppiana to his master the Duke of Savoy, provides a significant postscript to the French and Imperial despatches of the period, revealing the reign of Mary as an episode of first diplomatic importance in the Continental struggle between the Houses of Hapsburg and Valois. Thus it becomes increasingly probable that the growth of the Puritan movement must be traced to this anti-Hapsburg element in England's sixteenth century struggle for survival as a nation.

GARRETT, CHRISTINA HALLOWELL, 1939 (with M. R. TOYNBEE). Tudor and Stuart Mss. at Turin. Times (London) Literary Supplement, for September 16, 2 columns.

—— 1938. Review of Professor Haller's "Rise of Puritanism." Rev. of Religion, Columbia Press, 4: 74–82.

JAMES H. GAUL, Harvard University

Grant No. 352 (1939). Archaeological reconnaissance in southwest Bulgaria and Greek Thrace to determine the interrelationships of the Danube valley and the Aegean world in the III millenium B.C.

With a grant from the American Philosophical Society and one from the American School of Prehistoric Research the writer in August, 1939, explored the Struma valley from its source near Sofia to its mouth on the Aegean at Amphipolis, and eastward thence to the Turkish frontier, returning after the outbreak of war when further work was difficult.

Results: In the Sofia basin five sites have been found of the earliest Neolithic period in the lower middle Danube valley, viz., the Starčevo-Körös culture. One was also found in a cave in the middle Balkan range near Trojan. In the upper Struma valley four more sites of this culture were discovered, in two of which were sherds identical with Thessalian (Sesklo) scraped ware. Of the succeeding period, that represented in the lower middle Danube by the middle levels of Vinča, two cites in the Sofia basin and two in the upper Struma valley were found.

The discovery of these sites indicates that the earliest Danubian Neolithic cultures had ramifications to within reach of the earliest Greek Neolithic cultures, and may possibly be equated with them.

In Thrace east of the Struma six sites were discovered as far east as Komotini, in which Thess. II (black on red) sherds indicate that the Greek Neolithic Period extended from the Peloponese almost as far east on the northern mainland as the present Turkish frontier.

Graphite painted sherds at these sites indicate a succeeding late Neolithic phase related to the Bulgarian-Rumanian "Gumelniţa" culture, followed by an Early Bronze Age of Aegean-Macedonian type.

The results of this reconnaissance will be published in the Bulletin of the American School of Prehistoric Research in 1940.

ROBERT GAUNT, New York University

Grants No. 212 (1938) and No. 343 (1939). Functional interrelationship between adrenal cortex and the pituitary.

(The study of the effect of progesterone and other hormones on liver glycogen was made by Robert Gaunt, John W. Remington and Abraham Edelmann; that of the adrenal cortex and diabetes insipidus by Malvina

Schweizer, Robert Gaunt, Warren O. Nelson and Eleanor Loomis; that on the toxicity of estrogens in adrenalectomized animals by Robert Gaunt and Abraham Edelmann; that on adrenal transplants by W. J. Eversole, Abraham Edelmann and Robert Gaunt.

1. We had previously found that the beneficial effect of pituitary substances in adrenalectomized animals was probably due entirely to its stimulation of the corpus luteum; and that the corpus luteum hormone, progesterone, maintained life in adrenalectomized ferrets and rats. We studied next the question of whether progesterone had a cortical hormone-like action on carbohydrate metabolism, as judged by the effect of acute overdosage in intact fasting rats and ferrets.

It was found that progesterone, like cortin, when given in large doses increased liver glycogen three or more times above control levels in the fasting ferret. Muscle glycogen was not affected. The increase in liver glycogen was presumably at the expense of body protein. The highest glycogen stores were in pseudopregnant animals, possessing corpora lutea of their own and given progesterone injections in addition. In the rat, however, it was surprising to find that while cortin elevates glycogen stores of fasting animals readily, progesterone in huge doses did not affect it at all. This lack of a cortin-like action of progesterone on this phenomenon in the rat correlates with other uniform failures to find similar parallel effects of the two hormones in rats except for life-maintenance after adrenalectomy.

It indicates either that the rat lacks an ability, present in some forms, to transform effectively progesterone into a cortical-like compound; or that the rat, unlike other species, cannot substitute progesterone for the cortin-like compounds in its metabolism.

In the rat, negative results were obtained also with testosterone propionate and diethyl stilboesterol.

GAUNT, R., 1939 (with REMINGTON, J. W. and EDELMANN, A.). The Effect of Progesterone and Other Hormones on Liver Glycogen. Proc. Soc. Exp. Biol. and Med. 41: 429.

2. It is known that complete hypophysectomy results in a severe transient diabetes insipidus (excessive loss of water through the kidney) while removal of the posterior lobe alone causes a permanent marked diabetes insipidus. We considered it possible that the anterior lobe exerted its effect of maintaining this polyuric state by

virtue of its maintenance of the adrenal cortex in a normal functional condition. While this work was in progress, such an hypothesis was stated on the basis of indirect evidence by Silvette and Britton.

We investigated this hypothesis by the direct method of giving adrenotropic hormone to hypophysectomized rats and observing its effect upon their water balance. The results clearly showed that the adrenal cortex is not the intermediary agent through which the anterior pituitary exerts its stimulating effects on water exchange.

One group of hypophysectomized animals were given adrenotropic hormone for 7–14 days after operation. The treatment did not prevent the subsidence of diabetes insipidus. In another group which showed an initial diabetes insipidus subsequent treatment with adrenotropic hormone failed to reinstitute a polyuria.

—— 1938 (with SCHWEIZER, M., NELSON, W. O., and LOOMIS, E.). Adrenal Cortex and Diabetes Insipidus. Anat. Rec. 72: (Suppl.), 122. (Abstract.)

3. It has been found in this and other laboratories that estrogens are distinctly toxic to adrenalectomized animals (rats and ferrets), whereas the androgens are non-toxic and progesterone life-maintaining. The cause of this toxicity of the estrogens is of considerable theoretical interest. It has been at least twice suggested (Cavanaugh and Gaunt; D'Amour and Funk) that the deleterious action of estrogen was due to its ability to inhibit the pituitary, and thus to superimpose an hypophyseal deficiency upon an adrenal insufficiency. This hypothesis was tested by injecting a life-reducing dose of estrin (100 I. U. amniotin daily) into adrenalectomized rats simultaneously treated with a pituitary extract. The extract contained growth and other metabolism-stimulating factors and its administration should have prevented any deficiencies in those hormones; it was weak in gonadotropic content and hence did not induce the complication of excessive endogenous estrogen. There was, however, no difference in the life-span of 16 animals thus treated and in those receiving amniotin only. Such results fail to confirm the above-stated hypothesis.

It has been suggested that estrin is toxic to hypophysectomized animals because of its depressing effect on the unstable carbohydrate metabolism of these specimens (Nelson). Such an argument would apply equally well to adrenalectomized animals. In a series of estrogen-injected rats, half were given a high carbohydrate diet (10 per cent sugar added to the regular diet) and controls were fed our regular diet. No differences were noted in the survival of the two groups, suggesting that lack of available carbohydrate is not the cause of the toxicity of estrogen.

—— 1939 (with EDELMANN, A.). On the Toxicity of Estrogens in Adrenalectomized Animals. Anat. Rec. 75: (Suppl.), 125.

4. A comparison of the functional efficiency and ease of preparation of six differently situated types of adrenal cortical transplants was made in 131 adrenalectomized rats. Functional capacity was determined by the ability to maintain life and by the reaction of the animals to high doses of water. Autoplastic grafts of a single adrenal capsule were made.

Grafts to the ovary, kidney and intestinal mesentary were all of approximately equal efficiency, maintaining life in nearly all cases and offering some although not normal protection against excess water. Because of the greater ease of preparation, transplants to the kidney are probably the ones of choice for routine work.

Transplants to the eye were more difficult to obtain, would maintain life when established, but afforded little, if any, protection against "water intoxication." Liver and muscle grafts as used here were rarely successful.

Cortical tissue allowed to regenerate *in situ* from an enucleated adrenal capsule was more efficient than any of the grafts tried. No type of transplant produced complete normality in response to excess doses of water, and evidence was obtained that this was purely a cortical and not a medullary deficiency.

Unlike ovarian transplants, the function of cortical tissue is not impaired by having a site (intestinal mesentery) with hepatic portal drainage. This indicates that the cortical hormones are not, rapidly at least, inactivated by the liver.

—— 1940 (with EVERSOLE, W. J., and EDELMANN, A.). Effect of Adrenal Cortical Transplants on Life Maintenance and "Water Intoxication." Anat. Rec. (in press).

FRANK E. E. GERMANN, University of Colorado

Grant No. 249 (1938). Study of anomalous double refraction observed by Germann and Metz in solutions of certain inorganic salts in water to determine whether the effect is due to ions, or to molecules formed by hydrolysis.

Glass and brass sample tubes previously used had end windows ground in position and held by either capillary action or the pressure of a weak spring. These have been replaced by quartz and pyrex glass tubes having plane windows of the same material fused on to the ends. The instrument maker assured us the windows could be made practically strain free, but to date only the glass tubes have been made sufficiently free of strain to permit accurate measurements. This, however, was only possible after masking part of the field which showed the most distortion. With this new design of the apparatus it was found that attaching the water jacket to it caused a field distortion many times the magnitude of the effect being measured.

It accordingly became necessary to construct an entirely independent water jacket separated from the sample tube by an air space. Another source of annoyance has been the fact that the end glasses, when not perfectly parallel, cause a displacement of the light beam, necessitating frequent readjustments of the entire light path.

Our most recent visual work on sodium acetate of concentrations between 0.01 and 0.4 gm. per cc. has substantiated earlier work in that we again observed a sharp rise in the value of the Cotton-Mouton constant for concentrations between 0.02 and 0.06 gms. per cc.

A thermionic amplifier which we have purchased will add greatly to the accuracy of measurements, since it will eliminate uncertainties due to fatigue of the human eye.

GERMANN, FRANK E. E., 1939. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1938: 172–173.

EDWARD GIRDEN, Brooklyn College

Grant No. 236 (1938). Localization of the cortical determinants for specific auditory frequencies.

It has been ascertained that a restricted portion of the cerebral cortex within the temporal lobe functions in auditory localization

(L–R discrimination) in dogs.[1] The present study was directed to an analysis of the functions within this area. The L–R discrimination is permanently abolished for all test frequencies upon the complete bilateral extirpation of the cortical auditory area. When restricted lesions, varying in size and locus in different dogs, were made it was impossible to permanently disrupt the L–R discrimination for particular tones (the octaves from 128 cycles to 8192 cycles serving as the test frequencies).

Tests of auditory acuity indicated severe losses of hearing, which were not uniformly distributed, either from pitch to pitch or dog to dog. The hearing loss on some frequencies was little, in other cases as great as 70 decibels. These severe losses were completely eliminated within two weeks through a process of spontaneous recovery of function. This would seem to indicate that the cortical auditory mechanism is activated in the first instance by a place principle whereby different tracts mediate different pitches. But in emergencies, the remaining auditory cortex serves to maintain normal function by some principle of equipotentiality (frequency theory). The latter would apply only if some of the auditory cortex remained intact. A test of this hypothesis of cortical auditory functions is now being made.

It has been previously shown that the effect of curare has a 'dissociative' effect such that conditioned reflexes (CR) developed while the animal is curarized appear only in that condition, whereas normal learning appears only in the normal animal.[2] The hypothesis offered at the time suggested that the curare-CR was based upon subcortical (thalamic) mechanisms, while the normal-CR involved cortical pathways. Functional confirmation in support of this hypothesis has now been acquired. After the temporal lobes were completely extirpated, learning now established for the first time in one of the two states—normal or curare—appeared in the other condition. The observations seem to indicate that the animals under curare, contrary to anecdotal evidence, were either unconscious at the time, or after recovery suffer a "post-curare amnesia." This seems to hold both for normal animals as well as those in which the 'block' between the CR in normal and curare had been disrupted. The question of conscious behavior

[1] The findings and publications resulting from the initial grant No. 155 in 1937 are summarized in the Report of Progress, Yr. Bk. Amer. Philos. Soc. for 1938: 173–175.

[2] Girden, E., and Culler, E. J. Comp. Psychol. 23: 261–274. 1937.

in animals is beset with difficulties, but an attempt is being made to answer this question, trying among other things to duplicate the dissociations between normal and curare learning with the use of anesthesia.

GIRDEN, EDWARD, 1940. Cerebral Mechanisms in Conditioning under Curare. Amer. Jour. Phychol. 53: April (in press).

—— 1940. The Role of the Auditory Area of the Cortex. Amer. Jour. Psychol. 53: July (in press).

ESTHER M. GREISHEIMER, Woman's Medical College of Pennsylvania

Grant No. 76 (1935). (With Fay, M., Hafkesbring, R., Andersch, M., Kenyon, M., MacCalmont, W., Cortell, R., Ingleby, H., and Geiss, M.). Study of the effects of various general and spinal anesthetics on the nervous system, circulatory system, etc. . . . to be followed by the pathological examination of such tissues as the liver, kidney, brain and heart.

This report is a summary of the results of 275 urea clearance and 106 creatinine clearance tests on 10 dogs under 5 types of anesthesia, with autopsy reports on 7 of the dogs.

Three diets were used in the course of the study; these were Red Heart C, Victory Dog Food and Cero-Meato. No significant changes in clearance were found which could be attributed to the diet. It was noted that the dogs which were fed Cero-Meato gained weight and seemed in better general condition at the time of autopsy than those which had been fed either of the other diets exclusively.

The anesthetics used were cyclopropane, pento barbital sodium, ether, sodium amytal and sodium barbital.

In dogs with no renal pathology cyclopropane administration was followed by a temporary marked increase in the clearance. In one dog with a high blood urea and hypertension a fixed clearance was found; cyclopropane had no effect on this dog. Considerable renal pathology was found at autopsy in this animal.

Pento barbital sodium (Abbott) administration produced no significant changes in the clearance tests.

Ether administration was followed by a marked increase in the clearance.

The urea clearance did not show a constant change after sodium amytal, but the creatinine clearance increased in every case. One of the dogs which showed interstitial nephritis and nephrosclerosis at autopsy had shown little variation after the anesthetic. A second dog had a very high leukocyte count and unusually irregular clearances. At autopsy her renal glomeruli resembled those seen in lipoid nephrosis in human kidneys and cloudy swelling of the convoluted tubules was noted. A third dog which had shown irregular clearances was found at autopsy to have hemorrhagic nephritis. In one dog with practically no renal pathology the administration of sodium amytal was followed by an increase in the clearance.

The administration of sodium barbital was followed by a decrease in the urea clearance and an increase in the creatinine clearance in one dog with some renal pathology.

High leukocyte counts, elevation of temperature and renal pathology in dogs seem to be associated with highly irregular clearance results.

It is possible that fever, high leukocyte counts and sedation with barbiturates on the night preceding a clearance test may influence the results in human beings.

In many cases extensive damage to heart, liver and brain are found after an anesthetic death.

Greisheimer, Esther M., 1940. Clearance Tests in Relation to Renal Pathology. Jour. Lab. and Clin. Med. (accepted for publication).

—— 1940. Effects of Repeated Anesthetic Doses of Barbiturates; Sodium Amytal and Sodium Barbital. Vet. Med. 35: 196.

Nathaniel E. Griffin, Cambridge, Massachusetts

Grant No. 257 (1938). The life of Guido de Columnis. The sources and influence of his *Historia Destructionis Troiae* (to form volume two in a three-volume edition of this work).

(1) Guido's Family.

Guido was not of the noble Roman family of Colonna, his pluralized Italian surname *Colonne* ("Columns") having been presumably derived from one or another of the numerous place-names of this form both in Sicily and in Calabria. His holograph signatures upon legal documents take invariably the pluralized form. The singular *Colonna* varies with the plural *Colonne* in signatures in transcribed legal documents and in the manuscripts of the *His-*

toria (which twice contains the name of its author), but with the plural form in both cases preponderating. It seems not unlikely that his family originated in Capo delle Colonne, the easternmost promontory of Calabria. The place-name *Colonne* ("Columns"), frequently applied to small towns, took its origin, no doubt, from the remains of ancient temples (serving also as light-houses), though not from the legendary "Columns of Hercules," upon which Guido dilates in one passage of the *Historia*, by reason, perhaps, of the resemblance of the name to that of his own place of origin.

(2) Guido's Birthplace.

There is every reason to suppose that Guido was born in Messina, Sicily, the provision in the *Constitutiones* of Frederick II forbidding judges "to hold office in the city of their birth" being applicable only to judges in the national court ("Curia Regia"), not in the municipal court of Messina ("Curia Stratigoziale"), to which, as judge of contracts, Guido presumably belonged, all extant documents bearing his signature being exclusively of this class.

(3) Guido's Canzoni.

Of the six canzoni (in various contemporaneous canzoniere of early Sicilian poetry) ascribed at one time or another to Guido, four only bear his signature, including the two assigned him by Dante in *De Vulgari Eloquentia*. The other two were presumably written by Mazzeo di Ricco and by Giacomo di Lentino respectively.

(4) The Journey to England.

There is no good reason to doubt that, as reported by a succession of later historians, Guido accompanied Edward I back to England on the return of that monarch from the Holy Land through Sicily in 1273. There is, to be sure, no contemporaneous documentary evidence of this journey to England in any of the Calendars of Rolls in the Public Record Office or in the pages of the chroniclers. Hence certain modern historians have been disposed to deny it. But as judge in Messina Guido may well have been useful to Edward, who, as we know, was interested in reforming English Constitutional Law. From Bologna, as we know from contemporaneous documents, Edward took back with him to England a young lawyer Accursius to advise him on legal matters, and it seems not unreasonable to suppose that he may have likewise taken Guido.

(6) The Composition of Works upon English History.

As little is there reason to doubt that, as likewise reported by later historians, Guido, while in England, wrote a *Chronicon Magnum* and an *Historia de Rebus et Regibus Angliae*. To be sure neither of these histories is known to be extant today. Hence the same modern critics who doubt the trip to England doubt also the existence of these works. But that Guido composed at least one English history (and it is quite possible that the two titles name but a single work) is abundantly evidenced by Robert Fabyan, who in his *New Chronicles of England and France* (1504) repeatedly quotes considerable extracts from Guido concerning diverse historical events right down to the year 1273 when Guido was reported to have come to England, not infrequently comparing his statements with those of well established historians, such as Bede, Higden, and the author of the *Fleur des Histoires*. Furthermore two continental historiographers, Dietrich Englehus in the century preceding Fabyan and Casimir Oudin in the century following Fabyan, both cite Guido as one of the sources used in their treatment of English history, Englehus in his Trojan section also epitomizing Guido's Trojan History, thereby proving that it was not another but the same Guido who wrote both works. Nor is the fact without significance that the German chronographer specifies "thirty-five" as the number of books into which Guido's *Chronicon Britannorum*, as he terms it, is divided, that being the identical number of books of which *Historia Destructionis Troiae* consists. But the certainty that Guido wrote a history of England has, obviously, a reactionary bearing upon the likelihood of his alleged journey to England. For how could he have written such a work save as a result of such a journey? Strikingly accordant with this visit to England is Guido's own assertion in the Epilogue of *Historia Destructionis Troiae* that in 1272 he discontinued work upon that history to resume and complete it 15 years later in 1287. To be sure Guido ascribes this interruption to the death of his patron Matteo da Porta, which occurred in 1272. But the journey to England might well have fallen within this intervening 15 years. Accordant with this trip to England and at the same time limiting it to the first four years of this interval is a break in the continuity of legal documents bearing his Sicilian signature between 1273 and 1277.

(7) The Sources of *Historia Destructionis Troiae*.

The *Historia Destructionis Troiae* is for the most part a tolerably close rendering in prose of the metrical *Roman de Troie* of Benoit de Ste Maure. There is no evidence that in the body of his work Guido made any use of Dares or of Dictys, Benoit's two Latin prose sources. At the end of the *Historia*, however, Guido adds a correct summary of the factual differences between the versions of events presented by Dares and by Dictys not found in any of the extant manuscripts of Benoit. This he may have found added by the scribe to some lost manuscript of Benoit or he may, less probably, have appended it as a separate act of personal research. It is interesting to note that a large part of the Daretan portion of the summary occurs also at the end of certain manuscripts of Dares. By no means all of Guido is in Benoit, however. Guido has added, from his own reading, a very considerable number of learned digressions dealing with historical, legendary, mythological, and etymological matters. The mythological digressions are of the utmost interest as measuring the attitude of a typical mediaeval Christian apologist towards the ancient Greco-Roman mythology. Particularly noteworthy, as well, is the serious historical interest taken by Guido in all matters remotely concerning his own native Sicily. He shows the typical mediaeval historian's zeal in linking the origin of the various European countries with the legendary dispersion of the vanquished Trojans. Added to this is a peculiarly Italian interest in curious bits of local patriotic lore, not unlike what is constantly found in the romances of Boccaccio.

HENRY ALEXANDER GRUBBS, Princeton University

Grant No. 325 (1939). Research into the life and works of Jean-Baptiste Rousseau (1671–1741).

The work was done chiefly at the Bibliothèque Nationale in Paris. Short visits were made to the Bibliothèque de l'Arsenal and to the Bibliothèque de l'Institut, both in Paris. The French interlibrary loan system made it possible for me to consult at my leisure at the Bibliothèque Nationale a group of important manuscripts from the Bibliothèque Municipale de Chartres.

The results obtained may be divided as follows:

1. An important discovery: a manuscript which throws a considerable amount of new light on the poet's life. It is his own account of the notorious Affair of the Couplets, which led to his exile from France in 1710. Students of J. B. Rousseau's life have been hampered by the fact that all detailed accounts of the Affair were written by the poet's enemies; it was not known that he had written an *apologia pro vita sua* (though in his correspondence he had often spoken of intending to do so). This manuscript (Bibl. municipale de Chartres, n° 1591) had gone unnoticed for many years. The reason may be that the title (given by Rousseau himself) is misleading and contains no suggestion of the interest of the manuscript. There can be no doubt as to its authenticity. Internal evidence would be sufficient to demonstrate this, but in addition the poet's handwriting is easily recognizable. Furthermore, it is signed with the characteristic *paraphe* found at the end of a number of his letters.

The manuscript consists of forty folios. I had it photographed on microfilm, and in my proposed study of J. B. Rousseau's life and works I shall make extensive use of it.

2. Bibliographical research. I obtained complete information as to the various editions of the poet's works and as to the date of publication, authenticity of individual works, etc.

3. Checking up on all sources (printed or manuscript) of information as to the poet's life and works. Much of this work was productive of negative results, of course, that is, merely verifying that such and such a reference contained nothing that I didn't already know or nothing of value for my purpose. In the time at my disposal I was unable to exhaust all of the possibilities along this line, but I did the essential part. I accumulated much information, especially from five volumes of manuscripts from Chartres containing a projected edition of the poet's works prepared in the late eighteenth century by a certain Poulin de Fleins. It is a chaotic jumble, but in it I found many useful details.

As a result of my summer's research I have in my hands the material I need, and I can now proceed to the organization and writing of my study of the life and works of Jean-Baptiste Rousseau.

The closing of the Bibliothèque Nationale a few days before the outbreak of the War cut short my work by several days, but fortunately I had completed the essential part of my research.

FRANK T. GUCKER, JR., Northwestern University

Grant No. 230 (1938). Thermochemistry of aqueous solutions of amino acids and related substances.

The apparent molal heat capacity of a strong electrolyte and the heat of dilution of its very dilute solutions increase linearly as the square root of the concentration, with a slope depending upon the valence type. This is in qualitative agreement with the Debye-Hückel theory of inter-ionic attraction. Little is known of the thermal behavior of non-electrolytes; hence we undertook an experimental and theoretical study of these substances. Our grant from the Penrose Fund was used to continue this work, with the aid of Dr. Hugh B. Pickard.

The densities and heat capacities of urea already had been studied in this Laboratory. We have now determined the heats of dilution at 25°, from 0.01 *m* to 12 *m*. These data allow us to calculate the change with temperature of the activity and osmotic coefficients over the range from 40° to 2° C., and, by a reasonable extrapolation, to the freezing point. We have developed a new analytical method of calculating these coefficients from freezing points, and have compared the results of these freezing point measurements and vapor pressure measurements at different temperatures with recent precise isotonic measurements at 25°.

We have also completed a study of the heats of dilution of glycine and glycolamide at 25°, from 0.01 *m* to nearly saturated solutions. The study of heats of dilution of lactamide under the same conditions, carried out under this grant, is now being supplemented by similar studies on alpha and beta alanine.

Non-electrolytes soluble in water undoubtedly possess polar groups and many of them have an over-all dipole moment. It is interesting to see to what extent their properties in aqueous solution are due to dipole-dipole interaction. Fuoss has developed a theory of dilute solutions of dipolar solutes, each molecule of which is a sphere of diameter a with a point dipole of moment μ at the center. Following Kirkwood, we have altered the Fuoss treatment to consider the difference between the dielectric constants of the molecule and the medium. We have derived expressions for the relative partial molal volume, heat capacity and heat content. According to the equations, all of these properties should be linear functions of the *first power* of the concentration, and the slopes should increase for larger values of μ^2/a^3. The simple amino acids are particularly suitable for study because they are *zwitterions* with large dipole moments which have been estimated from the dielectric constants of their solutions. In qualitative agreement with the theory, all of the partial molal properties are linear functions of the concentration in dilute solutions. Also, the partial molal volumes and heat capacities of glycine ($\mu = 15$ Debye units) increase more rapidly with concentration than those of the isomeric glycolamide, and of urea ($\mu = 5$), which has about the same molecular radius. The slope of the heat of dilution curve for glycine is greater than that of either of the other solutes, but the *sign* of the heat of dilution is opposite to that predicted by the theory. The dipole-dipole interaction, like that between ions, should cause a *liberation* of heat in all these solutes, whereas actually heat is *absorbed*.

In order to find out how much error is introduced in neglecting the separation of charges and considering the molecules as point dipoles, we have calculated the effect of the higher terms of the dipolar interaction. They contribute about 20 per cent to the free energy of a solute like glycine, and affect the other properties by the same amount, but do not affect the *sign* of the heat of dilution.

The work is being continued with a study of the longer chain acids, where the dipole moment can be varied even more by moving the amino group along the chain. It is hoped that this may throw further light upon the nature of dipolar interaction.

MARY R. HAAS, Eufaula, Oklahoma

Grant No. 238 (1938). Field investigation pertaining to the history and development of the extant towns which formerly comprised the Creek Confederacy.

This investigation was made possible through a generous grant from the Penrose Fund of the American Philosophical Society. In some cases the results obtained tie in with previous work done among the Creek Indians which was supported by two grants from the Department of Anthropology, Yale University, in 1936 and 1937.

Representatives of a number of Creek towns were interviewed, including at least one representative of each of the following tribal towns located in various parts of the Creek and Seminole Nations in Oklahoma: Abihka, Coweta, Eufaula, Hilabi, Hitchiti-Seminole, Kasihta, Lapłakko, Otciapofa, Talwałakko, Tukabahchee, Tukpafka, Tulsa, and Wiogufki. In addition, representatives of the Koasati Indians of Louisiana were also interviewed. All of these towns were formerly a part of the Creek Confederacy and all of them speak the Muskogee (Creek) language with the exception of the Koasati and a part of the Hitchiti-Seminole.

The towns of the Creek Confederacy were divided into two sides generally known in English as the Red and White semidivisions. When my work on the history of these towns was begun the assumption was that a given town belonging to the White semidivision had been affiliated with that semidivision throughout the course of its history as a member of the Confederacy and that the same thing was true of a given town belonging to the Red semidivision. As the investigation progressed, however, it was discovered that the earlier assumption was erroneous and that, under certain definable circumstances, a given town would be required to change from one semidivision to the opposite. This discovery throws new light on the political organization of the confederate towns, and, in those cases where actual instances of change could be verified on the basis of oral tradition, adds new information pertaining to the history of the towns so affected. The results of this phase of the investigation have been embodied in my paper, "Creek Inter-Town Relations," listed below.

Other phases of Creek social organization will be treated in the following papers which are in process of preparation: (1) Creek Civil Kinship Terminology, (2) The Creek Inter-Town Ball Game, and (3) The Ceremonial Season of the Kasihta Creeks.

HAAS, MARY R. Creek Inter-Town Relations. (To be published in the American Anthropologist.)
—— Ablaut and its Function in Muskogee. (To be published in Language.)
—— Men's and Women's Speech in Koasati. Read at the Second Annual Summer Meeting of the Linguistic Society of America, Ann Arbor, 1939. (To be enlarged before publication.)

THOMAS HALE HAM, Harvard Medical School.

Grant No. 218 (1938). Studies on destruction of red blood cells: Chronic hemolytic anemia with paroxysmal nocturnal hemoglobinuria; certain immunological aspects of the hemolytic mechanism with special reference to serum complement (in collaboration with John H. Dingle).

Grant No. 315 (1939). Studies on destruction of red blood cells: Relation of intravascular stasis and of abnormal fragility of erythrocytes to the mechanism of hemolysis in certain hemolytic anemias[1] (in collaboration with William B. Castle).

It is known that the more nearly spherical are erythrocytes, the greater is their susceptibility to hemolysis, or "fragility," in hypotonic solutions of sodium chloride. In certain hemolytic anemias occurring in human beings, the increased rate of destruction of blood is associated with such increased sphericity and abnormal fragility of the erythrocytes *in vitro,* when compared to normal human erythrocytes. Because, however, red blood cells are not exposed to hypotonic solutions *in vivo* the erythrocyte abnormality, detected *in vitro* by the "fragility test," has never been satisfactorily related to the increased destruction of blood in these anemias. In congenital hemolytic jaundice, indeed, removal of the spleen may abolish the anemia without changing materially the abnormal fragility of the red blood cells. The spleen therefore is apparently essential to the hemolytic process *in vivo.* During the past year a study has been made regarding the relationship of intravascular stasis and of abnormal fragility of erythrocytes to the mechanism of hemolysis in certain hemolytic anemias. These observations have been carried out in collaboration with Dr. William B. Castle and a preliminary report was given at the Autumn Meeting of the American Philosophical Society.

A normal function of the spleen, that of storage of blood, is known to produce intravascular stasis and concentration of the erythrocytes by removal of plasma. When an attempt to imitate intravascular stasis was made *in vitro* by the sterile incubation at body temperature of whole defibrinated mammalian blood, the red blood cells showed progressive swelling, spherocytosis, and an increase in fragility to such a degree that hemolysis eventually oc-

[1] This report was given before the American Philosophical Society, November 18, 1939.

curred in the serum. The swelling in vitro of abnormally fragile erythrocytes progressed at a rate similar to that of normal cells but hemolysis occurred sooner, presumably because the spherical form was reached earlier. These effects apparently were related to metabolic changes. No hemolytic agents were demonstrated, nor was increase in fragility associated with the hemolysis produced by lytic agents, such as saponin and anti-human red blood cell immune serum.

It is believed that intravascular stasis, normally occurring in the spleen and other organs, is the immediate mechanism resulting in increased blood destruction in hemolytic anemias characterized by increased fragility of the erythrocytes, namely, congenital hemolytic jaundice, icterus neonatorum, and the acute hemolytic anemias caused by arsine and sulfanilamide. Histologic and physiologic studies of the spleen indicate its function as a stasis organ, and so account for the beneficial effect of its removal in congenital hemolytic jaundice despite the continued abnormal fragility of the erythrocytes.

Theoretically, therefore, increased intravascular stasis *in vivo* should be associated with increased destruction of blood. Stasis in the spleen induced by prolonged nembutal anesthesia in animals produced concentration of erythrocytes, hemoglobinemia and variable increase in the fragility of red blood cells in the spleen. Generalized intravascular hemagglutination produced in animals by concanavalin A (Sumner) caused similar changes in splenic blood and in the circulating blood with obvious hemoglobinemia and hemoglobinuria. It is believed that increased intravascular stasis accounts for certain hemolytic anemias in which hemolysins are not demonstrable but which are associated with: (*a*) intravascular agglutination from transfusion reactions, from type XIV anti-pneumococcus horse serum, in certain cases of Lederer's anemia and in cases associated with rouleau formation due to increased plasma globulins (hemolytic crises with infections); (*b*) increased blood viscosity in sickle cell anemia and possibly in acute infections; (*c*) increased local stasis in "hypersplenic hemolytic anemia" and in passive congestion of cardiac decompensation.

G. P. HARNWELL, University of Pennsylvania.

Grant No. 260 (1938). A permanent magnet beta-ray spectrograph employing electron-multiplying detection.

It is hoped that this type of beta-ray spectrograph will yield energy spectra, particularly in the low energy regions that are free of certain errors inherent in other determinations. The high degree of uniformity and permanence of the field over the semi-circular path should permit accurately reproducible readings. In addition an arrangement to permit continuous absolute calibration by a controlled source of electrons has been incorporated. Secondary-electron multiplier type of detection has the advantage that there is no absorbing material in any part of the trajectory. It should respond to individual electrons of all energies down to about one hundred volts. The usual detector, such as a Geiger-Müller counter, is not satisfactory, particularly for low energies, inasmuch as foils must be interposed in the path of the beta-rays; a photographic plate is likewise unsatisfactory, since the beta rays must traverse the sensitized gelatin. The design is also adapted for investigating another contributory error. This is scattering within the source and its support. It may be advantageously studied by progressively tracing the effects of thinner backings for the radio-sample.

The permanent magnet for the spectrograph has been constructed and tested. The Alnico magnet blocks, which are supported by a yoke of low carbon steel, have been tested and found to produce any desired field up to 3,000 gauss between the Armco iron poles. These poles are eight inches by sixteen inches. The field is constant over an area of seven by fifteen inches to better than 0.1 per cent. There is no perceptible change in field strength after the first hour following the energizing of the magnet. Magnetization is accomplished by a four section coil wound over the Alnico magnet assemblies.

The electron-multipliers for detecting single beta-rays which were donated by the R. C. A. Laboratories were found to be unsatisfactory. The excessive background currents, though acceptable in commercial applications, render them unsuitable for the detection of single particles. In consequence a special beryllium surface multiplier has been constructed in this laboratory following the general design of J. S. Allen (*Phys. Rev.* **55**: 966, 1939). This will shortly be installed and tested.

FRANCIS HARPER, the John Bartram Association, Philadelphia

Grant No. 291 (1939). Retracing the routes of John and William Bartram in the Southeast.

In 1765–66 John Bartram, in company with his son William, journeyed through the coastal portions of the Southern Colonies, from the Cape Fear River in North Carolina to the upper St. John's River in Florida. His diary of this journey, including notes on numerous plants and a few animals observed, on soils and fossils, on plantations visited, on the friends and acquaintances he met, and on various historical affairs, has been preserved by the Historical Society of Pennsylvania.

When William Bartram had half completed his journey of 1773–77 through the Southeast, he sent to his patron in London, Dr. John Fothergill, a lengthy account of his experiences and observations up to that time. The original is preserved in the British Museum (Natural History). While it covers the same ground as the first half of his "Travels" (1791), it is no mere duplicate of the published work, but contains important additional details and throws much new light on the "Travels."

In preparation for annotating and publishing these manuscripts, and for issuing a new, fully annotated, and illustrated edition of William Bartram's "Travels," a two-months' journey was undertaken during the past summer, for the purpose of retracing the routes of these Quaker naturalists as closely as possible through the Carolinas, Georgia, Florida, and Alabama. Many places of particular interest visited and described by them have been relocated and photographed, and their routes have been plotted on charts. Numerous plants and certain animals have been collected in the same localities where they were recorded by the Bartrams, and many uncertainties in the identification of their species have thus been solved.

The main support of this investigation is provided by the John Bartram Association.

HARPER, FRANCIS, 1939. William Bartram's Bicentennial. Sci. Monthly 48: 380–384.

—— 1939. A Southern Subspecies of the Spring Peeper (Hyla crucifera). Notulae Naturae Acad. Nat. Sci. Philadelphia, no. 27: 1–4.

—— 1939. The Bartram Trail through the Southeastern States. Bull. Garden Club America, Ser. 7, no. 5: 54–64.

EMIL W. HAURY, University of Arizona

Grant No. 299 (1939). A study bearing on the problems of the Mogollon culture in southwestern archaeology.

This archaeological project, made possible through a grant from the American Philosophical Society, includes the excavation of an early pithouse village in east-central Arizona and a study of the material remains recovered from the same. The problems inspiring this study were (*a*) the further delineation of the newly established Mogollon culture of southwestern prehistory and (*b*) the determination of the extent to which this culture influenced or was influenced by its northern neighbors, the Basket maker—Pueblo people.

The excavations, conducted under permit granted by the United States Department of the Interior, were carried on between June 15 and August 8, 1939. The ruin in question is situated in the Forestdale Valley, approximately ten miles south of Showlow, Arizona, on the Fort Apache Indian Reservation. During the field period five pithouses, one surface structure, three large hearths or earth ovens, and fourteen human skeletons were uncovered, together with miscellaneous testing necessary to determine the location of these features. Approximately twenty-five per cent of the formerly occupied area was examined. The net results of this work have been the establishment of a phase new to southwestern archaeology dating from approximately the seventh century A.D. as determined by cross-finds and a suggestive tree-ring date. The people who inhabited this site were predominantly brachycephalic and medium statured as to physical type and relied upon both game and agricultural products for sustenance. Houses of the village were of two types, round and square in form, the floors sunk from one to two meters below the surface existing at the time the houses were built. Both types exhibited ventilating shafts extending from the floor level out to the surface behind the house wall. These two architectural styles seem to bear direct relationship to the orthodox Mogollon culture on the one hand and its northern neighbor, the Basket maker Pueblo people, on the other hand. The ceramic products were strongly of Mogollon vintage with minor northern influences present. Although no painted pottery was produced by the occupants of the Forestdale village, they may be credited with the development of the smudging of pottery which left a very deep imprint on later southwestern ceramics. An interesting feature of the economy was the preparation of animal foods in large subterranean earth ovens. This is significant since it may be relied upon to establish a relationship between the site excavated and the more orthodox Mogollon culture to the south where the earth oven was regularly employed. Disposition of the dead was by inhumation, the bodies being loosely flexed and placed in the ground without particular attention to orientation.

Summarizing briefly this project resulted in:

(1) The definition of a new phase of southwestern archaeology.
(2) The recognition of cultural blending in the material remains.
(3) The determination of the age of the village, namely, seventh century A.D., through cross-finds and tree-rings.
(4) The discovery of a ceramic process of smudging, hitherto unknown as an indigenous product in a site of this early age.

Owing to the relatively small area of the village which was explored further work is desirable, and the completion of the report now in progress pends further investigation.

R. G. Herb, University of Wisconsin

Grant No. 272 (1938). Studies in nuclear physics by means of a 2.4 million volt electrostatic generator.

A great from the Penrose Fund has been of assistance in carrying on a research program with the Wisconsin electrostatic generator. Two problems were investigated: first, the scattering of protons by protons; second, the excitation of gamma rays from light elements due to proton bombardment.

For the first problem, protons from the generator were shot through a chamber containing hydrogen gas. The yield of scattered protons was measured at scattering angles between 15° and 45° for six different generator voltages between .860 million volts and 2.40 million volts. Observed scattering yields were compared to yields which would be expected if there were only coulomb forces between protons. Our results show that the ratios of observed yield to coulomb yield rise with increasing angle and with increasing voltage. Professor G. Breit, by an analysis of the data, found that a short range attractive ^1S interaction between protons could explain the experimental results.

In continuing work on the second problem, detailed measurements were made on excitation of gamma rays from aluminum and lithium bombarded by protons. Gamma radiation from aluminum is due to radiative capture of the protons resulting in the formation of silicon. An investigation of the yield curve between .450 million volts and 2.6 million volts revealed a complex system of resonance levels which correspond to energy levels of excited silicon nuclei.

Our investigation of gamma radiation from lithium showed that protons above .850 million volts excite Li^7 nuclei to an energy level which had been previously established at .455 million volts above the ground state.

HERB, R. G., 1939 (with KERST, D. W., PARKINSON, D. B., and PLAIN, G. J.). The Scattering of Protons by Protons. Phys. Rev. 55: 998.

—— (with PLAIN, G. J., HUDSON, C. M., and WARREN, R. E.). Gamma Rays from Aluminum due to Proton Bombardment. Phys. Rev. (in press).

—— (with HUDSON, C. M., and PLAIN, G. J.). Excitation of the 450 Kev Level of Li^7 by Proton Bombardment. (To be sent to the Physical Review for publication.)

GERHARD HERZBERG, University of Saskatchewan

Grant No. 139 (1937). Investigation of the solar spectrum in the photographic infra-red; various investigations of molecular spectra.

During the winter 1938–39 every clear day with temperatures below —30° C., of which there were about ten, was used to obtain spectra of the sun in the photographic infrared, in collaboration with Dr. R. N. H. Haslam. Comparison plates taken recently while the temperature was above 0° C. showed that in the spectrograms taken at —30° C. a very considerable decrease of H_2O absorption was obtained as anticipated. This winter we shall try to obtain exposures under similar conditions still farther in the infrared.

Mr. R. B. Sutton and the writer were able to find and analyze tail bands of the so-called Deslandres-d'Azambuja system of the C_2-molecule and thereby extend this system considerably. In consequence of this extension it was possible to improve considerably on the rotational and vibrational constants of the molecule in the upper and lower electronic states of these bands. A short extrapolation of the vibrational quanta of the upper state leads to a dissociation limit at 35900 cm.$^{-1}$ above the lower state ($^1\Pi_u$). From this the energy difference between the $^1\Pi_u$ state and the $^3\Pi_u$ ground state is determined to be 1.7 e-volts.

Mr. A. E. Douglas and the writer in studying the spectrum of a discharge in helium of high pressure to which a small amount of BCl_3 was added, discovered a system of bands whose fine structure shows intensity alternation which therefore and for certain other reasons must be ascribed to the B_2 molecule. Up to the present time the B_2 molecule was unknown although its existence and stability were predicted by the electronic theory of valence. We expect to be able, in the near future, to determine the rotational and vibrational constants of this molecule and in addition to determine the spin and statistics of the B^{11} and B^{10} nuclei.

In the same discharge, when a little nitrogen was present two further band systems were found which could be shown to be due to the BN molecule. This molecule, like B_2, has up to now not been investigated in the free state.

HERZBERG, G., 1938–39. Reports of Progress. Yr. Bk. Amer. Philos. Soc. for 1937: 232; for 1938: 178.

—— 1940 (with SUTTON, R. B.). (Accepted for publication in Canadian Jour. of Res.)

KARL F. HERZFELD, Catholic University of America

Grant No. 131 (1937). Theoretical investigations of the absorption spectra of organic compounds.

Grant No. 267 (1938). Investigation of the physical theory of the connection between molecular structure and absorption spectra of organic compounds.

In the last report, the investigation had been carried so far that a detailed understanding of the ultraviolet absorption spectrum of benzene had been achieved. The ground state has six "unsaturation" electrons, two each in the orbits 0, + 1, — 1. The absorption near 2500 A, a weak band, arises from a transfer of one electron in + 1 to the empty state + 2 or from — 1 to the empty state — 2. This transition, forbidden in itself, is made possible only through interaction with certain vibrations.

If one considers now monosubstituted benzenes, C_6H_5F, $C_6H_5CH_3$ (toluene), C_6H_5OH (phenol), $C_6H_5NH_2$ (aniline), one finds that the first two groups do not enhance the absorption appreciably, while the latter two do so very considerably. This turns out to be caused by the partial migration of an electron from the substituent into the otherwise empty orbits of the benzene ring. The enhancement is proportional to the second power of the amount of migration. This amount becomes smaller when the distance between the substituent and the ring increases and when the forces with which the substituent holds its own electrons (the electron affinity) become stronger. This explains the experimental results, as shown in the following table (the numbers are 10^{-4} electrons per molecule):

Compound	Excess strength of absorption over benzene theor. (vapor)	exp. (liquid)
C_6H_5F	3	(6) for C_6H_5Cl
$C_6H_5CH_3$	5	8
$C_6H_5NH_2$	140	150
C_6H_5OH	60	120

In a paper not yet published the calculations were extended to disubstituted benzenes. A rule is deduced for the joint action of the two substituents, which has similarity with an empirical rule of Conrad-Billroth. If both substituents are equal, the ratio of the enhancement for mono-, ortho-, meta-, and para-substitution should be 1:1:1:4.

HERZFELD, KARL F., 1938. Reports of Progress. Yr. Bk. Amer. Philos. Soc. for 1937: 230; for 1938: 179–180.

SKLAR, A. L., 1938 (with GOEPPERT-MAYER, M.). Calculations of the Lower Excited Levels of Benzene, Jour. Chem. Phys. 6: 645–652.

—— 1939 (with SPONER, H., NORDHEIM, G., and TELLER, E.). Analysis of the Near Ultraviolet Electronic Transition of Benzene, Jour. Chem. Phys. 7: 207–220.

—— 1939 (with LYDDANE, R. H.). Antisymmetric Molecular Orbitals II. Calculation of Integrals, Jour. Chem. Phys. 7: 374–379.

—— 1939. The Near Ultraviolet Absorption of Substituted Benzenes, Jour. Chem. Phys. 7: 984–993.

H. H. HESS, Princeton University, and M. EWING, Lehigh University

Grant No. 292 (1939). Continuation of a gravity survey of the Carribean region and the correlation of gravity field with geological structure.

Part I (Hess). A geological reconnaissance was made of that region in northern Venezuela and the Venezuelan islands of the Southern Caribbean, which consist of metamorphosed Mesozoic rocks. Type sections were mapped in the following areas: (1) Central Paraguana Peninsula, (2) Island of Orchila, (3) Island of Margarita. The metamorphic section of the Cordillera de la Costa in the vicinity of Caracas was also examined under the guidance of

Dr. G. Zuloaga of the Servicio de Geologia, Ministerio de Fomento, of the Venezuelan government.

The investigation was supported by funds from the Society's grant and by research funds from the Department of Geology of Princeton University. Besides direct grants, assistance was received from the following: (1) the Gulf Oil Corporation and its associated corporation, the Mene Grande Oil Company; (2) the Standard Oil Company of Venezuela; (3) the Ministerio de Fomento of the Republic of Venezuela; and (4) the Ministerio de Obras Publicas of the Republic of Venezuela.

The study of the material brought back from Venezuela is not yet completed and the report on the fossils collected on Margarita which are being examined by Mr. M. W. Haas of the Standard Oil Company of Venezuela is not yet at hand. It may be said, however, that a considerable amount of critical information was obtained with regard to the regional problem being investigated. The following major results may be enumerated: (1) The belt of serpentinized peridotites, which are intimately related to the postulated buckling of the crust and hence the gravity anomalies, was traced from Margarita westward through northern Venezuela for about five hundred miles; (2) these intrusions have been accurately dated; (3) the relations between the uppermost Cretaceous and lowermost Eocene, which previously had been obscure in the southern Caribbean area, have been worked out and a very thick Eocene section described (with D. F. Dallmus of the Standard Oil Company of Venezuela).

Part II (Ewing). As a result of the war, plans for a continuation of the gravity observations on a submarine had to be postponed. An improved multiple pendulum apparatus with quartz pendulums has been constructed and is ready to operate.

In view of the fact that it may be some time before it will again be possible to take observations from a submarine, an attempt is being made to adapt the apparatus to use on a surface vessel. Thus far it has never been possible to make accurate gravity observations on a surface vessel, so in advance of testing no predictions will be made as to the probability of success of this experiment. The method to be tried will involve lowering of the apparatus several hundred to a thousand feet below the surface. The apparatus will be suspended from a balloon so that the balloon and apparatus have only a pound or so of negative buoyance, which will be balanced by a cable from the ship. It is hoped that the trial experiments will be made in the next few months. Should they be successful the elimination of the need for a submarine will very greatly facilitate future gravity work at sea.

Dorothy Kent Hill, The Walters Art Gallery, Baltimore

Grant No. 326 (1939). The Etruscan remains at the Castellaccio of Castel Campanile.

In furtherance of a study of the pottery from Castel Campanile which was reported at the General Meeting of The Archaeological Institute of America, 1938 (see *A. J. A.* XLIII, 1939, p. 306) some field work was carried on at the Castellaccio of Castel Campanile, a hill 31 kilometers from Rome and 8 from Cerveteri. This was financed by a grant from the Penrose Fund of The American Philosophical Society and conducted by the archaeological service of the Italian government. Tombs excavated long ago were cleared of accumulated dirt and the hilltop was freed of vegetation so that a plan could be made.

The clearing revealed no trace of an Etruscan city; but the finding of potsherds a century ago on the hill, the lack of any tombs on the southern part, and the fact that this, the highest part of the hill, has the natural configuration invariably chosen by the Etruscans for their cities convince us that the southern part of the hill was once a small city. It was only 150 m. in length. Tufa blocks from the city, probably from its walls, are incorporated in mediaeval walls on the hill.

North of the Etruscan city a path worn in the rock extends for the length of the hill. For a distance of 200 m. north of the city this passes between two rows of rock-cut pithoi which probably have sepulchral significance. The pithoi prove that the path is ancient. The east and west edges of the hill are bordered each by a series of rock-cut tombs entered from the brow of the cliff. These tombs are roughly rectangular and contain one rock bed or none. At least one of these tombs was connected by a secondary entrance with the path in the rock. A few subsidiary pithoi and some cave tombs cut in the walls of the cliffs complete the Etruscan remains on this part of the hill, which must be considered the chief cemetery of the Etruscan city.

The extreme crudity of the tombs on the Castellaccio makes dating difficult; but comparison with tombs at other sites suggests that they are from the latter part of the period of Etruscan supremacy, perhaps from the fourth to the third centuries B.C., while the pottery from the district dates from the sixth to the fourth centuries B.C. The presence of other empty tombs scattered for miles up and down the valleys north and south of the Castellaccio makes it impossible to assign the vases of Castel Campanile as a group to tombs on the Castellaccio.

We can best explain the existence of this tiny city with its necropolis and scattered tombs—bad tombs containing good vases—by the theory that it was a trading station on the route between Caere (Cerveteri) and Veii. Its principal trade was in vases which were landed from Greece at Pyrgi, the port of Caere, and others which were made at Caere. These passed through the hands of merchants of this city on the way to the interior of Italy.

RUDOLF HÖBER, University of Pennsylvania

Grant No. 223 (1938). Investigation of the influence of organic substances upon the secretory activity of the liver.

The original plan to study the influence of organic substances upon secretory activity has been carried on in a number of separate investigations.

A. Influence of organic compounds upon the membrane potentials of muscle and nerve.

Assuming that the primary effect of the organic compounds may be located in the cell surface, it seemed advisable to study the resting potentials of muscle and nerve, which are supposed to be indicative of differences of the selective ion permeability of the surface membranes. It appeared that these membrane potentials are influenced mainly by those components, electrolytes as well as nonelectrolytes, which, owing either to the polar-nonpolar configuration of their molecules or to their affinity to lipoids, are able to increase the dispersion of the colloidal constituents of the membranes. According to the concentrations and to the exposure periods applied, the effect is either reversible or irreversible, irreversibility indicating disintegration of the membranes and cytolysis. Substances acting in this way are chiefly the salts of higher fatty acids, detergents (like laurylsulfate), the salts of aromatic carbonic acids and of the bile salts, saponine-like substances and anaesthetics.

B. Influence upon the secretion of dyestuffs by the liver.

Those organic compounds, which have been found to alter the resting potentials of muscle and nerve, owing to their dispersing effects on the colloidal constituents of the plasma membranes, also are able to promote the dyestuff secretion by the liver, unless the concentrations or the exposure times are extended beyond certain limits. On the other hand, substances which, according to the hydrophilic character of their molecules, have an antidispersing and shrinking effect, correspondingly diminish or prevent the secretory concentration of the dyestuffs. Suitable concentrations of inhibitory and promoting compounds, simultaneously applied, e.g., sucrose and taurocholate, counteract each other.

C. Correlation of the molecular configuration of dyestuffs and their attachment to the secretory structure of the kidney.

From earlier studies it follows that sulfonic acid dyestuffs are selectively secreted by the proximal tubules of the kidney. Now it has been tested whether a polar-nonpolar structure, which has been found to impart to organic substances the ability to react with constituents of the surface membranes, also is apt to start the transporting machinery of the kidney epithelia. For this purpose, the isolated Ringer perfused frog kidney was supplied with a great number of sulfonic acid azo dyestuffs. The result was that with dissulfonates the main decisive feature is the location of the sulfonate groups in the dye molecules. If either of the two sulfonates is attached to the same half of the molecule, the dye reappears in the secretion at a higher concentration. If one sulfonate anchors on one half, the other on the other, little or no secretion occurs.

D. The differential secretion of dyestuffs by the liver with regard to their physico-chemical properties.

When two dyestuffs are perfused simultaneously, the liver separates them, sometimes to such an extent that the secretion of one of them is entirely suppressed by the other. Which one prevailingly appears in the secretion, does not depend upon its diffusibility or its lipoid solubility, but probably upon its adsorbability. This is concluded mainly from the fact that polysulfonate dyestuffs, because of their highly hydrophilic character, are not permitted to pass the gland.

HÖBER, RUDOLF, 1938 (with MOORE, ELINOR). Experiments Concerning the Secretory Activity of the Liver. Proc. Amer. Philos. Soc. 78: 587–593.

—— 1939 (with ANDERSCH, MARIE, HÖBER, JOSEPHINE, and NEBEL, BERNARD). The Influence of Organic Electrolytes and Nonelectrolytes upon the Membrane Potentials of Muscle and Nerve. Jour. Cell. & Comp. Physiol. 13: 195–218.

—— 1939 (with MOORE, ELINOR). The Inhibitory and the Promoting Influence of Organic Electrolytes and Nonelectrolytes upon the Secretion of Dyestuffs by the Liver. Jour. Gen. Physiol. 23: 191–202.

—— 1939 (with BRISCOE, PRISCILLA). Correlation Between Secretion of Dyestuffs by the Kidney and Molecular Structure of these Dyes. Proc. Soc. Exper. Biol. & Med. 41: 624–626.

—— 1939. The Differential Secretion of Pairs of Dyestuffs by the Liver. Jour. Gen. Physiol. 23: 185–190.

—— 1940 (with BRISCOE, PRISCILLA). Conditions Determining the Selective Secretion of Dyestuffs by the Isolated Frog Kidney. (Will be published in Jour. Cell. & Comp. Physiol. in February.)

DAVENPORT HOOKER, University of Pittsburgh

Grants No. 118 (1936), No. 173 (1937) and No. 293 (1939). Physiological and morphological studies of human prenatal development.

Physiological Program

Seven human fetuses have been observed and photographed during 1939. They ranged in menstrual age from 10½ to 24½ weeks. Three were recorded as slightly anesthetized and one was not normal. However, all showed spontaneous movement, and tactile reflexes were elicited from all. Important data, new either as to age of appearance or the nature of the reflexes, were secured from six. Good to excellent motion-pictures (normal speed and slow motion) were secured from five, those of the other two being only fair, but entirely usable for study. These seven fetuses bring the total number studied to 48 cases. However, some of the lacunae in the series are still unfilled, other ages only partly documented.

A considerable number of new action charts has been made. In general, these supplement those previously made, but a few replace some of the less satisfactory charts published in the Preliminary Atlas. The photographer has perfected a method of accurately superimposing a grid on the enlargements for the charts. This greatly facilitates observation of changes in position in the successive stages of the activity portrayed.

Observations on all available human fetuses will be continued with a view to filling certain gaps in our data and to further validating the various age stages.

With the aid of a recently acquired part-time research recorder, the records are being checked and revised in a uniform manner. Detailed records of each action and its analysis are being extended over the more than 8,000 feet of 16 mm. positive motion-picture film available. This is a time-consuming process, but these records should be up to date before the academic year is past.

In general, the results of the more recent physiological studies have confirmed and not materially modified the summary presented in the YEAR BOOK of the American Philosophical Society for 1937, pages 109–111. The new data more closely delimit the age levels at which certain activities appear or disappear and have greatly added to the detailed knowledge of the nature of specific responses.

Morphological Program

The technical aspects of the investigation have progressed materially during the past year. On April first, the services of a full-time technician were made available from funds secured for the purpose. Since that date, the technician has sectioned, stained and mounted nearly 3,000 large slides, covering fifteen specimens. In addition, the 3,400 slides previously made have been reserviced, uniform labels provided and master reference cards prepared in triplicate for each series, for each tray, and for each slide. This has greatly increased the availability of the sections. The more recently prepared material is of excellent quality.

Doctor Hogg has made progress in the very difficult study of the origin, time and place of appearance, and nature of the sense organs of the skin. Doctor Humphrey is continuing her study of the development of the olfactory areas of the brain and of the ventral horn cell-columns of the cervical spinal cord. She has incidentally found that the accessory olfactory formation, present in many infra-human forms throughout life, but absent in adult man, is present in the human fetus. So far as can be determined, this has not been reported.

Doctor Donaldson is studying, and directing a group of students in a survey of the endocrine organs at various age levels. Though incomplete, this study has already demonstrated important relationships between the levels of development of the different endocrine organs. The study of lung development, which I am carrying on, is only just beginning. However, significant data regarding the level of lung development in relation to beginning functional capacity of these organs have already been secured.

Continued support for the investigation from sources other than the American Philosophical Society seems assured. My colleagues and I deeply appreciate the aid extended from the Penrose Fund which has made progress possible of a degree sufficient to secure additional support.

HOOKER, DAVENPORT, 1939. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1938: 184–186.

—— 1939. A Preliminary Atlas of Early Human Fetal Activity. 95 pp. Privately published.

—— 1939. Fetal Behavior. Res. Publ. Assn. Res. Nerv. and Ment. Disease 19: Chap. XIII, 237–243.

LAURENCE IRVING, Swarthmore College

Grant No. 309 (1939). Examination of the oxygen dissociation curves of blood of the Atlantic salmon while living in salt and in fresh water.

This investigation was carried out by Earl Benditt, Peter Morrison and Laurence Irving of The Edward Martin Biological Laboratory, Swarthmore, Pa.

The purpose of this investigation was to compare certain of the characteristics of the blood of Atlantic salmon taken from salt water with those after migration to fresh water. In the adjustment to this transition the general metabolism, and electrolyte balance in particular, of the salmon are greatly changed. Brackish water salmon were obtained from the commercial nets in Gaspé Bay, P. Q., Canada. Fresh water salmon, with two exceptions, were obtained from the lines of sport fishermen on the St. Jean River which empties into the Bay. All were bled by heart puncture while still living.

The average cell volume for 15 brackish water fish was 39.4 volumes per cent (24.4–47.5 variation), with an average oxygen capacity of 12.3 volumes per cent (20.6–14.9 variation). For six fresh water fish the average cell volume was 24.8 volumes per cent (19.3–28.4) and the average oxygen capacity 8.8 volumes per cent (6.2–10.1).

The oxygen dissociation curve (15° C and < 1 mm. CO_2) for brackish water fish showed a half saturation at 20 mm. of oxygen. The data on fresh water fish were sufficient only to show no gross variation from the brackish water fish.

Comparison of the maximum CO_2 effects, at oxygen pressures of 150–160 mm. and CO_2 pressure greater than 65 mm., showed that CO_2 reduced the oxygen capacity by 36 per cent (33–39) in five brackish water fish and by 43 per cent (42–44) in four fresh water fish. With this maximum CO_2 effect there was uniformly an increase in cell volume of 9.0 per cent (5.1–13.9) and 8.2 per cent (6.2–11.1) for the brackish and fresh water fish respectively.

Determination of the freezing point depression of the blood plasma showed Δ's of $-0.765°$ C. (-0.717 to -0.800) for five brackish water fish and $-0.638°$ C. (-0.597 to -0.675) for four fresh water fish.

With changes in the osmotic concentration of this magnitude and dilution of the erythrocytes the combination of oxygen with hemoglobin in the erythrocyte is apparently not significantly altered.

It is a pleasure to acknowledge the assistance of the Bureau of Mines and Fisheries, Province of Quebec, extended in particular through Mr. Charles Lindsay, and the hospitable provision of laboratory space by Le Séminaire, Gaspé, Quebec.

TABLE 1

	Brackish water fish	Fresh water fish
Cell volume	39.4 vols. %	24.8 vols. %
Variation	24.4–47.5 (15 fish)	19.3–28.4 (6 fish)
Oxygen capacity	12.3 vols. %	8.8 vols. %
Variation	10.6–14.9 (15 fish)	6.7–10.1 (6 fish)
Maximum CO_2 effect	63.9 vols. % saturation	57.2 vols. % saturation
Variation	61.1–67.1 (5 fish)	56.0–58.2 (4 fish)
Cell volume increase	9.0 vols. %	8.2 vols. %
Variation	5.1–13.9 (5 fish)	6.2–11.1 (4 fish)
$-\Delta F$	$-0.765°$ C.	$-0.638°$ C.
Variation	-0.717 to $-0.800°$ C.	-0.597 to $-0.675°$ C.

RONALD L. IVES, Science Service

Grant No. 284 (1938). Continuation of studies of areas in Middle Park, Colorado, shortly to be submerged by reservoirs of the Colorado-Big Thompson Transmountain Diversion Project.

Long-range (infra-red) photographs were taken of the Shadow Mountain reservoir site from Shadow Mountain (10,150′) and from the medial moraine northwest of Grand Lake (8,750′). These, with the photographs previously taken (Grant No. 242, 1938), give a complete photographic record of the major topographic features of the areas to be submerged.

Detailed studies of these areas, and of all valleys tributary to them, have been completed. From these studies, the following findings have been made:

1. Prior to the widespread Stillwater (probably Illinoisan) glaciation, ice covered parts of the region from the Continental Divide down to about the present 8,000 foot contour. The small amount of evidence now present suggests two pre-Stillwater glaciations, probably originating in ice caps atop the Front and Never-Summer Ranges, and probably representing the Kansan and Nebraskan glaciations of mid-continent areas.

2. A system of faults, striking north, and dipping steeply away from the summit of the Front Range, was discovered. Field evidence indicates that these faults are of pre-Pleistocene age.

3. A number of rock glaciers were discovered in the high cirques of the Front and Never-Summer Ranges.

Studies of artifacts, started some years ago, were continued. Plentiful evidence of pre-Columbian occupation of the area was found, but no evidence of Folsom Man was disclosed.

More than 400 samples of sedimentary rock were collected for Dr. K. E. Lohman, of the U. S. Geological Survey, for diatom analysis.

More than 400 samples of fresh water from the various streams in the area were sent to Dr. Ruth Patrick, of the Philadelphia Academy of Natural Sciences, for diatom analysis.[1]

With the active cooperation of Dr. Louis O. Quam, of the University of Colorado, an exact "stage for stage" correlation of glaciations in the Colorado headwaters region and those in the Estes

[1] Funds, materials and assistance supplied by the University of Colorado Museum made possible a diatom collection about four times as extensive as was originally planned.

Park area was worked out. Correlation of the later glacial stages in the Cache-La-Poudre and Colorado Valleys was found possible.

Further work in this area is contemplated. A number of papers, describing field findings in detail, are in preparation. Publications resulting from both grants (Nos. 242 and 284, both 1938), to date, include:

IVES, R. L., 1938. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1938: 191–192.

—— 1939. Valley-Head Cloud Windows. Mo. Weather Rev. 67: 11.

—— 1939. Glacier Measurements. Ann. Rpt. Int. Comm. Snow: 38.

—— 1939. Infra-red Photography as an Aid in Ecological Surveys. Ecology, 20: 433–439.

—— "River Fogs" of Middle Park, Colorado. Bull. Amer. Met. Soc. 20: 415–417.

—— 1939. Rock Glaciers in the Colorado Front Range (abstract). Bull. Geol. Soc. Amer. 50: 1913–1914.

H. S. JENNINGS, Johns Hopkins University

Grant No. 203 (1938). Cytology of ciliate protozoa, in particular, the chromosomes and their behavior at conjugation in Paramecium bursaria and in other species of Paramecium; also the chromosomes in the Opalinidae.

Grant 203 was made to enable me to arrange for Dr. T. T. Chen to cooperate with me in a program of genetical and cytological investigations on the ciliate protozoan Paramecium bursaria. The genetic experimentation and observations were carried on by the grantee, while Doctor Chen did the cytological work.

For part of the year cooperative work was carried on at the Johns Hopkins University; for the remainder of the year at the University of California at Los Angeles. Doctor Chen showed himself a skillful and resourceful cytologist, a scientific artist of most exceptional ability, and an unwearied, enthusiastic, and intelligent investigator. His work has done much to illuminate the problems under investigation. To show the bearing of the cytological work, it will be necessary to state briefly some main features of the genetic results.

The genetic study shows the following for Paramecium bursaria:

(1) The species includes three distinct "groups" or varieties, the members of any one group never conjugating with members of either of the other groups, so that the three groups remain unmixed, never intercrossing.

(2) In each of the groups there is a number of different "types," having relations to each other that are like the relations of the two sexes in other organisms. In Group I there are four such types, in Group II eight types, in Group III four types. To each type belong many different clones. Clones that belong to the same type do not conjugate together. But clones of a given type (as type A) may conjugate with clones of any of the other types of that group: thus clones of type A may conjugate with any clone of type B, C, or D, but not with any of type A.

(3) The many clones that belong to a given type differ greatly in other characteristics: in size, in form, and particularly in vigor, resistance, power of reproduction, and readiness to conjugate: as also in the vigor and mortality of their descendants by conjugation.

Dr. Chen undertook the study of the cytological bases of these phenomena and examined the cytology of the different groups, types and clones: also the cytological processes in conjugation and reproduction. He brought to light important correlations between the genetic and cytological phenomena and discovered many relations of great interest in the cytological processes underlying conjugation and reproduction. Dr. Chen made an elaborate series of preparations showing the processes at short intervals from beginning to end as well as a great number of remarkable drawings, showing beautifully the cytological diversities in the clones and types, and the processes undergone. For the most part Dr. Chen has reserved and accumulated his data and drawings, planning to publish them in a series of monographic papers.

Some of the cytological relations may be briefly stated as follows:

1. The different types of a group are not characterized by chromosomal diversities, but any type includes clones that differ greatly in chromosomal features, as they do in other characteristics.

2. The characteristic cytological diversities are between the different clones (of either the same type or of different types).

3. Clones of the same group or of the same type differ greatly in the amount of chromatin present in the nucleus: that is, in the number of chromosomes present. In some clones the nucleus (micronucleus) is large and densely filled with chromatin, made up of a great number—hundreds—of distinguishable chromosomes. In others the chromatin is much less abundant and the number of chromosomes is much smaller. Other clones have very few chromo-

somes, the nucleus showing almost no stainable chromatin. In still others there are no visible chromosomes, the nucleus being but an empty vesicle, which does not stain with chromatin dyes. In different clones all gradations occur from one extreme to the other.

4. These chromosomal diversities are correlated with differences in vigor, resistance, rate of mortality and power of reproduction. Clones with little chromatin (or with none in some of the individuals) are weak; they are difficult to cultivate and die in large numbers. Clones with much chromatin are vigorous, and strong in reproduction. The generality of these relations needs to be further tested by studies carried out on a statistical scale, employing great numbers of differing clones.

5. Conjugation occurs between clones that thus differ greatly in the number of chromosomes present in the nucleus. It occurs even between clones of the two extremes above mentioned, so that one of the mates contains a great number of chromosomes, while in the other the nucleus is empty. In such cases half the chromatin from the one individual passes into the other that carries no chromatin.

The details of these relations, in conjugation between clones differing in numbers of chromosomes, show much that is of interest for the understanding of conjugation and for the general problems of fertilization. Much of Chen's work is devoted to these relations. He has accumulated on them a great mass of data and of illuminating preparations and drawings. The field is one worthy of much further study.

6. Incidentally, other relations of interest have come to light; one or two examples may be mentioned:

(*a*) In collaboration with Dr. Vance Tartar, Chen shows that the agglutination leading to conjugation may occur between cytoplasmic fragments, without nucleus, if these are derived from individuals that belong to different types. A paper on this by the two authors is now in press.

(*b*) At times three individuals become united, and each of the three then undergoes the cytological changes characteristic for conjugation. Chen has collected a considerable number of such cases and is preparing a paper on the nature of the processes.

In sum, the cytological work of Chen seems to me of great interest and value. Cytological and genetic work need to be carried on together. In the present investigation practically all the relations in both fields are new.

Efforts are being made to arrange for further collaboration with Chen in joint work in the two fields, and for publication of the work already completed.

Roy W. Jones, Central State College, Oklahoma

Grant No. 334 (1939). The determination of the effect of growth promoting substances on the early differentiation of fish embryos as expressed by the rates of cell divisions in such embryos.

The project now under way has to do with the effect of "auxilin" (indolebutyric acid) on the early development of the Japanese minnow Medaka. The eggs of this fish remain attached to the vent of the mother for several hours after oviposition. They are usually in the 32 or 64 cell stage when collected. The eggs from a single female are divided into two finger bowls containing 200 cc. of distilled water each. To one is added enough auxilin to produce the concentration desired. The other is kept as a control. The two cultures are allowed to develop at relatively constant temperatures until the desired embryonic stage has been reached. Both series of embryos are then fixed in Smith's fixative, embedded and sectioned. For each concentration of auxilin ten embryonic stages have been obtained. The concentrations used were 1 per cent, 0.1 per cent and 0.05 per cent commercial auxilin. These are respectively: 4 milligrams per 100 cc., 0.4 milligram per 100 cc. and 0.2 milligram per 100 cc. of crystalline indolebutyric acid in distilled water.

It is proposed to count the cells in the developing eyes of the fish embryos and to determine the mitotic index for several specimens of each stage. In this way the effect of the auxilin on cell division may be correlated with its effect on morphogenesis and physiology.

Preliminary experiments indicate that auxilin is toxic to fish embryos in the dilute concentrations used. In the early embryos there seems to be a slowing up of the cleavage processes. Cleavage normally requires about 30 minutes at room temperature. Auxilin treated embryos required 40 minutes at room temperature. This retardation is also visible in the later embryos in the degree of development reached by auxilin treated and control embryos of the same age. The auxilin seems to affect the circulatory system most drastically. The red corpuscles do not form and those present in embryos not exposed to auxilin until the corpuscles are well developed appear to be destroyed. The muscular movements of the heart and vessels are weak and ineffectual. When allowed to continue development, the auxilin treated embryos eventually reach what appears to be the hatching stage but then die. During this time, there accumulates in the urinary bladder an orange red material. This may be due to the excretion of substances from the disintegrated red corpuscles.

After the studies on auxilin are completed it is proposed to undertake similar projects on the effects of colchecine and thiamin chloride. Preliminary experiments have already been made which indicate that they both affect the rate of development.

JONES, ROY W., 1939. Observations on the Effects of Auxilin on the Development and Physiology of Fish Embryos. A paper presented to the Oklahoma Academy of Science at Tulsa, Oklahoma, December 8, 1939. (To be published in the Trans. Oklahoma Acad. Sci.).

D. H. KABAKJIAN, University of Pennsylvania

Grant No. 207 (1938). Study of energy levels in pure or activated crystals, and the dependence of these on physical structure.

A study of energy states in crystals was conducted by examining the intensity of luminescence emitted by these under varying conditions and the wave length distribution of their emission bands by means of a quartz spectrograph. The results of this study were presented to the Washington meeting of the American Physical Society (April 1938). The following is an abstract of this paper.

> Luminescence of Pure Crystals. D. H. Kabakjian, University of Pennsylvania.—It has been asserted by many investigators that luminescence in solid compounds is due to the presence of small quantities of impurities and that pure substances do not luminesce. According to modern theories of the solid state, pure crystals should show the property of luminescence if the following two conditions are fulfilled: (1) Permissible but unoccupied energy levels exist in the crystal and (2) the energy absorbed from the exciting source is sufficient to displace electrons from normal to the higher levels. The writer has already shown that intense luminescence may be excited in certain pure zinc borate compounds, especially when these are obtained in a

crystalline state. It is now found that a fairly large number of crystals may be made luminescent by using rays from radioactive sources. The luminescence of six pure crystals, $RaBr_2$, $RaCl_2$, $RaSO_4$, $BaCl_2$, $BaBr_2$, $BaSO_4$, has been studied. With proper heat treatment, maximum luminescence in these crystals is produced with the highest degree of purity obtainable. However, the variation of brightness with the temperatures of heat treatment seems difficult to explain by any known theory.

This work was continued in 1939 and the results were embodied in a paper that was sent to the *Physical Review* for publication. The paper has been accepted by the publishers and will be published in the near future. An abstract of the paper follows.

Luminescence, excited in some carefully purified crystalline barium and radium compounds by alpha, beta, and gamma rays, has been examined. It was found that these compounds show a faint luminescence at ordinary room temperatures. When the compounds are heated to various temperatures and then cooled, they show a continuous increase in luminescence with increase of temperature of heat treatment until a maximum is reached. Heat treating at higher temperatures diminishes the brightness. The temperature of maximum brightness is not directly related to the melting point of the individual compounds. The maximum brightness in some cases was several hundred times the initial brightness of unheated crystals. No abrupt changes in intensity of luminescence, such as might be due to changes in crystalline form, were detected. The bearing of these experiments on the modern theories of luminescence in crystalline solids is discussed.

KABAKJIAN, D. H., 1938. Luminescence in Pure Crystals. Phys. Rev. 53: 919.

MARTIN KILPATRICK, University of Pennsylvania

Grants No. 248 (1938) and No. 335 (1939). Relative acid strengths in aqueous and non-aqueous solutions.

Since the last report (1938) the acid strengths relative to benzoic acid of some twenty substituted benzoic acids have been determined in methyl and ethyl alcohol. The results of the colorimetric method have been checked by electrometric measurements, and the measurements have been extended to the solvents n-butyl alcohol and dioxane-water mixtures by Mr. Elliott. In the following table the acids are listed in order of decreasing acid strengths. From these results it is evident that the relative order of acid strengths varies with the solvent and that safe conclusions cannot be drawn from the determination of the dissociation constants of the acids in water at one temperature.

Dr. Mears has modified the photoelectric colorimeter to measure the relative acid strengths of the deuterium compounds using small quantities of solvent.

Order of Acid Strengths of Substituted Benzoic Acids

Solvent	By extrapolation	Water	Methyl Alcohol	Ethyl Alcohol	n-Butyl Alcohol	Dioxane-Water
Dielectric Constant	∞	78.5	31.5	24.2	17.4	15
Substituent	o-NO_2	o-NO_2	o-NO_2	o-NO_2	o-NO_2	o-OH
	o-I	o-Br	o-OH	o-OH	o-OH	o-NO_2
	o-Br	o-I	o-Br	m-NO_2	p-NO_2	p-NO_2
	o-Cl	o-Cl	o-Cl	p-NO_2	m-NO_2	m-NO_2
	o-OH	o-OH	o-I	o-Br	o-Br	o-Br
	o-F	o-F	m-NO_2	o-Cl	o-Cl	o-Cl
	p-NO_2	p-NO_2	p-NO_2	o-I	o-I	o-I
	m-NO_2	m-NO_2	o-F	o-F	o-F	m-Cl
	o-CH_3	m-Br	m-Br	m-Br	m-Cl	m-Br
	m-Br	m-Cl	m-Cl	m-Cl	m-Br	m-F
	m-Cl	m-I	m-I	m-I	m-I	m-I
	m-F	m-F	m-F	m-F	p-Br	p-Br
	m-I	o-CH_3	p-Br	p-Br	m-F	p-Cl
	m-OH	p-Br	p-I	p-I	p-I	p-I
	p-I	p-Cl	p-Cl	p-Cl	p-Cl	
	p-Br	o-OCH_3	p-F	o-OCH_3	o-OCH_3	
	p-Cl	m-OH	o-OCH_3	p-F	p-F	
	o-OCH_3	p-F	o-CH_3	o-CH_3	o-CH_3	
	Benzoic Acid					
	p-F	m-CH_3	m-CH_3	m-CH_3	m-CH_3	m-OH
	m-CH_3	p-CH_3	m-OH	m-OH	m-OH	o-OCH_3
	p-CH_3	p-OCH_3	p-CH_3	p-CH_3	p-CH_3	m-CH_3
	p-OCH_3	p-OH	p-OCH_3	p-OCH_3	p-OCH_3	p-CH_3
	p-OH		p-OH	p-OH	p-OH	o-CH_3
						p-OCH_3
						p-OH

Kilpatrick, Martin, 1939. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1938: 193–194.

—— 1939 (with Minnick, L. J.). J. Phys. Chem. 43: 259–274, 294.

JACOB KLEIN, St. John's College, Annapolis, Md.

Grant No. 263 (1939). Galileo's physics, its problems, principles and origins.

The earlier writings of Galileo are influenced by his reading of Aristotle and Plato's *Timaeus*—in the medieval and humanistic presentation—by Ptolemy, by Euclid and by Archimedes. In order to understand the new approach to nature, as achieved by Galileo's physics, an intensive study of Plato's *Timaeus* and Aristotle's *De Coelo* was undertaken. The analysis of the *Timaeus* had to be pursued in two directions:

(*a*) an understanding of the structure of the Platonic dialogue without taking into consideration the interpretation to which the dialogue was later subjected;
(*b*) an investigation of that later interpretation, which leads to Galileo's understanding of the Platonic cosmology, as well as to his opposition to the Aristotelian-Ptolemaic doctrine.

This twofold analysis forms the first part of our study. Particular emphasis was laid upon the Platonic and Aristotelean notions of space, which are inseparable from the corresponding concepts of matter.

The second part deals with the geometrical and mechanical background of Galileo's physics as represented by:

(*a*) Euclid, especially the (Eudoxean) theory of ratios and proportions, and Archimedes;
(*b*) the nominalistic tradition, which can be traced back to Nicolaus Oresmus and Thomas Bradwardinus;
(*c*) the mechanical works of Galileo's immediate predecessors, notably Tartaglia and Benedetti.

The principle of applying the theory of ratios and proportions to all natural phenomena is at the base of Galileo's physics. The theory of falling bodies is not expressed by means of symbolic formulas representing the functional relation between two variables, but through Euclidean proportions. This implies a "geometrical" understanding of motion and change.

The last part deals with the fundamental modification in the concept of nature resulting from this new understanding of motion.

Whereas the historical chapters of the first two parts have been nearly completed, the third part, of a more systematic nature, has not yet been undertaken.

The entire study will be completed in 1940.

Klein, Jacob, 1940. Phenomenology and History of Science. Edmund Husserl Memorial Volume (Harvard Press), edited by Marvin Farber, of the University of Buffalo. (To be published.)

Richard Krautheimer, Vassar College

Grants No. 213 (1938) and No. 307 (1939). Corpus Basilicarum Christianarum Romae.

Since the previous report work on the "Corpus Basilicarum Christianarum Romae" has been continued. The following churches have been surveyed and their drawings definitely completed: S. Lorenzo in Damaso, S. Lorenzo in Fonte, S. Lucia in Selcis, S. Maria in Cosmedin, S. Maria de Metrio, S. Maria in Tempulo, S. Martino ai Monti, S. Passera, S. Pellegrino degli Svizzeri, S. Pietro in Vincolis. The survey is still in progress at the church of S. Marco. In addition to these churches, which are going to be included in the second volume of the "Corpus," we have made the plan and the elevations of the church of S. Susanna, since the destruction of later houses surrounding the church offered a unique opportunity to study the building as well as the Roman constructions below and adjacent to it.

All these churches contain considerable remains of the Early Christian and Roman period and thus will contribute towards our knowledge of Early Christian architecture in Rome. S. Martino ai Monti and S. Marco evidently present the normal type of IX century basilicas in Rome and clearly point towards the revival of IV and V century architecture in the Carolingian period. S. Pietro in Vincoli presents in its transept a very exceptional solution. Instead of showing the "normal" continuous transept of the Constantian basilicas in Rome, this early V century church shows a type of transept which finds its closest parallel in certain Early Christian basilicas of Greece such as basilica A at Nikopolis or the basilica at Dodona. At S. Lorenzo in Damaso we were able to locate below the courtyard of the Palazzo della Cancelleria and below the present XV century church, a number of walls which belong to different Antique buildings, to a Roman house, to a Mithraeum and possibly to the original church erected by Pope

Damasus (366–84). At S. Susanna we traced the IX century church which is still largely preserved in the walls of the XVII century building and which shows the very unusual type of a basilica with galleries over the aisles. The road building in progress uncovered a large number of different Roman constructions which belonged to different periods from the I century B.C. through the III century A.D.

KRAUTHEIMER, RICHARD, 1939 (with FRANKL, W.). Recent Discoveries in Churches in Rome. Amer. Jour. Arch. 43: 388–400.

HAROLD W. LANDIN, Ohio State University

Grant No. 355 (1939). Study of the political and cultural influence of the French Revolution on Sweden, with special reference to the activities of the Jacobin clubs which were organized in Sweden after 1791.

During my three and a half months in Stockholm I devoted myself to the printed and manuscript materials in the Kungliga Biblioteket and the Riksarkivet. Soon after I had begun my research I discovered that there were many important manuscripts in these collections which were worthy of publication as valuable sources of Franco-Swedish history. So vast was this material that I concluded there was insufficient time to copy the documents and that it would be wiser to read as much as time would allow and take such notes as would be necessary to enable a photographer to locate this material at some later date. When I left Stockholm on December 16, 1939, I had read all the materials dealing with the French revolution and Franco-Swedish relations during the last decade of the eighteenth century. Of these documents I made notes of seventeen hundred and nine which can be divided into the following groups:

1. The private letters of the Swedish ambassador to Paris, Baron Eric Magnus Staël von Holstein, addressed to Gustav III.
2. The official dispatches of Staël von Holstein from 1787 to 1796.
3. The official dispatches of Bergstedt and Gambs, the secretaries of the Swedish embassy in Paris. These cover the period from 1787 to 1795.
4. The dispatches of Count Axel von Fersen to Gustav III from the fall of 1791 to the end of 1792.

5. Letters from Gustav III to Louis XVI, Marie Antoinette, members of the French royal family and certain French nobles who were active in the counter-revolution.

6. Letters of Madame de Staël and of her father, Jacques Necker, to Gustav III, Gustav IV Adolf and their ministers of state.

7. The letters of Prince Carl and Duchess Charlotte Elizabeth to Staël von Holstein and G. M. Reuterholm, Minister of State.

Of these 1709 documents only a few have been published and these have appeared only in the form of brief excerpts. It is my hope that at least a large part of these documents may find their way into print because they are important sources for the history of the French revolution as well as for the history of Sweden. For a study of the lives of Gustav III, Gustav IV Adolf or Baron Staël von Holstein this material is indispensable.

PAUL R. LEBERMAN, University of Pennsylvania

Grant No. 192 (1937). The pathology of the human renal papilla.

Several years ago Dr. Alexander Randall in searching for the origin of primary renal calculi suggested that the human renal papilla might be the location of such a nidus.

With this in mind, a study of the pathology of the renal papilla was undertaken. To date 721 pairs of kidneys from autopsy material obtained from the Hospital of the University of Pennsylvania and the Philadelphia General Hospital have been studied. Specimens of papillae were collected that represented certain types of pathology. The following outline will demonstrate the various groups:

1. Normal papilla—diversifications of.
2. Papilla with calcium placques.
   - *a.* On the tip of papilla.
   - *b.* On the side of papilla.
   - *c.* Multiple placques.
   - *d.* Placques with stone.
   - *e.* Tubular inspissation.
3. Tuberculosis of the papilla.
4. Cysts of the papilla.
5. Varicosities of the papilla.
6. Flattened papilla due to hydronephrosis.
7. Papillitis.
8. Adhesions between papilla and calyx.

The case histories of the autopsies investigated were studied and notes made of the clinical histories, occurrence of lesions in decades of ages. Photographs and drawings of interesting specimens were made. Microscopic sections of the specimens were studied and compared with the photographs and drawings. Photomicrographs of the pathology noted were made.

These data have been assembled and are being made ready for publication.

RAPHAEL LEVY, University of Baltimore

Grant No. 327 (1939). Preparation of a commentary on Old French glosses important for French lexicography and mediaeval culture.

A previous investigation based on seventy sources, including fourteen manuscripts, was undertaken in Europe on a John Simon Guggenheim fellowship. The material was prepared and a monograph entitled "Recherches lexicographiques sur d'anciens textes français d'origine juive," was published under the auspices of the Johns Hopkins University. The monograph was limited to an enumeration of 815 glosses with the appropriate critical apparatus. The purpose of the present grant is to prepare a commentary in order to explain properly the utility of the glosses for French lexicography and for mediaeval culture.

The procedure in this project calls for an initial study of some 1,400 vocabularies of Old French texts and of modern French dialects, enumerated in the "Répertoire des lexiques du vieux français" and in the "Bibliographie des dictionnaires patois." Practically all of those lexica were found in twelve public and private libraries of the United States. Copious notes were taken; they are now being arranged systematically. For each gloss all special references which may yield pertinent material as to its origin, its diffusion, or its application will be consulted. The grantee expects to complete many of the word-studies during 1940.

CARL C. LINDEGREN, University of Southern California

Grants No. 169 (1937) and No. 247 (1938). Analysis of the mechanism of crossing-over by growing to maturity the plants produced from the spores of Neurospora crassa.

In their new text on genetics, Sturtevant and Beadle maintain the view that simultaneous multiple exchange at meiosis occurs at random with respect to the strands which are involved. Since the publication of their book, Huskins and Newcombe have reported contrary findings based on cytological evidence. Newcombe has recalculated the data which Emerson and Beadle used to support the thesis of non-randomness. He found that these data actually did not support the theory of randomness and were consistent with the contrary thesis.

Of all organisms used to study genetics, Neurospora is best adapted to this particular problem. We have proceeded to check again our earlier findings which showed that crossing-over was non-random. This is being done with an additional 1,000 asci; more than four times the number used in our previous report. This enormous task has nearly been completed but the data will not be analyzed until next summer during my vacation. An article will be published at that time.

GUY S. LOWMAN, JR., Linguistic Atlas, Brown University

Grant No. 341 (1939). Survey of the speech of Pennsylvania.

With the study of Pennsylvania English, the collection of materials for a Linguistic Atlas of the Middle Atlantic Region has now begun. The field records from the eastern half of the state have been completed and are being deposited at the Brown University headquarters of the "Atlas of the United States and Canada." An old-fashioned rural type has been studied in each county. The middle-aged type is usually rural, except in counties with few English speaking inhabitants. Additional informants have been selected in the larger counties in southeastern Pennsylvania. Cultivated speech has been studied in Philadelphia and other cities. A questionnaire containing about nine hundred items was changed only slightly from that used in New England and the South Atlantic Region.

German-speaking elderly informants who had learned English chiefly at school were selected in Lehigh, Carbon, Schuylkill, Snyder, Berks, Lebanon, Dauphin, and parts of Lancaster and York. No English-speaking rural families native to the spot had survived in these areas. It is hoped that these records of Pennsylvania-German English, in which many German terms are recorded as well, will be useful to those who are now constructing a German questionnaire for the study of regional differences in the dialects of Pennsylvania German.

The charting of items from my field records would require many months, but from memory alone I can picture a certain regionalism in Pennsylvania speech:

1. A compact Philadelphia area, including the English-speaking part of Bucks, Montgomery, and northern Chester counties.
2. An English-speaking area from the city of Chester to Stewartstown in York county has more affinities with Wilmington.
3. Adams, Franklin, Fulton, and Bedford counties, with some Maryland characteristics.
4. The area west of Harrisburg, already Western Pennsylvanian in type.
5. The northern Delaware River section, with traits from southeastern New York.
6. The northern tier of counties and adjacent areas with speech derived from New England, northern and western New York.
7. The English spoken by Germans in Schuylkill and Snyder counties is very different in phonetic pattern from that used in German-speaking counties nearer to Philadelphia.

The extension of the research into Western Pennsylvania and derivative areas in the Ohio Valley ought to show a similar variety of cultural pattern with historical significance.

JOHN FRANCIS MCDERMOTT, Washington University

Grant No. 345 (1939). Biography of Auguste Pierre Chouteau.

Before this grant was made in June, 1939, I had already examined practically all the works in print that mentioned Chouteau or that contained pertinent background material. I had also made extensive use of the Chouteau manuscripts and related collections of papers at the Missouri Historical Society (Saint Louis) and of the Probate Records in Saint Louis.

In August and September (1939), as a result of this grant, I spent more than four weeks in the eastern states searching for persons and papers connected with my subject. Two weeks of this time I used in Cambridge—principally to examine in detail the manuscripts of the American Board of Foreign Missions (now housed in the library of the Harvard Theological Seminary) concerned with the missions at Dwight, Union, and Harmony. Other manuscript materials I examined at New Haven, Hartford, and West Point. Although I was not able to exhaust all possible sources in the East, the additional information acquired will considerably enrich my study. Since I returned to Saint Louis, I have been able to gather more data through interlibrary loans and I have secured photostatic copies of a number of valuable documents which I had not been able to consult otherwise. The principal sources remaining for investigation are in Kansas City, Topeka, Oklahoma City, Chicago and Washington, D. C.

REGINALD D. MANWELL, Syracuse University

Grant No. 282 (1938). The exoerythrocytic cycle in avian malaria, and its relation to the development of immunity—studies to be centered about Plasmodium circumflexum.

Part 1. Immunity in Avian Malaria, with Special Reference to Plasmodium circumflexum.

This study has included the completion of work started some time ago on strain immunity, or the protection which a chronic infection of one strain of a species (in this case, Plasmodium circumflexum) confers against subsequent infection with a second strain, and experiments to test the possibility of giving passive immunity by the injection of serum from chronic cases into clean birds, or into birds which had been infected but were still in the incubation period.

The investigation of strain immunity involved the crossing of six strains, four of which originated in birds of three different species (robin, song sparrow, and white-throated sparrow) caught in Syracuse. One of the other two was isolated from a juniper thrush by Dr. Walter Kikuth of Elberfeld, Germany, and the other came from a red-winged blackbird caught at the Austin Ornithological Station on Cape Cod, by Dr. Carlton Herman. The method used was to inoculate chronic cases of a given strain with parasites of the same or a second strain, and follow them for a sufficient length of time (usually a month) to find whether an infection would result.

The results showed that there was almost always strong immunity to reinfection with the same strain, but that when different strains were used there was frequently a partial breaking-down of the defense mechanism. In general it appeared that the strains of Syracuse origin conferred considerable mutual protection, but this protection was quite incomplete against the infection with the strains of different geographic origin. This is possibly due to a common genetic relationship of the Syracuse strains, even though they were from three different species of hosts. This study shows quite clearly that immunity in avian malaria is strain-specific rather than species-specific, just as it is known to be in human and monkey malaria, and falls into line with more recent work by Redmond (1939) on Plasmodium relictum and cathemerium. The different results obtained by Gingrich (1932) on Plasmodium praecox (relictum) are probably to be explained by the fact that he did not use a sufficient number of strains.

The attempts to confer passive immunity involved first the repeated superinfection of the birds which were to serve as donors of the protective serum. This was done in order to raise the titre of immune factors to the highest point possible. Serum from these birds was then pooled and injected into clean birds. In some cases the treatments were given before infection, and in others both before and after. The number of treatments ranged from seven to nine, and the amount of serum given each bird in a single treatment was about 120 cmm. Injection was by different routes—intravenous, subcutaneous or intramuscular. In all, thirty-two cases were treated, fifteen before infection and seventeen at the time of and after infection. The serum was homologous with the strain of parasites used in nineteen cases and heterologous in thirteen cases. It was separated by centrifuging, and heated for thirty minutes at 56° C. The infective dose of parasites was incubated with immune serum at 37° C. for thirty minutes before inoculation.

The results showed that in many cases treatment before infection was sufficient to prevent the development of any infection at all, and that when infection did occur it was often much less severe than in the controls.

When immune serum was administered at the time of and after infection it was considerably less effective, but even here there was a definite beneficial effect. Parasites appeared in the blood later than in the controls, and were fewer in number, even at the height of the acute stage. In some cases however no benefit at all was evident, and the disease was even more severe than in the controls.

The results may be summarized as follows:

When treated	Completely protected	Partially protected	No protection	Total cases
Before infection	11	0	4	15
Simultaneously with and after infection	7	7	3	17
Totals	18	7	7	32

The question of how specific the effect of the immune serum is remains unsolved. There was some indication that it was strain-specific, but to settle the problem it would be necessary to use a good many more birds than we have been able to do thus far.

The significance of this work lies in the fact that it shows clearly that the immune mechanism in avian malaria is like that in human and monkey malaria, in that there are certainly protective substances present in the serum, though they seem always to be there in very low concentration. It is also clear that they either play a relatively minor part in the defense mechanism, or that they are regenerated very quickly, for twenty-six chronic cases from which proportionately very large amounts of blood had been withdrawn (from ⅓ to ½ the total volume), when injected with heavy doses of parasites, failed to show any evidence of relapse or reinfection thereafter. Three controls showed heavy infections.

It may be added that the reason for the failure of earlier attempts to demonstrate clearly the presence of protective substances in immune serum in avian malaria (Lotze, 1931; Taliaferro, 1931; Hegner and Eskridge, 1938; Hegner and Dobler, 1939) was probably that the titre of such substances is ordinarily so low that they are not easily detectable unless their concentration is increased by repeated superinfection. A second reason may have been the failure to use sufficiently large numbers of birds, for our work has shown that there is a good deal of variation both in the amount of immune factors contained in the serum of chronic cases and in its potency when injected into clean birds. More recent work by Taliaferro (1939) with Plasmodium lophurae in chickens has given results similar to those we have obtained with Plasmodium circumflexum.

The relationship between the occurrence of exoerythrocytic schizogony and the immune mechanism is still being studied, but no definite conclusions can yet be reported. Since schizogony of this type can only be demonstrated in fatal or very severe cases (and not in all of them) it can probably be assumed that it depends on a breakdown of the immune mechanism. Beyond that we cannot go at present. It is being studied in both Plasmodium circumflexum and Plasmodium relictum *var.* matutinum. In the latter this type of schizogony had not previously been known to occur, but it has been recently found in fatal cases. In these it has so far been seen in the lungs, heart muscle and brain. A number of cases in which the bird has been sacrificed have not exhibited exoerythrocytic stages, although they were killed at various times during the infection.

Part 2. A Study of Canary-Pox

This portion of the work was undertaken last spring when research on malaria was interrupted by a severe epidemic of canary-pox, a disease which is not only highly contagious but almost 100 per cent fatal to canaries. No effective treatment has been known for it, nor even any means of prevention. The disease is one of some economic importance too, for it causes heavy losses to canary breeders, particularly when it gets started in a large aviary. Indeed very little has been known about any phase of the disease, for it has been little studied, although a closely related malady of fowls (fowl-pox), which is also due to a virus, has received a great deal of attention because of its importance to poultrymen.

The work on canary-pox involved tests of several drugs which it was hoped might be effective in treatment, and also a study of the pathology, methods of transmission, and possible immunity in recovered cases.

It was found that mercurochrome, dissolved in 70 per cent ethyl alcohol to which a trace of acetone had been added, was highly effective. The solutions used contained from 1.5 to 3 per cent of mercurochrome, and were applied to the lesions locally, either with a medicine dropper or a swab. When treatment was started early in the course of the disease all cases recovered in from one to three weeks; advanced cases required longer treatment, and while they were benefited they often ended fatally nevertheless. Death however was usually delayed considerably.

Recovered cases were tested for immunity by reinfection. When a virus attenuated somewhat by storage in dessicated form for seven months was used, immunity was quite complete, but a fully virulent virus of another strain proved capable of producing relatively mild infections in a few cases. In all, forty cases were treated. Of these, thirty-three recovered and seven died. Eight of the recovered cases were tested for immunity from four to eight months after recovery, and were found to be nearly or quite refractory to reinfection. Inoculation of the blood of treated birds into clean birds immediately after recovery showed that the virus was no longer present in the blood.

The pathology of birds ill with canary-pox was typical of the description given by the few who have worked with it. In its most usual manifestation there are lesions about the eyes which rapidly increase in size until death occurs after a week or ten days. Microscopic examination of diseased tissue shows Bollinger and Borrel bodies in the cells—typical intracellular inclusions exhibited by birds suffering from any of the varieties of bird-pox. Some birds also exhibit gasping as the most prominent symptom. Such cases have lesions about the nares and pharynx which may be quite inconspicuous externally. There also seems to be a much more chronic variety of canary-pox which is characterized by warty outgrowths about the toes and legs. It is however none the less fatal.

Transmission is possible by direct contact of mucous surfaces, such as the eye, of clean and infected birds, or by indirect contact, as with perches upon which sick birds frequently rub their heads and bills. Experimentally the virus may be injected subcutaneously or intravenously, or it may be applied to the cornea by simple contact. The disease develops most quickly when the infectious material is rubbed in or injected. Probably mites may also transmit the virus, by bite or by contact. We have found that the dried virus retains its virulence for five or six months, after which it become more or less attenuated, and presumably becomes entirely non-infectious eventually.

Since fowl-pox has a good deal of economic importance and the only preventive known is vaccination, a few experiments were carried out with chickens. Some birds were inoculated and then treated with mercurochrome at the site of inoculation, and others were not treated until after the lesions were actually apparent. Five of eight birds treated in the first group were definitely benefited, and two showed no infection at all. All seven of the controls showed moderately severe lesions. When treatment was deferred until the lesions had actually developed there seemed to be little benefit, although it appeared that healing might be promoted somewhat.

The importance of this work lies in the fact that canary-pox is a disease of importance to canary breeders, and hitherto there has been no means of prevention or of treatment. It is also of importance because the canary is used considerably as an experimental animal and it is of a good deal of interest, and perhaps of theoretical significance, that here, almost for the first time, is a means of chemotherapy which appears to be very effective against a virus disease.

Mr. Frederick Goldstein, a graduate student in my laboratory, has acted as assistant in doing much of the work.

References

GINGRICH, W., 1932. Immunity to Superinfection and Cross-immunity in Malarial Infections of Birds. Jour. Prev. Med. 6: 197–246.

HEGNER, R., 1939 (with DOBLER, M.). Attempts to Obtain Passive Immunity in Avian Malaria with Blood Serum and Spleen. Amer. Jour. Hyg. 30: 81–91, Section C.

—— 1938 (with ESKRIDGE, L.). Passive Immunity in Avian Malaria. Amer. Jour. Hyg. 28: 367–376.

LOTZE, H., 1931. Die künstliche Proteosomainfektion der Vögel. Ein Beitrag zur Frage der Immunität und Immunisierung bei Vogelmalaria. 2. Mitteilung. Zentralbl. f. Bakt. 120: 107–113.

MANWELL, REGINALD D., 1939 (with GOLDSTEIN, F.). A New and Effective Method of Treating Canary-pox. Proc. Soc. Exp. Biol. and Med. 41: 554–555.

—— 1939 (with GOLDSTEIN, F.). Strain Immunity in Avian Malaria. Amer. Jour. Hyg. 30: 115–122, Section C.

—— 1940 (with GOLDSTEIN, F.). Passive Immunity in Avian Malaria. Jour. Exp. Med. (in press).

—— The treatment and pathology of canary-pox. (Submitted to) Amer Jour. Hyg.

REDMOND, W. B., 1939. The cross-immune relationships of various strains of Plasmodium cathemerium and P. relictum. Jour. Inf. Dis. 64: 273–287.

TALIAFERRO, W., 1931. The mechanism of acquired immunity in avian malaria. South. Med. Jour. 24: 409–415.

—— 1939. The protective action of immune serum against Plasmodium lophurae in chickens. Jour. Parasit. 25: 29.

ALLAN C. G. MITCHELL, Indiana University

Grant No. 294 (1939). A study of the radioactivity of antimony, manganese, indium, sodium and arsenic.

The radioactivity of indium, manganese, sodium, arsenic and antimony have been studied with the help of a coincidence counting circuit. All of the work on the first two substances was performed by using the 211 mg. radium-beryllium neutron source obtained through the Penrose Fund for this work. Preliminary work on the remaining three elements was carried out with the neutron source but in the final work strong sources were prepared in the Berkeley cyclotron and shipped to Indiana for investigation.

All of the radioactive elements studied were prepared by bombarding the stable isotope with neutrons. The radioactive product was then investigated by measuring coincidences between groups of gamma rays and between beta and gamma rays. The number of coincidences between beta and gamma rays was also measured as a function of their energy.

In all cases coincidences between gamma rays were found, showing that more than one gamma ray is given out per disintegration. In addition, coincidences between beta and gamma rays were found even for the highest energy beta rays indicating that the product nucleus is not formed in the ground state. In the cases of indium, sodium and antimony the number of beta-gamma coincidences per beta ray was independent of the energy of the beta ray, showing that there is only a single group of beta rays. In manganese and arsenic, on the other hand, several groups of beta rays are shown to exist. Finally, it was shown that arsenic and antimony disintegrate by capturing an electron from the K-shell of the atom in addition to the usual type of beta ray disintegration.

MITCHELL, ALLAN C. G., 1939. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1938: 206–207.

—— 1939 (with LANGER, L. M. and McDANIEL, P. W.). Coincidences between Beta- and Gamma-Rays in Indium. Phys. Rev. 56: 380–381.

—— 1939. Coincidences between Beta- and Gamma-Rays in Manganese. Phys. Rev. 56: 422–425.

—— 1939. Coincidences between Beta- and Gamma-Rays in Sodium. Phys. Rev. 56: 962–963.

—— 1939. Coincidence Measurements in Arsenic. Bull. Amer. Phys. Soc. Columbus Meeting, p. 8.

—— 1939. Investigation of Beta- and Gamma-Rays from Sb^{122} and Sb^{124}. Bull. Amer. Phys. Soc. Columbus Meeting, p. 8.

CURTIS L. NEWCOMBE, University of Maryland

Grant No. 197 (1937). A physical, chemical and biological investigation of the layer of low oxygen content in the deeper waters of the Chesapeake Bay in the Solomons Island Region.

Studies on the low oxygen waters of the Chesapeake Bay have been continued during 1939. Special consideration has been given to the analysis of those factors that may be, in the main, responsible for the development of oxygen-poor waters.

The waters of the Solomons Island region show a lack of homogeneity noticeably reflected in the horizontal variations in oxygen content as well in chlorinity, pH and phosphorus content. Below depths of approximately ten meters, the waters are, during summer, characterized by minimum oxygen and H ion concentrations, and maximum chlorinity and phosphate contents. A study of diurnal variations in phosphorus concentration seems to indicate that light and darkness produce distinct effects upon the amounts present. Available evidence suggests that phosphates are liberated in darkness by planktonic organisms resulting in the presence of appreciably higher concentrations in the water at night than during the hours of daylight. The effect of light and darkness upon the amount of phosphorus present helps to explain the peculiar seasonal cycle characterized by maximum concentration in summer and minimum content during winter when light penetration is greatest due to minimum turbidity. During the summer-fall transition, there is an abrupt decrease in turbidity and simultaneous decrease in phosphorus. The increase in amount of light penetration accompanying the decrease in turbidity corresponds with the reduction of phosphate. This correspondence has direct bearing on the relatively high phosphorus and low oxygen concentrations that characterize the bottom waters during summer when there is known to be minimum light penetration. The pronounced chlorinity stratification during summer, previously described, tends to isolate the bottom waters so that they are largely removed from an external oxygen source.

In the absence of specific data bearing on the amount of available light at different depths and on the rates of oxygen consumption at different levels, steps have been taken to provide a satisfactory technic for making these necessary measurements. Thus far, with the collaboration of Dr. Rodney Olson, it has been possible to demonstrate the feasibility of a polarigraphic method for measuring oxygen content *in situ* and a highly sensitive vacuum thermocouple for determining submarine illumination.

Newcombe, Curtis L., 1938. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1938: 209–211.

—— 1938 (with Horne, William A.). Oxygen-poor Waters of the Chesapeake Bay. Science 88: 80–81.

—— 1939 (with Lang, Andrew G.). The Distribution of Phosphates in Chesapeake Bay. Proc. Amer. Philos. Soc., 81: 393–420.

Harvey Harlow Nininger, American Meteorite Laboratory

Grant No. 298 (1939). Search for and laboratory investigations of meteorites.

For some years the American Meteorite Laboratory has been accumulating evidence that in connection with the falls of meteorites an adjacent area is showered with small particles. We have proposed a program of investigation of this phenomenon which is designed ultimately to furnish quantitative data regarding the extent and distribution of these showers. We decided to use the grant-in-aid to carry out some preliminary experiments designed to furnish more exact information as to our needs for the final carrying out of this project.

In these preliminary tests we used a magnetic rake designed and built by the American Meteorite Laboratory with funds supplied by Mr. Dean M. Gillespie of Denver, Colorado.

Our 1939 project was to test out this device in the vicinity of two well known meteorite craters with two objectives: first, to discover any weaknesses in its operation, so as to be the better prepared for the more exacting task of collecting quantitatively from showers of stony meteorite material, and second, to collect evidence of the nature of impact explosions which are assumed to be responsible for the formation of meteorite craters.

Dr. L. J. Spencer of the British Museum has recently suggested that the so-called rills which are seen radiating from many of the lunar craters are due to deposits of minute spherules and other fragments of nickel-iron which were shot out in jets by exploding meteorites upon their impact with the surface of that satellite. If this hypothesis is correct we reason that a similar distribution of small particles should be revealed by a magnetic survey of the soil surface surrounding meteorite craters on the earth.

The Arizona Meteorite Crater

We selected areas relatively free from obstructing rocks and vegetation on all sides of the crater at distances ranging from one-fourth mile to three miles from the crest of the rim. In all we traversed about 32 acres, stirring the soil to an average depth of 1 in. by means of a harrow which preceded the magnetic rake. From this area we gathered about 9,800 metallic fragments, having a total weight of 19.3 kg. and 136 kg. of oxidized meteoritic iron of the kind which D. M. Barringer, Geo. P. Merrill and others have designated as iron shale.

A careful inspection of the manner in which our rake operated led to the conclusion that we were recovering about one-half of the metallic fragments which were present in the upper 1 in. layer of the soil traversed. Of the oxide which is very much less magnetic and which we made no special effort to recover we estimate that we gathered about one-eighth of what was present.

The operation of our magnet and harrow tended to uproot some of the rather scanty stand of grass and for this reason the land owners restricted our activities to barren, or nearly barren, spots. This restriction rendered impossible the complete survey which we had hoped to make so that we are not able to say definitely whether or not the distribution of fragments fits the rill pattern of the lunar craters. We did, however, find definite indication of such distribution. We are certain that the distribution has not been uniform.

The Odessa, Texas Meteorite Crater

At this crater our work was limited to a very brief test. We found that the distribution of small metallic particles was much more abundant on the west and northwest portions of the rim than in any other areas tested. The limited time at our disposal did not allow for any exhaustive survey but such tests as were made indicated that very little material was present beyond a limit of 200 feet from the crest of the rim. On the western sector of the rim we found a more abundant concentration of fragments than had been found at any point around the Arizona crater.

Other Locations

Our device was tested in the vicinity of two stony meteorite showers: that at Holbrook, Arizona, which fell July 19, 1912, and that at Plainview, Texas, which probably took place in 1903 or 1904. At Holbrook we did not succeed in collecting any particles of stony meteorite. This was, in part, due to the condition of the terrain at the time of our visit which made it impossible to cover any of the territory which we deemed most likely to yield results. At Plainview we collected several fragments, ranging in size from a fraction of a gram to 15 grams in weight.

Our experiments on the stony meteorites indicate that we need a much more powerful magnet than that which we have used. The majority of stony meteorites contain enough metal so that if a magnet is applied small pieces are readily picked up. But for the magnet to work effectively in the field the attraction must be strong enough so as to overcome the difficulties occasioned by the obstructing soil and by the brevity of the time during which the particle is within the magnetic field.

Our rake was made up of six coils mounted in pairs on the plan of the horseshoe magnet. They were wound with No. 12 copper wire using 1,400 feet of wire per set or 1,800 turns. The weight of each pair of coils was about 30 lb. The cores were made of 1½ in. soft iron rods extending 4 in. beyond the coils. The upper ends of these were attached to an iron bar 1½ in. × ½ in. Each pair was enclosed in a steel jacket of 16 gauge sheet iron.

The energy was supplied by a 3½ h.p. gasoline engine through a 32 volt d.c. generator with a capacity of 1,500 watts. The entire assembly was mounted on a small trailer and drawn behind an automobile at speeds ranging from 2 to 3 miles per hour.

J. Bennett Nolan, Reading, Pa.

Grant No. 264 (1938). The early business career of Benjamin Franklin and the lives and occupations of the members of the Read family, relatives of Deborah Read Franklin.

This grant was expended in photostating, clerical work and copying necessary for the production of a volume, now being printed, entitled "Printer Strahan's Book Account—A Colonial Controversy." The volume affords new and unexplored vistas into the routine of the early book trade in Philadelphia and into Benjamin Franklin's activity as the collector of a doubtful account, a phase of his character never before touched upon. The recital also intertwines itself about the negotiations which preceded the establishment of the College of Philadelphia, later the University of Pennsylvania.

NOLAN, J. BENNETT, 1939. Printer Strahan's Book Account—A Colonial Controversy. Bar of Berks County, 143 pp.

RICHARD OFFNER, New York University

Grant No. 306 (1939). Origins and artistic environment of Giotto.

In accordance with my intention on application for a grant, I have since carried out a large part of the photographic program incidental to my projected plan for an exhaustive study on Giotto (his origins and influence). This was done largely with funds provided by the American Philosophical Society. The means put at my disposal have permitted me to have a great many detail photographs made by the best available photographer in Italy (Giacomo Brogi of Florence), of the greatest monument of this master: the frescoes of the Arena Chapel in Padua. One hundred and twenty-eight such details and some photographs of entire compositions were taken. These details had been carefully selected with a view to furnish a basis, not included in existing photographs, for a scientific study of Giotto's style. A part of the same grant went towards the photography of an illuminated Book of the Gospels (about 1270) in the Fitzwilliam Museum at Cambridge. This book, still entirely unpublished, is of radical importance in providing new and abundant material for tracing the origins of Giotto's iconography. A small portion of the grant has also been used for the reproduction of illuminations in important liturgical books of the early fourteenth century, in the Biblioteca Nazionale and the Library of St. Mark's in Florence, in the church at Impruneta, and in the cathedral of Castelfiorentino. Finally, a part of the grant covered photography of details of some of the frescoes by contemporaries and followers of Giotto in the Church of St. Francis in Assisi.

Having this material, I was in a position to publish some of my main conclusions in *The Burlington Magazine* in two articles; in the June, 1939 issue, pp. 257–269, and in the September, 1939 issue, pp. 98–109. The third remains to be published and should follow within the next few months. These three articles, when completed, will have defined the artistic genius of Giotto and the specific marks of his style, illustrated in the detail reproduction, in a manner as concrete and visible—scientific, that is—as is possible under the circumstances. This is necessary in order to prove what is by the master and what is due to pupils and imitators. By thus separating and defining this main art-historical figure of the period and each of its dependents, the historic panorama becomes clear and the main terms in it simpler to deal with in assigning them their approximate place in the collective development.

A vast amount of ground, however, still requires careful investigation.

Robert W. Pennak, University of Colorado

Grant No. 314 (1939). The comparative limnology of northcentral Colorado.

From a limnological standpoint, the large area between the Great Lakes and the Pacific coast is almost unknown. Boulder, Colorado however, lies approximately in the center of this region and is surrounded by a large number of lakes and reservoirs which constitute a variety of ecological conditions found in few other places on the surface of the earth. Plans for an extensive long-time research program concerned with the chemical, physical and biological characteristics of these bodies of water have been drawn up and a grant from the American Philosophical Society has made possible the purchase of certain indispensable pieces of limnological equipment.

During the period between June and November, 1939, a brief preliminary reconnaissance was carried out on 42 of these lakes and reservoirs. They ranged in altitude from 1,513 meters on the plains at the base of the foothills to 3,540 meters in the mountains where floating ice may often be found in midsummer. The depth of the lakes varied from 3.0 to 31.0 meters but the majority were found to be less than 10.0 meters deep. The smallest lake visited had an area of 0.5 hectare and the largest an area of about 100.0 hectares. In most instances, however, the areas were less than 15 hectares. The amounts of total dissolved solids in these waters give some indication of their ecological diversity. The range was from 16.5 to 8,425.0 milligrams per liter of water. Most of the lakes above an altitude of 1,800 meters contained less than 100.0 milligrams per liter while those which had unusually high residues (more than 1,000.0 milligrams per liter) were characteristic alkali lakes at the base of the foothills. The hydrogen ion concentration of the waters ranged from pH 6.4 to pH 8.5. Free carbon dioxide varied from —28.5 to 7.3 parts per million and bound carbon dioxide ranged from 2.0 to 123.4 parts per million.

JEAN PIATT, University of Vermont College of Medicine

Grant No. 265 (1938). The causes and factors underlying the anatomical and physiological specificity relationships which exist between any given muscle and the nerve which supplies it; the nerve-muscle specificity problem.

In any animal which has undergone a normal ontogeny the relation of a given nerve to its terminal muscle field is uniform and constant. This being the case, it is natural to suppose that the developmental factors responsible for this are themselves sufficiently constant to become the subject of experimental investigation. The nature and implementation of these particular causal factors constitute the study of nerve-muscle specificity.

A total of one-hundred and fifty operations were made on seventy-five adult Triturus pyrrhogaster.

Series A

1. Left forelimb: Arm amputated just above wrist. 45 animals.
2. Right forelimb: Ulnaris nerve divided below its origin from elbow plexus and entire nerve removed. Arm amputated just above wrist. 45 animals.

Series B

1. Left forelimb: Ulnaris and interosseus nerves divided at level of wrist. 30 animals.
2. Right forelimb: Ulnaris nerve divided just below its origin from elbow plexus and entire nerve removed. Interosseus nerve divided at level of wrist. 30 animals.

These four types of operations were made in order to have various checks and comparisons on the manner in which forelimb nerves in adult salamanders regenerate with respect to their normal muscle field. In the one case, series A, both ulnaris and interosseus nerves were forced to regenerate into tissue (muscle) which had itself regenerated. In the other case, series B, these two nerves regenerated into the original forearm and hand musculature of the animal. Again, in the one case, experiment 1 of both series A and B, the ulnaris and interosseus nerves were not spatially handicapped in the distance which they were forced to regenerate before reaching their terminal muscle field, and both began regeneration at the same transverse level of the forearm. In the other case, experiment 2 of both series A and B, the ulnaris nerve was cut more proximally than was the interosseus nerve, and the latter nerve might thus be capable of reaching its terminal muscle field ahead of the ulnaris and consequently ursurpation of the normal ulnaris muscle field might ensue. It was possible also to determine to what extent the degenerating distal nerve trunk is capable of influencing the distribution pattern of the regenerating proximal portion, i.e., the distal portion of the ulnaris was completely removed. The general problem of selective reinnervation of each individual muscle constitutes the bulk of the work.

The major conclusions from this study may be summarized.

1. Regenerating forelimb nerves in adult Triturus pyrrhogaster do not demonstrate a rigid nerve-muscle specificity. There is no inherent attractive force within any muscle which favors a rigid selective reinnervation; neither is there an inherent antagonism which precludes foreign innervation.

2. Considering the wide range of variation in the innervation of normal limbs, the general degree of nerve-muscle specificity following nerve regeneration is remarkably uniform.

3. The regenerated nerve pattern is, in general, normal.

4. The presence of a degenerating peripheral nerve trunk is not an indispensable factor in producing a normal nerve pattern.

5. Innervation of a muscle field by a regenerated nerve is less normal when the innervated tissue is regenerated also. This is due not to the nature of the regenerated tissue but to a lack of pre-established nerve pathways.

6. The degree of nerve-muscle specificity obtained is probably due to the fact that the general nerve pattern itself is approximately normal.

7. There is evidence that the general nerve pattern in regeneration is directly influenced by mechanical factors.

Piatt, Jean, 1939. A Study of Nerve-muscle Specificity in the Forelimb of Triturus pyrrhogaster. Jour. Morph. 65: 1.

GREGORY PINCUS, Clark University

Grant No. 278 (1938). Metabolism of rabbit eggs and embryos in different inbred strains and in hybrids between them, with particular reference to the metabolic basis of size differences in early ova.

The following is a summary of work accomplished under the grant made to me for the year 1938–1939.

(1) Dr. Shapiro perfected a microrespirometer suitable for making measurements with mammalian eggs.

(2) Considerable data on the respiration of rabbit eggs were accumulated and are in the process of analysis. Preliminary inspection of these data indicates an increase in QO_2 after fertilization with a rise in the course of cleavage. The conditions necessary for accurate QO_2 determination have been determined.

(3) Data on ova artificially activated are being analyzed.

(4) An improved culture method for rabbit ova was developed by Dr. Shapiro. The published paper suitably acknowledging grant assistance is given below.

Further publications will be made when our data are completely analyzed.

SHAPIRO, H., 1939. A Simple Rocking Device for Carrel Flasks. Science 90: 307.

W. B. REDMOND, Emory University, Georgia

Grant No. 296 (1939). Immunization of birds to malaria by vaccination.

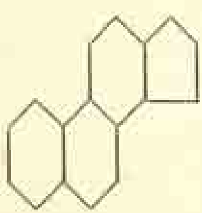
This grant, with a previous one made a year ago, has made it possible to complete the preliminary experiments on vaccination of birds to malaria. By injecting malarial parasites killed or attenuated in the red blood cells non-infected canaries have been immunized against subsequent infection with living parasites. Heavily infected blood was used for making the vaccine. The infected birds were etherized and the blood drawn from the jugular vein. After centrifugation the cells were placed in a heparinized solution of sodium citrate and urea. The tubes containing the suspension were sealed and placed in an ice bath containing enough potassium nitrate and barium chloride to lower the temperature to — 3° to — 3.5° C. The cells were kept at this temperature for 72 to 96 hours. The treatment produced only slight hemolysis. The cells from one infected bird were injected intravenously into two of the experimental birds. The vaccine was injected every other day in most instances until eight or more injections had been made. Normal birds injected from the experimental birds following the last dose of the vaccine revealed that all except three carried latent infections. Only an occasional parasite had been found in two of the birds on examination previous to subinoculation, however. When these birds were injected with living parasites no typical infections occurred. Eight birds were completely immune as only an occasional parasite was found. Three birds were partially immune since a very slight infection occurred in each. Normal birds injected at the same time and with the same dose of parasites showed typical infections. Birds injected with uninfected cells treated in the same way developed infections as severe as were those in the controls.

This work is to be reported at the meeting of the American Association for the Advancement of Science at Columbus, Ohio, December 28–30, 1939.

FRANCIS OWEN RICE, Catholic University of America

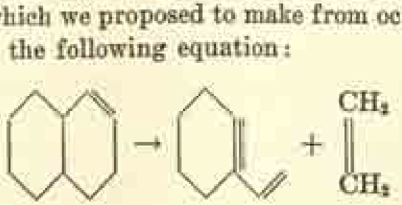
Grant No. 308 (1939). The synthesis of certain polynuclear ring systems.

The general aim of this investigation is the synthesis by thermal polymerization of certain polynuclear ring systems, especially those having the carbon skeleton

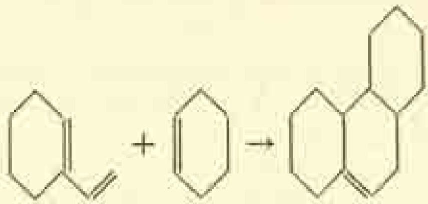


which is the nucleus of many important physiologically active compounds such as sex hormones, bile acids, vitamin D, and the cancer producing hydrocarbons.

An essential unit that is required in this synthesis is 1-vinyl-Δ_1-cyclohexene which we proposed to make from octahydronaphthalene according to the following equation:



Unfortunately, we obtained only poor yields of 1-vinyl-Δ_1-cyclohexene and we therefore adopted another way of preparing this compound. Using classical organic methods, we have now prepared about ten moles of 1-vinyl-Δ_1-cyclohexene, and we plan to study its reaction towards heat, both alone and when mixed with other unsaturated compounds. Our evidence so far indicates that it should be possible to condense 1-vinyl-Δ_1-cyclohexene with olefinic compounds to give the following type of reaction:



By using various substituted cyclohexenes, a great variety of polynuclear ring systems may be synthesized.

WILLIAM J. ROBBINS, New York Botanical Garden

Grant No. 232 (1938). Study of the condition necessary for the unlimited growth of excised tissues of higher plants, primarily excised root tips.

Two separate researches were undertaken both concerned with vitamins or vitamin like substances as growth substances for plants.

One resulted in the discovery that vitamin B_6 is an important growth substance for excised tomato roots. This is the first evidence for the significance of this vitamin in the development of a higher plant. Entirely aside from possible practical applications which may be made of these findings in the propagation or cultivation of plants, they are of interest, because they emphasize that vitamins play a fundamental part in the metabolism of all protoplasm both plant and animal. They show further that the deficiency symptoms found in animals, such as dermatitis in a deficiency of vitamin B_6, are merely evidences of a disturbance of some much more fundamental mechanism. Plant material, because of the controlled conditions under which it can be grown, offers in some respects a better means of attacking these fundamentals than animal material.

The second investigation was concerned with the significance of biotin in the development of two fungi. A biological method of determining biotin was applied to a variety of natural products, including sugars of various purities.

The results of these investigations were published in the following articles:

ROBBINS, WILLIAM J., 1939. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1938: 215.

—— 1939 (with SCHMIDT, MARY B.). Further Experiments on Excised Tomato Roots. Amer. Jour. Bot. 26: 149–159.

—— 1939. Preliminary Experiments on Biotin. Bull. Torrey Club 66: 139–150.

ROBERTS RUGH, Columbia University and New York University

Grant No. 261 (1938). Comparative study of the morphology and physiology of the urino-genital systems of Amphibia; effect of hypophysectomy on the testis of the immature and mature bullfrog; the susceptibility of frog gametes to x-radiation prior to and subsequent to fertilization.

Grant No. 336 (1939). Effect on the embryo of x-radiation of the gametes (frog); developing technique for artificial insemination in mouse or rat in anticipation of comparable x-ray studies on mammals.

Grant No. 261 was designated as aid for three rather distinct projects: (*a*) a study of amphibian urino-genital systems; (*b*) a study of the effect of hypophysectomy on amphibian gonads; and (*c*) a study of the susceptibility of amphibian gametes to x-radiation.

The first project is still under investigation, as it is necessary to include a variety of forms and also to investigate the relationship of the endocrines to secondary as well as primary sex characters. An histological study is being made of the male frog's entire urinogenital and endocrine systems as affected by the anterior pituitary hormone during every month of the year. This project will be completed late next Fall.

The second project has already brought forth one published report. It was found that the normal hibernating frog may be induced to ovulate 50 per cent or more of its eggs by the injection of three to four anterior pituitary glands from female frogs, but if the frog is first hypophysectomized and then allowed to recover completely from the operation, its own pituitary gland (or one from another female) will elicit the same degree of ovulation.

The third project has proven to be significant beyond all expectations. A full report of these data has recently appeared. Uniform suspensions of sperm from hibernating frogs, Rana pipiens, were irradiated with x-rays at 200 kv. from 15*r* to 50,000*r* prior to using them for artificially inseminating frog's eggs. No effect on motility or fertilizing powers of sperm were detected; nor on rate or pattern of early cleavages. Even at 15*r* some resulting embryos showed exo-gastrulation and spina bifida while at 1,000*r* some perfectly normal embryos resulted. This discrepancy is explained as a result of chance bombardment of vital points in chromosomes, since at higher doses all resulting embryos are abnormal. If hatching is considered as a critical end-point, there is a typical exponential curve of hatching percentage dropping from 97.8 per cent at 15*r* to 1.6 per cent at 10,000*r* and rising again to 90.5 per cent at 50,000*r*. This latter rise is explained as due to incapacitating sperm for syngamy but not for activation of the egg; hence gynogenetic development follows. Such abnormalities as are produced have been produced by other means such as subjecting the developing embryo to drastic environmental changes. Here the effect is applied through the sperm by irradiation prior to insemination of normal eggs. Preliminary tests indicate disruption of chromosomes, and therefore the effect is described as due to induced lethal mutations.

Grant No. 336 was awarded for technical assistance toward continuation of this latter research. This further work is in progress and includes a comparable study of the effect of high voltage x-radiation (700 kv.) on spermatozoa and subsequent development. It is of interest to know whether there is any qualitative difference between the low and high voltage x-rays as they affect biological systems. It is hoped that tissue culturing (transplantation of potentially lethal material to normal hosts) and a study of chromosomal aberrations will follow.

Rugh, R., 1939. Relation of the Intact Pituitary Gland to Artificially Induced Ovulation. Proc. Soc. Exper. Biol. and Med. 40: 132–136.

—— 1939. Developmental Effects Resulting from Exposure to X-Rays. 1. Effect on the Embryo of Irradiation of Frog Sperm. Proc. Amer. Philos. Soc. 81: 447–471.

JOSIAH C. RUSSELL, University of North Carolina.

Grant No. 245 (1938). Studies in the history of the population of Medieval England.

These studies are designed to provide the historian and demographer with information from the large body of sources, largely in the Public Record Office of London, about the population of Medieval England. They were made possible by grants for the summer of 1938 by the Social Science Research Council and for the year following by the American Philosophical Society, and continued research upon such printed collections as Domesday and the Hundred Rolls. Due largely to the threat of war and consequent closing of repositories, collection of data was pushed as rapidly as possible with their analysis limited to samples which would indicate the necessary lines of supplementary research. The types of data collected were as follows.

(1) Records of the poll tax of 1377 levied upon men and women (except mendicants) of fourteen years and over. These include totals for boroughs and counties, acquittances giving numbers for more than a thousand places, and lists of persons by name, sometimes arranged by houses.

(2) Surveys and extents of land holdings which give numbers of land holders of various social and economic classes. Land hunger seems to have caused all who could to hold land (contrary to some opinions) and thus these data seem quite valuable. Since they are well scattered over several centuries these data enable one to make an estimate of trends of population.

(3) Chantry returns and surveys of ports in the sixteenth century which give estimates of communicants of parishes and number of houses.

(4) Evidence as to the height and other physical characteristics from reports upon contents of ossuaries and estimates of chroniclers about the size of kings whose remains have been measured.

(5) Records of boroughs which usually give numbers of houses or burgages.

(6) Records from inquests post mortem which can be used to study the expectation of life.

(7) Miscellaneous information (such as frank pledge returns) which supplement and aid in understanding other data.

The studies deal with previous research upon medieval English population, problems of method, height, length and expectation of life, population of England at several periods (Domesday, 1086–1330, 1330–1377, 1377, 1377–1550), migration, Celtic areas, social mobility, and population theory.

HENRY L. SAVAGE, Princeton University

Grant No. 131 (1937). The historical background of the 14th century English poem *Sir Gawain and the Green Knight.*

This poem dates from the latter half of the century, and its unique MS. shows that its speech is that of the Yorkshire West Riding or that of S. E. Lancashire. The name of the author is still unknown. The motto of the order of the Garter, written on the last leaf of the poem, is the only indication of a connection between it and the events of its age. It is a fair inference that someone for whom the poet wrote, or to whom he presented his poem, was a member of that Order.

Study of the romance led the writer to believe that certain lines of the poem were descriptive of armorial bearings. A formal opinion from the one outstanding heraldic expert in this country, Mr. la Rose, indicated that the arms were those of the Anglo-French house of Coucy-Guisnes. Further research in such published *Calendars* of the Record Office as this country possessed indicated that a member of that house, who was a Knight of the Garter, resided in England intermittently from 1363–1377 A.D., and that he held lands within the counties of York and Lancashire.

To ascertain further definite information about the poem (*a*) certain documents in the Public Record Office at London would have to be examined; and (*b*) further substantiation of Mr. la Rose's opinion secured from British heraldic experts at the College of Arms. At this point application was made for a grant in aid of research from the American Philosophical Society.

As to (*a*) there is nothing to report. By examination of the Exchequer *Issue Rolls* the writer was able to plot out the career of the Sire de Coucy more precisely than he had been able to do in this country, but he found that the *Wardrobe Accounts* of the Exchequer, which he had hoped would be revealing, gave him no relevant information. Yet he did attain the negative result of eliminating from consideration a large number of unpublished Record Office documents which future conscientious students of the poem would have had to examine.

As to (*b*) it is the opinion of British heraldic experts that a good case can be made out for the identification of the arms aforesaid as those of Coucy. Thus *one* inference was proved sound.

During 1938–9 the writer has been occupied with the task of ascertaining from published *Calendars* of the Public Record Office how many Garter knights, between the year of the foundation of the Order (c. 1344) and 1399, held lands within the area whence the poem derives. Within those years sixty-two knights were members of the Order, and to date the holdings of twenty-three of that number have been examined (the examination is a protracted business). Of those twenty-three a few do hold lands within the specified dialectal area, and of them the Sire de Coucy is one of the largest holders. The task is still proceeding.

In 1939 as direct consequence of researches at the Public Record Office the writer published "Enguerrand de Coucy VII and the Campaign of Nicopolis," *Speculum* XIV, 423–42. In it he has brought out a connection, not previously known, between the Sire de Coucy and the English poet Chaucer. Since that nobleman knew one English poet who moved in courtly circles, the chances are very much greater that he knew other poets who lived in the same milieu.

Savage, Henry L. Sir Gawain and the Order of the Garter. Jour. of Eng. Lit. Hist. 5: 46–49.

—— 1939. Enguerrand de Coucy VII and the Campaign of Nicopolis. Speculum 14: 423–442.

Harry Richard Seiwell, Woods Hole Oceanographic Institution

Grant No. 269 (1938). Internal waves in the North Atlantic Ocean.

Large diurnal variations in the physical state of the sea are caused by action of an internal wave mechanism. Eleven independent investigations of this phenomenon in the western North Atlantic, by repeated sampling of the water column over periods ranging from 1 to 14 days, have shown that the disturbance extends to great depths; for instance, at 1,200 meters depth there may be temperature variations of 0.67° within 24 hours since the water particles at this depth may be displaced vertically as much as 110 meters. The treatment of the problem has been divided into (1) an investigation of variations (resulting from internal waves) affecting the practical computation of horizontal current velocities and water transports, and (2) a theoretical analysis of the character of the controlling mechanism.

Results of observation analysis reveal that, at standard depths, average daily temperature variations range from 0.17° to 1.35° between surface and 1,300 meters in the western North Atlantic and individual daily variations may range from minimum values of 0.06° to 0.26° at 300 meters depth to maximum values of 0.73° to 2.50° at 800 meters. These diurnal changes in the physical state of the sea, resulting from vertical displacements of the water particles, are sufficient to induce, within a few hours, differences of nearly 4 dynamic centimeters in the computed dynamic height of the sea surface and hence cause occasional large errors in computed current velocities. Quantitative information on the internal wave mechanism which may be used to estimate the expected variation is not yet available. The magnitude of the disturbance varies from day to day and since quiet days appear to be more frequent, larger variations will not be the usual rule.

Vertical oscillations of the water column appear to be dominated by periods of 24 and 12 lunar hours, plus a random residue (due to irregular motions of the water particles). Thus, a connection with tidal phenomena is suggested, which has been confirmed, to some extent, by an investigation of the variability of the 24 and 12 lunar hour components derived by harmonic analysis. A close correspondence appears to exist between average times of occurrence of maximum amplitudes of both waves and of directions of maximum correlations between phase and amplitude relations. Further study of the internal wave mechanism by utilizing a second order differential equation relating vertical displacement and vertical density distribution to compute theoretical amplitude and phase values shows acceptable agreement on comparison with actual values derived by harmonic analysis of observational data.

SEIWELL, H. R., 1939. The Effect of Short Period Variations of Temperature and Salinity on Calculations in Dynamic Oceanography. Papers in Physical Oceanography and Meteorology **VII**: No. 3.

—— 1939. Daily Temperature Variations in the Western North Atlantic. Journal du Conseil **XIV**: No. 3 (in press).

JAMES A. SHANNON, New York University

Grant No. 304 (1939). The renal tubular reabsorption of water.

Observations have been made on a series of normal dogs and upon four dogs with permanent diabetes insipidus. These observations have been directed at the delineation of the factors limiting the water reabsorption mechanism in the animals with diabetes insipidus as contrasted with the normal.

When the inulin U/P ratio is taken as the standard of reference, these preparations have the ability to form a concentrated urine which is about the same as the normal animal. Inulin U/P ratios higher than 300 are arrived at under the conditions of water deprivation for 18 hours. Although the osmotic pressure of these urines is not high as compared to the osmotic pressure observed in normal animals at comparable urine flows, it is definitely higher than that concurrent in the plasma.

The reduction in urine flow observed during dehydration may not be accompanied by a significant reduction in glomerular filtration rate; nor is it accomplished by a type of water reabsorption we have previously observed in the perfused kidney, i.e. one which is characterized by extensive creatinine reabsorption. The primary difference in the composition of concentrated urines obtained from animals with diabetes insipidus and from normal animals seems to lie in their low electrolyte content. It is possible to restore this factor, and hence the osmotic pressure of the urine, to normal by the administration of pituitrin without altering the extent of water reabsorption.

RICHARD H. SHRYOCK, University of Pennsylvania

Grant No. 328 (1939). The history and significance of irregular practice in modern medicine.

While there is a large amount of both contemporary and later literature about all forms of irregular practice (folk medicine, quackery), the bulk of it has been written either to defend or to condemn such practice. There has been a dearth of critical investigations intended to interpret and evaluate in an objective manner. In an attempt to employ the historical approach to the subject, studies were begun last year of the development of medical sects in the United States during the past century. Some attention was also given to the history of quackery, although it is not yet clear whether this is an historical constant, or to what extent it may be shown to be a variable in terms of trends and tendencies. As several of the American medical sects had their origin in European movements (notably homeopathy and hydropathy) and as at least one American sect reacted on Europe, it seemed necessary to study the European background to the American story. A grant from the Penrose Fund of the American Philosophical Society made it possible to spend several weeks in Europe during the summer of 1939, during which time materials were collected on the history of quackery and medical sects in Great Britain, Germany and Sweden. The Germanic countries seem to have exerted a greater influence on the United States than did the Latin, although it is hoped subsequently to study developments in France and Italy as well.

It appears that such sects represented a conservative rather than a radical movement in medicine. Homeopathy represented in Germany a persistence of monistic pathology and therapeutics, which had characterized most medical thought in the eighteenth century, but which was thrown off by regular medicine in the process of establishing experimental checks after about 1830. The same may be said of hydropathy. Such sects survived as medical heresies, as long as people supported them, and this support in itself afforded an indication of what the public felt was lacking in regular practice. As the latter improved, the public—through the State—became increasingly intolerant of medical heresy, at the very time it was becoming more and more tolerant of religious heresy. In Germany, however, this process was delayed by the abandonment of laws against quackery after about 1870, and in recent years by governmental encouragement of "nature healing," which in some ways resembles a sect and in other respects appears to be merely an inferior grade of regular medicine. The development of "Freudianism" in Germany prior to 1933, also suggests the revival of system-making within the pale of regular medicine—a reversion to the eighteenth century type of medical thinking which has not been without influence in this country.

A preliminary paper on general trends in modern quackery and sectarianism will be published in the next annual *Proceedings* of the Middle States Historical Association, but much more work will have to be done before any comprehensive study can be completed.

SOLOMON L. SKOSS, Dropsie College, Philadelphia

Grant No. 297 (1939). Technical assistance in finishing the edition of Volume II of the Hebrew-Arabic Dictionary of the Bible "*Kitāb Jāmi' al-Alfāẓ*" of David ben Abraham al-Fāsī the Karaite (Tenth cent.).

More than a hundred years ago, in 1830, the well known Karaite traveller and scholar Abraham Firkowitch, from Crimea, visited the Karaite synagogue in Jerusalem and found there, in an underground chamber where discarded fragments and old torn sacred books are stored away, among many other old and dusty defective manuscripts also one of a hitherto unknown Hebrew-Arabic Dictionary of the Bible. The codex, very old and badly damaged, was subsequently studied by Pinsker, who had fully described this newly discovered Dictionary in his important Hebrew work *Liḳḳūṭē Ḳadmōniyyōt*, which appeared in Vienna in 1860. About this time another manuscript of this Dictionary was discovered in the same synagogue by Adolph Neubauer, of the Bodleian Library in Oxford, and he published a lengthy report about it in *Journal Asiatique*, Décembre 1861 (pp. 465 ff.) and Avril-Mai 1862 (pp. 359 ff.).

From Pinsker's study we learn that the author of this lexicographical work was an adherent of the Karaite sect, which originated in 'Irāq in the eighth century and which denied the validity of the traditional teachings of the Talmud and later rabbinic literature. His name was David ben Abraham, known also by his Arabic appellation Abū Suleimān Dā'ūd ibn Ibrāhīm al-Fāsī. From his surname al-Fāsī we may surmise that he was born in, or came from, Fez, Morocco. A close study of the Dictionary reveals almost conclusive evidence that its author must have lived for some length of time in Jerusalem, where he most likely wrote this work. The manuscripts of the Dictionary were found in Jerusalem and its three separate abridgments which were later discovered were all written there. He shows an intimate acquaintance with the geography of Palestine and the political conditions of the Jews in Jerusalem in his time. In his Arabic dialect he uses several Persian expressions, in vogue among the Karaites of the Holy City during the tenth century.

That David b. Abraham lived in the tenth century is proved by the fact that on one hand he cites Saadia Gaon, who died in 942, so he could not have lived before him; on the other hand his Dictionary was abridged by Levi, the son of Yefet ben 'Alī, who refers to David as deceased, and since Levi lived in the end of the X and the beginning of the XI centuries, our author must have flourished somewhat earlier, or in the second half of the X century. There are other corroborative evidences to that effect.

Thus we learn that this lexicographical work represents one of the oldest monuments of Hebrew philology. It is planned on a very comprehensive scale, including the Aramaic vocabulary of the Bible and proper names. It contains many valuable contributions to biblical exegesis and comparative Semitic philology, for the author very frequently compares Hebrew roots with their cognates in the late Hebrew of the Mishna and the Arabic and Aramaic languages, at times anticipating indentifications which have been only recently rediscovered. The appearance of the first volume of this Dictionary was hailed by the reviewer of the *Journal of Biblical Literature* (LVII, p. 232) as "one of the most noteworthy contributions to the history of biblical philology in recent years."

Similarly in his identifications of places in Palestine the author in some instances anticipates modern rediscoveries. So "Perāt" of Jer. 13:5 he identifies with "'Aïn Fārah" in the vicinity of Jerusalem; about "Gibeon" (Jos. 9:3) he states that it is a place known by the name of "al-Jib"; in regard to "Āṣēl" (Zech. 14:5) he says that it is the name of a place behind the Mount of Olives (comp. the recent study of Abel in *Revue Biblique*, 1936, pp. 385 ff.).

Through the unremitting efforts of the late Dr. George Alexander Kohut, who took a lively personal interest in the preparation and publication of this important lexicographical work, the Yale University Press has undertaken to publish it on the Alexander Kohut Memorial Publication Fund in the Yale Oriental Series. The first volume appeared in 1936, and it has aroused the deep interest of biblical scholars and Semitic philologists in the United States and abroad. With the aid of the grant from the American Philosophical Society the edition of the second (and last) volume has been completed, and it is published by the Yale University Press. The following indices will be appended to this volume: (1) Names of Persons and Places; (2) Biblical verses translated and interpreted, and (3) Quotations from the Targum and Rabbinic Literature. A glossary of rare Arabic (and Persian) expressions and vulgar usages is planned, which will facilitate the use of this work and will no doubt be welcomed by all Arabists in their study of the Judaeo-Arabic idiom.

CHRISTIANNA SMITH, Mount Holyoke College

Grant No. 243 (1938). (*a*) The study of age involution of the thymus gland and the analysis of factors behind the formation of Hassall's corpuscles and (*b*) the fetal liver during its hematopoietic stage in tissue culture.

(*a*) The mouse thymus because of its small Hassall's corpuscles and scant lobulation is favorable material for the study of cellular changes accompanying age involution and the genesis of the replacing adipose tissue. During the past year, an investigation of its vascular pattern was made as a step in the understanding of conditions in the medulla and of the change to highly vascularized fat in the cortex. The picture of the blood vessels of the mouse thymus is different from that usually given for mammals where the larger ones are arranged at the inner and outer margins of the cortex. In the mouse, the main arteries and veins are disposed axially in the medulla with connecting radial capillary loops extending the width of the cortex. The length of these shortens with the decrease in the width of the cortex in involution and in markedly diminished organs their regular arrangement is no longer apparent.

(*b*) In 1929, Benewolenskaja published a paper on "Hematopoiesis in Cultures of the Embryonic Liver of Man" in which is described the development of the blood cells. These observations were made mostly on cover slip cultures in petri dishes of livers of 15 embryos cultivated in rabbit plasma and human embryonic extract. The positive results obtained by Benewolenskaja have not been repeated. In order to do this and to extend the study of the formation of erythrocytes, attempts were made to grow embryonic rat liver *in vitro*. Sporadic mitoses in erythroblasts have been seen but healthy cultures with developing tubes and groups of cells have not been obtained. During the past year over 800 cultures were made of livers from 70 embryos of 20 different litters. The usual method of cultivation was Maximow's inverted cover slip procedure, but trials were made with watch glasses, vials and Carrel flasks. These experiments are being continued. The culture media were varied in many ways. Plasma, with or without heparin, from a young cock was first used with extracts of chick embryos, rat or a mixture of the two. Later rabbit and rat plasma were substituted. The extracts were made in weak and strong solutions, alone, or with dextrose, hemin or thyroxin-hemin. Subsequent treatment was also varied. Samples of explants were fixed each day and studied mainly in sections. The liver cells became vacuolated in rabbit and cock plasma but survived in better condition in that of the rat. The liver cells spread in typical finger-like protuberances or sheets with occasional mitoses. Fibroblast-like cells and macrophages were seen.

Without the grant from the Penrose Fund for a half time assistant, this study would have been impossible and with deep appreciation we acknowledge our debt to the American Philosophical Society.

SMITH, CHRISTIANNA, 1939 (with CONANT, BETSY D., and SAYER, ELEANOR G.). The Vascular Pattern of the Mouse Thymus. Anat. Rec. 73: No. 3, Supp. No. 2, 47.

DONALD YOUNG SOLANDT, University of Toronto

Grant No. 256 (1938). Time factors in the excitation of single cells.

Lapicque, Lucas and others recognized the existence of one time factor in the stimulation of excitable tissue. They discovered that a stimulus must act for a finite length of time before it can be effective in eliciting a response. Lapicque called this time factor "chronaxie." More recently Hill, Monnier and Rashevsky have independently postulated the existence of a second time factor in excitation. Hill identifies the second time factor as that of "accommodation," basing his theory on the demonstrable fact that the threshold of excitation rises when an excitable tissue is exposed to a stimulus of slowly rising strength. Solandt, Suzuki and others have shown that, under certain conditions, the time factor of excitation (Lapicque) and that of accommodation (Hill) can vary independently; one time factor is not a simple function of the other.

Hitherto the experimental work on the time factor of accommodation has been performed entirely on masses of nerve and muscle fibers. The object of the present work is to measure both time factors operating in the stimulation of single nerve and single muscle fibers. This is being attempted on both amphibian and mammalian tissues. In every case stimulation is performed through calomel half-cell electrodes specially designed for use in the Chambers micro-manipulator. The time factors are measured by electrical excitation using condenser discharges for chronaxie determinations and exponentially rising currents for accommodation measurements in the conventional manner.

Chronaxie measurements on single nerve and single muscle fibers yielded results which agreed well with those of other workers in this field (Merdinger, Moore, Brücke).

On stimulating single muscle fibers in the retrolingual membrane of the frog with exponentially rising currents the usual linear relationship between current strength and rate of current rise was obtained, if a twitch-like response was taken as index of excitation. Under these conditions the values of the time factor of accommodation (λ) ranged from 10 to 50 sigmata. The twitch-like response was frequently followed by a slow contracture-like response. If the rate of rise of the stimulating current was very slow the contracture-like response might appear alone. Using the contracture-like response as index of excitation no accommodation could be detected; thus the contracture-like response was elicited by the same stimulus strength no matter how long the time taken for the stimulating current to reach this threshold strength. It has been suggested that the twitch-like response is produced by excitation of the muscle through its motor nerve or myoneural junction; the contracture-like response by direct electrical excitation of the muscle fiber. Mammalian muscle fibers, normal and at various periods after denervation, are at present being investigated with a view to clarifying this point.

Chemical excitation also is being investigated with a view to discovering what part adaptation to the natural chemical excitant, acetylcholine, may play in the accommodation process as observed in the single muscle fiber.

T. M. SONNEBORN, Johns Hopkins University

Grant No. 270 (1938). Sexuality and genetics in Paramecium aurelia.

The experiments of the eight month period covered by this report were confined exclusively to the intensive study of a single problem: the nature of the nuclear reorganization process occurring periodically in the absence of conjugation. Ever since the publication in 1914 of Woodruff and Erdmann's cytological account of this process, their views have been generally accepted. They reported that it involved a loss of the macronucleus and formation of a new one from a product of the micronucleus without chromosome reduction or fertilization. This view was challenged on cytological grounds by Diller in 1936 who maintained that it regularly involved chromosome reduction and fertilization and was therefore autogamy, not endomixis. These alternative views lead to very different theoretical consequences and a knowledge of the facts of the situation is prerequisite to further genetic investigation of the species. As competent cytological observers gave very different reports of the process and as direct cytological observation of the reduction of chromosome number is all but impossible, the problem was attacked by a genetical method.

By crossing two stocks differing in a single pair of genes (A and a), a hybrid stock of genotype Aa was obtained. These hybrids were then allowed to go through nuclear reorganization and from each reorganized animal a separate culture was developed. The genotypes of these were then ascertained by standard breeding methods. The results invariably showed that the original genotype Aa never persisted; all the reorganized cultures were of genotypes AA or aa. These genotypes would be expected if autogamy had occurred; but they could not have resulted from endomixis in which chromosome reduction and recombination of genes is excluded. The fact that no Aa combinations appeared showed that fertilization could only have occurred between identical haploid nuclei, presumably derived from a single reduced nucleus.

The experiment was performed thirty-six times, some under each of the following six conditions: (1) reorganizations at normal intervals; (2) reorganizations precociously induced; (3) reorganizations in daily isolation cultures; (4) reorganizations in mass cultures; (5) reorganizations at 26° C.; (6) reorganizations at 32° C. Under all these conditions the results were the same: the reorganizations were invariably autogamies, never endomixes. Whether endomixis may also occur under other conditions or in other varieties of P. aurelia remains to be determined.

From the results it can be concluded: (1) Clones developed after one nuclear reorganization are homozygous, containing no hidden recessive genes, and are therefore of particular value in genetic analysis. (2) The attempt to interpret the mating type relations as phenomena of self-sterility is excluded, because it is now clear that the organisms are regularly self-fertile. (3) The inference, drawn from studies of "endomixis," that fertilization is unnecessary for maintenance of vitality in P. aurelia is no longer tenable, because the nuclear reorganization essential for maintenance of vitality is not endomixis but autogamy. (4) The hereditary variations arising at conjugation among the progeny of a single reorganized individual cannot be gene recombinations, as commonly assumed, because the individuals are not only genetically identical but completely homozygous. This suggests that some at present unrecognized principle of heredity is involved in these genetic diversities.

Reports of work done with the aid of grants from the Penrose Fund were presented before the following audiences: Biological Departments of Indiana University, May 2, 1939; Marine Biological Laboratory, July 21, 1939; American Philosophical Society, November 18, 1939; Genetics Society of Washington, November 21, 1939; American Society of Zoologists, December 30, 1939.

Sonneborn, T. M., 1939. Sexuality and Related Problems in Paramecium. Coll. Net. 14: 77–84.

—— 1939. Paramecium aurelia: Mating Types and Groups; Lethal Interaction; Determination and Inheritance. Amer. Nat. 73: 390–413.

—— 1939. Genetic Evidence of Autogamy in Paramecium aurelia. Anat. Rec. 75, (Suppl.): 85.

Carl Caskey Speidel, University of Virginia

Grant No. 312 (1939). Investigation with the aid of ciné-photomicrography of the reactions of living tissues under various experimental conditions.

Many ciné-photomicrographs have been obtained showing the minute structural changes in living cells and tissues under both normal and various experimental conditions. One phase of this work was reported to the Society on November 18, 1939, under the title "Effects of Metrazol on Tissues of Frog Tadpoles with Special Reference to the Injury and Recovery of Individual Nerve Fibers," an abstract of which follows.

In recent years many cases of human mental disorder have been cured by injections of metrazol, a treatment which causes profound shock. The purpose of the present investigation was to determine whether any structural changes could be detected in individual nerve fibers (and other tissues) by direct microscopic observations during and following metrazol treatment. Although such observations cannot be made in man, they can be made quite readily in living frog tadpoles.

The reactions of nerve fibers and their endings have been watched after mild, moderate, and severe metrazol treatments. Illustrative motion pictures of the microscopic changes have been made. Typical changes of irritation and injury take place. Such changes in the myelinated fibers include swelling, vacuolation, fibrillation, myelin globule formation, and in extreme cases loss of some of the terminal myelin segments.

Changes in the nerve terminals include swelling, occasional retraction, and loss by degeneration of variable lengths of the endings. Sometimes in extreme cases a whole cluster of endings is lost.

Slightly injured nerve fibers quickly become normal again in appearance after a day or two of recovery. Severely injured fibers which have lost appreciable lengths of nerve substance by degeneration undergo the typical stages of regeneration. New endings grow out to establish connections which are different from those before the metrazol treatment. In other words, the metrazol treatment has brought about a "new deal" of nerve endings.

These observations strongly suggest that similar changes probably take place in nerve endings located within the brain at the synapses between nerve cells. On this basis the improvement in human mental conditions after metrazol injections is correlated with the breaking down of some of the old nerve endings and synapses, and the establishment of new ones.

Metrazol also markedly affects other tissues in tadpoles, such as muscle fibers, epithelial cells, and the blood.

A second phase of this investigation was reported at a meeting of the Marine Biological Laboratory, Woods Hole, Massachusetts, on August 21, 1939. Three reels of motion pictures were exhibited under the general title "Living Cells in Action." In abstract form a brief description of these has been published (see below). Several of the more significant results will be presented in more detail in a later report.

SPEIDEL, C. C., 1939. Living Cells in Action (motion pictures). Biol Bull. 77: 308–309.

LESLIE SPIER, Harvard University

Grant No. 221 (1938). Completion of an extended ethnography of the Modoc Indians of Oregon.

In 1934 the Committee on Field Training of the Laboratory of Anthropology (Santa Fé) placed six graduate students in my charge for an investigation of the ethnography of the Modoc Indians in Oregon. This resulted in a considerable body of data, which, however, needed amplification, coordination, and assessing at the hand of further field investigation before its valuable elements could be utilized. Under the present grant, two trips for the purpose were made in 1938 and 1939 by Dr. Verne F. Ray (University of Washington) under my supervision.

Because of their geographic position on the Oregon-California border at the margin of two culture areas, the cultural affiliations of the Modoc had been wholly uncertain. In general it had been assumed that they affiliated northward with Plateau tribes, on the assumption of an identity with the linguistically related and adjacent Klamath Indians. The present investigation shows this to be erroneous: Modoc culture in most of its manifestations links southward with the northeastern Californian tribes.

The investigation of 1938 was devoted largely to matters of material culture. Dr. Ray was able to supplement the earlier notes on almost every phase and to resolve satisfactorily many of their inconsistencies. Particularly full and specific information was obtained on the basic food economy, technological pursuits, clothing and bodily decoration, calendrical system, rules of games, etc. During the last part of the season a successful beginning was made with non-material aspects, particularly religion.

The primary object of the 1939 season's work was to obtain further data on social organization and religious life. It was found that here in particular the earlier notes needed meticulous checking before it could be known what items in them were credible and valuable. This was satisfactorily accomplished. Even more than phases of material life, Modoc social and religious phenomena lend themselves to an analysis of historical interrelations in this area and hence offer materials of first order for the study of the dynamics of culture growth.

A third brief trip is planned for the spring of 1940, after which the assembled materials will be prepared for publication.

WILLIAM C. STADIE, University of Pennsylvania

Grants No. 240 (1938) and No. 320 (1939). The chemical action of insulin upon the intermediary metabolism of isolated tissue of normal and pathological animals.

Work along the lines reported to the Committee in 1938 was continued. Tissues from normal or diabetic animals were equilibrated *in vitro*, and the course of the metabolism determined by the quantitative micro-determination of certain metabolites. The following is an outline of the findings since the previous report:

1. The ketone formation by the liver of the diabetic cat was measured in four different ways. It was found to be greatly in excess of the urinary ketone excretion, showing that the ketones are not a toxic waste-product of the diabetic organism, but are utilized freely by the muscle as a source of energy despite the absence of insulin.

2. *In vitro*, insulin inhibited the formation of ketones, but only when there was available fructose or *d*-lactate. This indicates that the coupling of ketone and carbohydrate metabolism occurs at the site of formation (liver) rather than at the site of utilization (muscles), particularly since ketone utilization by muscle was shown to be independent of insulin.

3. Simultaneous measurements of the oxygen uptake and ketone formation by diabetic liver slices showed that each fatty acid molecule yields four rather than one molecule of ketones. From this fact, it can be shown that the Knoop hypothesis of beta oxidation of fatty acids must be replaced by the hypothesis of multiple alternate oxidation.

4. On the basis of these facts, the non-ketone respiration of the liver can be calculated. It is possible to conclude, from the character of the non-ketone respiration of the diabetic liver, that the formation of carbohydrate from fats is improbable. In other words, the overproduction of carbohydrates from fats, as a possible defect in the diabetic metabolism, is ruled out.

5. In the hypophysectomized-depancreatized (Houssay) cat, ketone formation by the liver is practically zero. This is a further indication of the contra-insulin effect of the pituitary.

6. The current conception that, under the influence of insulin, fatty acids are oxidized by the liver beyond the ketone stage to acetic acid was not borne out by our experiments. In diabetic cats, in which the ketone formation had been reduced to low levels by adequate insulin treatment, there was found no acetic acid formed whatever. This is an indication that insulin either suppresses fat metabolism completely, or that it directs it along some pathway not involving ketone or acetic acid formation.

7. Preliminary observations show that the diabetic liver, in contrast to the normal, has a markedly increased formation of protein split products. This is a possible indication of the abnormal mechanism leading to the high protein metabolism of the diabetic.

8. Sundry new micro methods have been devised: among them a method for the determination of lactic acid and a new form of respiratory vessel for use with bicarbonate containing media.

Stadie, William C., 1939. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1938: 223–224.

—— 1940 (with Zapp, John A., Jr., and Lukens, Francis). The Effect of Insulin upon Oxidations of Isolated Minced Muscle Tissue. Jour. Biol. Chem. 132: 411.

—— 1940. The Effect of Insulin upon Urea Formation, Carbohydrate Synthesis, and Respiration of Liver of Normal and Diabetic Animals. Jour. Biol. Chem. 132: 393.

—— 1940. The Effect of Insulin upon the Ketone Metabolism of Normal and Diabetic Cats. Jour. Biol. Chem. 132: 423.

Isaac Starr, University of Pennsylvania

Grant No. 364 (1939). To ascertain and define the clinical utility of the ballistocardiogram, an instrument which records the heart's recoil and the blood's impact in man.

Though physicians constantly talk and write concerning weakness of the heart in clinical conditions, their methods of measuring and discovering the presence of cardiac weakness have been extremely indirect. A new method, the "Ballistocardiogram," has been used to obtain more direct evidence of cardiac weakness in clinical conditions. The data supplied by this instrument have been used in three ways:

(1) To estimate the amount of blood pumped by the heart each minute.

(2) To estimate the shape of the curve of systolic blood velocity in the great vessels and to determine deviations from normal.

(3) To calculate, roughly, the heart's work and to compare cardiac work and heart size in normal and abnormal persons.

The grant has been used to pay the salary of Caroline Hottle, part time technician, with whose help Ballistocardiograph records have been made on about 200 patients. These tests will be continued. From these and other data a paper has been prepared entitled "Ballistocardiogram II. Normal Standards and Common Pathological Variations." This has been accepted for publication.

Data to be the subject of subsequent publications are being analyzed and organization of this material will be begun shortly.

PAUL R. STEWART, Waynesburg College, and B. K. STEWART, University of Colorado

Grant No. 350 (1939). Paleontological survey of the 1100 ± feet above the Monongahela formation in southwestern Pennsylvania.

Collections have been made from twenty localities at present ranging from the base of the Dunkard Series upward to the 900 foot level. In many of these localities more extensive collections may yet be made. The aim of our work has been the collection of representative plant and animal fossils from the level of the Cassville shale as it occurs in southwestern Pennsylvania, to the top of the series. We now have collections from twelve consecutive levels at rather regular intervals averaging from 50 to 200 feet including the 900 foot level, in addition to collections from four localities of the Cassville shale. Some of the largest and most interesting collections have been obtained at the 500 and 700 foot levels. The various levels are often represented by more than one locality.

Fossil insects are being sent to Dr. Carpenter at Harvard for identification and description if advisable, and vertebrate remains to Dr. Romer.

The plants have been partially identified as to genera and sometimes to species as collections were made. A number of new species and some possible new genera have been discovered. The species from each locality will be determined and the descriptions written as the work proceeds. Certain localities are particularly interesting in their ecological relationships; one, a sigillarid swamp at the 400 foot level, contains ostracod, fish and reptile remains; another brings in the dominance of types similar to the French Permean as described by Zeiller; and a third, recently discovered, possesses a rich flora with many species showing fructifications. These collections show the very evident progressive extinction of the most typical Pennsylvanian species and the development of the transition species of the early Permean.

C. L. Turner, Northwestern University

Grant No. 251 (1938). Viviparity in cyprinodont fishes.

I. Abstract of a paper accepted for publication by the *Journal of Morphology.*

Pseudo-amnion, Pseudo-chorion and Follicular Pseudo-placenta in Poeciliid Fishes

Embryos of the Poeciliidae, a wholly viviparous family of the Order Cyprinodontes, differ but little in the least specialized species from those of oviparous cyprinodont fishes in devices by which they respire and receive nutritive materials.

In specialized species there is a reduction of the yolk sac and an extension of the belly sac upon which a portal network is spread. The portal network functions in respiration and in obtaining nutritive materials from the maternal blood. In Heterandria formosa the somatopleural wall of the pericardial sac of the embryo is drawn over the head and anterior portion of the body to form a pseudo-amnion and a pseudo-chorion. In the most specialized members of the subfamily Poeciliopsinae the modified ovarian follicle in which the embryo is contained is thickened, vascular and equipped with villi to form a follicular pseudo-placenta.

Superfetation occurs in the species which have developed the pseudo-amnion, pseudo-chorion or the follicular pseudo-placenta. At least eight small broods of embryos at different levels of development are present in the gravid ovaries of the most specialized species.

II. Abstract of a paper submitted to the *Journal of Morphology* in November, 1939.

Pericardial Sac, Trophotaeniae and Alimentary Tract in Embryos of Goodeid Fishes

In the embryo of the primitive goodeid fish, Ataeniobius toweri, the yolk sac functions as a nutritive supply and the portal network covering the yolk sac and pericardial sac function as a respiratory organ in early gestation. In late gestation the gut absorbs nutritive materials from the ovarian fluid. In the embryo of the more specialized Goodea luitpoldii a group of small trophotaeniae functionally replaces to some extent the portal network covering the yolk sac and pericardial sac.

The embryos of Characodon lateralis, Zoogoneticus quitzeoensis, Neotoca bilineata, Lermichthys multiradiatus and others have become highly specialized in their method of respiring and obtaining nutrition during gestation. The yolk sac has become diminutive and serves as a nutritional supply only during early stages. The pericardial sac has a fleeting existence as a respiratory organ. The trophotaeniae develop extensively and very early to become the only organs by which the embryo respires and obtains nutritive materials during later stages.

III. Abstract of a paper submitted to *Copeia*, October, 1939.

Superfetation in Viviparous Cyprinodont Fishes

Effective superfetation occurs in some species of the Poeciliidae. An abortive type of superfetation is found in several species of the Goodeidae and in the one species of the Jenynsiidae which has been investigated.

In the less specialized poeciliid fishes only one brood occurs in the ovary in one period of gestation. In the more specialized species there is an overlapping of the gestation period of two broods at different levels so that two broods may be present in the ovary at the same time. In the most highly specialized species there may be as many as nine small broods at different stages of development in the ovary at the same time so that the ovary is in a continuous stage of gestation.

Superfetation is not effective in the Goodeidae and Jenynsiidae where the embryos are evacuated into the ovarian cavity, a site not favorable physiologically for the retention of embryos at different stages of development. In the Poeciliidae each embryo is physiologically isolated in a modified follicle, a condition favoring superfetation.

The Union Library Catalogue of the Philadelphia Metropolitan Area

Charles W. David, Chairman, Board of Directors

A special grant of $7,500.00 was approved by Council in December, 1935, for expert work in the production of a Union Catalogue of the Libraries in the Philadelphia Metropolitan Area.

Grant No. 116 (1936) of $2,500.00 (an equal amount was appropriated by each of the Committees on Publication and Library making a total of $7,500.00).

Grant No. 177 (1937) of $6,000.00 for three years.

During the year 1939 The Union Library Catalogue of the Philadelphia Metropolitan Area has again made very gratifying progress. New cards, representing new accessions at one or more of the contributing local libraries, have been added to the number of 72,924, an increase of about 6,000 over the previous year. One new library, that of the Swedish Historical Museum, has also been added to the list of institutions which are now included in the Union Catalogue. At one time cards from contributing libraries were arriving in such numbers that our staff was unable to keep up with them and filing at the Union Catalogue fell somewhat into arrears; but with the assistance of some extra labor from the National Youth Administration, supplied through the cooperation of the University of Pennsylvania and Temple University, these accumulations are rapidly being cleared away.

One of the difficulties which has come to light in the operation of the Catalogue is the rather serious lag which usually occurs between the acquisition of a book by a contributing library and the actual appearance of the card recording that acquisition in our central file. Every effort is being made to shorten this delay through closer cooperation between local libraries and the Union Catalogue, and a promising experiment is now being made at the Lippincott Library (Wharton School, University of Pennsylvania) whereby new acquisitions are reported to us weekly on special filing slips which are to be replaced later when completed catalogue cards can be supplied. It is hoped that this prompter system of reporting, or some modification of it, may soon be extended to other contributing libraries and so make possible a more efficient service at the Union Catalogue.

The important work of combining all recorded holdings of an identical bibliographical item on a single card has made steady progress during the past year and is now well advanced in the letter R. There is good hope that this work will be completed to the end of the alphabet by March or April, 1940.

Though the Bibliographer has found it necessary to devote an increasing amount of his time to other matters, his chief occupation has continued to be the editing of the Catalogue, primarily for the purpose of clearing up difficulties about the correct order of filing and rendering the consultation of the Catalogue more expeditious and sure. During the year forty-eight difficult sections, involving states, cities, periodicals, semi-official bodies, classics and voluminous authors, have been revised and put in order—involving in all some 76,000 cards.

The regular daily location service, which is the principal function for which the Catalogue exists, has continued to grow at a normal rate. The total number of requests for the location of books and for other information which have been answered is 10,-710, an increase of 2,700 over the previous year. The requests range from single items to lists of twenty-five or more.

One of the most interesting and significant enterprises in which the Union Catalogue has been associated during the past year has been the re-cataloguing project of the Library Company of Philadelphia which was referred to in our last annual report. While this work has not advanced as rapidly as was hoped in the beginning it is gratifying to report that approximately two-thirds of the undertaking has been completed. It is earnestly to be hoped that the Library Company will find the means to push this enterprise through to the end. The Union Catalogue profits directly from some of the labor employed on the project, and in return our Bibliographer spends a considerable portion of his time in consultation with the Library Company's editorial staff upon the many problems that arise.

Perhaps the most exciting event in library circles in Philadelphia during the past year has been the organization of the Bibliographical Planning Committee to make a survey of the whole library situation in the Philadelphia metropolitan area and formulate plans for the establishment of a community centre of research in the new library building which the University of Pennsylvania hopes to erect upon its campus in the near future. The Planning Committee is a joint committee of the Union Library Catalogue and the University of Pennsylvania. Its work is being financed by a grant of $20,000 from the Carnegie Corporation of New York. The Union Catalogue naturally is cooperating to the utmost with this great forward-looking enterprise and anticipates with high hopes the publication of the Planning Committee's report in the spring or early summer.

One of the by-products of the work of the Bibliographical Planning Committee has been the establishment at the Union Catalogue of an experimental War Documentation Service. This central service, which it is hoped may offer an early illustration of the soundness and value of the Bibliographical Centre idea, has been financed for an experimental period by the University of Pennsylvania and is receiving all possible cooperation from the Union Catalogue, including the daily counsel of our Bibliographer.

One of the more recent developments at the Union Catalogue has been a concerted effort to develop closer cooperation with local library circles in dealing with mutual problems. Through the publication of an occasional bulletin of information as well as through a series of conferences with selected groups of librarians we are endeavoring to bring the Union Catalogue and the professional library community closer together. One of the first concrete results has been the establishment at the Catalogue of a centre of information bearing on the problems of cataloguing. It is maintained by our Bibliographer who keeps a file of all inquiries submitted to him and stands ready to give the best advice he can.

The growing interest in the Philadelphia Union Catalogue and the prestige which it enjoys beyond the Philadelphia area are well illustrated by a recent development in Georgia. In October we were visited and studied by ten members of a "faculty advisory council" in the interest of a cooperative movement between Agnes Scott College, Columbia Theological Seminary, Emory University, Georgia School of Technology, High Museum and School of Arts, and the University of Georgia. In December we were informed by the Librarian of Emory University that a grant had been made by the General Education Board to the libraries of the Athens-Atlanta area for the establishment of a union catalogue. And on January 2nd of this year we were visited again and studied further by the director of the proposed new catalogue. The new work is doubtless by this time well under way.

BERTHOLD, ARTHUR B., 1939. Russkie kollektivnye zagolovki: Russian corporate headings; a list of over one thousand Russian headings for official and semi-official bodies, based chiefly on the holdings of the Union Library Catalogue, with an attempt at their identification for cataloguing purposes. The edition is already exhausted and a new edition or a reprint is in contemplation.

—— 1939. Russian Corporate Entries in the Union Library Catalogue, Special Libraries **XXX**: 226–229.

—— 1939. Union Catalogues and Documentation; report of a survey of union catalogues in the United States. International Federation for Documentation, 15th Conference, Zürich, Rapports (The Hague, 1939), 1–5.

TAUBER, MAURICE F., 1939. Other Aspects of Union Catalogs, Library Quarterly **IX**: October, 411–431.

DAVID, CHARLES W., 1938–39. Reports of Progress. Yr. Bk. Amer. Philos. Soc. for 1937: 216–218; for 1938: 232–235.

J. E. WEAVER, University of Nebraska

Grant No. 282 (1939). Effects of the great drought on the grasslands of the midwest.

The great drought has prevailed intermittently in the midwest for a period of seven years. Earlier studies showed clearly that great changes in the plant populations of native grassland were occurring, less drought resistant species dying and their places being taken by more xeric grasses and other herbaceous plants. A survey was made in 1939 of five prairies in western Iowa and others southwestward through Nebraska to western Kansas. All were on deep, fertile, silt-loam soils and soil moisture was the chief limiting factor to plant growth. The bluestem prairies of Iowa, where rainfall was plentiful, had a continuous supply of water at all depths to six feet, the approximate maximum depth of root growth of the grasses. Those of Nebraska and Kansas had only a low supply after early spring and were repeatedly threatened with drought. Where bluestem grasses (Andropogon scoparius and A. furcatus) had died and western wheat grass (Agropyron smithii) had invaded certain prairies in Nebraska and

Kansas, available deep soil moisture was the exception and repeated exhaustion of the surface supply occurred. Water was available for growth only in the surface soil in the prairies of buffalo grass and grama grass (Buchloe dactyloides and Bouteloua gracilis) in western Kansas and only at two or three periods.

Grasses grew normally in Iowa, the foliage reaching a height of 18 inches; in eastern Nebraska they dried after midsummer and failed to flower. Wheat grass dried very early and burned readily early in July. The short grasses were dormant during most of the summer but grew to a height of three inches when refreshed by late summer showers.

No previous deterioration of vegetation had occurred in Iowa. The basal area of vegetation was only one-half to two-thirds normal in the drought-depleted bluestem prairies westward. Where drought and dust had destroyed most of the former plant cover, the prairies were now dominated by an open growth of western wheat grass which permitted a continuous pattern of bare soil. In western Kansas, the former 85 per cent basal cover of the short grasses had been reduced by continued drought, burial by dust, and injury by grasshoppers to 10 to 15 per cent. The remaining soil was bare.

There were 80 perennial species of grasses and other herbs in the immediate vicinity of the soil sampling stations in Iowa. Only 52 occurred at the Nebraska-Kansas bluestem stations, and 30 in the wheat-grass prairies. At the short-grass stations the number was reduced to 15.

Conditions found in this study of the central area of the mid-continental grassland reveal in general changes that have been wrought elsewhere from east to west by continuous drought.

A survey was made in the summer of 1939 of 88 ranges selected as representative of grazing lands in western Kansas and Nebraska, portions of southwestern South Dakota, eastern Wyoming and Colorado, and the Panhandle of Oklahoma. Severe drought, overgrazing, burial by dust, and damage by grasshoppers have resulted in greatly reducing the cover of range grasses. This portion of the mixed prairie has almost completely lost its upper story of mid grasses on the non-sandy lands. The short grasses and sedges have undergone a process of thinning which has resulted in only the most vigorous plants remaining alive. Many of the less xeric herbs other than grasses have practically disappeared and only six or eight of the most xeric native species are regularly represented by dwarfed and widely spaced individuals. The basal cover of perennial grasses was formerly 60 to 90 or more per cent. On only 16 per cent of the ranges is it now 21 per cent or more. A cover of 6 to 20 per cent was found in 44 per cent of the grazing areas. Cover was reduced to 2 to 5 per cent in a group totaling 16 per cent. The remaining one-fourth of the pastures (24 per cent) presented a cover of 1 per cent or less. Further deterioration seems certain because of the extremely low precipitation of the summer and fall of 1939.

WEAVER, J. E., 1940. Deterioration of Grassland from Stability to Denudation with Decrease in Soil Moisture. Botanical Gazette. (In press.)
—— 1940. Deterioration of Midwestern Ranges. Ecology. (In press.)

PAUL WEISS, University of Chicago

Grant No. 323 (1939). Neuro-muscular coordination in mammals.

Experimental ground work was laid for a re-investigation of the presumable nervous adjustments following muscle transplantation and nerve crossing in mammals. The chief result of these studies thus far has been the realization that under crucial test conditions the innate coordination of muscles in the rat is essentially inflexible. Muscle transpositions in the hind limb were performed so that contraction of the main dorsi-flexor muscles of the foot produced plantar flexion instead of dorsi-flexion, and contraction of the plantar flexor of the foot produced dorsi-flexion instead of plantar flexion. All other shank muscles were removed. These rats exhibited, both in "spontaneous" and reflex activity, complete reversal of all plantar and dorsi-flexion phases of the movements of the operated limbs. This reversal persisted for more than one year with no functional adjustment either in common activities or in special trained performances. Amputation of contralateral foot, amputation of front legs, training the rats to rise on hind limbs as well as to climb a ladder for food, failed to result in reeducation of the foot movements. Similar results were obtained when the nerves leading to the plantar flexors and dorsi-flexors were crossed instead of the muscles. If, however, following the nerve crossing the muscles were also transposed, this double reversal resulted in mechanically adequate function.

This unmodifiability of the contraction patterns in the hind limb musculature of the rat emphasizes the autonomy of fundamental motor patterns and their independence of experience. The analysis thus far has been carried out by the study of slow motion picture records of the operated animals. It will be continued with the aid of electrical action potential records; the apparatus for this is under construction. The pursuit of these studies has been greatly aided by the contribution received from the Penrose Fund, allowing the purchase of apparatus and other equipment.

SPERRY, R. W., 1939. Functional Results of Muscle Transposition in the Hind Limb of the Albino Rat. Anat. Rec. 75 (suppl.): 51 and 100.

P. W. WHITING, University of Pennsylvania

Grants No. 11 (1934), No. 48 (1935) and No. 305 (1939). Investigations on genetics and sex determination in the parasitic wasp Habrobracon.

In the YEAR BOOK for 1938 (pp. 243–244) the relationship of the sex determining factors in inbred lines was described. There are two kinds of haploid males, X and Y, and two corresponding kinds of diploid males, XX and YY. Determination of the female sex is complementary, XY. Crosses of female XY with male X give females XY and diploid males XX; with male Y give females XY and diploid males YY. The diploid males are highly inviable so that there are many unhatchable "bad" eggs. In contrast to these close-cross conditions, hatchability is normal in outcrosses and there are no diploid males; all fertilized eggs are female-producing. The explanation of this high reproductive economy in outcrosses, involving replacement of bad eggs and diploid males by females, was sought in two different hypotheses,—(1) differential maturation, according to which all zygotes are XY and (2) sex reversal by multiple factors, according to which XX and YY combinations are changed into females.

Because of recent findings these two hypotheses have been discarded and the explanation appears to lie in multiple alleles for sex. Thus the X and Y of one inbred stock are allelic with but not the same as the X and Y of another. Hence we may call these alleles xa and xb in one stock but xc and xd in another. Crosses within these stocks result in excess bad eggs, diploid males and low female ratio; crosses between these stocks show normal fecundity, no diploid males and high female ratio. In miscellaneous matings within mixed stocks, some fraternities are of the "outcross" type, others of the "close-cross" type.

By means of the semi-dominant body color gene *lemon*, it is now possible to identify half of the diploid males in the second generation from any cross involving this factor. Crosses of three unrelated stocks have recently been made. These show typical outcross progenies,—high fecundity, no diploid males, high female ratio. If the F_1 females are crossed to their fathers, or to their own parthenogenetically bred sons, they give close-cross results,—low fecundity, diploid males, low female ratio. The gene *lemon* makes it possible to identify fraternities as "outcross" or as "close-cross" among progenies in every generation which are inbred subsequent to cross-breeding. This was previously possible only in alternate generations.

Data previously accumulated, both published and unpublished, have now been analyzed in the light of the multiple allele theory and are all in agreement. A paper covering this analysis is now in press (*Jour. Morph.*). If the theory is valid it will be possible to plan experiments testing, among other points of interest, the relative viability of the different genotypes and the percentage of eggs fertilized both in outcrosses and in close-crosses, as affected by different conditions, both genetic and environmental. The number of different alleles existing in different wild stocks and the possibility of mutation from one allele to another may likewise be determined.

WHITING, P. W., 1935. Selective Fertilization. Jour. Hered. 26: 17–22.

—— 1935. Sex Determination in Bees and Wasps. Jour. Hered. 26: 263–278.

—— 1935. Genic Balance, Sex Determination and Selective Fertilization in Hymenoptera. Proc. Amer. Philos. Soc. 75: 517–520.

—— 1935. Sex Determination in Bees, Wasps and Ants. Miscellanea, American Philos. Soc. 1: 16–17.

—— 1935 (with SPEICHER, KATHRYN GILMORE). Impaternate Daughters of Females Heterozygous for a Sex-linked Gene in Habrobracon. Amer. Nat. 69: 82–83. (Abstract.)

—— 1936. Genetics of Hymenoptera with some Possible Applications to Apiculture. (English with Russian translation.) Advances in Modern Biology (Uspekhi Sovremennoi Biologii) 5: 658–682.

—— 1939. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1938: 243–244.

—— 1939. Sex Determination and Reproductive Economy in Habrobracon. Genetics 24: 110–111. (Abstract.)

CLARENCE ZENER and ROBERT H. RANDALL, College of the City of New York

Grant No. 220 (1938). Intercrystalline thermal currents as a source of internal friction.

The term internal friction refers to the capacity of a solid to convert its ordered energy of vibration into disordered heat energy. One of the grantees has recently suggested[1] that an important cause of this energy degradation lies in the thermoelastic effects which accompany vibration. Thus fluctuations in dilatation give rise to fluctuations in temperature, and hence to temperature gradients. But temperature gradients in turn give rise to thermal currents, and hence to an increase in the entropy of the system. The primary cause of fluctuation in dilatation in a vibrating solid is the elastic anisotropy and at least partial random orientation of the individual crystallites. It was thus suspected that an important cause of internal friction in polycrystalline metals lay in the intercrystalline thermal currents which accompany vibration. It is the purpose of the present research program to investigate experimentally the internal friction arising from these thermal currents. Two phases of this program have been completed; a third is in process of development.

(1) An experiment was designed to demonstrate the presence of these intercrystalline thermal currents, and to evaluate their relative importance as a cause of internal friction. A simple theoretical argument shows that this internal friction depends upon the frequency of measurement and the mean diameter of the crystallites only in the dimensionless combination

$$\textit{frequency} \times (\textit{mean diameter})^2/\textit{thermal diffusion constant.}$$

The argument further shows this internal friction to be a maximum when this parameter is of the order of magnitude of unity, decreasing to zero for large and for small values. In this first experiment this parameter was varied by taking measurements over a wide frequency range, and by using specimens identical in every respect except for crystallite size. The specimens, of alpha brass, were prepared by the American Brass Company. In this way measurements were made with the dimensionless parameter varying from

[1] Zener, C. Internal Friction in Solids. Phys. Rev. **52**: 230–235 (1937); **53**: 90–101 (1938); **53**: 582–586 (1938).

0.01 to more than 10,000. The results were in complete agreement with theory. (*a*) The internal friction was found to be a function of frequency and mean crystallite diameter only in the combination frequency $\times$ (mean diameter)^2. (*b*) The internal friction was found to have a maximum when the dimensionless parameter was of the order of magnitude of unity, and to fall to low values on both sides of the maximum. In the specimens examined the internal friction due to intercrystalline thermal currents was of a larger order of magnitude than that due to all other causes.

(2) A second experiment was designed to determine the precise manner in which the internal friction varies with mean crystallite diameter. Simple theoretical arguments show that that part of the internal friction due to intercrystalline thermal currents will vary as (mean diameter)^2 for small crystallite sizes, as 1/(mean diameter) for large crystallite sizes. Measurements were made on alpha brass specimens of very small crystallite size, and on zinc specimens with large crystallite size. The measurements were in complete agreement with the theoretical predictions. A method was devised for estimating that part of the internal friction due to causes other than thermal currents.

(3) A third phase of this program is still in progress. This is to obtain a correlation of the magnitude of the internal friction due to thermal currents with the thermal and elastic constants of the crystals. A theory has been developed which gives this magnitude as a function of the elastic anisotropy of the crystals. For the experimental investigation several sets of specimens are being investigated. Specimens of zinc have been prepared by the New Jersey Zinc Company, specimens of aluminum by the Aluminum Company of America.

RANDALL, R. H., 1939 (with ZENER, C. and ROSE, F. C.). Intercrystalline Thermal Currents as a Source of Internal Friction. Phys. Rev. 56: 343-348.

—— 1940 (with ZENER, C.). Variation of Internal Friction with Grain Size. Accepted for publication, Institute of Metals Division, A. I. M. E.

SUMMARY

The serial numbers of grants made in successive years and those for which no reports have been furnished for publication in the YEAR BOOKS for 1937, 1938 or 1939 may be summarized as follows:

Year	Grant Nos.	Reports lacking
1933–34	1–35	None
1935	36–83	Nos. 47, 78
1936	84–126	Nos. 102, 108
1937	127–200	Nos. 132, 159, 163, 166, 172, 196
1938	202–289	Nos. 210, 217, 224, 234, 237, 241, 244, 246, 254, 255, 271, 279, 280, 281, 285, 288, 289
1939	290–392	47 Reports in this volume

There has not been sufficient time for reports from all of these latest grants but these and some of the earlier ones will probably be represented in future numbers of the YEAR BOOK.

THE JOHNSON FUND

At the end of the year 1938 the accumulated income from the Eldridge Reeves Johnson Fund amounted to $13,000 and during 1939 the following six grants were made amounting to $9,730, a balance of $3,270 to be carried over and added to the 1940 income from this fund:

Grants Awarded from the Eldridge Reeves Johnson Fund

1939, April 14

Academy of Natural Sciences of Philadelphia:

Grant No. 15. Benjamin F. Howell, *et al.*, Geology and Paleontology Departments, for assistance in the study of type and undescribed specimens of fossils in the Academy's collection in preparation for making of a published, annotated and illustrated list of such specimens, including new material not heretofore described or illustrated (second grant). $3,580

Grant No. 16. James A. G. Rehn and John W. H. Rehn, for travel expenses in connection with field investigations of the Orthoptera of the Southern Alleghanies, Cumberland Plateau, Ozark and Ouachita Mountain Areas. 420

1939, June 9

University Museum, University of Pennsylvania:

Grant No. 17. Pierre Delougaz, for part-cost of printing and editorial work in the publication of the eleven volumes of the "Excavations at Khafaje." These volumes will report on the ancient towns of the region of the Diyala River as a cultural unity, which will be more satisfactory than taking each individual town by itself. (Joint publication with the Oriental Institute of the University of Chicago.) 1,000

Grant No. 18. Gerald M. Fitzgerald, for the printing of text and plates in the publication of his manuscript, "A Sixth Century Monastery at Beth-shan." This is a descriptive study of the architecture and mosaics of a Byzantine monastery excavated at Beth-shan. 2,300

1939, December 8

Eldridge Reeves Johnson Foundation for Medical Physics, University of Pennsylvania:

Grant No. 19. D. W. Bronk, for the study of neural and chemical factors affecting the excitation of nerve cells at synapses in sympathetic ganglia. 1,400

Grant No. 20. Glenn A. Millikan, for the measurement of rapid chemical processes in biological systems. 1,030

REPORTS FROM RECIPIENTS OF GRANTS FROM THE JOHNSON FUND

Academy of Natural Sciences of Philadelphia
Geology and Paleontology Department

Grant No. 15 (1939). Benjamin F. Howell. Study of type and undescribed specimens of fossils in the Academy's collection in preparation for making of a published annotated and illustrated list of such specimens, including new material not heretofore described or illustrated.

Stipends of Dr. B. F. Howell, Dr. E. H. Colbert, Miss Virginia W. Tomlin, Mr. W. T. Clarke, Jr. (for a part of the year), and Mr. Robert G. Chaffee (after Mr. Clarke's departure), were paid from the grant. These five members of the Academy's staff have during the year, with the aid of Miss Anne Harbison, Dr. Erling Dorf, Dr. H. G. Richards, and workers paid from other funds.

(1) Cleaned, sorted and rearranged the Academy's collection of fossil corals and echinoderms so that they are now easily available for study and reference,

(2) Completed the cleaning, sorting, and rearranging of the Academy's collection of fossil vertebrates so that they are now easily available for study and reference,

(3) Begun the cleaning, sorting, and rearranging of the Academy's collection of fossil plants so that they will be available for study and reference,

(4) Continued the preparation of the synoptic, stratigraphic, and geographic cross catalogues of the Academy's collections of vertebrate and invertebrate fossils which were begun last year,

(5) Continued the preparation of the catalogue of the mammalian type fossils owned by the Academy by the rechecking of the collections for previously unrecorded types which has meant the comparison of each specimen with the literature,

(6) Carried on field work on the Cretaceous geology of New Jersey, on which a comprehensive report is being prepared for publication,

(7) Cooperated with the various specialists who have consulted the Academy's paleontological collections during the year,

(8) Carried out field and laboratory studies of the Cambrian rocks and fossils of northwestern Vermont and western Quebec,

(9) Completed the study of the vertebrate fossils collected in Burma by the 1938 Asiatic Expedition for Early Man, which was partly financed by the American Philosophical Society,

(10) Aided in the preparation of new exhibits in the Academy's Hall of Earth History,

(11) Cooperated with the Faculty of the School of Earth Sciences of the University of Pennsylvania in further developing the teaching and research in that school. Also cooperated with the Faculty of Bryn Mawr College in the teaching of Vertebrate Paleontology,

(12) Cooperated with the New Jersey State Museum in a study of the Pleistocene marine and fresh-water faunas of North America, which is being partly financed by the Geological Society of America,

(13) Cooperated with Princeton University, Mount Holyoke College, the United States National Museum, and the University of Montana, in a broad program of research in the field of Cambrian paleontology and stratigraphy which is being partly financed by the National Research Council and the Geological Society of America,

(14) Answered many questions from the public and otherwise carried on the routine duties which fall to curators in such an institution as the Academy.

The additional progress made during the past year in rearranging and cataloguing its fossils has brought the Academy nearer to its goal of making accessible to its own staff and to visiting specialists the large and very valuable collections of extinct invertebrates, vertebrates and plants, which had for so many years been practically unavailable to scientists. Already this has resulted in an increased use of these collections by workers from the Philadelphia district, Washington, and elsewhere. With the assistance rendered by the American Philosophical Society, the Academy is again becoming active in the fields of paleontology and geology. Its collections of fossils are being used, its staff is carrying on research in the field of the Earth Sciences in the course of rearranging the collections, and its building is being used as a meeting place by the newly organized Geological Society of Philadelphia.

This new society which was organized largely as a result of the renaissance of the Earth Sciences at the Academy, is already promoting research and increasing the interest in geology, paleontology, and mineralogy in the Philadelphia region. The establishment of this society and the proper rearranging of the Academy's paleontological collections will be permanent results, of great value to science and education, of the temporary assistance which the American Philosophical Society has so generously extended to the Academy.

Grant No. 16 (1939). James A. G. Rehn and John W. H. Rehn, Field investigations on the Orthoptera of the Southern Appalachian mountain area.

Purpose.—The general purpose of the survey was to supplement in more elevated territory field investigations already made in lowland areas of the Southeastern and Gulf Coast states during the years 1911, 1913, 1915, 1917, 1921 and 1935 under the auspices of the Academy of Natural Sciences of Philadelphia. The specific objective was to secure more definite information than was previously available on the relationship of the Orthoptera of the southern Appalachians, and those of the isolated Ozark and Ouachita uplifts with those of more boreal areas to the northward, the extent to which these evidence the role of Pleistocene control in their present distribution, and the possible lines of movement and penetration since that time of the many elements of different early history, clearly intrusive from the southwest.

Time Spent in Field.—From July 29 to September 10, 1939, was spent by James A. G. Rehn and John W. H. Rehn in carrying out the investigation. Travel was by a personally owned automobile.

Summary of Work.—Examinations were made of 189 different stations extending from Maryland to New Mexico, where contact was made with areas examined in similar fashion in 1937. The localities on which efforts were chiefly concentrated were located in Virginia, West Virginia, Kentucky, Tennessee, North Carolina, Georgia, Alabama, Mississippi, Louisiana, Arkansas and Oklahoma. Personally supplied funds made it possible to examine in addition areas supplying contributory evidence to the main project in Texas and New Mexico. The stations examined in the southeastern states reached to an elevation of 6,500 feet, in New Mexico to 8,200 feet. The total mileage traveled was 7,500.

Material Secured.—Aside from the large amount of observational information secured, collections of 12,000 insects were made, of which nearly 8,000 were Orthoptera. This material is now in the hands of preparators, being mounted and labeled preliminary to laboratory study. This preparation work, which will require some months of labor, is moving forward rapidly as one of the major tasks of the preparatorial staff of the Department of Insects of the Academy of Natural Sciences of Philadelphia.

Preliminary Survey of Results.—While it is quite unwarranted to make any deductions or draft any general conclusions in advance of the preparation and full study of the material secured, in conjunction with the accompanying analysis of field observations and notes, it can be stated definitely that exact and detailed information was secured showing that certain boreal types apparently do not penetrate south of West Virginia; that others reaching to the Great Smoky Mountains of North Carolina and Tennessee are there very localized and in their structural features supply a most interesting index to the Pleistocene and post-Pleistocene migrations of these stocks; that endemism in the fightless Orthoptera of the Southern Appalachians is even more decided than previous information indicated, and that this endemism may be very much circumscribed areally; that numerous supposedly Sonoran types previously unknown from that area penetrate quite deeply into parts of Tennessee, Alabama, Mississippi and Arkansas, and that there is a definite distinction between the Orthopteran inhabitants of the two adjacent but biologically different Arkansas areas, the Ozarks and Ouachitas. On the purely systematic side, it will be possible from the results of the survey to secure a more logical and comprehensive understanding of the relationships of a number of the flightless forms of Orthoptera localized in the mountains of the southern United States, a task which requires full knowledge of both sexes of species often of secretive habits and strictly limited environmental preferences. The present investigation, together with the contributory evidence accumulated through various channels at the Academy during the past thirty years, has supplied much of the information needed for this critical phase of the work.

Eldridge Reeves Johnson Foundation for Medical Physics, University of Pennsylvania

Grant No. 11 (1938). Leslie A. Chambers and J. B. Bateman, Study of the molecular organization of cell surfaces in relation to biological activity and specificity.

The existence of specific differences between the two faces of films formed by spreading a streptococcal nucleoprotein antigen at the interface between air and an aqueous medium was demonstrated by microscopic estimation of the number of organisms adsorbed by the deposited films after sensitization with type and group antisera. However, the early experiments, involving a purely arbitrary selection of experimental conditions, frequently failed to show as sharp differentiation between the two film faces as was desirable, and it was suspected that the inconsistencies were due to incomplete orientation of the antigen.

An extensive investigation of the mechanical properties of ovalbumin films, the results of which have been reported in two papers, revealed that quite definite conditions for complete spreading and proper orientation could be defined. These conditions were determined for the case of the streptococcal nucleoprotein antigen and for certain related antigens.

Under the conditions determined to be optimum for complete spreading of the antigen (and presumably for complete orientation) the differentiation between the two film faces becomes well marked and is consistently reproducible. On the other hand, the reactions of the two surfaces are indistinguishable when conditions which prevent orientation are chosen.

A radical simplification of surface film technique has led to the development of a method for the rapid estimation of small quantities of protein. This has been applied to the determination of protein in normal and pathological cerebrospinal fluids, the results of which encourage the hope that, with a properly standardized technique, the method may have clinical value.

BATEMAN, J. B., 1938 (with CHAMBERS, L. A.). Rigidity in Protein Films, and the Properties of the Force-area Curves. Nature 142: 1158.

—— 1939. "Surface Elasticity" of Protein Films. I. Egg Albumin. Jour. Chem. Phys. 7: 244–250.

—— 1940. "Surface Elasticity" of Protein Films. II. Properties of Partly and Completely Spread Films. (In press.)

CHAMBERS, L. A., 1939. Orientation of Antigen-antibody Specificity in Monomolecular Films. Jour. of Immunology 36: 543–557.

Grant No. 12 (1938). Detlev W. Bronk, Study of the mechanism of chemical excitation of nerve cells.

In the previous report of work carried out under this grant techniques were described for recording the activity of single neurons initiated by chemical agents. At that time I reported our finding that removal of calcium ions from nerve cells initiates the discharge of rhythmic trains of impulses from the treated region. The frequency of these impulses provides a quantitative measure of the degree of chemical excitation. Determination of the impulse frequency is accordingly a valuable means for investigating the mechanism of initiating nerve impulses and other actions of chemicals on nerve tissue.

During this past year we have investigated the nature of the chemically induced cellular changes which give rise to the propagated impulses. The studies have been along several lines.

The first has been an evaluation of the theory that steady electric currents flowing between the chemically altered region and adjoining portions of the nerve initiate the impulses. Direct measurement reveals no change in the potential difference between these two regions during the development of persistent activity by the application of sodium citrate. Although the production of this activity is not the result of steady potential differences, the frequency of the impulse discharge can be modified by the development of such potential gradients. Thus an increase of the potassium ion concentration in the activated region makes that region negative to adjoining portions of a nerve and reduces the frequency of the impulses.

When the polarization of the nerve is modified by currents from an external source the chemically induced activity is briefly altered. If the current passes into the nerve at the treated region, the average frequency of impulses is decreased; current flow in the reverse direction increases the frequency. The maximum change in frequency is a linear function of the strength of the polarizing current between -4 and $+4$ microamperes. In contrast with the persistent reduction of activity produced by potassium ions, the change of frequency induced by current flow is transient. The essential difference between these two mechanisms for stabilizing a nerve deprived of calcium ions is being further studied by measuring the polarization potential produced by the current as well as the magnitude of the current. It is clear that either the current flow *per se* or the resulting polarization of the nerve membranes can control this activity.

Despite the importance of electrical properties of nerve as determinants of activity we find that the chemically induced impulses can be suppressed by agents in concentrations which have no demonstrable effect on the electrical parameters. Thus small concentrations of sodium cyanide added to the stimulating solution of sodium citrate reduce or abolish the discharge of impulses without blocking conduction through the treated region. Chloretone added to the citrate likewise suppresses the activity in proportion to its concentration. Inasmuch as these substances are known to inhibit partially the respiration of nerve, our experiments emphasize the role of oxidative reactions in producing and maintaining the trains of impulses which constitute the activity of the nervous system.

A nerve fiber discharging impulses from a region bathed in isotonic sodium citrate will conduct through the treated portion electrically initiated impulses. It is therefore possible to cause the nerve to conduct an additional train of impulses. After the end of such a superimposed tetanus the properties of the fiber are so modified that the frequency of the chemically induced impulses is greatly reduced for some seconds. This modification—by increased activity—of the capacity of a nerve to respond to its chemical environment has an important bearing on the mechanisms whereby impulses are initiated in the peripheral and central nervous systems. It is of especial interest in an analysis of the joint control of the respiratory center by afferent nerve impulses and chemical agents. We are now investigating that problem.

Bronk, D. W., 1939 (with Brink, F., and Larrabee, M. G.). The Chemical Excitation of Nerve Cells. Trans. Amer. Neurol. Assn. 46–49.

—— 1939 (with Brink, F., and Sjostrand, T.). Factors Determining the Frequency of Chemically Initiated Nerve Impulses. Amer. Jour. Physiol. 126: 442.

Grant No. 13 (1938). Detlev W. Bronk. A general investigation of the nervous control of body organs in terms of the properties of nerve cells and fibers which make up the sympathetic and parasympathetic nervous systems.

During the past year our work has been concerned primarily with two specific problems: the excitatory action of acetylcholine on nerve cells and the influence of the hypothalamus on the activity of the sympathetic nervous system.

There is still vigorous debate among physiologists as to whether synaptic transmission is accomplished by electrical processes or by acetylcholine liberated in these regions between adjoining nerve cells. We have held to our previous position that the mechanisms of synaptic action can be understood only through a study of the phenomena of transmission and impulse formation. In pursuance of the latter objective we have investigated the discharge of impulses from single nerve cells in sympathetic ganglia while perfusing the ganglia with varying concentrations of acetylcholine. The frequency with which impulses are formed in the ganglion cells varies with the concentration of the acetylcholine. Another significant finding is that the postsynaptic cells of the ganglia are very much more sensitive to the action of acetylcholine than are the presynaptic units or the axons which pass through the ganglion without synapse.

In order to compare the action of acetylcholine and of electric currents on nerve cells we have studied the stimulating effects of the former under conditions which are known to alter the electrical excitability. Increase of potassium or decrease of calcium raises the excitability; decrease of potassium or increase of calcium lowers the excitability. Using the frequency at which impulses are discharged from a nerve cell as a measure of its response to acetylcholine we find that an increase of potassium or a decrease of calcium augments the action of the acetylcholine; a decrease of potassium or an increase of calcium depresses its action. In general, factors which alter the excitability of a nerve cell to electrical currents similarly modify its response to acetylcholine.

It is generally recognized that the hypothalamus exerts some regulation over the activity of the heart and blood vessels. How this regulation is achieved can now be determined more definitely by electrically recording the nerve impulses discharged from the sympathetic centers during stimulation of localized regions in the hypothalamus. This we have done in an extensive series of experiments on cats. From among our many observations some of the more significant are these: The discharge of impulses from sympathetic nerve cells is increased by relatively high frequency stimulation of the hypothalamus; low frequencies of stimulation produce an inhibition of sympathetic activity and a fall of blood pressure; following a period of hypothalamic stimulation activity of the sympathetic nerve cells stops abruptly and is for some time depressed below its normal level; the hypothalamus profoundly modifies the regulation of blood pressure and heart rate that is normally dependent upon afferent impulses from the viscera.

Perhaps our most important contribution is the development of procedures for measuring the activity of single sympathetic nerve cells while under the influence of hypothalamic stimuli. This has made possible an analysis of the intimate mechanisms involved in the regulation of the cardiovascular system by the hypothalamus.

Bronk, D. W., 1939. Synaptic Mechanisms in Sympathetic Ganglia. Jour. Neurophysiol. 2: 380.

—— 1939 (with Larrabee, M. G., and Brink, F.). The Effect of Chemical Agents on the Excitability of Ganglion Cells. Amer. Jour. Physiol. 126: 561.

—— 1939 (with Pitts, R. F., and Larrabee, M. G.). The Rôle of the Hypothalamus in Cardiovascular Regulation. Proc. Assn. Res. Nerv. and Ment. Disease.

Grant No. 14 (1938). H. K. Hartline. Study of the photo-chemical and neural processes of vision.

Much of the time during the past year was spent constructing the new apparatus provided for by this grant. (1) An optical system is now nearly complete, which will furnish accurately controlled illumination upon an exposed retina. Three separate channels of illumination are provided, making it possible to stimulate different retinal areas independently. For example, a study will be made of the summation due to two spots of light separated on the retina by various distances, in conjunction with a dim background of illumination. The size, location and intensity of each of the two spots, and of the background, will thus be under independent control. (2) An electric timer has been completed, which, by operating electromagnetic light-valves in each of the three channels of illumination, provides control of the exposure of the different parts of the illuminated pattern. The exposures may be made simultaneously or in sequence, with any desired delay between them, so that the time course of retinal processes may be explored. These timed intervals can have any value down to a minimum set by the speed of action of the light-valves. Two light-valves have been completed; they control an aperture 2 mm. wide and operate satisfactorily to give flashes as short as 3 milliseconds. Intervals are timed automatically up to 10 seconds, with an accuracy of 1 per cent. (3) An amplifier for recording the retinal action potentials from a small group of visual sense-cells, simultaneously with the impulses in their optic nerve fibers, has been partially completed.

The electric timer, with one light valve, has been employed in a study of the changes in sensitivity of visual sense cells in the eye of Limulus, following exposure to light. Oscillographic records are taken of the bursts of impulses, in a single optic nerve fiber, elicited by test flashes applied to the eye at various times following a conditioning exposure. Exposure to light depresses the number of impulses elicited by a test flash of constant magnitude. The amount of this depression, and the course of the subsequent recovery, depends upon the intensity and the duration of the conditioning exposure. During the first one or two seconds immediately following the exposure the response which can be elicited undergoes a slight decrease, before the recovery process sets in. Recovery is rapid if the conditioning exposure is short or of low intensity; it is much slower if high intensities or long exposures are used. The time relations of the impulses in a burst, as well as their total number, are altered by previous exposure to light. An attempt will be made to correlate these changes in the nerve activity with the slow retinal action potentials from a small group of the receptor cells to test the hypothesis that the slow action potential of the sensory cell is the cause of the discharge of impulses in its axon.

THE DALAND FUND

During 1939 $6,000 was available for grants from the Judson Daland Foundation for Research in Clinical Medicine. With the approval of Drs. Alfred N. Richards and Edwin G. Conklin, who were appointed a sub-committee of the Committee on Research to consider and report upon applications for grants from the Daland Fund, this $6,000 was awarded to the Philadelphia Institute for Medical Research. The following is a report on the work accomplished under this grant.

PHILADELPHIA INSTITUTE FOR MEDICAL RESEARCH

Grant No. 2 (1939). Investigations on the role of the thymus and pineal glands in growth and development, and clinical problems.

In connection with the investigations on the role of the thymus and pineal glands in growth and development, the following seven papers have been published:

ROWNTREE, L. G., 1938 (with CLARK, J. H., STEINBERG, ARTHUR, EINHORN, N. H. and HANSON, A. M.). Biological Effects of Excess or Deficiency of Thymus Gland in Successive Generations of Rats. Proceedings of the 15th International Physiological Congress, Leningrad-Moscow, August 9th to 16th, 1935. The Sechenov Journal of Physiology of the U.S.S.R. 21: 5–6.

This paper gives an outline of the work up to August, 1935, as reported to the 15th International Physiological Congress.

—— 1938 (with STEINBERG, ARTHUR, EINHORN, N. H. and SCHAFFER, N. K.). Certain Iodine-reducing Substances of Thymus Extract (Biological considerations). Endocrinology 23: 5, 584–592.

This paper deals with the quantitative relationships of the iodine-reducing substances, glutathione, ascorbic acid and cysteine in the thymus extract. It revealed the fact that glutathione, ascorbic acid and cysteine are all capable of accelerating the rate of development of the offspring of treated rats, whereas glutathione in addition is capable of accelerating growth. The biological effects of these iodine-reducing substances simulate those of thymus extract in many respects, but they do not appear to be wholly responsible.

—— 1938 (with SCHAFFER, N. K. and ZIEGLER, W. M.). Certain Iodine-reducing Substances of Thymus Extract (Chemical considerations). Endocrinology 23: 5, 593–597.

This paper shows that ascorbic acid, glutathione and cysteine account for approximately all of the iodine reduction of fresh thymus extract, their respective percentages being about 55, 37 and 7, and their respective concentrations being 39, 65 and 5 mg. per cent.

—— 1939 (with EINHORN, N. H.). Experimental Phases of the Pineal Problem. Endocrinology 24: 2, 219–220.

This paper indicates that the resulting extract is potent and brings about changes similar to, but somewhat less marked than those produced by Hanson's extract of the pineal gland. It also reveals lack of biological results from pinealectomy and pineal implants carried on through successive generations of rats.

STEINBERG, ARTHUR, 1938. A Modified and Improved Method for the Preparation of Thymus Extract. Endocrinology 23: 5, 581–583.

This paper indicates that by decreasing the heat employed from 92° to 68° the thymus extract was potent and richer in iodine-reducing substances. Assays of various extracts made throughout the year revealed a seasonal variation in iodine-reducing substances, the lowest values being found in July and August.

—— 1939. A New and Improved Method for the Preparation of Pineal Extract. Endocrinology 24: 2, 221–229.

This paper describes an improved method for the preparation of pineal extract in which dilute hydrochloric acid was employed.

SCHAFFER, N. K., 1939 (with ZIEGLER, W. M.). Isolation of Glutathione from Thymus Glands. Proc. of the Soc. for Exp. Biol. and Med. 42: 94.

Outlines the isolation of glutathione from thymus glands and its identification.

On the clinical side ten papers have been prepared, dealing with various problems in which we have been greatly interested, namely:

ROWNTREE, L. G., 1939. Hypertension and Unilateral Disease of the Kidney. Urologic and Cutaneous Review, December.

This paper reports the complete disappearance of hypertension and complete and permanent cure to date of a patient following the removal of a diseased kidney. The removal of the kidney was advised because of the recent new concept of hypertension, based on the work of Goldblatt and his collaborators, on renal ischaemia.

—— (In press.) Discussion of the Rôle of the Kidney in Cardiorenal-vascular Disease.

This paper attempts to reveal the rôle of the kidney in cardio-renal-vascular disease, showing how the incidence of nephritis as the cause of death is decreasing, in part due to changing nomenclature, and in part to the recognition of the rôle of the involvement of the heart, brain and vessels.

—— Addison's Disease. Cyclopaedia of Medicine. F. A. Davis & Co., publisher.

—— Volume of Blood and Plasma. Cyclopaedia of Medicine, F. A. Davis & Co.

These papers are (*a*) a comprehensive presentation of Addison's disease and (*b*) of blood and plasma, which are the types of rather detailed presentation in the usual System of Medicine.

—— (In press.) Addison's Disease. Cecil's Text Book of Medicine.

A text book for Cecil's Text Book of Medicine, which is probably the leading text book on this subject in America.

—— 1939 (with Einhorn, N. H.). Some Endocrine Factors Controlling Growth and Development in Childhood. Penna. Medical Journal, July.

Covers material presented at a meeting of the State Medical Society in which are discussed the various elements controlling growth and development in childhood, together with illustrative cases selected to emphasize the factors considered.

—— Report of Three Cases of "Clinical" Addison's Disease Surviving more than Fifteen Years. Submitted to the Journal of Endocrinology.

This paper discussed three cases, the survival of 116 studied at the Mayo Clinic. All three survived more than 15 years. This unquestionably sets a world's record for a single report of prolonged survivals. These cases represent rather mild forms of the disease, and one a functional type with apparent cure.

—— Increasing Survival Time in Addison's Disease. Results in Six Successive Cases Continuously on Swingle's Extract of the Suprarenal

Cortex and on a High Sodium Intake. Submitted to the Journal of the American Medical Association.

Indicates the increasing survival time which is resulting from newer forms of therapy such as the use of Swingle's extract of the suprarenal cortex, with a high sodium intake. Whereas the ordinary case due to tuberculosis, according to the literature, survives less than 14 months, six cases are presented who, as the result of this treatment, have survived for a period of more than 6 years. These patients have been greatly rehabilitated, and most of them are carrying on their ordinary activities. There has not been a single death in the group.

—— The Results of Endocrine Therapy in Juvenile Myxedema. Submitted to the Journal of Pediatrics.

This is a brief clinical report of two cases of this disease who failed entirely to make satisfactory growth on mixed endocrine therapy, but who made perfectly satisfactory progress when placed on adequate amounts of thyroid. Both patients who otherwise would have been dwarfs have attained normal growth and development.

Mazer, C., 1939 (with Schechter, F. R.). Treatment of Vulvo-vaginitis with Estrogen. J. A. M. A. 112: 1925–1926.

This paper on the treatment of vulvo-vaginitis with estrogen is the report of a very careful study carried on over a period of two on three years by Dr. Charles Mazer and Dr. Schechter, in which they indicate that this disease in children can be adequately and rather rapidly controlled and actually cured by the administration of sex hormones by hypodermic injection. The dose of estrogen must be sufficient to cornify the vaginal epithelium and reduce the pH of the vaginal secretion to a point below 6.

In addition we have participated in a symposium on the thymus gland held at the annual meeting of the American Academy of Pediatrics. A transcript of this discussion covered the anatomy, physiology, pathology and roentgenography of the thymus gland, as well as a discussion of the condition called status thymicolymphaticus. The conclusion of the panel was to the effect that the current conception of what constitutes an enlarged thymus gland has been in error, and that what had previously been termed an enlarged gland is actually a normal gland; that enlargements when proven to exist and to be productive of respiratory obstruction should be treated with mild doses of X-ray until the symptoms are relieved. Secondly, in so far as status thymicolymphaticus is concerned, it was felt that no evidence that the thymus gland could produce sudden death has been advanced. This report appeared in Vol. 14, No. 4, April, 1938, of the *Journal of Pediatrics*. Our part in the symposium was presented by Dr. N. H. Einhorn. No reprints are available.

We have participated in another study with a group from the Philadelphia General Hospital, through our Associate, Dr. N. H. Einhorn: a survey of 1,000 cases of pneumonia in children treated without specific therapy at the Philadelphia General Hospital from March, 1932 to December 31st, 1938, dealing with the morbidity, symptomatology, location of lesion and complications, chief of which were otitis media and empyema. This paper has been submitted to the American Medical Association.

6. REPORT OF THE COMMITTEE ON FINANCE

According to the Laws of the Society, the Committee on Finance consists of the President and the Treasurer, *ex-officio*, and not fewer than five other members who shall be nominated by the President and elected by the Society at the General Meeting in April.

Chapter V, Articles 3 and 4 of the Laws read:

"The Committee on Finance shall have the general superintendence of the financial concerns of the Society. It shall have the custody and control of all the securities and investments of the Society, both real and personal, with full power and authority to buy and to sell, and to invest and reinvest the same; including the power to purchase and to sell real estate and to make leases thereof, to satisfy mortgages and extinguish ground rents, and to direct the placing of all such insurances as it may deem necessary; as well as to borrow on the credit of the assets of the Society, to create mortgages thereon, and to make such improvements, repairs and alterations to real estate as it may deem necessary. It shall have power to authorize the proper Officers of the Society to execute the necessary papers to effect all purchases, sales and assignments of property, both real and personal; to execute and to satisfy mortgages, to extinguish ground rents and to transfer registered securities; to subscribe to bond-holders' agreements to plans of reorganization involving any securities held by the Society or in which it has an interest, and to do all such acts as are necessary in pursuance of the foregoing powers.

"The Committee on Finance shall always have access to the Treasurer's books, accounts, and vouchers, and shall cause an audit of such accounts to be made at least once a year. It shall require from the Treasurer an annual report of all the operations of the treasury, which it shall present to the Council with an annual statement of estimates of receipts and expenditures. With the approval of the Council it shall determine the fiscal year of the Society and, in case of emergency needs, authorize appropriations over and above the annual budget."

During the year 1939, the Committee on Finance consisted of Marshall S. Morgan, *Chairman*, Thomas S. Gates, Nathan Hayward, John S. Jenks, George W. Norris, Charles J. Rhoads, J. Henry

Scattergood and Roland S. Morris, *President*. Edwin G. Conklin, *Executive Officer*, and Morris Duane, *Legal Consultant*, sat with the Committee.

The members of the Committee met regularly once a month from January to June and from October to December with occasional special meetings.

REPORT OF THE TREASURER

General and Special Funds

There are twenty-two funds in the keeping of the Society. Only four of these are unrestricted in the uses to which their income may be applied "for promoting useful knowledge"; three specify a primary purpose, after which any balance may be used for general purposes; fifteen are restricted to specific uses, eleven of these being for the purchase of books for the Library. These funds and the manner and purpose of their establishment are listed alphabetically below. In order to simplify the keeping of accounts and the better to safeguard the income from various funds, the Committee on Finance voted to establish an Associated Fund and to combine in this fourteen of the smaller funds.

Associated Fund

Created as of December 31, 1939, in accordance with a resolution adopted by the Committee on Finance, December 5, 1939, with the approval of Legal Counsel. All assets held in the Balch International Law Library, Boyé Library, Brush Endowment, Carlier Library, Franklin Library, Jefferson Library, Lewis, Magellanic, Michaux, Norris Library, Phillips Library, Proud Library, Seybert Library and Tilghman Library Funds, were transferred to the Associated Fund at their market value as of December 31, 1939, and each contributing fund was assigned a proportionate interest in the Associated Fund based on the value of assets contributed.

Balch International Law Library Fund

Founded by Thomas Willing Balch, Esq., of Philadelphia, October 13, 1911, with an initial gift of securities valued at about $700, increased by later gifts to about $1,600, as a memorial to his father for his part in bringing about the submission of the Alabama Claims to the Geneva Tribunal. A part of the income to be used for the purchase of books relating to the law of nations and such other uses, when thought advisable, as may promote the study of that science; a part, not less than one-half, to be added annually to the principal.

Boyé Library Fund

Bequest of $1,879.21 by Professor Martin Boyé, of Coopersburg, Pa., who died March 5, 1909. By resolution of the Society, December, 1910, the income to be expended in the purchase of books, preferably on chemistry and geology.

Brush Endowment Fund

Gift of $10,000 by Charles Francis Brush, LL.D., of Cleveland, Ohio, November 24, 1914. Income to be used for the general purposes of the Society.

Building Fund

Created by deed of trust dated June 4, 1900, Girard Trust Company, depositary and trustee. All money or property which shall be designated or devoted by any donor, testator or other person, for the acquisition of land or buildings for the Society's use, shall be forthwith paid over, conveyed, or delivered by the Society to the said depositary, for the acquisition of land and the construction and furnishing of buildings for the use and occupation of the Society. The present value is $625,527.40.

Carlier Library Fund

Bequest of $5,000 by Auguste Carlier, of Paris, who died March 16, 1890. The income, less 10 per cent which is to be added to the principal, is to be expended for the purchase of books for the Library.

Carnegie Library Fund

Gift of $100,000 by the Carnegie Corporation in 1931. The income to be used for the maintenance of the Library.

Daland Fund

Bequest of the residuary estate of Dr. Judson Daland, of Philadelphia, who died August 14, 1937, approximately $220,000. The income, less 10 per cent which is to be added annually to the principal, to be used by the Society for research in clinical medicine.

Franklin Library Fund

Established by the Library Committee in May, 1911, from funds derived from the proceeds of the sale in that year of duplicates, formerly the property of Benjamin Franklin, approximately $3,400. The income to be used for the purchase of books.

General Fund

This fund has been accumulated from various sources through many years; its income is available for the general purposes of the Society.

Jefferson Library Fund

Established by the Library Committee on January 20, 1905, from the proceeds of royalties from the publication of manuscripts acquired by the Society through President Thomas Jefferson, approximately $1,700. Income to be used for the purchase of books.

Johnson Fund

Established in 1937 when Mr. Eldridge Reeves Johnson removed the restriction on his gift of $500,000 and changed it to General Endowment until 1957, unless prior thereto Mr. Johnson directs that it be used for some other purpose of the Society. After 1957 it is to become an unrestricted gift. All income to be used for the general purposes of the Society.

Lewis Fund

Gift of $10,000 made by Mrs. John F. Lewis in 1935 in memory of her husband; the income to be used each year as an award to the American citizen who shall announce at any general or special meeting of the Society, and publish among its papers, some truth which the Council of the Society shall deem worthy of the award. In any year income not so awarded to be added to principal.

Magellanic Fund

Gift of 200 guineas by John Hyacinth de Magellan, of London, in 1786, for a gold medal to be annually awarded under prescribed terms, to the author of the best discovery or most useful invention relating to navigation, astronomy, or natural philosophy (mere natural history only excepted). Any surplus of interest remaining to be used for such purposes as may be authorized under the Society's Charter and Laws. By resolution of the Society, December, 1899, the unexpended annual income, less 10 per cent which is to be added to the principal, may be used for the purchase of books relating to those departments of science in which the premium is annually offered.

Michaux Fund

Bequest of 92,600 francs by François André Michaux, who died at Vaureal, France, October 23, 1855; for the extension and progress of agriculture, and more especially of sylviculture, in the United States. By resolution of the Society, March, 1899, the income, less 10 per cent reserved for reinvestment, to be used for the purchase of books on forestry, etc.

Norris Library Fund

Established by the Library Committee in May, 1911, from the proceeds of the sale in that year of duplicate pamphlets, presented to the Society in 1815 by Joseph Parker Norris, Esq., of Philadelphia, approximately $2,100. Income to be used for the purchase of books.

Phillips Library Fund

Bequest of his residuary estate, approximately $3,410 (December, 1895), by Henry Phillips, Jr., Esq., of Philadelphia, who died June 6, 1895, to which were later added two bequests to him, confirmed and audited October 5, 1903, of $7,547.54 from the estate of his aunt, Emily Phillips, and of $41,464.26, being an interest in the residuary estate of his uncle, Henry M. Phillips. Income to be used for the purchase of books on archaeology and philology in accordance with the terms of the bequest.

Phillips Prize Essay Fund

The gift on October 5, 1888, of $5,000 by Miss Emily Phillips, of Philadelphia, in memory of her brother Henry M. Phillips. Income to be used in the awarding of a prize for the best essay of real merit on the science and philosophy of jurisprudence.

Penrose Fund

Bequest of one-half of the residuary estate of Dr. Richard A. F. Penrose, Jr., of Philadelphia, who died July 31, 1931, approximately $3,900,000; by the terms of the bequest this gift to be considered an endowment fund, the income of which only is to be used and the capital to be properly invested.

Proud Library Fund

Established by the Library Committee in May, 1911, from the proceeds of the sale in that year of duplicate pamphlets presented in 1812 by Robert Proud, Esq., of Philadelphia, $2,500. Income to be used for the purchase of books.

Seybert Library Fund

Bequest of $2,000 by Henry Seybert, Esq., of Philadelphia, who died March 3, 1883. By resolution of the Society, November, 1909, the income to be expended for the purchase of books.

Tilghman Library Fund

Bequest of $200 by Chief Justice William Tilghman, of Philadelphia, who died April 30, 1827. Income to be expended for the purchase of books.

Wood Memorial Fund

Bequest of the residuary estate of Walter Wood, of Philadelphia, who died April 20, 1934, approximately $150,000, in memory of his uncle, George B. Wood, his cousin, Horatio G. Wood, and his two brothers, Richard and Stuart Wood, all of whom were members of the American Philosophical Society; to be used by the Society first for the construction of a building that shall be adequate for the needs of the Society and if there be any surplus, then the same to be applied to such useful purpose or purposes as the Counsel (sic) and Officers of said Society may determine.

BUDGET FOR 1940

ESTIMATED INCOME

Unrestricted Funds		
General Fund	$ 28,397.00	
Charles Francis Brush Endowment	508.00	
The Johnson Fund	13,610.00	
Richard A. F. Penrose, Jr., Endowment	134,458.58	
		$176,973.58
Semi-Restricted Funds		
Magellanic Fund	$ 238.50	
François André Michaux	1,896.50	
Wood Memorial Fund	5,628.25	
		$ 7,763.25
Restricted Funds		
A. Library Funds		
Thomas Balch International Law	$ 193.10	
Martin Boyé	128.50	
Auguste Carlier	553.50	
Carnegie Library	4,000.00	
Benjamin Franklin	388.50	
Thomas Jefferson	145.50	
Joseph Parker Norris	181.00	
Henry Phillips, Jr.	3,379.10	
Robert Proud	217.00	
Henry Seybert	145.50	
William Tilghman	76.00	
		$ 9,407.70
B. Special Funds [1]		
Judson Daland	$ 8,761.00	
John F. Lewis Prize	400.00	
Henry M. Phillips Prize Essay	472.75	
		$ 9,633.75
Sales of Publications		$ 1,500.00
		$205,278.28

[1] See Schedule VIII for Building Fund.

Estimated Expenses

Executive Office	$ 10,500.00	
Secretaries' Expense	2,000.00	
Telephone	400.00	
Insurance	3,000.00	
Committee on Publications	25,000.00	
Committee on Library:		
Books and Binding	10,000.00	
Librarians' Salaries	8,770.00	
Rental for Housing of Library	8,700.00	
Treasurer's Expense and Compensation	6,750.00	
Hall Fund	2,000.00	
Committee on Research:		
Penrose Fund	50,000.00	
Johnson Fund	13,000.00	
Daland Fund	7,000.00	
Research Expense (Penrose Fund)	1,000.00	
Meetings	6,000.00	
Miscellaneous	10,000.00	
		$ 164,120.00

Balances carried forward from 1939 to pay appropriations made under the 1939 Budget		
Books and Binding	$ 2,851.41	
Publication Expenses	22,830.22	
Research Fund (Penrose Fund)	27,992.21	
Research Fund (Johnson Fund)	4,940.00	
		$ 58,613.84

The total book value of the investments and cash held as Principal as shown by the Accountants' report is:

Unrestricted Funds	$5,554,822.12	
Semi-Restricted Funds	662,150.82	
Restricted Funds	495,884.36	
Building Fund	625,527.40	
		$7,338,384.70

Respectfully submitted,
Fidelity-Philadelphia Trust Company,
Treasurer,
Marshall S. Morgan, *President*.

REPORT OF THE CERTIFIED PUBLIC ACCOUNTANTS

WILSON, LINVILL & PARRY

Certified Public Accountants

Twelve South Twelfth Street, Philadelphia

February 14, 1940

ROLAND S. MORRIS, ESQ., *President,*
The American Philosophical Society,
Philadelphia, Pa.

Dear Sir:

GENERAL AND TRUST FUNDS

We have examined the accounts of the American Philosophical Society for the year ended December 31, 1939, as contained in the records of the Treasurer, the Fidelity-Philadelphia Trust Company. The appended statements, Schedules I to VII inclusive, are in accordance with these records.

We have examined paid cancelled checks and vouchers in connection with disbursements in the various funds except the Wood Fund Real Estate Income Account, as to which we have accepted the cash records of the Fidelity-Philadelphia Trust Company as agent, without any further examination. The cash in bank at December 31, 1939, as summarized in Schedule VI, has been verified.

We have examined into the changes during the year in the investments in all of the funds. We examined the perpetual fire insurance policies carried as an investment in the General Fund, and obtained detailed statements from the Fidelity-Philadelphia Trust Company and the Girard Trust Company, showing at December 31, 1939, the bonds, stocks, real estate and other investments held by them as agents for the Society, thus satisfactorily accounting for all of the investments of the Society as called for by the records at December 31, 1939.

The real estate (Dr. Judson Daland residence) received during the year from the Estate of Judson Daland, deceased, was sold for \$8,000.00 subject to a purchase money mortgage of \$6,500.00. Perpetual fire insurance on this real estate was cancelled and the proceeds added to principal, \$142.50.

The investments composing the various funds at December 31, 1939, as summarized in the appended statement (Schedule VII) are at book value, which, in all funds except the Associated Fund, is as follows: Bonds and Mortgages at par or face value; Stocks at cost when purchased or at inventory value when received as gifts or bequests; and Real Estate at amount of foreclosed mortgage plus costs of acquisition and subsequent improvements, and appraised or assessed value when acquired as gifts or devises.

The Associated Fund was created and formed as of December 31, 1939, in accordance with a resolution adopted by the Committee on Finance, December 5, 1939, with the approval of counsel. The assets in the form of cash and securities held by the individual trust funds were transferred to the Associated Fund at their market value as of December 31, 1939, and each contributing fund was assigned a proportionate interest in the Associated Fund based on the value of the assets contributed.

We have verified the December 31, 1939, market values of the investments transferred to the Associated Fund, but have not determined the current market value of any of the other investments of the Society.

Income due for the year from the investments has been received and recorded on the books prior to December 31, except as follows:

General and Other Trust Funds:	
Bond Interest in Default	$2,638.29
(Including $1,988.29 in default January 1, 1939)	
Carnegie Library Fund:	
Delinquent Mortgage Interest	1,135.00
(Including $400.00 in default January 1, 1939)	
	$3,773.29

We do not list as in arrears, deferred interest originally due November 1, 1938, and subsequent interest periods, from issues of the Lehigh Valley Railroad Company, which issues are subject to extension plan and agreement, dated August 25, 1938, under which 75 per cent of the interest has been deferred and only 25 per cent paid.

Comprehensive tests have been made of the income receivable from other sources, except as to real estate, for which we have not examined leases, rental statements or other data in connection with income recorded as being received.

Building Fund

Girard Trust Company, Trustee

We have examined statements submitted by the Girard Trust Company, Trustee, of the Building Fund for the year ended December 31, 1939, have examined the records in the Society's office of subscriptions or pledges to the fund, and have prepared the appended statement of Cash Receipts and Disbursements and Summary of the Assets for the year—Schedules VIII and IX.

The cash and investments are in accordance with a statement obtained by us from the Girard Trust Company, Trustee, setting forth in detail the assets in their possession at December 31, 1939. All of the investments are at par value except stocks, which are at cost, with real estate (participations) at amount of foreclosed mortgage plus costs of acquisition and subsequent improvements. We have not determined the present value of any of the investments, or the collectibility of the unpaid pledges to the fund.

We have examined into the changes during the year in the investments, and have accounted for all income due except delinquent mortgage interest $2,037.04, of which amount $815.34 was delinquent January 1, 1939. As explained under General and Trust Funds, we do not list as in arrears interest deferred on bonds of Lehigh Valley Railroad Company.

Respectfully submitted,

Wilson, Linvill & Parry,

Certified Public Accountants.

SCHEDULE I

CASH RECEIPTS AND DISBURSEMENTS

Year ended December 31, 1939

General Fund

Principal Account

Balance, January 1, 1939		$ 5,298.17
Receipts:		
Investments Sold or Redeemed:		
$16,000 Railroad and Public Utility Bonds	$ 15,801.14	
Preferred and Common Stocks	16,991.01	
On Account of Mortgages	2,100.00	
	$ 34,892.15	
Walter Wood Real Estate Principal Account:		
Payment on account of advances by General Fund	17,500.00	
Transferred from Income	65,000.00	
		117,392.15
		$122,690.32
Disbursements:		
Investments Purchased:		
Foreign Government Bonds ($6,000.00)	$ 5,950.00	
Railroad and Public Utility Bonds ($84,000)	85,225.00	
Common Stocks	30,784.84	
	$121,959.84	
Collection Charges on Investments Sold	2.10	
		121,961.94
Balance, December 31, 1939		$ 728.38

Income and Operating Account

Balance, January 1, 1939		$ 24,237.62
Receipts:		
Income from Investments	$ 31,649.36	
Girard Trust Company Building Fund Reimbursement for alterations, refitting, and furnishing Society's building, etc.	6,266.68	
Sale of publications	1,894.95	
Royalties on W. B. Scott's book, "History of Land Mammals in the Western Hemisphere"	726.28	
The Franklin Institute	250.00	
The Henry LaBarre Jayne Lecture Foundation	200.00	
Sale of Microfilms	181.93	
Refund—Workmen's Compensation Insurance	13.69	
Exchange Check	1.50	
Amounts forwarded	$ 41,184.39	$ 24,237.62

Amounts brought forward		$ 41,184.39	$ 24,237.62
Transfer of Income from Trust Funds:			
Richard A. F. Penrose, Jr., Endowment Fund	$145,216.72		
The Johnson Fund	13,000.00		
Judson Daland Fund	6,000.00		
Carnegie Library Fund	4,418.44		
Charles Francis Brush Endowment Fund	495.28		
		$169,130.44	
			210,314.83
			$234,552.45
Disbursements:			
Salaries—Executive Office		$ 10,080.00	
Salaries—Librarian and Assistant Librarians		9,773.17	
Secretaries' Expenses		2,116.19	
Telephone		411.66	
Publication Expenses		19,211.25	
Books and Binding		7,532.19	
Camera Expenses		405.33	
Insurance		25.05	
Meetings		5,606.45	
Hall Expenses		2,688.47	
Hall Equipment, Alterations and Repairs		3,956.37	
Engineering Survey and Expense in connection with possible use of old U. S. Custom House Building as a Library		1,254.28	
Library Rental (Drexel Building)		8,700.00	
Legal Services		1,319.63	
Auditing Fees		775.00	
Treasurer's Expense		12.95	
Research Fund Grants:			
Penrose Fund	$ 79,242.66		
Johnson Fund	8,060.00		
Daland Fund	6,000.00		
		93,302.66	
Research Expenses		345.78	
Exchange Check		1.50	
Forwarding Charges, Appraisals, etc.		4.34	
Treasurer's Commissions	$ 6,085.96		
Agent's Commission (Girard Trust Company, Carnegie Fund)	130.25		
	$ 6,216.21		
Charged Other Funds	5,407.14		
		809.07	
Transfer to Principal		65,000.00	
			$233,331.34
Balance, December 31, 1939—General Fund (forwarded)			$ 1,221.11

Amount brought forward (Balance, General Fund, 12-31-39)		$ 1,221.11
Grant from Carnegie Corporation of New York for Investigation on Methods and Results of Adult Education in Science	$ 15,740.29	
Expended	5,013.15	
Balance Unexpended, December 31, 1939		10,727.14
Total		$ 11,948.25

Note:

The following General Fund appropriations for 1939 balances are carried forward:

Books and Binding		$ 2,851.41
Publication Expenses		22,830.22
Research Fund:		
Penrose Fund	27,992.21	
Johnson Fund	4,940.00	
		32,932.21
		$ 58,613.84

SCHEDULE II

SUMMARY OF CASH RECEIPTS AND DISBURSEMENTS

Year ended December 31, 1939

TRUST FUNDS—PRINCIPAL ACCOUNT*

	Receipts				Disbursements				
	Balance 1-1-39	Proceeds from Investments Sold or Matured	Transferred from Income Account	Total	Investments Purchased	Miscellaneous	Transferred to Associated Fund 12-31-1939	Total	Balance 12-31-39
Unrestricted Funds:									
Charles Francis Brush Endowment	$ 10.00	—	—	$ 10.00	—	—	$ 10.00	$ 10.00	—
The Johnson Fund	22,757.19	$ 75,059.20	$1,473.30	99,289.69	$ 95,079.57	$ 4.92	—	95,084.49	$ 4,205.20
Richard A. F. Penrose, Jr. Endowment	45,430.10	793,086.41	—	838,516.51	684,834.96	36.37	—	684,871.33	153,645.18
	$68,197.29	$868,145.61	$1,473.30	$ 937,816.20	$779,914.53	$ 41.29	$ 10.00	$779,965.82	$157,850.38
Semi-Restricted Funds:									
Magellanic Fund	$ 389.03	$ 4,188.40	$ 14.19	$ 4,591.62	$ 3,922.98	—	$ 668.64	$ 4,591.62	—
François André Michaux	555.05	26,301.60	204.70	27,061.35	21,849.61	$ 2.10	5,209.64	27,061.35	—
	$ 944.08	$ 30,490.00	$ 218.89	$ 31,652.97	$ 25,772.59	$ 2.10	$ 5,878.28	$ 31,652.97	—
Restricted Funds:									
Library Funds:									
Thomas Balch International Law	$ 174.92	—	$ 96.54	$ 271.46	—	—	$ 271.46	$ 271.46	—
Martin Boyé	60.21	—	12.85	73.06	—	—	73.06	73.06	—
Auguste Carlier	136.26	$ 3,000.00	55.35	3,191.61	—	—	3,191.61	3,191.61	—
Carnegie Library	683.84	14,351.12	—	15,034.96	$ 7,163.64	$ 4.90	—	7,168.54	$ 7,866.42
Benjamin Franklin	59.80	—	38.85	98.65	—	—	98.65	98.65	—
Thomas Jefferson	20.15	—	14.55	34.70	—	—	34.70	34.70	—
Joseph Parker Norris	56.14	—	18.10	74.24	—	—	74.24	74.24	—
Henry Phillips, Jr.	1,489.75	32,775.15	371.42	34,636.32	12,200.07	—	22,436.25	34,636.32	—
Robert Proud	38.99	—	21.70	60.69	—	—	60.69	60.69	—
Henry Seybert	75.03	—	14.55	89.58	—	—	89.58	89.58	—
William Tilghman	60.25	—	7.60	67.85	—	—	67.85	67.85	—
	$ 2,855.34	$ 50,126.27	$ 651.51	$ 53,633.12	$ 19,363.71	$ 4.90	$26,398.09	$ 45,706.70	$ 7,866.42
Special Funds:									
Judson Daland	2,018.39	10,121.41	984.92	13,124.72	9,434.34	609.43	—	10,043.77	3,080.95
John F. Lewis Prize	174.50	—	40.00	214.50	—	—	214.50	214.50	—
Henry M. Phillips Prize Essay	125.06	—	47.28	172.34	—	—	—	—	172.34
	$ 5,173.29	$ 60,247.68	$1,723.71	$ 67,144.68	$ 28,798.05	$614.33	$26,612.59	$ 56,024.97	$ 11,119.71
Totals	$74,314.66	$958,883.29	$3,415.90	$1,036,613.85	$834,485.17	$657.72	$32,500.87	$867,643.76	$168,970.09
Associated Fund (Transfer of Principal Cash from Sundry Trust Funds as Indicated Above)									32,500.87
Total									$201,470.96

* Exclusive of: Wood Fund—See Schedules IV and V. Building Fund—See Schedules VIII and IX.

SCHEDULE III

SUMMARY OF CASH RECEIPTS AND DISBURSEMENTS

Year ended December 31, 1939

Trust Funds—Income Account*

	Balance 1-1-39	Receipts: Gross Income from Investments	Total	Disbursements: For Purpose of Fund	Treasurer's and Agent's Commissions and Misc.	Transferred to General Fund	Transferred to Principal Account	Total	Balance 12-31-39
Unrestricted Funds:									
Charles Francis Brush Endowment	—	$ 508.00	$ 508.00	—	$ 12.72	$ 495.28	—	$ 508.00	—
The Johnson Fund	$13,609.72	14,694.90	28,304.62	—	384.64	13,000.00	$1,473.30	14,857.94	$13,446.68
Richard A. F. Penrose, Jr. Endowment	—	149,025.32	149,025.32	—	3,808.60	145,216.72	—	149,025.32	—
	$13,609.72	$164,228.22	$177,837.94	—	$4,205.96	$158,712.00	$1,473.30	$164,391.26	$13,446.68
Semi-Restricted Funds:									
Magellanic Fund	$ 158.74	$ 141.47	$ 300.21	$ 13.37	$ 5.25	—	$ 14.19	$ 32.81	$ 267.40
François André Michaux	1,650.00	2,044.62	3,694.62	761.58	56.56	—	204.70	1,022.84	2,671.78
	$ 1,808.74	$ 2,186.09	$ 3,994.83	$ 774.95	$ 61.81	—	$ 218.89	$ 1,055.65	$ 2,939.18
Restricted Funds:									
Library Funds:									
Thomas Balch International Law	$ 208.64	$ 193.08	$ 401.72	—	$ 4.80	—	$ 96.54	$ 101.34	$ 300.38
Martin Boyé	181.73	128.48	310.21	—	3.20	—	12.85	16.05	294.16
Auguste Carlier	313.51	553.48	866.99	$ 130.48	13.84	—	55.35	199.67	667.32
Carnegie Library	—	5,036.44	5,036.44	—	618.00	$ 4,418.44	—	5,036.44	—
Benjamin Franklin	—	388.52	388.52	126.95	9.72	—	38.85	175.52	213.00
Thomas Jefferson	116.83	145.48	262.31	5.00	3.62	—	14.55	23.17	239.14
Joseph Parker Norris	157.79	181.00	338.79	82.80	4.54	—	18.10	105.44	233.35
Henry Phillips, Jr.	3,118.76	3,713.12	6,831.88	1,716.74	93.44	—	371.42	2,181.60	4,650.28
Robert Proud	217.48	217.00	434.48	40.29	5.42	—	21.70	67.41	367.07
Henry Seybert	136.02	145.52	281.54	—	3.62	—	14.55	18.17	263.37
William Tilghman	34.50	76.00	110.50	31.89	1.92	—	7.60	41.41	69.09
	$ 4,485.26	$ 10,778.12	$ 15,263.38	$2,134.15	$ 762.12	$ 4,418.44	$ 651.51	$ 7,966.22	$ 7,297.16
Special Funds:									
Judson Daland	2,851.82	9,847.75	12,699.57	—	260.65	6,000.00	984.92	7,245.57	5,454.00
John F. Lewis Prize	340.00	400.00	740.00	310.00	10.00	—	40.00	360.00	380.00
Henry M. Phillips Prize Essay	815.84	472.76	1,288.60	—	11.82	—	47.28	59.10	1,229.50
	$ 8,492.92	$ 21,498.63	$ 29,991.55	$2,444.15	$1,044.59	$ 10,418.44	$1,723.71	$ 15,630.89	$14,360.66
Totals	$23,911.38	$187,912.94	$211,824.32	$3,219.10	$5,312.36	$169,130.44	$3,415.90	$181,077.80	$30,746.52

* Exclusive of: Wood Fund—See Schedules IV and V. Building Fund—See Schedules VIII and IX.

SCHEDULE IV

CASH RECEIPTS AND DISBURSEMENTS

Year ended December 31, 1939

WOOD FUND—PERSONALTY

Principal Account

Balance, January 1, 1939		$ 319.93
Receipts:		
Investments sold or redeemed		2,193.40
		$ 2,513.33
Disbursements:		
Investment Purchased:		
40 shares Phelps Dodge Corp. Common		1,366.40
Balance, December 31, 1939		$ 1,146.93

Income Account

Balance, January 1, 1939		$12,503.66
Receipts:		
Income from Investments		5,537.14
		$18,040.80
Disbursements:		
Treasurer's Commission	$ 276.86	
Transferred to Wood Fund—Real Estate Principal Account	17,500.00	17,776.86
Balance, December 31, 1939		$ 263.94

SCHEDULE V

CASH RECEIPTS AND DISBURSEMENTS

Year ended December 31, 1939

WOOD FUND—REAL ESTATE

Principal Account

Balance, January 1, 1939		$ 241.00
Receipts:		
Transferred from Wood Fund—Personalty Income Account	$17,500.00	
Sale—1712 Rittenhouse Street	7,500.00	
On account sale—lots in Dade and Walker Counties, Georgia	3,000.00	
Acknowledgment—1712 Rittenhouse Street	.50	
		28,000.50
		$28,241.50
Disbursements:		
Payment on account of loan—General Fund Principal	$17,500.00	
Mortgage Investment—1712 Rittenhouse St.	6,000.00	
Commission on Sale—1712 Rittenhouse St.	375.00	
Appraisal Fee—1606 Ludlow Street, etc.	10.00	
Acknowledgment, Revenue Stamps, etc.	22.75	
		23,907.75
Balance, December 31, 1939		$ 4,333.75

Income Account

Balance, January 1, 1939		$ 5,452.78
Receipts:		
Income from Real Estate	$48,068.55	
Adjustment and Cancellation of Insurance	56.45	
Refund of Taxes and Water Rents	138.97	
Sale of Timber—Dade County, Georgia	150.15	
Coal Royalties—Walker County, Georgia	152.05	
Miscellaneous	5.24	
		48,571.41
		$54,024.19
Disbursements:		
Taxes on Real Estate	$14,524.55	
Water Rents	413.88	
Maintenance, Repairs and Insurance	23,645.66	
General Fund Income—Interest on advances	2,775.00	
Fee for Assessment Reduction	78.93	
Treasurer's Commission	354.28	
		41,792.30
Balance, December 31, 1939		$12,231.89

SCHEDULE VI

SUMMARY OF CASH

December 31, 1939

	Principal	Income	Total
Unrestricted Funds:			
General	$ 728.38	$11,948.25	$ 12,676.63
*Charles Francis Brush Endowment	——	——	——
The Johnson Fund	4,205.20	13,446.68	17,651.88
Richard A. F. Penrose, Jr. Endowment	153,645.18	——	153,645.18
	$158,578.76	$25,394.93	$183,973.69
Semi-Restricted Funds:			
*Magellanic Fund	——	$ 267.40	$ 267.40
*François André Michaux	——	2,671.78	2,671.78
Wood Memorial Fund:			
Personalty	$ 1,146.93	263.94	1,410.87
Real Estate	4,333.75	12,231.89	16,565.64
	$ 5,480.68	$15,435.01	$ 20,915.69
Restricted Funds:			
Library Funds:			
*Thomas Balch International Law	——	$ 300.38	$ 300.38
*Martin Boyé	——	294.16	294.16
*Auguste Carlier	——	667.32	667.32
Carnegie Library	$ 7,866.42	——	7,866.42
*Benjamin Franklin	——	213.00	213.00
*Thomas Jefferson	——	239.14	239.14
*Joseph Parker Norris	——	233.35	233.35
*Henry Phillips, Jr.	——	4,650.28	4,650.28
*Robert Proud	——	367.07	367.07
*Henry Seybert	——	263.37	263.37
*William Tilghman	——	69.09	69.09
	$ 7,866.42	$ 7,297.16	$ 15,163.58
Special Funds:			
Judson Daland	3,080.95	5,454.00	8,534.95
*John F. Lewis Prize	——	380.00	380.00
Henry M. Phillips Prize Essay	172.34	1,229.50	1,401.84
	$ 11,119.71	$14,360.66	$ 25,480.37
Associated Fund (Principal Balances in Funds Indicated by * Transferred 12-31-39 to Associated Fund)	$ 32,500.87	——	$ 32,500.87
Totals	$207,680.02	$55,190.60	$262,870.62

On deposit with Fidelity-Philadelphia Trust Company (Treasurer's Account)	$ 55,190.60
Included among the Trust Funds (Cash) of Fidelity-Philadelphia Trust Co.	199,813.60
Included among the Trust Funds (Cash) of Girard Trust Company (Carnegie Library Fund)	7,866.42
	$262,870.62

SCHEDULE VII

GENERAL AND SPECIAL FUNDS

PRINCIPAL

December 31, 1939

	Uninvested Cash 12-31-1939	Invested 12-31-1939	Total Funds at Book Value (A) 12-31-1939	Total Funds at Book Value 12-31-1938
Unrestricted Funds:				
General	$ 728.38	$ 720,869.25		
Loan to Wood Fund	——	82,500.00*		
	$ 728.38	$ 803,369.25	$ 804,097.63	$ 560,910.14
The Johnson Fund (Endowment)	4,205.20	504,797.71	509,002.91	503,571.00
Richard A. F. Penrose, Jr. Endowment	153,645.18	4,076,393.40	4,230,038.58	4,409,745.44
Total Unrestricted Funds	$158,578.76	$5,384,560.36	$5,543,139.12	$5,474,226.58
Semi-Restricted Funds:				
Wood Memorial Fund:				
Personalty	$ 1,146.93	$ 112,516.40		
Real Estate	4,333.75	566,256.00		
Loan due General Fund		−82,500.00*		
For the construction of a building adequate to the needs of the Society, any surplus remaining to be applied to such useful purposes as counsel and officers of Society may determine				
Total Semi-Restricted Funds	$ 5,480.68	$ 596,272.40	$ 601,753.08	$ 579,088.13
Restricted Funds:				
Library Fund:				
Carnegie Library				
For maintenance of Library	$ 7,866.42	$ 92,393.65	$ 100,260.07	$ 100,017.60
Special Funds:				
Judson Daland				
For research in clinical medicine	3,080.95	226,195.03	229,275.98	220,815.04
Henry M. Phillips Prize Essay				
Prize for essay on Science and Philosophy of Jurisprudence	172.34	12,400.00	12,572.34	12,125.06
Total Restricted Funds	$ 11,119.71	$ 330,988.68	$ 342,108.39	$ 332,957.70

Associated Fund:				
Thomas Balch International Law				
For books relating to the Law of Nations........	$ 271.46	$ 4,342.62	$ 4,614.08	$ 3,284.92
Martin Boyé				
For books—Chemistry and Geology..............	73.06	3,397.63	3,470.69	3,060.21
Charles Francis Brush Endowment				
For general purposes.....	10.00	11,673.00	11,683.00	10,110.00
Auguste Carlier				
For books...............	3,191.61	11,235.38	14,426.99	13,086.26
Benjamin Franklin				
For books...............	98.65	10,135.63	10,234.28	9,459.80
Thomas Jefferson				
For books...............	34.70	3,819.37	3,854.07	3,470.15
John F. Lewis Prize				
For an award to the American Citizen who shall announce at any general or special meeting of the Society and publish among its papers some truth which the Council of the Society shall deem worthy of the award..................	214.50	10,262.50	10,477.00	10,174.50
Magellanic Fund				
Prize for discovery or invention and for books in field of Navigation, Astronomy or Natural Philosophy............	668.64	5,074.13	5,742.77	5,089.03
François André Michaux				
For books on Forestry....	5,209.64	49,445.33	54,654.97	49,555.05
Joseph Parker Norris				
For books...............	74.24	4,722.75	4,796.99	4,406.14
Henry Phillips, Jr.				
For books on Archaeology and Philology.........	22,436.25	67,554.38	89,990.63	83,609.75
Robert Proud				
For books...............	60.69	5,815.75	5,876.44	5,188.99
Henry Seybert				
For books...............	89.58	3,849.37	3,938.95	3,525.03
William Tilghman				
For books...............	67.85	2,028.00	2,095.85	1,860.25
Total Associated Fund...........	$ 32,500.87	$ 193,355.84	$ 225,856.71	$ 205,880.08
Total All Funds...	$207,680.02	$6,505,177.28	$6,712,857.30	$6,592,152.49

Brought forward—Total All Funds	$207,680.02	$6,505,177.28	$6,712,857.30	$6,592,152.49
Invested in:				
U. S. Government Obligations			$2,228,734.84	$2,226,000.00
Foreign Government Bonds			100,000.00	——
State, County and Municipal Bonds			634,945.00	944,000.00
Railway, Utility, Industrial and Other Bonds			1,284,876.00	1,420,701.00
Stocks			1,596,602.09	1,256,922.07
Mortgages and Mortgage Participations			80,071.74	75,221.74
Real Estate and Real Estate Participations			579,127.91	588,349.22
Perpetual Fire Insurance Policies			819.70	784.70
			$6,505,177.28	$6,511,978.73
Uninvested Cash			207,680.02	80,173.76
			$6,712,857.30	$6,592,152.49

(A) Book Values 12–31–1939:
All funds except Associated Fund:
Bonds and Mortgages at par.
Stocks at cost when purchased, or at inventory value when received as gifts or bequests.
Real Estate at cost when foreclosed, and appraised or assessed value when acquired as gifts or devises.
Associated Fund:
Bonds and Stocks at market value December 31, 1939.
Book Values 12–31–1938:
Both Bonds and Stocks generally at par, except when inventory value was used, or cost for "no par" stock.

Summary of Decrease in Investments

Balance at Book Value 12–31–1938			$6,511,978.73	
Less net adjustment as of 12–31–1938 to reflect bonds at par and stocks at cost when purchased, or inventory value when received as gifts or bequests			2,721.96	(B)
			$6,509,256.77	
Add:				
Real Estate and Perpetual Fire Insurance from Estate of Judson Daland, Deceased		$ 8,142.50		
Investments Purchased at cost		981,311.41		
			989,453.91	
			$7,498,710.68	
Deduct:				
Investments Sold ($1,023,968.84) at book value		$994,227.00		
Premiums paid on Bonds purchased	$10,184.68			
Less Bonds purchased at a discount and written up to par	7,118.92			
		3,065.76		
			997,292.76	
			$6,501,417.92	
Add:				
Adjustment from Book Value to Market Value 12–31–1939 for securities transferred to Associated Fund (Net)			3,759.36	(C)
Balance at Book Value 12–31–1939			$6,505,177.28	

DETAIL OF ADJUSTMENTS BY FUNDS AS SUMMARIZED IN THE FOREGOING

Funds	(B) Increase *Decrease*	(C) Increase *Decrease*
General	$176,777.00	——
The Johnson Fund	2,375.02	——
Richard A. F. Penrose, Jr. Endowment	*212,298.23*	——
Wood Memorial Fund	10,200.00	——
Carnegie Library	210.00	——
Judson Daland	*93.75*	——
Henry M. Phillips Prize Essay	400.00	——
Associated Fund:		
Thomas Balch International Law	3,150.33	*1,917.71*
Martin Boyé	100.00	297.63
Charles Francis Brush Endowment	*434.00*	2,007.00
Auguste Carlier	382.00	903.38
Benjamin Franklin	249.00	486.63
Thomas Jefferson	137.84	231.53
John F. Lewis Prize	——	262.50
Magellanic Fund	200.00	174.13
François André Michaux	375.67	3,971.25
Joseph Parker Norris	133.00	239.75
Henry Phillips, Jr.	15,143.33	*3,919.02*
Robert Proud	137.83	527.92
Henry Seybert	133.00	266.37
William Tilghman	——	228.00
Totals	*$ 2,721.96*	$3,759.36

(B) Adjustment as of 12-31-1938 to reflect bonds at par and stocks at cost when purchased, or inventory value when received as gifts or bequests.

(C) Adjustment from Book Value to Market Value 12-31-1939 for securities transferred to Associated Fund.

SCHEDULE VIII

BUILDING FUND—GIRARD TRUST COMPANY, TRUSTEE

CASH RECEIPTS AND DISBURSEMENTS

Year ended December 31, 1939

Principal Account

Balance, January 1, 1939		$ 5,764.99
Receipts:		
Investment in Bonds Sold	$116,499.73	
Investment in Stock Sold	55,833.88	
Mortgages paid in full or in part	35,354.52	
Real Estate—Settlement arising out of foreclosure	109.18	
Transferred from Income Account (net)	12,835.31	
		220,632.62
		$226,397.61
Disbursements:		
Invested in Bonds	$ 30,757.50	
Cost of Acquiring and Reconditioning Real Estate	229.05	
Forwarding Charges on Investments Purchased and Sold	18.39	
		31,004.94
Balance, December 31, 1939		$195,392.67

Income Account

Receipts:		
Income from Investments	$ 22,689.61	
Estate of Henry G. Bryant, Deceased—on account of income	27.48	
		$ 22,717.09
Disbursements:		
Real Estate Expenses	$ 2,877.31	
Commission—Girard Trust Company	737.29	
Notary Fee	.50	
Transferred to Principal Account (net)	12,835.31	
Transferred to Fidelity-Philadelphia Trust Company, Treasurer (General Fund) in reimbursement for alterations and furnishing of Society's building, etc.	6,266.68	
		$ 22,717.09

SCHEDULE IX

BUILDING FUND—GIRARD TRUST COMPANY, TRUSTEE

SUMMARY OF ASSETS

	Balance 1-1-1939	Additions	Deductions	Balance 12-31-1939
Pledges Receivable	$ 11,229.17	—	—	$ 11,229.17
Investments:				
Bonds (Par Value)	185,500.00	$ 32,000.00	$115,000.00	102,500.00
Stocks (At Cost)	99,644.13	—	50,000.00	49,644.13
Mortgages (Participations)	197,260.11	—	37,140.88 7,500.00*	152,619.23
Real Estate (Participations)	117,751.50	229.05 7,500.00*	109.18	125,371.37
Cash—Principal	5,764.99	220,632.62	31,004.94	195,392.67
Cash—Income	—	22,717.09	22,717.09	—
	$617,149.90	$283,078.76	$263,472.09	$636,756.57†

SUMMARY OF INCREASE IN FUNDS

Year ended December 31, 1939

Income from Investments	$ 22,689.61	
Estate of Henry G. Bryant, deceased—on account of income	27.48	
Discounts on Bonds Purchased (net of premium paid)	1,242.50	
Premiums on Bonds Sold (net of discounts received)	1,499.73	
Profit on Sale of Stock	5,833.88	
		$ 31,293.20
Less:		
Real Estate Expenses	$ 2,877.31	
Transferred to Fidelity-Philadelphia Trust Company, Treasurer (General Fund) in reimbursement for alterations and furnishing of Society's building, etc.	6,266.68	
Loss on Sale of Mortgage Participation	1,786.36	
Commission—Girard Trust Company	737.29	
Forwarding charges on Investments Purchased and Sold	18.39	
Notary Fee	.50	
		11,686.53
		$ 19,606.67
Balance, January 1, 1939		617,149.90
Balance, December 31, 1939		$636,756.57

* Face value of mortgage foreclosed and real estate acquired.

† Includes bonds at Par Value. Total Fund including bonds at cost is $632,475.32.

VI

SPECIAL COMMITTEES

1. REPORT OF THE COMMITTEE ON EDUCATION AND PARTICIPATION IN SCIENCE

As the outgrowth of an inquiry by the Carnegie Corporation of New York through its President, Dr. Frederick P. Keppel, regarding the feasibility of studying methods of developing an interest in science among amateurs, the Society, on April 22, 1938, appointed a committee of its members to consider the problem. After a series of meetings, this Committee on Organization, with Dr. Edwin G. Conklin as Chairman, authorized a survey of the Philadelphia region to investigate facilities now existing for adult education in the physical and natural sciences and the activities of amateurs who were engaged in scientific pursuits in their leisure time. The Committee appointed an Executive Staff with Roland S. Morris as Chairman and four scientists to serve as consultants on a part-time basis. These consultants, with their respective fields, were: Roger Conant of the Philadelphia Zoological Society in Zoology; John M. Fogg, Jr., Assistant Professor of Botany at the University of Pennsylvania in Botany; Serge A. Korff of the Bartol Research Foundation in Physics and Astronomy; Edward E. Wildman of the Philadelphia Board of Public Education in Education. To take charge of the executive and secretarial work of the Committee, W. Stephen Thomas, formerly Director of Education of the Academy of Natural Sciences of Philadelphia, was appointed, on June 1, 1939, for a year on a full-time basis.

Since that date, the Committee has been engaged in an intensive survey of institutions and organizations which exist in the Philadelphia area for furthering the increase of scientific knowledge for adult men and women. As the name of the Committee implies, the emphasis has been placed on means for informal learning through self-education and the participation of individuals. In the realms of science, such activities can comprise a wide range, including experiments in home laboratories, the collection and identification of natural objects, the study of plant and animal life on field trips, the making of simple astronomical equipment and the observation of stars. All these types of endeavor in science for many persons, in many walks of life, take the form of leisure-time pursuits. Such hobbies are often chosen and interest in them sustained by the stimulation which comes from group discussion and group work.

For that reason, the Committee has focused its attention on the great variety of clubs and societies organized by amateur scientists, and its study of the last seven months reveals that there are 287 of these group organizations with approximately 32,000 persons included in their memberships. These organizations, in and near Philadelphia, may be classed in two divisions. First, those with interests strictly in the pure sciences and these include the amateur astronomers, botanists, entomologists, bird students, microscopists and fish-culturists; and second, a much larger division of more general scope but with interests related to the sciences. Under this second category are placed the members of garden clubs, the amateur photographers with twenty affiliated clubs, the radio amateurs with over 2,000 active operators, sportsmen, a very large body of hunters and fishermen with 144 individual clubs in the Philadelphia area and the aviation hobbyists.

Closely allied to the group organizations as facilities necessary for the spread of adult education and participation in the sciences are the many public institutions existing in a community. Philadelphia, the Committee's inquiry shows, is especially rich in these institutions, with 164 of them, such as universities with study collections, laboratories and observatories, institutes, academies, night schools with classes and forums, museums, libraries, parks, arboreta and zoos. Although a certain proportion of these institutions offer immediate opportunities, many of them represent potential centers for stimulating education and participation in science.

The specific task of the Committee's Executive Staff has been the compilation of the information briefly outlined. On the authorization of the Committee on Organization at its meeting on November 16, 1939, the material will be prepared as a directory of amateur science to be issued by the Committee. In addition, the scientific consultants have been engaged, since September 1, in a thorough investigation and evaluation of the amateur clubs and societies. This study, which has been carried out through a series of questionnaires and personal visits to organization meetings and inter-views with individuals, concerns the percentage of members taking part in activities, the amount and value of their contributions to science, their facilities for increasing their own knowledge and of taking part in original research, as well as other problems. It is hoped that, on the basis of this inquiry, means may be suggested for furthering the participation of amateur scientists in programs worthwhile not only to themselves but to the world at large.

Another field within the scope of the Committee's consideration has been the problem of discovering the needs and interests in science of a cross-section of the adult population who are not affiliated with organizations or formal groups. As an exploratory venture in connection with its survey and to sound out public opinion, the Committee, starting with a mimeographed issue, has now been authorized to issue in printed form, for a temporary period, a circular entitled, "Activities in Science in the Philadelphia Area." This leaflet, which circulates to amateur organizations and amateur scientists, lists a daily calendar of events in science, such as lectures, demonstrations, field trips, broadcasts and other informal means by which knowledge may be gained at little or no cost. Also, a questionnaire has been issued and is now being distributed to find out the background and qualifications of the hundreds of amateur scientists whom the Committee has been able to find.

Miscellaneous activities of the Executive Staff and its Secretary have included the providing of information on the plans of the Committee's survey to the public press and the preparation of special articles. The latter include accounts in the *Philadelphia Bulletin, Inquirer, Ledger, New York Times, The Journal of Adult Education, Science, Museum News, The Sky,* and other newspapers and periodicals. A fuller account, outlining the historical background and scope of the Committee's program, is to be found in "The Contribution of Friends to Adult Education" by Roland S. Morris in *The Friend,* November, 1939.

At the invitation of the American Philosophical Society, on behalf of this Committee, the Delaware Valley Naturalists' Union, a federation of twelve amateur scientific societies, met on November 25 in the Hall of the Society. The program comprised a tour of sites in old Philadelphia associated with the history of science, an illustrated lecture on "The Fauna of Caves" by Charles E. Mohr, a brief report of the Committee on Education and Participation in Science, and an address on the "Early Scientific Work of the American Philosophical Society" by W. Stephen Thomas, *Executive Secretary* of the Committee on Education and Participation in Science (see below), which emphasized the rôle of amateur scientists of the past.

EARLY SCIENTIFIC WORK OF THE AMERICAN PHILOSOPHICAL SOCIETY

W. Stephen Thomas

(Read before Autumn Meeting of the Delaware Valley Naturalists' Union, November 25, 1939)

As naturalists of the Delaware Valley, representing member clubs with roots deep in the traditions of Philadelphia and a wide area surrounding it, your gathering in the Hall of the American Philosophical Society has particular significance. The Society welcomes you, for your hobbies and interests in the natural sciences represent much the same spirit which made possible the founding of this old organization.

During the eighteenth and early nineteenth centuries it was the practice to use the term philosophy for two main branches of knowledge. These were, natural philosophy, or what is now called physical science, and mental and moral philosophy which included the present content of philosophy together with psychology and such social sciences as then existed. Also, it is well to note that although there were specialists in those days, a man could often cover many fields of knowledge and be something of an all-around scientist, a level which, naturally, is less possible to approach today.

It is scarcely advisable to give a detailed history of the founding of the American Philosophical Society but a brief statement may be helpful. The Society is an outgrowth of Benjamin Franklin's Junto, which, at the age of twenty-one, he founded in Philadelphia in 1727. This original and remarkable group of twelve members was composed of congenial friends, young men, for the most part artisans and tradesmen. It was organized as a discussion group with weekly meetings at which such topics as morals, civic affairs, literature and natural philosophy were treated according to certain rules carefully set down by its astute founder.[1]

[1] Van Doren, Carl, *Benjamin Franklin*, 74–77

For that reason, it may be considered as a pioneer venture, at least in this country, in what is today a most progressive form of adult education. The group must have been a most successful body not only in a social sense but as an organization for the self-improvement of its members, for it lasted for some thirty years and stimulated other clubs of the same type.

Later, when Franklin first proposed the American Philosophical Society, which he did in the form of a printed circular letter distributed to friends throughout the colonies in 1743, he evidently had in mind an intercolonial Junto.[1] But at the same time, he envisioned something far broader than a local club, outlining plans for a group of savants, "virtuosi or ingenious men" he called them, who would maintain a constant correspondence and improve the stock of common knowledge. When he mentioned that at its headquarters in Philadelphia there should always be included, besides regular officers, a physician, a botanist, a mathematician, a geographer, and a general natural philosopher, he doubtless had in mind a feature of the older learned body across the Atlantic. In fact, in drawing up his plans for his group's incorporation, membership and other qualifications, Franklin evidently used as his model the Royal Society, which dated from 1660.[2] It is interesting, also, to note that the men who assumed these posts when the Society got under way were by no means all professional scientists. The Society was duly organized with Thomas Hopkinson as first President and Benjamin Franklin as Secretary but it ceased to hold regular meetings after a few years. Meanwhile, the Junto, in 1766, had become the American Society for Promoting Useful Knowledge and about this time the American Philosophical Society was revived. In 1769, both societies were joined in a single body which is known today as "The American Philosophical Society held at Philadelphia for Promoting Useful Knowledge."

As we are picturing the early scientific work of the American Philosophical Society in the second half of the eighteenth century with particular reference to natural history, we shall turn to the state of science in the American Colonies in 1769 at the time of the joining of the two bodies just mentioned to make the present

[1] Van Doren, Carl, *Benjamin Franklin*, 138.

[2] Brasch, Frederick Edward, "The Royal Society of London and Its Influence Upon Scientific Thought in the American Colonies," *Scientific Monthly*, Oct., Nov., 1931.

American Philosophical Society. In Europe, about this time, blazed such bright names as Newton, Herschel, Boyle, Laplace, Lavoisier in the physical sciences and in biology the great systematic naturalists, Linnaeus, Buffon, Cuvier and Lamarck. Westward, across the Atlantic, in the English Colonies relatively few persons were concerned with science but those who were had a rich field before them. It was natural that among these few, many should be learned men, physicians, ministers, lawyers, but there were also merchants and a few persons in more humble callings. Up to this time, the colonists in the new world had been rather too busy to indulge in intellectual pursuits. In his "Proposals" for the Society, Franklin himself had said that now that the first drudgery of settling the colonies was over, there was opportunity for speculation and examination of the natural world which would lead to discoveries.[1] He was careful to outline the fields of interest of the Society which included plant life, horticulture and agriculture, cure and prevention of disease, mineralogy and mining, mathematics, mechanical appliances and their invention, all new arts, trades and manufactures, surveys and topography and, to use his words, "all philosophical experiments that let light into the nature of things, tend to increase the power of man over matter, and multiply the conveniences or pleasures of life." It is clear that a distinct emphasis was placed on the utilitarian value of science. But a study of pure science also had an important place.

At this period in Europe and America accumulated biological knowledge of the world consisted chiefly of what we call today descriptive natural history. There was an eagerness to name and classify new species of plants and animals. A study of form and function was to come in later years under the fields of morphology and physiology. The two latter specialities did not develop until the compound microscope was adapted for general use well after 1835.[2]

A reading of the early Minutes of the Society reveals some interesting trends in scientific interests of the day. At one of the first meetings by-laws were drawn up providing for the appointment of six Committees to handle the different categories of natural knowledge. These were:

[1] Smythe, A. H., *The Complete Works of Franklin*, 1905–07, 2: 228–232.

[2] Coe, Wesley R., "A Century of Zoology in America," *American Journal of Science*, July, 1918, 355.

1. Geography, mathematics, natural philosophy and astronomy.
2. Medicine and anatomy.
3. Natural history and chemistry.
4. Trade and commerce.
5. Mechanics and architecture.
6. Husbandry and American improvements.

In addition, three Curators were appointed to take charge of the specimens, models and instruments which commenced to pour in. The Committees were active in studying and reporting upon discoveries of objects and suggestions for human betterment in many fields. They gave serious consideration to a method for destroying wild garlic and propagation of the chestnut tree. A method of curing the bite of the rattlesnake, for which Sampson, a negro, had obtained his freedom, most appropriately, was referred to the Committee on Medicine. Two important endeavors, which would be called "work projects" today, undertaken in 1769 were the observation of the transit of Venus across the sun and promotion of a survey for the Delaware and Chesapeake Canal. The planning and execution of the former was a splendid piece of astronomy and entailed foresight and skill. David Rittenhouse first proposed it a year in advance, in June 1768. It was a cooperative venture of the first order. Surprisingly enough, the Pennsylvania Legislature, at the petition of the Society, raised an appropriation of fifty pounds for a telescope and allowed the erection of an observatory, the site of which is at the south entrance of Independence Hall. When the great event took place in 1769, members of the Society were stationed at three points, at Philadelphia, Norriton and the Delaware Capes. The work was a success as attested by the various reports published in the first volume of the Society's TRANSACTIONS, and although it was planned and carried through by self-taught amateurs, it commanded the attention and approval of the learned world. To the canal project, local merchants contributed forty pounds.

For the next twenty years the Society's Minutes show that the members' range of scientific interests embraced an almost universal scope. In the field of botany and natural history there was much attention given to the medicinal value of plants. Papers were presented on the thorn apple, ipecac and quinine. The paper which Moses Bartram, a nephew of John Bartram, read in 1768 on "Observations on the Native Silk Worms of North America" was an indication of the interest which led to serious experiments in silk production which the Society later sponsored.

In February 1774, Dr. Benjamin Rush gave an oration before the Society on the natural history of medicine among the Indians. Meanwhile, as early as 1769, efforts were made to increase the cabinet with specimens of plants and animals to be procured from "merchants, army officers and ship captains as well as foreign members." Some years after this, Dr. Nicholas Collin, Rector of the Swedish Churches in Pennsylvania, read before the Society a paper which outlined natural history studies which would benefit the country. In his list of subjects in nature about which little was known, he lists remedies for canker worms, fire-flies ("we know not where these lamps are hid") and the horn-snake of which he mentioned "some accounts agree that the spur of his tail is so venemous as to kill young trees." Also he raises the question of the specific differences of quadrupeds of the same genus in America and the Orient and even speculates on the possibility that the mammoth may be still roaming the western wilderness.[1] In that period from 1769 to the early eighteen hundreds, other studies were reported on useful minerals, fossils, bones, such invertebrates as worms and bees and even the electric eel from South America. That these important scientific contributions were the work of amateurs is evident from the fact that their authors were chiefly doctors, ministers, lawyers or merchants.

At the same time the applications of scientific findings to human needs received ready attention. It is true that there was fair emphasis placed on such studies in pure science as those already mentioned, but the Committees on Husbandry and American Improvements and Mechanics and Architecture were especially busy in examining and reporting on such diverse topics as peach tree worms, silk worm culture, spring blocks, paddle wheel boats and even devices for military defense.[2]

Rather than generalizing upon the work of the Society as a whole, I shall pick out a few members of the early period from 1769 to the first part of the nineteenth century who were outstanding and sketch something of the part they played in the development of science and particularly natural history. My first choice may seem a trifle obvious.

[1] TRANS. Amer. Philos. Soc. 3: iii–xxvii. 1793.

[2] "Early Proceedings of the American Philosophical Society, 1744–1838." PROC. Amer. Philos. Soc. 23: pt. 3, 1–295.

Much has been said of Franklin and his contributions to electricity, as well as of his inventions of such ingenious and mechanical devices as the "Pennsylvania fireplace" or Franklin stove, bifocal glasses and other ventures in applied science. But the versatile man who had his fingers in so many public and political affairs was also versatile in science. Strangely, not much emphasis has been put on the attention he paid to many phases of natural history. One can readily understand that with his intense curiosity concerning the world about him he would not neglect the fauna and flora.

His serious interest in science probably stemmed from his first visit to England (1724–26) where he met, among others, Dr. Henry Pemberton, Secretary of the Royal Society.[1] His published journal of the return voyage shows how closely he studied nature from sea-weed and dolphins to lunar rainbows. Even during his great period of preoccupation with electrical experiments from 1746, after he had retired from active business, to 1752, he had time for speculation on paleontology, the breeding of pigeons, the power of communication among ants, and soil fertility. Bird-lovers would do well to reread his accurate descriptions of the bald eagle which led him to remark that as a symbol of our country "the turkey is in comparison a much more respectable bird."[2]

One of the most striking references to Franklin and his natural history interests and one relatively little known is the description written by the Reverend Mannaseh Cutler of Massachusetts when he visited him in Philadelphia in 1787. After showing his visitor a two-headed snake and other curiosities in his study, Franklin spent several hours exhibiting large botanical plates, illustrating the *Systema Vegetabilum* of Linnaeus which led him to lament that "he did not, in his early life, attend to this science." Cutler goes on to say that "he seemed extremely fond . . . of dwelling on philosophical subjects and particularly that of natural history while the other gentlemen were swallowed up in politics."[3]

When we review Franklin's scientific interests, his responsibility for the founding of the American Philosophical Society and his long connection with it have peculiar significance. For not only were his studies important but the influence he had on

[1] Becker, Carl L., Benjamin Franklin in *Dictionary of American Biography*, **VI**: 588.

[2] Smythe, A. H., *Complete Works of Franklin*, **IX**: 161–168.

[3] Cutler, Manasseh, *Life, Journals and Correspondence*, **I**: 1888, 267–270.

others and on his advancement of science. He chose purposefully the difficult post as secretary of the infant society, because, as Van Doren points out, "it was important that new things should be known, not that he himself should find them out."[1] Franklin in his own words said, "If I can be the means of communicating anything valuable to the world, I do not think of gaining or even of saving by my business. . . ."[2] In that statement lies the secret of his long devotion to this unusual organization.

There has been so much written on the lives of both John and William Bartram, it is discouraging to attempt a new appraisal. Both of them were members of this Society. The elder Bartram, who was the botanist of the original group of seven members proposed by Franklin in 1743, was essentially a worker with living plants. For that reason, undoubtedly, Linnaeus described him as the greatest contemporary "natural botanist" in the world. His most distinctive service lay in his contribution to the work of the great scientists of Europe and to the horticulturists of England such as Peter Collinson, John Fothergill and Lord Petre. The wealth of material he collected was made possible by his remarkable journeys throughout the colonies for which in 1765 he was appointed King's Botanist and also the experiments he made with growing plants in his famous Garden, which still stands as his memorial. The Garden, incidentally, was studied by André Michaux, Nuttall and other celebrated naturalists long after its founder's death. John Bartram was also interested in almost all objects in nature. He had the vision to see the importance of a great survey trip through the western part of the continent and it would seem that this thought, conveyed to Franklin in turn was the inspiration for Jefferson's plans for Michaux and later for the Lewis and Clark explorations. All these plans had a close connection with the American Philosophical Society.[3] In many ways John Bartram's son, William, has had a more lasting influence, particularly for his *Travels*, published in 1791. One of the earliest books of natural history description, it made its mark on the writings of such authors as Chateaubriand, Coleridge, Wordsworth and many others. In addition to this fact, his early descriptions of animals and plants of the southern states are being

[1] Van Doren, Carl, *Benjamin Franklin:* 1938, 140.

[2] Smythe, A. H., *Complete Writings of Benjamin Franklin*, **II**: 291.

[3] Peattie, D. C., Sketch of John Bartram in *Dictionary of American Biography*, **II**: 27.

reestablished, after a century and a half of neglect, by the researches of Dr. Francis Harper, aided by the American Philosophical Society.

Although David Rittenhouse (1732–96) is best remembered as an astronomer, instrument maker and mathematician, he was sufficiently versatile to be hailed as *the* American philosopher. In this sense he was far more of a professional scientist in his training and work than Franklin or any other contemporary figure. His public services took many forms over his entire lifetime. But it was as engineer of the Committee of Safety in 1775 and in other capacities during the Revolution that he was especially useful. During this period to obtain lead for bullets he substituted iron for lead clock-weights throughout Philadelphia, supervised the casting of cannon and manufacture of saltpeter and on one occasion nearly put his eyes out experimenting with telescopic rifle sights. His later post as first Director of the United States Mint is schoolbook knowledge. The fact that he served the American Philosophical Society for thirty years as Curator, Secretary and Vice-president before he became President is not so well known. He contributed seventeen original papers to its TRANSACTIONS and served on many important committees.[1]

Today we hear much of Thomas Jefferson's political and social ideas but little of the scientific side of the man. It was different at times during his own career when his scholarly pursuits were ridiculed by opponents. In his own studies, though occasionally inaccurate, he was a pioneer in numerous branches of science, notably paleontology, ethnology and geography. His "Notes on Virginia," a comprehensive treatise upon topography, natural history and natural resources, appeared in 1781 and was, in the opinion of some persons, the most important scientific work published up to that time.[2] Like Franklin, it was as a patron and promoter of science that he shone. He kept up a prodigious correspondence with scientists, both in America and abroad. On his journey from Virginia to Philadelphia to become Vice-president of the United States, he brought with him a whole wagon load of the bones of the great ground sloth, Megalonyx, thinking them something quite different. His paper on the subject appears in the Society's TRANSACTIONS. Again when he was President in 1808,

[1] Rufus, W. Carl, *Dictionary of American Biography*, **XV**: 631.

[2] Goode, G. Brown, "Beginnings of Natural History in America," *Smithsonian Institute Annual Report*, 1897, Pt. II.

the huge bones of a mammoth discovered in New York were spread over the floor of a room in the White House where Dr. Caspar Wistar selected specimens for the American Philosophical Society. While he was at the head of the government, Jefferson was also President of the Society, an office he held from 1797 to 1815. Previously as a member he took the lead in 1792 in raising a thousand guineas for a trans-Mississippi exploration by André Michaux. Jefferson's later sponsorship of the Lewis and Clark Expedition was an outgrowth of this original plan.[3]

Many other prominent names in eighteenth century American science, such as John Morgan, John Ewing, Charles Thomson, Humphrey Marshall, Charles Willson Peale and others stand out as members, actively connected with the American Philosophical Society, who aided in the promotion and diffusion of knowledge. But it was not alone the leading personalities who made possible an advance in knowledge. All the members in their various ways and largely by the fact that they had zeal laid the foundations for scientific research and the advancement of science through education.

The Society in the early days, which have been reviewed, placed much emphasis on the diffusion as well as the promotion of useful knowledge. It accomplished this end to a certain degree through its TRANSACTIONS, the first scientific publication of its type in America, through its occasional public lectures and by other means. In view of these circumstances, it is probable that the founders and early members would have heartily approved the experiment which the Society, through its Committee on Education and Participation in Science, is now sponsoring to find means for a broader understanding of science on the part of everyday people.

[3] Curtis, William, *The True Jefferson*, 1901: 362–371.

VII

AWARDS OF PRIZES

MAGELLANIC FUND, established in 1786 by the gift of 200 guineas by John Hyacinth de Magellan, of London, for a gold medal to be annually awarded under prescribed terms, to the author of the best discovery or most useful invention relating to navigation, astronomy, or natural philosophy (mere natural history only excepted). Any surplus of interest remaining to be used for such purposes as may be authorized under the Society's Charter and Laws.

Awards of the Magellanic Premium

December 1790. To FRANCIS HOPKINSON, Philadelphia, Penna. For the Invention of the Spring Block. "Description of a Spring Block Designed to Assist a Vessel in Sailing" (TRANS. Amer. Philos. Soc. **3**, Art. 40, 1793).

December 1792. To ROBERT PATTERSON, Philadelphia, Penna. For the Improvement of Electrical Rods, or Lightning Conductors, by Pointing them with Black-lead. "An Improvement on Metalic Conductors or Lightning-rods in a Letter to Dr. David Rittenhouse from Robert Patterson" (TRANS. Amer. Philos. Soc. **3**, Art. 35, 1793).

December 1792. To WILLIAM THORNTON, London, England. For "Cadmus" or a Philosophical Dissertation on the Elements of Written Language. "Cadmus, or a Treatise on the Elements of Written Language, illustrating, by a Philosophical Division of Speech, the power of each Character, thereby mutually fixing the Orthography and Orthoepy. With an Essay on the Mode of Teaching the Surd, or Deaf and Consequently Dumb to Speak" (TRANS. Amer. Philos. Soc. **3**, Art. 33, 1793).

December 1794. To NICOLAS COLLIN, Philadelphia, Penna. For a Paper on an Elevator (Nititor [sic] in ardua virtus). "Description of a Speedy Elevator by the Inventor" (TRANS. Amer. Philos. Soc. **4**, Art. 75, 1799).

November 1804. To CAPTAIN WILLIAM MUGFORD, Salem, Mass. For the Invention of a Temporary Rudder. "An account and description of a Temporary Rudder Invented by Capt. William Mugford of Salem, Mass." (TRANS. Amer. Philos. Soc. **6**, Art. 34, 1809).

December 1804. To Dr. Ben Smith Barton, Philadelphia, Penna. For a Paper on a "Number of the Pernicious Insects of the United States."

October 1807. To John Garnett, New Brunswick, N. J. For a Paper on "A New Simple Nautical Chart." "Description and use of a new and simple Nautical Chart, for working the different problems in Navigation" (Trans. Amer. Philos. Soc. **6**, Art. 49, 1809).

April 1809. To James Humphries, Jr., Philadelphia, Penna. For a Model and Description of Steering Apparatus.

April 1820. To Joshua Chapman, Bristol, Penna. For an Improvement in the Manufacture of Canvas.

March 1823. To Dr. Jas. Ewing, Philadelphia, Penna. For the invention of the "Improved Hydrant."

May 1825. To C. C. Brodie. For an invention to repair the side of ships, under the surface of the water.

March 1836. To James P. Espy, Philadelphia, Penna. Author of the paper signed "Investigator."

December 1864. To Pliny Earle Chase, Philadelphia, Penna. For a paper on "The discovery of Certain new relations between the solar- and lunar-diurnal variations of magnetic force and of barometric pressure" (Proc. Amer. Philos. Soc. **9**: 487–495).

December 1887. To Lewis M. Haupt, Philadelphia, Penna. For a paper on "The Physical Phenomena of Harbor Entrances. Their Causes and Remedies. Defects of Present Methods of Improvement" (Proc. Amer. Philos. Soc. **25**: 19–41).

April 1922. To Paul R. Heyl and Lyman J. Briggs, U. S. Bureau of Standards, Washington, D. C. For the invention of the Earth Inductor Compass. "The Earth Inductor Compass" (Proc. Amer. Philos. Soc. **61**: 15–32).

The Henry M. Phillips Prize Essay Fund, established in 1888 by the gift of $5,000 by Miss Emily Phillips, of Philadelphia. Income to be used in the awarding of a prize for the best essay of real merit on the science and philosophy of jurisprudence.

Awards of The Henry M. Phillips Prize Essay

May 1895. To George H. Smith, Esq., Los Angeles, Calif. $500. "The Theory of State" (Proc. Amer. Philos. Soc. **34**: 181–334).

June 1900. To W. H. Hastings, Esq., Wilber, Neb. $2,000. "The Development of Law as Illustrated by the Decisions Relating to the Police Power of the State" (Proc. Amer. Philos. Soc. **39**: 359–554).

April 1912. To Charles H. Burr, Esq., Philadelphia, Penna. $2,000. "The Treaty-Making Power of the United States and the Methods of its Enforcement as Affecting the Police Powers of the States" (Proc. Amer. Philos. Soc. **51**: 271–422).

April 1921. To Quincy Wright, Esq., Minneapolis, Minn. $2,000. "The Relative Rights, Duties and Responsibilities of the President, of the Senate and the House, and of the Judicary in Theory and Practice" (Proc. Amer. Philos Soc. **60**: 99–455).

October 1935. To Lon L. Fuller, Dean of the Law School, Duke University, Durham, N. C. $1,500 and Diploma. "American Legal Realism" (Proc. Amer. Philos. Soc. **76**: 191–235).

The John F. Lewis Fund, established in 1935 by the gift of Mrs. John F. Lewis, of Philadelphia, of $10,000 in memory of her late husband; the income to be used each year as an award to the American citizen who shall announce at any general or special meeting of the Society, and publish among its papers, some truth which the Council of the Society shall deem worthy of the award.

Awards of The John F. Lewis Prize

April 1937. To Ralph E. Cleland, Goucher College, Baltimore, Md. $300 and Diploma, for presentation to the Society and publishing in its Proceedings: "Cyto-taxonomic Studies on Certain Oenotheras from California" (Read April 19, 1934,—Proc. Amer. Philos. Soc. **75**: 339–429). "A Cyto-genetic and Taxonomic Attack upon the Phylogeny and Systematics of Oenothera (Evening Primrose) with Special Reference to the Sub-genus Onagra" (Read April 18, 1935,—Proc. Amer. Philos. Soc. **77**: 477–544).

April 1938. To Arthur J. Dempster, University of Chicago, Chicago, Ill. $300 and Diploma, for presentation to the Society and publishing in its Proceedings: "New Methods in Mass Spectroscopy" (Read in part April 20, 1935,—Proc. Amer. Philos. Soc. **75**: 755–767). "Further Experiments on the Mass Analysis of the Chemical Elements" (Read April 25, 1936,—Proc. Amer. Philos. Soc. **76**: 491–496).

April 1939. To Henry Norris Russell, Princeton University Observatory, Princeton, N. J. $300 and Diploma, for presentation to the Society and publishing in its Proceedings: "Stellar Energy" (Read February 17, 1939,—Proc. Amer. Philos Soc. **81**: 295–307).

VIII

GENERAL MEETING LECTURERS

THE R. A. F. PENROSE, JR., LECTURERS

1934. Edwin G. Conklin
"A Generation's Progress in the Study of Evolution"
1935. W. F. G. Swann
"Is the Universe Running Down?"
1936. Dixon Ryan Fox
"The American Tradition in a New Day"
1937. Irving Langmuir
"The Surfaces of Solids and Liquids"
1938. S. A. Mitchell
"With an Astronomer on an Eclipse Expedition"
1939. Eduard Beneš
"Politics as Art and Science"

THE AUTUMN LECTURERS

1936. D'Arcy W. Thompson
"Astronomy in the Classics"
1937. William Lyon Phelps
"Truth and Poetry"
1938. Alfred J. Lotka
"Contacts of Population Study with Related Branches of Science"
1939. Carlton J. H. Hayes
"The Novelty of Totalitarianism in the History of Western Civilization"

IX

REPRESENTATION AT CELEBRATIONS OF SOCIETIES, INSTITUTIONS, ETC.

January 17. Celebration of the birthday of Benjamin Franklin at the Benjamin Franklin Memorial by the Poor Richard Club of Philadelphia and the Franklin Institute of Pennsylvania. John A. Miller, William E. Lingelbach and Edwin G. Conklin.

March 31–April 1. Forty-third Annual Meeting of the American Academy of Political and Social Sciences, Philadelphia, Pa. James T. Young, Edward P. Cheyney and Harold W. Dodds.

April 20–21. Inauguration and dedication of the San Jacinto Museum of History, San Jacinto, Texas. Edgar O. Lovett.

July 2. Patriotic and Religious Service at the Memorial Chapel of the Holy Communion, Philadelphia, Pa. Lawrence J. Morris.

July 24–August 12. Sixth Pacific Science Congress of the Pacific Science Association of the National Research Council, San Francisco, Calif. Eliot Blackwelder and Herman Augustus Spoehr.

August 23–30. Seventh International Congress of Genetics of the Institute of Animal Genetics, Edinburgh, Scotland. Albert F. Blakeslee.

September 4–15. Meeting of the International Union of Geodesy and Geophysics, Washington, D. C. Reginald A. Daly and Arthur L. Day.

October 25. Celebration of the one hundredth anniversary of the birth of Robert Henry Thurston, Cornell University, Ithaca, N. Y. William F. Durand.

November 9–10. Conference on Inter-American Relations in the Field of Education, Washington, D. C. Invitation received from the Secretary of State, the Honorable Cordell Hull. Edwin G. Conklin.

November 27, December 29. Centenary Celebration of the American Statistical Association, Boston, Mass., Philadelphia, Pa. Raymond Pearl.

Committee of the Philadelphia Society for Promoting Agriculture to cooperate with the Franklin Institute and the Philadelphia Society for Promoting Agriculture in organizing the Soil Fertility Foundation. Lawrence J. Morris and Samuel P. Wetherill.

American Council of Learned Societies, Washington, D. C.
(for four years, 1937–41). Edward Capps.
(for four years, 1938–42). William E. Lingelbach.

National Research Council, Division of Foreign Relations, Washington, D. C. (for three years, 1937–40). Leo S. Rowe.

X
LIST OF MEMBERS

MEMBERS RESIDING WITHIN THE UNITED STATES

Date of Election

Abbot, Charles Greeley, M.Sc., D.Sc., LL.D. 1914
Astrophysicist, Secretary, Smithsonian Institution,
Washington, D. C.

Adams, Edwin Plimpton, M.S., Ph.D., Sc.D. 1915
Professor of Physics, Princeton University,
Princeton, N. J.

Adams, James Truslow, A.M., LL.D., Litt.D., L.H.D. 1938
Author, American Historian.
Sheffield House, Southport, Conn.

Adams, Roger, A.B., A.M., Ph.D., Sc.D. 1935
Head of the Chemistry Department, University of Illinois.
603 Michigan Avenue, Urbana, Ill.

Adams, Walter Sydney, A.M., Sc.D., LL.D. 1915
Astronomer, Director, Mount Wilson Observatory,
Pasadena, Calif.

Adler, Cyrus, M.A., Ph.D., D.H.L., Litt.D. 1900
Philologist and Orientalist, President, Dropsie College
for Hebrew and Cognate Learning,
Broad and York Streets, Philadelphia, Pa.

Aitken, Robert Grant, A.M., Sc.D., LL.D. 1919
Astronomer, Director Emeritus, Lick Observatory.
1109 Spruce Street, Berkeley, Calif.

Albright, William F., Ph.D., Litt.D., D.H.L., Th.D. 1929
Orientalist and Archaeologist, Professor of Semitic
Languages, Johns Hopkins University, Baltimore, Md.

Alexander, James W., A.M., Ph.D., A.A. 1928
Professor of Mathematics, Institute for Advanced Study.
29 Cleveland Lane, Princeton, N. J.

	Date of Election
Allen, Charles Elmer, B.S., Ph.D. Professor of Botany, University of Wisconsin. 2014 Chamberlin Avenue, Madison, Wis.	1922
Anderson, Carl David, Ph.D. Professor of Physics, California Institute of Technology, Pasadena, Calif.	1938
Andrews, Charles McLean, Ph.D., L.H.D., Litt.D., LL.D. Professor Emeritus of American History, Yale University. 424 St. Ronan Street, New Haven, Conn.	1924
Andrews, Donald Hatch, A.B., Ph.D. Chairman, Chemistry Department, Director, Chemistry Laboratory, Johns Hopkins University, Baltimore, Md.	1933
Andrews, Roy Chapman, M.A., Sc.D. Zoologist, Director, American Museum of Natural History, New York, N. Y.	1927
Angell, James Rowland, A.B., A.M., Ph.D., Litt.D., LL.D. Psychologist, President Emeritus, Yale University. 155 Blake Road, Hamden, Conn.	1924
Armstrong, Edward Cooke, A.B., Ph.D., LL.D., L.H.D. Professor of French Language, Princeton University. 26 Edgehill Street, Princeton, N. J.	1932
Arthur, Joseph Charles, Sc.D., LL.D. Professor Emeritus of Botany, Purdue University. 915 Columbia Street, Lafayette, Ind.	1919
Aydelotte, Frank, A.M., B.Litt., L.H.D., LL.D., D.Litt., D.C.L. Educator, President, Swarthmore College, Swarthmore, Pa.	1923
Baekeland, Leo H., D.Sc., D.Nat.Sc., D.Ch., D.Ap.Sc., LL.D. Chemist, President, Bakelite Corporation. 247 Park Avenue, New York, N. Y.	1935
Bailey, Irving Widmer, A.B., M.F., Sc.D. Professor of Plant Anatomy, Harvard University. 17 Buckingham Street, Cambridge, Mass.	1926

	Date of Election
Bailey, Liberty Hyde, M.S., Litt.D., D.Sc., LL.D. Botanist, Professor Emeritus of Agriculture (Horticulture), Director, Bailey Hortorium, Cornell University, Ithaca, N. Y.	1896
Bancroft, Wilder Dwight, A.B., Ph.D., Sc.D., LL.D. Professor Emeritus of Physical Chemistry, Cornell University. 7 East Avenue, Ithaca, N. Y.	1920
Barbour, Thomas, Ph.D., Sc.D., Dr. en Ciencias Director, University Museum and Museum of Comparative Zoology, Professor of Zoology, Harvard University. 278 Clarendon Street, Boston, Mass.	1937
Bartlett, Harley Harris, A.B. Chairman, Department of Botany, Director, Botanical Garden, University of Michigan. 538 Church Street, Ann Arbor, Mich.	1929
Barton, George Aaron, A.M., Ph.D., S.T.D., LL.D. Orientalist and Archaeologist, Professor Emeritus of Semitic Languages, University of Pennsylvania. 3610 Royal Palm Avenue, Coconut Grove, Fla.	1911
Bateman, Harry, M.A., Ph.D. Professor of Mathematics, Theoretical Physics and Aeronautics, California Institute of Technology, Pasadena, Calif.	1924
Beams, Jesse Wakefield, Ph.D. Professor of Physics, University of Virginia. Monroe Hill, University, Va.	1939
Beard, Charles Austin, LL.D., Ph.D. Historian, Formerly Professor of Politics, Columbia University. New Milford, Conn.	1936
Becker, Carl, Ph.D., Litt.D. John Stambaugh Professor of History, Cornell University, Ithaca, N. Y.	1936
Bell, Eric Temple, Ph.D. Professor of Mathematics, California Institute of Technology. 434 South Michigan Avenue, Pasadena, Calif.	1937

	Date of Election
Benedict, Francis Gano, Ph.D., Sc.D., M.D. Physiologist, Director (ret.), Nutrition Laboratory, Carnegie Institution of Washington (1907–37). Machiasport, Maine.	1910
deBenneville, James S., A.B. Chemist. 907 West Roosevelt Boulevard, Philadelphia, Pa.	1897
Berkey, Charles Peter, B.S., M.S., Ph.D., Sc.D. Newberry Professor Emeritus of Geology, Columbia University, New York, N. Y.	1928
Berry, Edward Wilber Professor of Paleontology, Dean, Provost, Johns Hopkins University, Baltimore, Md.	1919
Bigelow, Henry Bryant, Ph.D. Director, Woods Hole Oceanographic Institution; Professor of Zoology, Harvard University. Museum of Comparative Zoology, Cambridge, Mass.	1937
Birge, Edward Asahel, Ph.D., LL.D., Sc.D. Zoologist, President Emeritus, University of Wisconsin. 2011 Van Hise Avenue, Madison, Wis.	1923
Birkhoff, George David, A.M., Ph.D., Sc.D., D. (hon.), LL.D. Perkins Professor of Mathematics, Harvard University. 987 Memorial Drive, Cambridge, Mass.	1921
Blackwelder, Eliot, Ph.D. Professor of Geology, Stanford University, Calif.	1939
Blakeslee, Albert F., A.M., Ph.D., D.Sc. Botanist, Director, Department of Genetics, Carnegie Institution of Washington, Cold Spring Harbor, Long Island, N. Y.	1924
Bliss, Gilbert Ames, B.S., M.S., Ph.D., Sc.D. Professor of Mathematics, Chairman, Department of Mathematics, University of Chicago, Chicago, Ill.	1926
Boas, Franz, Ph.D., M.D., LL.D., Sc.D. Professor Emeritus of Anthropology, Columbia University. Grantwood, Bergen County, N. J.	1935

Date of Election

Bogert, Marston Taylor, A.B., Ph.B., Sc.D., LL.D., R.N.D. 1909
Professor Emeritus of Organic Chemistry in Residence, Columbia University, New York, N. Y.

Bolton, Herbert Eugene, Ph.D., D.Litt., L.H.D., LL.D. 1937
Sather Professor of History, Chairman, Department of History, Director, Bancroft Library, University of California, Berkeley, Calif.

Bonner, Campbell, A.M., Ph.D. 1938
Professor of the Greek Language and Literature, University of Michigan. 1025 Martin Place, Ann Arbor, Mich.

Bowen, Norman L., M.A., B.Sc., Ph.D., Sc.D. 1930
Geologist, Charles L. Hutchinson Distinguished Service Professor of Petrology, University of Chicago, Chicago, Ill.

Bowman, Isaiah, B.S., Ph.D., M.A., D.Sc., LL.D. 1923
Geographer, President, Johns Hopkins University, Baltimore, Md.

Bridgman, Percy Williams, A.M., Ph.D., Sc.D. 1916
Physicist, Hollis Professor of Mathematics and Natural Philosophy, Harvard University. Research Laboratory of Physics, Cambridge, Mass.

Briggs, Lyman J., Ph.D., Sc.D., D.Eng., LL.D. 1935
Physicist, Director, National Bureau of Standards. 3208 Newark Street, Cleveland Park, Washington, D. C.

Bronk, Detlev W., M.S., Ph.D., Sc.D. 1934
Physiologist, Johnson Professor of Biophysics, Director, Eldridge Reeves Johnson Foundation for Medical Physics, Director, Institute of Neurology, University of Pennsylvania, Philadelphia, Pa.

Brooke, C. F. Tucker, M.A., B.Litt., Litt.D. 1938
Sterling Professor of English, Yale University. 88 Cold Spring Street, New Haven, Conn.

Brooks, Van Wyck, Litt.D. 1939
Author and Literary Historian. Westport, Conn.

Brubaker, Albert P., A.M., M.D., LL.D. 1895
Professor Emeritus of Physiology, Jefferson Medical College. 109 North 34th Street, Philadelphia, Pa.

Date of Election

Bryant, William L. 1935
Paleontologist, Director, Park Museum,
Providence, R. I.

Buck, Carl Darling, A.B., Ph.D., Litt.D. 1923
Professor Emeritus of Comparative Philology,
University of Chicago, Chicago, Ill.

Buddington, Arthur F., Ph.B., M.S., Ph.D. 1931
Professor of Geology, Chairman, Department of Geology,
Princeton University, Princeton, N. J.

Bumpus, Hermon Carey, Ph.D., Sc.D., LL.D. 1909
Zoologist, Educator (ret.), Formerly Director, American
Museum of Natural History. Duxbury, Mass.

Bush, Vannevar, Sc.D., Eng.D., LL.D. 1937
Engineer, President, Carnegie Institution
of Washington, Washington, D. C.

Butler, Nicholas Murray, Ph.D., LL.D. 1938
President, Columbia University, New York, N. Y.

Byrd, Richard Evelyn, D.Eng., Sc.D., LL.D. 1930
Geographer, Navigator, Rear-Admiral (ret.), United
States Navy. 9 Brimmer Street, Boston, Mass.

Calvert, Philip Powell, Ph.D. 1918
Professor Emeritus of Zoology, University of
Pennsylvania. P. O. Box 14, Cheyney, Pa.

Campbell, Douglas Houghton, Ph.D., LL.D. 1910
Professor Emeritus of Botany, Stanford University, Calif.

Cannon, Annie J., B.S., M.A., Sc.D., LL.D. 1925
Astronomer, Curator of Astronomical Photographs,
Harvard College Observatory, Cambridge, Mass.

Cannon, Walter Bradford, A.M., M.D., Sc.D., LL.D., Dr. (hon.) 1908
George Higginson Professor of Physiology,
Harvard Medical School, Boston, Mass.

Capps, Edward, Ph.D., LL.D., Litt.D., L.H.D. 1920
Professor Emeritus of Classics, Princeton University,
Princeton, N. J.

Date of Election

Carlson, Anton Julius, A.M., Ph.D., M.D., LL.D. 1928
Professor of Physiology, University of Chicago.
5228 Greenwood Avenue, Chicago, Ill.

Carpenter, Rhys, Ph.D. 1935
Professor of Archaeology, Bryn Mawr College.
Jerry Run, R.D. 2, Downingtown, Pa.

Carrel, Alexis, M.D., Sc.D., LL.D. 1909
Surgeon, Biologist, Member Emeritus, Rockefeller Institute for Medical Research, 66th Street and York Avenue, New York, N. Y.

Case, Ermine Cowles, A.B., A.M., M.S., Ph.D. 1931
Chairman, Department of Geology, Director and Curator of Vertebrates, Museum of Paleontology, University of Michigan, Ann Arbor, Mich.

Castle, William Bosworth, M.D. 1939
Professor of Medicine, Harvard Medical School; Associate Director, Thorndike Memorial Laboratory, Boston City Hospital, Boston, Mass.

Castle, William Ernest, A.M., Ph.D., Sc.D., LL.D. 1910
Professor Emeritus of Genetics, Harvard University; Research Associate in Genetics, University of California. Hilgard Hall, Berkeley, Calif.

Cather, Willa, Litt.D., LL.D. 1934
Author. Care A. A. Knopf, 501 Madison Avenue, New York, N. Y.

Cattell, James McKeen, Ph.D., LL.D., D.H.L., Sc.D. 1888
Psychologist, Editor. Garrison, N. Y.

Chapman, Frank Michler, Sc.D. 1921
Curator in Ornithology, American Museum of Natural History, New York, N. Y.

Chase, George Henry, A.B., A.M., Ph.D., L.H.D., Litt.D. 1929
Professor of Archaeology, Dean of the University, Harvard University. 1 Bryant Street, Cambridge, Mass.

Cheyney, Edward Potts, A.M., Litt.D., LL.D. 1904
Professor Emeritus of European History, University of Pennsylvania. R.F.D. 3, Media, Pa.

	Date of Election
Chinard, Gilbert, B.L., L.èsL., LL.D. Professor of French Literature, Princeton University, Princeton, N. J.	1932
Chittenden, Russell H., Ph.D., LL.D., Sc.D., M.D. (hon.) Professor Emeritus of Physiological Chemistry, Director Emeritus, Sheffield Scientific School, Yale University. 83 Trumbull Street, New Haven, Conn.	1904
Clark, William Mansfield, Ph.D., Sc.D. De Lamar Professor of Physiological Chemistry, Johns Hopkins University, School of Medicine, Baltimore, Md.	1939
Cleland, Ralph Erskine, A.B., M.S., Ph.D. Professor and Head, Botany Department, Indiana University, Bloomington, Ind.	1932
Coble, Arthur Byron, Ph.D., LL.D. Professor of Mathematics, University of Illinois. 702 W. Washington Boulevard, Urbana, Ill.	1939
Cockerell, Theodore Dru Alison, D.Sc. Professor Emeritus of Zoology, University of Colorado. 908 10th Street, Boulder, Colo.	1928
Coghill, George Ellett, Ph.D., Sc.D. Anatomist. Box 77A, R.F.D. 2, Gainesville, Fla.	1935
Commons, John Rogers, LL.D. Professor of Economics (ret.), University of Wisconsin. P. O. 1498, Ft. Lauderdale, Fla.	1936
Compton, Arthur Holly, B.Sc., Ph.D., Sc.D., LL.D. Professor of Physics, University of Chicago. 5637 Woodlawn Avenue, Chicago, Ill.	1925
Compton, Karl Taylor, Ph.D., Sc.D., D.Eng., LL.D. Physicist, President, Massachusetts Institute of Technology, Cambridge, Mass.	1923
Conant, James Bryant, Ph.D., LL.D. Chemist, President, Harvard University. 17 Quincy Street, Cambridge, Mass.	1935
Conklin, Edwin Grant, Ph.D., Sc.D., LL.D. Professor Emeritus of Biology, Princeton University, Princeton, N. J.	1897

Date of Election

Cook, Gustavus Wynne, Sc.D. 1934
Investigator in Astronomical Science. Roslyn House, Wynnewood, Pa.

Coolidge, William David, Ph.D., Sc.D. 1938
Physicist, Director, Research Laboratories of the General Electric Company. 1480 Lenox Road, Schenectady, N. Y.

Corwin, Edward Samuel, Ph.D., LL.D., Litt.D. 1936
Professor of Jurisprudence, Princeton University, Princeton, N. J.

Cottrell, Frederick Gardner, Ph.D., LL.D. 1938
Chemist, Consultant to Research Corporation, New York. 3904 Ingomar Street, N.W., Washington, D. C.

Cret, Paul Philippe, Sc.D., N.A. 1928
Architect, Architects Building, Philadelphia, Pa.

Crew, Henry, Ph.D. 1921
Professor Emeritus of Physics, Northwestern University. 620 Library Place, Evanston, Ill.

Crile, George, A.M., M.D., LL.D. 1912
Surgeon, Director, Cleveland Clinic Foundation, Euclid Avenue at East 93rd Street, Cleveland, Ohio.

Crocker, William, A.B., A.M., Ph.D. 1931
Botanist, Managing Director, Boyce Thompson Institute for Plant Research, Inc. 1086 North Broadway, Yonkers, N. Y.

Cross, Whitman, B.S., Ph.D., Sc.D. 1915
Geologist, United States Geological Survey (ret.). 101 East Kirke Street, Chevy Chase, Md.

Cross, Wilbur L., A.B., Ph.D., Litt.D., L.H.D., LL.D. 1934
Governor of Connecticut (1932–38); Professor Emeritus of English, Yale University; Editor of *The Yale Review*. 24 Edgehill Road, New Haven, Conn.

Curtis, Heber Doust, A.M., Ph.D., Sc.D. 1920
Astronomer, Director, The Observatory, University of Michigan, Ann Arbor, Mich.

Dahlgren, Ulric, A.B., M.S. 1919
Professor of Biology, Princeton University, Princeton, N. J.

	Date of Election
Daly, Reginald Aldworth, A.M., Ph.D., Sc.D. Professor of Geology, Harvard University. 23 Hawthorn Street, Cambridge, Mass.	1913
Damrosch, Walter Johannes, Mus.D. Musician, Conductor. 168 East 71st Street, New York, N. Y.	1939
Darrach, William, A.B., A.M., M.D., Sc.D., LL.D. Professor of Clinical Surgery, Dean Emeritus of the Medical Faculty, Columbia University. 180 Fort Washington Avenue, New York, N. Y.	1929
Darrow, Karl Kelchner, Ph.D. Research Physicist, Bell Telephone Laboratories. 230 West 105th Street, New York, N. Y.	1936
Davenport, Charles Benedict, S.B., A.M., Ph.D. Biologist, Research Associate, Carnegie Institution of Washington, Cold Spring Harbor, Long Island, N. Y.	1907
Davis, Bradley Moore, A.M., Ph.D. Professor of Botany, University of Michigan, Ann Arbor, Mich.	1914
Davis, Harvey Nathaniel, Ph.D., Sc.D., LL.D., D.Eng. Mechanical Engineer, President, Stevens Institute of Technology. Hoxie House, Castle Point, Hoboken, N. J.	1935
Davis, John William, A.B., LL.B., LL.D. Lawyer, Solicitor General United States (1913–18); United States Ambassador to Great Britain (1918–21). 15 Broad Street, New York, N. Y.	1923
Davisson, Clinton J., Ph.D., D.Sc. Physicist, Bell Telephone Laboratories. 463 West Street, New York, N. Y.	1929
Day, Arthur L., Ph.D., Sc.D. Geophysicist, Director (ret.), Geophysical Laboratory (1907–36), Carnegie Institution of Washington. 1565 Old Georgetown Road, Bethesda, Md.	1912
Day, Edmund Ezra, Ph.D., LL.D. President, Cornell University, Ithaca, N. Y.	1937
Delano, Frederic Adrian Administrator (ret.); Vice-chairman, National Resources Committee since 1933. 2400 16th Street, Washington, D. C.	1935

Date of Election

Dempster, Arthur Jeffrey, A.B., A.M., Ph.D., Sc.D. 1932
Professor of Physics, University of Chicago.
5757 Kenwood Avenue, Chicago, Ill.

Derleth, Charles, Jr., C.E., LL.D. 1936
Engineer, Dean, College of Engineering, University of California, Berkeley, Calif.

Dewey, John, Ph.D., LL.D. 1911
Professor Emeritus of Philosophy, Columbia University, New York, N. Y.

Dinsmoor, William Bell, Litt.D. 1933
Professor of Archaeology, Columbia University.
9 East 77th Street, New York, N. Y.

†Dodd, William Edward, Ph.D., LL.D. 1936
United States Ambassador to Germany (1933–37); Formerly Professor of American History, University of Chicago. Round Hill, Va.

Dodds, Harold Willis, Ph.D., LL.D. 1935
Administrator, President, Princeton University, Princeton, N. J.

Dresden, Arnold, M.S., Ph.D. 1932
Professor of Mathematics, Swarthmore College.
606 Elm Avenue, Swarthmore, Pa.

Dugan, Raymond Smith, B.A., M.A., Ph.D. 1931
Professor of Astronomy, Princeton University, Princeton, N. J.

Duggar, Benjamin Minge, A.M., Ph.D. 1921
Professor of Plant Physiology and Economic Botany, University of Wisconsin, Madison, Wis.

Dunn, Gano, M.S., E.E., D.Sc. 1924
Engineer, President, J. G. White Engineering Corporation; President, Cooper Union for the Advancement of Science and Art. 80 Broad Street, New York, N. Y.

Du Pont, Francis I. 1930
Chemist. P. O. Box 847, Wilmington, Del.

Du Pont, Pierre Samuel, B.S. 1917
Chemist, Manufacturer, E. I. du Pont de Nemours and Company. Du Pont Building, Wilmington, Del.

† Deceased February 9, 1940.

	Date of Election
Durand, William Frederick, Ph.D., LL.D. Professor Emeritus of Mechanical Engineering, Stanford University, Calif.	1917
Edgerton, Franklin, Ph.D. Professor of Sanskrit and Comparative Philology, Yale University. 174 Blake Road, Hamden, New Haven, Conn.	1935
Einstein, Albert, Ph.D., M.D. Professor of Theoretical Physics, Institute for Advanced Study, Princeton, N. J.	1930
Eisenhart, Luther Pfahler, A.B., Ph.D., Sc.D., LL.D. Professor of Mathematics, Dean, Graduate School, Princeton University. Wyman House, Princeton, N. J.	1913
Emmet, William LeRoy, Sc.D. Consulting Engineer, General Electric Company, Schenectady, N. Y.	1898
Erlanger, Joseph, B.S., M.D., LL.D., Sc.D. Professor of Physiology, Washington University. 4580 Scott Avenue, St. Louis, Mo.	1927
Farrand, Max, Ph.D., LL.D., L.H.D. Historian, Director, Huntington Library and Art Gallery, San Marino, Calif.	1928
Fels, Samuel S., LL.D. President, Fels and Company, Paschall Oxygen Company. 39th and Walnut Streets, Philadelphia, Pa.	1939
Ferguson, William Scott, A.M., Ph.D., LL.D., Litt.D. MacLean Professor of Ancient and Modern History, Dean, Faculty of Arts and Sciences, Harvard University. 8 Scott Street, Cambridge, Mass.	1937
Fermi, Enrico, Ph.D. Professor of Physics, Columbia University, New York, N. Y.	1939
Fernald, Merritt Lyndon, S.B., D.C.L., D.Sc. Professor of Natural History, Director, Gray Herbarium, Harvard University, Cambridge, Mass.	1936
Fetter, Frank Albert, Ph.D., LL.D. Professor Emeritus of Political Economy, Princeton University. 168 Prospect Avenue, Princeton, N. J.	1935

Date of Election

†Finley, John Huston, M.A., LL.D., L.H.D., J.U.D., Litt.D. 1919
Editor Emeritus, *The New York Times*, New York, N. Y.

Fisher, Irving, A.B., Ph.D., LL.D. 1927
Professor of Political Economy, Yale University.
Box 1825, New Haven, Conn.

Flexner, Simon, M.D., Sc.D., LL.D. 1901
Pathologist, Director Emeritus, Rockefeller Institute for Medical Research, 66th Street and York Avenue, New York, N. Y.

Foote, Paul Darwin, A.B., M.A., Ph.D. 1927
Physicist, Executive Vice-president, Gulf Research and Development Company. P.O. Drawer 2038, Pittsburgh, Pa.

Forbes, Alexander, A.B., A.M., M.D. 1931
Professor of Physiology, Harvard Medical School, Shattuck Street, Boston, Mass.

Ford, Guy Stanton, Ph.D., Litt.D., LL.D. 1939
Historian, President, University of Minnesota.
517 Essex Street, Minneapolis, Minn.

Ford, Worthington Chauncey, A.M., Litt.D., LL.D. 1922
Historian, Statistician. 11 bis Rue Henri Cloppet, Le Vésinet, S. et O., France.

Fosdick, Raymond Blaine, B.A., M.A., LL.B., LL.D. 1930
Lawyer, President, Rockefeller Foundation and General Education Board, 49 West 49th Street, New York, N. Y.

Fox, Dixon Ryan, Ph.D., Pd.D., L.H.D., Litt.D., LL.D., D.C.L. 1935
Historian, President, Union College, Schenectady, N. Y.

Fox, Herbert, A.B., M.D. 1932
Pathologist to the Philadelphia Zoological Society; Professor of Comparative Pathology, University of Pennsylvania; Director, William Pepper Laboratory, Hospital of the University of Pennsylvania, Philadelphia, Pa.

† Deceased March 7, 1940.

Date of Election

Franck, James, Ph.D., LL.D. 1937
Professor of Physical Chemistry,
University of Chicago, Chicago, Ill.

Frankfurter, Felix, LL.B. 1939
Associate Justice, Supreme Court of the
United States, Washington, D. C.

Frost, Robert, L.H.D., Litt.D. 1937
Poet, Professor of English, Amherst College.
South Shaftsbury, Vt.

Gaposchkin, Cecilia Payne, B.A., Ph.D. 1936
Astronomer, Harvard College Observatory,
Cambridge, Mass.

Gasser, Herbert Spencer, A.M., M.D., Sc.D. 1937
Physiologist, Director, Rockefeller Institute for
Medical Research, 66th Street and York Avenue,
New York, N. Y.

Gates, Thomas Sovereign, Ph.B., LL.B., LL.D. 1930
Administrator, President, University of Pennsylvania,
Philadelphia, Pa.

Gay, Edwin Francis, A.B., Ph.D., Litt.D., LL.D. 1932
Professor Emeritus of Economic History, Harvard
University. 2040 Pasqual Street, Pasadena, Calif.

Gies, William J., B.S., Ph.B., M.S., Ph.D., Sc.D., LL.D. 1915
Professor of Biological Chemistry, Columbia University
Medical School. 630 West 168th Street, New York, N. Y.

Gifford, Walter Sherman, A.B., LL.D., D.Sc., D.C.L. 1931
Administrator, President, American Telephone and
Telegraph Company. 195 Broadway, New York, N. Y.

Gomberg, Moses, B.S., Sc.D., LL.D. 1920
Professor Emeritus of Chemistry, University of
Michigan. 712 Onondaga Street, Ann Arbor, Mich.

Goodrich, Herbert Funk, A.B., LL.B., LL.D. 1937
Dean, Law School, Professor of Law, Vice-president,
University of Pennsylvania. 7701 Cresheim Road,
Chestnut Hill, Philadelphia, Pa.

Goodspeed, Arthur Willis, A.B., Ph.D. 1896
Professor Emeritus of Physics, University of
Pennsylvania. 4623 Sansom Street, Philadelphia, Pa.

Date of Election

Graves, Frank Pierrepont, A.M., Ph.D., Litt.D., L.H.D., LL.D., D.C.L. 1927
Educator, President, University of the State of New York, Commissioner of Education. State Education Building, Albany, N. Y.

Greene, Evarts B., Ph.D., Litt.D., L.H.D., LL.D. 1931
Professor Emeritus of American History, Columbia University. Box 194, Croton-on-Hudson, N. Y.

Gregory, Herbert Ernest, Ph.D., D.Sc. 1923
Silliman Professor Emeritus of Geology, Yale University; Director Emeritus, Bernice P. Bishop Museum, Honolulu, Hawaii.

Gregory, William King, A.M., Ph.D., D.Sc. 1925
Professor of Vertebrate Paleontology, Columbia University; Curator, Department of Comparative Anatomy, Department of Ichthyology, American Museum of Natural History, New York, N. Y.

Griffith, J. P. Crozer, A.B., M.D., Ph.D. 1907
Physician, Professor Emeritus of Pediatrics, University of Pennsylvania. 1810 Spruce Street, Philadelphia, Pa.

Guggenheim, William, B.S. 1930
Industrialist, Administrator, Philanthropist. 3 Riverside Drive, New York, N. Y.

Haney, John Louis, A.B., A.M., B.S., Ph.D., LL.D. 1929
Educator, President, Central High School of Philadelphia. 6419 Woodbine Avenue, Overbrook, Philadelphia, Pa.

Harkins, William Draper, A.B., Ph.D. 1925
Professor of Physical Chemistry, University of Chicago. 5437 Ellis Avenue, Chicago, Ill.

†Harkness, Edward S., A.B., M.A., LL.D. 1934
Administrator, Philanthropist. 654 Madison Avenue, New York, N. Y.

Harper, Robert A., M.A., Ph.D., D.Sc. 1909
Professor Emeritus of Botany, Columbia University, New York, N. Y.

Harrison, Ross G., M.A., Ph.D., M.D., Sc.D. 1913
Professor Emeritus of Biology, Yale University; Chairman, National Research Council. 142 Huntington Street, New Haven, Conn.

† Deceased January 29, 1940.

Date of Election

Harvey, E. Newton, Ph.D. 1929
Henry Fairfield Osborn Professor of Biology, Princeton University, Princeton, N. J.

Hawk, Philip Bovier, M.S., Ph.D. 1915
Chemist, President and Director, Food Research Laboratories, Inc., of New York. 114 East 32nd Street, New York, N. Y.

Hayward, Nathan, A.B., S.B. 1937
President (ret.), The Franklin Institute. 12 South Twelfth Street, Philadelphia, Pa.

Hazen, Charles D., A.B., Ph.D., L.H.D., Litt.D. 1923
Professor of History, Columbia University, New York, N. Y.

Heiser, Victor George, M.D., A.B., Sc.D., LL.D. 1918
Physician. Room 410, Metropolitan Tower, New York, N. Y.

Henderson, Lawrence J., M.D., Sc.D., Dr.(hon.) 1921
Abbott and James Lawrence Professor of Chemistry, Harvard University. 4 Willard Street, Cambridge, Mass.

Henderson, Robert, B.A., D.Sc. 1927
Mathematician, Actuarial Consultant. Crown Point, Essex County, N. Y.

Henderson, Yandell, Ph.D. 1935
Professor Emeritus of Physiology, Yale University. 440 Prospect Street, New Haven, Conn.

Hendrickson, George Lincoln, A.B., L.H.D. 1932
Professor of Greek and Latin Literature, 851 Branford College, Yale University, New Haven, Conn.

Hobbs, William Herbert, A.M., Ph.D., D.Eng., LL.D. 1909
Professor Emeritus of Geology, University of Michigan, Ann Arbor, Mich.

Holland, Leicester Bodine, B.S., M.A., Ph.D., F.A.I.A. 1931
Archaeologist, Professor of Fine Arts, University of Pennsylvania; Chief, Division of Fine Arts, Library of Congress. 4203 Pine Street, Philadelphia, Pa.

Date of Election

Hooton, Earnest A., B.A., M.A., Ph.D., B.Litt., Sc.D. 1931
Professor of Anthropology, Curator of Somatology, Peabody Museum, Harvard University, Cambridge, Mass.

Hoover, Herbert, Dr. Eng., M.D., Sc.D., LL.D., D.C.L., J.D. 1918
Engineer, Thirty-first President of the United States. Stanford University, Calif.

Hopkins, B Smith, Ph.D., D.Sc. 1927
Professor of Inorganic Chemistry, University of Illinois, Urbana, Ill.

Hopkinson, Edward, Jr., A.B., LL.B. 1938
Lawyer, Banker, Trustee, University of Pennsylvania. 8700 Montgomery Avenue, Chestnut Hill, Philadelphia, Pa.

Howard, Leland Ossian, M.D., Ph.D., Sc.D., LL.D. 1911
Zoologist, Consulting Entomologist, United States Public Health Service. Bureau of Entomology, United States Department of Agriculture, Washington, D. C.

Howell, William Henry, A.B., Ph.D., M.D., Sc.D., LL.D. 1903
Professor Emeritus of Physiology, Formerly Dean, Medical Faculty and Director, School of Hygiene, Johns Hopkins University. 112 St. Dunstan's Road, Baltimore, Md.

Hrdlička, Aleš, M.D., Sc.D. 1918
Curator, Division of Physical Anthropology, United States National Museum, Washington, D. C.

Hubble, Edwin P., B.Sc., Ph.D., B.A., D.Sc., LL.D. 1929
Astronomer, Mount Wilson Observatory, Pasadena, Calif.

Huebner, Solomon Stephen, B.L., M.L., Ph.D., Sc.D. 1930
Economist, Professor of Insurance and Commerce, University of Pennsylvania. 697 South Highland Avenue, Merion, Pa.

Hughes, Charles Evans, A.B., A.M., LL.B., LL.D., D.C.L. 1926
Chief Justice of the United States. 2223 R Street, N.W., Washington, D. C.

Date of Election

Hulett, George A., A.B., Ph.D. 1913
Professor Emeritus of Physical Chemistry, Princeton University. 44 Washington Road, Princeton, N. J.

Humphreys, William Jackson, A.B., C.E., Ph.D. 1929
Professor Emeritus of Meteorological Physics, George Washington University; Collaborator, United States Weather Bureau, Washington, D. C.

Huntington, Edward Vermilye, A.B., A.M., Ph.D., Sc.D. 1933
Mathematician, Professor of Mechanics, Harvard University. 48 Highland Street, Cambridge, Mass.

Ives, Herbert E., B.S., Ph.D., Sc.D. 1917
Physicist, Bell Telephone Laboratories. 32 Laurel Place, Montclair, N. J.

Jackson, Dugald Caleb, C.E., D.Sc., D.Eng. 1931
Professor Emeritus of Electrical Engineering, Massachusetts Institute of Technology. 5 Mercer Circle, Cambridge, Mass.

Jacobs, Merkel Henry, A.B., Ph.D. 1930
Professor of Physiology, University of Pennsylvania, Philadelphia, Pa.

Jayne, Horace Howard Furness, A.B., A.M. 1934
Archaeologist, Chief Division of Eastern Art, Pennsylvania Museum; Director, University Museum, University of Pennsylvania. Wallingford, Pa.

Jenks, John Story 1936
Banker, Trustee, President, University Museum, University of Pennsylvania. 123 South Broad Street, Philadelphia, Pa.

Jennings, Herbert S., Ph.D., Sc.D., LL.D. 1907
Professor Emeritus of Zoology, Johns Hopkins University, Baltimore, Md.

Jessup, Philip C., LL.B., LL.D., Ph.D. 1939
Professor of International Law, Columbia University, New York, N. Y.

Jewett, Frank Baldwin, Ph.D., D.Sc., D.Eng., LL.D. 1938
Vice-president, American Telephone and Telegraph Company; President, Bell Telephone Laboratories. 195 Broadway, New York, N. Y.

Date of Election

Johnson, Douglas, Ph.D., D.Sc. 1920
Geologist and Geographer, Professor of Physiography, Columbia University, New York, N. Y.

Johnson, Eldridge Reeves, A.E.D. 1928
Industrialist, Founder, Victor Talking Machine Company. 608 West Jersey Trust Building, Camden, N. J.

Johnson, Emory R., Litt.M., Ph.D., Sc.D. 1915
Professor Emeritus of Transportation and Commerce, Logan Hall, University of Pennsylvania, Philadelphia, Pa.

Jones, Lewis Ralph, Ph.B., Ph.D., Sc.D., LL.D. 1925
Professor of Plant Pathology, University of Wisconsin, Madison, Wis.

Joslin, Elliott Proctor, B.A., M.A., Ph.B., M.D. 1925
Physician, Clinical Professor Emeritus of Medicine, Harvard Medical School. 81 Bay State Road, Boston, Mass.

Kemmerer, Edwin Walter, A.B., Ph.D., LL.D., D.C.S., D.Sc., Hon.D. 1932
Walker Professor of International Finance, Princeton University, Princeton, N. J.

Keppel, Frederick Paul, Litt.D., LL.D. 1938
President, Carnegie Corporation of New York, 522 Fifth Avenue, New York, N. Y.

Kettering, Charles Franklin, M.E., E.E., D.Eng., D.Sc. 1930
Research Engineer, Vice-president, General Motors Corporation; General Director, Research Laboratories Division, General Motors Corporation. Ridgeleigh Terrace, Dayton, Ohio.

Keyes, Frederick George, M.S., Ph.D., D.Sc. 1938
Professor and Head, Department of Chemistry, Massachusetts Institute of Technology. 15 Berkeley Street, Cambridge, Mass.

Kidder, Alfred Vincent, Ph.D., LL.D. 1934
Archaeologist, Chairman, Division of Historical Research, Carnegie Institution of Washington. 10 Frisbie Place, Cambridge, Mass.

	Date of Election
Kofoid, Charles A., A.M., Ph.D., Sc.D., LL.D. Professor Emeritus of Zoology, University of California, Berkeley, Calif.	1924
Köhler, Wolfgang, Ph.D. Professor of Psychology, Swarthmore College, Swarthmore, Pa.	1939
Kraus, Charles August, Ph.D. Professor of Chemistry and Director of Research in Chemistry, Brown University. 92 Keene Street, Providence, R. I.	1939
Lamb, Arthur Becket, Ph.D., D.Sc. Professor of Chemistry, Harvard University. 12 Oxford Street, Cambridge Mass.	1936
Lamont, Thomas William, A.B., LL.D. Banker, Trustee. 23 Wall Street, New York, N. Y.	1932
Lampland, Carl O., A.B., A.M., LL.D. Astronomer, Lowell Observatory, Flagstaff, Ariz.	1931
Lancaster, Henry Carrington, M.A., Ph.D. Professor of French Literature, Chairman, Department of Romance Languages, Johns Hopkins University. 604 Edgevale Road, Baltimore, Md.	1938
Landsteiner, Karl, M.D., D.Sc. Pathologist, Rockefeller Institute for Medical Research. 25 East 86th Street, New York, N. Y.	1935
Langmuir, Irving, M.A., Ph.D., Sc.D., LL.D. Chemist and Physicist, Associate Director, Research Laboratory, General Electric Company, Schenectady, N. Y.	1922
Lanman, Charles R., A.B., Ph.D., LL.D. Professor Emeritus of Sanskrit, Harvard University. 9 Farrar Street, Cambridge, Mass.	1906
Lashley, Karl Spencer, M.S., Ph.D., Sc.D. Research Professor of Neuropsychology, Harvard University, Cambridge, Mass.	1938
Lawrence, Ernest Orlando, B.S., A.M., Ph.D., Sc.D., LL.D. Professor of Physics, Director, Radiation Laboratory, University of California, Berkeley, Calif.	1937

Date of Election

Lawson, Andrew Cowper, M.A., Ph.D., Sc.D., LL.D. 1925
Professor of Mineralogy and Geology (ret.),
University of California, Berkeley, Calif.

Lefschetz, Solomon, M.E., Ph.D. 1929
Research Professor of Mathematics, Princeton University.
129 Broadmead, Princeton, N. J.

Leith, Charles Kenneth, B.S., Ph.D., LL.D., D.Sc. 1926
Professor of Geology, University of Wisconsin.
Moraine, Old Sauk Road, Madison, Wis.

Leland, Waldo G., A.B., A.M., Litt.D., L.H.D. 1931
Historian, Director, American Council of
Learned Societies. 907 Fifteenth Street,
Washington, D. C.

Leuschner, Armin Otto, A.B., Ph.D., Sc.D., LL.D. 1924
Professor of Astronomy, Director Emeritus,
Students' Observatory, University of California.
1816 Scenic Avenue, Berkeley, Calif.

Levene, Phoebus A., M.D. 1923
Chemist, Rockefeller Institute for Medical Research.
129 East 82nd Street, New York, N. Y.

Leverett, Frank, B.Sc., Sc.D. 1924
Geologist (ret.), United States Geological Survey.
1724 South University Avenue, Ann Arbor, Mich.

Lewis, Gilbert Newton, A.B., A.M., Ph.D., D.Sc. 1918
Professor of Chemistry, Dean, College of Chemistry,
University of California, Berkeley, Calif.

Lillie, Frank Rattray, B.A., Ph.D., Sc.D. 1916
Andrew MacLeish Distinguished Service Professor
Emeritus of Embryology, University of Chicago.
5801 Kenwood Avenue, Chicago, Ill.

Lillie, Ralph Stayner, B.A., Ph.D., Sc.D. 1937
Professor of General Physiology, University of Chicago.
5545 Kenwood Avenue, Chicago, Ill.

Lingelbach, William E., B.A., Ph.D. 1916
Professor of Modern European History,
Dean of the College, University of Pennsylvania.
4304 Osage Avenue, Philadelphia, Pa.

	Date of Election
†**Lippincott, J. Bertram** Publisher, Chairman of the Board, J. B. Lippincott Company. 1712 Spruce Street, Philadelphia, Pa.	1921
Livingston, Burton E., B.S., Ph.D. Professor of Plant Physiology and Forest Ecology, Director, Laboratory of Plant Physiology, Johns Hopkins University, Baltimore, Md.	1933
Loeb, Leo, M.D. Professor Emeritus and Research Professor of Pathology, Washington University Medical School, St. Louis, Mo.	1910
Loomis, Alfred Lee, A.B., LL.B., D.Sc., M.Sc. Physicist, Director, Loomis Laboratories. Tuxedo Park, N. Y.	1930
Lovejoy, Arthur Oncken, A.B., A.M., LL.D. Professor of Philosophy, Johns Hopkins University. 827 Park Avenue, Baltimore, Md.	1932
Lovett, Edgar Odell, Ph.D., Sc.D., LL.D. Mathematician and Astronomer, President, The Rice Institute, Houston, Texas.	1904
Lowell, Abbott Lawrence, A.B., LL.B., Ph.D., Litt.D., LL.D. President Emeritus, Harvard University. 171 Marlborough Street, Boston, Mass.	1909
Lowes, John Livingston, Ph.D., LL.D., Litt.D., L.H.D. Francis Lee Higginson Professor Emeritus of English Literature, Harvard University. 984 Memorial Drive, Cambridge, Mass.	1934
Lydenberg, Harry Miller, L.H.D., Litt.D. Director, New York Public Library. 23 Park Road, Scarsdale, N. Y.	1939
Lyman, Theodore, A.M., Ph.D. Professor Emeritus of Physics, Director, Jefferson Laboratory, Harvard University, Cambridge, Mass.	1918
McClung, Clarence E., A.M., Ph.D. Professor of Zoology, Director, Zoological Laboratory, University of Pennsylvania, Philadelphia, Pa.	1913

† Deceased January 19, 1940.

Date of Election

McClure, Charles Freeman Williams, A.M., Sc.D. 1897
Professor Emeritus of Comparative Anatomy,
Princeton University, Princeton, N. J.

MacCurdy, George Grant, A.B., A.M., Ph.D. 1925
Professor Emeritus of Anthropology, Yale University;
Director, American School of Prehistoric Research,
Old Lyme, Conn.

McDaniel, Walton Brooks, A.B., A.M., Ph.D. 1917
Professor Emeritus of Latin Language and Literature,
University of Pennsylvania. 4082 Malaga Avenue,
Coconut Grove, Fla.

MacDougal, Daniel Trembly, M.A., Ph.D., LL.D. 1916
Director, Laboratory for Plant Physiology (ret.),
Carnegie Institution of Washington. Carmel, Calif.

Macfarlane, John Muirhead, B.S., Sc.D., LL.D., Litt.D. 1892
Professor Emeritus of Botany, University of Pennsylvania.
427 West Hansberry Street, Germantown,
Philadelphia, Pa.

MacNider, William de Berniere, M.D., Sc.D., LL.D. 1939
Kenan Research Professor, Dean, Medical School,
University of North Carolina, Chapel Hill, N. C.

McGregor, James Howard, B.S., M.A., Ph.D. 1929
Professor of Zoology, Columbia University,
New York, N. Y.

McIlwain, Charles Howard, A.M., Ph.D., LL.D. 1938
Eaton Professor of the Science of Government, Harvard
University. 48 Village Hill Road, Belmont, Mass.

Magie, William Francis, A.M., Ph.D., LL.D., D.Sc. 1896
Professor Emeritus of Physics, Princeton University.
118 Library Place, Princeton, N. J.

Manly, John Matthews, A.M., Ph.D., LL.D., Litt.D. 1912
Professor Emeritus of English, University of Chicago.
12 La Creciente, Route 2, Box 635, Tucson, Ariz.

Mark, Edward Laurens, A.M., Ph.D., LL.D. 1907
Professor Emeritus of Anatomy, Harvard University.
109 Irving Street, Cambridge, Mass.

Mason, William Smith, Ph.B., A.M., L.H.D., D.Litt. 1928
Man of Affairs, Collector of Frankliniana, University
Trustee. 1401 Ridge Avenue, Evanston, Ill.

Date of Election

Matthews, Albert, A.B. 1899
Modern Philologist and Historian.
19 St. Botolph Street, Boston, Mass.

Mees, Charles Edward Kenneth, D.Sc. 1937
Chemist, Vice-president in Charge of Research and Development, Eastman Kodak Company, Rochester, N. Y.

Meritt, Benjamin Dean, Ph.D., D.Litt., LL.D. 1938
Professor of Greek Epigraphy, Institute for Advanced Study, Princeton, N. J.

Merriam, Charles Edward, Ph.D., LL.D. 1935
Professor of Political Science, University of Chicago.
6041 University Avenue, Chicago, Ill.

Merriam, John C., B.S., Ph.D., Sc.D., LL.D. 1914
Paleontologist, President Emeritus, Carnegie Institution of Washington, Washington, D. C.

Merrill, Elmer Drew, B.S., M.S., Sc.D., LL.D. 1932
Professor of Botany, Administrator of Botanical Collections, Harvard University. Arnold Arboretum, Jamaica Plain, Mass.

Merrill, Paul Willard, Ph.D. 1939
Astronomer, Mount Wilson Observatory, Carnegie Institution of Washington. Pasadena, Calif.

Miller, Dayton Clarence, A.M., Sc.D., LL.D., D.Eng. 1919
Honorary Professor of Physics, Acting Head of the Department, Case School of Applied Science, Cleveland, Ohio.

Miller, Gerrit Smith, Jr., A.B. 1927
Zoologist, Curator of Mammals, United States National Museum, Washington, D. C.

Miller, Hunter, LL.B., LL.M., D.C.L. 1928
International Law, Editor of *The Treaties*, Department of State. Craiglands, R. M. D. 1, Victoria, B. C., Canada.

Miller, John Anthony, A.M., Ph.D., LL.D. 1915
Professor Emeritus of Astronomy, Director Emeritus, Sproul Observatory, Swarthmore College, Wallingford, Pa.

Date of Election

Millikan, Robert Andrews, Ph.D., LL.D., Sc.D. 1914
Director, Norman Bridge Laboratory of Physics, Chairman, Executive Council, California Institute of Technology, Pasadena, Calif.

Minot, George Richards, A.B., M.D., S.D. 1935
Professor of Medicine, Harvard University; Director, Thorndike Memorial Laboratory, and Visiting Physician, Boston City Hospital, Boston, Mass.

Mitchell, Howard Hawks, Ph.D. 1925
Professor of Mathematics, University of Pennsylvania. 416 Sycamore Avenue, Merion, Pa.

Mitchell, Samuel Alfred, Ph.D., LL.D. 1923
Professor of Astronomy, Director, Leander McCormick Observatory, University of Virginia, University, Va.

Mitchell, Wesley Clair, A.B., Ph.D., LL.D., D.Litt. 1931
Professor of Economics, Columbia University; Director of Research, National Bureau of Economic Research. 2 Horatio Street, New York, N. Y.

Montgomery, James Alan, A.B., Ph.D., S.T.D., Litt.D. 1925
Philologist, Formerly Director and President, American Schools of Oriental Research; Professor Emeritus of Hebrew, Graduate School, University of Pennsylvania. 6806 Greene Street, Germantown, Philadelphia, Pa.

Moore, George Thomas, A.M., Ph.D. 1905
Botanist, Director, Missouri Botanical Garden, St. Louis, Mo.

Moore, J. Percy, Ph.D. 1918
Professor Emeritus of Zoology, University of Pennsylvania, Philadelphia, Pa.

Moore, John Bassett, LL.D. 1907
International Law, Diplomatist, Member, Permanent Court of Arbitration (1912–28); Judge, Permanent Court of International Justice (1921–28). 960 Park Avenue, New York, N. Y.

Morey, Charles Rufus, A.M., L.H.D. Litt.D. 1938
Marquand Professor of Art and Archaeology, Princeton University, Princeton, N. J.

Date of Election

Morgan, Marshall S., A.B. 1933
President, Fidelity-Philadelphia Trust Company.
R.F.D. 2, Malvern, Pa.

Morgan, Thomas Hunt, B.S., Ph.D., D.Sc., LL.D. 1915
Zoologist, Director, Kerckhoff Laboratories of Biological Sciences, California Institute of Technology, Pasadena, Calif.

Morison, Samuel Eliot, Ph.D., M.A., Litt.D. 1937
Professor of History, Harvard University.
Harvard College Library 417, Cambridge, Mass.

Morris, Harrison Smith 1899
Author, Formerly Managing Director, Pennsylvania Academy of the Fine Arts. Chelten Avenue and York Road, Philadelphia, Pa.

Morris, Lawrence J., A.B. 1936
Man of Affairs, Secretary, Pennsylvania Hospital.
240 South 4th Street, Philadelphia, Pa.

Morris, Roland S., A.B., LL.B., LL.D., D.C.L., L.H.D. 1922
Lawyer, Diplomatist, Professor of International Law, University of Pennsylvania; United States Ambassador to Japan (1917–21). 1617 Land Title Building, Philadelphia, Pa.

Morse, Marston, Ph.D., Sc.D. 1936
Professor of Mathematics, Institute for Advanced Study, Princeton, N. J.

Moulton, Forest Ray, A.B., Ph.D., Sc.D., LL.D. 1916
Mathematician, Astronomer, Permanent Secretary, American Association for the Advancement of Science, Smithsonian Institution Building, Washington, D. C.

Moulton, Harold Glenn, Ph.D., LL.D. 1938
Economist, President, The Brookings Institution, 722 Jackson Place, N. W., Washington, D. C.

Murlin, John Raymond, B.S., A.M., Ph.D., Sc.D. 1932
Professor of Physiology, Director, Department of Vital Economics, University of Rochester, 260 Crittenden Boulevard, Rochester, N. Y.

Date of Election

Nitze, William Albert, Ph.D., L.H.D. 1936
Professor of Romance Languages and Literatures, University of Chicago, Chicago, Ill.

Noble, G. Kingsley, Ph.D. 1933
Zoologist, Curator of Herpetology and of Experimental Biology, American Museum of Natural History, New York, N. Y.

Norris, George Washington 1937
Banker, Formerly Governor, Philadelphia Federal Reserve Bank. Land Title Building, Philadelphia, Pa.

Norris, George William, B.A., M.D. 1922
Physician, Author, Chief, Medical Service "A," Pennsylvania Hospital. Dimock, Susquehanna County, Pa.

Northrop, John Howard, M.A., Ph.D., D.Sc., LL.D. 1938
Biochemist, Rockefeller Institute for Medical Research, Princeton, N. J.

Novy, Frederick G., Sc.D., M.D., LL.D. 1934
Dean Emeritus, Medical School, Professor Emeritus of Bacteriology, University of Michigan, Ann Arbor, Mich.

Noyes, William Albert, A.B., B.S., Ph.D., LL.D., Chem.D., D.Sc. 1914
Professor Emeritus of Chemistry, University of Illinois, Urbana, Ill.

Olivier, Charles P., M.A., Ph.D. 1932
Professor of Astronomy; Director, Flower Observatory, University of Pennsylvania, Upper Darby, Pa.

O'Neill, Eugene Gladstone, Litt.D. 1935
Author, Playwright. Danville, Contra Costa County, Calif.

Osgood, William Fogg, A.M., Ph.D., LL.D. 1915
Professor Emeritus of Mathematics, Harvard University. 10 Dorset Road, Belmont, Mass.

Osterhout, Winthrop John Vanleuven, A.M., Ph.D., Sc.D. 1917
Physiologist, Rockefeller Institute for Medical Research, 66th Street and York Avenue, New York, N. Y.

Packard, Francis Randolph, M.D., LL.D. 1933
Physician, Author. 304 South 19th Street, Philadelphia, Pa.

Date of Election

Painter, Theophilus Shickel, Ph.D., Sc.D. 1939
Professor of Zoology, University of Texas.
610 West 33rd Street, Austin, Texas.

Parker, George Howard, Sc.D. 1911
Professor Emeritus of Zoology, Harvard University.
16 Berkeley Street, Cambridge, Mass.

Paton, Stewart, M.A., M.D. 1914
Psychiatrist, Author. Baltimore, Md.

Patterson, Ernest Minor, A.B., A.M., Ph.D., LL.D. 1932
Professor of Economics, University of Pennsylvania.
404 South 47th Street, Philadelphia, Pa.

Patterson, Lamar Gray 1898
Chemist. Perdido Beach, Ala.

Paul, J. Rodman, A.M. 1899
Lawyer. 1830 Land Title Building, Philadelphia, Pa.

Pauling, Linus Carl, Ph.D., Sc.D. 1936
Professor of Chemistry, Chairman, Division of Chemistry and Chemical Engineering, Director, Gates and Crellin Laboratories of Chemistry, California Institute of Technology, Pasadena, Calif.

Pearl, Raymond, Ph.D., Sc.D., LL.D., Litt.D. 1915
Professor of Biology, Johns Hopkins School of Hygiene and School of Medicine. 1901 East Madison Street, Baltimore, Md.

Pender, Harold, A.B., Ph.D., Sc.D. 1917
Dean, Moore School of Electrical Engineering, University of Pennsylvania; Consulting Engineer, Philadelphia, Pa.

Penniman, Josiah Harmar, A.B., Ph.D., LL.D., Litt.D., L.H.D. 1901
Professor of English Literature, Provost Emeritus, University of Pennsylvania, Philadelphia, Pa.

Pepper, George Wharton, B.A., LL.B., LL.D., D.C.L. 1897
Lawyer, United States Senator (1922–27);
Formerly Professor of Law, University of Pennsylvania.
2231 Land Title Building, Philadelphia, Pa.

Date of Election

Pepper, William, A.B., M.D., Sc.D. 1937
Dean, School of Medicine, University of Pennsylvania.
Prospect Avenue, Melrose Park, Philadelphia, Pa.

Perry, Ralph Barton, Ph.D., Litt.D., L.H.D. 1939
Professor of Philosophy, Harvard University.
445 Widener Library, Cambridge, Mass.

Phelps, William Lyon, Ph.D., Litt.D., L.H.D., LL.D., D.D., D.S.T. 1927
Author, Professor Emeritus of English Literature,
Yale University. 110 Whitney Avenue, New Haven, Conn.

Prince, John Dyneley, B.A., Ph.D. 1913
Orientalist and Comparative Philologist, Professor
Emeritus of East European Languages,
Columbia University, New York, N. Y.

Putnam, Herbert, Litt.D., LL.D. 1937
Librarian of Congress Emeritus, Washington, D. C.

Rand, Edward Kennard, A.B., A.M., Ph.D., Litt.D., LL.D. 1925
Pope Professor of Latin, Harvard University.
107 Lake View Avenue, Cambridge, Mass.

Ravenel, Mazÿck P., M.D. 1901
Physician, Editor-in-Chief, *American Journal of Public Health*. University of Missouri, Columbia, Mo.

Read, Conyers, A.B., Ph.D., B.Litt., Litt.D. 1934
Professor of English History, University of Pennsylvania.
226 South 16th Street, Philadelphia, Pa.

Reese, Charles Lee, Ph.D., Sc.D. 1922
Chemist, Director, E. I. du Pont de Nemours & Company.
1600 Brinckle Avenue, Wilmington, Del.

Reeves, Jesse S., Ph.D., L.H.D., LL.D. 1934
Professor of Political Science, University of Michigan.
1945 Cambridge Road, Ann Arbor, Mich.

Reid, Harry Fielding, C.E., A.B., Ph.D. 1910
Professor Emeritus of Dynamical Geology and
Geography, Johns Hopkins University, Baltimore, Md.

Repplier, Agnes, Litt.D. 1928
Author. 920 Clinton Street, Philadelphia, Pa.

Date of Election

Rhoads, Charles James, A.B. 1921
Banker (ret.), Trustee, Bryn Mawr College, Haverford College. Bryn Mawr, Pa.

Richards, Alfred Newton, Ph.D., Sc.D., M.D., LL.D. 1935
Professor of Pharmacology, University of Pennsylvania. 6 Rugby Road, Bryn Mawr, Pa.

Richards, Horace Clark, A.B., Ph.D. 1907
Professor Emeritus of Mathematical Physics, University of Pennsylvania. 509 Woodland Terrace, Philadelphia, Pa.

Riddle, Oscar, A.B., Ph.D., LL.D. 1926
Physiologist, Carnegie Institution, Station for Experimental Evolution, Cold Spring Harbor, Long Island, N. Y.

Roberts, Owen J., A.B., LL.B., LL.D., D.C.L. 1934
Associate Justice, Supreme Court of the United States, Washington, D. C.

Robinson, David Moore, Ph.D., LL.D., L.H.D., Litt.D. 1936
Professor of Archaeology and Epigraphy, Lecturer in Greek Literature, Johns Hopkins University, Baltimore, Md.

Rockefeller, John D., Jr., A.B., A.M., LL.D. 1931
Administrator, Trustee, Rockefeller Institute for Medical Research; Chairman of the Board, Rockefeller Foundation. 30 Rockefeller Plaza, New York, N. Y.

Rolfe, John Carew, Ph.D., Litt.D. 1907
Professor Emeritus of Latin, University of Pennsylvania. 4014 Pine Street, Philadelphia, Pa.

Rosenbach, A. S. W., B.S., Ph.D., D.F.A. 1928
Author, Bibliographer, President, Gratz College. 1320 Walnut Street, Philadelphia, Pa.

Rostovtzeff, Michael I., Ph.D., LL.D. 1929
Director of Archaeological Research, Yale University. 470 Whitney Avenue, New Haven, Conn.

Rous, Peyton, M.D., D.Sc. 1939
Member, Rockefeller Institute for Medical Research. 125 East 72nd Street, New York, N. Y.

Date of Election

Rowe, Leo S., A.B., Ph.B., Ph.D., LL.D. 1911
Director General, Pan-American Union,
Washington, D. C.

Russell, Henry Norris, A.M., Ph.D., D.Sc. 1913
Professor of Astronomy, Director, Princeton University
Observatory. 79 Alexander Street, Princeton, N. J.

Ruthven, Alexander G., B.S., Ph.D., LL.D., Sc.D. 1931
Zoologist, President, University of Michigan,
Ann Arbor, Mich.

Sanders, Henry A., A.B., A.M., Ph.D. 1932
Professor Emeritus of Latin, University of Michigan.
2037 Geddes Avenue, Ann Arbor, Mich.

Sarton, George A. L., D.Sc., L.H.D., LL.D. 1934
Historian of Science, Editor of *Isis*.
Harvard Library 185, Cambridge, Mass.

Scattergood, J. Henry, A.B. 1931
Man of Affairs, Treasurer, Haverford College,
Bryn Mawr College. Villa Nova, Pa.

Schaeffer, J. Parsons, A.M., M.D., Ph.D., Sc.D. 1927
Professor of General Anatomy, Director, Daniel Baugh
Institute of Anatomy, Jefferson Medical College.
4634 Spruce Street, Philadelphia, Pa.

Schelling, Felix E., Ph.D., Litt.D., LL.D. 1902
Professor Emeritus of English Literature,
University of Pennsylvania. Lumberville, Pa.

Schlesinger, Frank, B.S., M.S., M.A., Ph.D., Sc.D. 1912
Director, Yale University Observatory.
New Haven, Conn.

Schramm, Jacob Richard, A.B., Ph.D. 1932
Professor of Botany, Director, Department of
Botany, Director, Morris Arboretum,
University of Pennsylvania, Philadelphia, Pa.

Schuchert, Charles, M.A., LL.D., Sc.D. 1913
Professor Emeritus of Paleontology, Yale University.
Yale Station, New Haven, Conn.

Schultz, Adolph H. 1936
Associate Professor of Physical Anthropology, School of
Medicine, Johns Hopkins University, Baltimore, Md.

Date of Election

Schurman, Jacob Gould, A.B., A.M., Sc.D., Ph.D., LL.D. 1908
Administrator, Diplomatist, President, Cornell University (1892–1920); United States Minister to China (1921–25); United States Ambassador to Germany (1925–30). 1 West 54th Street, New York, N. Y.

Scott, James Brown, A.B., A.M., J.U.D., LL.D. 1930
Secretary, Carnegie Endowment for International Peace. 700 Jackson Place, N.W., Washington, D. C.

Scott, John Morin, A.B. 1926
Lawyer. 1903 Spruce Street, Philadelphia, Pa.

Scott, William Berryman, M.A., Ph.D., Sc.D., LL.D. 1886
Professor Emeritus of Geology and Paleontology, Princeton University. 7 Cleveland Lane, Princeton, N. J.

Seares, Frederick Hanley, B.S., LL.D. 1917
Astronomer, Assistant Director, Mount Wilson Observatory, Pasadena, Calif.

See, Thomas Jefferson Jackson, A.M., Lt.M., Sc.M., Ph.D., D.Sc. 1897
Physicist, Astronomer, Geometer, Professor of Mathematics, United States Navy (ret.). 614 Ohio Street, Vallejo, Calif.

Setchell, William Albert, A.M., Ph.D. 1919
Professor Emeritus of Botany, University of California, Berkeley, Calif.

Seymour, Charles, Ph.D., Litt.D., LL.D., L.H.D. 1939
Professor of History and President, Yale University. 43 Hillhouse Avenue, New Haven, Conn.

Shapley, Harlow, A.M., Ph.D., LL.D., Sc.D. 1922
Astronomer, Director, Harvard College Observatory, Cambridge, Mass.

Shear, Theodore Leslie, Ph.D., L.H.D. 1939
Professor of Classical Archaeology, Princeton University, Princeton, N. J.

Shotwell, James Thomson, Ph.D., LL.D. 1936
Professor of History, Columbia University; Trustee and Director, Division of Economics and History, Carnegie Endowment for International Peace. 405 West 117th Street, New York, N. Y.

Date of Election

Shull, George Harrison, B.S., Ph.D. 1918
Professor of Botany and Genetics, Princeton University.
60 Jefferson Road, Princeton, N. J.

Simpson, George Gaylord, Ph.D. 1936
Associate Curator of Vertebrate Paleontology,
American Museum of Natural History, New York, N. Y.

Singer, Edgar Arthur, Jr., B.S., Ph.D. 1925
Professor of Philosophy, University of Pennsylvania.
4224 Chester Avenue, Philadelphia, Pa.

Sinnott, Edmund Ware, Ph.D. 1939
Professor of Botany, Columbia University.
Schermerhorn Hall, Columbia University,
New York, N. Y.

Sioussat, St. George Leakin, Ph.D. 1928
Chief, Division of Manuscripts, Incumbent, Chair of
American History, Library of Congress,
Washington, D. C.

Slipher, Vesto Melvin, A.M., Ph.D., LL.D., Sc.D. 1921
Astronomer, Director, Lowell Observatory,
Flagstaff, Ariz.

Smith, Preserved, A.M., Ph.D., Litt.D. 1937
Professor of History, Cornell University.
156 Cascadilla Park, Ithaca, N. Y.

Smyth, Charles Phelps, Ph.D. 1932
Professor of Chemistry, Princeton University.
22 Morven Street, Princeton, N. J.

Spoehr, Herman Augustus, Ph.D., Sc.D. 1931
Chairman, Division of Plant Biology, Carnegie Institution
of Washington, Stanford University, Calif.

Sprague, Oliver Mitchell Wentworth, A.M., Ph.D., Litt.D. 1938
Edmund Cogswell Converse Professor of Banking and
Finance, Harvard Graduate School of Business,
Soldier's Field, Boston, Mass.

Stebbins, Joel, Ph.D., Sc.D. 1925
Professor of Astronomy, Director, Washburn Observatory,
University of Wisconsin, Madison, Wis.

Date of Election

Stefansson, Vilhjalmur, Ph.D., LL.D. 1923
Arctic Explorer, Geographer and Adviser on Northern Operations to Pan-American Airways.
67 Morton Street, New York, N. Y.

Stillwell, Lewis Buckley, Sc.D. 1898
Electrical Engineer. Elm Road, Princeton, N. J.

Stone, Harlan Fiske, LL.B., LL.D. 1939
Associate Justice, Supreme Court of the United States. 2340 Wyoming Avenue, Washington, D. C.

Struve, Otto, Ph.D., Sc.D. 1937
Professor of Astrophysics, University of Chicago; Director, Yerkes Observatory, Williams Bay, Wis.

Sturtevant, Alfred Henry, Ph.D. 1936
Professor of Genetics, California Institute of Technology, Pasadena, Calif.

Sturtevant, Edgar Howard, Ph.D., L.H.D. 1939
Professor of Linguistics, Yale University.
408 Whitney Avenue, New Haven, Conn.

Sumner, Francis Bertody, Ph.D. 1938
Professor of Biology, Scripps Institution of Oceanography, University of California, La Jolla, Calif.

Swann, William Francis Gray, M.A., D.Sc. 1926
Physicist, Director, Bartol Research Foundation, Whittier Place, Swarthmore, Pa.

Tatlock, J. S. P., Ph.D., Litt.D., LL.D. 1937
Professor of English, University of California.
1994 San Antonio Street, Berkeley, Calif.

Taussig, Frank W., A.B., Ph.D., LL.B., Litt.D., LL.D. 1929
Professor Emeritus of Economics,
Harvard University, Cambridge, Mass.

Taylor, Deems, A.B., Mus.D., Litt.D. 1934
Musician, Composer, Writer. The Haviland Road, Stamford, Conn.

Taylor, Henry Osborn, A.B., LL.B., D.Litt., L.H.D. 1926
Author, Historian. 135 East 66th Street, New York, N. Y.

Date of Election

Taylor, Hugh Stott, D. Sc., LL.D. 1928
David B. Jones Professor of Chemistry, Chairman, Department of Chemistry, Princeton University. 115 Broadmead, Princeton, N. J.

Tennent, David Hilt, Ph.D. 1938
Research Professor of Biology, Bryn Mawr College. 818 Summit Grove Avenue, Bryn Mawr, Pa.

Thorndike, Edward L., A.B., A.M., Ph.D., Sc.D., LL.D. 1930
Professor of Educational Psychology, Teachers College, Columbia University, New York, N. Y.

Thorndike, Lynn, Ph.D., L.H.D. 1939
Professor of History, Columbia University, New York, N. Y.

Timoshenko, Stephen P., D.Sc. 1939
Professor of Theoretical and Applied Mechanics, Stanford University. 536 West Crescent Drive, Palo Alto, Calif.

Tolman, Richard Chace, Ph.D. 1932
Professor of Physical Chemistry and Mathematical Physics, California Institute of Technology, Pasadena, Calif.

Tozzer, Alfred Marston, A.B., A.M., Ph.D. 1937
Professor of Anthropology, Harvard University. 7 Bryant Street, Cambridge, Mass.

Trelease, William, Sc.D., LL.D. 1903
Professor Emeritus of Botany, University of Illinois, Urbana, Ill.

True, Rodney H., M.S., Ph.D. 1923
Professor Emeritus of Botany, Director (ret.), Morris Arboretum, University of Pennsylvania, Philadelphia, Pa.

Tucker, Richard Hawley, C.E., Sc.D. 1908
Astronomer, Formerly of Lick Observatory. 1525 Waverly Street, Palo Alto, Calif.

Tyzzer, Ernest Edward, Ph.B., A.M., M.D., Sc.D. 1931
Professor of Comparative Pathology and Tropical Medicine, Harvard Medical School, Wakefield, Mass.

Date of Election

Urey, Harold Clayton, Ph.D., D.Sc., N.L. 1935
Professor of Chemistry, Executive Officer of the Department, Columbia University.
355 Highwood Avenue, Leonia, N. J.

Van Vleck, John Hasbrouck, Ph.D. 1939
Professor of Mathematical Physics,
Harvard University, Cambridge, Mass.

Van Slyke, Donald Dexter, Ph.D., Sc.D., M.D. 1938
Biochemist, Rockefeller Institute for Medical Research,
66th Street and York Avenue, New York, N. Y.

†Vauclain, Samuel M., Sc.D. 1899
Engineer, Chairman of the Board, Baldwin Locomotive Works. 123 South Broad Street, Philadelphia, Pa.

Vaughan, Thomas Wayland, B.Sci., A.M., Ph.D., LL.D. 1923
Director Emeritus, Scripps Institution of Oceanography; Principal Scientist (ret.), United States Geological Survey; Associate, United States National Museum.
3333 P Street, Washington, D. C.

Veblen, Oswald, A.B., Ph.D., D.Sc. 1912
Professor of Mathematics, Institute for Advanced Study.
58 Battle Road, Princeton, N. J.

von Neumann, John, Ph.D., C.E. 1938
Professor of Mathematics, Institute for Advanced Study.
Fine Hall, Princeton, N. J.

Warren, Charles, A.B., A.M., LL.D. 1939
Lawyer. 710 Mills Building, Washington, D. C.

Warren, Charles Hyde, Ph.B., Ph.D. 1928
Dean, Sheffield Scientific School, Professor of Geology, Yale University. 100 High Street, New Haven, Conn.

Webster, David Locke, A.B., Ph.D. 1922
Professor and Executive Head, Department of Physics, Stanford University, Calif.

Wetherill, Samuel Price, B.S., LL.D. 1933
Engineer. 1203 Morris Building, Philadelphia, Pa.

† Deceased February 4, 1940.

Date of Election

Wetmore, Alexander, A.B., M.S., Ph.D., D.Sc. 1930
Zoologist, Assistant Secretary, Smithsonian Institution; In Charge, United States National Museum, Washington, D. C.

Weyl, Hermann 1935
Professor of Mathematics, Institute for Advanced Study. Fine Hall, Princeton, N. J.

Whipple, George Hoyt, M.D., M.A., D.Sc., LL.D. 1938
Professor of Pathology, Dean, School of Medicine and Dentistry, University of Rochester. 320 Westminster Road, Rochester, N. Y.

Whitney, Willis R., S.B., Ph.D., Sc.D., Ch.D., LL.D. 1931
Chemist, Vice-president in Charge of Research, General Electric Company, Schenectady, N. Y.

Willis, Bailey, E.M., C.E., Ph.D. 1905
Professor Emeritus of Geology, Stanford University, Calif.

Willits, Joseph Henry, A.M., Ph.D., LL.D. 1938
Director for the Social Sciences, Rockefeller Foundation, 49 West 49th Street, New York, N. Y.

Wilson, Edwin Bidwell, A.B., Ph.D. 1917
Professor of Vital Statistics, Harvard School of Public Health. 55 Shattuck Street, Boston, Mass.

Wilson, George Grafton, Ph.D., LL.D. 1936
Professor Emeritus of International Law, Harvard University, Cambridge, Mass.

Wilson, Harold Albert, M.A., M.Sc., D.Sc. 1914
Professor of Physics, The Rice Institute, Houston, Texas

Winlock, Herbert Eustis, Art.D., Litt.D. 1939
Director Emeritus and Formerly Curator, Egyptian Department, Metropolitan Museum of Art, New York, N. Y.

Wissler, Clark, A.M., Ph.D., LL.D. 1924
Curator of Anthropology, American Museum of Natural History, New York, N. Y.

Witmer, Lightner, A.M., Ph.D. 1897
Professor Emeritus of Psychology, University of Pennsylvania. Box 186, Devon, Pa.

Date of Election

Woodworth, Robert Sessions, A.B., A.M., Ph.D., Sc.D., LL.D. 1936
Professor of Psychology, Columbia University,
New York, N. Y.

Wright, Frederick E., Ph.D. 1914
Petrologist, Geophysical Laboratory, Carnegie Institution of Washington. 2134 Wyoming Avenue, Washington, D. C.

Wright, Sewall, B.S., M.S., Sc.D. 1932
Ernest D. Burton Distinguished Service
Professor of Zoology, University of Chicago.
5762 Harper Avenue, Chicago, Ill.

Wright, William Hammond, D.Sc. 1935
Astronomer, Director, Lick Observatory,
Mount Hamilton, Calif.

Yeatman, Pope, E.M., D.E. 1920
Mining Engineer. 165 Broadway, New York, N. Y.

Yerkes, Robert Mearns, Ph.D., D.Sc., LL.D. 1936
Director, Yale Laboratories of Primate Biology;
Professor of Psychobiology, Yale University,
333 Cedar Street, New Haven, Conn.

Young, James Thomas, Ph.D. 1933
Political Scientist, Professor of Public Administration,
University of Pennsylvania, Philadelphia, Pa.

Young, Owen D., A.B., D.H.L., LL.B., Litt.D., D.C.S. 1929
Lawyer, Honorary Chairman, General Electric Company.
570 Lexington Avenue, New York, N. Y.

Zeleny, John, M.A., Ph.D. 1915
Professor of Physics, Yale University.
44 Cold Spring Street, New Haven, Conn.

Zinsser, Hans, M.D., Sc.D. 1937
Professor of Bacteriology and Immunology, Harvard
Medical School. 52 Chestnut Street, Boston, Mass.

Total Resident Members—423

December 31, 1939.

FOREIGN MEMBERS

	Date of Election
Adams, Frank Dawson, Ph.D., D.Sc., LL.D., F.R.S. Geologist, Vice-principal Emeritus, McGill University, Montreal, Canada.	1916
Adrian, Edgar Douglas, M.A., M.D., Sc.D., LL.D., F.R.S. Professor of Physiology, Cambridge University. St. Chad's, Grange Road, Cambridge, England.	1938
Beneš, Eduard, Ph.D., LL.D. Formerly President, Czechoslovak Republic; Professor, University of Chicago, Chicago, Ill.	1939
†Brögger, Waldemar Christofer, LL.D., D.Sc., F.R.S., Ph.D. Formerly Professor of Mineralogy and Geology, Oslo University, Oslo, Norway.	1899
Dale, Sir Henry Hallett, M.D., D.Sc., LL.D., F.R.S. Director, National Institute for Medical Research. Mt. Vernon House, Hampstead, London, N.W.3, England.	1939
de Broglie, Prince Louis Victor, D.Sc. Professor of Theoretical Physics, University of Paris. 94 Rue Perronet, Neuilly-sur-Seine, France.	1939
Debye, Peter Director, Kaiser Wilhelm-Institut für Physik, Berlin-Dahlem, Harnackstrasse, Germany.	1936
Dirac, Paul Adrien Maurice, Ph.D., F.R.S. Lucasian Professor of Mathematics, Cambridge University. St. John's College, Cambridge, England.	1938
Eddington, Sir Arthur Stanley, M.A., B.Sc., D.Sc., LL.D., F.R.S. Astronomer, Director, The Observatory, Cambridge, England.	1931
Evans, Sir Arthur, Kt., M.A., D.Litt., LL.D., F.R.S., F.B.A. Extraordinary Professor of Prehistoric Archaeology, Oxford University. Youlbury, Oxford, England.	1913

† Deceased February 17, 1940.

	Date of Election
Gooch, George Peabody, D.Litt. Honorary Fellow, Trinity College, Cambridge University. 76 Campden Hill Road, London, W.8, England.	1939
Hardy, Godfrey Harold, D.Sc., LL.D., D.Phil. Sadleirian Professor of Pure Mathematics, University of Cambridge; Fellow, Trinity College, Cambridge, England.	1939
Heisenberg, Werner, Ph.D. Professor of Theoretical Physics, University of Leipzig. Bozenerweg 14, Leipzig, Germany.	1937
Hilbert, David Professor of Mathematics, University of Göttingen. Wilhelm-Weber-Strasse, Göttingen, Germany.	1932
Hill, Archibald Vivian, Sc.D., LL.D., M.D. Physiologist, Foulerton Research Professor and Secretary of the Royal Society. University of London, University College, Gower Street, London, W.C.1, England.	1938
Hjort, Johan, Ph.D., Sc.D. Professor of Marine Biology, Oslo University, Oslo, Norway.	1939
Hopkins, Sir Frederick Gowland, M.A., M.B., D.Sc., LL.D., D.C.L., F.R.S. Physiologist, Professor of Biochemistry, University of Cambridge. Saxmeadham, Grange Road, Cambridge, England.	1937
Hu Shih, A.B., Ph.D., LL.D., Litt.D., L.H.D. Philosopher, Professor and Dean, College of Letters, National University of Peking, Peiping; Chinese Ambassador to United States. Chinese Embassy, Washington, D. C.	1936
Irvine, Sir James Colquhoun, C.B.E., Ph.D., Sc.D., LL.D., D.C.L., F.R.S. Chemist, Principal and Vice-chancellor, University of St. Andrews, Fifeshire, Scotland.	1933
Keith, Sir Arthur, Kt., F.R.S., M.D., D.Sc., F.R.C.S., LL.D. Anthropologist, Master, Buckston Browne Research Farm, Downe, Farnborough, Kent, England.	1931

Date of Election

Keith, Arthur Berriedale, D.C.L., D.Litt., LL.D. 1935
Barrister at Law, Advocate and Orientalist, Regius Professor of Sanskrit and Comparative Philology, Lecturer on the Constitution of the British Empire, University of Edinburgh, Edinburgh, Scotland.

Kenyon, Sir Frederic George, M.A., D.Litt., LL.D., L.H.D., Ph.D. 1937
Archaeologist and Philologist, Secretary, British Academy; Formerly President, London Society of Antiquaries; Formerly Director, British Museum. Kirkstead, Godstone, Surrey, England.

Larmor, Sir Joseph, Kt., M.A., Sc.D., LL.D., D.C.L., F.R.S. 1913
Physicist, Professor Emeritus of Mathematics, Cambridge University; Fellow, St. John's College. Holywood, Northern Ireland.

Lodge, Sir Oliver Joseph, Kt., Sc.D., LL.D., F.R.S. 1901
Physicist, Formerly Principal, University of Birmingham, Normanton, Lake, Salisbury, England.

de Margerie, Emmanuel 1932
Geologist, Formerly President, Geological Society of France. 110 Rue du Bac, Paris VII, France.

Nilsson, Martin P., Ph.D. 1939
Professor of Classical Archaeology and Ancient History, University of Lund. Bredgatan 25, Lund, Sweden.

Penck, Albrecht F. K., Ph.D., Sc.D. 1908
Professor Emeritus of Geography, University of Berlin. Meierottostrasse 511, Berlin W15, Germany.

Petrie (William Matthew), Sir Flinders, Kt., D.C.L., Litt.D., LL.D., Ph.D., F.R.S., F.S.A. 1905
Professor Emeritus of Egyptology, University College, London; Founder, British School of Egyptian Archaeology. Care American Schools of Oriental Research, Jerusalem, Palestine.

Picard, Emile, Sc.D. 1910
Mathematician, Permanent Secretary, Academy of Sciences; Professor, Paris University. 25 Quai Conti, Paris (vi), France.

Date of Election

Planck, Max, Ph.D., M.D., D.Sc. 1933
Professor of Physics, University of Berlin, Berlin, Germany.

Plaskett, John Stanley, C.B.E., B.A., D.Sc., LL.D., F.R.S. 1930
Director (ret.), Dominion Astrophysical Observatory. 318 Armit Street, Esquimalt, Victoria, B. C., Canada.

Prain, Sir David, Kt., M.A., M.B., LL.D., F.R.S. 1917
Botanist, Formerly Trustee, British Museum and Director, Royal Botanic Gardens, Kew. The Well Farm, Whyteleafe, Surrey, England.

Richardson, Sir Owen Willans, Kt., M.A., D.Sc., LL.D., F.R.S. 1910
Physicist, Yarrow Research Professor of the Royal Society; Director of Research in Physics, Kings College, London. Chandos Lodge, Alton, Hants, England.

Rist, Charles, LL.D. 1938
Professor of Political Economy, University of Paris. 18 bis, Rue du Parc de Clagny, Versailles, France.

Spemann, Hans, Ph.D., Sc.D. 1937
Professor of Zoology, Freiburg University. Freiburg, I.B., Mercystrasse 35, Germany.

Stein, Sir Aurel, Ph.D., D.Litt., D.Sc., D.O.L. 1939
Archaeologist and Geographer. Srinagar, Kashmir.

Szombathy, Josef Hofrat 1886
Anthropologist. Vienna XIX, Obkirchergasse 15, Germany.

Temperley, Harold William Vazeille, M.A., Litt.D. 1938
Professor of Modern History, Cambridge University; Master of Peterhouse, Cambridge, England.

Thomson, Sir Joseph John, O.M., Kt., M.A., Sc.D., Ph.D., LL.D., F.R.S. 1903
Physicist, Master, Trinity College. Trinity Lodge, Cambridge, England.

Volterra, Vito, Ph.D., Sc.D., LL.D., Math.Dr., Phys.Dr. 1914
Professor of Mathematics, Universities of Pisa, Turin and Rome. Via in Lucina 17, Rome, Italy.

Wilkins, Sir Hubert, Kt., M.C., F.R.G.S., M.B.O.U. 1930
Geographer. Royal Society's Club, St. James, London, England.

Total Foreign Members—41

December 31, 1939.

CLASSIFIED LIST OF MEMBERS

CLASS I. MATHEMATICAL AND PHYSICAL SCIENCES

Mathematics

Alexander, James W. . . . . Princeton, N. J.
Bateman, Harry . . . . Pasadena, Calif.
Bell, Eric Temple . . . . Pasadena, Calif.
Birkhoff, George David . . . . Cambridge, Mass.
Bliss, Gilbert Ames . . . . Chicago, Ill.
Coble, Arthur Byron . . . . Urbana, Ill.
Dirac, Paul Adrien Maurice . . . . Cambridge, England
Dresden, Arnold . . . . Swarthmore, Pa.
Eisenhart, Luther Pfahler . . . . Princeton, N. J.
Hardy, Godfrey Harold . . . . Cambridge, England
Henderson, Robert . . . . Crown Point, N. Y.
Hilbert, David . . . . Göttingen, Germany
Huntington, Edward Vermilye . . . . Cambridge, Mass.
Lefschetz, Solomon . . . . Princeton, N. J.
Lovett, Edgar Odell . . . . Houston, Texas
Mitchell, Howard Hawks . . . . Merion, Pa.
Morse, Marston . . . . Princeton, N. J.
Osgood, William Fogg . . . . Belmont, Mass.
Picard, Emile . . . . Paris, France
Veblen, Oswald . . . . Princeton, N. J.
Volterra, Vito . . . . Rome, Italy
von Neumann, John . . . . Princeton, N. J.
Weyl, Hermann . . . . Princeton, N. J.

Astronomy

Abbot, Charles Greeley . . . . Washington, D. C.
Adams, Walter Sydney . . . . Pasadena, Calif.
Aitkin, Robert Grant . . . . Berkeley, Calif.
Cannon, Annie J. . . . . Cambridge, Mass.
Cook, Gustavus Wynne . . . . Wynnewood, Pa.
Curtis, Heber Doust . . . . Ann Arbor, Mich.
Dugan, Raymond Smith . . . . Princeton, N. J.

Eddington, Arthur Stanley..................Cambridge, England
Gaposchkin, Cecilia Payne......................Cambridge, Mass.
Hubble, Edwin P..............................Pasadena, Calif.
Lampland, Carl O............................Flagstaff, Ariz.
Leuschner, Armin Otto........................Berkeley, Calif.
Merrill, Paul Willard........................Pasadena, Calif.
Miller, John Anthony.........................Wallingford, Pa.
Mitchell, Samuel Alfred......................University, Va.
Moulton, Forest Ray........................Washington, D. C.
Olivier, Charles P..........................Upper Darby, Pa.
Plaskett, John Stanley..................Victoria, B. C., Canada
Rous, Peyton...............................New York, N. Y.
Russell, Henry Norris........................Princeton, N. J.
Schlesinger, Frank.........................New Haven, Conn.
Seares, Frederick Hanley.....................Pasadena, Calif.
Shapley, Harlow............................Cambridge, Mass.
Slipher, Vesto Melvin........................Flagstaff, Ariz.
Stebbins, Joel..............................Madison, Wis.
Struve, Otto..............................Williams Bay, Wis.
Tucker, Richard Hawley.......................Palo Alto, Calif.
Wright, William Hammond.................Mt. Hamilton, Calif.

Physics

Adams, Edwin Plimpton........................Princeton, N. J.
Anderson, Carl David.........................Pasadena, Calif.
Beams, Jesse Wakefield.......................University, Va.
Bridgman, Percy Williams....................Cambridge, Mass.
Briggs, Lyman J............................Washington, D. C.
Compton, Arthur Holly..........................Chicago, Ill.
Compton, Karl Taylor........................Cambridge, Mass.
Coolidge, William David....................Schenectady, N. Y.
Crew, Henry...................................Evanston, Ill.
Darrow, Karl Kelchner........................New York, N. Y.
Davisson, Clinton J..........................New York, N. Y.
de Broglie, Louis Victor...............Neuilly-sur-Seine, France
Debye, Peter................................Berlin, Germany
Dempster, Arthur Jeffrey.......................Chicago, Ill.
Einstein, Albert.............................Princeton, N. J.
Fermi, Enrico...............................New York, N. Y.
Foote, Paul Darwin..........................Pittsburgh, Pa.
Franck, James..................................Chicago, Ill.
Goodspeed, Arthur Willis....................Philadelphia, Pa.
Heisenberg, Werner..........................Leipzig, Germany
Humphreys, William Jackson................Washington, D. C.

Ives, Herbert E. . . . . Montclair, N. J.
Larmor, Joseph . . . . Holywood, Northern Ireland
Lawrence, Ernest Orlando . . . . Berkeley, Calif.
Lodge, Oliver Joseph . . . . Salisbury, England
Loomis, Alfred Lee . . . . Tuxedo Park, N. Y.
Lyman, Theodore . . . . Cambridge, Mass.
Magie, William Francis . . . . Princeton, N. J.
Miller, Dayton Clarence . . . . Cleveland, Ohio
Millikan, Robert Andrews . . . . Pasadena, Calif.
Planck, Max . . . . Berlin, Germany
Richards, Horace Clark . . . . Philadelphia, Pa.
Richardson, Owen Willans . . . . Alton, Hants, England
See, Thomas Jefferson Jackson . . . . Vallejo, Calif.
Swann, William Francis Gray . . . . Swarthmore, Pa.
Thomson, Joseph John . . . . Cambridge, England
Tolman, Richard Chace . . . . Pasadena, Calif.
Van Vleck, John Hasbrouck . . . . Cambridge, Mass.
Webster, David Locke . . . . Stanford University, Calif.
Wilson, Harold Albert . . . . Houston, Texas
Zeleny, John . . . . New Haven, Conn.

Chemistry

Adams, Roger . . . . Urbana, Ill.
Andrews, Donald Hatch . . . . Baltimore, Md.
Baekeland, Leo H. . . . . New York, N. Y.
Bancroft, Wilder Dwight . . . . Ithaca, N. Y.
deBenneville, James S. . . . . Philadelphia, Pa.
Bogert, Marston Taylor . . . . New York, N. Y.
Clark, William Mansfield . . . . Baltimore, Md.
Conant, James Bryant . . . . Cambridge, Mass.
Cottrell, Frederick Gardner . . . . Washington, D. C.
Du Pont, Francis I. . . . . Wilmington, Del.
Du Pont, Pierre Samuel . . . . Wilmington, Del.
Gomberg, Moses . . . . Ann Arbor, Mich.
Harkins, William Draper . . . . Chicago, Ill.
Hawk, Philip Bovier . . . . New York, N. Y.
Hopkins, B Smith . . . . Urbana, Ill.
Hulett, George A. . . . . Princeton, N. J.
Irvine, James Colquhoun . . . . Fifeshire, Scotland
Keyes, Frederick George . . . . Cambridge, Mass.
Kraus, Charles August . . . . Providence, R. I.
Lamb, Arthur Becket . . . . Cambridge, Mass.
Langmuir, Irving . . . . Schenectady, N. Y.
Levene, Phoebus A. . . . . New York, N. Y.

Lewis, Gilbert Newton.......................... Berkeley, Calif.
Mees, Charles Edward Kenneth.................. Rochester, N. Y.
Northrop, John Howard......................... Princeton, N. J.
Noyes, William Albert............................ Urbana, Ill.
Patterson, Lamar Gray..................... Perdido Beach, Ala.
Pauling, Linus Carl............................ Pasadena, Calif.
Reese, Charles Lee............................ Wilmington, Del.
Smyth, Charles Phelps......................... Princeton, N. J.
Taylor, Hugh Stott............................ Princeton, N. J.
Urey, Harold Clayton............................. Leonia, N. J.
Van Slyke, Donald Dexter...................... New York, N. Y.
Whitney, Willis R........................... Schenectady, N. Y.

Engineering

Bush, Vannevar............................ Washington, D. C.
Davis, Harvey N................................ Hoboken, N. J.
Derleth, Charles, Jr........................... Berkeley, Calif.
Dunn, Gano..................................... New York, N. Y.
Durand, William Frederick............ Stanford University, Calif.
Emmet, William LeRoy........................ Schenectady, N. Y.
Hoover, Herbert...................... Stanford University, Calif.
Jackson, Dugald Caleb....................... Cambridge, Mass.
Jewett, Frank Baldwin......................... New York, N. Y.
Kettering, Charles Franklin........................ Dayton, Ohio
Pender, Harold............................. Philadelphia, Pa.
Stillwell, Lewis Buckley...................... Princeton, N. J.
Timoshenko, Stephen P......................... Palo Alto, Calif.
†Vauclain, Samuel M......................... Philadelphia, Pa.
Wetherill, Samuel Price..................... Philadelphia, Pa.
Yeatman, Pope................................. New York, N. Y.

CLASS II. GEOLOGICAL AND BIOLOGICAL SCIENCES

Geology, Paleontology, Geography

Adams, Frank Dawson....................... Montreal, Canada
Berkey, Charles Peter......................... New York, N. Y.
Berry, Edward Wilber........................... Baltimore, Md.
Blackwelder, Eliot................... Stanford University, Calif.
Bowen, Norman L................................. Chicago, Ill.
Bowman, Isaiah................................. Baltimore, Md.
†Brögger, Waldemar Christofer.................... Oslo, Norway

† Deceased.

Bryant, William L. .... Providence, R. I.
Buddington, Arthur F. .... Princeton, N. J.
Byrd, Richard Evelyn .... Boston, Mass.
Case, Ermine Cowles .... Ann Arbor, Mich.
Cross, Whitman .... Chevy Chase, Md.
Daly, Reginald Aldworth .... Cambridge, Mass.
Day, Arthur L. .... Bethesda, Md.
Gregory, Herbert Ernest .... Honolulu, Hawaii
Gregory, William King .... New York, N. Y.
Hobbs, William Herbert .... Ann Arbor, Mich.
Johnson, Douglas .... New York, N. Y.
Lawson, Andrew Cowper .... Berkeley, Calif.
Leith, Charles Kenneth .... Madison, Wis.
Leverett, Frank .... Ann Arbor, Mich.
de Margerie, Emmanuel .... Paris, France
Merriam, John C. .... Washington, D. C.
Penck, Albrecht F. K. .... Berlin, Germany
Reid, Harry Fielding .... Baltimore, Md.
Schuchert, Charles .... New Haven, Conn.
Scott, William Berryman .... Princeton, N. J.
Simpson, George Gaylord .... New York, N. Y.
Stefansson, Vilhjalmur .... New York, N. Y.
Vaughan, Thomas Wayland .... Washington, D. C.
Warren, Charles Hyde .... New Haven, Conn.
Wilkins, Hubert .... London, England
Willis, Bailey .... Stanford University, Calif.
Wright, Frederick E. .... Washington, D. C.

Zoology, Anatomy

Andrews, Roy Chapman .... New York, N. Y.
Barbour, Thomas .... Boston, Mass.
Bigelow, Henry Bryant .... Cambridge, Mass.
Birge, Edward Asahel .... Madison, Wis.
Bumpus, Hermon Carey .... Duxbury, Mass.
Calvert, Philip Powell .... Cheyney, Pa.
Castle, William Ernest .... Berkeley, Calif.
Chapman, Frank Michler .... New York, N. Y.
Cockerell, Theodore D. A. .... Boulder, Colo.
Coghill, George Ellett .... Gainesville, Fla.
Conklin, Edwin Grant .... Princeton, N. J.
Dahlgren, Ulric .... Princeton, N. J.
Davenport, Charles Benedict ..... Cold Spring Harbor, L. I., N. Y.
Harrison, Ross G. .... New Haven, Conn.

Hjort, Johan....................................Oslo, Norway
Howard, Leland Ossian........................Washington, D. C.
Jennings, Herbert S............................Baltimore, Md.
Kofoid, Charles A...............................Berkeley, Calif.
Lillie, Frank Rattray............................Chicago, Ill.
McClung, Clarence E...........................Philadelphia, Pa.
McClure, Charles F. W..........................Princeton, N. J.
McGregor, James Howard.......................New York, N. Y.
Mark, Edward Laurens.........................Cambridge, Mass.
Miller, Gerrit Smith, Jr.......................Washington, D. C.
Moore, J. Percy..................................Philadelphia, Pa.
Morgan, Thomas Hunt..........................Pasadena, Calif.
Noble, G. Kingsley..............................New York, N. Y.
Painter, Theophilus Shickel....................Austin, Texas
Parker, George Howard........................Cambridge, Mass.
Pearl, Raymond..................................Baltimore, Md.
Ruthven, Alexander G..........................Ann Arbor, Mich.
Schaeffer, J. Parsons...........................Philadelphia, Pa.
Schultz, Adolph H...............................Baltimore, Md.
Spemann, Hans..................................Freiburg, Germany
Sturtevant, Alfred Henry.......................Pasadena, Calif.
Sumner, Francis Bertody.......................La Jolla, Calif.
Tennent, David Hilt.............................Bryn Mawr, Pa.
Wetmore, Alexander............................Washington, D. C.
Wright, Sewall....................................Chicago, Ill.

Botany, Bacteriology

Allen, Charles Elmer............................Madison, Wis.
Arthur, Joseph Charles.........................Lafayette, Ind.
Bailey, Irving Widmer..........................Cambridge, Mass.
Bailey, Liberty Hyde.............................Ithaca, N. Y.
Bartlett, Harley Harris.........................Ann Arbor, Mich.
Blakeslee, Albert F..............Cold Spring Harbor, L. I., N. Y.
Campbell, Douglas Houghton...........Stanford University, Calif.
Cleland, Ralph Erskine........................Bloomington, Ind.
Crocker, William.................................Yonkers, N. Y.
Davis, Bradley Moore..........................Ann Arbor, Mich.
Duggar, Benjamin Minge.......................Madison, Wis.
Fernald, Merritt Lyndon.......................Cambridge, Mass.
Harper, Robert A................................New York, N. Y.
Jones, Lewis Ralph...............................Madison, Wis.
Livingston, Burton E............................Baltimore, Md.
MacDougal, Daniel Trembly....................Carmel, Calif.

Macfarlane, John Muirhead....................Philadelphia, Pa.
Merrill, Elmer Drew........................Jamaica Plain, Mass.
Moore, George Thomas.........................St. Louis, Mo.
Novy, Frederick G............................Ann Arbor, Mich.
Prain, David....................Warlingham, Surrey, England
Schramm, Jacob Richard.......................Philadelphia, Pa.
Setchell, William Albert........................Berkeley, Calif.
Shull, George Harrison..........................Princeton, N. J.
Sinnott, Edmund Ware.........................New York, N. Y.
Spoehr, Herman Augustus............Stanford University, Calif.
Trelease, William..................................Urbana, Ill.
True, Rodney H.................................Philadelphia, Pa.
Zinsser, Hans.....................................Boston, Mass.

Anthropology, Psychology

Angell, James Rowland.......................New Haven, Conn.
Boas, Franz.....................................Grantwood, N. J.
Cattell, James McKeen...........................Garrison, N. Y.
Hooton, Earnest A..............................Cambridge, Mass.
Hrdlička, Aleš..................................Washington, D. C.
Keith, Arthur.....................Farnborough, Kent, England
Köhler, Wolfgang..............................Swarthmore, Pa.
Lashley, Karl Spencer.........................Cambridge, Mass.
MacCurdy, George Grant.........................Old Lyme, Conn.
Paton, Stewart...................................Baltimore, Md.
Szombathy, Josef Hofrat.......................Vienna, Germany
Thorndike, Edward L...........................New York, N. Y.
Tozzer, Alfred Marston........................Cambridge, Mass.
Wissler, Clark..................................New York, N. Y.
Witmer, Lightner.............................Philadelphia, Pa.
Woodworth, Robert Sessions....................New York, N. Y.
Yerkes, Robert Mearns.........................New Haven, Conn.

Physiology, Pathology

Adrian, Edgar Douglas.....................Cambridge, England
Benedict, Francis Gano.....................Machiasport, Maine
Bronk, Detlev W...............................Philadelphia, Pa.
Brubaker, Albert P............................Philadelphia, Pa.
Cannon, Walter Bradford..........................Boston, Mass.
Carlson, Anton Julius.............................Chicago, Ill.
Chittenden, Russell H........................New Haven, Conn.
Dale, Henry Hallett...........................London, England
Erlanger, Joseph.................................St. Louis, Mo.

Flexner, Simon....................................New York, N. Y.
Forbes, Alexander................................Boston, Mass.
Fox, Herbert......................................Philadelphia, Pa.
Gasser, Herbert Spencer........................New York, N. Y.
Gies, William J...................................New York, N. Y.
Harvey, E. Newton...............................Princeton, N. J.
Henderson, Lawrence J.........................Cambridge, Mass.
Henderson, Yandell.............................New Haven, Conn.
Hill, Archibald Vivian..........................London, England
Hopkins, Frederick Gowland.................Cambridge, England
Howell, William Henry...........................Baltimore, Md.
Jacobs, Merkel Henry..........................Philadelphia, Pa.
Landsteiner, Karl.................................New York, N. Y.
Lillie, Ralph Stayner...............................Chicago, Ill.
Loeb, Leo..St. Louis, Mo.
Murlin, John Raymond..........................Rochester, N. Y.
Osterhout, Winthrop J. V.......................New York, N. Y.
Richards, Alfred Newton........................Bryn Mawr, Pa.
Riddle, Oscar..................Cold Spring Harbor, L. I., N. Y.
Tyzzer, Ernest Edward..........................Wakefield, Mass.
Whipple, George Hoyt..........................Rochester, N. Y.

Medicine, Pharmacology, Surgery

Carrel, Alexis.....................................New York, N. Y.
Castle, William Bosworth..........................Boston, Mass.
Crile, George......................................Cleveland, Ohio
Darrach, William.................................New York, N. Y.
Griffith, J. P. Crozer............................Philadelphia, Pa.
Heiser, Victor George...........................New York, N. Y.
Joslin, Elliott Proctor.............................Boston, Mass.
MacNider, William de Berniere...............Chapel Hill, N. C.
Minot, George Richards..........................Boston, Mass.
Norris, George William............................Dimock, Pa.
Packard, Francis Randolph...................Philadelphia, Pa.
Pepper, William.................................Philadelphia, Pa.
Ravenel, Mazÿck P...............................Columbia, Mo.

CLASS III. SOCIAL SCIENCES

Economics, Statistics

Commons, John Rogers........................Ft. Lauderdale, Fla.
Day, Edmund Ezra..................................Ithaca, N. Y.
Dodds, Harold Willis............................Princeton, N. J.
Fetter, Frank Albert............................Princeton, N. J.

Fisher, Irving..............................New Haven, Conn.
Gay, Edwin Francis..........................San Marino, Calif.
Huebner, Solomon Stephen....................Merion, Pa.
Johnson, Emory R............................Philadelphia, Pa.
Kemmerer, Edwin Walter......................Princeton, N. J.
Mitchell, Wesley Clair......................New York, N. Y.
Moulton, Harold Glenn.......................Washington, D. C.
Patterson, Ernest Minor.....................Philadelphia, Pa.
Rist, Charles ....Versailles, France
Sprague, Oliver M. W........................Boston, Mass.
Taussig, Frank W............................Cambridge, Mass.
Willits, Joseph Henry.......................New York, N. Y.
Wilson, Edwin Bidwell.......................Boston, Mass.
Young, James Thomas ....Philadelphia, Pa.

Modern History

Adams, James Truslow........................Southport, Conn.
Andrews, Charles McLean.....................New Haven, Conn.
Beard, Charles Austin.......................New Milford, Conn.
Becker, Carl................................Ithaca, N. Y.
Bolton, Herbert Eugene......................Berkeley, Calif.
Cheyney, Edward Potts.......................Media, Pa.
†Dodd, William Edward.......................Round Hill, Va.
Farrand, Max................................San Marino, Calif.
Ford, Guy Stanton...........................Minneapolis, Minn.
Ford, Worthington Chauncey..................Seine-et-Oise, France
Fox, Dixon Ryan.............................Schenectady, N. Y.
Gooch, George Peabody.......................London, England
Greene, Evarts B............................Croton-on-Hudson, N. Y.
Hazen, Charles D............................New York, N. Y.
Lingelbach, William E.......................Philadelphia, Pa.
McIlwain, Charles Howard ....Belmont, Mass.
Morison, Samuel Eliot.......................Boston, Mass.
Read, Conyers...............................Philadelphia, Pa.
Seymour, Charles............................New Haven, Conn.
Shotwell, James Thomson.....................New York, N. Y.
Sioussat, St. George Leakin.................Washington, D. C.
Temperley, Harold William Vazeille..........Cambridge, England

Jurisprudence

Corwin, Edward Samuel.......................Princeton, N. J.
Davis, John William.........................New York, N. Y.

† Deceased.

Frankfurter, Felix........................Washington, D. C.
Goodrich, Herbert Funk........................Philadelphia, Pa.
Hughes, Charles Evans........................Washington, D. C.
Jessup, Philip C........................New York, N. Y.
Miller, Hunter........................Victoria, B. C., Canada
Moore, John Bassett........................New York, N. Y.
Morris, Roland S........................Philadelphia, Pa.
Paul, J. Rodman........................Philadelphia, Pa.
Pepper, George Wharton........................Philadelphia, Pa.
Reeves, Jesse S........................Ann Arbor, Mich.
Roberts, Owen J........................Washington, D. C.
Scott, James Brown........................Washington, D. C.
Scott, John Morin........................Philadelphia, Pa.
Stone, Harlan Fiske........................Washington, D. C.
Warren, Charles........................Washington, D. C.
Wilson, George Grafton........................Cambridge, Mass.

Administration, Government

Beneš, Eduard........................Chicago, Ill.
Butler, Nicholas Murray........................New York, N. Y.
Delano, Frederic Adrian........................Washington, D. C.
Fosdick, Raymond Blaine........................New York, N. Y.
Gates, Thomas Sovereign........................Philadelphia, Pa.
Gifford, Walter Sherman........................New York, N. Y.
Guggenheim, William........................New York, N. Y.
†Harkness, Edward S........................New York, N. Y.
Keith, Arthur Berriedale........................Edinburgh, Scotland
Lowell, Abbott Lawrence........................Boston, Mass.
Merriam, Charles Edward........................Chicago, Ill.
Putnam, Herbert........................Washington, D. C.
Rockefeller, John D., Jr........................New York, N. Y.
Rowe, Leo S........................Washington, D. C.
Schurman, Jacob Gould........................New York, N. Y.
Young, Owen D........................New York, N. Y.

Affairs

Fels, Samuel S........................Philadelphia, Pa.
Hayward, Nathan........................Philadelphia, Pa.
Hopkinson, Edward, Jr........................Philadelphia, Pa.
Jenks, John Story........................Philadelphia, Pa.
Johnson, Eldridge Reeves........................Camden, N. J.
Lamont, Thomas William........................New York, N. Y.

† Deceased.

†Lippincott, J. Bertram........................Philadelphia, Pa.
Mason, William Smith..............................Evanston, Ill.
Morgan, Marshall S...................................Malvern, Pa.
Morris, Lawrence J............................Philadelphia, Pa.
Norris, George Washington....................Philadelphia, Pa.
Rhoads, Charles James..........................Bryn Mawr, Pa.
Scattergood, J. Henry.............................Villa Nova, Pa.

CLASS IV. HUMANITIES

Philosophy, Education

Dewey, John...New York, N. Y.
Graves, Frank Pierrepont...........................Albany, N. Y.
Haney, John Louis..............................Philadelphia, Pa.
Hu Shih..Washington, D. C.
Keppel, Frederick Paul.........................New York, N. Y.
Lovejoy, Arthur Oncken..........................Baltimore, Md.
Penniman, Josiah Harmar.....................Philadelphia, Pa.
Perry, Ralph Barton...........................Cambridge, Mass.
Singer, Edgar Arthur, Jr.......................Philadelphia, Pa.

Ancient, Medieval and Cultural History

Chinard, Gilbert....................................Princeton, N. J.
Ferguson, William Scott......................Cambridge, Mass.
Leland, Waldo G.................................Washington, D. C.
Rostovtzeff, Michael I.........................New Haven, Conn.
Sarton, George A. L............................Cambridge, Mass.
Smith, Preserved......................................Ithaca, N. Y.
Taylor, Henry Osborn...........................New York, N. Y.
Thorndike, Lynn....................................New York, N. Y.

Archaeology

Albright, William F..................................Baltimore, Md.
Barton, George Aaron.........................Coconut Grove, Fla.
Carpenter, Rhys..................................Downingtown, Pa.
Chase, George Henry...........................Cambridge, Mass.
Dinsmoor, William Bell.........................New York, N. Y.
Evans, Arthur..Oxford, England
Holland, Leicester Bodine...................Philadelphia, Pa.
Jayne, Horace Howard Furness..............Wallingford, Pa.
Kenyon, Frederic George..............Godstone, Surrey, England

† Deceased.

Kidder, Alfred Vincent........................Cambridge, Mass.
Meritt, Benjamin Dean........................Princeton, N. J.
Nilsson, Martin P..............................Lund, Sweden
Petrie, Flinders..........................Jerusalem, Palestine
Robinson, David Moore.........................Baltimore, Md.
Shear, Theodore Leslie........................Princeton, N. J.
Stein, Aurel..............................Srinagar, Kashmir
Winlock, Herbert Eustis.......................New York, N. Y.

Philology and Languages

Adler, Cyrus..................................Philadelphia, Pa.
Armstrong, Edward Cooke.......................Princeton, N. J.
Bonner, Campbell..............................Ann Arbor, Mich.
Buck, Carl Darling.............................Chicago, Ill.
Capps, Edward.................................Princeton, N. J.
Edgerton, Franklin...........................New Haven, Conn.
Hendrickson, George Lincoln..................New Haven, Conn.
Lancaster, Henry Carrington...................Baltimore, Md.
Lanman, Charles R.............................Cambridge, Mass.
McDaniel, Walton Brooks....................Coconut Grove, Fla.
Matthews, Albert...............................Boston, Mass.
Montgomery, James Alan.......................Philadelphia, Pa.
Nitze, William Albert..........................Chicago, Ill.
Prince, John Dyneley.........................New York, N. Y.
Rand, Edward Kennard.........................Cambridge, Mass.
Rolfe, John Carew............................Philadelphia, Pa.
Sanders, Henry A.............................Ann Arbor, Mich.
Sturtevant, Edgar Howard.....................New Haven, Conn.
Tatlock, John S. P............................Berkeley, Calif.

Literature, Fine Arts

Aydelotte, Frank..............................Swarthmore, Pa.
Brooke, C. F. Tucker.........................New Haven, Conn.
Brooks, Van Wyck..............................Westport, Conn.
Cather, Willa.................................New York, N. Y.
Cret, Paul Philippe..........................Philadelphia, Pa.
Cross, Wilbur L..............................New Haven, Conn.
Damrosch, Walter Johannes....................New York, N. Y.
†Finley, John Huston..........................New York, N. Y.
Frost, Robert..........................South Shaftsbury, Vt.
Lowes, John Livingston........................Cambridge, Mass.

† Deceased.

Lydenberg, Harry Miller........................Scarsdale, N. Y.
Manly, John Matthews..........................Tucson, Ariz.
Morey, Charles Rufus..........................Princeton, N. J.
Morris, Harrison Smith........................Philadelphia, Pa.
O'Neill, Eugene Gladstone.....................Danville, Calif.
Phelps, William Lyon..........................New Haven, Conn.
Repplier, Agnes...............................Philadelphia, Pa.
Rosenbach, A. S. W............................Philadelphia, Pa.
Schelling, Felix E............................Lumberville, Pa.
Taylor, Deems.................................Stamford, Conn.

MEMBERS ELECTED APRIL 21, 1939

CLASS I. MATHEMATICAL AND PHYSICAL SCIENCES

Resident

Jesse Wakefield Beams........................University, Va.
William Mansfield Clark........................Baltimore, Md.
Arthur Byron Coble..............................Urbana, Ill.
Enrico Fermi...................................New York, N. Y.
Charles August Kraus........................Providence, R. I.
Paul Willard Merrill..........................Pasadena, Calif.
Stephen Timoshenko..................Stanford University, Calif.
John Hasbrouck Van Vleck...................Cambridge, Mass.

Foreign

Prince Louis Victor de Broglie.....................Paris, France
Godfrey Harold Hardy.....................Cambridge, England

CLASS II. GEOLOGICAL AND BIOLOGICAL SCIENCES

Resident

Eliot Blackwelder...................Stanford University, Calif.
William Bosworth Castle.........................Boston, Mass.
Wolfgang Köhler..............................Swarthmore, Pa.
William de Berniere MacNider...............Chapel Hill, N. C.
Theophilus Shickel Painter.......................Austin, Texas
Peyton Rous...................................New York, N. Y.
Edmund Ware Sinnott........................New York, N. Y.

Foreign

Sir Henry Hallett Dale.......................London, England
Johan Hjort.....................................Oslo, Norway

CLASS III. SOCIAL SCIENCES

Resident

Samuel S. Fels..............................Philadelphia, Pa.
Guy Stanton Ford.........................Minneapolis, Minn.

Felix Frankfurter........................Washington, D. C.
Philip C. Jessup.........................New York, N. Y.
Charles Seymour.........................New Haven, Conn.
Harlan Fiske Stone......................Washington, D. C.
Charles Warren..........................Washington, D. C.

Foreign

Eduard Beneš..................Formerly Prague, Czechoslovakia
George Peabody Gooch.....................London, England

CLASS IV. HUMANITIES

Resident

Van Wyck Brooks..........................Westport, Conn.
Walter Johannes Damrosch.................New York, N. Y.
Harry Miller Lydenberg...................Scarsdale, N. Y.
Ralph Barton Perry.......................Cambridge, Mass.
Theodore Leslie Shear....................Princeton, N. J.
Edgar Howard Sturtevant..................New Haven, Conn.
Lynn Thorndike...........................New York, N. Y.
Herbert Eustis Winlock...................New York, N. Y.

Foreign

Martin P. Nilsson...........................Lund, Sweden
Sir Aurel Stein..........................Srinagar, Kashmir

MEMBERS DECEASED DURING 1939

	Date of Election
Henry Van Peters Wilson, January 4, aet. 75	1932
William P. Gest, January 12, aet. 77	1926
Albert Sauveur, January 26, aet. 75	1919
Edward Sapir, February 4, aet. 55	1937
James Playfair McMurrich, February 9, aet. 79	1907
Tenney Frank, April 3, aet. 62	1927
Charles R. Stockard, April 7, aet. 60	1924
Alfred Stengel, April 10, aet. 70	1903
Witmer Stone, May 23, aet. 72	1913
Arthur E. Kennelly, June 18, aet. 77	1896
Charles Hall Grandgent, September 11, aet. 76	1929
James Pyle Wickersham Crawford, September 22, aet. 57	1929
Harvey Cushing, October 7, aet. 70	1930
Waldemar Lindgren, November 4, aet. 79	1917
Floyd K. Richtmyer, November 7, aet. 58	1935
Livingston Farrand, November 8, aet. 72	1924

TABLE OF TOTALS

	Resident Members	Foreign Members
December 31, 1938	408	34
Elected during 1939	30	8
Deceased during 1939	15	1
December 31, 1939	423	41

XI

OBITUARY NOTICES

ERNEST WILLIAM BROWN[1]

(1866–1938)

Ernest William Brown was born at Hull, England, on November 29, 1866, the only son of William and Emma (Martin) Brown. He was educated at East Riding College, where he showed an aptitude for mathematics, and it was decided that he was to go on to Cambridge University. He was graduated with the degree B.A. in 1887 as sixth wrangler and was elected a fellow of Christ's College. Then, as now, Cambridge University excelled in mathematical training without giving much thought to what application the student was to make of this training. It is interesting to note that, upon graduation, Brown applied for a post as a meteorologist, fortunately (for astronomy) unsuccessfully. In 1891 he received and accepted a place as Professor of Applied Mathematics at Haverford College near Philadelphia, where he remained until 1907, when he was called to Yale University as a successor to the late Willard Gibbs (1839–1903). When the Sterling Professorships were founded at Yale University in 1920, he was among the first group of three to receive these appointments. In 1931 he became the first incumbent of the Willard Gibbs Professorship. The following year he retired, partly on account of ill-health and partly because he wished to be free from his teaching duties. The years of his retirement, in spite of a constant struggle with ill-health, proved to be among the most fruitful of his career.

The Cambridge instructor to whom he was most indebted and upon whom he most relied was George Howard Darwin (1845–1912). It was upon his advice that Brown studied carefully George William Hill's (1838–1913) great memoir of 1877 upon the lunar theory. He became more and more interested in this subject; and when he went to Haverford College in 1891, he had resolved to undertake the enormous task of computing the moon's

[1] Reprinted from the *Astrophysical Journal* 89: 152.

orbit upon this theory. One of the attractions that drew him to Yale University was the assurance of a fund for assistance in computing and for publishing the results. Later he had a number of tempting offers of other posts, including one to succeed his old teacher, Darwin, at Cambridge University. But he had become deeply attached to America and, in particular, to his surroundings at New Haven; and there he remained throughout his remaining years. He was elected a member of the American Philosophical Society in 1898 at the age of thirty-one.

The computation of the path of the moon occupied him to the practical exclusion of every other research for a full quarter-century; indeed, he was busy with some phase of the lunar theory until within two weeks of his death. He had a superb facility for throwing mathematical expressions into the best form for computing. In this respect he has seldom been equaled in the whole history of applied mathematics. He carried out his work on the moon so accurately and so thoroughly that it is difficult to imagine that it will have to be reviewed or revised in any sense for many decades to come.

The principal object of this laborious task was to see whether the motion of the moon could be accounted for by the attraction of the known bodies in the solar system. It came out that in two respects they apparently fail to do so. The first of these concerns the "secular acceleration" of the moon's place, discovered by Halley (1656–1742) some two centuries earlier. It was suggested by Newcomb (1835–1909) that this may really be a retardation in the rate of rotation of the earth, but it was left to Brown to prove that this is actually so, and more recently two English geophysicists have shown that such a retardation can be accounted for quantitatively by tidal friction in shallow channels like the Irish Sea and Bering Strait. The other respect in which Brown found that gravitation fails to account for the motion of the moon relates to the "fluctuations" (so called by Newcomb), oscillations (in a rough period of several decades) about the moon's mean place. Brown showed that these, too, are due to irregularities in the earth's rotation; their origin is, however, still very obscure.

In the years that Brown was busy on the moon, he made only two investigations of other problems: the relation between the sun-spot period and the periods of revolution of Jupiter and Saturn, and on the cause of the shapes of the spiral arms in extragalactic nebulae. In the latter case he suggested that what we really see is the envelopes of continuous closed orbits of the separate constituents of the nebulae.

Once the moon was at least partly out of the way, Brown turned with great success to other difficult problems in celestial mechanics, like the orbit of the eighth satellite of Jupiter, asteroid gaps, periodic orbits, and the orbits of the Trojan group of asteroids, bodies that form nearly equilateral triangles with Jupiter and the sun. During the last two or three years of his life he concerned himself, again with happy results, with the stellar problem of three bodies in which the masses concerned are of the same order of magnitude.

Throughout the half-century that Brown worked, he never lost the least particle of his enthusiasm for celestial mechanics. Once on the track of a promising lead, he was wont to work himself into a fever of excitement that made it difficult for him to lay it aside. For many years he was accustomed to awake in the small hours of the night; and, after refreshing himself with a draft of coffee from a thermos bottle and with his never failing cigarette, he would work in bed until it was time to arise for a nine o'clock breakfast. This he did wherever he happened to be—whether at home, visiting with friends, or even on shipboard.

Although he was not particularly fond of teaching, he fulfilled these duties with distinction; and he won the respect, admiration, and warm friendship of all his students. He was not in the habit of preparing his lectures very minutely in advance, and as a result he was occasionally stuck. But he always extricated himself promptly, and it was instructive for his students to see how accurately and unerringly his mind worked under such circumstances.

Brown knew how to play as well as to work. In his youth he rowed in the Christ's College boat, and he was addicted to mountain-climbing. He was an excellent performer on the piano to within a few years of his death, before palsy made it impossible for him to strike the keys accurately. He was devoted to music in all its forms and was for a time head of the New Haven Oratorio. He was fond of chess and played a good game. Late in life he took up card playing but, oddly enough, with only moderate success. He was an authority on nonsense verse; he could recite without a slip long excerpts from Gilbert and Sullivan's operas, from the "Bab Ballads," and from the poems of Lewis Carroll. In earlier years he read the English classics, but later he devoted most of his reading-time to detective stories. He was an inveterate traveler, especially in his famous Ford motor car, widely known as "Sylvia," which he usually drove at a higher speed than is recommended by the police. He was a constant attendant at the meetings of many scientific societies, although he was not always present during the reading of papers; there is no doubt that his chief object in going was to renew his many friendships among his colleagues.

Like some of his predecessors in celestial mechanics, Brown never married. His household was presided over by his maiden sister, Mildred, two years his junior. For most of her adult life she made the comfort of her distinguished brother her chief, almost her sole, concern; and she succeeded in thoroughly spoiling him. She died some two years before he did, and thereafter his only surviving close relative was a sister who lives in New Zealand.

From his early manhood Brown was affected by bronchial trouble, probably as a result of his rowing activities. Just before his retirement in 1932 he suffered an attack of intestinal ulcers. He refused to take the usual treatment for this complaint, admonishing his physician not to try to prolong his life but to make him as comfortable as possible. Strange to say, this illness cured itself but left him in a much weakened condition. The six years that were left to him were a constant struggle with ill-health. But he went about his work undaunted and unafraid. He died at last of sheer exhaustion on July 22, 1938, in his seventy-second year.

FRANK SCHLESINGER.

JAMES PYLE WICKERSHAM CRAWFORD

(1882–1939)

Dr. J. P. Wickersham Crawford died on the 22nd of September, 1939, at the age of 57. Born in Lancaster, Pennsylvania, he received his early education in Philadelphia at Eastburn Academy and Friends Central School. He was graduated from the College of the University of Pennsylvania in 1902 and after spending two years in the Graduate School, continued his studies at the Universities of Grenoble, at Madrid, and Freiburg (Germany). He received the degree of Ph.D. from the Graduate School of the University of Pennsylvania in 1906 and the honorary degree of Litt.D. from Franklin and Marshall College in 1925. He became an Instructor in Romance Languages in the year 1906, Assistant Professor in 1911, and Professor of Romance Languages and Literatures in 1914. For almost twenty years, he was Chairman of the Department of Romance Languages, discharging the manifold duties of this position with characteristic devotion.

Dr. Crawford's academic and scholarly career was interrupted for a time by the war. Early in 1918, he was commissioned Captain in the U. S. Army with an assignment in Washington. After the war was over, he occupied the post of Military Attaché at Bogota, Colombia. Upon his retirement from active military service, he received a commission as Major in the Officers' Reserve Corps.

Dr. Crawford was a pioneer in the field of Hispanic studies in this country and was known and respected throughout the world for his research in his chosen field. His dissertation for the degree of Ph.D. was entitled "The Life and Works of Cristóbal Suárez de Figueroa." Later he prepared a critical edition of the *Tragedia de Narciso*, which was published in 1909. His study entitled the "Spanish Pastoral Drama" appeared in 1915 and his most important work, the "Spanish Drama before Lope de Vega," in 1922. The revised edition of the latter work, which included much new material, appeared in 1937. At the time of his death, he had practically completed a study of Spanish lyric poetry of the 16th and 17th centuries, which it is hoped may be published at an early date. In 1930, as a project of the Spanish Section of the Modern Language Association, he founded the Hispanic Review, which began publication in 1933, and he served as its Editor until the time of his death. Dr. Crawford was also interested in research in the field of Education. From 1920 to 1924 he was Editor of the *Modern Language Journal*, organ of the National Federation of Modern Language Teachers, and he served as Assistant and Acting Director of the Modern Foreign Language Study conducted from 1924 to 1929 by the American and Canadian Committees on Modern Languages.

Dr. Crawford was a member of Phi Beta Kappa, the Modern Language Association, the Linguistic Society of America, the Medieval Academy of America, the American Academy of Arts and Sciences, the American Philosophical Society (elected in 1929), and many other learned societies, and he was a corresponding member of the Hispanic Society of America, the Real Academia Hispano-Americana de Ciencias y Artes de Cadiz, the Academia de Bellas Artes de Valladolid, and the Real Academia Española.

The inspiration of Dr. Crawford's career will not cease with the termination of his innumerable activities. He will long be remembered as an unfailing and beloved guide, teacher, and friend of graduate and undergraduate students, and his work will continue to have great influence on future research in Spanish literature.

E. B. Williams.

HARVEY CUSHING

(1869–1939)

Harvey Cushing came of old New England stock, a family mainly professional and of so enterprising a sort that in the early days of New England it left the East to aid in developing the Western Reserve of New Connecticut. When a man of this background turns out to be a genius, his nature is likely to be complex and stimulating. Such Cushing's was: intelligent, artistic, intense, untiring and ambitious. His traditions directed him into clinical medicine, a field to which he probably was best adapted, for he was always more an artist than a scientist.

His undergraduate training was at Yale University, his postgraduate education at Harvard University and the Massachusetts General Hospital. His early surgical years, those of his first, vigorous productive period, were passed at Johns Hopkins University. His truly scientific training came late, from Kocher, Kroneker and Sherrington. Thus, his clinical side was developed first and always predominated.

It was Cushing's fortune to fall in with Osler, a man whom he admired, loved and intuitively copied. From Osler, Cushing took his interest in books and writing, perhaps some part of his desire to inspire and help his younger professional colleagues. It is easy to see how the example of Osler's admirably shrewd and generous helpfulness influenced Cushing's more artistic and egotistical character. However, even Osler could hardly have improved Cushing's native quality as an observer or have shown him how to make a more picturesque record of his patients and their diseases. In effect, Osler directed Cushing's tastes in a direction likely to make them most productive, gave him a life-long avocation, and served as an example of teacher and clinician which Cushing always had in mind and often followed.

Viewed in this light, Cushing's career, a stirring, successful and well-rewarded one, was entirely logical. At Johns Hopkins University, Halsted was chief, brooking no rival. Much Cushing learned from him and carried this knowledge into that new field which his own vigor and imagination caused him to cultivate—the surgery of the central nervous system. Here he attacked the brain tumor which hitherto had defied all attempts at cure or, for that matter, investigation. His teaching and research were carried on at the Johns Hopkins Hunterian Laboratory, where he made his first fundamental observations upon the physiology and pathology of the pituitary gland. Indeed, during his entire subsequent career, he continued to make, on this subject, brilliant contributions which opened with his identification of asexual adiposity as a symptom-complex resulting from a lack of hypophyseal activity.

In Cushing's early forties, at the height of his mental and physical vigor, he created an atmosphere so brilliant and productive as to make him the obvious choice of Harvard University, for its Mosely [1] Professorship in surgery, and of the newly opened Peter Bent Brigham Hospital, for its first Chief Surgeon. In Boston, he continued his development of neurological surgery and, here, there began to flock to him, from all over the world, young men who saw their opportunity to be introduced, under the most stimulating auspices, into a great new surgical field. What he was able to do for these men, and for others less bent upon specialization, is sufficiently told by their subsequent careers, almost universally successful. From Cushing, they learned, painfully, perhaps, at moments, the art of observation and of systematic recording, which left nothing to the imagination, but, above all, they were taught the most meticulous care of the patient—the gentle, safe performance and exquisite completion of formidable, dangerous, operative procedures, the painless and conscientious changing of complicated dressings.

Undoubtedly, Cushing's life as a professor of surgery and chief executive of the surgical department in a general hospital was not entirely happy. He was a first-rate judge of men but lacked in some degree the power to delegate authority. He stimulated rather than instructed. He neither readily entered into the ideas

[1] Actually, Cushing's appointment as Mosely Professor was only made two years after he had been invited to come to Boston, on the death of Dr. Maurice H. Richardson.

of others nor communicated to them his own. Had he been so endowed he could hardly have been the genius he was. Nor, as a scientist, was he entirely beyond criticism. That he made, from the clinic and laboratory, a more important contribution to medicine than any other man of his day is proved by the recognition he received from learned and scientific bodies all over the world, honorary degrees, honorary membership in famous scientific bodies without number. Yet he was no Pasteur. He had brilliant ideas, brilliant conceptions of disease, which his inclination never tempted him to disprove, for he saw the confirmatory more clearly than the unfavorable evidence. In other words, he was an ardent human being and lacked the cold, critical faculty of the true scientist.

The sides of Cushing's teaching which his pupils and associates found most inspiring were the artistry and perfection of his operative technique, the minuteness of the study and care of his patients. The particular difficulties which he had had to face in searching for and removing brain tumors had led him to invent special procedures for dealing with soft and often excessively vascular tissues. The cotton pledgets, with black silk attached, the clips of silver wire for closing a blood vessel at the full reach of a narrow-bladed artery clamp, indeed, the elaborate rites, as they really were, of cerebral surgery, all were artistic to a degree. The same artistry was evident in his case histories, which were filled not only with systematic preoperative data, photographs, sketches and charts, but, following his surgical therapy and as the years went on, with information derived from the patient, his family and his local physician, a complete story, in every last detail, of the subsequent life of the individual. This nicety and unending care in the treatment of his patients and the study of their diseases is Cushing's contribution both to the art and science of surgery, a contribution so fundamental that no follower of his will ever be willing to depart from the principles that such a master has laid down.

Writing, with Cushing, was as important a side of his art as his clinical observations, operations and experimental work. It began with operative notes and sketches, which he would make, however tired he was, after his long hours of operating. His publications were intended to be authoritative, to be based upon a full knowledge of what others had done. They must refer to the important contributions of the past, the earlier fundamental contributions, especially if they were picturesque and of vital, human interest. They must be readable and, if possible, entertaining. In writing, Cushing seldom dictated, and once having arranged his ideas on paper, mulled over and corrected his product until he was utterly satisfied. Although the result was polished, it was still vigorous and not at all self-conscious. Anyone who has ever seen one of Cushing's manuscripts will never forget it—the small handwriting, a little cramped, with its long letters gracefully curved—insertions, transpositions everywhere. Nor can one forget his sketches, vigorous, accurate, recording a dramatic moment of an operation or a patient's characteristic attitude.

Cushing's publications [1] were mainly scientific, beginning with "The Pituitary Body and its Disorders," and ending with his superb, complete study, the "Meningiomas, Their Classification, Regional Behaviour, Life History and Surgical End-Results." Yet he felt impelled, and inspired, to write many essays which were published under the title of "Consecratio Medici," and his innumerable addresses and lectures would constitute for some literary men a life's work. For all this, he had time—it took several years—to write a biography of Sir William Osler, a complete, year-by-year story of a full life with all its personal contacts and interrelations with the world of medicine. He saw to it that the name of no one, whose associations with Osler contributed in any way to develop his character or illuminate his life, should be omitted. He made Osler live again in the recollection of everyone who at any time had met him. He was, indeed, a generous biographer.

Like many other intense persons, Cushing could relax in a delightful way. One evening, a young British surgeon, who was visiting him, suggested that they go to the circus. They did so and enjoyed themselves very well, but at the end of the show, Cushing was not quite satisfied. He suggested that they should look up some of the performers and see what they were like. So off the two went, arm in arm. The circus was packing up, preparing to entrain itself for another city, and so the investigators ended their search in a freight yard at the car of the tattooed lady. Cushing had no particular knowledge of the circus, its performers in general or of tattooed ladies in particular, but was so charming

[1] On the occasion of his seventieth birthday an account of Cushing's writings was published (1939) but will undoubtedly require supplementation.

and so sympathetic that a very interesting and sensitive woman gave them tea and told them the touching story of her life. It was like Cushing, that when he did embark upon a venture of this sort, his intellectual curiosity should continue active, with results impossible to foresee. It was another of his attractive qualities that he should remember in detail and relate with gusto those experiences and incidents which appealed to his imagination and his whimsical sense of humor. No one was ever the worse for these stories, for he was never coarse or malicious. And since, in good company, he could listen as well as talk, he was in demand with groups of able and intellectual men who enjoyed meeting together, whether at table or elsewhere. In any gathering he was at once magnetic and provocative. He was elected to the American Philosophical Society in 1920.

Cushing's successful, productive years at Harvard University and the Peter Bent Brigham Hospital, years which made him the foremost figure of the medical world, were followed by his return to Yale University, his Alma Mater, which honored itself and him by freely offering him the opportunity to reflect, to follow up those patients whose course, as the years went on, must confirm or modify his conceptions of disease and treatment, to collect and publish his observations upon brain tumors, his clinical life's work, to write vigorous addresses, full of fascinating historical notices, and to continue the development and strengthening of his remarkable medical library. It was altogether characteristic of him that in his last years, he sought out those great men, still living, who had made, during the last fifty years, the most striking and fundamental advances in all the sciences and secured from them reprints of their most famous work.

Shortly before his death, he had seen plans completed for a great medical library at Yale University, a library to which he had long looked forward to entrusting his most cherished possession, a superb collection of medical books. With the acquisition and study of these books are associated, as his intimates realize, many ingenious inquiries and researches unknown to the world. Of these adventures it was fascinating to hear him tell, and indeed, the atmosphere of his library best brought out those delightful qualities which made Harvey Cushing, to all who enjoyed his friendship, a beloved figure.

JOHN HOMANS.

RUSSELL DUANE

(1866–1938)

Russell Duane, trial lawyer, citizen, teacher and scholar, was born in the rectory of Trinity Parish, Swedesborough, New Jersey, on June 15, 1866, the son of Charles William and Helen Frances Duane. He was a direct descendant of Benjamin Franklin, founder of the American Philosophical Society, and his life as a student, a citizen of Philadelphia and a member of the Society revealed many of the best qualities of his notable forbear.

Graduated from Harvard University summa cum laude, with a degree of A.B., a Phi Beta Kappa membership and a number of close and intimate friends, he studied law at the University of Virginia and the University of Pennsylvania, from the latter of which he graduated with further honors in 1888 with a degree of LL.B. Immediately thereafter he was admitted to the Philadelphia Bar, at which he practiced continuously until his death.

At the Commencement of his class in the Law School, Mr. Duane was appointed by the faculty to deliver the Law oration, and having selected as his subject, "The Case of the Sayward," he presented a new and original argument in behalf of the claims of the United States in the Bering Sea controversy with Great Britain. In the spring of 1892, a copy of the *American Law Register and Review*, in which Mr. Duane's oration was afterwards published, happened to come into the possession of James G. Blaine, then Secretary of State, and this led to the appointment of Mr. Duane as one of the junior counsel for the Government in the Bering Sea Arbitration proceedings. During this appointment Mr. Duane prepared a portion of those sections of the case of the United States which related to the questions of measure of damages and of maritime jurisdiction.

Mr. Duane was one of the founders in 1901, with Roland S. Morris and Stevens Heckscher, of the firm of Duane, Morris & Heckscher in Philadelphia and was still its senior partner at the time of his death.

He was also a member of the Auxiliary Law Faculty of the University of Pennsylvania, and for a number of years delivered courses of lectures at the Law School on Court Procedure and the Conduct of Jury Trials. He also published several magazine articles on legal topics, and delivered many public addresses on subjects relating to politics, education and international law.

While his leanings, both individual and inherited, were democratic, he was never a hidebound partisan. His efforts were always toward good government, without much interest by what party achieved. He was never afraid to lead or join a "forlorn hope." We therefore find him making a vain effort for election to City Council in the Seventh Ward and making numerous addresses against the Free Silver Fallacy in 1896 and later. He was one of the original members of the Committee of Seventy organized in 1904 for the purpose of bringing about reforms in the government of the City of Philadelphia and subsequently Chairman of the Committee for a number of years. In 1906, he acted as City Chairman of the Lincoln party in the gubernatorial campaign of that year.

For many years Russell Duane was the chief trial counsel for the Philadelphia Rapid Transit Company and also tried cases for a number of insurance companies. He was a director of the Manufacturers Casualty Insurance Company, the Manufacturers Fire Insurance Company, the Philadelphia Life Insurance Company, and the Theodore Presser Company. He also served at various times as the president of the Contemporary Club, as president of the New Jersey Society of Pennsylvania, as president of the Society of the Descendants of the Signers of the Declaration of Independence, as president of the Philadelphia Osteopathic Hospital and Philadelphia College of Osteopathy, and as president of the Society of the War of 1812. He was a trustee of The Presser Foundation, and a member of the New England Society, the Phi Beta Kappa Society, the Phi Kappa Sigma fraternity, the Philadelphia Club, the Harvard Club of Philadelphia, the Sons of the Revolution, the American, Pennsylvania, and Philadelphia Bar Associations, and other organizations.

For many years Mr. Duane was a leader of the civic, legal and social life of the City of Philadelphia, where he took his place in a line of distinguished ancestors whose primary object was the service of that community. In addition to being a direct descendant of Benjamin Franklin, he was also descended from William Duane, the Editor of the *Aurora*, who was credited by Thomas Jefferson as being one of the founders of the Democratic party, and of William J. Duane who was Secretary of the Treasury under

Andrew Jackson, and who was Stephen Girard's lawyer and drafted the famous will creating Girard College.

In 1906, Russell Duane was elected a member of the American Philosophical Society. He always treasured that membership. He was diligent in his attendance at meetings and in his service to the Society. He served on the Council of the Society from 1928 to 1931. He was the Society's lawyer from 1934 until the date of his death, at which time his son, Morris Duane, was appointed to that important position.

Russell Duane was married at Philadelphia on June 14, 1899, to Mary Burnside Morris, a descendant of Anthony Morris, the second Mayor of Philadelphia, of Captain Samuel Morris, the bodyguard of Washington and earliest commander of the First City Troop, Philadelphia Cavalry, and of Justice Burnside of the Supreme Court of Pennsylvania, and sister of Roland S. Morris, President of the American Philosophical Society. Mr. Duane is survived by his wife and two children, Morris Duane and Sarah Franklin Duane, and two grandchildren, Margaretta Sergeant Large Duane and Russell Duane II, and a sister, Mrs. Bodine Wallace.

Limits of space permit no adequate summary of the personal qualities of Russell Duane. Naturally of a sensitive and affectionate disposition, he developed those qualities throughout his life, and upon his death persons in all classes of life mourned his passing. His sense of humor was exhibited not only in his wit which was instantaneous, but in his delight in humorous stories of which he had a store always in his mind, backed up by a large collection of books containing such anecdotes. His skill as a lawyer was notable at a Bar where some of the greatest pleaders of the Country are always in practice. His writings on legal and civic subjects reflected his passion for detail and the large extent of his cultural background. Any presentation made by him left no important points unmentioned. Above all, particularly in his latter years, his kindness was his outstanding quality. A kind man, a just man, a humorous man, a man perhaps a little shy and withal a man of perseverance, a lover of honest controversy, with a mind of extraordinary capacity and judgment, Russell Duane was one of those outstanding lawyers and citizens for whom Philadelphia has always been noted.

George W. Norris.

TENNEY FRANK

(1876–1939)

With the death of Tenney Frank we have lost one of the foremost humanists of our time, one who was a humanist in both the accepted meanings of this somewhat misused word: a distinguished classical scholar and a student of human nature and human affairs. As an investigator in the fields of Latin language and literature, Roman history and archaeology, economics and law, Frank attained an international reputation surpassed by no other American scholar and probably unequalled by any. This academic distinction he combined with rare qualities of character and personality. His integrity and independence were admired and sometimes feared; his sound judgment and practical wisdom made him a valuable counselor; his charm of manner, catholicity of interest, and quiet wit emerged at frequent intervals to assure a widening circle of friends. His active interests ranged from Latin syntax to practical gardening and natural history, from the classification and analysis of Roman building stone to American economic problems, from aesthetic literary analysis to constitutional law. Whatever he touched he adorned.

Tenney Frank was in every way a typical American, so far as his national origins and early background were concerned. Like another great American humanist who has recently died, James Henry Breasted, he was a native of the great plains of the Middle West. He was born on a farm near Clay Center, Kansas, May 19, 1876, of Swedish-American parents. To the last Frank remained proud of his rural beginnings, of his Scandinavian origin, and of the acquaintance with manual labor and with different types of mercantile employment which his youthful poverty made necessary. His American heritage was his most prized possession and he never yielded to the cheap temptation which has proved fatal to so much American idealism, the temptation to court the casual awards dispensed by undemocratic states and by arrogant academic schools.

After high school in Kansas City and college at the University of Kansas (A.B., 1898; A.M., 1899), he attended the University of Chicago for several years, studying Latin under William Gardner Hale and receiving his Ph.D. in 1903. His thesis was entitled "Attraction of Mood in Early Latin" and all his earliest publications were in the field of Latin and Germanic syntax. Far as these studies might seem to be from the horizon in which he later achieved eminence, they were none the less of great value to him, since they ensured the formation of the philological precision without which literary and historical research are too often shallow and slovenly.

His academic career moved slowly but surely upward through Chicago, Bryn Mawr, and Johns Hopkins, where he was Professor of Latin from 1919 to his death, April 3, 1939. Several invitations came to him from other institutions, notably from Harvard University, but he declined them all and remained faithful to the institution which had first recognized his promise of distinction as an investigator. During this period of his life his prevailing interest shifted to Roman history, economics, and constitutional law, as illustrated by a remarkable series of volumes, "Roman Imperialism" (1914), "Economic History of Rome" (1920, 1927), "A History of Rome" (1923), "Life and Literature of the Roman Republic" (1930), "Aspects of Social Behavior in Ancient Rome" (1931), and especially by his monumental work in five volumes, "An Economic Survey of Ancient Rome" (1933-—), the final volume of which is nearly ready for press. In the last work he undertook, with the aid of a distinguished group of American and European collaborators, to describe, as adequately and objectively as possible, the material and documentary evidence for the economic history of Rome from its republican beginnings to its imperial climax. This great work contains a wealth of material and will long be indispensable to the Latinist, the ancient historian, the historian of social, economic, and cultural movements in all Mediterranean lands. But despite the intense intellectual labor and the continuous drudgery which were required by these studies, Frank by no means neglected the field of Latin literature, to which he contributed several remarkable biographies (Vergil, Catullus, Horace, Cicero) and many brilliant papers and essays. Three years at the Classical School of the American Academy in Rome familiarized him with problems of Roman archaeology, to which he made a striking pioneer contribution in his "Roman Buildings of the Republic" (1924), a monograph which opened a new and significant field for archaeological exploitation.

In his later years, academic honors were lavished on him by the learned world. He held lectureships at Bryn Mawr College, the University of California, Oberlin College, and the British Academy; he was a fellow of the British Academy, the Swedish Royal Society of Letters, the American Academy of Arts and Sciences, honorary member of the British Society for the Promotion of Roman Studies, and a member of the American Philosophical Society (elected in 1927); he received an honorary L.H.D. from Union College in 1938. The greatest honor which came to him and the one he most appreciated, however, was his call to Oxford University as Eastman Professor for 1938–39—the first American classical scholar to be thus recognized. It was a fitting climax to a laborious and unobtrusive career as a scholar in the truest and fullest sense that he should spend the last few months of his life as an honored guest in congenial scholarly environment.

W. F. ALBRIGHT.

WILLIAM PURVES GEST

(1861–1939)

William Purves Gest was born in Philadelphia, February 27, 1861, and died there January 12, 1939. He was the son of John Barnard and Elizabeth (Purves) Gest. One of his brothers was the Honorable John Marshall Gest (1859–1934), a distinguished member of this Society, whose obituary notice appeared in the 1938 YEAR BOOK.

Mr. Gest was of distinguished American lineage, being descended from Henry Gest who came to Pennsylvania from England in 1686 and Richard Barnard who came to the same colony in 1684.

He was educated at the famous "Classical Institute" of Dr. John W. Faries at Philadelphia; entered the University of Pennsylvania, received the A.B. degree in 1880, A.M. and LL.B. in 1883, and was admitted to the Bar the same year. He was a member of the Phi Kappa Sigma Fraternity and Phi Beta Kappa. He entered the law office of Bullitt and Dickson, with whom he had been a law student; later became associated with his brother, John Marshall Gest (referred to above), and continued with him until 1889, when he went with the then Fidelity Trust Company as assistant to his father, John Barnard Gest, then Vice-president. He became assistant to the President in 1891, Vice-president in 1900 and President in 1915, which position he held until the consolidation with Philadelphia Trust Company in 1926, when he became Chairman of the Board, and so continued in active service until a few months before his death.

He married Isabel Thorn Howell, of Philadelphia, daughter of William and Rebecca T. Howell, on November 15, 1894. They were the parents of two daughters, Isabel and Lillian Gest.

He was Chairman of the Philadelphia Clearing House Committee, a Trustee of the University of Pennsylvania, which institution honored him with the degree of Doctor of Laws, a Trustee of the Presbyterian Hospital and Union Benevolent Association. Among the more important institutions he served as Director were The First National Bank, Insurance Company of North America, Lehigh Coal and Navigation Company, Lehigh and New England Railroad Company, Pennsylvania Salt Manufacturing Company, Philadelphia Traction Company, Wentz Corporation and Whitehall Cement Manufacturing Company.

Mr. Gest was elected a member of this Society on April 24, 1926. He served as Chairman of the Committee on Finance from 1932 until his death, and in this capacity also served on the Council. On March 3, 1933, he was elected Treasurer and represented the Fidelity-Philadelphia Trust Company since its election on April 21, 1933, as the Society's Treasurer.

While Mr. Gest played an active and distinguished part in the business and financial affairs of Philadelphia, a recording of the offices and directorships held by him would only be a part of the story. He always retained a deep interest in matters historical, literary, philosophical and charitable.

In spite of all the public positions filled by him he was essentially a modest and retiring personality. With a small group of friends he was at his best, and his background of the Classics, history and literature of all ages illuminated any discussion. One such occasion was at a small dinner tendered George W. Norris in 1936 upon his retirement as Governor of the Federal Reserve Bank of Philadelphia. Mr. Gest was the only speaker, other than Mr. Norris, and after a few remarks of appreciation of Mr. Norris, he turned to the subject most on his mind, the quickening trend of our Government to discard the safeguards designed in our Constitution and to follow the paths of prior civilizations which had swung through the cycles of greatness and wealth to decay. He spoke almost without notes, but with a wealth of allusion and apt quotation which fascinated the group fortunate enough to hear him. He was persuaded to put the substance of it in a little pamphlet, which he did under the title "The Tendency of a Free Government to Degenerate." To quote a few of its paragraphs:

> "For it seems as if our nation in company with her sister nations was being swept along on a mighty and ruthless current of the time. Representative government has turned to Democracy and Democracy is being debased to Despotism. The dole is on us, the harbinger of decay.
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> "This is the change realized in some cases, foretold in others, by philosopher, statesman and poet from the early centuries down to our own times. The tendency is stated in the writings of Plato and Aristotle, and when a world empire arose there was afforded Polybius the ground for a more general and regular theory of the cycle of Government. The danger was foreseen by the makers of the Constitution and they endeavored to fortify the nation against it. It was dreaded by the Federalists, it was felt by Webster. Francis Lieber, our most historical publicist, and John Fiske, our most philosophical historian, described it.
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> "It has been looked for during succeeding periods until delay persuaded optimistic fatalists that it could not happen with us. It is as when we wait for ocean waves to break—wave follows wave and those that threaten most subside and ripple harmless on the beach, until, when least expected, some mighty billow bursts upon the shore and drowns us in its thunder and confusion."

He quoted the following written by deTocqueville after his journey in America a century ago:

> "I think, then, that the species of oppression by which democratic nations are menaced is unlike anything which ever existed before in the world. . . . Above this race of men stands an immense and tutelary power, which takes upon itself alone to secure their gratifications, and to watch over their fate. That power is absolute, minute, regular, provident, and mild. . . . After having . . . successively taken each member of the community in its powerful grasp, and fashioned him at will, the supreme power then extends its arm over the whole community. It covers the surface of society with a network of small complicated rules, minute and uniform, through which the most original minds and the most energetic characters cannot penetrate, to rise above the crowd. The will of man is not shattered, but softened, bent and guided; men are seldom forced by it to act, they are constantly restrained from acting; such a power does not destroy, but it prevents existence; it does not tyrannize, but it compresses, enervates, extinguishes and stupefies a people, till each nation is reduced to be nothing better than a flock of timid and industrious animals, of which the government is the shepherd."

Mr. Gest then added:

"Could any prophetic words more accurately portray the vast and uncoordinated mass of so-called administrative law with which we are being overwhelmed? I am tempted to parody an old line:

> A World of Wonders! Legislation seems
> No more the work of Reason, but her dreams!

There is no answer to prophecy fulfilled. But what of the future? What is the defence against these perpetual tendencies? Washington and others after him have found no answer except the political virtue of the people. If that is lost the end comes sure and soon."

This train of reasoning was one given long thought by Mr. Gest and his "The Philosophy of American History," published privately in 1900, takes Hegel's "Philosophy of History" and considers it in the light of events on the North American continent. He points out how Hegel, "consciously or not, had other reasons for belittling the progress of America. He had completed his system without her." A further quotation is justified by its present timeliness:

"For there is indeed in Hegel's application of his theory to the facts of history—perhaps we should say his application of the facts of history to his theory—a sort of implication that the cycle of history is ended. 'The East knew and knows only that one is Free; the Greek and Roman world that some are Free; the German world knows that all are Free.' Hegel's classification of historic data left no room for the 'Land of the Future.' But there was perhaps another reason. Hegel's philosophy, like all systems that deify necessity, by whatever name they choose to call it, becomes the argument of despotism. Imperialism has always justified itself by fatalistic philosophy. Napoleon believed in himself as the child of Fate, and Hegel deified the conqueror of his country under the name of the 'World Soul.' It is a just criticism of the tendencies of his system that optimism, hero worship, acquiescence in might as right and the necessity of war are suggested to be profound historical truths. So Napoleon III, taking his cue from his predecessor, claimed that Providence raised up such saviors of society as Caesar, Charlemagne and Napoleon. Among democratic nations a similar justification of imperialism is found in the fatalistic theory of the destiny of the superior race. They are in a special sense the chosen of God: of which the true criterion is the ordeal of battle. This is the modern judicial duel, as clearly fatalistic as the ancient legal wager of battle or the more modern fatalism of the divine right of kings. No doubt the tendency is as old as government, and there will never be wanting poets of imperialism to echo the words of Euripides that tyranny is god-like.

"These considerations suggest a number of reasons why Hegel's prejudices would dissuade him from applying his philosophy to a country, where seventy years ago the State still meant the People, and Liberty had not become Necessity. Seeing little to admire in America, Hegel, as many lesser men have done when a fact will not suit their theory, belittled and derided it. The antinomies of American history were not then sufficiently developed to enable an observer to trace the action of the Hegelian law, and the detailed consideration of America as a democracy would therefore have been as distracting to the rhythm of his dialectics, as disturbing to the serenity of his politics."

Mr. Gest was always impatient of sumptuary legislation and our experiment in prohibition was to his clear thinking the wrong way to go about it. He published two articles in *The Atlantic Monthly,* one in October, 1924, "The Font of Liberty" that has a sub-title "A Paper on the Approaching Millennium," and the other in August, 1926, entitled "Playing at Providence" with the subtitle "Omnipotent Lawgivers and Omnipresent Human Nature."

In both these articles he traces the history of all kinds of prohibitory and sumptuary laws through the ages. They are full of real humor and happy expression. They well merit rereading. In "The Font of Liberty," he approaches his subject thus:

"At a time when 'capacity production' is regarded as the great desideratum, every well-wisher of his country must be interested in the widening scope of legislation, and the increased activity of our legislatures.

"We stand at the threshold of a New Liberty. Liberty now consists in the voluntary subjection of the will of the citizen to law:

"Naught nobler is than to be free;
The stars of heaven are free because
In amplitude of liberty
Their joy is to obey the laws.

"This sentiment must be politically true (I say nothing as to its physical truth), for the poet was seriously considered as Laureate. Webster stated the principle more prosaically in his Charleston Speech. 'Liberty,' said he, 'exists in proportion to wholesome restraint.'

"It follows from this that the more laws we have, to which to subject our wills, the freer we are. The New Liberty then is not merely a liberty regulated by law; it is a liberty created by law. Let us examine the elements of our New Liberty."

Referring to the Prohibition Law, he said:

"Any act of this character will require teeth, and this brings us to the second principle of the New Liberty, which is that all reform legislation must have the sanction of severe penalties vigorously enforced.

"I pause to explain that this expression 'to put teeth into an act' had its origin in a very early prohibitory measure. That was the act prohibiting mice from eating cheese. According to the ancient story as related in an old law book, 'The women were much concerned at the continued depredations on their stores. A body of very wise men had an Act passed with half the words in the English language and backed by all the rhetoric of Lincoln's Inn, that it should be death without benefit of clergy for a mouse to eat cheese. Still the pantries were robbed and the lawgivers laughed at. A sage cat armed and clad in scarlet, having crept into the Senate House through a borough, urged that he be allowed to execute the decree.' The rest of the story is well known. Since then the language has been enriched with the phrase a 'law with teeth in it,' and mice are on their good behavior."

He closed with these satirical paragraphs:

"Our electorate is educated and able to express an opinion on every question. Bands of quick-witted men and noble-hearted women accomplish continuous reforms with a fine 'apotheosis of instinct' which renders the slow and laborious methods of experience and study quite unnecessary. I behold the vision of a political structure too vast to be called a nation, too democratic to be called an empire—patriotic because paternal; permanent because progressive, which devises its legislation with a noble imagination, and enforces it in serene majesty.

"This future it is ours to form and to re-form. Let us address ourselves to the task, taking for our motto the apothegm of Voltaire, 'No Government ever perished except by suicide.'"

In "Playing at Providence" he took further illustrations from the English "Gin Act" of 1736, various laws regarding sheep-stealing, beard control, and compulsory shaving. His concluding paragraphs were:

"What strange principle is at the root of these laws? It has been often stated. It lies in the nature of power, which must always exert itself, and thereby extend its province. Would that we could call back the spirit of Penn, to whisper into the ear of all legislators that admonition which, with more force than elegance, he sent to his Deputy, Lloyd: 'For God's sake, me, and the poor country, do not be so governmentish.'

"Knowledge comes, but the wisdom of moderation lingers. Doctors physic too much; preachers preach too much; legislators legislate too much; yes, and you will say writers write too much. I confess it, and yet the astute reader has discovered that all the requisites of a good law cited at the outset have now been illustrated with more or less directness. Some things in the science of legislation I may have left untouched. Let me, then, adopt the apology of Montesquieu: 'We must not always exhaust a subject, so as to leave no work for the reader. My business is not to make people read, but to make them think.'"

The selection of these paragraphs quoted from Mr. Gest's publications has not been an easy one, and the temptation was strong to use much more because every line he wrote was characteristic and so happily phrased. They do serve, however, to illustrate the depth of his thinking, the breadth of his learning and the real humor with which he could appraise even those things of which he most disapproved. It seems too bad that the pressure of his other activities left so little time for his pen because he might easily have been one of the great essayists of our time, as well as contributing greatly to the clarity of our thinking on the vital questions of the day.

EDWARD HOPKINSON, JR.

CHARLES HALL GRANDGENT

(1862–1939)

Charles H. Grandgent was born in Dorchester, Mass., on November 14, 1862, and died in Cambridge, Mass., on September 11. 1939. His formal education was obtained at Harvard University and it was there that he was Tutor from 1886 to 1889 and Professor of Romance Languages from 1896 to his retirement in 1932. In the interval between 1889 and 1896 he was Director of Modern Language Instruction in the Boston public school system. In 1915–16 and again in 1931 he was Exchange Professor at the University of Paris. From 1902 to 1911 he was Secretary of the Modern Language Association of America and in 1912 was its President. He held honorary degrees from various American institutions, membership in several foreign academies, and decorations from the Italian and French governments. He was elected a member of the American Philosophical Society in 1929. A bibliography of his writings is given in Vol. 47 (1932) of the *Publications of the Modern Language Association*—a volume which was dedicated to him. About that time his health was broken by a serious illness from which he never sufficiently recovered to permit a resumption of his literary activity.

Grandgent is widely known for his linguistic studies (Phonology and Morphology of Old Provençal, 1905, Introduction to Vulgar Latin, 1907, Italian translation of some, 1914, Spanish translation, 1928, From Latin to Italian, 1927), and for his critical edition of Dante's *Divina Commedia* (1909–13 and revised edition 1933) which, along with his critical studies and his verse translations from Dante, made him the leading American Dante scholar. He was also the author of various essays of a more general character, marked by clarity, penetration, and rich humor. Of a broad and rich culture and with a genial and most attractive personality, he had an exceptionally large circle of friends and admirers, and he was a true humanist in many of the best senses of the world.

EDWARD C. ARMSTRONG.

ARTHUR EDWIN KENNELLY

(1861–1939)

With the death of Dr. Arthur Edwin Kennelly in Cambridge, Mass., on June 18, 1939, there passed away almost the last of the small group of distinguished pioneers in the field of electrical engineering—a field whose phenomenal development has been one of the most characteristic features of our modern civilization.

He was born at Colaba near Bombay, India, on December 17, 1861. At that time Thomas Alva Edison and Oliver Heaviside were boys of fourteen and eleven years of age respectively. At only twelve years Kennelly became attracted towards the electrical field through hearing a lecture in London by Mr. Latimer Clark on "Submarine Telegraphy." Thus he followed the two great precursors mentioned by a scant decade; and one may surmise that they, more than any others, served him later as exemplars,[1] the American inventor Edison embodying the intense, ardent devotion to constructive scientific work which Kennelly so admirably showed, while the English theorist Heaviside symbolized Kennelly's own deep love for mathematical forms of thought.

Kennelly's early schooling was largely in private schools in Great Britain, France, and Belgium, and especially in the Univer-

[1] In this connection it is illuminating to read Kennelly's entertaining and instructive biographical accounts of Edison (Memoirs Nat. Acad. Sci., 1933) and Heaviside (Proc. Amer. Acad. Arts and Sciences, 1936).

sity College School, London. His formal education ended, however, when as a boy of fifteen he entered the submarine cable service of the Eastern Telegraph Company. Thus, just like Edison and Heaviside, he never encountered the usual academic routine. It should be remarked, however, that Kennelly always possessed a very high intellectual cultivation, conversing fluently in French, German and Italian, and being widely informed in his own profession and in outside fields as well. His friend and colleague Professor Chester L. Dawes has written of hearing him give a lecture on Macaulay, the English essayist and historian, "that would do credit to an arts professor."[1]

Kennelly continued to be occupied with submarine telegraphy until about twenty-five years of age, when he had attained the status of Senior Electrical Engineer on the ships of the Eastern Telegraph Company. During this period he secured for himself a theoretic grasp of underlying principles as well as a mastery of the practical art of laying and repairing cables. It was near the end of this period that he began to publish scientific papers bearing on electrical problems. For submarine cable service in the Red Sea during the Soudanese war, he received the award of the Third Order of the Medjedieh from the Egyptian Government in 1885, the first of a number of awards, prizes, medals and insignia to be later bestowed upon him.

In 1898 he went to work as Edison's chief electrical assistant in the laboratory at East Orange, New Jersey, an association which must have been most valuable both for Kennelly and for Edison. In 1894 he entered into the firm of Houston and Kennelly, consulting electrical engineers; and he continued in this work until 1901. E. J. Houston was himself a distinguished pioneer in the field; and the two men wrote jointly some seventeen text books and monographs, covering various aspects of the field of applied electricity. The year 1902 was spent by Kennelly as engineer in charge of laying cables for the Mexican government, Vera Cruz to Frontera and Frontera to Campeche.

It was in 1902 that Kennelly was called as Professor of Electrical Engineering to Harvard University, becoming Emeritus in that post in 1930. He was also Professor of Electrical Communication and Director of Electrical Engineering Research in the Massa-

[1] See *Science*, Oct. 6, 1939, where many details about Kennelly's life not here given are referred to. Further data are to be found in the material gathered by Kennelly himself.

chusetts Institute of Technology from 1913 to 1923, during the merger of the Harvard School of Engineering with the Institute. These posts afforded splendid scope to his abilities as research worker, and he proved himself to have unusual quality as a teacher of advanced students of engineering.

The first higher academic degree received by Kennelly was that of honorary Doctor of Science given him in 1897 by the University of Pittsburgh. Other academic distinctions came to him later, the honorary degree of Master of Arts from Harvard University in 1906, the degree of Doctor (honoris causa) from the University of Toulouse, France, in 1922, and of Doctor of Engineering from the Technische Hochschule of Darmstadt, Germany, in 1936. He was elected a member of the American Philosophical Society (1896), of the American Academy of Arts and Sciences (1905), and of the National Academy of Sciences (1921) in this country, and of various other learned and professional bodies here and abroad, his election as member of the Royal Swedish Academy of Sciences in 1939 being the last distinction of this kind to come to him. Significant of the general esteem in which he was held by the members of his own professional group were his election for two terms as President of the American Institute of Electrical Engineers (1898–1900), for one term, of the Illuminating Engineering Society (1911), and of the Institute of Radio Engineers (1916).

In 1903 Kennelly married Julia Grice of Philadelphia, who died less than a year before him. A son, Reginald Grice Kennelly, a chemist, survives them.

It is not possible here to give any reasoned account of Kennelly's varied written contributions. He had a systematic and prolific pen, being the author of about 350 articles, some twenty-eight books (the sole author of ten of these), and also of several hundred unsigned articles. Fortunately he left a brief *catalogue raisonné* of his scientific writings, indicating his own critical estimate of their value. For this reason it may be permitted to signal for brief reference two of these to which Kennelly himself attached especial importance.

Kennelly was the first (1892) to introduce $\sqrt{-1}$ as an operator and so to deal with Heaviside's "impedance" as a kind of vectorial electrical resistance rather than as a scalar quantity. This was a very useful and suggestive idea in the electrical engineering field. Heaviside had formulated the underlying mathematical equations for long smooth transmission lines by use of hyperbolic functions and scalar methods; but their significance was easier to understand when systematically approached from Kennelly's vectorial point of view, involving the hyperbolic functions of complex angles. Kennelly attacked many technical problems in the electrical field, and so gained an unusual mathematical experience with continued fractions, ordinary and partial linear differential equations, etc., which he must have enjoyed intensely. But it was his useful exploitation of the notion of impedance in graphic form and of hyperbolic functions of complex angles which appealed to him most.

In the second place Kennelly suggested in March, 1902, the theory that there should be an ionized layer of the upper atmosphere, which would operate to reflect radio and other electromagnetic waves coming from the surface of the earth. The same theory was suggested by Heaviside in an Encyclopedia Britannica article published in December of the same year. The basis for these independent conjectures lay in the then recent work of J. J. Thomson on the electrical conductivity of a rarefied gas such as is found in the upper atmosphere. At the present time, the existence of such a "Kennelly-Heaviside layer" is regarded as a thoroughly established fact.

On the purely engineering side, one may refer to his method of discovering electrically faults in submarine cables by varying current strength. His paper on this subject, published in 1887, received the Institution Premium of the Institute of Telegraph Engineers at London in that year. His researches on the heating of electric wires carrying steady electric currents in air, extended from 1884 to 1915, and culminated in the invention of a hot-wire anemometer. For this Kennelly received the Medal of the Franklin Institute in 1917. He also received the Longstreth Medal of the Institute in 1916 for his work on the "skin effect" in steel rails.

He gave much attention to questions concerning electrical and other units, and was an influential supporter of the Meter-Kilogram-Second system which was recently adopted internationally.

Kennelly's quality of intense sustained devotion to his scientific work could hardly be surpassed. Despite his failing eyesight since 1930, so that the services of a secretary became essential, he continued to go to his office regularly and carry on a systematic active round of duties to the very end. There was never the least faltering on his part. Although he was not religiously inclined in the conventional sense, still there was in him a selfless, perfect faith in the eternal order of things, and a consecration of purpose, beautifully illustrating the heraldic motto of his own family "Ora et Labora." His life afforded a noble and inspiring example to all who knew him, while his work has become an integral part of our heritage in pure science and electrical engineering.

GEORGE D. BIRKHOFF.

JAMES PLAYFAIR McMURRICH

(1859–1939)

To many, especially the older, members of the American Philosophical Society the death of their honored associate, James Playfair McMurrich, will bring a sense of keen personal loss. His membership in this Society and frequent attendance began in 1907 and lasted throughout his life. It was not his only connection with the intellectual life of Philadelphia; he was also a member of the Academy of Natural Sciences of this city, and from 1911 until the end of his life he served on the Advisory Board of the Wistar Institute of Anatomy and Biology. As a young man he was Professor of Biology at Haverford College (1886–89). Prior to that he was domiciled at the Johns Hopkins University for two years as Instructor in Zoology. His early scientific life was thus moulded in the States of Maryland and Pennsylvania, and his subsequent career confirmed the soundness and promise of his formative years.

He was born in Toronto, Ontario, in 1859, educated in the old established Upper Canada College and in the University of Toronto, from which he received his B.A. degree before his twentieth birthday, and his M.A. degree two years later. After a brief experience teaching Biology in the Ontario Agricultural College he resumed his studies at the Johns Hopkins University, where he was also Instructor in Mammalian Anatomy (1884–86), and received his Ph.D. degree in Zoology (1885). He then served as Professor of Biology in Haverford College (1886–89). By that time he had already published twenty-five research papers and was so clearly marked as a productive investigator that he was called to Clark University at Worcester, Massachusetts, an institution newly established under the presidency of G. Stanley Hall to be a university "of the highest and most advanced grade, with special prominence given to original research." Clark University was planned to be a step in advance of even the Johns Hopkins University in its exclusive devotion to graduate work, and was destined for the next three years to be with Johns Hopkins University the most important influence in the rapidly rising development of research in American universities. Here McMurrich was associated with leaders of scientific research in America, C. O. Whitman, H. H. Donaldson, Warren Lombard, A. A. Michelson, J. U. Nef and others, and had unrivaled opportunity for personal research. This experience was an important influence in his life in more ways than one.

Unfortunately, Clark University soon fell upon evil days financially, and the majority of the scientific staff were forced to seek other opportunities. McMurrich went to the University of Cincinnati as Professor of Biology (1892–94). At the end of this period he made a radical change in his scientific career by accepting the chair of Anatomy in the Medical School of the University of Michigan (1894–1907), where he joined his old friend Warren Lombard of Clark University days, who was Professor of Physiology there. This was in a way a daring innovation both for the Professor and the school; for the school thereby departed from the universal tradition of having a medical man, usually a clinician, in the Department of Anatomy, and the Professor was really the first broadly trained biologist to accept such a position in America. The consequences were great both for the Professor and for Anatomy. For McMurrich it meant a life service in medical schools, and for Anatomy it meant a beginning of its development on a truly scientific basis in American medical schools. The pioneering University of Chicago had proceeded in the same direction two years previously by making Anatomy an academic department under Franklin P. Mall. The tendency was in the air, so to speak, but McMurrich was one of the early pioneers.

He returned to the land of his birth as Professor of Anatomy in the University of Toronto in 1907. In 1930 he became Emeritus but continued his scientific work there until his death from coronary thrombosis. His interests in Toronto included not only his department and the medical school, but embraced all aspects of University life. For the eight years preceding his retirement he was Dean of the School of Graduate Studies, which he was instrumental in establishing. Each of the three universities with which he was most prominently connected expressed appreciation of his services and attainments by awarding the honorary degree of LL.D., the

University of Michigan in 1912, the University of Cincinnati in 1923, and the University of Toronto in 1931.

McMurrich's scientific publications, 107 in number, extended from 1882 to 1932, a period of fifty years. They exhibit an extraordinary breadth of interest. They range over the zoological kingdom from protozoa to man; his original researches were in taxonomy, in embryology, and in human and comparative anatomy; he wrote a text-book of "Invertebrate Morphology" (1894), which appeared in a second edition in 1896. His text-book on "Development of the Human Body" (1902), ran through seven editions up to 1923. He wrote parts of two human anatomies and edited a three-volume German Atlas of Human Anatomy by Sobotta (1928). He published studies on fisheries problems dealing with salmon and halibut. He wrote on "Science in Education" and on other educational problems, and on "Evolution and Religion." Interest in the history of Anatomy first appeared in a publication of 1906 and lasted throughout his life, attaining the position of chief interest shortly after his retirement, and culminating in a magnificent study of "Leonardo da Vinci—the Anatomist," published by the Carnegie Institution of Washington in 1930 (pp. xx, 265). His studies on the anatomy and classification of Actinia (sea-anemones) (1887–1913), on embryology, on human and vertebrate anatomy, and on the history of Anatomy will rank as his principal original contributions.

Owing to his scholarly activity, his administrative ability, and the genial quality of his nature he was in constant demand from professional organizations in the United States and in Canada, to which he responded with lively interest and a keen sense of responsibility. He was Secretary of the American Morphological Society, later the American Society of Zoologists (1890–93), President of the American Society of Naturalists (1907), President of the American Association for the Advancement of Science (1922), President of the Royal Society of Canada (1922), Vice President of the History of Science Society (1921), and member of the American Philosophical Society (elected in 1907) and of other societies both in America and abroad. Among other extra-mural activities, he served on the Biological Board of Canada from 1911 and was Chairman of the Board (1926–35); in this connection he developed a keen interest in fisheries, and stimulated research especially on Pacific Coast salmon, to which he also made contributions. Reference has already been made to his long membership on the Advisory Board of the Wistar Institute of Anatomy and Biology of Philadelphia. Early in his life he was closely associated with the Marine Biological Laboratory of Woods Hole, Massachusetts, and a life-long member from 1890. He was Instructor there in the summers of 1889–91, and a Trustee of the institution (1892–96). Some of his close friendships with American biologists hark back to cordial associations of that time in the atmosphere of friendly cooperation that existed there.

As a scholar, McMurrich was a man of many parts, and this was also true in his life outside his profession. Close associates have this to say of him:

"Professor McMurrich's knowledge and scholarship were profound and extended to many subjects far beyond his professional field. His memory and keen insight were both truly remarkable and a source of wonder and admiration to all who knew him. But his scientific interests did not warp his life and render him one-sided in development. He had many attractive social graces, possessed many friends and took an interest in his clubs, his recreation, especially golf, and in his church. He was kindly and human, stimulating his staff and his students." (James C. Watt, C. M. Jackson, E. Horne Craigie, the *Anatomical Record,* Vol 74, No. 1 and Suppl. No. 1, page 5.)

Married in 1882, he had a happy family life. A son and a daughter survive him. His life of eighty years was long, full, unblemished and complete.

Frank R. Lillie.

EDWARD SAPIR

(1884–1939)

Edward Sapir died on February 4, 1939, aged 55 years and a few days. Born at Lauenburg, Pomerania, January 26, 1884, he came to this country with his parents in 1889. He studied at Columbia University, which granted him the degrees of A.B. (1904), A.M. (1905), Ph.D. (1909), and honorary Sc.D. (1929). He was Research Assistant in Anthropology in the University of California, 1907–8; Instructor in Anthropology in the University of Pennsylvania, 1908–10; Chief of the Division of Anthropology of the Geological Survey, Canadian National Museum, Ottawa, 1910–25; Associate Professor of Anthropology, 1925–27, and Professor of Anthropology and General Linguistics, 1927–31, in the University of Chicago; Sterling Professor of Anthropology and Linguistics in Yale University since 1931. A bibliography of his more important scholarly publications down to 1937, prepared by himself, was printed in the journal *Psychiatry* 1: 154 ff. (February, 1938); it is supplemented below by a few more recent works. It omits book reviews, and a few other minor publications (chiefly of early date). It also omits his poems. Yet it includes (with the supplement) 112 items, among them about ten substantial books. Besides the American Philosophical Society (elected in 1937), he was a member of the National Academy, and of the American Academy of Arts and Sciences; a corresponding member of the Société des Américanistes de Paris, and of the Reale Accademia delle Scienze di Bologna. He was an active member of the American Anthropological Association, the Linguistic Society of America, the American Folklore Society, and the American Oriental Society; he had held the Presidency of the first three of these.

He was married in 1911 to Florence Delson, who died in 1924; and again in 1926 to Jean V. McClenaghan, who survives him. Two sons and a daughter by the first marriage, and two sons by the second, also survive.

His bibliography suggests one of his most striking characteristics, his versatility. One of the greatest linguistic scholars of the world, he was also a profound student of ethnology, folklore, sociology, religion, psychology, and even psychiatry. He had musical and poetic gifts; he wrote on "Representative Music" and "The Musical Foundations of Verse," and published a good deal of original poetry. The title of one of his articles, "Language as a Form of Human Behavior," is characteristic of his philosophic approach to linguistic studies, and of not a little of what he wrote. What are called the "broader aspects" of linguistics, the philosophy, psychology, and sociology of language, engaged his attention very insistently. But not to any neglect of the formal side, of the bed-rock facts, the basic data of language. Aided by exceptional facility of acquisition and retentive memory, both of which aroused the wonder and envy of his colleagues, he was able to amass and keep in mind, and to produce on a moment's notice, vast stores of detailed facts about an unbelievable number of languages in many parts of the earth. Yet, as has been said, language was only one of many interests to him, although certainly the first (to which he invariably returned after many excursions). Many of us tend to be slightly suspicious of one who seems to know so much about so many things; and this suspicion is only enhanced if he not only seems to control the facts, but is able to arrange them with apparent facility and artistic perfection and to relate them to one another, as Sapir always could. There may be a touch of envy in this attitude. Unable to cover so much ground ourselves, we are ready to ask whether breadth has not been won at the expense of depth. But while such suspicion may sometimes be justified, I never heard of anyone who thought it justified in the case of Sapir. He seemed able to meet every one of us on our own grounds, to see the minutiae of many provinces as with a magnifying glass, and at the same time effortlessly to survey the whole terrain.

To this rare capacity for combining brilliant theorizing with profound learning he added a third quality, which made him one of the greatest of teachers and the most fascinating of personal associates: an ability to present the product of that knowledge and thought, however abstruse and technical it might be, in simple, lucid, and effective words. He wore his intellectual greatness easily and gracefully, like a well-fitting garment. No one was overawed by it; on the contrary, he constantly drew into the circle of his interests many who were attracted at first as much by his personality as by the subject.

To evaluate properly his achievements in linguistics alone would be impossible in this brief notice, and I do not feel competent even to discuss what he did in other fields of learning. His book on "Language: an Introduction to the Study of Speech" (1921) contains many original and stimulating ideas; one of the most influential has proved to be the concept of "drift" in linguistic change, —independent development of related dialects in similar directions. This book, and many of his articles, are things which, while extremely valuable to linguistic scientists, are also of great interest to laymen. The bulk of his linguistic publications, however, consists of more severely technical studies. He was a pupil of Franz Boas, the dean of Americanists and founder of a new school and method of investigation of unrecorded languages. Sapir always recognized with full appreciation his debt to this great scholar and teacher; who would, however, I believe, not only call Sapir his greatest pupil, but also acknowledge that he played an important part in developing the method, which is sometimes spoken of under their joint names. Products of this phase of his work appear in a large body of original texts in Indian languages, with interpretations and grammatical analyses. The same method has been applied by Sapir himself to African languages, and by others to other fields. In more recent years Sapir turned his attention to active cultivation of older linguistic branches: Semitic, Indo-European, Sinitic, Tibetan, and others, always with brilliant and stimulating results. He was one of the leading exponents of what is called the "laryngeal hypothesis" in Indo-European phonology, which is now promising to revolutionize our conventional views of that subject. He began an intensive study of Tocharian, a little-known Indo-European language once spoken in Central Asia. He left behind him a large mass of notes on this subject, which it is hoped may some day be worked over and made available to science. They contain many highly original views, very important if demonstrable; for instance, Sapir believed that he could show extensive inter-borrowings between Tocharian and Tibetan, which was geographically near to it.

His all too early death deprives us of one of the greatest figures in American humanistic scholarship. That he was not only a scientist of the first rank, but also an artist, seems to me significant. These were not two separate sides of his nature; he was an artist in science, or a scientist in art—a thoroughly integrated personality in any event. Possibly this may in part explain why many of us do not think it going too far to call him a genius.

I append here the few additional titles which, to the best of my knowledge, complete his scientific bibliography since 1937 (see above).

1938

Why Cultural Anthropology Needs the Psychiatrist. *Psychiatry*, **1**: 7–12. [With bibliography prepared by the author, pp. 154–157.]

Glottalized Continuants in Navaho, Nootka, and Kwakiutl (with a note on Indo-European). *Language*, **14**: 248–274.

Nootka Texts. (With Morris Swadesh.) William Dwight Whitney Linguistic Series; published for Yale University by the Linguistic Society of America. 334 pp.

1939 (posthumous)

Indo-European Prevocalic *S* in Macedonian. *American Journal of Philology,* **60**: 463–465.

Review of Z. Harris, "Grammar of the Phoenician Language." *Language,* **15**: 60–65. [Mentioned as containing important original observations and theories.]

"From Sapir's Desk." [Notes found after his death and published by E. H. Sturtevant.] *Language,* **15**: 178–187.

FRANKLIN EDGERTON.

CHARLES RUPERT STOCKARD

(1879–1939)

With the death of Charles Rupert Stockard on April 7, 1939, there passed from the fellowship of American scientists one whose achievements were already great and whose immediate participation in research presaged much in contributions to follow.

Professor Stockard's early years were passed in the state of Mississippi, where in Washington County he was born and received his preliminary education in the schools of the community. A circumstance of much significance in this period of his life appears to be the influence he received from his father, who was a practitioner of medicine. Through this medium he became familiar with much of the philosophy of common folk and with many of the every-day problems of human biology. It was natural, therefore, that his interests soon veered towards the field of medicine.

He entered at an early age the Mississippi Agricultural and Mechanical College and in 1899 he received the B.S. degree from this institution. Though he set forth on the road leading to an academic career as a teacher of military science in his alma mater, this rôle occupied him for only a relatively short time, whereupon he entered the Graduate School of Columbia University and embarked on a course of graduate study in the Department of Zoology. In 1906 he received the Ph.D. degree from Columbia University and in turn, a few years later, higher degrees came to him from Cincinnati (Sc.D.) and Wurzburg Universities (M.D.). Immediately following the completion of his doctorate work at Columbia University, Professor Stockard became associated with the teaching staff of Cornell University Medical College. He was advanced in 1909 to the rank of Assistant Professor of Embryology and two years later he was appointed Professor of Anatomy and Director of that Department, a post he continued to hold until his labors were terminated by disease. Although academic assignments claimed a major share of his attention, he had a profound interest at all times in the fundamental problems of biology and so it was that regularly he spent his summers either at Woods Hole or one of the other biological stations in this country or abroad.

A glance over the history of every institution of learning that has gained a measure of enduring fame reveals written on its early pages the names of a few men who rendered great service in shaping its destinies and in implanting in its curriculum the mark of forceful educational ideals. Professor Stockard was one of these great intellectual benefactors to the Cornell University Medical College, for he joined its staff just eight years after the establishment of the institution by the University whose name it bears, and at a time when a keen struggle was on to raise it into the group of top-ranking medical colleges in the country. Cornell University Medical College owes much to him for bringing into that small group of his contemporaries on the faculty a far-reaching educational outlook, a pioneering and vigorous investigative spirit, and a sound philosophy of the medical disciplines.

Of the scientific organizations to which he became a member there are many, but none perhaps received a greater share of his attention nor more of his influence in shaping important policies than the American Anatomical Society for which he served as Secretary-treasurer for eight years, and finally as its President. He communicated many papers to the Society but some of his most valuable contributions were made, perhaps, in the discussions at which he was vividly original and constructively critical. Professor Stockard found time also to serve on many committees and boards, but mention will be made here of only two: namely, the Board of Trustees of the Marine Biological Laboratories to which he gave devoted service for nineteen years, and the Board of Scientific Directors of the Rockefeller Institute, to which he was elected in 1925 and became its Chairman ten years later, continuing in this post until his death. He was elected a member of the American Philosophical Society in 1924.

Professor Stockard was a real experimentalist; not, however, of the school to extol the experiment per se, but rather of those who comprehend the broader values of experimental research in illuminating large biological problems. Very soon after his entry into the field of science his attention became directed to problems of development and this interest was greatly extended by experiments carried on at Woods Hole, Tortugas and at Naples. In his bibliography there are over 150 titles devoted to a wide range of topics in the fields of cytology, embryology, genetics, endocrinology, medicine and education. These convey at once an idea of Professor Stockard's extraordinary versatility and symbolize in a concrete way something of the genius, the originality, and the scholarliness of his mind. That thoroughness of groundwork so prominent in his teachings in later years finds expression in the fact that approximately thirty-five of his earliest papers deal with a variety of problems on regeneration and the artificial production of structural anomalies in lower forms. To him the most complex aspect of developmental morphology formed a simple story, since he had dealt with these phenomena first hand. He who will build the foundation well may build high, and so by logical steps Professor Stockard elaborated and adapted these previously acquired basic concepts into many later studies. A noteworthy place among his researches which followed is occupied by the extensive study he made on the influence of alcohol on embryonic mammalian development and racial degenerative changes. The structural, genetic and social implications of this study form one of the most interesting chapters in the many faceted career of this man. His scientific prevision enabled him also to accept fruitful leads and so in the midst of his researches on the action of alcohol on the mammalian organism he brought forth, with the invaluable assistance of his fellow worker, Dr. Papanicolaou, the results of observations on the characteristic histological changes accompanying a typical oestrous cycle, a line of investigation which marked the beginning of a new era in the understanding of the female reproductive function.

His zeal for undertaking studies in the field of endocrinology was greatly augmented by the suggestions arising from the studies on oestrus, and many who knew him intimately will recall the ardent enthusiasm with which he took up those studies destined to become his major interest for the remainder of his life—that unparalled series of experiments on "The genetics of modified endocrine secretion and associated form patterns among dog breeds." Although far from a finished line of experimental work when sickness overtook him, many of the important lanes he had already charted, and these, together with other interesting discoveries he had made, are to appear in a posthumous account of his last labors.

As a teacher he was brilliant and witty, and one whose presentations were inspiring with the elements of character and uplift in them which never failed to impress students. He was always eager to impart to his class his own all-absorbing interests which he gave in an impressively unusual way. He read extensively in his own and related subjects, he possessed a comprehensive knowledge, a broad outlook and a faculty of bringing into single focus evidence from different fields.

Professor Stockard was a free and engaging conversationalist. He possessed a mind ready to challenge any height and ready to champion any cause he believed to be right. Although he did not hesitate to denounce the human frailties of great men, nor stricture famed institutions, he had a most kindly nature, and his friendships were many and loyal. He has left behind a memory that will not soon pass away.

DAYTON J. EDWARDS.

WITMER STONE

(1866–1939)

Witmer Stone, member of the American Philosophical Society since 1913, was born in Philadelphia, Pennsylvania, on September 22, 1866, and throughout his life lived in and near that city. He was a student at the University of Pennsylvania, where he received his Bachelor's degree with the class of 1887, and continued to take his Master of Arts in 1891. For his scientific attainment the University honored him with its Doctorate of Science in 1913.

Stone became a frequenter of the Academy of Natural Sciences of Philadelphia, while a student, and in 1891, on completing his college work, was appointed Conservator in the Ornithological Section, a title that he retained until 1918, though other duties came in connection with the Academy with the progress of the years. From 1893 to 1908 he was Assistant Curator of the Museum, from 1908 to 1918 Curator, and from 1918 to 1925 Executive Curator. In the latter year he was appointed Director, and in 1927 he was elected Vice-president. His physical condition made it necessary for him to retire from active administrative duties in 1928 when he became Emeritus Director, a title that he retained until his death on May 24, 1939. His entire adult life was thus devoted to the work of the Academy of Natural Sciences.

From boyhood Witmer Stone was an active and energetic field naturalist, an interest that continued without cessation throughout his life. Work in the field in southern Mexico from February to May, 1890, gave him a view of the life of the American tropics, and in later years he made many journeys, to Florida, to West Virginia, to California, to Arizona, to Louisiana, and to other places, always in quest of information and specimens primarily relating to birds and plants, but including also mammals, reptiles, amphibians, shells, insects, and in fact everything living that he encountered. Such work in eastern Pennsylvania and in New Jersey occupied most of his holidays, and in addition to publishing steadily on collections of birds and of mammals received at the Academy from many sources throughout the world—Sumatra, Brazil, California, Central America, West China, Africa—he wrote extensively on the natural history of his local area. Cape May, New Jersey, site of extended work by many of the scientists associated with the Academy, was especially attractive to him, and in his later years he spent his summers here in field work that was summarized finally in his two volumes on "Bird Studies at Old Cape May" in which a wealth of original observations on the birds of the region is presented in delightful word pictures of the Cape May of today and of former years.

The contribution of Witmer Stone to the biological sciences has been definite and important and has covered a period of nearly fifty years. While concerned principally during his long and active life with studies of birds and mammals that covered these groups throughout the world, and with the natural history of Pennsylvania and New Jersey, he was an authority in other fields, particularly in botany. A true naturalist he found interest in everything that he encountered out-of-doors, and he was also an entirely competent student in the Museum, with broad systematic knowledge. Associated with Everett Cram, Stone wrote one of the first popular works on North American Mammals. He published technically on this group also, and on amphibians and reptiles, plants, and in other fields. He is, however, most widely known as an ornithologist through his early association with the American Ornithologists' Union, and through the twenty-five years, from 1912 to 1936, that he served as Editor for the *Auk*, the official publication of that organization, to which he contributed steadily in notes, reviews of literature and general articles. In addition, he was chairman of the committee for the fourth edition of the official checklist of North American birds, published in 1931, and was active for many years in the Delaware Valley Ornithological Club. His bibliography includes hundreds of notes and papers on birds, mammals, reptiles and plants with occasional contributions in other fields. He was an early student of molt in birds, of migration, and of color and color patterns, as well as of geographic distribution and variation.

Ill health in his later years brought necessity for care in physical exertion but could not overcome Stone's never flagging interest in the out-of-doors. Unable to wander far afield in search of birds and plants he turned to entomology as a more sedentary pursuit, and collected insects assiduously even through his final summer at Cape May.

A man of constant industry in his chosen work, Dr. Stone was always cheerfully helpful to others, willing always to assist not only his colleagues but also the younger students who might diffidently approach him. He was one of those who has left his definite impress on his chosen field of work. The writer may be permitted to add in closing that his personal friendship with Witmer Stone is a treasured memory and that he has profited deeply by his long association with this friend who now is gone.

ALEXANDER WETMORE.

ALBERT BARNES WEIMER

(1857–1938)

Albert Barnes Weimer was a man with whom Benjamin Franklin surely would have enjoyed association in the American Philosophical Society. Mr. Weimer's interests, like those of Franklin, covered many and varied fields of human knowledge and activity. His interest and knowledge in the field of geology was up to that of many persons who have made geology a profession. But transplant him from an Alaskan glacier to Rome and he was equally at home among those who were authorities upon the history and significance of the Eternal City. He was, for many years, Vice-dean of the famous Shakespeare Society of Philadelphia. He was, by profession, a lawyer and a writer of law books. Franklin and his associates of that day would have enjoyed having Mr. Weimer among them as have his associates in the American Philosophical Society of two centuries later.

Mr. Weimer was born in Philadelphia January 5, 1857, and was graduated from Harvard University with a Bachelor of Arts degree in 1880 and admitted to the practice of law in Philadelphia in 1902. Nine years later Mr. Weimer became Editor of the *Philadelphia County Court Reports.* This service he continued until 1921 when the series was discontinued. Then he became State Editor for the *Pennsylvania District and County Reports* until 1930. In 1901, he was made Assistant Official State Reporter for the Supreme and Superior Court. In 1919, he became the Official State Reporter and held this position until 1932. Many volumes of official legal records of the State of Pennsylvania bear his name as Editor.

In addition, he wrote some law books on his own authority. Among them are "Railroad Law of Pennsylvania," 1894; "Corporation Law of Pennsylvania," 1897, and a "Digest of Pennsylvania County Court Reports," Volumes 1 to 35, 1910.

On June 16, 1910, Mr. Weimer married Miss Ella C. Goforth, daughter of John Goforth, and she died in August, 1927. Mr. Weimer was a member of the American Philosophical Society (elected in 1927), the Historical Society of Pennsylvania, the Shakespeare Society of Philadelphia, the American and Pennsylvania State Bar Associations, the University Club of Philadelphia. He was, for many years, a member of the Junior Legal Club and acted as its Secretary.

HERBERT F. GOODRICH.

HENRY VAN PETERS WILSON

(1863–1939)

Henry Van Peters Wilson, son of the Reverend Samuel A. and Sophia Anne (Stansbury) Wilson, was born in Baltimore, February 16, 1863, entering upon life in a home where general reading and intellectual activity received strong encouragement. After the grammar schools of Baltimore he passed through the Baltimore City College, at that time actually, as Dr. Wilson has said, a first-class secondary school, in which he was fortunate in having the guidance of excellent teachers, and in securing a thorough ground-ing in Latin, English, German and History. From the City College, he stepped into the galvanic atmosphere of the new Johns Hopkins University in 1880, from which, as a member of the fifth graduating class, he received the bachelor's degree in 1883.

Having in view a career in the practice of medicine, he had, in his last year of undergraduate work, come under the influence of such great teachers as Remsen, Martin, Sedgwick and Brooks. It was in the general biology class, conducted by Professor William T. Sedgwick, that the young Wilson first thought of finding a career in research. Following graduation, he spent a summer at Brooks' Station for Marine Biology at Hampton, Virginia, and then returned for a year as graduate student and laboratory assistant to complete the full curriculum of undergraduate biology work. In the fall of 1884, he registered in the Medical School of the University of Maryland but recognized within a few weeks that his real interest was in teaching and research rather than in medicine.

Withdrawing promptly from the Medical School, he accepted on the recommendation of Professor Brooks a position as private tutor to Dr. Edward Phelps Allis, Jr., a manufacturer in Milwaukee, who had determined relatively late in life to become a zoologist. It was an unusual assignment for a beginning graduate student, but the relation seems to have been a satisfactory one on both sides. Dr. Allis, with an intense interest in biological studies and unusual abilities as student and as business executive, managed to combine the successful conduct of an important and prospering manufacturing business with the effective prosecution, during off hours, of laboratory studies in which he was guided by the young graduate freshly equipped with the methods and infused with the spirit of a pioneering institution. The relation was terminated after a year only because the student felt ready to begin research, which the instructor felt unprepared to direct. It may not be known to many of the younger biologists that it was Dr. Allis, who shortly afterward founded the Lake Laboratory of Biology at Milwaukee, of which C. O. Whitman was Director, and who by financial aid made possible the founding of the *Journal of Morphology*. Dr. Allis, it should be added, now approaching ninety years of age and living in Menton, France, has, himself, had a distinguished career in research in zoology.

After his return to Baltimore in 1885, Wilson entered upon graduate work in Johns Hopkins University under Professor

Brooks. Following the migratory habit of Brooks and his students, he transferred the next spring to Beaufort, North Carolina, working in the Hopkins Station for Marine Zoology. Again, in the spring of 1887, Brooks and his party moved to Nassau, New Providence, in the Bahamas, and it was here that Wilson settled down to a study of the development of the coral *Manicina areolata*, completing the dissertation that formed a part of the requirements for the degree of Ph.D., received in June 1888. During the four years of his graduate work, he had been a laboratory assistant (1883–84), a graduate scholar (1885–87), and a fellow (1887–88).

On receiving the doctorate, he was made the first occupant of the Adam T. Bruce Fellowship of Johns Hopkins University and then with C. L. Edwards made his second visit to the Bahama Islands. The two young scientists resided something like young Crusoes on Green Turtle Cay where Dr. Wilson began the studies of sponges which he was never to discontinue for any considerable period of time.

Soon after his return to Baltimore in January 1889, he was appointed (in May) Scientific Assistant in the United States Fish Commission to work at Woods Hole, Mass., where he had charge of the Fisheries Biological Laboratory, then by far the best-equipped marine laboratory in America. During the first year of service at Woods Hole, Dr. Wilson made it his task to conduct a thorough study of fish embryology, the tangible fruit of which was his monograph entitled: "The Embryology of the Sea Bass (*Serranus atrarius*)." This work, published in the *Bulletin* of the United States Fish Commission for 1889 (1891), with 68 pages of text and 20 plates of original and precise figures, has long been recognized as a classic study in vertebrate embryology and has perhaps been as widely consulted and "followed through" by graduate students as any other original monograph of the time.

In the latter year of his stay at Woods Hole, Wilson returned to his studies of sponges, his first publication appearing a little later in the *Journal of Morphology* (1891). Thus, within about three years after the completion of graduate work at Johns Hopkins University, the general fields of his life work in research were to an extent marked out. The great majority of his papers from this time on, and his primary interests in teaching, were in embryological and experimental studies with sponges and coelenterates and in vertebrate embryology, although he virtually ceased publication in the last-mentioned field at a very early time.

In 1891 Dr. Wilson accepted the position of Professor of Biology in the University of North Carolina, which was then about to embark upon a career of moderate expansion. Coming to Chapel Hill, he found himself in a very small University, hardly more than a college except for its spirit, its traditions, and the presence of a few stimulating associates. Apparently he was no better placed for a future career than many a young Doctor of Philosophy, who, to his own disappointment, goes out into a small college to have an overload of teaching and social activity snuff out forever the fluttering flame of research. Few such novitiates in science could, however, find themselves carrying such a burden of teaching as Dr. Wilson soon loaded upon himself. When he joined the faculty, there were only 248 students, even counting the 69 in professional schools of law and medicine. The Biological Laboratory, occupying the top floor of a small building that housed also the Department of Geology, one of the literary societies, and a considerable number of student bedrooms, was equipped with extreme meagerness and supported on a negligible budget.

From the very beginning Professor Wilson determined that the Department of Biology should be notably thorough in its work, broad in its offerings and as well-equipped as the very limited resources and his own Scotch thrift could make possible. During the first two years he taught six courses but gradually added to these until the maximum was reached in the fifth year (1895–96) when we find him offering the following ten courses: Elements of Physiology (1 semester), General Biology (2 semesters), Systematic Botany of Flowering Plants (1 semester), Mammalian Anatomy (1 semester), Vertebrate Embryology (1 semester), Vertebrate Histology (open also to medical students) (1 semester), Microscopic Technique (1 semester), Comparative Anatomy of Vertebrates (1 semester), Invertebrate Morphology (2 semesters) and Research Courses in Zoology. These courses were not mere "offerings," but were actually given with strict attention and with drive, and unfortunate was the student who made any other assumption in registering for one of the courses.

In the third year he had added also two summer courses: an elementary and a more advanced course in Marine Zoology, but the courses offered at Beaufort soon drop from the catalogue, doubtless because he felt it distinctly preferable to devote the summers to research.

One might well assume that it was impossible for so much teaching to be done efficiently with any time left for productive research; yet we find rarely less than two and sometimes three or four papers appearing over his signature in scientific journals during each year of the '90s. Such accomplishments were possible because Dr. Wilson had a notably alert and quick mind, an exceptional memory, and the capacity and will for intense concentration and strict organization of time and effort. Every hour of work during the day was budgeted; weekday offhours, Saturdays, Sunday mornings, holidays, vacation periods, and especially the summers, were methodically devoted to research.

Meantime, as the result of a meticulous habit in care and use of apparatus and material, the laboratory came to be fairly well-equipped for both undergraduate and graduate work. Friends have smiled surreptitiously at his long-continued habit of counting corks and vials and the measuring out of cover glasses, pins, tacks and chalk, but it was through such an attitude of mind with reference to both time and material things that the department was brought to a relatively high state of efficiency at the same time that its head and sole teacher was acquiring distinction in research. Those interested in "racial" characteristics may note later that, on the paternal side, Dr. Wilson was only two generations removed from Scotland!

In 1904, the Department of Biology gave place to two departments, Zoology and Botany, Dr. Wilson continuing as head of the former until his voluntary retirement from administrative responsibilities at the age of 72 in 1935. Meantime the two departments had moved into a new building, Davie Hall, built in 1908. By election of his fellows on the Faculty, he was one of the first small group of "Kenan Professors" appointed in 1917 and he continued in this position with active teaching until a few days before his death. Reluctantly, but voluntarily, he gave up undergraduate teaching in 1938 when he was 75 years of age.

Dr. Wilson's activities in laboratory organization and in research were not restricted to Chapel Hill. Very early he followed the example of Brooks in instituting a summer station for studies of marine life. Although, unlike Brooks' peripatetic "Chesapeake Laboratory," which might be as often in North Carolina or the

Bahamas as on Chesapeake Bay, Wilson's summer work took deep and lasting root at Beaufort, North Carolina. He probably went to Beaufort in the summers of 1892 and 1893; we have no definite record of those seasons; but he was offering a course there in the summer of 1894, according to the catalogue, and we believe that from that year on to the last summer of his life he never failed to spend a part of the summer in research at Beaufort, except in 1902 and possibly 1903, the summers preceding and following his first year in Europe. Very soon he had interested the United States Fish Commission in the operation of a temporary summer laboratory at Beaufort and for several years (1899–1902) he was its Director. Although no formal courses of study were offered in the laboratory, nevertheless teachers and graduate students came from north, south and west to work in the dilapidated frame structure which then constituted the Marine Biological Laboratory at Beaufort. All who worked in that institution could testify to its systematic and efficient operation and its fine atmosphere of research and good fellowship.

It was fortunate that among Dr. Wilson's closest neighbors and friends was a man who combined in almost exceptional fashion comprehension of biology and its possible applications, vivid and constructive imagination, complete lack of self interest and most uncanny ability to cut straight and proper paths through dank political jungles. This was the late Joseph A. Holmes, recently head of the Department of Geology and Natural History, from which Dr. Wilson's Department of Biology had been formed, and then lecturer in geology, organizer and Director of the North Carolina Geological and Economic Board (predecessor of the present Department of Conservation and Development) and later to be organizer and first Director of the United States Bureau of Mines. With the two disinterested friends working in cooperation, it was only a short time before, by Act of Congress (signed May 12, 1900), provision was made for a second permanent Fisheries Biological Station to be located at Beaufort, North Carolina. The enabling act omitted the detail of authorization for purchase of site, but, through the generosity of a friend, Mr. Alonzo Thomas of Beaufort, owner of the island, and several educational institutions, including Johns Hopkins University, and the State universities of Virginia, Georgia, South Carolina and North Carolina, there was purchased and presented to the Fish Commission a small island known as Pivers Island or Still Island (for turpentine "stills," be it said in behalf of the locality!). Although taking a leading part in design of the main building, Dr. Wilson was unwilling to assume further administrative responsibility and Dr. Caswell Grave, then of the Faculty of Zoology, Johns Hopkins University, became the first Director of the new, well-designed and excellently located laboratory which opened while still partially incomplete in the summer of 1902.

Dr. Wilson's more important research projects were: first, his dissertation on the development of *Manicina areolata* (1888); a critical study on the early development of the frog (1900–01), the results of which were thought to be incompatible with the then widely accepted "concrescence theory" of the way in which a vertebrate embryo was formed; a paper on the development of sponges (1894); a taxonomic study of a collection of sponges which Alexander Agassiz had collected on an oceanic expedition (1904) (a considerable part of the work in this study being done in the Zoologisches Institut of F. E. Schulze in Berlin); studies on regeneration of sponges from dissociated cells (1907*a*, *b*; 1910; 1911; 1928; 1932; 1938; etc.)—the work which attracted widest attention; studies on the regenerative capacities of dissociated cells of coelenterates and echinoderms—largely negative for the latter (1911b; 1913; 1914); and an extensive study in taxonomy based on a collection of Philippine sponges (brief papers published from time to time and a final report in 1925). A full bibliography will be found in the *Journal of the Elisha Mitchell Scientific Society,* Vol. 50, pp. 411–415 and Vol. 55, pp. 5–6.[1]

Dr. Wilson was a member of the American Society of Naturalists, the Boston Society of Natural History, the American Association for the Advancement of Science; a charter member of the American Morphological Society (1890), which later became the American Society of Zoologists, of which Dr. Wilson was President in 1911 and member of the Executive Committee from 1914 to 1921; a member of the Société Linnéenne de Lyon, the Elisha Mitchell Scientific Society (President in 1905–06 and again in 1938–39) and the North Carolina Academy of Science (President, 1912). He was a charter member of the American Association of University Professors and a member of its Council for 6 years. He was repre-

[1] One title must be added: Sara Gwendolen Andrews. Science, Vol. 85: 213.

sentative of the American Society of Zoologists in the National Research Council, 1929–32, a member of the Council of Sigma Xi, 1932–37, and at various times a member of the editorial boards of the *Journal of Morphology, Biological Abstracts*, and the *Journal of the Elisha Mitchell Scientific Society.* He was elected to the National Academy of Sciences in 1927 and to the American Philosophical Society in 1932. He was a Southern Exchange lecturer in 1915–16 and Dohme lecturer at the Hopkins in 1936.

It is clear then that, long before his passing at the age of approximately 76 years, Dr. Wilson had attained high distinction as a teacher, as the organizer, with the most limited resources, of a good University laboratory, reasonably well-equipped with apparatus, materials, books and particularly journals, as a leader in the foundation of an important marine station for biological and fisheries research, and as an original contributor to biological science.

Since his accomplishments in all these respects were effected under difficulties which might well have overwhelmed the ordinary man, some account of his personal qualities may be of interest not only to his personal acquaintances and to biologists of the world who have known him through his work, but also to any who may be interested in the achievements of one who does not seek to go where opportunities are so much as to find opportunities where one is: in a measure, of course, such is the character of most of those who achieve much. A man, as we know him, may be thought of as a combination of his heredity, his environment and something else (if it is something else), which, because we can relate it wholly neither to heredity nor to environment, we call his self-made individuality. We may look briefly at the man from these three points of view.

Fortunately among the innumerable memoranda on various subjects which Dr. Wilson left were a small batch made some 35 years ago for a correspondent desiring data concerning his ancestry and family qualities, and among these we find personal characterizations in his own concise and incisive style. On the maternal side the family through several lines seems to have lived in Maryland, principally in Baltimore County for many generations. His mother, Sophia Ann Stansbury, was the daughter of a Maryland planter owning two or more farms and the Stansbury ancestry could be traced back well into colonial times. The home called "Adventure," which remained in the family for a number of generations, was purchased in 1768, according to the record before us, by Daniel Stansbury, who was born in Baltimore County in 1727. The Stansburys were probably of English extraction. His mother, according to Dr. Wilson's memorandum, was a woman of marked individuality of mind, generally somewhat aloof socially, but far from antisocial, and one who encouraged the children to study and to think.

The maternal grandmother, Eleanora Gossard, was characterized as having a "partisan, masterful, willful disposition with great kindliness and affection and remarkable black eyes." On his paternal side, his grandfather, Thomas Wilson, came from Scotland about 1815; his grandmother was Henetta van Peters, a native of Westphalia, Germany, but of a Dutch family (the *van* became anglicized to *Van*). His father, Samuel Augustus Wilson of Washington County, Maryland, was a clergyman in the Methodist Episcopal Church, who, while still young, was forced by voice trouble to retire from active service in the ministry although he continued to preach on occasion as substitute for various friends. He is characterized as having been "interested in ideas and events as shown in his miscellaneous reading, extemporizing in sermons and prayers," as being "frugal and cautious and with considerable ability in business and investments" and as a man who "made very many friends, was loyal to them and they to him." Interestingly enough, Dr. Wilson has characterized himself as having "some power of application but with a discursive tendency, considerable interest in direct perceptions (observations), in ideas as set down in literature" and as having "the usual out-of-doors occupations except games." He records also that his height was 5 feet 6½ inches and his weight never over 120 pounds.

Now to consider environmental influences. Having begun with good heredity and a home of cultivation, Dr. Wilson, as we have already seen, was trained in a secondary school of superior quality, and in the collegiate and university divisions of a new institution which was in process of revolutionizing graduate education in America. At Johns Hopkins University he was in close association with teachers and fellow students who were, or were to become, leaders in biological research and teaching. He was fortunate, furthermore, in finding exceptionally favorable conditions for post-doctorate research. Rare, indeed, were the research fellowships of those days or the institutions offering opportunities and facilities for the pursuit of biological research as a primary function. We find him passing from the new Bruce Fellowship to a scientific assistantship in the United States Fish Commission, a position which, while the Commission was directed by Spencer F. Baird, was fully equivalent to a National Research Council Fellowship or a Rockefeller or Guggenheim Fellowship of the present time.

Personal qualities which stand out most strongly were his alertness and incisiveness of thought and expression, his superior memory, his capacity for sustained work, his resolutely methodical habit of life, amounting to a virtual mastery of time, his highly developed critical faculty, and his sharp impatience with slovenliness in any form.

He had a penchant for argument and a rare facility in debate. As a young man, he once told me, he had become one of a group who arranged to meet weekly for debate. As I recall, they supped together, and it was a rule that whatever opinion any one expressed on any subject he must be prepared to defend against the onslaughts of all the others, the others being corespondingly obligated to attack any statement regardless of their own belief on the subject under consideration. He thought that this training had been valuable in development not only of skill in debate but also of clear thinking and ready and precise expression. He added, however, that he thought that the practice and the skill gained through it had one disadvantage in that it led to an exaggeration of the desire to debate. At any rate he had developed a highly critical habit and could find instantly the weak point in any broad statement. No doubt he sometimes saw weak points where they did not exist, but one soon learned, at least, that in argument with Dr. Wilson it did not pay to be either vulnerable at the start or queasy in the rejoinder. No one, however, could question the fact that his sharp rebuttals were sincere and provocative of clear thinking. In his latter years, he was less disposed to argue but no less inclined to differ. "I won't argue the matter with you," he would sometimes say, "but I do not believe at all in what you say."

His inclination to debate seemed to prevail even when reading, and some of his books bear innumerable marginal notes as if materials for an answering article although not so intended. They are always brief and incisive: "Sermon like—first startle, then assuage;" "Nice caution;" "A false start;" "Try out this statement before a jury—how tenuous does it become?" etc. Similarly incisive or even devastating comments were made upon margins of students' papers. Likewise, he could give spontaneous and generous praise for good work.

His meticulousness in the habit of making memoranda is worthy of note. Colleagues and students were familiar enough with the frequent memoranda on desks or even received by mail; slipping the memorandum in a stamped envelope was sometimes less troublesome than placing it on a desk in an adjoining office. But hardly any one could have anticipated the innumerable memoranda that he addressed to himself and left in great piles in his office. After his death there was found an accumulation of at least eight years' memoranda that would form the basis for a most interesting character study. Piles of classified memoranda, observations, reminders, random thoughts, miscellaneous notes; one, for example, labelled "hodgepodge of notes for Hopkins lecture." Many were critical but none personally unkind: "Medical students playing ball, making noise, 3:30 P.M." "Should I not protest against (certain policies)?" "Have F. copy marginal notes (on examination papers) I marked with an asterisk (I have not yet marked them). Give copy to each student;" etc.

He was doubtless at times monitorial in manner, and he would not have resented the term; "I know," he said once, "I am the schoolmaster." Although his criticisms might sometimes be caustic, no good student questioned the personal affection which Dr. Wilson had for him, or failed to mix affection with profound respect in his own feeling toward the Master. Provided the student showed effort, industry, and a reasonable degree of intelligence and could be relieved of any habit of slovenliness he may have had, Dr. Wilson had a great sympathy for deficiencies of training, background, experience or ability, a sympathy that was not always immediately apparent to the student. He had an enduring interest in past students and cherished a large number of dissections and records which he could always refer to as that of A. B. or X. Y.

A man of intense powers of concentration and of great capacity for work, Dr. Wilson was quite lacking in the wanderlust characterizing so many biologists. Until he graduated from Johns Hopkins University at the age of 20, his regular journeys, so far as can be learned from the information available, were between home and school or college, with occasional family expeditions in summer to farms in the country near Baltimore. His wanderings took place chiefly during the following eight years, with a year in Milwaukee, the trips that have been previously mentioned to the lower Chesapeake, the seashore of North Carolina and the Bahamas, and the two years spent at Woods Hole, Massachusetts. From the beginning of his work in Chapel Hill in 1891 until his death in 1939, the beaten paths were those of the village of Chapel Hill, with a shift in the summer to what was really for him a second home at the laboratory at Beaufort, North Carolina. He did spend two years abroad, one in F. E. Schulze's Laboratory in Berlin, and one chiefly in the Naples Laboratory. There were also occasional, but infrequent, trips to scientific meetings; but outside of visits to members of his family, Dr. Wilson's bodily presence during the greater part of his life was almost always in Chapel Hill or Beaufort.

It is hoped that what has been written has not given the false impression that a halo of austerity constantly framed the subject of this sketch. It is almost paradoxical that one so extremely methodical, so iron-bound in habit, and so capable of austerity, should have been masked by a high buoyancy of spirit and a catholicity of interest that made him a man of wide reading, particularly in biological literature but also in magazines and fiction, and a social, jovial and stimulating companion in the home and drawing room. In the early years at Chapel Hill his own home was made all the more delightful, through the efficient management, the hospitality and the personal charm of his wife, the former Edith Stickney of Boston, whom he married in June, 1893. There were three children: Edith Stickney (now the wife of Professor Thorndike Saville, Dean of the School of Engineering, New York University), Eleanora Stansbury (now the wife of Dr. Howell Peacock of Bala-Cynwyd, Pennsylvania), and Dr. Henry Van Peters Wilson, surgeon of Dover, Delaware. After Mrs. Wilson's death in 1900, the home was guided by one of his sisters, later by the daughters in succession as they grew up, but in later years by himself alone. After Mrs. Wilson's death, much of the original buoyancy of spirit passed from him, but the abundant energy, the drive in work and the keenness of thought and vigor in conversation were intensified.

It was typical of Dr. Wilson's self-reliance and resolute will that he was convinced, as he had said, that he would never return alive from a hospital, and that, in his last illness, he drove himself in regular routine almost to the end against the urgent advice of physicians and friends. When he consented finally to be hospitalized, it was only four days until his prophecy was fulfilled.

It was typical of the impress he made upon associates in all walks of life that, on the occasion of his last birthday, the proprietor of the restaurant, where in later years he regularly dined, caused invitations to be sent to a number of University people and townsmen to "drop in" for dinner "on the house," and that, after Dr. Wilson had concluded his regular meal and several restaurant tables had been pushed together, the Greek host assembled the scattered friends, who up to this moment had appeared as casual "diners out," and placed them about the surprised guest of honor to await the stately procession of candled cake and champagne. Before another birthday hundreds of former students and friends everywhere might metaphorically lift a cup at notice that the "Schoolmaster" and the strong figure in American science had passed from this life almost with booted feet, or, more appropriately, with fingers barely lifted from the fine adjustment of his microscope.

R. E. COKER.

INDEX

16/1/76

Philosophy – America

America – Philosophy