

REPORT OF THE
NATIONAL ACADEMY OF
SCIENCES

FOR THE YEAR
1914



REPORTED BY MR. FLETCHER.

IN THE SENATE OF THE UNITED STATES,

February 19 (calendar day, March 3), 1915.

Resolved, That the report submitted by the National Academy of Sciences on February twenty-second, nineteen hundred and fifteen, for the year ended December thirty-first, nineteen hundred and fourteen, be printed as a Senate document.

Attest:

JAMES M. BAKER,
Secretary.

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LETTER OF TRANSMITTAL.

NATIONAL ACADEMY OF SCIENCES,
February 18, 1915.

The Honorable THOMAS R. MARSHALL,
Vice President of the United States,
Washington, D. C.

SIR: I have the honor to transmit to you herewith the annual report of the president of the National Academy of Sciences for the year ending December 31, 1914.

Very respectfully,

ARTHUR L. DAY,
Home Secretary.

ACT OF INCORPORATION.

AN ACT To incorporate the National Academy of Sciences.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That Louis Agassiz, Massachusetts; J. H. Alexander, Maryland; S. Alexander, New Jersey; A. D. Bache, at large; F. B. Barnard,¹ at large; J. G. Barnard, United States Army, Massachusetts; W. H. C. Bartlett, United States Military Academy, Missouri; U. A. Boyden, Massachusetts; Alexis Caswell, Rhode Island; William Chauvenet, Missouri; J. H. C. Coffin, United States Naval Academy, Maine; J. A. Dahlgren, United States Navy, Pennsylvania; J. D. Dana, Connecticut; Charles H. Davis, United States Navy, Massachusetts; George Engelmann, Saint Louis, Missouri; J. F. Frazer, Pennsylvania; Wolcott Gibbs, New York; J. M. Gilliss,² United States Navy, District of Columbia; A. A. Gould, Massachusetts; B. A. Gould, Massachusetts; Asa Gray, Massachusetts; A. Guyot, New Jersey; James Hall, New York; Joseph Henry, at large; J. E. Hilgard, at large, Illinois; Edward Hitchcock, Massachusetts; J. S. Hubbard, United States Naval Observatory, Connecticut; A. A. Humphreys, United States Army, Pennsylvania; J. L. Le Conte, United States Army, Pennsylvania; J. Leidy, Pennsylvania; J. P. Lesley, Pennsylvania; M. F. Longstreth, Pennsylvania; D. H. Mahan, United States Military Academy, Virginia; J. S. Newberry, Ohio; H. A. Newton, Connecticut; Benjamin Peirce, Massachusetts; John Rodgers, United States Navy, Indiana; Fairman Rogers, Pennsylvania; R. E. Rogers, Pennsylvania; W. B. Rogers, Massachusetts; L. M. Rutherford, New York; Joseph Saxton, at large; Benjamin Silliman, Connecticut; Benjamin Silliman, junior, Connecticut; Theodore Strong, New Jersey; John Torrey, New York; J. G. Totten, United States Army, Connecticut; Joseph Winlock, United States Nautical Almanac, Kentucky; Jeffries Wyman, Massachusetts; J. D. Whitney, California; their associates and successors duly chosen, are hereby incorporated, constituted, and declared to be a body corporate, by the name of the National Academy of Sciences.

SEC. 2. *And be it further enacted,* That the National Academy of Sciences shall consist of not more than fifty ordinary members, and the said corporation hereby constituted shall have power to make its own organization, including its constitution, by-laws, and rules and

¹ The official list of members gives the name of F. A. P. Barnard.

² The official list of members gives the name of J. M. Gilliss.

regulations; to fill all vacancies created by death, resignation, or otherwise; to provide for the election of foreign and domestic members, the division into classes, and all other matters needful or usual in such institution, and to report the same to Congress.

SEC. 3. *And be it further enacted*, That the National Academy of Sciences shall hold an annual meeting at such place in the United States as may be designated, and the academy shall, whenever called upon by any department of the Government, investigate, examine, experiment, and report upon any subject of science or art, the actual expense of such investigations, examinations, experiments, and reports, to be paid from appropriations which may be made for the purpose, but the academy shall receive no compensation whatever for any services to the Government of the United States.

Approved, March 3, 1863.

AMENDMENTS.

AN ACT To amend the act to incorporate the National Academy of Sciences.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the act to incorporate the National Academy of Sciences, approved March third, eighteen hundred and sixty-three, be, and the same is hereby, so amended as to remove the limitation of the number of ordinary members of said academy as provided in said act.

Approved, July 14, 1870.

AN ACT To authorize the National Academy of Sciences to receive and hold trust funds for the promotion of science, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the National Academy of Sciences, incorporated by the act of Congress approved March third, eighteen hundred and sixty-three, and its several supplements, be, and the same is hereby, authorized and empowered to receive bequests and donations and hold the same in trust, to be applied by the said academy in aid of scientific investigations and according to the will of the donors.

Approved, June 20, 1884.

AN ACT To amend the act authorizing the National Academy of Sciences to receive and hold trust funds for the promotion of science, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the act to authorize the National Academy of Sciences to receive and hold trust funds for the promotion of science, and for other purposes, approved June twentieth, eighteen hundred and eighty-four, be, and the same is hereby, amended to read as follows:

“That the National Academy of Sciences, incorporated by the act of Congress approved March third, eighteen hundred and sixty-three, be, and the same is hereby, authorized and empowered to receive, by devise, bequest, donation, or otherwise, either real or personal property, and to hold the same absolutely or in trust, and to invest, reinvest, and manage the same in accordance with the provisions of its constitution, and to apply said property and the income arising therefrom to the objects of its creation and according to the instructions of the donors: *Provided, however,* That the Congress may at any time limit the amount of real estate which may be acquired and the length of time the same may be held by said National Academy of Sciences.”

SEC. 2. That the right to alter, amend, or repeal this act is hereby expressly reserved.

Approved, May 27, 1914.

ANNUAL REPORT OF THE NATIONAL ACADEMY OF SCIENCES.

MEETINGS OF THE NATIONAL ACADEMY.

During the year 1914 the academy held two stated meetings, the annual meeting in April at Washington and the autumn meeting in December at the University of Chicago, Chicago, Ill.

The conspicuous events of the year have been two, the inauguration of the William Ellery Hale lectures and the initial awards of the Medal for Eminence in the Application of Science to the Public Welfare.

The William Ellery Hale lectures were established through a foundation, generously offered by the children of William Ellery Hale, which provides for a course of two or three lectures at each semi-annual meeting of the academy, to be delivered by some scientist of distinction. As at present arranged by the committee in charge, the lectures will be devoted to a presentation of the general subject of evolution and the effort will be made to choose lecturers who have been leaders in the development of some conspicuous phase of this subject.

In pursuit of this plan, the first course of lectures, delivered at the April meeting of the academy in Washington, was devoted to the general subject of the evolution of matter, the lecturer being Sir Ernest Rutherford of Manchester, England, whose studies of radium and its related elements and derivatives have done much to create a new epoch in our knowledge of matter in its ultimate forms and relations.

The second course of lectures, given at the autumn meeting of the academy in Chicago, was presented by William Wallace Campbell, on the evolution of our stellar system, in which the effort was made to establish a genetic relationship through all the stages of development from tenuous nebulae to cold, solid bodies like our planet.

The third course is to carry the same subject somewhat further, and treat of the earth, its geologic history and its present stage of progress. This course will be delivered at the April meeting in 1915,

and the lecturer will be Prof. Thomas Chrowder Chamberlin, of the University of Chicago, a distinguished member of the academy.

Future lecturers, preserving the continuity of the series, will deal with organic evolution and illustrate the bearing of recent investigations in paleontology, zoology and botany on the evolution of plant and animal life. The evolution of man will form the subject of a subsequent course and the series will close with an account of the rise of the earliest civilizations, coming into touch with modern times in the life of the Nile Valley.

A period of five years is contemplated for the completion of the entire series.

The Medal for Eminence in the Application of Science to the Public Welfare was established in 1913 through the generosity of Mrs. Helen Hartley Jenkins, who provided a fund to be called, in memory of her father, the Marcellus Hartley fund, the income of which is to be used in perpetuity to provide a medal for the recognition of exceptional achievement in a field which appeals alike to our patriotism and our scientific ideals and yet has received hitherto but meager recognition from the scientific world. In the words of the first committee of award:

Patriotism and justice alike demand that certain public services involving the application of science should receive a conspicuous recognition at the hands of the National Academy of Sciences. * * * It is the purpose of the Medal for Eminence in the Application of Science to the Public Welfare to mark the appreciation of the National Academy for eminent services to the public, performed without a view to great monetary gains and by methods which, in the opinion of the academy, are truly scientific.

Awards of this medal were made at the April meeting in 1914 to George Washington Goethals and to William Crawford Gorgas for distinguished service in engineering and sanitation, respectively, in building the Panama Canal.

ANNUAL MEETING.

The sessions were held in the Oak Room of the Raleigh Hotel and in the United States National Museum, Washington, D. C., April 21, 22, 23, 1914.

Sixty-one members were present, as follows: Abbe, Allen, Ames, Becker, Bell, Boaz, Boltwood, Cattell, Clark (W. B.), Clarke (F. W.), Clarke (J. M.), Conklin, Councilman, Crew, Cross, Dall, Davenport, Day, Gill, Hague, Hale, Hall, Harper, Harrison, Hayford, Hillebrand, Holmes, Howell, Iddings, Kemp, Loeb, Mall, Mark, Meltzer, Merriam, Michelson, Morgan, Morse (H. N.), Nichols (E. L.), Noyes (A. A.), Noyes (W. A.), Osborn (H. F.), Parker, Pickering, Pirsson, Pupin, Reid, Remsen, Rosa, Smith (Erwin F.), Smith (Theobald),

Thomson, Trelease, Van Hise, Walcott, Webster, Welch, Wheeler (W. M.), White, Wilson, Woodward.

The president announced the death, since the last annual meeting, of the following members:

Silas Weir Mitchell, January 4, 1914. Elected 1865.

Seth Carlo Chandler, January 10, 1914. Elected 1888.

Benjamin Osgood Peirce, January 14, 1914. Elected 1906.

Edward Singleton Holden, March 16, 1914. Elected 1885.

George William Hill, April 16, 1914. Elected 1874.

Charles Santiago Sanders Peirce, April 22, 1914. Elected 1876.

And foreign associates:

Karl Harry Ferdinand Rosenbusch, January 14, 1914. Elected 1904.

Sir David Gill, January 24, 1914. Elected 1898.

Sir John Murray, March 16, 1914. Elected 1912.

REPORTS OF THE PRESIDENT AND THE TREASURER.

The reports of the president¹ and of the treasurer² for 1913, as transmitted to the Senate of the United States by the president of the academy, were presented in their printed form and approved.

SPECIAL COMMISSION ON THE FUR SEAL.

The president reported that a request had been received from the President of the United States that a member of the academy be nominated to serve as a member of a special commission to visit the Pribilof Islands during the summer of 1914 for the purpose of advising the Government regarding the condition of the fur-seal herd and of making recommendations concerning the policy which should be adopted with reference thereto.

Following is the communication from the President of the United States:

THE WHITE HOUSE,
Washington, February 20, 1914.

MY DEAR DR. WELCH: You are respectfully requested to nominate a member of the National Academy of Sciences properly qualified to study the economic and scientific questions involved in the administration of the fur-seal herd, but not hitherto identified in any way with the fur-seal controversy, to go to the Pribilof Islands in the season of 1914 as a member of the special commission hereinafter mentioned.

The Secretary of Agriculture and the Secretary of the Smithsonian Institution have each been asked to designate a member of this special commission. The three persons named constituting the commission will be asked to make a practical investigation of the present condition of the seal herd and submit a full report to the Secretary of Commerce, with recommendations, not later than December 31, 1914.

The subjects for special determination will be:

1. The numerical strength of various components of the herd.

¹ Report of the National Academy of Sciences for the year 1913, pp. 9-31.

² *Idem*, pp. 31-39.

2. The effect of the suspension of pelagic sealing.
3. The adequacy of the adult male life in view of the apparent increase of breeding females.
4. The quota of seals of specified age which should be taken for the food and other purposes of the natives.
5. The strength of the surplus male life in relation to the close-time provision of existing law and to treaty obligations.
6. The propriety of past and present methods as to driving.
7. The economic and legal questions involved in the killing of surplus male seals under recent and current instructions.
8. What changes, if any, are demanded in the relations of the Government to the business, social, educational, and other interests of the natives of the islands.
9. Such other matters as the Secretary of Commerce or the Commissioner of Fisheries may suggest for consideration.

It will be understood, however, that the members of the special commission are not limited to suggestions arising from the officers of the department, but may freely, and as they shall themselves initiate, take such action as will afford for the use of Congress and the department the fullest possible information respecting the seal herd.

The Secretary of Commerce will provide for the compensation of such members of the special commission as are not employees of the Government at the rate of \$250 per month and their actual traveling expenses, to be paid from the appropriations for the fur-seal service. The Secretary of Commerce will also arrange with the Secretary of the Treasury for the detail of a revenue cutter engaged in the fur-seal patrol to take the commission to and from the Pribilof Islands.

The Deputy Commissioner of Fisheries will during the coming season visit the coast of Alaska and the Pribilof Islands, but his journey will be solely for administrative purposes and will have no relation to the work of the proposed commission.

It will be necessary that the commission leave Seattle not later than June 18, and it is essential that they be on the islands during the dates July 1 to 10, inclusive, and August 1 to 10, inclusive, which will involve a stay upon the islands of not less than five weeks.

The above request is made pursuant to section 3 of the act of incorporation of the National Academy of Sciences, which provides that "the academy shall, whenever called upon by any department of the Government, investigate, examine, experiment, and report upon any subject of science or art, the actual expense of such investigations, examinations, experiments, and reports to be paid from appropriations which may be made for the purpose, but the academy shall receive no compensation whatever for any services to the Government of the United States."

Said action is also pursuant to section 3 of Article II of the constitution of the academy, which provides that the President of the United States "shall refer investigations required by the Government of the United States to members especially conversant with the subjects and report thereon to the academy at its sessions next ensuing."

I shall be glad to be advised at earliest convenience of the person designated by you in accordance with the above request.

Cordially and sincerely, yours,

WOODROW WILSON.

Dr. WILLIAM H. WELCH,

President National Academy of Sciences,

Johns Hopkins University, Baltimore, Md.

To this letter the following reply was returned:

MY DEAR MR. PRESIDENT: In compliance with the request in your letter of February 20, received to-day, I shall at once and gladly proceed, with the advice of other members, to select a member of the National Academy of Sciences properly qualified to serve on the special commission to study and report on questions relating to the fur-seal herd. I shall expect to send his name to you at an early date.

It is most gratifying to receive your request, for the academy is eager to be of all possible service to the National Government in its capacity of adviser in scientific matters under the act of incorporation and the constitution of the academy.

With the highest regard and cordial best wishes, I am,

Very respectfully and faithfully, yours,

WILLIAM H. WELCH,

President of the National Academy of Sciences.

The PRESIDENT, *White House.*

The president reported further that the matter had been presented to the council at a special meeting held on March 4, 1914, and that, with the advice and consent of the council, he had nominated Mr. George H. Parker, of Harvard University, to be a member of the commission. The Secretary of the Smithsonian Institution had nominated Mr. Wilfred H. Osgood, of the Field Museum of Natural History, Chicago, and the Department of Agriculture Mr. Edward A. Preble, assistant biologist of the Biological Survey.

REPORT OF THE HOME SECRETARY.

The President of the National Academy of Sciences.

SIR: I have the honor to present herewith the annual report of the home secretary of the National Academy of Sciences for the year ending April 24, 1914.

The annual report of the president of the academy for the year 1913 was transmitted to the United States Senate February 28, 1914. The edition of 2,000 copies, authorized by Congress, was printed; 500 copies for the use of the Senate, 1,000 copies for the use of the House of Representatives, and 500 copies for distribution by the National Academy of Sciences.

The report was received from the Government Printing Office April 20, 1914. Copies will be distributed to the members, foreign associates, institutions, and reference libraries on our exchange list. The remainder of the limited edition will be distributed on application to learned societies and members of the academy.

At the annual meeting in April, 1913, the following were elected to membership in the academy: Henry Andrews Bumstead, Sloane Physical Laboratory, New Haven, Conn.; Leonard Eugene Dickson, University of Chicago, Chicago, Ill.; Ross Granville Harrison, Yale University, New Haven, Conn.; Armin Otto Leuschner, University of California, Berkeley, Cal.; Gilbert Newton Lewis, University of California, Berkeley, Cal.; Lafayette Benedict Mendel, Yale University, New Haven, Conn.; George Howard Parker, Harvard University, Cambridge, Mass.; Louis Valentine Pirsson, Yale University, New Haven, Conn.; Edward Bennett Rosa, Bureau of Standards, Washington, D. C.; Erwin Frink Smith, Bureau of Plant Industry, Washington, D. C.

The proof-reading and preparation of the plates for the memoir entitled *Monograph of the Bombycine Moths of North America*, by A. S. Packard, which is to appear as the first memoir of Volume XII of the *Memoirs of the National Academy of Sciences*, has been completed and the volume will soon be issued, as will also the *Catalogue of the Meteorites of North America*, by Oliver C. Farrington, forming Volume XIII; *Variations and Ecological Distribution of the Snails of the Genus Io*, by Charles C. Adams,

forming Volume XII, second memoir, and the Turquoise, by Joseph E. Pogue, forming Volume XII, third memoir.

The biographical memoir of John H. C. Coffin has been published during the year, and manuscripts are in hand for the biographies of John Wesley Powell, Charles A. Schott, J. Peter Lesley, and Miers Fisher Longstreth.

The anniversary volume has been issued, and copies were presented at the autumn meeting.

Five members have died since the last annual meeting: Silas Weir Mitchell, January 4, 1914; Seth Carlo Chandler, January 10, 1914; Benjamin Osgood Peirce, January 14, 1914; Edward Singleton Holden, March 16, 1914; and George William Hill, April 16, 1914.

Of our foreign associates we have to record the death of: Sir John Murray, March 16, 1914; Karl Harry Ferdinand Rosenbusch, January 14, 1914, and Sir David Gill, January 24, 1914.

There are 127 active members on the membership list, 1 honorary member, and 46 foreign associates.

ARTHUR L. DAY,
Home Secretary.

APRIL 21, 1914.

REPORT OF THE DIRECTORS OF THE BACHE FUND.

The following appropriations have been made:

No. 177. Franklin D. Barker. \$150. June 3, 1913. An exhaustive economic, morphological, and systematic study of the parasitic fauna of the fishes, turtles, and marine invertebrates of Bermuda.

No. 178. Carl O. Johns. \$150. June 18, 1913. The synthesis of new alkyl purines in order to obtain more complete series of these compounds that they may be used for the pharmacological and physiological study of purine derivatives related to caffeine and theobromine, etc.

No. 179. J. Voûte. \$1,000, to be paid in five yearly installments. June 18, 1913. Observations on stellar parallax in the Southern Hemisphere.

No. 180. P. W. Bridgman. \$500. October 13, 1913. To find the changes of phase produced by high pressures in various substances.

No. 181. Gilbert N. Lewis. \$500. November 7, 1913. The exact determination of electrode potentials.

CHARLES S. MINOT,
Chairman.

APRIL, 1914.

REPORT OF THE TRUSTEES OF THE WATSON FUND.

The object of the Watson fund is "The Promotion of Astronomical Science." The donor expressed the wish that tables of the Watson asteroids should be prepared. Accordingly, nearly the entire income during the last 12 years, beyond that employed for the Watson medals, has been used for this purpose. It was hoped that the entire work could be completed by July, 1914, with the appropriation made last year. As this result can not be attained, it is recommended that the additional sum of \$960 be appropriated to Prof. A. O. Leuschner, which will enable the work to be continued until July, 1915. As it seems highly desirable that a fund for general purposes should be used for more than one research, it is hoped that appropriations for other purposes may be made shortly.

EDWARD C. PICKERING,
Chairman.

W. L. ELKIN.
EDWIN B. FROST.

REPORT OF THE COMMITTEE ON THE HENRY DRAPER FUND.

On behalf of the committee on the Henry Draper fund, I have the honor to report that a grant (No. 1) for \$500 was made to Mr. Charles Greeley Abbot, director of the Astrophysical Observatory of the Smithsonian Institution, on January 26, 1914, to pay for the services of a computer engaged for the reduction of observations of the solar radiation and the absorption of the sun's atmosphere. Mr. Abbot has presented a report of progress, showing that many important results have been obtained through the aid of the grant.

Other applications for grants have been received by the committee and are now under consideration.

GEORGE E. HALE,
Chairman.

REPORT OF THE COMMITTEE ON THE J. LAWRENCE SMITH FUND.

The committee on the J. Lawrence Smith fund reports in regard to researches now in progress which have received aid from this fund, as follows:

1. Edmund Otis Hovey, curator in the department of geology and invertebrate paleontology in the American Museum of Natural History, New York, received in 1909 a grant of \$400 to aid in the study of certain meteorites. This work is still in progress.

2. C. C. Trowbridge, professor of physics in Columbia University, New York, received in 1909 a grant of \$400 in aid of his studies of the luminous trains which follow certain meteorites. A further grant of \$1,000 (to be paid in four annual installments of \$250 each) was, on the recommendation of the committee, made in 1912 to Prof. Trowbridge by vote of the academy, to assist in the collection and tabulation of records of visual and instrumental observations of meteor trains. During the past year many such new records have been obtained from England, Austria, Denmark, and Russia. In accordance with the vote of the academy in 1912, two payments have been made from this grant, and it is expected that a third installment will be required during the current year.

3. George P. Merrill, head curator in the department of geology in the United States National Museum, received a grant of \$200 in 1910, a further grant of \$200 in 1911, and a third of \$400 in 1913, to assist in verifying the occurrence of certain rare elements in meteorites. Final results have been reported in the case of eight meteoric falls. It is desirable to carry the investigation further, but progress during the last year has been slow, owing to the difficulty in securing large samples without making their cost excessive.

The amount available from unexpended income for grants was \$86.58 on April 20, 1914.

EDWARD W. MORLEY,
Chairman.

APRIL 20, 1914.

REPORT OF THE BOARD OF DIRECTORS OF THE BENJAMIN APTHORP GOULD FUND.

The income balance of the Gould fund is now \$5,606.74. From this balance an appropriation of \$3,000 was made to the *Astronomical Journal* in February, 1913; a grant of \$500 was made to Dr. A. H. Pfund in March, 1914, and a grant of \$200 to Prof. Sidney D. Townley in March, 1914. This leaves an unappropriated balance of the Gould fund of \$1,906.74.

The subsidy to the *Astronomical Journal* is in continuation of the practice inaugurated some years ago in harmony with the wishes of Miss Gould. The grant to Dr.

A. H. Pfund was for the purpose of securing apparatus to continue his investigations regarding the radiant energy received from the stars and planets. The grant to Prof. Townley was for the purpose of assisting him to make observations on variable stars with the 12-inch telescope of the Lick Observatory.

F. R. MOULTON,
Chairman.

G. W. HILL.

E. E. BARNARD.

APRIL 11, 1914.

REPORT OF THE DIRECTORS OF THE WOLCOTT GIBBS FUND.

The directors of the Wolcott Gibbs fund for chemical research have the honor to report that a bequest from the late Morris Loeb added \$2,500 to the capital of the fund in the autumn of 1913.

A balance of income of \$237 having accumulated, the directors published a notice in the February number of the Journal of the American Chemical Society calling for applications for grants, but so far only one has been received. This was from Dr. Mary E. Holmes, of Mount Holyoke College, South Hadley, Mass., to whom a grant of \$100 (grant No. 2) was voted to provide apparatus and chemicals for a research on the electrolytic determination of cadmium. She will study the deposition of cadmium from solutions of its various salts and its separation from other elements.

C. L. JACKSON,
Chairman.

APRIL, 1914.

REPORT OF THE COMMITTEE ON SOLAR RESEARCH UPON THE BONN MEETING OF THE INTERNATIONAL UNION FOR COOPERATION IN SOLAR RESEARCH.

The fifth meeting of the International Union for Cooperation in Solar Research was held in the Physical Institute of Bonn University on July 30 to August 5, 1913. The National Academy of Sciences was represented by Messrs. Pickering, Nichols (E. L.), and Campbell (W. W.), as members of the standing committee on solar research, and by Mr. Ames. The United States was further represented by 15 astronomers and physicists as members of other constituent societies of the union. The total attendance was 97 members, from 16 countries.

The social entertainment provided for the members was remarkable in cordiality and extent. There were banquets given by the municipal governments of Bonn and Cologne, a reception at the Bonn Observatory by Direktor and Frau Küstner, an automobile excursion through the Moselle and Rhine Valleys provided by citizens of Bonn, Prof. Kayser's evening excursion and dinner on the Rhine, and other enjoyable events.

Scientific sessions, presided over successively by Profs. Kayser, Küstner, Schwarzschild, Runge, and Pringsheim, with Prof. Turner as chairman of the executive committee, were held on the forenoons of five days. They were occupied chiefly with the presentation and consideration of the reports of the nine standing committees. These reports reviewed the progress made in the respective subjects since the date of the fourth meeting, on Mount Wilson, in 1910, and recommended methods of procedure for further research. The subjects considered were: The Work of the Computing Bureau, Solar Radiation, Standards of Wave Lengths, Classification of Stellar Spectra, Spectrographic Measurements of the Sun's Rotation, Spectra of Sunspots, Solar Eclipse Problems and Expeditions, and Spectroheliographic Observations of the Sun.

By special arrangement, 12 brief reports upon solar and closely related subjects were made by individual members.

There was an evening conversazione at which a wide range of scientific work was exhibited, chiefly by means of photographs.

The title of the committee on work with the spectroheliograph was changed to read the committee on solar atmosphere, and this committee was divided into two sub-committees, one representing visual observations and the other photographic observations of solar atmospheric phenomena.

The resolutions adopted, relating chiefly to further research, and the lists of standing committees of the union as at present constituted may be found in the *Astrophysical Journal* for October, 1913, pages 302-307.

It was decided to hold the next meeting of the Union in Rome in 1916.

GEORGE E. HALE,
Chairman.

EDW. C. PICKERING.

W. W. CAMPBELL.

EDW. L. NICHOLS.

REPORT OF THE COMMITTEE ON THE MEDAL FOR EMINENCE IN THE APPLICATION OF SCIENCE TO THE PUBLIC WELFARE.

The committee on the Medal for Eminence in the Application of Science to the Public Welfare presented the following report, which was adopted:

PURPOSE OF THE MEDAL.

Patriotism and justice alike demand that certain public services involving the application of science should receive a conspicuous recognition at the hands of the National Academy of Sciences. Technical inventions and improvements are made for the most part with a view to pecuniary benefits and commonly obtain their reward. Scientific inventions, such as the spectroscope, add to the luster of scientific reputations and command the same honors as do discoveries. But there are other applications of science which can not be rewarded in either of these ways. Such, for example, was the establishment of the Fish Commission by Spencer F. Baird. Though it was of vast importance to the whole country it received no monetary compensation worth speaking of, while since it involved no scientific discovery it would not have entitled Baird to membership in the academy.

It is the purpose of the Medal for Eminence in the Application of Science to the Public Welfare to mark the appreciation of the National Academy for eminent services to the public performed without a view of great monetary gains and by methods which, in the opinion of the academy, are truly scientific.

CONDITIONS OF AWARD.

Name.—This medal shall be known as the Medal for Eminence in the Application of Science to the Public Welfare.

Eligibility.—No candidate for this medal shall be regarded as entitled to it unless he receives the votes of two-thirds of the members of the committee. No candidate who is a member of the National Academy of Sciences shall receive this medal unless the committee votes unanimously in his favor.

Number of medals.—Not more than two medals shall be conferred in any one year.

Time.—The awards shall be made at the stated annual meeting of the academy and the recipients shall be invited to receive the medals in person.

Privileges.—Holders of the Medal for Eminence in the Application of Science to the Public Welfare shall be notified like members of meetings of the academy and invited to participate in its scientific meetings. The possession of a medal shall be no bar to membership in the academy, but shall constitute no claim to membership.

Your committee is considering names of future recipients, on which it expects to report to the council at the autumn meeting.

Your committee requests the council to make a recommendation as to whether the dies for the medal be left at the Paris Mint or brought to this country and deposited in the Philadelphia Mint or similar institution.

Your committee has the pleasure of announcing that Mrs. Helen Hartley Jenkins has generously added the sum of \$1,100 to her original gift of \$1,500 to the Marcellus Hartley fund, and that the sum is expected to be sufficient for the defrayal of all the expenses in connection with the annual award of the medal.

Your committee submits the following resolutions:

That the secretary be instructed to convey to Mrs. Helen Hartley Jenkins an expression of the appreciation of her generous additional contribution to the Marcellus Hartley Foundation of the Medal for Eminence in the Application of Science to the Public Welfare.

That the report of the committee be adopted, and that the council be requested to formulate a suitable entry for the annual report of the academy, of the regulations proposed by the committee for the Award of the Medal for Eminence in the Application of Science to the Public Welfare and its establishment by the Marcellus Hartley fund.

ELIHU THOMSON,
Chairman.

M. I. PUPIN.
A. G. WEBSTER.
W. F. HILLEBRAND.
GEORGE F. BECKER.
HENRY FAIRFIELD OSBORN.

BUSINESS FROM THE COUNCIL.

The following recommendations from the council were adopted:

That the annual dues for 1914 be \$5.

That the election of two members of the council, new members, and foreign associates be held Thursday morning, April 23.

That the treasurer be authorized to pay the annual subscription of 200 francs to the International Association of Academies.

That the American Security & Trust Co., of Washington, D. C., and Spencer Trask & Co., of New York City, be designated fiscal advisers of the academy for 1914-15.

That the time and place of the autumn meeting be left to the president and home secretary with power.

The council reported further that under the authority contained in Article IV, section 4, of the constitution, the standing committee on mathematics and astronomy had been divided into two standing committees, mathematics and astronomy, respectively.

REPORT OF THE COMMITTEE ON A PERMANENT BUILDING.

From the committee on a permanent building for the academy, Mr. Hale presented an informal report of progress, together with sketches of floor plans of the proposed building, which had been prepared by Mr. Coolidge, of Boston. The members were invited to criticize the plans freely, and in particular the proposal to include laboratories for the active prosecution of research in the physical and biological sciences.

REPORT OF THE COMMITTEE ON THE PUBLICATION OF PROCEEDINGS.

The council reported to the academy the recommendations of the special committee on the publication of proceedings, which were adopted by the council at its meeting on April 20, 1913, as follows:

That the first number of the proceedings be issued on January 1, 1915, and that one number be issued on the first of each following month, the number of pages in each number to be varied within reasonable limits with the amount of material available; also that the place of publication be the office of the home secretary, Washington, D. C.

That the publication of the proceedings be conducted by the council through a board of editors to be appointed by the council; that this board consist of a chairman, a managing editor (who need not be a member of the academy), of the home secretary and the foreign secretary ex officio, and of a staff of associate editors representing all the more important branches of research related to the work of the academy; that the chairman be primarily responsible for the preparation of the journal, and that the home secretary be primarily responsible for its distribution, cooperating with the foreign secretary with respect to the presentation and exchange of copies in foreign countries; that it be the duty of the chairman to submit to the council at the autumn meeting of each year a report on the condition of the proceedings, a budget of prospective receipts and expenditures for the ensuing calendar year, and recommendations as to changes in the staff of associate editors and as to other matters relating to the proceedings; that it be the duty of the managing editor to refer any paper presented for publication in the proceedings to one of the associate editors for his opinion as to the acceptance, rejection, or modification of the paper. In case of agreement between the managing editor and associate editor, the action agreed upon shall be taken; in the case of doubt or disagreement, the paper shall be referred to at least two other members of the academy; that it be the duty of each associate editor to secure for the proceedings, as far as possible, papers describing, in suitable form, the best American work done in the field of research which he represents, and that it be his further duty to advise the managing editor in regard to the acceptance or modification of the papers offered for publication in his field; that a meeting of the board of editors be held at each annual meeting of the academy for the discussion of the general policies to be followed in maintaining and developing the proceedings.

That the proceedings be of the general character described in the report of the former committee on proceedings, presented to the academy on November 18, 1913. In the opinion of the committee the main function of the proceedings should be to present in the form of brief, original articles a comprehensive survey of the more important contributions to scientific research currently made by American investigators. The articles should be much shorter and less detailed than those published in special journals. The articles might well, as a rule, vary from 2 to 6 pages in length, with maximum limit in exceptional cases of 10 to 12 pages.

The committee recommends that the proceedings be similar in make-up to the proceedings of the Royal Society, with a printed page about $4\frac{1}{4}$ by $7\frac{3}{8}$ inches and a paper page 7 by 10 inches.

CHANGES IN RULES.

The following resolutions concerning changes in the rules were offered and adopted:

1. That Rule II of the standing rules of the academy be repealed. The rule, which is obsolete under the present system of recording the minutes, reads as follows:

On the first day of each stated session, immediately after calling the roll of members, a recording secretary may be elected by a plurality of members present, to assist the home secretary in keeping the records of the session.

2. That it is the sense of the academy that Rule V, section 2, roll of members called by the home secretary, be amended, in substance, as follows:

That the full roll of the academy be called at the opening session of the academy, and that the presence of members at subsequent sessions be noted in the usual manner by the secretary or assistant secretary.

NEW RULES.

The following new rules, formulated by the committee on research and trust funds, were recommended by the council and adopted:

Rule XXIII. The home secretary shall keep a record of all grants of money or awards of prizes or medals made from trust funds of the academy. The record for each grant of money shall include the following items:

1. Name of fund.
2. Date and number of the grant.
3. Name and address of recipient.
4. Amount of grant and date or dates of payment.
5. Purpose of grant.
6. Record or report of progress.
7. Resulting publications.

Rule XXIV. The treasurer shall keep the home secretary informed of all warrants received from directors of trust funds not controlled by the academy and of the date or dates of payment of all warrants.

Rule XXV. A suitable summary of the annual reports of committees or directors concerning the trust funds of the academy (required by Rule XXII) shall be included in the annual report of the president of the academy to Congress.

Rule XXVI. All apparatus and other materials of permanent value purchased with money from any grant from a trust fund shall be the property of the academy unless specific exception is made in the grant or by subsequent action of the council or the directors of the trust fund concerned. Receipts for all such property shall be signed by the grantee and shall be forwarded to the home secretary. All apparatus and unused material of value acquired in this way shall be delivered to the home secretary on completion of the investigation for which the grant was made, or at any time on demand of the council, and the home secretary shall give an appropriate release therefor.

Rule XXVII. Standing committees of the academy on trust funds, the income of which is applied to the promotion of research, shall consist of three or five members, not including the president. In order to secure rotation in office in such committees, when not in conflict with the provisions of the deeds of gift, the term of service on a committee of three members shall be three years; on a committee of five members the term shall be five years. On adoption of this rule the president shall reappoint all committees coming under it, designating by lot or otherwise the term of service of each member, so that thereafter there shall be one vacancy each year in each such committee.

REPORT OF THE COMMITTEE ON THE COLLECTION OF HISTORICAL PORTRAITS, MANUSCRIPTS, AND INSTRUMENTS, INCLUDING INSTRUMENTS PURCHASED AT THE EXPENSE OF THE TRUST FUNDS.

The committee on the collection of historical portraits, manuscripts, and instruments, including instruments purchased at the expense of the trust funds which are no longer needed for the original purpose, has taken into consideration the following: (1) What material is on hand; (2) What material should be secured.

(1) WHAT MATERIAL IS ON HAND.

The academy possesses at this time a collection of 200 photographs of the members and arrangements are being made for listing these and filing them in alphabetical order. A collection of medals, which is deposited in the United States National Museum, consists of the following:

1. Gold medal of the Royal Geographical Society, awarded to Alexander D. Bache.
2. Gold medal awarded to Alexander D. Bache by Victor Emanuel II, King of Italy.
3. Gold medal awarded to Alexander D. Bache by Oscar, King of Norway and Sweden.
4. Bronze medal of the Exhibition of the Works and Industries of all Nations, London, 1851, awarded to Alexander D. Bache.
5. Bronze medal commemorating the services of Sir Theodore Oppolzer to the science of astronomy.
6. Bronze medal commemorating, 1901, the two hundredth anniversary of the founding of Yale College.
7. Bronze medal of the Institute of France commemorating the first session in Paris of the International Association of Academies.
8. Bronze medal commemorating, 1904, the fiftieth anniversary of the first commencement exercises of the University of Wisconsin.
9. Bronze medal commemorating, 1906, the fiftieth anniversary of the founding of the Academy of Science of St. Louis.
10. Bronze copy of the James Craig Watson medal awarded to Sir David Gill for researches in astronomy, 1900.
11. Bronze copy of the Alexander Agassiz medal awarded to scientific men in all parts of the world for original contributions to the science of oceanography.
12. Bronze copy of the Henry Draper medal awarded to Henri Deslandres for discoveries in astronomical physics.

(2) WHAT MATERIAL SHOULD BE SECURED.

Dr. Hale, a member of the committee, has gone into this matter quite in detail, suggesting the securing of oil paintings of the presidents and vice-presidents and other members whose investigations have been of importance, as well as instruments apparatus, manuscripts, and type specimens used by members of the academy which are epoch making, together with the instruments and apparatus purchased at the expense of the special funds.

Copies of Mr. Hale's two letters form an appendix to this report, as does one from Mr. Hague, discussing the points brought up by Mr. Hale.

The committee recommends that such material as may be accumulated before a building is secured be deposited in the Smithsonian Institution, and that the part of it which is available for exhibition be deposited in the National Museum for exhibition in the name of the National Academy of Sciences.

As this committee has only been in existence for a very short time, and must give consideration to ways and means of carrying out the work which it has to do, this report should be considered as one of progress.

CHARLES D. WALCOTT.

Chairman.

APRIL 23, 1914.

REPORT OF THE COMMITTEE ON THE WILLIAM ELLERY HALE LECTURES.

The William Ellery Hale lectures, founded in memory of the late William Ellery Hale, of Chicago, were inaugurated by Sir Ernest Rutherford, of the University of Manchester, who spoke in the auditorium of the National Museum, Washington, D. C., on April 21 and 23, 1914, at 4 p. m.

The committee in charge has planned a series of such lectures covering several years on the general subject of Evolution, which is designed to give a clear and comprehensive outline of the broad features of inorganic and organic evolution in the light of recent research. Sir Ernest Rutherford's lectures dealt with the Constitution of Matter and the Evolution of the Elements. Aided by many illustrations, including some of the experiments which brought to him the award of the Nobel prize, Sir Ernest explained how the discovery of radioactivity and the study of the electron have revolutionized our views on the nature of matter. By these new means of investigation the chemical elements and the complex compounds which they unite to form were shown to consist of units of positive and negative electricity; moreover, that all negative electrons are precisely alike, from whatever form of matter they may be derived. Thus were shown some of the transformations of the chemical elements, such as the spontaneous disintegration of radium and from it the production of helium.

These addresses on the fundamental structure of matter prepare the way for the succeeding lectures, which will deal with the various transformations of matter involved in the evolution of the earth and its inhabitants.

The second course in the evolution series will be given at the next autumn meeting of the academy by Dr. William Wallace Campbell, director of the Lick Observatory, Mount Hamilton, Cal. Provided with raw material, as it were, by Sir Ernest Rutherford, Dr. Campbell will sketch the various types of bodies which make up the universe, describe their connection in systems, and explain the principal theories of stellar evolution. His object will be to show how stars and stellar systems are gradually evolved from an earlier state and to afford a view of the earth in its first phases of development. In this way the intimate relationship of the earth with the moon and the other bodies of the solar system will be made apparent, as well as the continuity of the process which connects the present with the remote past. Dr. Campbell will introduce some of the results of his extensive researches with the powerful instruments of the Lick Observatory and will employ a large collection of astronomical photographs for purposes of illustration.

A distinguished European geologist will be invited to give the third course of lectures at the annual meeting of the academy in 1915. Taking the earth from the hands of the astronomer, he will show how its surface features have been altered in the process of time. Later lectures, preserving the continuity of the series, will then enter the field of organic evolution and illustrate the bearing of recent investigations in paleontology, zoology, and botany on the evolution of plant and animal life. The evolution of man will form the subject of a subsequent course, and the series will close with an account of the rise of the earliest civilizations, coming into touch with the modern times in the life of the Nile Valley.

In all cases the lectures will be given by leading European and American investigators whose personal researches have contributed largely toward the development of the fields of science which they represent. Every effort will be made to secure continuity and homogeneity of treatment, in order that the published lectures may unite into an adequate and well-balanced description of evolution in the broadest sense. The lecturers chosen will be able to eliminate unessential technicalities and to present their subjects clearly and intelligibly to general audiences. The series on evolution should therefore appeal to a large public interested in the broader aspects of science but not necessarily familiar with its special methods or technical details.

GEORGE E. HALE, *Chairman.*

ANNOUNCEMENTS OF COMMITTEE PERSONNEL.

Committee on publication of proceedings.—A. A. NOYES (chairman), E. G. CONKLIN, CHARLES B. DAVENPORT, ARTHUR L. DAY, SIMON FLEXNER, GEORGE E. HALE, CHARLES S. MINOT.

Committee on collection of historical portraits, manuscripts, and instruments, including instruments purchased at the expense of the trust funds.—CHARLES D. WALCOTT (chairman), FRANK WIGGLESWORTH CLARKE, ARNOLD HAGUE, GEORGE E. HALE, SAMUEL J. MELTZER, MICHAEL I. PUPIN.

Committee on palæontologia universalis.—ARNOLD HAGUE (chairman), W. B. CLARK, J. M. CLARKE, W. H. DALL, H. F. OSBORN, CHARLES SCHUCHERT, W. B. SCOTT, C. D. WALCOTT, DAVID WHITE.

ELECTION OF TRUSTEE OF THE WATSON FUND.

The ad interim appointment of E. C. Pickering as one of the trustees of the Watson fund was confirmed by formal election.

EVIDENCE OF EXPERT OPINION IN JUDICIAL PROCEDURE.

The following resolution was presented and adopted:

Resolved, That the National Academy of Sciences recognizes the urgent need in the United States of radical reform in the methods of securing evidence of expert opinion in judicial procedure;

That the academy approves the efforts of the American Association for the Advancement of Science in this behalf; and

That the council of the National Academy of Sciences is hereby authorized and directed to cooperate with the committee of the American Association for the Advancement of Science in the endeavor to bring about such reform.

REPORT OF THE LOCAL COMMITTEE ON THE ANNUAL MEETING OF THE ACADEMY.

The following program of the annual meeting of the National Academy of Sciences, 1914, was carried out in full:

PROGRAM ANNUAL MEETING, APRIL 21, 22, 23, 1914.

Tuesday, April 21.

10.00 a. m.—Business meeting of the academy in the Oak Room of the Hotel Raleigh.

1.30 p. m.—Luncheon in the private dining room of the Hotel Raleigh.

4.00 p. m.—Auditorium, National Museum. Inauguration of the William Ellery Hale lectures by Sir Ernest Rutherford, of the University of Manchester. (Open to the public.) Subject: "The Constitution of Matter and the Evolution of the Elements." (Illustrated.)

10.00 p. m.—Reception to the members of the academy and their guests at the home of Mr. Alexander Graham Bell, 1331 Connecticut Avenue.

Wednesday, April 22.

10.00 a. m.—Auditorium, National Museum. Public scientific session for the reading of papers.

1.00 p. m.—Luncheon in the Oak Room of the Hotel Raleigh.

2.30 p. m.—Auditorium, National Museum. Public scientific session for the reading of papers.

8.00 p. m.—Annual dinner of the members of the academy and invited guests, in honor of the retiring president, Mr. Ira Remsen, and the retiring home secretary, Mr. Arnold Hague, held in the Oak Room of the Hotel Raleigh.

Presentation of the Medals for Eminence in the Application of Science to the Public Welfare, awarded to Col. George Washington Goethals and Brig. Gen. William Crawford Gorgas, made at the dinner.

Thursday, April 23.

10.00 a. m.—Oak Room, Hotel Raleigh. Business meeting of the academy for the election of members, foreign associates, and two members of the council.

1.30 p. m.—Luncheon in the private dining room of the Hotel Raleigh.

4.00 p. m.—Auditorium, National Museum. Second of the William Ellery Hale lectures, by Sir Ernest Rutherford, of Manchester. (Open to the public.) Subject: "The Constitution of Matter and the Evolution of the Elements." (Illustrated.)

W. F. HILLEBRAND, *Chairman.*

SCIENTIFIC SESSION.

(Auditorium of the National Museum, April 22, 1914.)

1. W. F. Hillebrand, H. E. Merwin, and Fred E. Wright: Hewettite, Metaheuwettite, and Pascoite, Hydrous Calcium Vanadates.

2. Charles B. Davenport: Heredity of Some Emotional Traits. Diagrams and lantern slides. (15 minutes.)

3. Charles D. Walcott: Pre-Cambrian Algonkian Algæ. Lantern slides. (15 minutes.)

4. F. W. Clarke: Composition of Crinoid Skeletons. (12 minutes.)

5. W. H. Howell: Causes of the Clotting of the Blood. (15 minutes.)

6. Edward L. Nichols and Horace Leonard Howes: The Luminescence of Kunzite. (15 minutes.)

7. Samuel J. Meltzer: Prompt Distribution of Convulsants in Cardiectomized Frogs Deprived of Their Lymph Hearts. (15 minutes.)

8. Louis V. Pirsson: Contributions to the Geology of Bermuda. (20 minutes.)

9. Jacques Loeb: Heterogenous Hybridization. (10 minutes.)

10. W. J. Humphreys (introduced by Cleveland Abbe): On the relation between American temperatures and European rainfall. (10 minutes.)

11. J. P. Iddings: The Physics of Magmatic Eruption. (30 minutes.)

12. John Johnston (introduced by Arthur L. Day): High Pressure as a Factor in Geologic Processes. (15 minutes.)

13. Harry Fielding Reid: The Movements of Magnets Caused by Earthquakes. (15 minutes.)

PAPERS READ BY TITLE.

1. John M. Coulter: The Origin of Monocotyledony.

2. E. L. Nichols: Biographical Memoir of Henry Morton.

3. William M. Davis: Biographical Memoir of J. Peter Lesley.

4. G. P. Merrill (introduced by Charles D. Walcott): A History of American State Geological and Natural History Surveys.
5. Cleveland Abbe: Biographical Memoir of Charles A. Schott.
6. Arthur L. Day: Biographical Memoir of Miers Fisher Longstreth.

PRESENTATION OF MEDALS FOR EMINENCE IN THE APPLICATION OF SCIENCE
TO THE PUBLIC WELFARE.

At the annual dinner of the academy, held at the Hotel Raleigh on April 23, 1914, two awards were made of the Medal for Eminence in the Application of Science to the Public Welfare, provided by the Marcellus Hartley fund, to George Washington Goethals and to William Crawford Gorgas for distinguished service in engineering and sanitation, respectively, in building the Panama Canal.

ELECTION OF MEMBERS OF THE COUNCIL.

E. G. Conklin and A. A. Noyes were elected members of the council for the term of three years, ending with the annual meeting in 1917.

ELECTION OF NEW MEMBERS.

The following were elected to membership in the academy:

Francis Gano Benedict, chemist, Nutrition Laboratory of Carnegie Institution of Washington, Boston, Mass.; Nathaniel Lord Britton, botanist, director New York Botanical Gardens, New York City; Walter Bradford Cannon, physiologist, Harvard University, Cambridge, Mass.; Henry Herbert Donaldson, neurologist, Wistar Institute of Anatomy, Philadelphia, Pa.; Jesse Walter Fewkes, ethnologist, Bureau of American Ethnology, Washington, D. C.; Edward Curtis Franklin, chemist, Stanford University, California; Moses Gomberg, chemist, University of Michigan, Ann Arbor, Mich.; Herbert Spencer Jennings, zoologist, Johns Hopkins University, Baltimore, Md.; Ernest Merritt, physicist, Cornell University, Ithaca, N. Y.; Frederick Leslie Ransome, geologist, United States Geological Survey, Washington, D. C.

DELEGATES.

Mr. J. C. Kapteyn, foreign associate, to represent the academy at the tercentenary celebration of the University of Groningen, Groningen, Holland, during summer of 1914.

Mr. Arthur L. Day to represent the academy at the Napier tercentenary celebration, Edinburgh, Scotland, July 24–31, 1914.

AUTUMN MEETING.

The autumn meeting of the National Academy of Sciences was held in the botanical laboratory of the University of Chicago on December 7, 8, and 9, 1914, with 22 members of the academy present: Campbell (W. W.), Chamberlin, Comstock, Coulter, Councilman,

Crew, Cross, Day, Donaldson, Frost, Gomborg, Hale, Hayford, Michelson, Moore, Moulton, Noyes (W. A.), Stieglitz, Trelease, Van Vleck, Webster, Welch.

At the business session the president announced:

That the following members and foreign associates had died since the annual meeting in April:

Members.—Theodore Nicholas Gill, September 25, 1914. Elected 1873.

Charles Sedgwick Minot, November 19, 1914. Elected 1897.

Henry Lord Wheeler, October 30, 1914. Elected 1909.

Foreign associates.—Eduard Suess, April 26, 1914. Elected 1898.

August Weismann, November 5, 1914. Elected 1913.

Hugo Kronecker, June 6, 1914. Elected 1901.

That Mr. Ira Remsen was acting as chairman of the board of directors of the Bache fund for the time being in the place of Mr. Charles S. Minot, deceased.

That on the death of Mr. Theodore N. Gill a vacancy was created in the finance committee, which had been filled by the appointment of Mr. Arnold Hague.

That the following standing committees of the academy had been chosen by the council in accordance with article 4, section 4, of the constitution:

Standing committee on mathematics.—Maximé Bôcher, Oskar Bolza, L. E. Dickson, E. H. Moore (chairman), F. R. Moulton, W. F. Osgood, W. E. Story, E. B. Van Vleck, A. G. Webster, R. S. Woodward.

Standing committee on astronomy.—E. E. Barnard, W. W. Campbell, G. C. Comstock (chairman), W. L. Elkin, E. B. Frost, G. E. Hale, A. O. Leuschner, F. R. Moulton, E. C. Pickering, R. S. Woodward.

That the following committees had been appointed by the president:

Standing committee on nominations.—R. H. Chittenden, G. C. Comstock, E. G. Conklin, Arnold Hague, W. H. Holmes, E. H. Moore, A. A. Noyes (chairman), William Trelease, R. S. Woodward.

Standing committee on program.—B. B. Boltwood (chairman), J. McK. Cattell, Edwin B. Frost, F. P. Mall.

Auditing committee.—William Healey Dall (chairman), Frank Wigglesworth Clarke, Arthur L. Day.

Committee on the revision of the constitution and rules.—Whitman Cross (chairman), Arthur L. Day, Charles D. Walcott.

That the following committees on trust funds had been reappointed in accordance with rule 27, as follows:

The Henry Draper fund.—A. W. Wright (1915), John Trowbridge (1916), A. A. Michelson (1917), G. E. Hale (chairman) (1918), W. W. Campbell (1919).

The J. Lawrence Smith fund.—R. Pumpelly (1915), Ira Remsen (1916), Arnold Hague (1917), E. S. Dana (1918), E. W. Morley (chairman) (1919).

The Comstock fund.—Elihu Thomson (1915), Henry Crew (1916), A. G. Webster (1917), E. L. Nichols (chairman) (1918), A. A. Noyes (1919).

The Murray fund.—William H. Dall (1915), Arnold Hague (chairman), (1916), George H. Parker (1917).

REPORT OF COMMITTEE ON AMENDMENT TO ACT OF INCORPORATION.

The committee on the amendment to the act of incorporation of the academy, Mr. Charles D. Walcott, chairman, reported the following amendment, passed by both Houses of Congress during the last session and approved on May 27, 1914:

[Public, No. 109, Sixty-third Congress.]

[S. 4096.]

AN ACT To amend the act authorizing the National Academy of Sciences to receive and hold trust funds for the promotion of science, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the act to authorize the National Academy of Sciences to receive and hold trust funds for the promotion of science, and for other purposes, approved June twentieth, eighteen hundred and eighty-four, be, and the same is hereby, amended to read as follows:

That the National Academy of Sciences, incorporated by the act of Congress approved March third, eighteen hundred and sixty-three, be, and the same is hereby, authorized and empowered to receive, by devise, bequest, donation or otherwise, either real or personal property, and to hold the same absolutely or in trust, and to invest, reinvest, and manage the same in accordance with the provisions of its constitution, and to apply said property and the income arising therefrom to the objects of its creation and according to the instructions of the donors: *Provided, however,* That the Congress may at any time limit the amount of real estate which may be acquired and the length of time the same may be held by said National Academy of Sciences.

SEC. 2. That the right to alter, amend, or repeal this act is hereby expressly reserved.

Approved, May 27, 1914.

REPORT OF COMMITTEE ON REVISION OF CONSTITUTION AND RULES.

At the business session on December 8, 1914, the committee on the revision of the constitution and rules reported a series of amendments to the constitution of the academy, which, after discussion, were referred to the council for consideration and report. The council presented its report, with further amendments, to the academy at the stated session on December 9, 1914, and the following amended report was adopted by the academy sitting as a committee of the whole. This report will be offered for final consideration by the academy at the stated meeting in April, 1915.

CONSTITUTION OF THE NATIONAL ACADEMY OF SCIENCES.

[Showing amendments proposed by the committee on revision of the constitution and rules as amended by council and by the academy in committee of the whole, and adopted by committee of the whole on December 9, 1914. All new matter is printed in *italics*. All omitted or replaced matter is crossed out by a line.]

As amended and adopted April 17, 1872, and further amended April 20, 1875; April 21, 1881; April 19, 1882; April 18, 1883; April 19, 1888; April 18, 1895; April 20, 1899; April 17, 1902; April 18, 1906; November 20, 1906; April 17, 1907; November 20, 1907; April 20, 1911; April 16, 1912.

PREAMBLE.

Empowered by the act of incorporation enacted by Congress, and approved by the President of the United States on the 3d day of March, A. D. 1863, and in conformity with the amendments to said act approved July 14, 1870, *June 20, 1884, and May 27, 1914*, the National Academy of Sciences adopts the following amended constitution and rules:

ARTICLE I.—OF MEMBERS.

SECTION 1. The academy shall consist of members, honorary members, and foreign associates. Members must be citizens of the United States.

SEC. 2. Members who, from age or inability to attend the meetings of the academy, wish to resign the duties of active membership, may, at their own request, be transferred to the roll of honorary members by a vote of the academy.

SEC. 3. The academy may elect 50 foreign associates.

SEC. 4. Honorary members and foreign associates shall have the privilege of attending the meetings and of reading and communicating papers to the academy, but shall take no part in its business, shall not be subject to its assessments, and shall be entitled to a copy of the publications of the academy.

ARTICLE II.—OF THE OFFICERS.

SECTION 1. The officers of the academy shall be a president, a vice president, a foreign secretary, a home secretary, and a treasurer, all of whom shall be elected for a term of six years, by a majority of votes present, at the first stated meeting after the expiration of the current terms, provided that existing officers retain their places until their successors are elected. In case of a vacancy, the election for six years shall be held in the same manner at the meeting when such vacancy occurs, or at the next stated meeting thereafter, as the academy may direct. A vacancy in the office of treasurer or home secretary may, however, be filled by appointment of the president of the academy until the next stated meeting of the academy.

SEC. 2. The officers of the academy, together with six members to be elected by the academy, shall constitute a council for the transaction of such business as may be assigned to them by the constitution or the academy.

SEC. 3. The president of the academy, or, in case of his absence or inability to act, the vice president, shall preside at the meetings of the academy and of the council; shall name all committees except such as are otherwise especially provided for; shall refer investigations required by the Government of the United States to members especially conversant with the subjects and report thereon to the academy at its meeting next ensuing; and, with the council, shall direct the general business of the academy.

It shall be competent for the president, in special cases, to call in the aid, upon committees, of experts or men of special attainments not members of the academy.

The president shall be, ex officio, a member of all committees empowered to consider questions referred to the academy by the Government of the United States.

SEC. 4. The foreign and home secretaries shall conduct the correspondence proper to the respective departments, advising with the president and council in cases of doubt, and reporting their action to the academy at one of the stated meetings in each year.

It shall be the duty of the home secretary to give notice to the members of the place and time of all meetings, of all nominations for membership, and of all proposed amendments to the constitution.

~~The minutes of each meeting shall be duly engrossed before the next stated meeting under the direction of the home secretary.~~

It shall be the duty of the home secretary to keep the minutes of each business and scientific session, and after approval to enter these upon the permanent records of the academy.

SEC. 5. The treasurer shall attend to all receipts and disbursements of the academy, giving such bond and furnishing such vouchers as the council may require. He shall collect all dues, assessments, and subscriptions, and keep a set of books showing a full account of receipts and disbursements *and the condition of all funds of the academy.* ~~He shall present a general report at the annual meeting.~~ He shall be the custodian of the corporate seal of the academy.

ARTICLE III.—OF THE MEETINGS.

SECTION 1. The academy shall hold one stated meeting in each year, called the annual meeting, in the city of Washington, beginning on the third ~~Tuesday~~ *Monday* in April, and another, called the autumn meeting, may be held at such place and time as the council shall determine.

Special business meetings of the academy may be called, by order of eight members of the council, at such place and time as may be designated in the call.

Special scientific meetings of the academy may be held at times and places to be designated by a majority of the council.

SEC. 2. The names of the members present at each session of a meeting shall be recorded in the minutes, and the members present at any session shall constitute a quorum for the transaction of business.

SEC. 3. Scientific sessions of the academy, unless otherwise ordered by a majority of the members present, shall be open to the public; sessions for the transaction of business shall be closed.

SEC. 4. Stated meetings of the council shall be held during the stated or special meetings of the academy *and four members shall constitute a quorum for the transaction of business.* Special meetings of the council may be convened at the call of the president and two members of the council, or of four members of the council.

SEC. 5. ~~No member who has not paid his dues shall take part in the business of the academy.~~

No member whose dues are in arrears shall vote at any business meeting of the academy.

ARTICLE IV.—OF ELECTIONS AND RESIGNATIONS.

SECTION 1. All elections of *officers and members* shall be by ballot, and each election shall be held separately. ~~unless otherwise ordered by this constitution.~~

SEC. 2. The time for holding an election of officers shall be fixed by the academy at least one day before the election is held.

SEC. 3. The election of the six members of the council shall be as follows:

At the annual meeting in April, 1907, six members of the council to be elected, of whom two shall serve for three years, two for two years, and two for one year, their respective terms to be determined by lot. Each year thereafter the terms of two members shall expire, and their successors, to serve for three years, shall be elected at the annual meeting in each year.

SEC. 4. The academy shall be divided by the council into ~~standing committees~~ *sections* representing the principal branches of scientific research. ~~A member may be assigned to more than one of these committees sections.~~ The president of the academy shall appoint, subject to the approval of the council, a member of each committee as its chairman, who shall be responsible for the work of the committee.

Each section shall elect its own chairman, who shall serve for three years. The chairman shall be responsible to the academy for the work of his section.

Nominations to membership in the academy shall be made in writing, approved by a majority of the members of the committee on the branch of research in which the person nominated is eminent, or by a majority of the council in case there is no committee on the subject. The nominations shall be sent to the home secretary by the chairman of the committee before January 1 of the year in which the election is to be held, and each nomination shall be accompanied by a list of the principal contributions of the nominee to science. This list shall be printed by the home secretary for distribution among the members of the academy.

SEC. 5. Election of members shall be held at the annual meeting in Washington in the following manner: There shall be two ballots—a preference ballot, which may be prepared either before or at the annual meeting and must be transmitted to the home secretary, and a final ballot, to be taken at the meeting.

Preference ballot.—Each member may inscribe on a ballot not more than ~~40~~ 15 names of nominees selected from the submitted list. A list of the nominees shall then be prepared, on which the names shall be entered in the order of the number of votes received by each. In case two or more nominees ~~should~~ have the same number of votes on this preference list, the order in which they shall be placed on the list shall be determined by a majority vote of ~~these~~ members present.

Final ballot.—A vote shall first be taken on the nominee who appears first on the preference list, and he shall be declared elected if he receive two-thirds of the votes cast and not less than 25 votes in all. ~~provided that the number of members of the academy be not 150 or over, in which case to be declared elected he must receive four-fifths of the votes cast and not less than 25 votes in all.~~ A vote shall then be taken in similar manner on the nominee standing second on the preference list, and so on until all the nominees on the preference list shall have been acted on, or until ~~40~~ 15 nominees shall have been elected *or until the total membership of the academy shall have reached 250.*

Not more than ~~40~~ 15 members shall be elected at one annual meeting.

Before and during elections a discussion of the merits of nominees will be in order.

The election of members may be suspended at any time by a majority vote of the members present.

SEC. 6. Every member elect shall accept his membership, personally or in writing, before the close of the next stated meeting after

the date of his election. Otherwise, on proof that the secretary has formally notified him of his election, his name shall not be entered on the roll of members.

~~SEC. 7. The election of foreign associates shall be in the following manner:~~

~~Foreign associates may be nominated by the council and may be elected at the annual meeting by a two-thirds vote of the members present. Each member shall indicate on a ballot those names for which he votes, and those nominees whose names appear on two-thirds of the votes cast shall be declared elected. A list of those nominated shall be sent to all members of the academy with the notice of the meeting at which the election is to be held.~~

SEC. 8. A diploma, with the corporate seal of the academy and the signatures of the officers, shall be sent by the appropriate secretary to each member on his acceptance of his membership, and to foreign associates on their election.

SEC. 9. Resignations shall be addressed to the president and acted on by the academy.

SEC. 10. Whenever a member has not paid his dues for four successive years, the treasurer shall report the fact to the council, which may report the case to the academy with the recommendation that the person thus in arrears be declared to have forfeited his membership. If this recommendation be approved by two-thirds of the members present, the said person shall no longer be a member of the academy, and his name shall be dropped from the roll.

ARTICLE V.—SCIENTIFIC COMMUNICATIONS, PUBLICATIONS, AND REPORTS.

SECTION 1. Communications on scientific subjects shall be read at scientific sessions of the academy, and papers by any member may be read by the author or by any other member, notice of the same having been previously given to the secretary.

SEC. 2. Any member of the academy may read a paper from a person who is not a member, and shall not be considered responsible for the facts or opinions expressed by the author, but shall be held responsible for the propriety of the paper.

Persons who are not members may read papers on invitation of the council or of the committee of arrangements.

SEC. 3. The academy may provide for the publication, under the direction of the council, of proceedings, *scientific memoirs*, *biographical memoirs*, and reports.

The proceedings shall include the transactions of the academy, brief original announcements of the results of scientific investigations made by members of the academy or others, together with short original articles giving a comprehensive survey of the more important scientific researches currently made by American investigators, and other matters of general scientific interest.

The scientific memoirs shall provide opportunity for the publication of longer and more detailed scientific investigations.

The biographical memoirs shall contain an appropriate record of the life and work of deceased members of the academy.

An annual report shall be presented to Congress by the president, and shall contain the annual reports of the treasurer, and the auditing committee, a suitable summary of the reports of the committees in charge of trust funds, and a record of the activities of the academy for the calendar year immediately preceding and other appropriate matter. This report shall be presented to Congress by the president after authorization by the council. It shall also be presented to the academy at the annual meeting next following.

The treasurer shall prepare a full report of the financial affairs of the academy at the end of the fiscal year. This report shall be submitted to the council for approval and afterwards presented to the academy at the annual meeting.

SEC. 4. Propositions for investigations or reports by the academy shall be submitted to the council for approval, except those requested by the Government of the United States, which shall be acted on by the president, who will in such cases report their results to the Government as soon as obtained and to the academy at its next following stated meeting.

SEC. 5. The advice of the academy shall be at all times at the disposition of the Government upon any matter of science or art within its scope.

~~SEC. 6. An annual report to be presented to Congress shall be prepared by the president, and before its presentation submitted by him, first to the council and afterwards to the academy, at one of the stated meetings.~~

~~SEC. 7. Medals and prizes may be established, and the means of bestowing them accepted by the academy upon the recommendation of the council, by whom all the necessary arrangements for their establishment and award shall be made.~~

~~Bequests and trusts having for their object the advancement of science may also be accepted and administered by the academy.~~

(N. B.—This section is replaced by Art. VI.)

ARTICLE VI.—OF THE PROPERTY OF THE ACADEMY.

SECTION 1. ~~All investments shall be made by the treasurer in the corporate name of the academy with the approval of a finance committee of three members, to be appointed annually by the president, of which the treasurer shall be one. Investments shall be made in bonds of the United States, in State bonds, or bonds or notes secured by first mortgages on real estate, in investments legal for savings banks under the laws of Massachusetts or New York, or~~

~~in other bonds recommended to the treasurer by the fiscal advisers of the academy.~~

All investments and reinvestments of either principal or accumulations of income of the trust and other funds of the academy shall be made by the treasurer, with the approval of the finance committee, in the corporate name of the academy, in the manner and in the securities designated or specified in the instruments creating the several funds, and, in the absence of such designation or specification, in bonds of the United States or of the several States, or bonds or notes secured by first mortgages on real estate, in investments legal for savings banks under the laws of Massachusetts or New York, or in other bonds recommended to the treasurer by the fiscal advisers of the academy.

The treasurer may invest the capital of all trust funds of the academy which are not required by the instruments creating such funds to be kept separate and distinct, in a consolidated fund and shall apportion the income received from such consolidated fund among the various funds composing the same in the proportion that each of said funds shall bear to the total amount of funds so invested: Provided, however, that the treasurer shall at all times keep accurate accounts showing the amount of each trust fund, the proportion of the income from the consolidated fund to which it is entitled, and the expenses and disbursements properly chargeable to such fund.

Sec. 2. The council shall, at its annual meeting in each year, designate one bank or trust company in Washington, D. C., and one in New York City to act, when requested by the treasurer, as the fiscal advisers of the academy.

~~The treasurer shall have the authority, with the approval of the finance committee, to change any investment held by him in the corporate name of the academy.~~

Sec. 3. The treasurer shall have authority, with the approval of the finance committee, to sell, transfer, convey and deliver in the corporate name and for the benefit of the academy any stocks, bonds, or other securities standing in the corporate name.

SEC. 4. No contract shall be binding upon the academy which has not been first approved by the council.

SEC. 5. The assessments required for the support of the academy shall be fixed by the academy on the recommendation of the council and shall be payable within the calendar year for which they are assessed.

ARTICLE VII.—TRUST FUNDS AND THEIR ADMINISTRATION.

Section 1. Devises, bequests, donations, or gifts having for their object the promotion of science or the welfare of the academy may be accepted by the council for the academy. Before the acceptance of any such trust the council shall consider the object of the trust and all conditions or specifications attaching thereto. The council shall make a report of its action to the academy.

Sec. 2. Medals and prizes may be established in accordance with the provisions of trusts or by action of the academy.

Sec. 3. Unless otherwise provided by the deed of gift, the income of each trust fund shall be applied to the objects of that trust by the action of the academy on the recommendation of a standing committee on that fund.

ARTICLE VIII.—OF ADDITIONS AND AMENDMENTS.

Additions and amendments to the constitution shall be made only at a stated meeting of the academy. Notice of a proposition for such a change must be ~~given at a stated meeting, and shall be referred submitted~~ to the council, which may amend the proposition, and shall report thereon to the academy. Its report shall be considered by the academy in committee of the whole for amendment.

The proposition as amended, if adopted in committee of the whole, shall be voted on at the next stated meeting, and if it receives two-thirds of the votes cast it shall be declared adopted.

Absent members may send their votes on pending changes in the constitution to the home secretary in writing, and such votes shall be counted as if the members were present.

NEW RULE.

The following rule was adopted:

The holders of the Medal for Eminence in the Application of Science to the Public Welfare shall be notified, like members, of the meetings of the academy, and invited to participate in its scientific sessions.

AMENDMENT TO RULE III.

The second and third sentences of Rule III were amended to read as follows:

It shall be the duty of the auditing committee to verify the records, receipts, and disbursements maintained by the treasurer and the agreement of book and bank balances; to examine all securities in the custody of the treasurer, and to compare the stated income of such securities with the receipts of record; to examine all vouchers covering disbursements for the account of the academy and the authority therefor, and to compare them with the treasurer's record for expenditures; to examine and verify the account of the academy with each trust fund. The auditing committee may employ the services of an expert accountant to assist in the examination of the books of the treasurer.

REPORT OF THE COMMITTEE ON THE HENRY DRAPER FUND.

By unanimous vote of the committee, the Henry Draper gold medal has been awarded to Dr. Joel Stebbins, of the University of Illinois, for his application of the selenium cell photometer to the measurement of stellar magnitudes and the study of variable stars. The gain in sensitiveness thus attained over previous observational methods has led to the discovery of variations in brightness which are quite imperceptible to the eye, or on the photographic plate. Dr. Stebbins has thus succeeded, with modest instrumental means, in opening a new and very important field of research. This has recently been enlarged by several European astronomers by the substitution of photoelectric for selenium cells, so that a variation in brightness of one part in a thousand is now measurable in the case of faint stars.

The medal will be presented to Dr. Stebbins at the next annual meeting of the academy.

GEORGE E. HALE,
Chairman.

The recommendation of the committee on the Henry Draper fund to award the Draper Medal in 1915 to Dr. Joel Stebbins, of the University of Illinois, in recognition of his work on Application of the Selenium Cell to Stellar Photometry was approved.

SPECIAL MEETING IN 1915.

A resolution of the council providing for a special business meeting and a special scientific meeting of the academy on April 19, 1915, to be followed by the stated meeting on Tuesday and Wednesday, April 20, 21, 1915, as required by the constitution, was unanimously adopted.

The following resolutions were unanimously adopted:

That the thanks of the National Academy of Sciences be given to the chairman, Mr. E. H. Moore, and to the members of the local committee for their most successful arrangements for the autumn meeting held in Chicago, December 7, 8, 9, 1914.

That the thanks of the academy be extended to President Judson, to the University of Chicago, to the Quadrangle Club, and to the Chaos Club for their aid in arranging the social features which contributed so much to the enjoyment of the autumn meeting.

SCIENTIFIC SESSIONS.

MONDAY, DECEMBER 7.

1. W. W. Campbell: On the radial velocities of nebulae. (10 minutes.)
2. Heber, D. Curtis (introduced by W. W. Campbell): Preliminary note on nebular proper motions. (10 minutes.)
3. R. A. Millikan (introduced by A. A. Michelson): The coefficient of slip in gases and its relation to the nature of the impact between a molecule of a gas and the surface of a solid or liquid. (10 minutes.)
4. W. D. Harkins and E. C. Humphrey (introduced by Julius Stieglitz): The capillary and electrical forces at the interface between two liquids. (10 minutes.)
5. Herbert N. McCoy (introduced by Julius Stieglitz): The solubilities of radium compounds as indicated by the solubilities of analogous compounds of calcium, strontium, and barium. (10 minutes.)
6. L. A. Bauer (introduced by George E. Hale): Present status of the general magnetic survey of the globe. (10 minutes.)
7. Charles J. Chamberlain (introduced by J. M. Coulter): A phylogenetic study of cycads. (10 minutes.)
8. C. M. Child (introduced by J. M. Coulter): A dynamic conception of the organic individual. (15 minutes.)
9. S. W. Williston (introduced by T. C. Chamberlin): The American land vertebrate fauna and its relations. (15 minutes.)
10. A. J. Carlson (introduced by J. M. Coulter): Some new observations on the physiology of the stomach in man. (10 minutes.)
11. Leonard E. Dickson: Recent progress in the theories of modular and formal invariants. (By title.)
12. Henry S. White (introduced by L. E. Dickson): The synthesis of triad systems Δ_t in t elements, in particular for $t=31$. (By title.)
13. E. J. Wilczynski (introduced by E. H. Moore): Conjugate systems of space curves with equal Laplace-Darboux invariants. (10 minutes.)

TUESDAY, DECEMBER 8.

14. Edwin B. Frost: An interesting stellar system. (10 minutes.)
15. George E. Hale: The direction of rotation of solar storms. (15 minutes.)
16. A. A. Michelson: Behavior of metals and other substances near the rupture point. (15 minutes.)
17. C. W. Balke and George W. Sears (introduced by W. A. Noyes): The atomic weight of tantalum. (10 minutes.)
18. E. W. Washburn (introduced by W. A. Noyes): Our systematic knowledge of the properties and behavior of solutions of nonelectrolytes. (15 minutes.)
19. T. C. Chamberlin: The fundamental segmentation of the earth. (20 minutes.)
20. William Trelease: Phoradendron. (15 minutes.)
21. Charles E. Allen (introduced by E. B. Van Vleck): Development of the male germ cells of *polytrichum*. (15 minutes.)
22. C. T. Knipp (introduced by W. A. Noyes): Experimental data on the stability of positive and negative ions. (10 minutes.)
23. S. W. Parr (introduced by W. A. Noyes): The development of an acid-resisting alloy for a bomb calorimeter. (10 minutes.)
24. W. L. Tower (introduced by J. M. Coulter): Experimental production of a new ordinal character. (15 minutes.)
25. G. A. Miller (introduced by L. E. Dickson): The φ -subgroup of a group of finite order. (10 minutes.)
26. E. E. Barnard: Explanation of certain phenomena of the tail of comet Morehouse (III, 1908). (15 minutes.)
27. Philip Fox (introduced by E. B. Frost): The rotation period of the sun. (10 minutes.)

WEDNESDAY, DECEMBER 9.

28. J. C. Kapteyn and W. S. Adams (introduced by George E. Hale): On the relations between the proper motions and the radial velocities of the stars of the spectral types F, G, K, and M. (10 minutes.)
29. S. B. Nicholson (introduced by W. W. Campbell and A. O. Leuschner): Discovery of a ninth satellite of Jupiter. (10 minutes.)
30. Frank R. Lillie (introduced by J. M. Coulter): The fertilizing power of sperm dilutions. (15 minutes.)
31. Gilbert Ames Bliss (introduced by E. H. Moore): A generalization of a theorem of Gauss concerning geodesic triangles. (10 minutes.)
32. F. R. Moulton: An extension of the process of successive approximations for the solution of differential equations. (15 minutes.)
33. Julius Stieglitz: Molecular rearrangements of triphenylmethyl derivatives. (15 minutes.)
34. William Crocker and J. F. Groves (introduced by J. M. Coulter): Methods of determining the life duration of seeds. (10 minutes.)
35. Edwin O. Jordan (introduced by J. M. Coulter): Variation in bacteria. (15 minutes.)
36. Shiro Tashiro (introduced by J. M. Coulter): On the nature of nerve impulse. (10 minutes.)
37. Eliakim H. Moore: On the integration by successive approximations of the ordinary differential equation of the first order in general analysis. (10 minutes.)

THE WILLIAM ELLERY HALE LECTURES.

Two public lectures were given under the William Ellery Hale Foundation by Prof. William Wallace Campbell, director of the Lick Observatory, at Leon Mandel Assembly Hall, University of Chicago. Subject: Stellar evolution and the formation of the earth.

DECEASED MEMBERS.

SILAS WEIR MITCHELL.

Silas Weir Mitchell, eminent as neurologist, physiologist, and man of letters, was born in Philadelphia, February 15, 1829, and died after a brief illness from pneumonia at his home in the same city where his life was spent, on January 4, 1915. His father, Dr. John Kearsley Mitchell, was likewise a distinguished physician of Philadelphia. Obligated to leave the University of Pennsylvania in the senior year of his arts course on account of ill health, he later entered on the study of medicine at the Jefferson Medical College, where his father was professor, and received his medical degree in 1850. He then spent a year in medical study in Paris, where he came under the influence of Claude Bernard and Robin. Returning to Philadelphia he began medical practice, but this was not so engrossing as to withdraw him from scientific investigation. Until the year 1863 Mitchell's chief interest and all of his published works were in the domains of physiology, pharmacology, and toxicology, which he pursued mainly by the experimental method. At this period Mitchell was active in the Academy of Natural Sciences of Philadelphia and with Leidy, Hammond, and Woodward was instrumental in establishing the biological department of the academy. In 1857 he was one of the founders of the Pathological Society of Philadelphia. During the first 12 years of his professional life Mitchell published not less than 22 papers, none of these being clinical and nearly all being within the experimental medical sciences. The most valuable of his publications of this period is his monograph of 150 pages upon the venom of the rattlesnake, which appeared in 1860 in the *Smithsonian Contributions*. This subject engaged his attention off and on for the next half century, and indeed had interested his father. An epochal result of this prolonged experimental study was the first demonstration by Mitchell and Reichert in 1883 of the so-called toxic albumins, to which class belong not only the snake venoms, but the bacterial and certain other plant poisons.

Mitchell's reputation as a physiologist was established before he devoted himself to neurology, and this physiological interest continued throughout his life, his later contributions to physiology being mainly in neurophysiology. Although he made no physiological discovery equaling in importance that of Beaumont on gastric digestion in 1825, his name and that of his friend and contemporary, Dalton, are the most significant from the standpoint of systematic, productive investigation in American physiology before the laboratory era introduced by Bowditch and Newell Martin in the seventies. He was always ready to come whenever needed to the defense of the experimental method of research upon which depends the advancement of medical science and art.

In 1863, during the Civil War, Mitchell, then an acting assistant surgeon, was placed, together with Morehouse, in medical charge of a military hospital for nervous diseases and injuries in Philadelphia. This furnished him a unique opportunity, which he utilized to the utmost, and this determined his future career as a neurologist. The most important first fruits of the observations and studies there made by Mitchell, with his associates Morehouse and Keen, were the monograph on Reflex Paralysis and the memorable volume on Gun-shot Wounds and other Injuries of Nerves, both published in 1864. In 1872 Mitchell gathered together his observations and experiments in perhaps the most important of his medical writings—the book entitled *Injuries of Nerves and their Consequences*. This work constituted the most important contribution which had been made to the subject of peripheral nerve phenomena in disease and resulting from injury.

After the war Mitchell rapidly became and remained the leading neurologist of America and one of the most distinguished in the world.

Mitchell's neurological contributions were many and important. He published not fewer than 250 medical papers and books. He was peculiarly interested in certain curious, out-of-the-way phenomena, such as cat-fear, disorders of sleep, and functional disorders. His name is probably most familiar to the public and the medical professor as the originator of the method of treatment which goes by his name and consists in the employment of rest, seclusion, full feeding, massage and electricity.

Many of Mitchell's scientific and medical papers are characterized by a felicity of style not often found in such publications. He is a remarkable example of distinction not only as a physician and man of science, but also a poet and writer of novels and short stories. He did not indulge his literary bent until after his professional reputation was established. After 1882 there followed his well-known novels: *Hugh Wynne*, *The Adventures of Francois*, *The Red City*, *Westways*, and many others, which have established his reputation in the world of letters.

Mitchell possessed an extraordinarily suggestive mind, and many are the researches of others stimulated and inspired by him.

He received many honors and recognitions in this country and abroad. His election to the National Academy of Sciences dates from 1865 and was due to his work in experimental science rather than to that in clinical medicine. His presence was always a source of cheer and inspiration. He spoke of the past history of the academy at the fiftieth anniversary dinner, and his last contribution was the biographical sketch of his intimate friend, Dr. John S. Billings.

(Prepared by William H. Welch.)

SETH CARLO CHANDLER.

Seth Carlo Chandler, astronomer, died on December 31, 1913, in his sixty-seventh year after a short attack of pneumonia.

He was born at Boston, Mass., September 17, 1846, and attended the English high school at Boston, graduating in 1861, but did not pursue a collegiate course as he had already become interested in mathematical computations while still at school, being employed upon the computations of Prof. Benjamin Peirce. After graduation he joined Dr. B. A. Gould as private assistant and thus obtained his first taste for astronomical subjects. Dr. Gould was at that time engaged in developing the longitude determinations of the Coast Survey, and through him Chandler was persuaded to join the United States Coast Survey as aid in 1864. Later, when Dr. Gould made his trip to the Argentine Republic, which eventually resulted in the establishment of a national observatory by the Argentine Government, Dr. Chandler refused an offer to accompany the expedition in favor of a position as actuary with the Continental Life Insurance Co., in New York City.

Seven years later he returned to Boston to accept a position as consulting actuary for the Union Mutual Life Insurance Co., of Boston.

Though his activities had been diverted into other channels, Dr. Chandler still felt an interest in astronomical subjects, and so it was not surprising that with Harvard College Observatory so near at hand, he should have joined in the work of the observatory. Astronomers had long felt the need of some system of communicating such discoveries as comets in order that such objects might not be lost through the inability to observe them at any one station. Realizing this need, Dr. Chandler and Mr. John Ritchie formulated a code for the speedy transmission of discoveries by telegraph to observatories all over the United States. Though this system has since been revised, it is still being operated by the Harvard College Observatory.

It was during his connection with Harvard College Observatory that Dr. Chandler invented and constructed the almucanter, an instrument for measuring stellar positions.

After the year 1886 he became a private investigator, and during his lifetime published more than 200 scientific articles.

As an astronomer, Dr. Chandler will be remembered for his work upon variable stars, and for his discovery of the variation of latitude. This latter discovery resulted in the establishment of international latitude stations at different points on the earth to facilitate the study of the periodic shifting of the earth's pole.

He was awarded the Watson Medal of the National Academy of Sciences in 1895, and also in 1896 he received the gold medal of the Royal Astronomical Society. In 1891, De Pauw University conferred upon him the degree of LL. D.

(Extract from the paper by Benjamin Boss in *Science*, n. s., vol. 39, no. 1001.)

BENJAMIN OSGOOD PEIRCE.

Benjamin Osgood Peirce was born in Beverly, Mass., February 11, 1854. At the age of 9, Peirce took a voyage with his parents to the Cape of Good Hope, where his extraordinary power of observation aided by a retentive memory, left a record so vivid that 50 years afterwards he was able to surprise South Africans by his accurate descriptions of conditions there. He was educated in the public schools of Beverly, Mass., and in the two following years, during which he also learned the carpenter's trade, he prepared himself for Harvard. At Harvard he took a well-selected course, but showed such a marked talent for mathematics and physics that on graduation in 1876 he received a traveling fellowship and proceeded to Germany for further study, remaining there for four years. In 1879 he obtained the degree of Ph. D. at Leipzig, where he had worked in Wiedemann's physical laboratory, and the next year he spent under Helmholtz in Berlin. Returning to the United States in 1880, and after teaching a year at the Boston Latin School, Peirce was appointed instructor in mathematics at Harvard, and was promoted in 1884 to an assistant professorship. In 1888 he received the appointment to the Hollis professorship of mathematics and natural philosophy, which perhaps gave him a freer hand and enabled him to distribute his time as he preferred in the laboratory and in mathematical physics. His courses in the latter subject were worked up to a high degree of efficiency, this subject being entirely new in this country at that time. In the laboratory, in a similarly painstaking manner, he developed an admirable course in electrical measurements. Peirce was a voracious reader, particularly of biography and history, spoke French well, and German, even including the South German dialect, so well as to deceive the native. He had a passion for music, and possessed an excellent knowledge of musical form and history. Painting and architecture also he keenly enjoyed, delighting particularly in the Gothic forms. He kept a font of type in the laboratory, and set up many of the complicated mathematical formulæ in one of his books with his own hand, while his figures were always drawn by himself, and the curves carefully made by templates filed out in sheet metal. In 1900, too strict attention to work brought on nervous prostration and two years' leave of absence, after which, even though health had not returned, Peirce never lost a lecture. President Lowell, in conferring the degree of doctor of science upon Peirce, called him "a scientist ignorant only of his own deserts." He was a member of the National Academy of Sciences, the American Mathematical Society, the American Physical Society, the Astronomical and Astrophysical Society of America, the Société Française de Physique, the Circolo Matematico di Palermo, a fellow of the American Academy of Arts and Sciences, and of the American Philosophical Society.

Among his published works are *Theory of the Newtonian Potential Function*, *Table of Integrals*, and *Experiments in Magnetism*.

Prof. Peirce died on January 14, 1914, lacking but a few days of 60 years of age.

(Extract from the paper by Arthur Gordon Webster in the *Nation*, vol. 98, no. 2547.)

EDWARD SINGLETON HOLDEN.

Edward Singleton Holden was born on November 5, 1846, and died on March 16, 1914. He received the degree of B. S. at Washington University (St. Louis) in 1866 and graduated from the United States Military Academy in 1870. In 1879 Washington University conferred upon him the degree of A. M., and in 1887 Wisconsin conferred the degree of LL. D., followed by Columbia conferring the same degree in 1888. Two other honorary degrees came to him—that of Sc. D. from Pacific University and doctor of letters from Fordham University in 1910. He was lieutenant of Artillery in the United States Army in 1870 to 1871; lieutenant of Engineers from 1871 to 1873; professor of mathematics in the United States Navy from 1873 to 1882; director of Washburn Observatory from 1881 to 1885; president of the University of California from 1885 to 1888, and director of the Lick Observatory from 1885 to 1897. From 1901 he was the librarian of the United States Military Academy. Among the foreign orders he received Knight Commander Ernestine Order, Saxony, 1894, Order of Bolivar, 1896, Knight Royal Order of Danebrog, Denmark, 1895. His membership in societies included the National Academy of Sciences, to which he was elected in 1885, the American Philosophical Society, fellow of the American Academy, associate of the Royal Astronomical Society, Société Astronomique de France and of the Società degli Spettroscopisti Italiani.

His appointment to Lick Observatory was the beginning of his studies of the physical constitution of the sun and its surroundings, and the planetary markings of the surfaces of such minute disks as those of Jupiter's satellites or the planet Uranus also engaged his attention. The helical forms of nebulae were the subject of intimate study. His 12 years' direction in the Lick Observatory from 1885 to 1897 resulted in the accomplishment of much useful work, and it was with the resignation of the position of director of the Lick Observatory that his scientific activities apparently ceased.

GEORGE WILLIAM HILL.

George William Hill was born in New York City on March 3, 1838, and died at West Nyack, N. Y., on April 16, 1914. He graduated from Rutgers College in 1859, and almost immediately after graduation he accepted a position in the Nautical Almanac Office, then at

Cambridge, Mass., but removed to Washington in 1857. He remained in the Nautical Almanac Office until he reached the retiring age, when he withdrew to his family home at West Nyack.

Hill's aptitude for mathematics was shown while he was yet a boy and determined his parents to send him to college. In college he exhibited a most extraordinary ability for mathematical subjects and read many of the works of the French masters, such as Laplace's *Mécanique Céleste*, Lagrange's *Mécanique Analytique*, and Legendre's *Fonctions Elliptiques*. These works laid a foundation which was of the greatest service to him in his own subsequent investigations.

For more than 30 years during which Hill was connected with the Nautical Almanac he spent his leisure hours on the more difficult parts of celestial mechanics. His researches included nearly every branch of mathematical astronomy, but he rose to the greatest heights in his work on the Lunar Theory. By a radical departure from all the methods which had hitherto been employed he succeeded in obtaining the most important terms in the expressions for the coordinates of the moon with a convenience that had not been approached by his predecessors. In this work he employed many new mathematical processes. For example, in his determination of the coefficients of the Variational Orbit, he solved an infinite system of implicit functions. In connection with his theory of the Variational Orbit he took the first steps in the modern developments of the periodic solutions of the problem of three bodies. Poincaré, in his introduction to his matchless researches in this domain, confessed his indebtedness to Hill, and on almost every page of Darwin's work the influence of Hill is visible. In his work on the motion of the lunar perigee Hill solved for the first time a linear differential equation having periodic coefficients. In the solution of this equation he introduced into analysis the infinite determinant. Besides these matters of fundamental importance, at every turn Hill introduced considerations showing the most remarkable ingenuity.

Hill's merit as an original and profound mathematician has been widely recognized both in America and abroad. But it has often been supposed that his work was largely theoretical and was not capable of practical application. Nothing could be farther from the truth. No earlier work had approached it in practical applicability, and no subsequent work has surpassed it. For example, he gave the coefficients of the periodic orbit which was to serve as the first approximation to the motion of the moon to fifteen decimals and worked out all the terms that were sensible with this degree of accuracy.

Personally Hill was a scientific man of the old school. He was retiring and modest to the verge of timidity. He was absorbed in his own work, but never inflicted it on others. In fact, he would hardly

discuss it when others desired him to do so. He seemed altogether indifferent to his reputation with all except a few authorities, and he knew he did not need to give any thought regarding his reputation with them. As he never married, he had neither the satisfaction nor the distraction which a family brings. He was, in short, a man of exceptional abilities who found keen pleasure in devoting a long and serene life to the pursuits of science, and in his death America loses one of her most original and profound men.

(Prepared by F. R. Moulton.)

CHARLES SANTIAGO SANDERS PEIRCE.

Charles S. Peirce, as his name was more commonly written, was born on September 20, 1839, at Cambridge, Mass., and died April 20, 1914, at Milford, Pa. He was a logician, a mathematician, and a philosopher. He graduated from Harvard in 1859, and for a number of years was connected with the United States Coast and Geodetic Survey. Later he lectured on logic at Harvard University, Johns Hopkins University, and the Lowell Institute, and it was in this subject that most of his original work was done. His paper on the algebra of logic and on the logic of relatives, being pioneer work, gave him an international reputation. Probably his most conspicuous contribution to the philosophical thought of the time was the idea of pragmatism, afterwards developed and modified by William James. In 1887 he retired to Pike County, Pa., to devote himself completely to logic. Mr. Peirce was a member of the National Academy of Sciences and a fellow of the American Academy of Arts and Sciences. He was the author of *Photometric Researches*, and of numerous articles upon logic, history of science, metaphysics, psychology, mathematics, gravitation, astronomy, map projections, color sense, chemistry, and on the cataloguing of libraries. He contributed a large portion of the scientific definitions to the *Century Dictionary* and some of the chief articles on logic to *Baldwin's Dictionary of Psychology and Philosophy*.

(Extract from the *Nation*, vol. 98, no. 2547.)

THEODORE NICHOLAS GILL.

Theodore Nicholas Gill was born in New York City on March 21, 1837. At an early age he developed an interest in natural science, and during the winter of 1857-58 visited Barbados, Trinidad, and other West Indian Islands in the interest of Mr. D. Jackson Stewart, for whom he collected shells and various natural history specimens. The results of these explorations were published in the *Annals of the New York Lyceum of Natural History* and in the *Proceedings of the Philadelphia Academy of Natural Sciences*. It was in the library of the Philadelphia Academy that he laid the foundation of that great

knowledge of books and authorities which, through the aid of a splendid memory, served him so well in his after years.

In 1859, Dr. Gill visited Newfoundland and studied its fauna, and in 1860 prepared a report on the fishes of the northern boundary for the State Department of the United States. In 1861 he came to Washington and became a member of the department of zoology at Columbian, now George Washington University, with which institution he remained connected until his death, although subsequent to 1910 he withdrew from active work as emeritus professor of zoology. After settling in Washington, Gill came under the influence of Prof. Spencer F. Baird, who found congenial work for him in the library of the Smithsonian Institution, of which he had charge from 1862 until 1866. When the library became a part of the national collections in the Capitol, he continued in that service until 1874 and was for a time assistant librarian of Congress. Upon severing his connection with that library, he devoted his attention almost exclusively to studies in natural history, working largely in the libraries of the Smithsonian Institution and the United States National Museum, holding the honorary appointment of associate in zoology on the scientific staff of the museum subsequent to 1894.

George Washington University conferred upon him the honorary degrees of A. M. in 1865; M. D. in 1866; Ph. D. in 1870; and finally in 1895 bestowed upon him its highest doctorate, that of laws.

He was a member of the National Academy of Sciences, the American Academy of Arts and Sciences, and the American Philosophical Society. He was elected to the National Academy of Sciences in 1873, and at the time of his death his length of membership was exceeded by only five other members. He represented the Academy at the International Zoological Congress in 1898 and was its delegate and that of the Smithsonian Institution at the four hundred and fiftieth anniversary of the founding of the University of Glasgow in 1901. In 1868 he was elected to the American Association for the Advancement of Science, and in 1897 succeeded to the presidency of that organization on the death of Edward Drinker Cope.

Dr. Gill died in Washington City at noon on September 25, 1914.

(Extract from *Science*, n. s., vol. 40, no. 1033.)

CHARLES SEDGWICK MINOT.

Charles Sedgwick Minot was born in Boston, Mass., December 23, 1852, and died at his home near there after a painful illness of several months' duration on November 19, 1914.

After graduating as bachelor of science from the Massachusetts Institute of Technology in 1872, Minot pursued graduate studies in physiology, histology, embryology, and zoology in the Harvard Medical School under Bowditch, in the Universities of Leipzig under

Ludwig and Leuckart, of Paris under Ranvier, and of Würzburg under Kölliker and Semper. He returned to America with a mastery of microscopical technique and a broad foundation of knowledge in the biological sciences, to which he had already begun to make contributions. His earliest studies were in entomology. Under Bowditch and Ludwig he was trained as a physiologist and conducted valuable experiments upon the physiology of muscle, for which he received in 1878 the degree of doctor of science from Harvard University. He was, however, more attracted to morphological studies, and after his appointment in 1880 as lecturer on embryology, to which histology was added, in the Harvard Medical School, his main scientific work lay in these fields. After filling successively the positions of lecturer, instructor, and assistant professor, he became professor of these subjects in 1892 and since 1905 he held the professorship of comparative anatomy and the directorship of the anatomical laboratories in the Harvard Medical School.

Minot devised two widely used forms of automatic microtomes. His contributions to mammalian embryology were numerous and important and are embodied in many papers and memoirs and in his great work on Human Embryology, published in 1892, his Bibliography of Vertebrate Embryology (1893), and his Laboratory Textbook of Embryology (1903), the third edition of which he left nearly ready for the printer at the time of his death.

Minot developed a laboratory admirably equipped for teaching and research. Here he gathered a wonderful collection of over 1,900 embryos of various animals, cut into sections, arranged, and catalogued so as to constitute a vast material for the study of vertebrate embryology. He substituted for the chick embryo largely that of the pig and other mammals for teaching embryology. His name is particularly associated with the advancement of knowledge concerning the placenta and the embryonic membranes.

Of the more purely histological studies perhaps the most important is that published in 1900 "On a Hitherto Unrecognized Form of Blood Circulation without Capillaries," in which he described a lacunar system of vessels to which he gave the name "sinusoids."

The breadth of biological interest with which Minot approached the investigation of structure was especially manifested in his studies of growth, the results of which are presented in his thoughtful and suggestive work entitled *Age, Growth, and Death*, published in 1908. Here he seeks to establish the cytological causes of senescence, which he finds in the increase and differentiation of cytoplasm as related to nucleoplasm.

Endowed with intellectual gifts of a high order, with broad and exact scientific training, with vision and insight, with rare powers of public speech, Minot was one of the strong and stimulating influ-

ences in the organization and development of the biological sciences in America during the past 30 years. He was especially active in promoting the interests of the Society of Naturalists, of the American Association for the Advancement of Science, of which he was president in 1900, of the Boston Society of Natural History, of which he was president from 1897, and of the Anatomisk. He was elected a member of the National Academy of Sciences in 1897 and was active in the work of the academy. His administration of the Elizabeth Thompson Fund is an example of the possibilities of usefulness of even relatively small grants in the aid of research.

Many of Minot's admirable presidential and other general addresses, including those delivered as Harvard Exchange professor to the Universities of Berlin and of Jena in 1912-13, have been published in two German works entitled *Die Methode der Wissenschaft*, 1913, and *Moderne Probleme der Biologie*, 1913, also translated into English. Some indication of their scope may be furnished by such titles as *The Work of the Naturalist in the World, Knowledge and Practice*, *The Embryological Basis of Pathology*, *Ideals of Medical Education*, *The Problem of Consciousness in its Biological Aspects*.

Minot was a member of many American and foreign scientific societies, Sc. D. of Oxford, and LL. D. of Yale, Toronto, and St. Andrew's Universities.

The significance of Minot's work is not to be found solely, or even chiefly, in the narrower fields of anatomical inquiry which he cultivated so successfully, but even more is to be sought in his services in spreading the spirit of science, in advancing scientific research, and in endeavoring to direct educational and scientific institutions and societies toward these great ends.

(Prepared by William H. Welch.)

KARL HARRY FERDINAND ROSENBUSCH.

Although the subject of this notice was generally known in this country under the name of Heinrich Rosenbusch, I can find no authority for the use of this Christian name. His official designation was as given above, while in all his published writings and private letters, down to the year 1900, he subscribed himself H. Rosenbusch, after that date using the name Harry only.

The distinguished petrographer was born at Einbeck in Hanover in the year 1836, and was educated at the gymnasium of Hildesheim and the Universities of Göttingen, Freiburg, and Heidelberg, acquiring a taste for mineralogical studies at the last-mentioned seat of learning under Prof. Blum. Before taking his doctor's degree, however, Rosenbusch accepted a post as tutor in a Portuguese family and proceeded to South America, and it was at this time probably

that he made that wide acquaintance with foreign languages by which he was so greatly distinguished in after life. In 1868 he was back again in Freiburg, where he took his degree, and in the following year became a privat-docent.

Rosenbusch's residence in Freiburg had very important results not only in his own career but in the development of petrographical science. The professor of mineralogy in the University of Freiburg at that day was Heinrich Fischer, who had not only made himself acquainted with all that had been previously done in applying the microscope to the study of rocks, but had brought together a large collection of rock sections upon which he had based his *Kritische mikroskopisch-mineralogische Studien* and his well-known treatise on Nephrite and Jade. These sections and Fischer's extensive library were placed at Rosenbusch's service, as he gratefully acknowledged, and soon the enthusiastic pupil was able to carry the work much farther than the master had done. Rosenbusch recognized the important fact that the exact determination of the minerals seen in a rock section must be based on rigid optical methods, and he set to work to make the improvements in the microscope which would enable such methods to be employed. In 1873 Rosenbusch's epoch-making work on the rock-forming minerals made its appearance, to be followed in 1877 by his great treatise on rocks. Of the far-reaching influence of these works and of the successive editions of them it is unnecessary to speak—their praise is in all the schools.

After the war of 1870 the German Imperial Government determined to prepare a geological map of Alsace and Lorraine, and Rosenbusch was appointed a member of the survey and at the same time extraordinary professor in the University of Strassburg; this led to the publication of his well-known memoir on the Andlau granite and the contact metamorphism produced by its extrusion.

But in 1878, by his appointment to the full professorship of Geology at Heidelberg, Rosenbusch reached the goal of his ambitions, and soon founded his famous Mineralogisch-geologisches Institut. Here during the following 28 years he attracted successive generations of enthusiastic students from all countries, perfecting his methods and applying them in a number of petrographical memoirs, but doing still more important work by his example and influence on the labors of his devoted followers.

In 1904 he was elected a foreign associate of the National Academy of Sciences.

In 1906, upon reaching the age of 70, Rosenbusch retired from his professorship, the event being made the occasion of the publication of a *Festschrift*, in which his students from all parts of the world published original memoirs devoted to the science they had learned from their great master. On January 20, 1914, Rosenbusch passed

away, after a short and severe illness, leaving a widow, but no children.

No notice of Rosenbusch would be complete without a reference to the amiability and charm of his personality. He was a born teacher and inspired the strongest feelings of affection in his pupils. They loved to dwell in after years on his conversations as he made the round of his laboratory, his enthusiasm when, with lighted cigar, he demonstrated the existence of carbon dioxide in cavities of quartz, and his constant insistence that no determination of a mineral should be considered settled till every optical test had been applied. By his scientific contemporaries in all countries he was equally esteemed and loved. Ever ready to exchange specimens, sections, and ideas, he was modest and gentle in expressing dissentient views, and friendly and generous in agreement and appreciation of the work of others. Rosenbusch has left a great and enduring mark upon the geological science of the nineteenth century.

(Extract from the paper by John W. Judd in the *Geological Magazine*, no. 597, decade VI, vol. I, no. III.)

SIR DAVID GILL.

Sir David Gill, the eminent astronomer, died in London on January 24 in the seventieth year of his age. He was educated at the University of Aberdeen, and spent the time between his twenty-fifth and thirtieth years in preparing himself to be an astronomer at a private observatory in Aberdeen. During the next three years, 1873 to 1876, he directed the private observatory of the late Earl of Crawford, then Lord Lindsay, and organized the Lord Lindsay expedition to Mauritius to observe the transit of Venus; the observations being undertaken with a view to a redetermination of the distance of the sun, a problem which had a lasting interest for Sir David, and to which he was constantly returning.

From the measurement of the distance of the sun he turned to the measurement of the earth. During the same three years he connected the longitudes of Berlin, Malta, Alexandria, Suez, Aden, Seychelles, Mauritius, and Rodriguez, and measured the base line for the geodetic survey of Egypt, near Cairo. This was the first step toward realizing what he called the dream of his life, namely, the measurement of the great African arc of the earth on the thirtieth meridian.

In 1880 he proposed the geodetic survey of Natal and Cape Colony, although the project was not carried to completion till 16 years later. He lived to see the gap in the arc between Rhodesia and the Limpopo filled up and its subsequent extensions through German East Africa, along Lake Tanganyika, toward the Sudan. When that work is altogether completed the great arc will join that of Greece and

Struve's great arc, which terminates at the North Cape, and will be the greatest length of the world's surface, 105° , more than 6,000 miles, to be measured with mathematical accuracy.

But before this, in 1877, he proposed and carried out an expedition to Ascension Island to determine the solar parallax by observations on Mars, and in 1879 he was offered the post of astronomer royal at the Cape of Good Hope. He continued his work along the lines of solar parallax determinations, organizing transit of Venus expeditions to this end.

In 1882 a great comet became visible, and Sir David, with the assistance of an intelligent Cape photographer, succeeded in obtaining some beautiful pictures of the comet, the camera being strapped on the telescope, and not only of the comet, but of the surrounding stars. They were the first really fine photographs of a comet, but they were also the first of the modern photographic star plates, and from these photographs sprang the whole project of the great Star Map, which still engages the observatories of the world. From this also originated the new method of determining the sun's distance by photographic observations of the minor planet Eros. The spirit which inspired Sir David Gill in his work is best described in an extract from his presidential address to the British association in 1907:

Accurate and minute measurement seems to the nonscientific imagination a less lofty and dignified work than the looking for something new. But nearly all the grandest discoveries of science have been the reward of accurate measurement and patient long-continued labor in the minute sifting of numerical results.

Sir David Gill was elected a foreign associate of the National Academy of Sciences in 1898 and was the recipient of numerous honors, among others being the F. R. S. and K. C. B.

(Extract from paper in Scientific American, vol. cx, no. 9.)

SIR JOHN MURRAY.

Full of years and honors, the marine biologist and oceanographer, Sir John Murray, met with sudden death at the age of 73 on the 16th of March, 1914. Born March 3, 1841, and partly educated in Canada, he had passed most of his life in Scotland, and was one of the most conspicuous figures in the scientific world of Great Britain.

In the history of oceanography, especially on the biological side, two names are preeminent: Alexander Agassiz and John Murray. Agassiz, the Swiss-born American, collaborated in the task of placing before the world the epochal results of the *Challenger* expedition; and Murray, who took part in that expedition and edited nearly the whole of the fifty-volume *Challenger* report, paid a graceful tribute to the memory of his former colleague when, during a recent visit

to America, he intrusted the National Academy of Sciences with a fund for awarding an Agassiz Medal to persons distinguished in oceanographic research.

The *Challenger* expedition, which in the years 1872-76 carried out no less than 68,900 miles of deep-sea exploration, was the foundation of oceanography as a coherent branch of science. The submarine world was then, for the first time, revealed in a comprehensive way to the insight of man; and this voyage has accordingly been pronounced the most momentous geographic undertaking since the voyages of Columbus and Magellan. Murray, who had previously visited the Arctic regions in a whaler for purposes of biological research, was one of the two naturalists on the *Challenger* under Wyville Thomson, chief of the scientific staff. The failing health of the latter, and his death in 1882, resulted in throwing the whole burden of superintending the publication of the scientific results upon Murray. The execution of this formidable task, as well as his individual contributions to the great report, at once placed him in the front rank of marine investigators.

Thereafter, as the recognized leader in his field, he was obliged to bear the burden of public and private duties which always falls to the lot of the eminent specialist. He found time, however, for numerous researches on his own initiative, including expeditions to explore the Faroe Channel in 1880 and 1882; was a frequent contributor to scientific journals; and received abundant honors, culminating in the K. C. B. in 1898.

In 1911 he presented to the National Academy of Sciences a fund of \$6,000 to found the Alexander Agassiz gold medal in honor of a former president of the academy, to be awarded for original contributions to the science of oceanography.

The greatest work of Murray's latter years was the execution, with the aid of able collaborators, of a bathymetrical survey of the fresh-water lochs of Scotland, the results of which were published in six volumes in 1910. In the latter year he induced the Norwegian Government to send the exploring ship *Michael Sars* on a cruise of the North Atlantic, which proved to be one of the most fruitful enterprises of its kind ever undertaken. Murray defrayed the expenses of this cruise and took part in it. The results of this voyage furnished the bulk of the material for the splendid compendium of oceanography, *The Depths of the Ocean*, published by Murray and Hjort in 1912.

Sir John Murray received many honors and among them was his election as a foreign associate of the National Academy of Sciences, 1912.

(Extract from paper in Scientific American, vol. 40, no. 13.)

EDUARD SUESS.

Eduard Suess, one of the most distinguished geologists of his time, was born in London on August 20, 1831, of German parentage, and died on April 26, 1914, at the age of 83 years. In 1834 his parents removed to Prague. During his early life it was said of him that he acquired a new language each year, and he remained through life a linguist of extraordinary ability. His first paper was a short sketch of the geology of Carlsbad and its mineral waters; in 1851 he was appointed assistant in the geological department of the Royal Natural History Museum at Vienna, where for 11 years he devoted himself to paleontology, and chiefly to brachiopods of the Paleozoic and Mesozoic eras. In 1859 and 1860 a number of these studies were embodied in a book of 122 pages, entitled "Die Wohnsitze der Brachiopoden." It was Suess who proposed the scheme for bringing the abundant pure water of the Alps into Vienna by means of an aqueduct 110 kilometers in length, a project which was eventually adopted and successfully carried out in 1873. For this great service the citizens of Vienna bestowed upon him the highest civic distinction by electing him an honorary burgess. For more than 30 years he sat in the Austrian Parliament as the leader of the Liberal Party, retiring in 1896. In 1892 he published his "Die Zukunft des Silbers," and this work was translated into English and published in 1893 by the Finance Committee of the United States Senate. At the age of 26, Suess was appointed professor extraordinary, and in 1867 was promoted to full professorship in the University of Vienna, where he remained for 44 years, retiring with the title emeritus at the age of 70. Among his students may be mentioned Meumayr, Mojsisovics, Fuchs, Waagen, and Penck.

The greater part of Suess's long life was devoted to working out the evolution of the features of the earth's surface. The problem of mountain building presented itself to his mind during his many excursions in the eastern Alps, and in 1875 his views appeared in a small volume called "Die Entstehung der Alpen," an octavo of 168 pages. His master work, "Der Antlitz der Erde," is known wherever geology is studied. It appeared toward the close of his life and has been translated into many languages.

Eduard Suess was elected as foreign associate of the academy in 1898.

(Extract from the paper by Charles Schuchert in *Science*, n. s., vol. 30, no. 1017.)

AUGUST WEISMANN.

August Weismann was born in Frankfort on the Main on January 17, 1834, and died December 5, 1914. He received his early schooling in his native town, and at the age of 18 left there to go to the Uni-

versity of Göttingen, where he prepared for the practice of medicine. After getting his diploma he went to Giessen to study zoology with Leuckart, and was so successful in his studies on the embryology of the two-winged insects that he decided to apply his methods to other groups of animals. In 1863 he became professor of zoology at the University of Freiburg and remained there for the rest of his life. Shortly after becoming a professor his sight became so weakened that he was unable to use the microscope for about 10 years. During this time it was necessary for him to suspend all research work, and most of his reading and writing had to be done with the help of others. His chief contributions to science on the side of evolutionary thought of the last half century were the theory of the continuity of the germ plasm, the theory of amphimixis as the source of variations, the theory of heredity resting on the concept of the germ plasm, and the theory of germinal selection.

Dr. Weismann was elected a foreign associate of the National Academy of Sciences in 1913.

(Extract from the paper by Benjamin C. Gruenberg in the *Scientific American*, vol. cxi, no. 21.)

HUGO KRONECKER.

Hugo Kronecker was born in Liegnitz, Prussia, January 27, 1839, and died on June 6, 1914, at Berne, Switzerland, at the age of 75. He was a pupil and assistant of Helmholtz, du Bois-Raymond, and Carl Ludwig. After finishing his general education at the Gymnasium in Liegnitz he studied medicine in Berlin, Heidelberg, and Pisa (Italy). In Heidelberg he came under the special influence of Helmholtz, who introduced Kronecker into the science of physiology. The problem of muscular fatigue, which Kronecker studied first under Helmholtz and which he treated in his thesis, became the source of many important investigations, carried out at various times during his scientific career.

In 1865 he became assistant to Traube, but later, on account of a temporary pulmonary affection, Traube sent him to Italy, where he stayed for some time. After recovering his health he served in the Prussian wars with Austria and France. In the Franco-Prussian War he received the iron cross for bravery.

In 1868 he entered Ludwig's celebrated Physiologische Anstalt in Leipzig, where he remained until 1876, becoming assistant in 1871 and professor extraordinarius in 1874. In 1872 he was called to Berlin to become the head of the division of experimental physiology in the Institute of Physiology, which had been recently organized by du Bois-Raymond. In 1884 he was called to the University of Berne, Switzerland, where he filled the chair of physiology until his death.

Kronecker's scientific activities extended over more than half a century; his thesis appeared in 1863. But the investigation which

raised him to the rank of a first-class physiologist was his work on Fatigue and Recovery of Striated Muscles, published from Ludwig's laboratory in 1872. The later work during his Leipzig period was mainly devoted to the cardiac muscle; some of the results found a permanent place in physiology.

A subject in which he took a great interest in the last two decades of his life was the nature and origin of mountain disease, and his interest in it was brought about by the Swiss Government asking him to pass an opinion at the time of the building of the Jungfrau Railroad as to whether going up a high mountain in a railway would be accompanied by mountain disease and other disturbances of health.

Kronecker was the chief founder, and for some time the president, of the Institut Marey in Paris. He was a foreign associate of the National Academy of Sciences, of the Royal Society of London, and of many European academies, and honorary degrees were conferred upon him from many universities. In England he received the degree of LL.D. from the Universities of Glasgow, Aberdeen, St. Andrews, and Edinburgh, and the degree of D. Sc. from Cambridge.

(Extract from the paper by S. J. Meltzer, reprinted from the Biochemical Bulletin, vol. III, nos. 11, 12, April and July, 1914.)

ANNUAL REPORT OF THE TREASURER.

JANUARY 1 TO DECEMBER 31, 1914.

TO THE PRESIDENT OF THE NATIONAL ACADEMY OF SCIENCES.

SIR: I have the honor to submit the following report as treasurer for the fiscal year, January 1 to December 31, 1914. Before presenting the detail statements of the report a general review of the financial transactions of the year will be given.

The income of the academy during the year, from dues and investments, contributions to the Proceedings fund, William Ellery Hale lectureship and semicentennial fund, was \$16,140.69; the expenditures, exclusive of investments, amounted to \$10,595.29.

The sum of investments held by the academy on December 31 was \$229,764.35 (price paid), yielding on that date at the rate of 4.97 per cent. The total income from investments received during the year was \$11,299.02.

Changes in investments may be summarized as follows: One first-mortgage note on real estate, amounting to \$4,500, was paid in full, and two notes were curtailed by the payment of \$1,000 each; bonds were purchased to the amount of \$8,911.25 (face value, \$9,000).

The Marcellus Hartley fund has been increased by a further gift of \$1,100 from Mrs. Helen Hartley Jenkins. This sum, together with a balance from the earlier donation, will serve as a foundation for the academy medal for eminence in the application of science to the public welfare.

The special fund contributed by members and friends of the academy toward the expenses of the publication of the proceedings amounts to \$3,171.67.

Payments made on grants from various funds, in aid of research, amounted to \$5,560.

TRUST FUNDS OF THE ACADEMY.

The trust funds of the academy, the income of which is administered for specific purposes are enumerated below. The capital of certain funds has been increased beyond the original gift, or bequest, by the transfer of accumulated income, at the request of the donors or by action of the academy:

Bache fund: Bequest of Alexander Dallas Bache, a member of the academy, 1870. To aid researches in physical and natural sciences....	\$56,000.00
Watson fund: Bequest of James C. Watson, a member of the academy, 1874. For the promotion of astronomical science through the award of the Watson gold medal and grants of money in aid of research.....	25,000.00

Draper fund: Gift of Mrs. Henry Draper, 1883, in memory of her husband, a former member of the academy. To found the Henry Draper gold medal, to be awarded for notable investigations in astronomical physics. The balance of income is applied to aid research in the same science.....	\$10,000.00
Smith fund: Gift of Mrs. J. Lawrence Smith, 1884, in memory of her husband, a former member of the academy. To found the Lawrence Smith gold medal, to be awarded for important investigations of meteoric bodies and to assist, by grants of money, researches concerning such objects.....	10,000.00
Gibbs fund: Established by a gift of Wolcott Gibbs, a member of the academy, 1892, and increased by a bequest of the late Morris Loeb, 1914. For the promotion of researches in chemistry.....	5,500.00
Gould fund: Gift of Miss Alice Bache Gould, 1897, in memory of her father, a former member of the academy. For the promotion of researches in astronomy.....	20,000.00
Comstock fund: Gift of Gen. Cyrus B. Comstock, a member of the academy, 1907. To promote researches in electricity, magnetism, or radiant energy, through the Comstock prize, of money, to be awarded once in five years for notable investigations. The fund is to be increased ultimately to \$15,000.....	11,337.50
Marsh fund: Bequest of Othniel Charles Marsh, a member of the academy, 1909. To promote original research in the natural sciences. It is anticipated that in time the full amount of the bequest of \$10,000 will be received.....	9,377.65
Murray fund: A gift from Sir John Murray, 1911, to found the Alexander Agassiz gold medal, in honor of a former member and president of the academy, to be awarded for original contributions to the science of oceanography.....	6,000.00
Hartley fund: A gift from Mrs. Helen Hartley Jenkins, 1913-14, in memory of her father Marcellus Hartley, to found the medal of the academy awarded for eminence in the application of science to the public welfare.....	1,600.00

In addition to the above-named funds, the academy holds the following:

Agassiz fund: Bequest of Alexander Agassiz, a member of the academy, 1910, for the general uses of the academy.....	\$50,000.00
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CONDENSED STATEMENT OF RECEIPTS AND EXPENDITURES, 1914.

RECEIPTS.

Balance Jan. 1, 1914, as per last report.....	\$6,196.51
Total income from investments during 1914.....	11,299.02
Accrued interest, account changes in investments.....	194.47
Interest on bank deposits.....	177.37
William Ellery Hale lectureship.....	1,000.00
Advance general fund to Hale lectureship.....	258.70
Contributions to proceedings.....	3,171.67
Addition to Marcellus Hartley fund.....	1,100.00
Mortgage notes paid.....	6,500.00
Investments transferred.....	1,010.00
Advance to Murray fund returned.....	297.92

Annual dues:

1913.....	\$25.00	
1914.....	640.00	
		\$665.00

George E. Hale refund for reporting..... 52.85

Subscriptions to semicentennial fund..... 5.00

31,928.51

EXPENDITURES.

Investments transferred.....	1,010.00
Investments of capital.....	6,871.25
Investment of income.....	2,040.00
Accrued interest, account changes in investments.....	130.97

Warrants on trust funds:

Bache fund—

J. Voûte.....	\$200.00
P. W. Bridgman.....	500.00
W. C. Kendall.....	600.00
C. G. Abbot.....	250.00

Draper fund—

C. G. Abbot.....	500.00
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Gibbs fund—

Mary E. Holmes.....	100.00
W. J. Hale.....	100.00
W. D. Haskins.....	200.00

Gould fund—

A. H. Pfund.....	500.00
S. D. Townley.....	200.00
Astronomical Journal.....	1,000.00

Murray fund—

Agassiz medal—Return to general fund.....	297.92
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Smith fund—

C. C. Trowbridge.....	250.00
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Watson fund—

A. O. Leuschner.....	960.00
Mrs. A. H. Watson.....	200.00

5,857.92

General expenses:

Semicentennial celebration anniversary volume.....	263.75
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Gibbs fund—

Engrossing resolutions.....	21.00
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Murray fund—

Cablegram.....	2.08
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Hale lectureship—

E. Rutherford honorarium.....	700.00
W. W. Campbell honorarium.....	300.00
Invitations to Hale lectures, etc.....	258.70

Proceedings.....	347.83
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General fund—

Salary, assistant secretary and treasurer, 12 months.....	600.00
Treasurer's office (auditing bond, printing, etc.).....	161.45
Home secretary's office (clerical help, printing minutes, lists of members, circulars, etc.).....	453.31

General expenses—Continued.

General fund—Continued.

Foreign secretary's office (engrossing, addresses, etc.)...	\$88.27
Memoirs, printing, etc.....	310.78
Hale lectureship advance from general fund.....	495.62
Anniversary volume.....	221.44
Napier tercentenary dues.....	9.98
Meetings—	
Annual meeting, etc.....	280.42
International Association of Academies dues.....	38.75
Postage.....	80.47
Election of members (printing, diplomas, etc.).....	103.52
	<hr/>
	\$4,737.37
Cash balance in bank Dec. 31, 1914: ¹	
Cash income balance Dec. 31, 1914.....	10,327.70
Uninvested capital Dec. 31, 1914.....	953.30
	<hr/>
	31,928.51

Unpaid dues: 1913, \$5; 1914, \$40; total, \$45.

STATEMENT OF ASSETS AND LIABILITIES, DECEMBER 31, 1914.

ASSETS.

1. Mortgage notes, secured by first mortgages on real estate.....	\$114,750.00
2. Bonds, giving source, face value, rate of interest, and cost:	
Province of Alberta, \$2,600, 4½ per cent.....	\$2,502.50
Broadway Realty Co., \$12,000, 5 per cent.....	12,335.00
Bush Terminal Buildings Co., \$10,000, 5 per cent.....	9,850.00
Chesapeake & Ohio, \$5,000, 4½ per cent.....	4,556.25
City of Tacoma, Green River gravity system, \$4,000, 5 per cent.....	4,150.60
Cleveland Electric Illuminating Co., \$5,000, 5 per cent..	5,100.00
Cosmos Club, \$21,000, 4½ per cent.....	21,000.00
Detroit Edison Co., \$7,000, 5 per cent.....	7,180.00
Dominion Coal Co., \$5,000, 5 per cent.....	5,000.00
Georgia Railway & Electric Light Co., \$2,000, 5 per cent.....	2,060.00
Milwaukee Railway & Electric Light Co., \$5,000, 5 per cent.....	4,570.00
Minneapolis General Electric Co., \$6,000, 5 per cent..	6,080.00
Niagara Falls Power Co., \$4,000, 5 per cent.....	4,100.00
Riggs Realty Co., \$20,000, 5 per cent.....	20,705.00
Southern Bell Telephone & Telegraph Co., \$6,000, 5 per cent.....	5,825.00
	<hr/>
	115,014.35
3. Bank balance, Dec. 31, 1914 ¹	11,281.00
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	241,045.35

¹ Twelve outstanding checks, \$293.34.

LIABILITIES.		
	Income.	Capital.
General fund:		
Invested.....	\$5,200.00
Uninvested.....	1,416.65
Agassiz fund:		
Invested.....		\$49,900.00
Uninvested.....		100.00
Bache fund:		
Invested.....	2,575.00	55,932.95
Uninvested.....	2,552.81	67.05
Building fund:		
Invested.....	1,077.50	6,990.00
Uninvested.....	437.53	10.00
Comstock fund:		
Invested.....	192.50	11,315.00
Uninvested.....	620.81	22.50
Draper fund:		
Invested.....	2,035.00	10,000.00
Uninvested.....	1,018.33
Gibbs fund:		
Invested.....		5,472.50
Uninvested.....	164.49	27.50
Gould fund:		
Invested.....	4,057.50	19,981.25
Uninvested.....	1,062.14	18.75
Marsh fund:		
Invested.....	192.50	9,377.65
Uninvested.....	425.87
Murray fund:		
Invested.....		5,965.00
Uninvested.....		35.00
Smith fund:		
Invested.....	1,532.50	9,985.00
Uninvested.....	696.58	15.00
Watson fund:		
Invested.....	1,020.00	24,922.50
Uninvested.....	81.15	77.50
Marcellus Hartley fund:		
Invested.....		1,020.00
Uninvested.....	22.50	580.00
Proceedings:		
Invested.....	1,020.00
Uninvested.....	1,828.84
Total.....	29,230.20	211,815.15
		29,230.20
		241,045.35

Account with individual funds Jan. 1, 1914, to Dec. 31, 1914.

	General fund.		Agassiz fund.		Bache fund.	
	Income.	Capital.	Income.	Capital.	Income.	Capital.
Balance Jan. 1, 1914:						
Cash.....	\$1,147.37				\$1,120.23	\$67.05
Invested.....	4,190.00			\$50,000.00	2,575.00	55,932.95
Receipts:						
Interest on investments.....	2,782.34				2,982.58	
Accrued interest.....	194.47					
Interest on deposits.....	177.37					
George E. Hale refund reporting..	52.85					
Dues:						
1913.....	25.00					
1914.....	640.00					
Murray fund refund.....	297.92					
Total.....	9,507.32			50,000.00	6,677.81	56,000.00
Disbursements:						
Warrants.....					1,550.00	
General expenses.....	2,374.22					
Hale lectureship advance.....	495.62					
Accrued interest.....	20.83					
Balances Dec. 31, 1914:						
Cash.....	1,416.65			100.00	2,552.81	67.05
Invested.....	5,200.00			49,900.00	2,575.00	55,932.95
Total.....	9,507.32			50,000.00	6,677.81	56,000.00
Mortgage paid.....				3,000.00		
Mortgage transferred.....	500.00					
Bond transferred.....	510.00					
Investment made.....				2,900.00		

Account with individual funds Jan. 1, 1914, to Dec. 31, 1914—Continued.

	Comstock fund.		Draper fund.		Gibbs fund.	
	Income.	Capital.	Income.	Capital.	Income.	Capital.
Balance Jan. 1, 1914:						
Cash.....	\$81.50	\$22.50	\$943.33		\$345.59	\$27.50
Invested.....	192.50	11,315.00	2,035.00	\$10,000.00		5,472.50
Receipts:						
Interest on investments.....	539.31		575.00		239.90	
Total.....	813.31	11,337.50	3,553.33	10,000.00	585.49	5,500.00
Disbursements:						
Warrants.....			500.00		400.00	
General expenses.....					21.00	
Balances Dec. 31, 1914:						
Cash.....	620.81	22.50	1,018.33		164.49	27.50
Invested.....	192.50	11,315.00	2,035.00	10,000.00		5,472.50
Total.....	813.31	11,337.50	3,553.33	10,000.00	585.49	5,500.00

Account with individual funds Jan. 1, 1914, to Dec. 31, 1914—Continued.

	Gould fund.		Marsh fund.		Murray fund.	
	Income.	Capital.	Income.	Capital.	Income.	Capital.
Balance Jan. 1, 1914:						
Cash	\$1,039.24		\$104.65			\$35.00
Invested	4,567.50	\$20,000.00	192.50	\$9,377.65		5,965.00
Receipts:						
Interest on investments	1,271.38		321.22		\$300.00	
Total	6,878.12	20,000.00	618.37	9,377.65	300.00	6,000.00
Disbursements:						
Warrants	1,700.00					
General expenses					2.08	
Accrued interest	58.48					
Refund to general fund					297.92	
Balances Dec. 31, 1914:						
Cash	1,062.14	18.75	425.87			35.00
Invested	4,057.50	19,981.25	192.50	9,377.65		5,965.00
Total	6,878.12	20,000.00	618.37	9,377.65	300.00	6,000.00
Mortgage paid		3,000.00				
Bond transferred	510.00					
Investment made		2,981.25				

Account with individual funds Jan. 1, 1914, to Dec. 31, 1914—Continued.

	Smith fund.		Watson fund.		Semicentennial.	
	Income.	Capital.	Income.	Capital.	Income.	Capital.
Balance Jan. 1, 1914:						
Cash	\$401.58	\$15.00		\$77.50	\$258.75	
Invested	1,532.50	9,985.00	\$1,020.00	24,922.50		
Receipts:						
Interest on investments	545.00		1,271.22			
Semicentennial subscriptions					5.00	
Total	2,479.08	10,000.00	2,293.22	25,000.00	263.75	
Disbursements:						
Warrants	250.00		1,160.00			
General expenses			30.07		263.75	
Balances Dec. 31, 1914:						
Cash	696.58	15.00	81.15	77.50		
Invested	1,532.50	9,985.00	1,020.00	24,922.50		
Total	2,479.08	10,000.00	2,291.22	25,000.00	263.75	

Account with individual funds Jan. 1, 1914, to Dec. 31, 1914—Continued.

	Building fund.		M. Hartley fund.	
	Income.	Capital.	Income.	Capital.
Balance, Jan. 1, 1914:				
Cash.....	\$39.79			\$500.00
Invested.....	1,077.50	\$7,000.00		
Receipts:				
Interest on investments.....	421.07		\$25.00	
Mrs. Helen Hartley Jenkins.....				1,100.00
Total.....	1,538.36	7,000.00	25.00	1,600.00
Disbursements:				
General expenses.....	23.33		2.50	
Balances, Dec. 31, 1914:				
Cash.....	437.53	10.00	22.50	580.00
Invested.....	1,077.50	6,990.00		1,020.00
Total.....	1,538.36	7,000.00	25.00	1,600.00
* Mortgage transferred.....		500.00		
Mortgage paid.....		500.00		
Investments made.....		990.00		1,020.00

Account with individual funds Jan. 1, 1914, to Dec. 31, 1914—Continued.

	Hale lectureship.		Proceedings.	
	Income.	Capital.	Income.	Capital.
Balance Jan. 1, 1914:				
Cash.....				
Invested.....				
Receipts.....	\$1,000.00			
Contributions to proceedings.....			\$3,171.67	
Interest on investments.....			25.00	
Total.....	1,000.00		3,196.67	
Disbursements:				
Honorariums.....	1,000.00			
General expenses.....			347.83	
Balances Dec. 31, 1914:				
Cash.....			1,828.84	
Invested.....			1,020.00	
Total.....	1,000.00		3,196.67	

Combined statement, individual funds.

	Income.	Capital.	Total
Balance Jan. 1, 1914:			
Cash.....	\$5,451.96	\$744.55	\$6,196.51
Invested.....	17,416.38	209,936.72	227,353.10
Receipts:			
Interest on investments.....	11,299.02		
Accrued interest.....	194.47		
Interest on deposits.....	177.37		
Annual dues—			
1913.....	25.00		
1914.....	640.00		
Hale lectureship.....	1,000.00		
Contributions to proceedings.....	3,171.67		
Refund by George E. Hale for reporting at annual meeting.....	52.85		
Murray fund, advance returned.....	297.92		
Semicentennial subscriptions.....	5.00		16,863.30
Marcellus Hartley fund.....		1,100.00	1,100.00
Total.....			251,512.91
Disbursements:			
Warrants.....	5,857.92		
General expenses.....	4,473.67		
Accrued interest.....	130.97		10,467.56
Balances, Dec. 31, 1914:			
Cash.....	10,327.70	953.30	11,281.00
Invested.....	18,902.50	210,861.85	229,764.35
Total.....			251,512.91
Mortgages paid.....		6,500.00	
Mortgage transferred.....	500.00		
Bond transferred.....	510.00		
Investments made.....	2,040.00	6,871.25	

Respectfully submitted.

WHITMAN CROSS, *Treasurer.*

JANUARY 5, 1915.

85019—S. Doc. 989, 63-3—5

REPORT OF THE AUDITING COMMITTEE.

WASHINGTON, D. C., *January 15, 1915.*

We hereby certify that we have examined the securities and papers contained in the box of the National Academy of Sciences at the American Security & Trust Co.'s building and have found them to correspond with the list checked by the auditing committee on **January 15, 1914**, and to differ because of the removal of the following papers:

1 Cosmos Club bond No. 300, \$1,000, called in, paid, and received for.

18 Certificates, Province of Alberta bonds, \$2,600, surrendered on issue of the bonds.

We find that the coupons due in 1914 have been cut and are accounted for; also that the coupons due January 1, 1915, have been detached and are accounted for by an appropriate entry in the pass book. We have accepted the certified statement of William L. Yaeger, public accountant, as to the correspondence between the vouchers, pass book, and accounts of the treasurer and as to the balance shown by the books of the treasurer on December 31, 1914, and certify to its agreement with the balance shown by the report of the treasurer by his check book and by the American Security & Trust Co.

WM. H. DALL.

ARTHUR L. DAY.

APPENDICES.

APPENDIX A.

CONSTITUTION OF THE NATIONAL ACADEMY.

As amended and adopted April 17, 1872, and further amended April 20, 1875; April 21, 1881; April 19, 1882; April 18, 1883; April 19, 1888; April 18, 1895; April 20, 1899; April 17, 1902; April 18, 1906; November 20, 1906; April 17, 1907; November 20, 1907; April 20, 1911; April 16, 1912.

PREAMBLE.

Empowered by the act of incorporation enacted by Congress, and approved by the President of the United States on the 3d day of March, A. D. 1863, and in conformity with the amendment to said act approved July 14, 1870, the National Academy of Sciences adopts the following amended constitution and rules:

ARTICLE I.—OF MEMBERS.

SECTION 1. The academy shall consist of members, honorary members, and foreign associates. Members must be citizens of the United States.

SEC. 2. Members who, from age or inability to attend the meetings of the academy, wish to resign the duties of active membership, may, at their own request, be transferred to the roll of honorary members by a vote of the academy.

SEC. 3. The academy may elect 50 foreign associates.

SEC. 4. Honorary members and foreign associates shall have the privilege of attending the meetings and of reading and communicating papers to the academy, but shall take no part in its business, shall not be subject to its assessments, and shall be entitled to a copy of the publications of the academy.

ARTICLE II.—OF THE OFFICERS.

SECTION 1. The officers of the academy shall be a president, a vice president, a foreign secretary, a home secretary, and a treasurer, all of whom shall be elected for a term of six years, by a majority of votes present, at the first stated meeting after the expiration of the current terms, provided that existing officers retain their places until their successors are elected. In case of a vacancy, the election for six years shall be held in the same manner at the meeting when such vacancy occurs, or at the next stated meeting thereafter, as the academy may direct. A vacancy in the office of treasurer or home secretary may,

however, be filled by appointment of the president of the academy until the next stated meeting of the academy.

SEC. 2. The officers of the academy, together with six members to be elected by the academy, shall constitute a council for the transaction of such business as may be assigned to them by the constitution or the academy.

SEC. 3. The president of the academy, or, in case of his absence or inability to act, the vice president, shall preside at the meetings of the academy and of the council; shall name all committees except such as are otherwise especially provided for; shall refer investigations required by the Government of the United States to members especially conversant with the subjects and report thereon to the academy at its meeting next ensuing; and, with the council, shall direct the general business of the academy.

It shall be competent for the president, in special cases, to call in the aid, upon committees, of experts or men of special attainments not members of the academy.

SEC. 4. The foreign and home secretaries shall conduct the correspondence proper to the respective departments, advising with the president and council in cases of doubt, and reporting their action to the academy at one of the stated meetings in each year.

It shall be the duty of the home secretary to give notice to the members of the place and time of all meetings, of all nominations for membership, and of all proposed amendments to the constitution.

The minutes of each meeting shall be duly engrossed before the next stated meeting under the direction of the home secretary.

SEC. 5. The treasurer shall attend to all receipts and disbursements of the academy, giving such bond and furnishing such vouchers as the council may require. He shall collect all dues from members and keep a set of books showing a full account of receipts and disbursements. He shall present a general report at the annual meeting. He shall be the custodian of the corporate seal of the academy.

ARTICLE III.—OF THE MEETINGS.

SECTION 1. The academy shall hold one stated meeting in each year, called the annual meeting, in the city of Washington, beginning on the third Tuesday in April, and another, called the autumn meeting, may be held at such place and time as the council shall determine.

Special business meetings of the academy may be called, by order of eight members of the council, at such place and time as may be designated in the call.

Special scientific meetings of the academy may be held at times and places to be designated by a majority of the council.

SEC. 2. The names of the members present at each session of a meeting shall be recorded in the minutes, and the members present

at any session shall constitute a quorum for the transaction of business.

SEC. 3. Scientific sessions of the academy, unless otherwise ordered by a majority of the members present, shall be open to the public; sessions for the transaction of business shall be closed.

SEC. 4. Stated meetings of the council shall be held during the stated or special meetings of the academy. Special meetings of the council may be convened at the call of the president and two members of the council, or of four members of the council.

SEC. 5. No member who has not paid his dues shall take part in the business of the academy.

ARTICLE IV.—OF ELECTIONS AND RESIGNATIONS.

SECTION 1. All elections shall be by ballot, and each election shall be held separately unless otherwise ordered by this constitution.

SEC. 2. The time for holding an election of officers shall be fixed by the academy at least one day before the election is held.

SEC. 3. The election of the six members of the council shall be as follows:

At the annual meeting in April, 1907, six members of the council to be elected, of whom two shall serve for three years, two for two years, and two for one year, their respective terms to be determined by lot. Each year thereafter the terms of two members shall expire, and their successors, to serve for three years, shall be elected at the annual meeting in each year.

SEC. 4. The academy shall be divided by the council into standing committees representing the principal branches of scientific research. A member may be assigned to more than one of these committees. The president of the academy shall appoint, subject to the approval of the council, a member of each committee as its chairman, who shall be responsible for the work of the committee.

Nominations to membership in the academy shall be made in writing, approved by a majority of the members of the committee on the branch of research in which the person nominated is eminent, or by a majority of the council in case there is no committee on the subject. The nominations shall be sent to the home secretary by the chairman of the committee before January 1 of the year in which the election is to be held, and each nomination shall be accompanied by a list of the principal contributions of the nominee to science. This list shall be printed by the home secretary for distribution among the members of the academy.

SEC. 5. Election of members shall be held at the annual meeting in Washington in the following manner: There shall be two ballots—a preference ballot, which may be prepared either before or at the

annual meeting and must be transmitted to the home secretary, and a final ballot, to be taken at the meeting.

Preference ballot.—Each member may inscribe on a ballot not more than 10 names of nominees selected from the submitted list. A list of the nominees shall then be prepared, on which the names shall be entered in the order of the number of votes received by each. In case two or more nominees should have the same number of votes on this preference list, the order in which they shall be placed on the list shall be determined by a majority vote of those present.

Final ballot.—A vote shall first be taken on the nominee who appears first on the preference list, and he shall be declared elected if he receive two-thirds of the votes cast and not less than 20 votes in all, provided that the number of members of the academy be not 150 or over, in which case to be declared elected he must receive four-fifths of the votes cast and not less than 25 votes in all. A vote shall then be taken in similar manner on the nominee standing second on the preference list, and so on until all the nominees on the preference list shall have been acted on, or until 10 nominees shall have been elected.

Not more than 10 members shall be elected at one annual meeting. Before and during elections a discussion of the merits of nominees will be in order.

The election of members may be suspended at any time by a majority vote of the members present.

SEC. 6. Every member elect shall accept his membership, personally or in writing, before the close of the next stated meeting after the date of his election. Otherwise, on proof that the secretary has formally notified him of his election, his name shall not be entered on the roll of members.

SEC. 7. The election of foreign associates shall be in the following manner:

Foreign associates may be nominated by the council and may be elected at the annual meeting by a two-thirds vote of the members present. Each member shall indicate on a ballot those names for which he votes, and those nominees whose names appear on two-thirds of the votes cast shall be declared elected. A list of those nominated shall be sent to all members of the academy with the notice of the meeting at which the election is to be held.

SEC. 8. A diploma, with the corporate seal of the academy and the signatures of the officers, shall be sent by the appropriate secretary to each member on his acceptance of his membership, and to foreign associates on their election.

SEC. 9. Resignations shall be addressed to the president and acted on by the academy.

SEC. 10. Whenever a member has not paid his dues for four successive years, the treasurer shall report the fact to the council, which may report the case to the academy with the recommendation that the person thus in arrears be declared to have forfeited his membership. If this recommendation be approved by two-thirds of the members present, the said person shall no longer be a member of the academy and his name shall be dropped from the roll.

ARTICLE V.—OF SCIENTIFIC COMMUNICATIONS, PUBLICATIONS, AND REPORTS.

SECTION 1. Communications on scientific subjects shall be read at scientific sessions of the academy, and papers by any member may be read by the author or by any other member, notice of the same having been previously given to the secretary.

SEC. 2. Any member of the academy may read a paper from a person who is not a member, and shall not be considered responsible for the facts or opinions expressed by the author, but shall be held responsible for the propriety of the paper.

Persons who are not members may read papers on invitation of the council or of the committee of arrangements.

SEC. 3. The academy may provide for the publication, under the direction of the council, of proceedings, memoirs, and reports.

SEC. 4. Propositions for investigations or reports by the academy shall be submitted to the council for approval, except those requested by the Government of the United States, which shall be acted on by the president, who will in such cases report their results to the Government as soon as obtained and to the academy at its next following stated meeting.

SEC. 5. The advice of the academy shall be at all times at the disposition of the Government upon any matter of science or art within its scope.

SEC. 6. An annual report to be presented to Congress shall be prepared by the president, and before its presentation submitted by him, first to the council and afterwards to the academy, at one of the stated meetings.

SEC. 7. Medals and prizes may be established, and the means of bestowing them accepted by the academy upon the recommendation of the council, by whom all the necessary arrangements for their establishment and award shall be made.

Bequests and trusts having for their object the advancement of science may also be accepted and administered by the academy.

ARTICLE VI.—OF THE PROPERTY OF THE ACADEMY.

SECTION 1. All investments shall be made by the treasurer in the corporate name of the academy with the approval of a finance committee of three members, to be appointed annually by the president,

of which the treasurer shall be one. Investments shall be made in bonds of the United States, in State bonds, or bonds or notes secured by first mortgages on real estate, in investments legal for savings banks under the laws of Massachusetts or New York, or in other bonds recommended to the treasurer by the fiscal advisers of the academy.

The council shall, at its annual meeting in each year, designate one bank or trust company in Washington, D. C., and one in New York City, to act, when requested by the treasurer, as the fiscal advisers of the academy.

The treasurer shall have the authority, with the approval of the finance committee, to change any investment held by him in the corporate name of the academy.

SEC. 2. No contract shall be binding upon the academy which has not been first approved by the council.

SEC. 3. The assessments required for the support of the academy shall be fixed by the academy on the recommendation of the council.

ARTICLE VII.—OF ADDITIONS AND AMENDMENTS.

Additions and amendments to the constitution shall be made only at a stated meeting of the academy. Notice of a proposition for such a change must be given at a stated meeting, and shall be referred to the council, which may amend the proposition, and shall report thereon to the academy. Its report shall be considered by the academy in committee of the whole for amendment.

The proposition as amended, if adopted in committee of the whole, shall be voted on at the next stated meeting, and if it receives two-thirds of the votes cast it shall be declared adopted.

Absent members may send their votes on pending changes in the constitution to the home secretary in writing, and such votes shall be counted as if the members were present.

APPENDIX B.

RULES.

I. In the absence of any officer a member shall be chosen to perform his duties temporarily, by a plurality of viva voce votes, upon open nomination.

II. The accounts of the treasurer shall, between January 1 and January 15 of each year, be audited by a committee of three members to be appointed by the president at the autumn meeting of the academy. It shall be the duty of the auditing committee to verify the record of receipts and disbursements maintained by the treasurer and the agreement of book and bank balances; to examine all securities in the custody of the treasurer and to compare the stated income of such securities with the receipts of record; to examine all vouchers covering disbursements for account of the academy and the authority therefor and to compare them with the treasurer's record of expenditures; to examine and verify the account of the academy with each trust fund. The auditing committee may employ an expert accountant to assist the committee in the examination of the books of the treasurer. The annual report of the treasurer shall be published with that of the president to Congress. The reports of the treasurer and auditing committee shall be presented to the academy at the annual meeting.

III. A committee of arrangements, consisting of five members, shall be appointed by the president for each stated session of the academy. This committee shall meet not less than two weeks previous to each session. It shall be in session during the meetings to make arrangements for the reception of the members, to arrange the business of each day, and, in general, to attend to all business and scientific arrangements.

It shall be the duty of the committee of arrangements to ascertain the length of time required for reading the several memoirs presented, and, when it appears advisable, to recommend a limit of time to be occupied in their discussion.

IV. At the meetings the order of business shall be as follows:

1. Chair taken by the president, or, in his absence, by the vice president.

2. Roll of members called by home secretary (first session of the meeting only).

3. Minutes of the preceding meeting read and approved.
4. Stated business.
5. Reports of president, secretaries, treasurer, and committees.
6. Business from council.
7. Other business.
8. On the last day of the session the rough minutes of that day's proceedings are to be read for correction.

V. The rules of order of the academy shall be those of the Senate of the United States, unless suspended by unanimous consent.

VI. Unless otherwise ordered by the academy, the scientific meetings at the April session shall be held in the afternoon, the mornings being reserved for business.

VII. At each meeting the president shall announce the death of any members who may have died since the preceding meeting. As soon as practicable thereafter he shall designate a member to write—or with the approval of the president to secure from some other source—a biographical notice of each deceased member.

VIII. The secretaries will receive memoirs at any time, and report the date of their reception at the next session; but no memoir shall be published unless it has been read or presented by title before the academy.

Before publication all memoirs must be referred to the committee on publication, who may, if they deem best, refer any memoir to a special committee appointed by the president to determine whether the same should be published by the academy.

IX. Memoirs shall date, in the records of the academy, from the date of their presentation to the academy, and the order of their presentation shall be so arranged by the secretary that, so far as may be convenient, those upon kindred topics shall follow one another.

X. Papers from persons not members read before the academy and intended for publication shall be referred at the meeting at which they are read to a committee of members competent to judge whether the paper is worthy of publication. Such committee shall report to the academy as early as practicable, and not later than the next stated session.

XI. The annual report of the academy may be accompanied by a memorial to Congress in regard to such investigations and other subjects as may be deemed advisable, recommending appropriations therefor when necessary.

XII. The proper secretary shall acknowledge all donations made to the academy, and shall report them at the next stated session.

XIII. The books, apparatus, archives, and other collections of the academy shall be deposited in some safe place in the city of Wash-

ington. A list of the articles so deposited shall be kept by the home secretary, who is authorized to employ a clerk to take charge of them.

XIV. A stamp corresponding to the corporate seal of the academy shall be kept by the secretaries, who shall be responsible for the due marking of all books and other objects to which it is applicable.

Labels or other proper marks of similar device shall be placed upon objects not admitting of the stamp.

XV. The treasurer is authorized to defray, when approved by the president, all the proper expenses of committees appointed to make scientific investigations at the request of departments of the Government, and in each case to look to the department requesting the investigation for reimbursement to the academy.

XVI. Nominations for membership should state the full name, residence, the official position, and the special scientific studies of the candidate. A form of nomination shall be prepared by the home secretary.

XVII. Ballots for election of members may be sent by sealing them up in a blank envelope, and inclosing this in another, across the back of which is written the name of the sender, and which is addressed to the home secretary; such envelopes will be opened only by the tellers.

XVIII. All discussions as to the claims and qualifications of nominees at meetings of the academy will be held strictly confidential, and remarks and criticisms then made may be communicated to no person who was not a member of the academy at the time of the discussion.

XIX. Any rule of the academy may be amended, suspended, or repealed on the written motion of any two members, signed by them, and presented at a stated session of the academy, provided the same shall be approved by a majority of the members present.

XX. The fiscal year of the academy shall end on December 31 of each year.

XXI. The annual reports of the committees on research funds shall, so far as the academy has authority to determine their form, give a current number to each award, stating the name, position, and address of the recipient, the subject of research for which the award is made, and the sum awarded; and in later annual reports the status of the work accomplished under each award previously made shall be announced, until the research is completed, when announcement of its completion and, if published, the title and place of publication shall be stated, and the record of the award shall be reported as closed.

XXII. The home secretary shall keep a record of all grants of money or awards of prizes or medals made from trust funds of the

academy. The record for each grant of money shall include the following items:

1. Name of fund.
2. Date and number of the grant.
3. Name and address of recipient.
4. Amount of grant and date or dates of payment.
5. Purpose of grant.
6. Record or report of progress.
7. Resulting publications.

XXIII. The treasurer shall keep the home secretary informed of all warrants received from directors of trust funds not controlled by the academy and of the date or dates of payment of all warrants.

XXIV. A suitable summary of the annual reports of committees or directors concerning the trust funds of the academy (required by Rule XXII) shall be included in the annual report of the president of the academy to Congress.

XXV. All apparatus and other materials of permanent value purchased with money from any grant from a trust fund shall be the property of the academy unless specific exception is made in the grant or by subsequent action of the council or the directors of the trust fund concerned. Receipts for all such property shall be signed by the grantee and shall be forwarded to the home secretary. All apparatus and unused material of value acquired in this way shall be delivered to the home secretary on completion of the investigation for which the grant was made, or at any time on demand of the council, and the home secretary shall give an appropriate release therefor.

XXVI. Standing committees of the academy on trust funds the income of which is applied to the promotion of research shall consist of three or five members, not including the president. In order to secure rotation in office in such committees, when not in conflict with the provisions of the deeds of gift, the term of service on a committee of three members shall be three years; on a committee of five members the term shall be five years. On adoption of this rule the president shall reappoint all committees coming under it, designating by lot or otherwise the term of service of each member, so that thereafter there shall be one vacancy each year in each such committee.

XXVII. That the holders of the Medal for Eminence in the Application of Science to the Public Welfare shall be notified, like members, of the meetings of the academy, and invited to participate in its scientific sessions.

By a resolution adopted January 12, 1864, the president is ex officio a member of all government committees of the academy.

APPENDIX C.

ORGANIZATION OF THE ACADEMY, 1914-15.

	Expiration of term.
WELCH, WILLIAM H., <i>President</i>	April, 1919
WALCOTT, CHARLES D., <i>Vice President</i>	April, 1919
HALE, GEORGE E., <i>Foreign Secretary</i>	April, 1916
DAY, ARTHUR L., <i>Home Secretary</i>	April, 1919
CROSS, WHITMAN, <i>Treasurer</i>	April, 1917

ADDITIONAL MEMBERS OF COUNCIL.

COUNCILMAN, W. T.	1912-1915.	WOODWARD, R. S.
WILSON, EDMUND B.	1913-1916.	CHITTENDEN, R. H.
CONKLIN, E. G.	1914-1917.	NOYES, A. A.

STANDING COMMITTEES OF THE ACADEMY.

I. MATHEMATICS.

BÔCHER, MAXIMÉ	MOULTON, F. R.	WEBSTER, A. G.
BOLZA, OSKAR	OSGOOD, W. F.	WOODWARD, R. S.
DICKSON, L. E.	STORY, W. E.	
MOORE, E. H. (<i>Chairman</i>).	VAN VLECK, E. B.	

2. ASTRONOMY.

BARNARD, E. E.	ELKIN, W. L.	MOULTON, F. R.
CAMPBELL, W. W.	FROST, E. B.	PICKERING, E. C.
COMSTOCK, G. C. (<i>Chairman</i>).	HALE, G. E.	WOODWARD, R. S.
	LEUSCHNER, A. O.	

3. PHYSICS AND ENGINEERING.

ABBE, CLEVELAND	HAYFORD, J. F.	ROSA, E. B.
ABBOT, H. L.	MENDENHALL, T. C.	THOMSON, ELIHU
AMES, J. S.	MERRITT, ERNEST	TROWBRIDGE, JOHN
BARUS, CARL	MICHELSON, A. A.	WEBSTER, A. G.
BELL, A. G.	MORLEY, E. W.	WOOD, R. W.
BUMSTEAD, H. A.	NICHOLS, E. F.	WOODWARD, R. S. (<i>Chairman</i>).
CREW, HENRY	NICHOLS, E. L.	
HALL, E. H.	PICKERING, E. C.	WRIGHT, A. W.
HASTINGS, C. S.	PUPIN, M. I.	

4. CHEMISTRY.

BOLTWOOD, B. B.	HILGARD, E. W.	NOYES, A. A. (<i>Chairman</i>).
CHANDLER, C. F.	HILLEBRAND, W. F.	NOYES, W. A.
CHITTENDEN, R. H.	JACKSON, C. L.	OSBORNE, T. B.
CLARKE, F. W.	LEWIS, G. N.	REMSSEN, IRA
CRAFTS, J. M.	MICHAEL, ARTHUR	RICHARDS, T. W.
FRANKLIN, E. C.	MORLEY, E. W.	SMITH, E. F.
GOMBERG, MOSES	MORSE, H. N.	STIEGLITZ, J. O.
GOOCH, F. A.	NEF, J. U.	WELLS, H. L.

5. GEOLOGY AND PALEONTOLOGY.

BECKER, G. F.	DAY, A. L.	PUMPELLY, RAPHAEL, ¹
BRANNER, J. C.	GILBERT, G. K.	RANSOME, F. L.
CHAMBERLIN, T. C.	HAGUE, ARNOLD (<i>Chairman</i>).	REID, H. F.
CLARK, W. B.		SCHUCHERT, CHARLES
CLARKE, J. M.	IDDINGS, J. P.	SCOTT, W. B.
CROSS, WHITMAN	KEMP, J. F.	VAN HISE, C. R.
DALL, W. H.	LINDGREN, WALDEMAR	WALCOTT, C. D.
DANA, E. S.	OSBORN, H. F.	WHITE, DAVID
DAVIS, W. M.	PIRSSON, L. V.	

6. BOTANY.

BRITTON, N. L.	GOODALE, G. L.	THAXTER, ROLAND
CAMPBELL, D. H.	HARPER, R. A.	TRELEASE, WILLIAM (<i>Chairman</i>).
COULTER, J. M.	SARGENT, C. S.	
FARLOW, W. G.	SMITH, E. F.	

7. ZOOLOGY AND ANIMAL MORPHOLOGY.

ALLEN, J. A.	JENNINGS, H. S.	OSBORN, H. F.
CONKLIN, E. G. (<i>Chairman</i>).	MALL, F. P.	PARKER, G. H.
DALL, W. H.	MARK, E. L.	VERRILL, A. E.
DAVENPORT, C. B.	MERRIAM, C. H.	WALCOTT, C. D.
DONALDSON, H. H.	MORGAN, T. H.	WHEELER, W. M.
HARRISON, R. G.	MORSE, E. S.	WILSON, E. B.

8. PHYSIOLOGY AND PATHOLOGY.

ABEL, J. J.	FLEXNER, SIMON	PRUDDEN, T. M.
BENEDICT, F. G.	HOWELL, W. H.	SMITH, THEOBALD
CANNON, W. B.	LOEB, JACQUES	WELCH, W. H.
CHITTENDEN, R. H. (<i>Chairman</i>).	MALL, F. P.	WOOD, H. C.
	MELTZER, S. J.	
COUNCILMAN, W. T.	MENDEL, L. B.	

9. ANTHROPOLOGY AND PSYCHOLOGY.

BOAS, FRANZ	FEWKES, J. W.	MORSE, E. S.
CATTELL, J. McK.	HOLMES, W. H. (<i>Chairman</i>).	PUTNAM, F. W.
DEWEY, JOHN	MERRIAM, C. H.	ROYCE, JOSIAH

ON WEIGHTS, MEASURES, AND COINAGE.

MENDENHALL, T. C. (<i>Chairman</i>).	MICHELSON, A. A.	MORLEY, E. W.
WEBSTER, A. G.	WOODWARD, R. S.	

ON SOLAR RESEARCH.

HALE, G. E. (<i>Chairman</i>).	CAMPBELL, W. W.	MICHELSON, A. A.
NICHOLS, E. L.		PICKERING, E. C.

ON PUBLICATION.

The PRESIDENT.	The HOME SECRETARY.	WALCOTT, C. D.
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EDITORIAL BOARD OF THE PROCEEDINGS.

NOYES, ARTHUR A., <i>Chairman.</i>	WILSON, EDWIN B., <i>Managing Editor.</i>	
DAY, ARTHUR L., <i>Home Secretary.</i>	HALE, GEORGE E., <i>Foreign Secretary.</i>	
ABEL, J. J.	CREW, HENRY	HARRISON, R. G.
CANNON, W. B.	DAVENPORT, C. B.	HOLMES, W. H.
CATTELL, J. McK.	FLEXNER, SIMON	KEMP, J. F.
CONKLIN, E. G.	FROST, E. B.	MOORE, E. H.
COULTER, J. M.	GOMBERG, MOSES	SCHUCHERT, CHARLES

¹ Died February 5, 1915.

FINANCE COMMITTEE.

CROSS, WHITMAN

HAGUE, ARNOLD

WALCOTT, C. D.

COMMITTEE ON COLLECTION OF HISTORICAL PORTRAITS, MANUSCRIPTS,
INSTRUMENTS ,ETC.WALCOTT, CHARLES D.
(*Chairman*).HAGUE, ARNOLD
HALE, GEORGE E.MELTZER, SAMUEL J.
PUPIN, MICHAEL I.

CLARKE, FRANK W.

COMMITTEE ON PROGRAM.

BOLTWOOD, B. B. (*Chairman*).
FROST, E. B.

CATTELL, J. MCK.

MALL, F. P.

TRUST FUNDS.

THE BACHE FUND.

[\$56,000.]

For researches in physical and natural science.

REMSEN, IRA (*Chairman*).

FROST, E. B.

HARRISON, R. G.

THE WATSON FUND.

[\$25,000.]

For the promotion of astronomical research.

PICKERING, E. C. (*Chairman*).

ELKIN, W. L.

FROST, E. B.

THE HENRY DRAPER FUND.

[\$10,000.]

Medal for important discoveries in astronomy.

HALE, G. E. (*Chairman*), 1918. CAMPBELL, W. W., 1919. MICHELSON, A. A., 1917.
TROWBRIDGE, JOHN, 1916. WRIGHT, A. W., 1915.

THE J. LAWRENCE SMITH FUND.

[\$10,000.]

For the investigation of meteoric bodies.

MORLEY, E. W. (*Chairman*), 1919. DANA, E. S., 1918. HAGUE, ARNOLD, 1917.
PUMPELLE, RAPHAEL, 1915.¹ REMSEN, IRA, 1916.THE BARNARD MEDAL.²

Medal for meritorious service to science.

WOODWARD, R. S. (*Chairman*).
NOYES, A. A.

CAMPBELL, W. W.

NICHOLS, E. F.
RICHARDS, T. W.¹ Died February 5, 1915.² Every five years the committee recommends the person whom they consider most deserving of the medal, and upon the approval of the Academy the name of the nominee is forwarded to the trustees of Columbia College, who administer the Barnard Medal fund.

THE BENJAMIN APTHORP GOULD FUND.

[\$20,000.]

For researches in astronomy.

MOULTON, F. R. (*Chairman*).

BARNARD, E. E.

THE WOLCOTT GIBBS FUND.

[\$5,500.]

For chemical research.

JACKSON, C. L. (*Chairman*)

REMSEN, IRA

SMITH, E. F.

THE COMSTOCK FUND.

[\$11,337.50.]

For researches in electricity, magnetism, and radiant energy.

NICHOLS, E. L. (*Chairman*), 1918.

CREW, HENRY, 1916.

NOYES, A. A., 1919.

THOMSON, ELIHU, 1915.

WEBSTER, A. G., 1917.

THE MARSH FUND.

[\$9,377.65.]

For promoting original research in the natural sciences.

(Not yet available.)

THE AGASSIZ FUND.

[\$50,000.]

For the general uses of the Academy.

(Administered by the Academy.)

THE MURRAY FUND.

[\$6,000.]

For original contributions to the science of oceanography.

HAGUE, ARNOLD (*Chairman*), 1916.

DALL, W. H., 1915.

PARKER, G. H., 1917.

THE MARCELLUS HARTLEY FUND.

[\$1,600.]

Medal for eminence in the application of science to the public welfare.

THOMSON, ELIHU (*Chairman*).

BECKER, G. F.

OSBORN, H. F.

WEBSTER, A. G.

HILLEBRAND, W. F.

PUPIN, M. I.

WELCH, W. H.

THE JOSEPH HENRY FUND.

To assist meritorious investigators, especially in the direction of original research.

The sum of \$40,000 was contributed by Fairman Rogers, Joseph Fatterson, George W. Childs, and others as an expression of their respect and esteem for Prof. Joseph Henry. This amount was deposited with the Pennsylvania Company for the Insurance of Lives and Granting Annuities in Trust, with authorization to collect the income thereon and to pay over the same to Prof. Joseph Henry during his natural life, and after his death to his wife and daughters, and after the death of the last survivor to "deliver the said fund and the securities in which it shall then be invested to the National Academy of Sciences, to be thenceforward forever held in trust under the name and title of the 'Joseph Henry fund.'"

MEMBERS OF THE NATIONAL ACADEMY OF SCIENCES, DECEMBER 31,
1914.

	Date of election.
ABBE, CLEVELAND.....	U. S. Weather Bureau, Washington, D. C. 1879
ABBOT, HENRY L., U. S. A.....	23 Berkeley St., Cambridge, Mass. 1872
ABEL, JOHN JACOB.....	Johns Hopkins University, Baltimore, Md. 1912
ALLEN, J. ASAPH.....	American Museum of Natural History, N. Y. City. 1876
AMES, JOSEPH S.....	Johns Hopkins University, Baltimore, Md. 1909
BARNARD, E. E.....	Yerkes Observatory, Williams Bay, Wis. 1911
BARUS, CARL.....	Brown University, Providence, R. I. 1892
BECKER, GEORGE F.....	U. S. Geological Survey, Washington, D. C. 1901
BELL, A. GRAHAM.....	1331 Connecticut Ave., Washington, D. C. 1883
BENEDICT, FRANCIS GANO.....	Nutrition Laboratory, Boston, Mass. 1914
BOAS, FRANZ.....	Columbia University, New York City. 1900
BÔCHER, MAXIMÉ.....	Harvard University, Cambridge, Mass. 1909
BOLTWOOD, B. B.....	Yale University, New Haven, Conn. 1911
BOLZA, OSKAR.....	Reichsgrafenstr. 10, Freiburg, Germany. 1909
BRANNER, JOHN C.....	Stanford University, California. 1905
BRITTON, NATHANIEL LORD.....	New York Botanical Gardens, N. Y. City. 1914
BUMSTEAD, HENRY ANDREWS.....	Yale University, New Haven, Conn. 1913
CAMPBELL, D. H.....	Stanford University, California. 1910
CAMPBELL, WILLIAM W.....	Lick Observatory, Mount Hamilton, California. 1902
CANNON, WALTER BRADFORD.....	Harvard University, Cambridge, Mass. 1914
CATTELL, JAMES MCK.....	Garrison, N. Y. 1901
CHAMBERLIN, THOMAS C.....	University of Chicago, Chicago, Ill. 1903
CHANDLER, CHARLES F.....	Columbia University, New York City. 1874
CHITTENDEN, RUSSELL H.....	Sheffield Scientific School, New Haven, Conn. 1890
CLARK, W. B.....	Johns Hopkins University, Baltimore, Md. 1908
CLARKE, F. W.....	U. S. Geological Survey, Washington, D. C. 1909
CLARKE, J. M.....	State Hall, Albany, N. Y. 1909
COMSTOCK, GEORGE C.....	Washburn Observatory, Madison, Wis. 1899
CONKLIN, E. G.....	Princeton, N. J. 1908
COULTER, J. M.....	University of Chicago, Chicago, Ill. 1909
COUNCILMAN, WILLIAM T.....	Harvard Medical School, Boston, Mass. 1904
CRAFTS, JAMES M.....	59 Marlborough St., Boston, Mass. 1872
CREW, HENRY.....	Northwestern University, Evanston, Ill. 1909
CROSS, WHITMAN.....	U. S. Geological Survey, Washington, D. C. 1908
DALL, WILLIAM H.....	Smithsonian Institution, Washington, D. C. 1897
DANA, EDWARD S.....	Yale University, New Haven, Conn. 1884
DAVENPORT, CHARLES B.....	Cold Spring Harbor, N. Y. 1912
DAVIS, WILLIAM MORRIS.....	31 Hawthorn St., Cambridge, Mass. 1904
DAY, ARTHUR L.....	Geophysical Laboratory, Washington, D. C. 1911
DEWEY, JOHN.....	Columbia University, New York City. 1910
DICKSON, LEONARD E.....	University of Chicago, Chicago, Ill. 1913
DONALDSON, HENRY HERBERT.....	Wistar Institute of Anatomy, Phila, Pa. 1914
ELKIN, WILLIAM L.....	Yale University Observatory, New Haven, Conn. 1895
FARLOW, W. G.....	Harvard University, Cambridge, Mass. 1879
FEWKES, JESSE WALTER.....	Bureau of American Ethnology, Washington, D. C. 1914
FLEXNER, SIMON.....	Rockefeller Institute, New York City. 1908
FRANKLIN, EDWARD CURTIS.....	Stanford University, California. 1914
FROST, EDWIN B.....	Yerkes Observatory, Williams Bay, Wis. 1908
GILBERT, GROVE K.....	U. S. Geological Survey, Washington, D. C. 1883

	Date of election.
GOMBERG, MOSES.....	University of Michigan, Ann Arbor, Mich. 1914
GOOCH, FRANK A.....	Yale University, New Haven, Conn. 1897
GOODALE, GEORGE L.....	Harvard University, Cambridge, Mass. 1890
HAGUE, ARNOLD.....	U. S. Geological Survey, Washington, D. C. 1885
HALE, GEORGE E.....	Solar Observatory Office, Pasadena, Cal. 1902
HALL, EDWIN H.....	Harvard University, Cambridge, Mass. 1911
HARPER, R. A.....	Columbia University, New York City. 1911
HARRISON, ROSS G.....	Yale University, New Haven, Conn. 1913
HASTINGS, CHARLES S.....	Yale University, New Haven, Conn. 1889
HAYFORD, JOHN F.....	Northwestern University, Evanston, Ill. 1911
HILGARD, EUGENE W.....	University of California, Berkeley, Cal. 1872
HILLEBRAND, WILLIAM F.....	Bureau of Standards, Washington, D. C. 1908
HOLMES, WILLIAM H.....	U. S. National Museum, Washington, D. C. 1905
HOWELL, WILLIAM H.....	Johns Hopkins University, Baltimore, Md. 1905
IDDINGS, JOSEPH P.....	U. S. Geological Survey, Washington, D. C. 1907
JACKSON, CHARLES L.....	6 Boylston Hall, Cambridge, Mass. 1883
JENNINGS, HERBERT SPENCER.....	Johns Hopkins University, Baltimore, Md. 1914
KEMP, JAMES F.....	Columbia University, New York City. 1911
LEUSCHNER, ARMIN O.....	University of California, Berkeley, Cal. 1913
LEWIS, GILBERT N.....	University of California, Berkeley, Cal. 1913
LINDGREN, WALDEMAR.....	Mass. Inst. of Technology, Boston, Mass. 1909
LOEB, JACQUES.....	Rockefeller Institute, New York City. 1910
MALL, FRANKLIN P.....	Johns Hopkins University, Baltimore, Md. 1907
MARK, EDWARD L.....	109 Irving St., Cambridge, Mass. 1903
MELTZER, SAMUEL JAMES.....	Rockefeller Institute, New York City. 1912
MENDEL, LAFAYETTE B.....	18 Trumbull St., New Haven, Conn. 1913
MENDENHALL, THOMAS C.....	329 North Chestnut St., Ravenna, Ohio. 1887
MERRIAM, C. HART.....	1919 Sixteenth St., Washington, D. C. 1902
MERRITT, ERNEST.....	Cornell University, Ithaca, N. Y. 1914
MICHAEL, ARTHUR.....	219 Parker St., Newton Center, Mass. 1889
MICHELSON, ALBERT A.....	University of Chicago, Chicago, Ill. 1888
MOORE, ELIAKIM H.....	University of Chicago, Chicago, Ill. 1901
MORGAN, T. H.....	Columbia University, New York City. 1909
MORLEY, EDWARD W.....	West Hartford, Conn. 1897
MORSE, EDWARD S.....	Salem, Mass. 1876
MORSE, HARMON N.....	Johns Hopkins University, Baltimore, Md. 1907
MOULTON, F. R.....	University of Chicago, Chicago, Ill. 1910
NEF, JOHN ULRIC.....	University of Chicago, Chicago, Ill. 1904
NICHOLS, EDWARD L.....	Cornell University, Ithaca, N. Y. 1901
NICHOLS, ERNEST F.....	Dartmouth College, Hanover, N. H. 1908
NOYES, ARTHUR A.....	Massachusetts Institute of Technology, Boston, Mass. 1905
NOYES, WILLIAM A.....	University of Illinois, Urbana, Ill. 1910
OSBORN, H. F.....	American Museum of Natural History, New York City. 1900
OSBORNE, T. B.....	Agricultural Experiment Station, New Haven, Conn. 1910
OSGOOD, WILLIAM FOGG.....	Harvard University, Cambridge, Mass. 1904
PARKER, GEORGE H.....	16 Berkeley St., Cambridge, Mass. 1913
PICKERING, EDWARD C.....	Harvard College Observatory, Cambridge, Mass. 1873
PIRSSON, LOUIS V.....	41 Trumbull St., New Haven, Conn. 1913
PRUDDEN, T. MITCHELL.....	Columbia University, New York City. 1901
PUMPELLEY, RAPHAEL ¹	Gibbs Ave., Newport, R. I. 1872

¹ Died February 5, 1915.

	Date of election.
PUPIN, MICHAEL I.	Columbia University, New York City. 1905
PUTNAM, FREDERICK W.	Peabody Museum, Cambridge, Mass. 1885
RANSOME, FREDERICK LESLIE.	U. S. Geological Survey, Washington, D. C. 1914
REID, H. FIELDING.	Johns Hopkins University, Baltimore, Md. 1912
REMSEN, IRA.	Johns Hopkins University, Baltimore, Md. 1882
RICHARDS, THEODORE W.	Wolcott Gibbs Mem. Lab., Cambridge, Mass. 1899
ROSA, EDWARD B.	Bureau of Standards, Washington, D. C. 1913
ROYCE, JOSIAH.	Harvard University, Cambridge, Mass. 1906
SARGENT, CHARLES S.	Arnold Arboretum, Jamaica Plain, Mass. 1895
SCHUCHERT, CHARLES.	Yale University, New Haven, Conn. 1910
SCOTT, WILLIAM B.	Princeton University, Princeton, N. J. 1906
SMITH, EDGAR F.	University of Pennsylvania, Philadelphia, Pa. 1899
SMITH, ERWIN F.	Bureau of Plant Industry, Washington, D. C. 1913
SMITH, THEOBALD.	Harvard Medical School, Boston, Mass. 1908
STIEGLITZ, J. O.	University of Chicago, Chicago, Ill. 1911
STORY, WILLIAM E.	Clark University, Worcester, Mass. 1908
THAXTER, ROLAND.	Harvard University, Cambridge, Mass. 1912
THOMSON, ELIHU.	Swampscott, Mass. 1907
TRELEASE, WILLIAM.	University of Illinois, Urbana, Ill. 1902
TROWBRIDGE, JOHN.	Harvard University, Cambridge, Mass. 1878
VAN HISE, C. R.	University of Wisconsin, Madison, Wis. 1902
VAN VLECK, E. B.	University of Wisconsin, Madison, Wis. 1911
VERRILL, A. E.	Yale University, New Haven, Conn. 1872
WALCOTT, CHARLES D.	Smithsonian Institution, Washington, D. C. 1896
WEBSTER, ARTHUR G.	Clark University, Worcester, Mass. 1903
WELCH, WILLIAM H.	807 St. Paul St., Baltimore, Md. 1895
WELLS, HORACE L.	Yale University, New Haven, Conn. 1903
WHEELER, WILLIAM M.	Harvard University, Cambridge, Mass. 1912
WHITE, DAVID.	U. S. Geological Survey, Washington, D. C. 1912
WILSON, EDMUND B.	Columbia University, New York City. 1899
WOOD, HORATIO C.	4107 Chester Ave., Philadelphia, Pa. 1879
WOOD, ROBERT W.	Johns Hopkins University, Baltimore, Md. 1912
WOODWARD, ROBERT S.	Carnegie Institution, Washington, D. C. 1896
WRIGHT, ARTHUR W.	Yale University, New Haven, Conn. 1881

HONORARY MEMBER.

SMITH, SIDNEY I.	Yale University, New Haven, Conn. 1884
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FOREIGN ASSOCIATES.

ARRHENIUS, S. A.	Nobelinstitut, Stockholm. 1908
AUWERS, G. F. J. ARTHUR ¹	Bellevue Str. 55, Grosslichterfelde W., Berlin. 1883
BACKLUND, OSKAR.	Astron. Sternwarte, Pulkowa. 1903
BAEYER, ADOLPH RITTER VON.	Universität, Munich. 1898
BARROIS, CHARLES.	Université, Lille. 1908
BOVERI, THEODOR.	Würzburg. 1913
BRØGGER, W. C.	Universitet, Christiania. 1903
CROOKES, SIR WILLIAM.	London. 1913
DARBOUX, GASTON.	Academy of Sciences, Paris. 1913
DESLANDRES, HENRI.	Astrophysical Observatory, Meudon. 1913

¹ Died January 24, 1915.

	Date of election.
DEWAR, SIR JAMES.....	<i>University, Cambridge.</i> 1907
EHRlich, PAUL.....	<i>Königl. Inst. für Exper. Therapie, Frankfurt a. Main.</i> 1904
FISCHER, EMIL.....	<i>Chemisches Inst. der Universität, Berlin.</i> 1904
FORSYTH, A. R.....	<i>Trinity College, Cambridge.</i> 1907
GEIKIE, SIR ARCHIBALD.....	<i>Haslemere, Surrey.</i> 1901
GROTH, PAUL VON.....	<i>Universität, Munich.</i> 1905
HEIM, ALBERT.....	<i>Zürich.</i> 1913
HILBERT, DAVID.....	<i>Universität, Göttingen.</i> 1907
KAPTEYN, JOHN C.....	<i>Rijks Universiteit, Groningen.</i> 1907
KLEIN, FELIX.....	<i>Universität, Göttingen.</i> 1898
KÖSSEL, ALBRECHT.....	<i>Heidelberg.</i> 1913
KUSTNER, KARL FRIEDRICH.....	<i>Bonn.</i> 1913
LANKESTER, E. RAY.....	<i>South Kensington, London.</i> 1903
LAMOR, SIR JOSEPH.....	<i>St. Johns College, Cambridge.</i> 1908
LORENTZ, HENDRIK ANTON.....	<i>Rijks Universiteit, Leiden.</i> 1906
OSTWALD, WILHELM.....	<i>Grossbothen, bei Leipzig.</i> 1906
PAVLOV, IVAN PETROVITCH.....	<i>Kais. Inst. für Exper. Med., Petrograd.</i> 1908
PENCK, ALBRECHT.....	<i>Universität, Berlin.</i> 1909
PFEFFER, WILHELM.....	<i>Bot. Inst. der Universität, Leipzig.</i> 1903
PICARD, CHARLES ÉMILE.....	<i>Université, Paris.</i> 1903
RAMSAY, SIR WILLIAM.....	<i>University College, London.</i> 1904
RAYLEIGH, LORD.....	<i>University, Cambridge.</i> 1898
RETZIUS, GUSTAV.....	<i>Högskolan, Stockholm.</i> 1909
RUTHERFORD, SIR ERNEST.....	<i>University, Manchester.</i> 1911
SCHUSTER, ARTHUR.....	<i>Secretary of the Royal Society, London.</i> 1913
SEELIGER, HUGO RITTER VON.....	<i>Universität, Munich.</i> 1908
THOMSON, SIR JOSEPH.....	<i>University, Cambridge.</i> 1903
VOLTERRA, VITO.....	<i>Università, Rome.</i> 1911
VRIES, HUGO DE.....	<i>Universiteit, Amsterdam.</i> 1904
WAALS, JOHANNES D. VAN DER.....	<i>Amsterdam.</i> 1913
WALDEYER, WILHELM.....	<i>Universität, Berlin.</i> 1909
WOLF, MAX F. J. C.....	<i>Heidelberg.</i> 1913
WUNDT, WILHELM.....	<i>Universität, Leipzig.</i> 1909

DECEASED MEMBERS.

	Date of election.	Date of death.
AGASSIZ, ALEXANDER.....	1866	Mar. 27, 1910
AGASSIZ, LOUIS.....	(1)	Dec. 14, 1873
ALEXANDER, J. H.....	(1)	Mar. 2, 1867
ALEXANDER, STEPHEN.....	(1)	June 25, 1883
BACHE, ALEXANDER DALLAS.....	(1)	Feb. 14, 1867
BAIRD, SPENCER F.....	1864	Aug. 19, 1887
BARKER, GEORGE F.....	1876 ²	May 24, 1910
BARNARD, F. A. P.....	(1) (2)	Apr. 27, 1889
BARNARD, J. G.....	(1)	May 14, 1882
BARTLETT, W. H. C.....	(1)	Feb. 11, 1893
BEECHER, CHARLES EMERSON.....	1899	Feb. 14, 1904
BILLINGS, JOHN S.....	1883 ²	Mar. 11, 1913
BOSS, LEWIS.....	1889 ²	Oct. 5, 1912
BOWDITCH, HENRY P.....	1887 ²	Mar. 13, 1911
BREWER, WILLIAM H.....	1880 ²	Nov. 2, 1910
BROOKS, WILLIAM KEITH.....	1884	Nov. 12, 1908
BROWN-SEQUARD, CHARLES E.....	1868	Apr. 2, 1894
BRUSH, GEORGE JARVIS.....	1868 ²	Feb. 6, 1912
CASEY, THOMAS L.....	1890	Mar. 25, 1896
CASWELL, ALEXIS.....	(1)	Jan. 8, 1887
CHANDLER, SETH CARLO.....	1888 ²	Jan. 10, 1914
CHAUVENET, WILLIAM.....	(1)	Dec. 13, 1870
CLARKE, HENRY JAMES.....	1872	July 1, 1873
COFFIN, JAMES.....	1869	Jan. 6, 1873
COFFIN, J. H. C.....	(1)	Jan. 8, 1890
COMSTOCK, CYRUS B.....	1884	May 29, 1910
COOK, GEORGE H.....	1887	Sept. 22, 1889
COOKE, JOSIAH P.....	1872	Sept. 3, 1894
COPE, EDWARD D.....	1872 ²	Apr. 12, 1897
COUES, ELLIOTT.....	1877	Dec. 25, 1899
DALTON, J. C.....	1864	Feb. 2, 1889
DANA, JAMES D.....	(1) (2)	Apr. 14, 1895
DAVIDSON, GEORGE.....	1874 ²	Dec. 2, 1911
DAVIS, CHARLES H.....	(1)	Feb. 14, 1877
DRAPER, HENRY.....	1877	Nov. 20, 1882
DRAPER, JOHN W.....	1877	Jan. 4, 1882
DUTTON, C. E.....	1884 ²	Jan. 4, 1912
EADS, JAMES B.....	1872	Mar. 8, 1887
EMMONS, SAMUEL F.....	1892	Mar. 28, 1911
ENGLEMANN, GEORGE.....	(1)	Feb. 4, 1884
FERREL, WILLIAM.....	1868	Sept. 18, 1891
FRASER, JOHN FRIES.....	(1)	Oct. 12, 1872
GABB, WILLIAM M.....	1876	May 30, 1878
GENTH, F. A.....	1872	Feb. 2, 1893
GIBBS, JOSIAH WILLARD.....	1879	Apr. 28, 1903
GIBBS, WOLCOTT.....	(1)	Dec. 9, 1908
GILL, THEODORE NICHOLAS.....	1873 ²	Sept. 25, 1914
GILLIS, JAMES MELVILLE.....	(1)	Feb. 9, 1865
GOODE, G. BROWN.....	1888	Sept. 6, 1896
GOULD, AUGUSTUS A.....	(1)	Sept. 15, 1866
GOULD, BENJAMIN A.....	(1) (2)	Nov. 27, 1896
GRAY, ASA.....	(1)	Jan. 30, 1888
GUYOT, ARNOLD.....	(1)	Feb. 8, 1884

¹Charter members, March 3, 1863.²Biographical notices have not been presented.

	Date of election.	Date of death.
HADLEY, JAMES.....	1864	Aug. 1, 1872
HALDEMAN, S. S.....	1876	Sept. 20, 1880
HALL, ASAPH.....	1875	Nov. 22, 1907
HALL, JAMES.....	(1) (2)	Aug. 8, 1898
HAYDEN, F. V.....	1873	Dec. 22, 1887
HENRY, JOSEPH.....	(1)	May 13, 1878
HILGARD, JULIUS E.....	(1)	May 8, 1891
HILL, GEORGE WILLIAM.....	1874 ²	Apr. 6, 1914
HILL, HENRY B.....	1883	Apr. 6, 1903
HITCHCOCK, EDWARD.....	(1)	Feb. 27, 1864
HOLBROOK, J. E.....	1868	Sept. 8, 1871
HOLDEN, EDWARD SINGLETON.....	1885 ²	Mar. 16, 1914
HUBBARD, J. S.....	(1)	Aug. 16, 1863
HUMPHREYS, A. A.....	(1)	Nov. 28, 1883
HUNT, T. STERRY.....	1873 ²	Feb. 12, 1892
HYATT, ALPHEUS.....	1875	Jan. 16, 1902
JOHNSON, S. W.....	1866	July 21, 1909
KEELER, J. E.....	1900	Aug. 12, 1900
KING, CLARENCE.....	1876	Dec. 24, 1901
KIRKLAND, JARED P.....	1865	Dec. 10, 1877
LANE, J. HOMER.....	1872	May 3, 1880
LANGLEY, SAMUEL P.....	1876	Feb. 27, 1906
LE CONTE, JOHN.....	1878	Apr. 29, 1891
LE CONTE, JOHN L.....	(1)	Nov. 15, 1883
LE CONTE, JOSEPH.....	1875	July 6, 1901
LEA, MATTHEW CAREY.....	1892	Mar. 15, 1897
LEIDY, JOSEPH.....	(1)	Apr. 30, 1891
LESLEY, J. PETER.....	(1) (2)	June 3, 1903
LESQUEREUX, LEO.....	1864	Oct. 25, 1889
LONGSTRETH, MIERS F.....	(1)	Dec. 27, 1891
LOOMIS, ELIAS.....	1873	Aug. 16, 1889
LOVERING, JOSEPH.....	1873	Jan. 18, 1892
LYMAN, THEODORE.....	1872	Sept. 10, 1897
MAHAN, D. H.....	(1)	Sept. 16, 1871
MARSH, G. P.....	1866	July 23, 1882
MARSH, O. C.....	1874 ²	Mar. 18, 1889
MAYER, ALFRED M.....	1872 ²	July 13, 1897
MAYO-SMITH, RICHMOND.....	1890 ²	Nov. 11, 1901
MEEK, F. B.....	1869	Dec. 21, 1877
MEIGS, M. C.....	1865	Jan. 2, 1892
MINOT, CHARLES SEDGWICK.....	1897 ²	Nov. 19, 1914
MITCHELL, HENRY.....	1885 ²	Dec. 1, 1902
MITCHELL, SILAS WEIR.....	1865 ²	Jan. 4, 1914
MORGAN, LEWIS H.....	1875	Dec. 14, 1831
MORTON, HENRY.....	1874	May 9, 1902
NEWBERRY, J. S.....	(1)	Dec. 7, 1892
NEWCOMB, SIMON.....	1869 ²	July 11, 1909
NEWTON, H. A.....	(1)	Aug. 1, 1896
NEWTON, JOHN.....	1876	May 1, 1895
NORTON, WILLIAM A.....	1873	Sept. 21, 1883
OLIVER, JAMES E.....	1872	Mar. 27, 1895
PACKARD, A. S.....	1872 ²	Feb. 14, 1905
PIERCE, BENJAMIN OSGOOD.....	1906 ²	Jan. 14, 1914

¹ Charter members, March 3, 1863.² Biographical notices have not been presented.

	Date of election.	Date of death.
PIERCE, CHARLES SANTIAGO SANDERS.....	1876 ²	April 20, 1914
PENFIELD, SAMUEL L.....	1900	Aug. 13, 1906
PETERS, C. H. F.....	1876 ²	July 18, 1890
POURTALES, L. F.....	1873	July 19, 1880
POWELL, JOHN W.....	1880	Sept. 23, 1902
RODGERS, JOHN.....	(1)	May 5, 1882
ROGERS, FAIRMAN.....	(1)	Aug. 23, 1900
ROGERS, ROBERT E.....	(1)	Sept. 7, 1884
ROGERS, WILLIAM A.....	1885	Mar. 1, 1898
ROGERS, WILLIAM B.....	(1)	May 30, 1882
ROOD, OGDEN N.....	1885	Nov. 12, 1902
ROWLAND, HENRY A.....	1881	Apr. 16, 1901
RUTHERFURD, LEWIS M.....	(1)	May 30, 1892
SAXTON, JOSEPH.....	(1)	Oct. 26, 1873
SCHOTT, CHARLES A.....	1872 ²	July 31, 1901
SCUDDER, SAMUEL H.....	1877 ²	May 17, 1911
SELLERS, WILLIAM.....	1873 ²	Jan. 24, 1905
SILLIMAN, BENJ. Sr.....	(1)	Nov. 24, 1864
SILLIMAN, BENJ. Jr.....	(1)	Jan. 14, 1885
SMITH, J. LAWRENCE.....	1872	Oct. 12, 1883
STIMPSON, WILLIAM.....	1868 ²	May 26, 1873
STRONG, THEODORE.....	(1)	Feb. 1, 1869
SULLIVANT, W. S.....	1873	Apr. 30, 1882
TORREY, JOHN.....	(1)	Mar. 10, 1873
TOTTEN, J. G.....	(1)	Apr. 22, 1864
TROWBRIDGE, WILLIAM P.....	1872	Aug. 12, 1892
TRUMBULL, JAMES H.....	1872	Aug. 5, 1897
TUCKERMAN, EDWARD.....	1868	Mar. 15, 1886
WALKER, FRANCIS A.....	1878	Jan. 5, 1897
WARREN, G. K.....	1876	Aug. 8, 1882
WATSON, JAMES C.....	1868	Nov. 23, 1880
WATSON, SERENO.....	1889	Mar. 9, 1892
WHEELER, HENRY LORD.....	1909 ²	Oct. 30, 1914
WHITE, CHARLES A.....	1889	June 29, 1910
WHITMAN, C. O.....	1895	Dec. 6, 1910
WINLOCK, JOSEPH.....	(1)	June 11, 1875
WOODWARD, J. J.....	1873	Aug. 17, 1884
WORTHEN, A. H.....	1872	May 6, 1888
WYMAN, JEFFRIES.....	(1)	Sept. 4, 1874
YOUNG, CHARLES A.....	1872	Jan. 3, 1908

¹ Charter members, March 3, 1863.² Biographical notices have not been presented.

DECEASED FOREIGN ASSOCIATES.

ADAMS, J. C.	KÖLLIKER, ALBERT VON
AIRY, SIR GEORGE B.	KRONECKER, HUGO
ARGELANDER, F. W. A.	LACAZE-DUTHIERS, HENRI DE
BAER, KARL ERNEST VON	LEUCKART, RUDOLPH
BARRANDE, JOACHIM	LIE, SOPHUS
BEAUMONT, L. ÉLIE DE	LIEBIG, JUSTUS VON
BECQUEREL, HENRI	LISTER, LORD
BERTHELOT, M. P. E.	LOEWY, MAURICE
BERTRAND, J. L. F.	LUDWIG, K. F. W.
BOLTZMANN, LUDWIG	MAREY, E. J.
BORNET, EDOUARD	MENDELÉEFF, D. I.
BOUSSINGAULT, J. B. J. D.	MILNE-EDWARDS, HENRI
BRAUN, ALEXANDER	MOISSAN, HENRI
BREWSTER, SIR DAVID	MURCHISON, SIR RODERICK I.
BUNSEN, ROBERT W.	MURRAY, SIR JOHN
BURMEISTER, C. H. C.	OPPOLZER, THEODORE VON
CANDOLLE, ALPHONSE DE	OWEN, SIR RICHARD
CAYLEY, ARTHUR	PASTEUR, LOUIS
CHASLES, MICHEL	PETERS, C. A. F.
CHEVREUL, M. E.	PLANA, G. A. A.
CLAUSIUS, RUDOLPH	POINCARÉ, JULES HENRI
CORNU, ALFRED	RAMMELSBERG, C. F.
DARWIN, SIR GEORGE HOWARD	REGNAULT, VICTOR
DOVE, H. W.	REYMOND, EMIL DU BOIS
DUMAS, J. B.	RICHTHOFEN, F. VON
FARRADAY, MICHAEL	ROSENBUSCH, KARL HARRY FERDINAND
GEGENBAUR, KARL	SACHS, JULIUS VON
GYLDÉN, HUGO	SCHIAPARELLI, GIOVANNI
GILL, SIR DAVID	STAS, JEAN SERVAIS
HAMILTON, SIR WILLIAM ROWAN	STOKES, SIR GEORGE G.
HELMHOLTZ, BARON H. VON	STRASBURGER, EDOUARD
HOFF, J. H. VAN'T	STRUVE, OTTO VON
HOFMANN, A. W.	SUESS, EDOUARD
HOOKE, SIR JOSEPH D.	SYLVESTER, J. J.
HUGGINS, SIR WILLIAM	TISSERAND, F. F.
HUXLEY, T. H.	VIRCHOW, RUDOLPH VON
IBAÑEZ, CARLOS	VOGEL, H. C.
JANSSEN, J.	WEIERSTRASS, KARL
JOULE, JAMES P.	WEISMANN, AUGUST
KEKULÉ, AUGUST	WÖHLER, FRIEDRICH
KELVIN, LORD	WÜRTZ, ADOLPH
KIRCHOFF, G. R.	ZIRKEL, FERDINAND
KOCH, ROBERT	ZITTEL, K. A. R. VON
KOHLRAUSCH, FRIEDRICH	