

REPORT
OF THE
NATIONAL ACADEMY OF SCIENCES
FOR
THE YEAR 1910



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CONTENTS.

	Page.
Letter of transmittal.....	5
Act of incorporation.....	7
Amendments to act of incorporation.....	8
Meetings of the academy during 1910.....	9
Annual meeting at Washington, April 19-21, 1910.....	9
Business sessions—	
Report of the home secretary.....	9
Report of the treasurer.....	10
Report of the auditing committee.....	11
Statement of the board of directors of the Bache fund.....	11
Report of the trustees of the Watson fund.....	12
Report of the committee on the Henry Draper fund.....	12
Report of the committee on the J. Lawrence Smith fund.....	13
Report of the board of directors of the B. A. Gould fund.....	13
Report of the committee on the Barnard medal.....	14
Report of the board of directors of the Gibbs fund.....	15
Marsh fund.....	15
Agassiz fund.....	16
Report of the committee on international cooperation in research.....	16
Report of the committee on solar research.....	18
Elia de Cyon prize.....	18
Academy medalists.....	20
Bureau of Seismology.....	20
Subdivision of committees on biology and anthropology.....	20
Appointment of delegates.....	20
Election of officers.....	20
Election of new members.....	20
Election of foreign associates.....	21
Trustee of the Watson fund.....	21
Scientific sessions—	
April 19.....	21
April 20.....	21
April 21.....	21
Autumn meeting at St. Louis, Mo., November 8-10, 1910.....	22
Business sessions—	
Foreign secretary.....	22
J. Lawrence Smith fund.....	22
Deaths of members announced.....	22
Scientific sessions—	
November 8.....	22
November 9.....	22
November 10.....	23

Deaths during 1910.....	23
Alexander Agassiz.....	23
George Frederick Barker.....	24
Cyrus Ballou Comstock.....	24
Charles Abiathar White.....	25
William Henry Brewer.....	25
Charles Otis Whitman.....	25
Appendix A: Constitution of the academy.....	29
Appendix B: Rules of the academy.....	35
Appendix C:	
Organization of the academy.....	39
Committees of the academy.....	39
Committees on trust funds of the academy.....	41
Members of the academy.....	42
Honorary member.....	44
Foreign associates.....	44
Deceased members.....	45
Deceased foreign associates.....	48

LETTER OF TRANSMITTAL.

NATIONAL ACADEMY OF SCIENCES,
OFFICE OF THE PRESIDENT,
Washington, D. C., February 11, 1911.

SIR: In conformity with the requirements of the act of incorporation, approved March 3, 1863, I have the honor to submit herewith a report of the operations of the National Academy of Sciences for the year ending December 31, 1910.

Very respectfully,

IRA REMSEN, *President.*

The PRESIDENT OF THE SENATE.

TRANSMITTAL

Very respectfully,
[Illegible Name]
[Illegible Title]

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. A. P. Barnard, 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, Mo.; J. F. Frazer, Pennsylvania; Wolcott Gibbs, New York; J. M. Gilliss, 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 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.

ANNUAL REPORT
OF THE
NATIONAL ACADEMY OF SCIENCES.

MEETINGS OF THE NATIONAL ACADEMY.

During the year 1910 the academy held two stated meetings. The first was the regular annual meeting held at Washington, April 19 to 21, inclusive; the second, the autumn meeting, held at St. Louis, November 8 to 10, inclusive.

ANNUAL MEETING.

BUSINESS SESSIONS.

The business sessions were held at the Smithsonian Institution, Washington, D. C., April 19 to 21, 1910.

The following members were present during the meeting: Messrs. Abbot, Ames, Becker, Billings, Boss, Brewer, Brush, Chandler (C. F.), Cattell, Clark (W. B.), Clarke (F. W.), Clarke (J. M.), Comstock (G. C.), Coulter, Crafts, Crew, Cross, Dall, Davis, Emmons, Gill, Hague, Hale, Hillebrand, Holmes, Lindgren, Mall, Merriam, Minot, Mitchell, Morley, Morse (E. S.), Morse (H. N.), Nef, Nichols (E. L.), Noyes (A. A.), Peirce (B. O.), Putnam, Remsen, Thomson, Trelease, Walcott, Webster, Welch, Wheeler, and Woodward.

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 19, 1910.

The annual report of the president of the academy for the year 1909 was transmitted to the United States Senate January 18, 1910, through the courtesy of Senator George P. Wetmore. The usual edition of 2,000 copies authorized by Congress was printed—500 copies for the Senate, 1,000 copies for the House, and 500 copies for distribution by the Academy of Sciences. The report was received from the Government Printing Office March 28. Nearly one-half of the edition has been distributed to members of the academy, foreign associates, and such libraries and institutions as are on our domestic exchange list.

Messrs. Albrecht Penck, of Berlin, Germany; Gustaf Retzius, of Stockholm, Sweden; Wilhelm Waldeyer, of Berlin, Germany; and Wilhelm Wundt, of Leipzig, Germany, were elected foreign associates of the academy at the annual meeting in April, 1909.

Messrs. Joseph S. Ames, Maxime Bôcher, Oskar Bolza, F. W. Clarke, J. M. Clarke, J. M. Coulter, Henry Crew, Waldemar Lindgren, Thomas H. Morgan, and Henry L. Wheeler were elected members of the academy at the annual meeting in April, 1909.

The following biographical memoirs were published during the year and included in volume 6 of the Biographical Memoirs of the National Academy of Sciences: Josiah Willard Gibbs, by Charles S. Hastings; Elliott Coues, by J. A. Allen; and Ogden Nicholas Rood, by Edward L. Nichols. This volume, which contains 18 memoirs, has been distributed to all of the institutions on the domestic exchange list. The following biographical memoirs have been published as the first three memoirs in volume 7: Wolcott Gibbs, by F. W. Clarke; William Keith Brooks, by E. G. Conklin; and Charles Augustus Young, by E. B. Frost.

The secretary desires to call attention to the fact that at the time the academy came into possession of the album of portraits of the members of the academy collected by Dr. Marcus Benjamin, it owned a complete set of such pictures of its members from its organization in 1863 up to 1907. Since that date recently elected members have neglected to present the academy with a suitable photograph and accompanying autograph. It is earnestly desired that members who have not already done so furnish the secretary, for the academy archives, copies of photographs, engravings, or etchings of themselves. All members who have recently obtained good likenesses would confer a favor by forwarding to the academy a copy of such pictures.

The tables of the Watson asteroids, which have been prepared under the direction of Prof. A. O. Leuschner by means of an appropriation from the Watson fund, are now in page proof, and will soon be issued. The delay in publication was caused by the absence of Prof. Leuschner in Europe and the illness and death of Prof. Newcomb.

Three members have died during the past year: Simon Newcomb, on July 11, 1909. Samuel W. Johnson, on July 21, 1909, and Alexander Agassiz, on March 27, 1910; Friedrich Kohlrausch, an honored foreign associate, died January 17, 1910. There are now 111 active members on the membership list, 1 honorary member, and 44 foreign associates.

ARNOLD HAGUE, *Home Secretary.*

APRIL 19, 1910.

REPORT OF THE TREASURER.

THE PRESIDENT OF THE NATIONAL ACADEMY OF SCIENCES.

SIR: I have the honor to transmit herewith my report as treasurer of the National Academy of Sciences for the year ending April 19, 1910:

Income.	General fund.	Bache fund.	Watson fund.	Draper fund.	J. Lawrence Smith fund.
Balance brought forward:					
Cash.....	\$972.37	\$160.91	\$650.70	\$638.04	\$999.87
Invested income.....	5,000.00	5,446.64	4.00	260.12	830.07
Receipts:					
Interest.....	620.07	2,557.71	1,235.08	518.74	514.52
Members' tax.....	590.00				
Total.....	7,182.44	8,165.26	1,889.78	1,416.90	2,344.46
Disbursements.....	1,294.92	2,195.89	396.18	28.50	\$14.40
Balance:					
Cash.....	1,887.52	1,522.73	1,493.60	628.28	699.99
Invested income.....	4,000.00	4,446.64		760.12	830.07
Total.....	7,182.44	8,165.26	1,889.78	1,416.90	2,344.46

Income.	Gould fund.	Emmons and Gill, trustees.	Gibbs fund.	Building fund.	Comstock fund.	Marsh fund.
Balance brought forward:						
Cash.....	\$1,713.41	\$494.70		\$145.93	\$604.28	
Invested income.....	1,500.00					
Receipts:						
Interest.....	1,076.12	50.00	\$79.53	95.00	435.00	\$31.25
Members' tax.....						
Total.....	4,289.53	544.70	79.53	240.93	1,039.28	31.25
Disbursements.....	2,232.02	544.70		9.40	19.23	10.07
Balance:						
Cash.....	157.51		79.53	31.53	420.05	21.18
Invested income.....	1,900.00			200.00	600.00	
Total.....	4,289.53	544.70	79.53	240.93	1,039.28	31.25

S. F. EMMONS, *Treasurer.*

APRIL 19, 1910.

The treasurer's report was referred to an auditing committee composed of Messrs. Gill and Dall, who, after due examination, reported as follows:

The committee appointed to audit the accounts of the treasurer hereby certify that they have examined the statements of expenditures, receipts, and balances, and find them to correspond to the vouchers and accounts of the treasurer; also that they have examined the securities and papers contained in the box of the academy at the American Security and Trust Co.'s building, and have found them to correspond to the list furnished by the treasurer.

The treasurer made a statement as to the final apportionment among the trust funds of the account which has been carried under the name "Emmons and Gill, trustees." He also stated that the Wolcott Gibbs fund had been restored to its full amount.

STATEMENT OF THE BOARD OF DIRECTORS OF THE BACHE FUND.

(Apr. 15, 1910.)

Since the last stated meeting of the academy, April, 1909, the directors have made the following appropriations:

November, 1909. John Trowbridge.....	\$500
For the study of matter, especially steel, submitted to very great pressure.	
January, 1910. George C. Comstock.....	1,200
For committee of Astronomical Society, for observations on Halley's comet.	
February, 1910. Henry F. Osborn.....	500
For the academy committee on correlation of geological horizons (second and final appropriation).	
Total.....	2,200

Respectfully submitted.

SETH C. CHANDLER, *Chairman.*

REPORT OF THE TRUSTEES OF THE WATSON FUND.

For some years the income of the Watson fund has been devoted to computing tables of the minor planets discovered by Prof. James C. Watson. This work has been undertaken by Prof. Armin O. Leuschner, of the University of California, and the several appropriations made since 1901 were to enable him to defray expenditures incurred for computing and for miscellaneous expenses. In 1908 Prof. Leuschner placed in the hands of Prof. Newcomb, then chairman of the Watson fund, the completed tables for 12 of the Watson planets, in a manuscript designed for printing. The impending absence of Prof. Newcomb in Europe and the subsequent departure of Prof. Leuschner for Europe, where he was to pass his sabbatical year, prevented progress upon the publication until the autumn of 1909. At last reports the manuscript was all in type, and the early publication of this work is shortly to be anticipated.

The sum of \$147.95 has been expended since September last to defray incidental expenses in connection with proof reading for the volume described.

The balance of income which existed in 1901, when this work was begun, together with accumulations since that time, was exhausted in 1908, and there has been a suspension of computations for two years.

Estimates from Prof. Leuschner indicate, in his judgment, that the work can be completed on all nine remaining small planets within 12 to 14 months from September 1, 1910, at an average expenditure of \$220 per month. There would be two computers who have already received a thorough training in this difficult class of computations. Prof. Leuschner wishes to resume work on September 1, 1910. Examinations show that the state of the Watson fund warrants the undertaking on the basis described.

The trustees therefore recommend that the expenditure of \$2,700, or so much thereof as may be necessary, be authorized at present in order to carry out the arrangement with Prof. Leuschner, already described, in relation to completing the tables for minor planets discovered by Prof. James C. Watson.

Lewis Boss, *Chairman.*

REPORT OF THE COMMITTEE ON THE HENRY DRAPER FUND.

The committee on the Henry Draper fund unanimously recommends to the academy that the Draper medal be awarded to Mr. Charles Greeley Abbot, director of the Smithsonian Astrophysical Observatory, for his researches on the infra-red region of the solar spectrum and his accurate measurements, by improved devices, of the solar "constant" of radiation.

Mr. Abbot began his work of investigation as an assistant to the late Dr. Langley, whose invention of the bolometer had provided a means of recognizing and recording radiations of great wave-lengths, invisible to the eye, and producing no impression upon the photographic plate. Through devices perfected by Mr. Abbot, the troublesome "drift" of the galvanometer needle, experienced in all previous work with the bolometer, has been practically eliminated. The latest bolographs of the solar spectrum, made automatically with apparatus constructed after his designs, are of remarkable perfection. They include both the visible spectrum and the ultra-violet, in addition to that extensive region in the infra-red which is known to us only through the work of the Smithsonian Astrophysical Observatory.

As the duties of administration left Secretary Langley little opportunity for research, he confined the immediate direction of the Smithsonian Observatory to Mr. Abbot, who made excellent use of his opportunities. Finding the conditions for solar observation to be exceptionally favorable in California, Mr. Abbot went to Mount Wilson to determine the solar "constant" of radiation. In this research the heating effect of the sun's rays is measured by novel and ingenious forms of pyrheliometers devised by Mr. Abbot, while the absorption of the earth's atmosphere in all parts of the spec-

trum is determined with the bolometer. The success of this method of correcting for the atmosphere absorption is demonstrated by the fact that values of the solar "constant," determined simultaneously in Washington near sea level and on Mount Wilson and Mount Whitney at elevations of 5,800 feet and 14,500 feet, respectively, are in very close agreement.

The results of several continuous series of observations, made in the course of Mr. Abbot's expeditions to Mount Wilson, have indicated solar fluctuations as great as 10 per cent. As the method is so highly perfected as to show clearly variations of 2 or 3 per cent, due to the ellipticity of the earth's orbit, these irregular fluctuations are probably to be attributed to actual changes in the sun, and not to errors of measurement or to changes in the earth's atmosphere.

In view of the foregoing work, and of other investigations described in Volumes I and II of the Annals of the Smithsonian Astrophysical Observatory, the committee on the Henry Draper fund feels that Mr. Abbot fully deserves to receive the Draper medal.

Respectfully submitted.

GEORGE E. HALE, *Chairman.*
 W. W. CAMPBELL.
 A. A. MICHELSON,
 JOHN TROWBRIDGE.
 A. W. WRIGHT.

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

To the NATIONAL ACADEMY OF SCIENCES:

During the year the committee on the J. Lawrence Smith fund have received two applications for grants from the fund, which were reported to the academy with our recommendation at the meeting in November last. The academy voted to give \$400 to Dr. E. O. Hovey, of the American Museum of Natural History, and to give a like sum to Prof. C. C. Trowbridge, of Columbia University. Both investigations are in progress, but it is not yet time to expect any report from them.

Respectfully submitted.

EDWARD W. MORLEY, *Chairman.*

APRIL 19, 1910.

REPORT OF THE BOARD OF DIRECTORS OF THE B. A. GOULD FUND.

Since the date of the last report (Apr. 20, 1909) the following appropriations have been made:

For the Astronomical Journal.....	\$1,000
Prof. C. L. Doolittle, to provide for assistance in computations, etc., upon his observations made at the Flower Observatory in continuance of the simultaneous series with the zenith-tube and zenith-telescope for investigating the aberration of the fixed stars and change of latitude.....	1,000
Honorarium to Prof. Henry S. Peck, of Syracuse University, for computation of the definitive orbit of a comet.....	100
Honorarium to Dr. Frank E. Ross, of the International Latitude Station at Gaithersburg, Md., for computation of the definitive orbit of a comet.....	100
Total.....	2,200

In November, 1909, the directors of the Gould fund, with the approval of the donor, unanimously passed the following minute:

"Whereas the Astronomical Journal has been turned over to the Dudley Observatory by its former editor, Dr. S. C. Chandler; and whereas the fund provided by Dr. Gould for meeting deficiencies in its income has been exhausted, we, the directors

of the Gould fund, hereby declare our intention to appropriate from time to time, up to the limit of the available income of the Gould fund, whatever may be needed to meet the deficiency of income in the publication of the Journal, and until adequate provision for meeting such deficiency may be otherwise made."

All of which is respectfully submitted.

LEWIS BOSS, *Chairman.*

S. C. CHANDLER.

GEORGE WILLIAM HILL.

APRIL 19, 1910.

REPORT OF THE COMMITTEE ON THE BARNARD MEDAL.

To the COUNCIL OF THE NATIONAL ACADEMY OF SCIENCES:

Your committee appointed to recommend a nominee for an award of the Barnard medal of Columbia University begs leave to submit the following report:

The conditions under which the Barnard medal may be bestowed are specified in the following regulations provided by Columbia University in conformity with the will of Dr. Frederick A. P. Barnard, who was one of the founders of the academy and president of Columbia College from 1864 to the time of his death, in 1889:

"A gold medal of the value of \$200, established by the provisions of the will of President Barnard and endowed by him, known as the 'Barnard medal for meritorious service to science,' is awarded quinquennially to such person, if any, whether a citizen of the United States or any other country, as shall within the five years next preceding have made such discovery in physical or astronomical science, or such novel application of science to purposes beneficial to the human race, as in the judgment of the National Academy of Sciences of the United States shall be esteemed most worthy of such honor."

By reason of the limitations of these conditions and by reason of the number of eminent investigators whose contributions to science required consideration, the duty of your committee has been beset by many difficulties. It is an instructive and gratifying indication of the current activity and progress in physical science that no less than half a dozen of the investigators considered have produced work in all respects worthy of the distinction contemplated by the founder of the medal in question.

Bearing in mind, however, the precise conditions quoted above, your committee concludes, and hereby recommends, that the Barnard medal for the five-year period ending with the year 1909 be conferred upon Ernest Rutherford, D. Sc., LL. D., F. R. S., now Langworthy professor of physics and director of the physical laboratory in the University of Manchester, for meritorious services to science resulting especially from his investigations of the phenomena of radio-active materials.

Prof. Rutherford has been identified with this branch of physical science since its inception by the discovery of the so-called X rays in 1895. His researches, published in numerous communications to current journals, appear to have contributed more than those of any contemporary to the establishment of the salient properties of radio-active substances. Not content with the experimental determination and verification of these properties, he has recently gone further and pointed out the convincing evidence they afford of the correctness of the ancient doctrine of the atomic structure of matter. In addition to his contributions in this field of investigation of many original, ingenious, and penetrating methods of observation and measurement, he has also furnished the best general account of its origin, development, and present status in his book on Radio-active Transformations (published in 1906) and in his presidential address read before the section of mathematics and physics of the British Association for the Advancement of Science, in August, 1909.

The fertility in experimental methods and in definitive results shown by Prof. Rutherford may be sufficiently indicated here by reference to his recent determination

of the number of molecules in a cubic centimeter of helium gas under specified conditions of pressure and temperature. By two independent methods, one electrical and one optical, he has been able to actually count the number of individual Alpha particles entering a suitable detecting vessel per unit of time, and hence to determine that the number of such particles in a cubic centimeter of helium gas under standard pressure and temperature is 25.6×10^{18} .

The bearing of his researches and the results he has attained on the kinetic theory of gases and on the atomic and electronic theories of matter is of the highest importance. It seems not too much to assert that in the line of direct experimental evidence on these theories his researches are unequaled.

It is a noteworthy fact, illustrating at once the concentration of effort and the trend of development in molecular physics, that the three previous awards of the Barnard medal have all been made to investigators in this general field of inquiry, namely, to Rayleigh and Ramsay in 1895, to Röntgen in 1900, and to Becquerel in 1905. In the opinion of your committee the work of Prof. Rutherford is not less worthy of this high distinction than the work of his eminent contemporaries upon whom the same honor has been conferred.

Very respectfully submitted.

R. S. WOODWARD, *Chairman.*

W. W. CAMPBELL.

E. F. NICHOLS.

A. A. NOYES.

T. W. RICHARDS.

REPORT OF THE BOARD OF DIRECTORS OF THE GIBBS FUND.

The trustees of the Wolcott Gibbs fund have the honor to report that the fund is still accumulating.

C. L. JACKSON, *Chairman.*

MARSH FUND.

The home secretary read the following letter from Mr. W. W. Farnam, executor of the estate of O. C. Marsh:

NEW HAVEN, CONN., *November 17, 1909.*

Prof. S. F. EMMONS,

Treasurer of the National Academy of Sciences,

Washington, D. C.

DEAR SIR: I think you are perhaps already aware that the late Prof. O. C. Marsh left a bequest to the National Academy of Sciences. The seventh clause of his will is as follows:

"I give, devise, and bequeath to the corporation known as the National Academy of Sciences, in Washington, D. C., the sum of \$10,000, as a trust fund, the income to be used and expended by it for promoting original research in the natural sciences."

When Prof. Marsh died he was somewhat in debt, and we have just succeeded in paying the last of his notes, and have a small balance over, so are sending you with this a check for \$1,250 as a first payment of the above legacy. We hope later to be able to pay the whole amount, as we receive from time to time certain moneys from the George Peabody estate, as certain trusts fall back into that estate, and it is probable that the amount still to be received from that source will be enough to do this. Will you kindly acknowledge the receipt of this payment, and at a later date send us the acceptance of the academy of the above trust? With great respect, I am, sir,

Very truly, yours,

WM. W. FARNAM,

Executor Estate of O. C. Marsh.

On the recommendation of the council the following resolutions were adopted:

Resolved, That the trust fund left to the academy by Prof. O. C. Marsh be accepted.

Resolved, That the trust fund left to the academy by Prof. O. C. Marsh be allowed to accumulate until it shall amount to \$10,000 before any use shall be made of it.

AGASSIZ FUND.

The home secretary read a letter from Mr. Rudolph Agassiz, announcing the bequest to the academy by Mr. Alexander Agassiz of the sum of \$50,000.

REPORT OF THE COMMITTEE ON INTERNATIONAL COOPERATION IN RESEARCH.

The duties of this committee, as expressed in resolutions adopted by the academy in April, 1908, are as follows:

(1) To keep in close touch with the work of the International Association of Academies, and to assist in securing suitable representation of the academy at the council and general meetings of the association.

(2) To consider plans for cooperation in research and to recommend from time to time the initiation of such cooperative investigations as may warrant the support of the academy.

The chairman, appointed by President Remsen to represent the National Academy, attended the council meeting of the International Association of Academies at Rome in June, 1909. It was decided by the council that the admission to the association of the Swiss Society of Natural Sciences be voted on at the triennial meeting of the association at Rome in May, 1910. After examining the status of this society, your committee recommends that the delegate of the National Academy be instructed to vote in favor of the admission of the Swiss Society to the Association of Academies.

The committee has also considered a project for the publication of Annual Physical-Chemical Tables, to be prepared by an international committee appointed by the Seventh International Congress of Applied Chemistry. An outline of the proposed plan is shown by the statement appended hereto.

Your committee recommends that the academy be asked to express its indorsement of this publication, and that its delegate at Rome be instructed to vote in the affirmative in case the plan is presented to the International Association of Academies for its indorsement.

Your committee has received reports from the various special committees of the academy on cooperative research, including those dealing with the study of the brain, international paleontologic correlation, chemistry, and solar research. These reports have been presented to the academy by the respective committees.

Respectfully submitted.

GEORGE E. HALE, *Chairman*.

ANNUAL PHYSICAL-CHEMICAL TABLES.

The Annual Physical-Chemical Tables will have for their object the collection of all constants and numerical data which may possibly be of interest in connection with physics or chemistry, or with the technical applications of these sciences. They will form in a sense a continuation or extension of the various tables which already exist (e. g., those of Landolt and Börnstein); or, rather, they will serve as a complete storehouse of data, from which in the future new tables of a general or special nature could be compiled or by means of which existing tables could be brought up to date.

They will become a powerful aid to the work of the investigator, of the scholar, and of the technical man, by enabling him to find with ease the data which he may require

and which he might possibly be quite unable to obtain by individual search through the literature.

Based, as they will be, on a methodical process of abstracting all the existing periodicals connected in any way with physics or chemistry, the Annual Physical-Chemical Tables will be the means of saving from oblivion numberless useful measurements of a subsidiary character, whose existence can not be inferred from the titles of the papers containing them.

The data to be brought together in the tables will be classified under the following heads: ¹

I. *General physics*.—(Gravitation constant, modulus of rigidity, compressibility, breaking stress, hardness, coefficient of friction, density, surface tension, etc.)

II. *Heat*.—(Coefficients of linear and cubical expansion, melting point, boiling point, vapor pressure, specific heat, latent heat of fusion, latent heat of vaporization, thermal conductivity, etc.)

III. *Electricity and magnetism*.

(a) *General properties*.—(Dielectric constant, dielectric strength, thermoelectric power, conductivity and resistivity, magnetic permeability and susceptibility, etc.)

(b) *Electric conduction in gases*.—(Disruptive potential, mobility of ions, charge on the ions, coefficient of recombination, etc.)

(c) *Radio-activity*.—(Activity, average life, rate of decay, heat evolved, coefficient of absorption, etc.)

IV. *Light and sound*.—(Wave-length, index of refraction, coefficient of absorption, rotatory power, emissive power, constants of the laws of radiation, velocity of sound, etc.)

V. *Physical chemistry*.

(a) *General chemistry and chemical mechanics*.—(Atomic weight, solubility, coefficient of diffusion, transition temperature, etc.)

(b) *Electro-chemistry*.—(Electrode potential, decomposition potential, electro-chemical equivalent, equivalent and molecular conductivity, dissociation constant, mobility, transport number, etc.)

(c) *Thermo-chemistry*.—(Heat of solution, heat of dilution, heat of hydration, heat of ionization, heat of neutralization, heat of formation, heat of combustion, calorific value, etc.)

Every value given in the tables will be accompanied by the name of the author, by a reference to the original paper, and by an indication of the conditions (temperature, pressure, etc.), under which the measurement was made.

The above summary, short as it is, should be sufficient to give some idea of the importance of the task which has been intrusted to the international commission by the Seventh Congress of Applied Chemistry.²

The general organization is now well advanced, and the work of abstracting has begun in all the countries represented, under the direction of their respective delegates.

The first volume of the tables will be published early in 1911, and will contain all data published during 1910.

THE INTERNATIONAL COMMITTEE OF PUBLICATION
ANNUAL PHYSICO-CHEMICAL TABLES.

¹ This abridged classification is given merely as an illustration. In practice it will be enlarged and modified.

² The various countries are represented on the commission by the following persons: Austria, Prof. Rothmund; Belgium, Prof. Spring; British Empire, Drs. Findlay and Wilmore; Denmark, Norway, and Sweden, Dr. Lunden; France, Dr. Marie and Prof. Urbain; Germany, Profs. Abegg and Bodenstein; Holland, Prof. Cohen; Italy, Profs. Bruni and Carrara; Russia, Profs. Kistiakowski and Walden; Spain, Dr. Mourelo; Switzerland, Prof. Dutoit; United States, Profs. Bancroft and Lewis.

REPORT OF THE COMMITTEE ON SOLAR RESEARCH.

The committee on solar research begs to report that the work of the International Union for Cooperation in Solar Research, organized through the initiative of the National Academy, is progressing satisfactorily. A preliminary meeting, held on the occasion of the St. Louis Scientific Congress in 1904, was followed by largely attended conferences at Oxford, in 1905, and Paris, in 1907. Invitations for the next conference, which is to be held on Mount Wilson during the period August 29–September 6 next, were issued in December. Acceptances from 35 European astronomers and physicists have already been received, and a large American attendance is assured. It is hoped that many of the foreign delegates will take part in the meeting of the Astronomical and Astrophysical Society at the Harvard Observatory and travel together by special train to California.

The following societies are now represented in the Solar Union by committees: The Academies of Amsterdam, Barcelona, Paris, St. Petersburg, Stockholm, and Vienna; the Royal Society of London, the National Academy of Sciences, the Astronomical Societies of America, France, and London; the Physical Societies of America, France, Germany, Italy, and Spain; the Swiss Society of Natural Sciences, the Society of Italian Spectroscopists, the Solar Physics Committee of London, and the International Meteorological Committee.

The chief work of the union is undoubtedly the stimulation of interest in solar research and the encouragement of workers in this field. It has brought together astronomers and physicists on common ground, thus contributing toward the solution of problems lying on the borderland between these subjects. The influence of the union seems to be apparent in the marked activity which has resulted in many recent additions to our knowledge of the sun. But it has also accomplished much in other ways. The establishment of a new system of wave lengths, based on Michelson's determination of the absolute wave length of the green cadmium line, and the measurements of standard lines already made by Fabry and Buisson, Eversheim, and Pfund, will be of lasting benefit to exact science. The daily photography of the sun, with spectroheliographs in Sicily, France, Spain, Germany, England, Mexico, the United States, and India, will soon be supplemented, it is hoped, by stations in Australia and China, and possibly in Japan. In this way the changing phenomena of the solar atmosphere are recorded from hour to hour. A program for the cooperative study of sun-spot spectra, adopted at Paris, will now be revised to adapt it to the new conditions presented by recent discoveries. The chief progress in the study of the intensity of the solar radiation has come through the work of the Smithsonian Astrophysical Observatory, but the use in Italy, France, and India of standard pyrheliometers sent out by Abbot should soon result in the initiation of a general scheme of cooperation. Adams's discovery that the law of the solar rotation varies at different altitudes in the sun's atmosphere has been confirmed by Pérot, and others are entering this important field. Cooperation in eclipse observations and in other departments of solar research has also been initiated by the union.

Respectfully submitted.

GEORGE E. HALE, *Chairman.*

ELIA DE CYON PRIZE.

The home secretary read the following letter in regard to the Elia de Cyon prize:

INTERNATIONAL COMPETITION FOR THE ELIA DE CYON PRIZE.

The class of physical sciences of the Royal Academy of Bologna hereby calls attention to an international competition for a biennial prize of 3,000 lire, established from the income of a generous donation made to the class by one of its corresponding mem-

bers, Prof. Elia de Cyon, with the object of promoting researches and studies in the subjects which he cultivated with so much success. This reward will be conferred on competitors whose works treat of the same subjects, and particularly those relating to:

(1) The functions of the heart, and, above all, of the cardiac and vaso-motor nervous systems.

(2) The functions of the labyrinth of the ear.

(3) The functions of the thyroid glands, of the hypophyses, and of the pineal gland.

The first prize will be awarded on March 1, 1911.

CONDITIONS OF THE COMPETITION.

[Extract from the regulations approved by royal decree of October 6, 1909.]

ARTICLE 1. An international competition for a prize of 3,000 lire will be held every two years by the class of physical sciences of the Royal Academy of Sciences of the Institute of Bologna, open to the authors of scientific works relating to the studies carried on by the illustrious donor, Prof. Elia de Cyon, especially those relating to:

(a) The functions of the heart, and, above all, of the cardiac and vaso-motor nervous systems.

(b) The functions of the labyrinth of the ear.

(c) The functions of the thyroid glands, of the hypophyses, and of the pineal gland.

ART. 2. The works entered in competition for the prize must be sent to the secretary of the class of physical sciences of the Royal Academy of Sciences of Bologna, via Zamboni 33, with an explicit statement that they are intended for the competition.

ART. 3. The works may be in manuscript or printed, but should not date prior to the period of two years preceding the competition in which they are entered; that is to say, those intended for this first competition must not bear date earlier than March 1, 1909.

ART. 4. The works should be written in the Latin, Italian, French, English, or German language.

ART. 5. The works, if anonymous, should be accompanied by a sealed box containing a note giving the name of the author and bearing on the outside a motto, which is repeated at the head of the manuscript. Only the box relating to the work which draws the prize will be opened, while the other boxes will be burned without opening them.

ART. 6. The competitors may be called upon to repeat their experiments in the presence of the examining committee.

ART. 7. The committee will be composed of three members elected by the class.

ART. 8. The committee itself will be required to report within three months of the close of the competition.

ART. 9. The report of the examining committee will be submitted for the approval of the entire class and may be published in the *Comptes-Rendus* of the class itself.

ART. 10. The prize will be awarded at a full meeting of the academy, not later than four months after the close of the competition.

ART. 11. The prize can not be awarded more than once to the same person.

ART. 12. The prize is indivisible.

ART. 13. If the work which draws the prize is unpublished, it may be published in the *Proceedings* of the Class of Physical Sciences if the class thinks it advisable to do so.

ART. 14. The prize can not be awarded to anyone who may hold any kind of membership in the class of physical sciences of the Royal Academy of Bologna.

SEN. AUGUSTO RIGHI, *President*.

ERCOLE GIACOMINI, *Secretary*.

BOLOGNA, *January 16, 1910.*

ACADEMY MEDALISTS.

On the recommendation of the council the following resolution was adopted:

Resolved, That those scientists who receive medals from the academy or upon its recommendation be invited to present at one of the regular meetings of the academy addresses describing their investigations.

BUREAU OF SEISMOLOGY.

The home secretary read a communication from the president of the American Philosophical Society in regard to the establishment of a bureau of seismology.

On the recommendation of the council the academy adopted the following resolution:

Resolved, That the academy strongly approves the establishment of the proposed Seismological Laboratory, and its organization under the direction of the Smithsonian Institution.

SUBDIVISION OF COMMITTEES ON BIOLOGY AND ANTHROPOLOGY.

On the recommendation of the council the academy adopted the following resolution:

Resolved, That the president be authorized to appoint a committee which shall include the chairmen of the committees on nomination of new members in biology and anthropology, and such other members of these committees as he may deem necessary, to take up the question of a more appropriate subdivision of the committees on biology and anthropology.

APPOINTMENT OF DELEGATES.

The president announced the appointment of Mr. E. G. Conklin as a delegate to represent the academy at the International Zoological Congress at Gratz in August and at the meeting of the International Association of Academies at Rome in May; of Mr. Arnold Hague to the one hundredth anniversary of the University of Berlin, October 10-12; and of Mr. S. F. Emmons to the International Geological Congress at Stockholm, August 17-25.

ELECTION OF OFFICERS.

Mr. George E. Hale was elected to succeed Mr. Alexander Agassiz as foreign secretary of the academy for a term of six years.

Messrs. Chittenden and Osborn were elected to serve as members of the council of the academy for three years.

ELECTION OF NEW MEMBERS.

The following men were elected members of the academy: Messrs. D. H. Campbell, of the University of California; John Dewey, of Columbia University, New York City; Jacques Loeb, of the Rockefeller Institute, New York City; F. R. Moulton, of the University of Chicago; W. A. Noyes, of the University of Illinois; T. B. Osborne, of the Agricultural Experiment Station, New Haven, Conn.; and Charles Schuchert, of Yale University.

ELECTION OF FOREIGN ASSOCIATES.

Mr. Giovanni Schiaparelli was elected a foreign associate of the academy.

TRUSTEE OF THE WATSON FUND.

The president announced that he had appointed Mr. Frost to fill a vacancy in the board of trustees of the Watson fund, and that his attention had been later called to the fact that the deed of trust provided for the election of the board of trustees by the academy.

The appointment of Mr. Frost was approved by the academy.

SCIENTIFIC SESSIONS.

The scientific sessions were held in the United States National Museum, Washington, D. C., April 19 to 21, 1910.

APRIL 19.

Solar magnetism. George E. Hale.

On some visual and photographic observations of Mars. George E. Hale.

The distribution of Agave in the West Indies. William Trelease.

The vascular plate and cotyledons of gymnosperms. John M. Coulter.

Some crucial experiments demonstrating the necessity of accepting the one-fluid theory in electricity. F. E. Nipher (introduced by William Trelease).

A probable indirect relation between solar disturbances and terrestrial temperatures.

W. J. Humphreys (introduced by Cleveland Abbe).

Quantitative studies of tuning forks. E. A. Harrington (introduced by A. G. Webster).

A new method for the study of elastic hysteresis. A. G. Webster.

APRIL 20.

The 16-inch Metcalf doublet. E. C. Pickering.

The Bureau of Standards. S. W. Stratton. (By invitation of the local committee.)

The determination of temperature constants in mineral formations. Arthur L. Day. (By invitation of the local committee.)

A new form of gas thermometer and the boiling points of water and naphthalene. J. M. Crafts.

The temperature coefficient of osmotic pressure. H. N. Morse.

Hydraulics of the Chagres River. H. L. Abbot.

The development of *Olenellus*. C. D. Walcott.

A new development of mudlump activity at the mouth of the Mississippi River. E. W. Hilgard.

APRIL 21.

The Austral Devonian. J. M. Clarke.

Denudation evidence in relation to the age of the earth. George F. Becker.

The influence of environment upon human types. Franz Boas.

On the spectrum of Mars as photographed with high dispersion. W. W. Campbell and Sebastian Albrecht.

READ BY TITLE.

The correlation of the Pleistocene of Europe and North America. H. F. Osborn.

The epidermal covering of the trachodont dinosaurs. H. F. Osborn.

Report of progress in the study of the Miocene ungulates of Patagonia. W. B. Scott.

Quandaries following from the theory of isostasy. W. M. Davis.

- Composition of American river waters. R. B. Dole. (Introduced by F. W. Clarke.)
 A preliminary study of chemical denudation. F. W. Clarke.
 The ionization relations of poly-ionic salts. A. A. Noyes.
 The structural characteristics and relations of the apodals. Theodore Gill.
 Recent discoveries of the early history of the common eel. Theodore Gill.
 Some studies in molecular rearrangement. Ira Remsen.
 The number of double stars as a function of the separation of the component. R. G. Aitken. (Introduced by W. W. Campbell.)
 Second catalogue of spectroscopic binary stars. W. W. Campbell.

AUTUMN MEETING.

The autumn meeting was held at St. Louis, Mo., November 8 to 10, inclusive, 1910.

The following members were in attendance at the meeting: Messrs. Chamberlin, Comstock (G. C.), Coulter, Crew, Davis, Hague, Moulton, Nef, Noyes (W. A.), Remsen, Trelease, and Wilson.

BUSINESS SESSIONS.

The business sessions were held at the Missouri Botanical Garden, St. Louis, November 8 and 9, 1910.

FOREIGN SECRETARY.

The home secretary was authorized by vote of the academy to act as foreign secretary during the absence of that officer from the country on account of illness, or until the annual meeting in April, 1911.

J. LAWRENCE SMITH FUND.

In accordance with the recommendation of the committee on the J. Lawrence Smith fund the academy approved a grant of \$200 to Dr. George P. Merrill, of the United States National Museum, for a study of the presence or absence of certain elements reported as occurring in small quantities in meteorites.

DEATHS.

The president announced the death, since the last meeting of the academy, of the following members: Messrs. G. F. Barker, W. H. Brewer, C. B. Comstock, and C. A. White.

SCIENTIFIC SESSIONS.

NOVEMBER 8.

- Some problems of stellar motion. G. C. Comstock.
 Preliminary note on the sun's velocity with respect to stars of spectral type A. E. B. Frost.
 A monograph of Agave in the West Indies. William Trelease.
 The mode of chromosome reduction. R. R. Gates. (Introduced by Mr. Trelease.)

NOVEMBER 9.

- On the origin of binary stars. F. R. Moulton.
 The cycadophytes. J. M. Coulter.
 The front range of the Rocky Mountains in Colorado. W. M. Davis.
 Mutualism, parasitism, and symbiosis. George T. Moore. (Introduced by Mr. Trelease.)

NOVEMBER 10.

Sugar chemistry from the new chemico-physical standpoint, or the behavior of the sugars toward enzymes, alkalies, and oxydizing agents. John U. Nef.

Molecular rearrangements in the camphor series: isocamphoric acid. William A. Noyes and Luther Knight.

A molecular rearrangement leading to the formation of amidines. Ira Remsen.

DEATHS DURING 1910.

Since the appearance of the last annual report six members¹ of the academy have passed away. These are Alexander Agassiz, George F. Barker, Cyrus B. Comstock, C. A. White, William H. Brewer, and C. O. Whitman. Biographical memoirs will be prepared and published later in accordance with the usage of the academy.

ALEXANDER AGASSIZ.

Alexander Agassiz was born at Neuchatel, Switzerland, December 17, 1835, and was the only son of Louis Agassiz. He was brought to America in 1849, and entered the Cambridge High School. He entered Harvard College and was graduated in 1855 with the degree of A. B. and then studied engineering, geology, and chemistry in the Lawrence Scientific School, receiving one degree of B. S. in 1857 and another in natural history in 1862. After graduating from the Lawrence Scientific School he taught until 1859, when he was appointed an assistant in the United States Coast Survey. After a year's service of this kind he returned to Cambridge to continue his zoological studies. He worked here with his father and assisted him from the time the Museum of Comparative Zoology was opened in 1860 until 1866, when he went to Michigan to develop the Calumet and Hecla copper mine. Out of the wealth that came to him through this connection he gave over \$1,000,000 to the building up of the museum which his father had founded.

The following paragraph is quoted from an interesting article on Agassiz by Alfred G. Mayer, which appeared in the *Popular Science Monthly* for November, 1910:

He never adopted the methods of the histologist, which were not used by his father, and he confined himself to the study of living animals whenever this was possible. Thus it is that he ranks among the foremost of those systematists and embryologists who have devoted themselves to the observation of marine animals, but histology was wholly neglected by him. Nor did he ever take part in that stirring discussion of Darwinism which engrossed the attention of all of his contemporaries. It would be unfair to say that he did not believe in evolution, but the truth is that he was but little interested in the speculative side of science, excepting in so far as its deductions could be based upon the observations of facts. In later life he came to regard the labors of the physiologist and of the laboratory experimenters upon the reactions of animals as beyond the scope of zoology.

He became a member of the National Academy of Sciences in 1866, and was president of the academy from 1901 to 1907, and its foreign secretary from 1891 to 1901 and from 1908 until his death, on March 27, 1910. He bequeathed the sum of \$50,000 to the academy.

¹ Since these biographical notes were prepared two of our members have passed away: H. P. Bowditch on March 13, and S. F. Emmons on March 28.

GEORGE FREDERICK BARKER.

George Frederick Barker was born at Charlestown, Mass., July 14, 1835, and died at Philadelphia, May 24, 1910. He was graduated from the Sheffield Scientific School in 1858. From 1859 to 1861 he served as assistant in the Harvard Medical School. He afterwards taught successively in Wheaton College, Illinois, and in the Albany Medical College. In 1863 he taught in the University of Pittsburg, and in 1868 and 1869 he delivered lectures on chemistry in Williams College. In 1869 he was appointed professor of physiological chemistry and toxicology in the Yale Medical School, going thence, in 1872, to the University of Pennsylvania as professor of physics. In 1900 he was made emeritus professor.

Prof. Barker had to a very unusual degree the power of clear exposition. When the so-called new chemistry, after many struggles, came to be accepted, by the younger generation at least, his *Elementary Chemistry* appeared, and this undoubtedly helped to spread the new ideas. For a number of years it was in extensive use in colleges.

In 1881 he was United States commissioner to the Electrical Exhibition at Paris and vice president of the jury of awards. In recognition of this service, France made him a commander in the Legion of Honor.

He was elected to the academy in 1876.

CYRUS BALLOU COMSTOCK.

Cyrus Ballou Comstock for more than a quarter of a century has taken an active interest in promoting the objects for which the academy was organized. He was born at West Wrentham, Mass., on February 3, 1831, and was graduated with first honors at the Military Academy at West Point in 1855. He was assigned to the Corps of Engineers, and during the war served with both eastern and western armies on the staff of different commanding generals, terminating with that of Gen. Grant, with whom he continued to hold the confidential position of aid-de-camp for several years after the close of hostilities. Subsequently he was charged with many responsible duties pertaining to the Corps of Engineers, among which for long periods may be named that of Director of the Geodetic Survey of the Northern and Northwestern Lakes, and president of the Mississippi River Commission.

Gen. Comstock took much interest in promoting works of original research; and in 1907, under the act approved June 20, 1884, he donated to the National Academy a trust fund of \$10,000 for researches in electricity, magnetism, and radiant energy.

His professional writings were numerous, both personal and as member of important boards and commissions on river and harbor

improvements. Among them should be mentioned his final Report on the Primary Triangulation of the United States Lake Survey.

He was elected to the academy in 1884, and died on May 29, 1910.

CHARLES ABIATHAR WHITE.

Charles Abiathar White was born January 26, 1826, at Dighton, Mass. He early moved to Burlington, Iowa, and there began a scientific study of the natural history of that portion of the State. His ability soon received the recognition of Prof. James Hall, who made him his assistant, but after two years upon the New York State survey he took up the study of medicine and returned to Iowa. His practice was interrupted by his appointment to the position of State geologist, the duties of which he assumed in April, 1866. University work at Grinnell, Iowa, and at Bowdoin College, Maine, occupied his time until the year 1876, when he resigned to undertake the study of the invertebrate paleontological collections of the Surveys West of the One Hundredth Meridian, of the Geological Survey of the Rocky Mountain Region, and of the Fortieth Parallel Survey. He was one of the founders of the Geological Society of America, a member of the reorganized United States Geological Survey from 1882 to 1892, a curator in the United States National Museum, and a scientific associate of the Smithsonian Institution from 1895 to his death, on June 29, 1910. He was elected a member of the academy in 1895.

WILLIAM HENRY BREWER.

Prof. Brewer was born in Poughkeepsie, N. Y., September 14, 1828, and died November 2, 1910. He was graduated with the first class of the Yale Scientific School. He afterwards studied with Liebig before studying abroad had become common. In 1858 he was elected professor of chemistry and geology in Washington College. From 1860 to 1864 he served in the California State survey and for a part of this time he was professor of natural science in the University of California. In 1864 he became professor of agriculture in the Sheffield Scientific School of Yale University, in which position he served until 1903, when he was made professor emeritus. He served on many important Government commissions, such as the topographical survey of Connecticut; on cereal productions in the United States (Tenth Census); United States Forestry Commission, 1896; scientific survey of the Philippine Islands, etc.

He became a member of the academy in 1880 and was one of the most regular attendants on the meetings.

CHARLES OTIS WHITMAN.

Charles Otis Whitman was born in Woodstock, Me., on December 14, 1842. After spending a few years under Leuckert at Leipzig he went to the University of Tokyo in 1880, then to the zoological

station at Naples, and returned to the United States in 1883 to take up work in the Zoological Laboratory of Harvard University. In 1886 he was appointed director of the Allis Lake Laboratory at Milwaukee, and from 1889 to 1892 he was the head of the department of zoology in the newly founded Clark University. He became the first director of the Marine Biological Laboratory at Woods Hole in 1888, and the head of the department of zoology at the University of Chicago in 1892. He resigned the former position in 1908, but retained his position in the University of Chicago until his death, on December 6, 1910. The latter position called for an administration in harmony with the institution of which it formed a part; the other enabled him successfully to resist the external and internal forces tending to unite the laboratory with any other institution, and it now stands alone, a center of biological research and a monument to the ideals of its first director. While thus called upon to direct the affairs of three institutions (Clark, Chicago, and Woods Hole) during their formative period, he nevertheless found time to exercise a singularly enthusiastic devotion to teaching and personal research, and his publications are masterful contributions to the most fundamental problems of biology. He was elected to the academy in 1895.

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.

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.

SEC. 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 sessions 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 fifty 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.

SEC. 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 session 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 session when such vacancy occurs, or at the next stated session 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 session 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 sessions 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 their respective departments, advising with the president and council in cases of doubt, and reporting their action to the academy at one of the stated sessions 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 session shall be duly engrossed before the next stated session, 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 April session. He shall be the custodian of the corporate seal of the academy.

ARTICLE III.—OF THE MEETINGS.

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

Special sessions 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.

Scientific sessions 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 daily meeting shall be recorded in the minutes, and the members present at any meeting shall constitute a quorum for the transaction of business.

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

SEC. 4. The stated meetings of the council shall be held during the stated or special sessions of the academy. Special sessions 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.

SEC. 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 first stated session in each year.

SEC. 4. Nominations to membership in the academy shall be made in writing, approved by a majority of the members of the committee on the subject 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. 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.

Election to membership shall be held as described below. There shall be two ballots—a preference ballot, which may be prepared either before or at the meeting and must be transmitted to the home secretary, and a final ballot to be taken at the meeting.

1. *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.

2. *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.

Election of members shall be held at the regular stated session of each year held in Washington, and not more than 10 members shall be elected at that session.

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 session 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 regular stated session of each year, held in Washington, 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.

Recommendations for nomination of foreign associates may be sent to the home secretary at any time.

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.

SEC. 1. Communications on scientific subjects shall be read at scientific meetings 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 president, with the advice of the council.

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 session.

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 sessions.

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.

SEC. 1. All investments shall be made by the treasurer, in the corporate name of the academy, in stocks of the United States, or, with the approval of the council, in State bonds or first-mortgage bonds on real estate. The treasurer shall have authority, with the approval of the council, to sell and transfer any United States bonds 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 session of the academy. Notice of a proposition for such a change must be given at a stated session, 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 session, and if it receive 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 nominations.

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

III. The accounts of the treasurer shall be referred to an auditing committee to be appointed by the president at or before the annual meeting. This committee shall also inspect and verify the bonds, securities, and other property in the custody of the treasurer. The report of this committee shall be presented to the academy before the close of the session.

IV. 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.

V. 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.

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.

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

VII. 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.

VIII. The death of members shall be announced by the president on the last day of any session, when a member shall be selected by the president to furnish a biographical notice of the deceased at the next stated session. If such notice be not then furnished, another member may be selected by the president in place of the first, and so on until the duty is performed.

IX. 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 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.

X. 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.

XI. 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.

XII. 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.

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

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

XV. 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.

XVI. 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.

XVII. 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.

XVIII. 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.

XIX. 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.

XX. 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.

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, 1910-11.

	Expiration of term.
REMSEN, IRA, <i>President</i>	April, 1913
WALCOTT, C. D., <i>Vice President</i>	April, 1913
HALE, GEORGE E., <i>Foreign Secretary</i>	April, 1916
HAGUE, ARNOLD, <i>Home Secretary</i>	April, 1913
EMMONS, S. F., <i>Treasurer</i>	April, 1914

ADDITIONAL MEMBERS OF COUNCIL.

1908-1911.	
WELCH, W. H.	WILSON, E. B.
1909-1912.	
DAVIS, W. M.	WOODWARD, R. S.
1910-1913.	
OSBORN, H. F.	CHITTENDEN, R. H.

COMMITTEES OF THE ACADEMY.

1. Mathematics and astronomy.

ABBE, C.
 BÔCHER, MAXIME.
 BOLZA, OSKAR.
 BOSS, LEWIS.
 CAMPBELL, W. W.
 CHANDLER, S. C.
 COMSTOCK, G. C. (*Chairman*).
 Davidson, G.
 ELKIN, W. L.
 FROST, E. B.
 HALE, G. E.
 HILL, G. W.
 HOLDEN, E. S.
 MOORE, E. H.
 MOULTON, F. R.
 OSGOOD, W. F.
 PEIRCE, C. S.
 PICKERING, E. C.
 STORY, W. E.
 WEBSTER, A. G.
 WOODWARD, R. S.

2. Physics and engineering.

ABBE, C.
 ABBOT, H. L.
 AMES, J. S.
 BARUS, C.
 BELL, A. G.
 CREW, HENRY.
 HASTINGS, C. S.
 MENDENHALL, T. C.
 MICHELSON, A. A.
 MORLEY, E. W.
 NICHOLS, E. F.
 NICHOLS, E. L.
 PEIRCE, B. O.
 PICKERING, E. C.
 PUPIN, M. I.
 THOMSON, ELIHU.
 TROWBRIDGE, J.
 WEBSTER, A. G.
 WOODWARD, R. S. (*Chairman*).
 WRIGHT, A. W.

3. Chemistry.

BRUSH, G. J.
 CHANDLER, C. F.
 CHITTENDEN, R. H.
 CLARKE, F. W.
 CRAFTS, J. M.
 DANA, E. S.
 GOOCH, F. A.
 HILGARD, E. W.
 HILLEBRAND, W. F.
 JACKSON, C. L.
 MICHAEL, A.
 MORLEY, E. W.
 MORSE, H. N.
 NEF, JOHN U.
 NOYES, A. A. (*Chairman*).
 NOYES, W. A.
 OSBORNE, T. B.
 REMSEN, IRA.
 RICHARDS, T. W.
 SMITH, E. F.
 WELLS, H. L.
 WHEELER, H. L.

4. Geology and paleontology.

BECKER, G. F.
 BRANNER, J. C.
 CHAMBERLIN, T. C.
 CLARK, W. B.
 CLARKE, J. M.
 CROSS, WHITMAN.
 DALL, W. H.
 DAVIS, W. M.
 DUTTON, C. E.
 EMMONS, S. F.
 GILBERT, G. K.
 HAGUE, ARNOLD (*Chairman*).
 IDDINGS, J. P.
 LINDGREN, WALDEMAR.
 OSBORN, H. F.
 PUMPELLY, R.
 SCHUCHERT, CHAS.
 SCOTT, W. B.
 VAN HISE, C. R.
 WALCOTT, C. D.

5. Biology.

ALLEN, J. A.
 BOWDITCH, H. P.
 CAMPBELL, D. H.
 CHITTENDEN, R. H. (*Chairman*).
 CONKLIN, E. G.
 COULTER, J. M.
 COUNCILMAN, W. T.
 DALL, W. H.
 FARLOW, W. G.
 GILL, T. N.
 GOODALE, G. L.
 HOWELL, W. H.
 LOEB, JACQUES.
 MALL, F. P.
 MARK, E. L.
 MERRIAM, C. H.
 MINOT, C. S.
 MORGAN, T. H.
 MORSE, E. S.
 OSBORN, H. F.
 PRUDDEN, T. M.
 PUTNAM, F. W.
 SARGENT, C. S.
 SMITH, THEOBALD.
 SCUDDER, S. H.
 TRELEASE, WILLIAM.
 VERRILL, A. E.
 WALCOTT, C. D.
 WELCH, W. H.
 WILSON, E. B.
 WOOD, H. C.

6. Anthropology.

BILLINGS, J. S. (*Chairman*).
 BOAS, FRANZ.
 CATTELL, J. MCK.
 DEWEY, JOHN.
 FLEXNER, SIMON.
 HOLMES, W. H.
 MERRIAM, C. H.
 MINOT, C. S.
 MITCHELL, S. W.
 MORSE, E. S.
 PEIRCE, C. S.
 PUTNAM, F. W.
 ROYCE, JOSIAH.
 WELCH, W. H.

ON WEIGHTS, MEASURES, AND COINAGE.

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

ON PUBLICATION.

The PRESIDENT.	The HOME SECRETARY.	WALCOTT, C. D.
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ON SOLAR RESEARCH,

HALE, GEORGE E., <i>Chairman.</i>	MICHELSON, A. A.	COMSTOCK, G. C.
CAMPBELL, W. W.	NICHOLS, E. L.	

TRUST FUNDS.

BOARD OF DIRECTION OF THE BACHE FUND.

[1879, residual estate, \$47,500.]

For researches in physical and natural science.

CHANDLER, S. C., <i>Chairman.</i>	REMSEN, IRA.	MINOT, C. S.
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BOARD OF TRUSTEES OF THE WATSON FUND.

[1883, residual estate, \$18,666.88.]

For the promotion of astronomical research.

BOSS, LEWIS, <i>Chairman.</i>	ELKIN, W. L.	FROST, E. B.
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THE HENRY DRAPER FUND.

[1885, \$6,000.]

Award of medal for important discoveries in astronomy.

HALE, GEORGE E., <i>Chairman.</i>	TROWBRIDGE, JOHN.	WRIGHT, A. W.
CAMPBELL, W. W.	MICHELSON, A. A.	

THE J. LAWRENCE SMITH FUND.

[1885, \$8,000.]

For the investigation of meteoric bodies.

MORLEY, E. W., <i>Chairman.</i>	DANA, E. S.	HAGUE, ARNOLD.
PUMPELLE, R.	REMSEN, IRA.	

THE BENJAMIN APTHORP GOULD FUND.

[1897, \$20,000.]

For researches in astronomy.

BOSS, LEWIS, <i>Chairman.</i>	CHANDLER, S. C.	HILL, G. W.
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THE BARNARD MEDAL.¹

For meritorious service to science.

WOODWARD, R. S., <i>Chairman.</i>	CAMPBELL, W. W.	NOYES, A. A.
NICHOLS, E. F.	RICHARDS, T. W.	

¹ 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 WOLCOTT GIBBS FUND.

[1893, \$2,673.17.]

For chemical research.

JACKSON, C. L., *Chairman.*

REMSEN, IRA.

SMITH, EDGAR F.

THE COMSTOCK TRUST FUND.

[1907, \$10,000.]

For researches in electricity, magnetism, and radiant energy.

NICHOLS, E. L., *Chairman.*

NOYES, ARTHUR A.

THOMSON, ELIHU.

HALE, GEO. E.

WEBSTER, A. G.

THE MARSH TRUST FUND.

[1909, \$1,250.]

For promoting original research in the natural sciences.

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 Patterson, 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, MARCH 1, 1911.

	Date of election.
ABBE, CLEVELAND.....	<i>U. S. Weather Bureau, Washington, D. C.</i> 1879
ABBOT, HENRY L., U. S. A.....	<i>23 Berkeley St., Cambridge, Mass.</i> 1872
ALLEN, J. ASAPH.....	<i>American Museum of Natural History, New York City.</i> 1876
AMES, JOSEPH S.....	<i>Johns Hopkins University, Baltimore, Md.</i> 1909
BARUS, CARL.....	<i>Brown University, Providence, R. I.</i> 1892
BECKER, GEORGE F.....	<i>U. S. Geological Survey, Washington, D. C.</i> 1901
BELL, A. GRAHAM.....	<i>1331 Connecticut Ave., Washington, D. C.</i> 1883
BILLINGS, JOHN S., U. S. A.....	<i>32 E. Thirty-first St., New York City.</i> 1883
BOAS, FRANZ.....	<i>123 W. Eighty-second St., New York City.</i> 1900
BÔCHER, MAXIME.....	<i>Harvard University, Cambridge, Mass.</i> 1909
BOLZA, OSKAR.....	<i>Marienstrasse 7, Freiburg, Germany.</i> 1909
BOSS, LEWIS.....	<i>Dudley Observatory, Albany, N. Y.</i> 1889
BOWDITCH, HENRY P. ¹	<i>Harvard Medical School, Boston, Mass.</i> 1887
BRANNER, JOHN C.....	<i>Stanford University, California.</i> 1905
BRUSH, GEORGE J.....	<i>14 Trumbull St., New Haven, Conn.</i> 1868
CAMPBELL, D. H.....	<i>Stanford University, California.</i> 1910
CAMPBELL, WILLIAM W.....	<i>Lick Observatory, Mount Hamilton, California.</i> 1902
CATTELL, JAMES MCK.....	<i>Garrison, N. Y.</i> 1901
CHAMBERLIN, THOMAS C.....	<i>University of Chicago, Chicago, Ill.</i> 1903
CHANDLER, CHARLES F.....	<i>Columbia University, New York City.</i> 1874
CHANDLER, SETH C.....	<i>Box 216, Wellesley Hills, Mass.</i> 1888
CHITTENDEN, RUSSELL H.....	<i>Sheffield Scientific School, New Haven, Conn.</i> 1890
CLARK, W. B.....	<i>Johns Hopkins University, Baltimore, Md.</i> 1908

¹ Mr. Bowditch died on March 13, 1911.

	Date of election.
CLARKE, F. W.	<i>U. S. Geological Survey, Washington, D. C.</i> 1909
CLARKE, J. M.	<i>State Hall, Albany, N. Y.</i> 1909
COMSTOCK, GEORGE C.	<i>Washburn Observatory, Madison, Wis.</i> 1899
CONKLIN, E. G.	<i>Princeton, N. J.</i> 1908
COULTER, J. M.	<i>University of Chicago, Chicago, Ill.</i> 1909
COUNCILMAN, WM. T.	<i>Harvard Medical School, Boston, Mass.</i> 1904
CRAFTS, JAMES M.	<i>59 Marlborough St., Boston, Mass.</i> 1872
CREW, HENRY.	<i>Northwestern University, Evanston, Ill.</i> 1909
CROSS, WHITMAN.	<i>U. S. Geological Survey, Washington, D. C.</i> 1908
DALL, WILLIAM H.	<i>Smithsonian Institution, Washington, D. C.</i> 1897
DANA, EDWARD S.	<i>Yale University, New Haven, Conn.</i> 1884
DAVIDSON, GEORGE.	<i>2221 Washington St., San Francisco, Cal.</i> 1874
DAVIS, WILLIAM MORRIS.	<i>17 Francis Ave., Cambridge, Mass.</i> 1904
DEWEY, JOHN.	<i>Columbia University, New York City.</i> 1910
DUTTON, CLARENCE E., U. S. A.	<i>Englewood, N. J.</i> 1884
ELKIN, WILLIAM L.	<i>Yale University Observatory, New Haven, Conn.</i> 1895
EMMONS, SAMUEL F. ¹	<i>U. S. Geological Survey, Washington, D. C.</i> 1892
FARLOW, W. G.	<i>Harvard University, Cambridge, Mass.</i> 1879
FLEXNER, SIMON.	<i>Rockefeller Institute, New York City.</i> 1908
FROST, EDWIN B.	<i>Yerkes Observatory, Williams Bay, Wis.</i> 1908
GILBERT, GROVE K.	<i>U. S. Geological Survey, Washington, D. C.</i> 1883
GILL, THEODORE N.	<i>Smithsonian Institution, Washington, D. C.</i> 1873
GOOCH, FRANK A.	<i>Yale University, New Haven, Conn.</i> 1897
GOODALE, GEORGE L.	<i>Harvard University, Cambridge, Mass.</i> 1890
HAGUE, ARNOLD.	<i>U. S. Geological Survey, Washington, D. C.</i> 1885
HALE, GEORGE E.	<i>Solar Observatory office, Pasadena, Cal.</i> 1902
HASTINGS, CHARLES S.	<i>Yale University, New Haven, Conn.</i> 1889
HILGARD, EUGENE W.	<i>University of California, Berkeley, Cal.</i> 1872
HILL, GEORGE W.	<i>West Nyack, N. Y.</i> 1874
HILLEBRAND, WILLIAM F.	<i>Bureau of Standards, Washington, D. C.</i> 1908
HOLDEN, EDWARD S.	<i>U. S. Military Academy, West Point, N. Y.</i> 1885
HOLMES, WILLIAM H.	<i>U. S. National Museum, Washington, D. C.</i> 1905
HOWELL, WILLIAM H.	<i>Johns Hopkins University, Baltimore, Md.</i> 1905
IDDINGS, JOSEPH P.	<i>Brinklow, Md.</i> 1907
JACKSON, CHARLES L.	<i>6 Boylston Hall, Cambridge, Mass.</i> 1883
LINDGREN, WALDEMAR.	<i>U. S. Geological Survey, Washington, D. C.</i> 1909
LOEB, JACQUES.	<i>Rockefeller Institute, New York City.</i> 1910
MALL, FRANKLIN P.	<i>Johns Hopkins University, Baltimore, Md.</i> 1907
MARK, EDWARD L.	<i>109 Irving St., Cambridge, Mass.</i> 1903
MENDENHALL, THOMAS C.	<i>Worcester, Mass.</i> 1887
MERRIAM, C. HART.	<i>1919 Sixteenth St., Washington, D. C.</i> 1902
MICHAEL, ARTHUR.	<i>219 Parker St., Newton Center, Mass.</i> 1889
MICHELSON, ALBERT A.	<i>University of Chicago, Chicago, Ill.</i> 1888
MINOT, CHARLES S.	<i>Harvard Medical School, Boston, Mass.</i> 1897
MITCHELL, S. WEIR.	<i>1524 Walnut St., Philadelphia, Pa.</i> 1865
MOORE, ELIAKIM H.	<i>University of Chicago, Chicago, Ill.</i> 1901
MORGAN, T. H.	<i>Columbia University, New York City.</i> 1909
MORLEY, EDWARD W.	<i>West Hartford, Conn.</i> 1897
MORSE, EDWARD S.	<i>P. O. Box 268, Salem, Mass.</i> 1876
MORSE, HARMON N.	<i>Johns Hopkins University, Baltimore, Md.</i> 1907
MOULTON, F. R.	<i>University of Chicago, Chicago, Ill.</i> 1910
NEF, JOHN ULRIC.	<i>University of Chicago, Chicago, Ill.</i> 1904
NICHOLS, EDWARD L.	<i>Cornell University, Ithaca, N. Y.</i> 1901

¹ Mr. Emmons died on March 28, 1911.

Date of
election.

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.....	Agr. Exp. Station, New Haven, Conn.	1910
OSGOOD, WILLIAM FOGG.....	Harvard University, Cambridge, Mass.	1904
PEIRCE, BENJAMIN O.....	Harvard University, Cambridge, Mass.	1906
PEIRCE, CHARLES S.....	Milford, Pa.	1876
PICKERING, EDWARD C.....	Harvard College Observatory, Cambridge, Mass.	1873
PRUDDEN, T. MITCHELL.....	Columbia University, New York City.	1901
PUMPELLY, RAPHAEL.....	Gibbs Ave., Newport, R. I.	1872
PUPIN, MICHAEL I.....	Columbia University, New York City.	1905
PUTNAM, FREDERICK W.....	Peabody Museum, Cambridge, Mass.	1885
REMSEN, IRA.....	Johns Hopkins University, Baltimore, Md.	1882
RICHARDS, THEODORE W.....	Harvard University, Cambridge, Mass.	1899
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
SCUDDER, SAMUEL H.....	Cambridge, Mass.	1877
SMITH, EDGAR F.....	University of Pennsylvania, Philadelphia, Pa.	1899
SMITH, THEOBALD.....	Harvard Medical School, Boston, Mass.	1908
STORY, WILLIAM E.....	Clark University, Worcester, Mass.	1908
THOMSON, ELIHU.....	Swampscott, Mass.	1907
TRELEASE, WM.....	Missouri Botanical Garden, St. Louis, Mo.	1902
TROWBRIDGE, JOHN.....	Harvard University, Cambridge, Mass.	1878
VAN HISE, C. R.....	University of Wisconsin, Madison, Wis.	1902
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, HENRY L.....	Sheffield Scientific School, New Haven, Conn.	1909
WILSON, EDMUND B.....	Columbia University, New York City.	1899
WOOD, HORATIO C.....	4107 Chester Ave., Philadelphia, Pa.	1879
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, ARTHUR.....	Königl. Akad. der Wissenschaften, Berlin.	1883
BACKLUND, OSKAR.....	Astron. Sternwarte, Pulkowa.	1903
BAEYER, ADOLPH RITTER VON.....	Universität, Munich.	1898
BARROIS, CHARLES.....	Université, Lille.	1908
BORNET, EDOUARD.....	Paris.	1901
BRÜGGER, W. C.....	Universitet, Christiania.	1903
DARWIN, SIR GEORGE HOWARD.....	Newnham Grange, Cambridge.	1904
DEWAR, SIR JAMES.....	University, Cambridge.	1907
EHRlich, PAUL.....	Königl. Inst. für Exper. Therapie, Frankfurt a. Main.	1904
FISCHER, EMIL.....	Chemisches Inst. der Universität, Berlin.	1904
FORSYTH, A. R.....	Trinity College, Cambridge.	1907
GEIKIE, SIR ARCHIBALD.....	Haslemere, Surrey.	1901
GILL, SIR DAVID.....	Royal Observatory, Cape Town.	1898
GROTH, PAUL VON.....	Universität, Munich.	1905

	Date of election.
HILBERT, DAVID.....	<i>Universität, Göttingen.</i> 1907
HOOKE, SIR J. D.....	<i>14 South Parade, Bath.</i> 1880?
KAPTEYN, JOHN C.....	<i>Rijks Universiteit, Groningen.</i> 1907
KLEIN, FELIX.....	<i>Universität, Göttingen.</i> 1898
KRONECKER, HUGO.....	<i>Kantonale Universität, Berne.</i> 1901
LANKESTER, E. RAY.....	<i>South Kensington, London.</i> 1903
LARMOR, JOSEPH.....	<i>St. Johns College, Cambridge.</i> 1908
LISTER, LORD.....	<i>Regents Park, W., London.</i> 1898
LORENTZ, HENDRIK ANTON.....	<i>Rijks Universiteit, Leiden.</i> 1906
OSTWALD, WILHELM.....	<i>Grossbothen, bei Leipzig.</i> 1906
PAVLOV, IVAN P.....	<i>Kais Inst. für Exper. Med., St. Petersburg.</i> 1908
PENCK, ALBRECHT.....	<i>Universität, Berlin.</i> 1909
PFEFFER, WILHELM.....	<i>Bot. Inst. der Universität, Leipzig.</i> 1903
PICARD, EMILE.....	<i>Université, Paris.</i> 1903
POINCARÉ, HENRI.....	<i>Université, Paris.</i> 1898
RAMSAY, SIR WILLIAM.....	<i>University College, London.</i> 1904
RAYLEIGH, LORD.....	<i>University, Cambridge.</i> 1898
RETZIUS, GUSTAV.....	<i>Universität, Stockholm.</i> 1909
ROSENBUSCH, H.....	<i>Universität, Heidelberg.</i> 1904
SEELIGER, HUGO RITTER VON.....	<i>Universität, Munich.</i> 1908
STRASBURGER, EDOUARD.....	<i>Universität, Bonn.</i> 1898
SUESS, EDOUARD.....	<i>Universität, Vienna.</i> 1898
THOMSON, JOSEPH JOHN.....	<i>University, Cambridge.</i> 1903
VRIES, HUGO DE.....	<i>Universiteit, Amsterdam.</i> 1904
WALDEYER, WILHELM.....	<i>Universität, Berlin.</i> 1909
WUNDT, WILHELM.....	<i>Universität, Leipzig.</i> 1909
ZIRKEL, FERDINAND.....	<i>Königsstrasse 2a, Bonn.</i> 1903

DECEASED MEMBERS.

	Date of election.	Date of death.
AGASSIZ, ALEXANDER ¹	1866	Mar. 27, 1910
AGASSIZ, LOUIS.....	(2)	Dec. 14, 1873
ALEXANDER, J. H.....	(2)	Mar. 2, 1867
ALEXANDER, STEPHEN.....	(2)	June 25, 1883
BACHE, ALEXANDER DALLAS.....	(2)	Feb. 14, 1867
BAIRD, SPENCER F.....	1864	Aug. 19, 1887
BARKER, GEORGE F ¹	1876	May 24, 1910
BARNARD, F. A. P. ¹	(2)	Apr. 27, 1889
BARNARD, J. G.....	(2)	May 14, 1882
BARTLETT, W. H. C. ¹	(2)	Feb. 11, 1893
BEECHER, CHARLES EMERSON.....	1899	Feb. 14, 1904
BREWER, WILLIAM H. ¹	1880	Nov. 2, 1910
BROOKS, WILLIAM KEITH.....	1884	Nov. 12, 1908
BROWN-SEQUARD, CHARLES E.....	1868	Apr. 2, 1894
CASEY, THOMAS L.....	1890	Mar. 25, 1896
CASWELL, ALEXIS.....	(2)	Jan. 8, 1887
CHAUVENET, WILLIAM.....	(2)	Dec. 13, 1870
CLARKE, HENRY JAMES.....	1872	July 1, 1873
COFFIN, JAMES.....	1869	Jan. 6, 1873
COFFIN, J. H. C. ¹	(2)	Jan. 8, 1890
COMSTOCK, CYRUS B. ¹	1884	May 29, 1910
COOK, GEORGE H.....	1887	Sept. 22, 1889
COOKE, JOSIAH P.....	1872	Sept. 3, 1894

¹ Biographical notices have not been presented.² Charter members, Mar. 3, 1863.

Deceased Members—Continued.

	Date of election.	Date of death.
COPE, EDWARD D.....	1872	Apr. 12, 1897
COUES, ELLIOTT.....	1877	Dec. 25, 1899
DALTON, J. C.....	1864	Feb. 2, 1889
DANA, JAMES D. ¹	(²)	Apr. 14, 1895
DAVIS, CHARLES H.....	(²)	Feb. 14, 1877
DRAPER, HENRY.....	1877	Nov. 20, 1882
DRAPER, JOHN W.....	1877	Jan. 4, 1882
EADS, JAMES B.....	1872	Mar. 8, 1887
ENGELMANN, GEORGE.....	(²)	Feb. 4, 1884
FERREL, WILLIAM.....	1868	Sept. 18, 1891
FRAZER, JOHN FRIES.....	(²)	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.....	(²)	Dec. 9, 1908
GILLISS, JAMES MELVILLE.....	(²)	Feb. 9, 1865
GOODE, G. BROWN.....	1888	Sept. 6, 1896
GOULD, AUGUSTUS A.....	(²)	Sept. 15, 1866
GOULD, BENJAMIN A. ¹	(²)	Nov. 27, 1896
GRAY, ASA.....	(²)	Jan. 30, 1888
GUYOT, ARNOLD.....	(²)	Feb. 8, 1884
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.....	(²)	May 13, 1878
HILGARD, JULIUS E.....	(²)	May 8, 1891
HILL, HENRY B.....	1883	Apr. 6, 1903
HITCHCOCK, EDWARD.....	(²)	Feb. 27, 1864
HOLBROOK, J. E.....	1868	Sept. 8, 1871
HUBBARD, J. S.....	(²)	Aug. 16, 1863
HUMPHREYS, A. A.....	(²)	Nov. 28, 1883
HUNT, T. STERRY ¹	1873	Feb. 12, 1892
HYATT, ALPHEUS.....	1875	Jan. 16, 1902
JOHNSON, S. W. ¹	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. ¹	1876	Feb. 27, 1906
LE CONTE, JOHN.....	1878	Apr. 29, 1891
LE CONTE, JOHN L.....	(²)	Nov. 15, 1883
LE CONTE, JOSEPH.....	1875	July 6, 1901
LEA, MATTHEW CAREY.....	1892	Mar. 15, 1897
LEIDY, JOSEPH ¹	(²)	Apr. 30, 1891
LESLEY, J. PETER ¹	(²)	June 3, 1903
LESQUIREUX, LEO.....	1864	Oct. 25, 1889
LONGSTRETH, MIERS F. ¹	(²)	Dec. 27, 1891
LOOMIS, ELIAS.....	1873	Aug. 16, 1889
LOVERING, JOSEPH.....	1873	Jan. 18, 1892
LYMAN, THEODORE.....	1872	Sept. 10, 1897
MAHAN, D. H.....	(²)	Sept. 16, 1871
MARSH, G. P.....	1866	July 13, 1882

¹ Biographical notices have not been presented.² Charter members, Mar. 3, 1863.

Deceased Members—Continued.

	Date of election.	Date of death.
MARSH, O. C. ¹	1874	Mar. 18, 1899
MAYER, ALFRED M. ¹	1872	July 13, 1897
MAYO-SMITH, RICHMOND ¹	1890	Nov. 11, 1901
MEEK, F. B.....	1869	Dec. 21, 1877
MEIGS, M. C.....	1865	Jan. 2, 1892
MITCHELL, HENRY ¹	1885	Dec. 1, 1902
MORGAN, LEWIS H.....	1875	Dec. 14, 1881
MORTON, HENRY ¹	1874	May 9, 1902
NEWBERRY, J. S.....	(²)	Dec. 7, 1892
NEWCOMB, SIMON ¹	1869	July 11, 1909
NEWTON, H. A.....	(²)	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. ¹	1872	Feb. 14, 1905
PENFIELD, SAMUEL L.....	1900	Aug. 13, 1906
PETERS, C. H. F. ¹	1876	July 18, 1890
POURTALES, L. F.....	1873	July 19, 1880
POWELL, JOHN W. ¹	1880	Sept. 23, 1902
RODGERS, JOHN.....	(²)	May 5, 1882
ROGERS, FAIRMAN.....	(²)	Aug. 23, 1900
ROGERS, ROBERT E.....	(²)	Sept. 7, 1884
ROGERS, WM. A.....	1885	Mar. 1, 1898
ROGERS, WILLIAM B.....	(²)	May 30, 1882
ROOD, OGDEN N.....	1885	Nov. 12, 1902
ROWLAND, HENRY A.....	1881	Apr. 16, 1901
RUTHERFURD, LEWIS M.....	(²)	May 30, 1892
SAXTON, JOSEPH.....	(²)	Oct. 26, 1873
SCHOTT, CHARLES A. ¹	1872	July 31, 1901
SELLERS, WILLIAM ¹	1873	Jan. 24, 1905
SILLIMAN, BENJ., Sr.....	(²)	Nov. 24, 1864
SILLIMAN, BENJ., Jr. ¹	(²)	Jan. 14, 1885
SMITH, J. LAWRENCE.....	1872	Oct. 12, 1883
STIMPSON, WILLIAM ¹	1868	May 26, 1873
STRONG, THEODORE.....	(²)	Feb. 1, 1869
SULLIVANT, W. S.....	1873	Apr. 30, 1882
TORREY, JOHN.....	(²)	Mar. 10, 1873
TOTTEN, J. G.....	(²)	Apr. 22, 1864
TROWBRIDGE, WILLIAM P.....	1872	Aug. 12, 1892
TRUMBULL, JAMES H. ¹	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
WHITE, CHARLES A. ¹	1889	June 29, 1910
WHITMAN, C. O. ¹	1895	Dec. 6, 1910
WINLOCK, JOSEPH.....	(²)	June 11, 1875
WOODWARD, J. J.....	1873	Aug. 17, 1884
WORTHEN, A. H.....	1872	May 6, 1888
WYMAN, JEFFRIES.....	(²)	Sept. 4, 1874
YOUNG, CHARLES A.....	1872	Jan. 3, 1908

¹ Biographical notices have not been presented.² Charter members, Mar. 3, 1863.

DECEASED FOREIGN ASSOCIATES.

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