

59TH CONGRESS,
2d Session.

SENATE.

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No. 308.

REPORT

OF THE

NATIONAL ACADEMY OF SCIENCES

FOR

THE YEAR 1906.

FEBRUARY 12, 1907.—Ordered to be printed.



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LETTER FROM THE PRESIDENT OF THE NATIONAL ACADEMY
OF SCIENCES SUBMITTING A REPORT OF THE OPERATIONS OF
THE NATIONAL ACADEMY OF SCIENCES FOR THE YEAR 1906.

NATIONAL ACADEMY OF SCIENCES,
OFFICE OF THE PRESIDENT,
Washington, D. C., January 2, 1907.

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 past year:

Very respectfully,

ALEXANDER AGASSIZ.

The PRESIDENT OF THE SENATE.

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ACT OF INCORPORATION AND AMENDMENTS.

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.

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.

True copies.

DEPARTMENT OF STATE, *June 10, 1882.*

SEVELLON A. BROWN, *Chief Clerk.*

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.

DEPARTMENT OF STATE, *June 24, 1884.*

A true copy.

SEVELLON A. BROWN, *Chief Clerk.*

REPORT OF THE NATIONAL ACADEMY OF SCIENCES.

SESSIONS OF THE NATIONAL ACADEMY.

During the year 1906 the academy held three sessions. The first was the regular annual session, held at Washington April 16 to 18, inclusive; the second, a scientific session held at Boston November 20 to 22; the third, a special session held at Boston November 20 and 21 for the transaction of business.

ANNUAL MEETING.

The council met at the residence of the home secretary, 1724 I street NW., Washington, D. C., Tuesday morning, April 16, with the president, Mr. Alexander Agassiz, in the chair. The remainder of the session was held at the United States National Museum.

The following members were present during the session: Messrs. Abbot, Agassiz, Becker, Billings, Boss, Brewer, Brush, Campbell, Cattell, Chittenden, Crafts, Dall, Dutton, Emmons, Gill, Hague, Hale, Holmes, Howell, Merriam, Morley, Morse, Newcomb, Noyes, Osborn, Peirce, Pupin, Remsen, Trelease, Walcott, Webster, Welch, Wells, 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 16, 1906.

The annual report of the president of the academy was transmitted to Congress January 14, 1906, through the courtesy of Senator Wetmore, chairman of the Committee on the Library. The edition of 500 copies was received from the Government Printing Office February 23. Nearly one-half of the edition has been distributed to the members of the academy, foreign associates, and such libraries as are on our domestic exchange list.

Since the last annual meeting Part II of Dr. A. S. Packard's "Monograph on Bombycine moths" has been issued as volume IX of the Memoirs of the Academy. The entire edition was received from the Government Printing Office October 26, 1905. About one-half the entire edition has been distributed. Three hundred and twenty-four copies were sent to those on the foreign and domestic exchange list, and the others to the members of the academy, foreign associates, and to special investigators in entomological work.

Memoirs 1, 2, and 3 of Volume X have been received—No. 1, entitled "The absolute value of the acceleration of gravity determined by the ring-pendulum method," by Charles E. Mendenhall; No. 2, entitled "Claytonia grönov," by Theodore Holm; No. 3, entitled "A research upon the action of alcohol upon the circulation," by Horatio C. Wood and Daniel M. Hoyt. Copies of each have been sent to members and foreign associates of the academy and such other persons named in the list furnished by the respective authors of these memoirs. One-half of the edition is still held at the Government Printing Office for binding when the volume is completed.

Memoir 4, Volume X, entitled "Phoronis Architecta," by W. K. Brooks and R. P. Cowles, is now in press and will soon be issued.

Memoir 5, entitled "On a new Pyrosoma," by W. K. Brooks, was transmitted to the Public Printer April 10.

The only biographical memoir published during the year appeared as No. 1 of Volume VI of the Biographical Memoirs of the Academy. It is a biography of Dr. J. S. Newberry by Dr. C. A. White.

Messrs. John C. Branner, William H. Holmes, William H. Howell, Arthur A. Noyes, and Michael I. Pupin were elected members of the Academy at the annual meeting in April, 1905. One member, Mr. S. P. Langley, died during the past year. To-day there are 95 names on the active membership list and 40 foreign associates.

Very respectfully,

ARNOLD HAGUE,
Home Secretary.

APRIL 17, 1906.

REPORT OF THE TREASURER.

WASHINGTON, D. C., April 18, 1906.

THE PRESIDENT OF THE NATIONAL ACADEMY OF SCIENCES.

SIR: I have the honor to transmit herewith my financial report as treasurer of the National Academy of Sciences for the year ending April 16, 1906:

Income.	General fund.	Bache fund.	Watson fund.	Draper fund.	J. Lawrence Smith fund.	Gould fund.	Emmons and Gill, trustees.	Building fund.
Balance brought forward:								
Cash.....	\$443.31	\$766.37	\$119.97	\$71.21	\$612.79	\$765.94	\$103.80	\$199.29
Invested income.....	3,900.00	3,000.00	3,293.71	.....	1,746.57	1,000.00	.....	1,500.00
Interest.....	496.70	2,222.14	1,113.09	330.46	368.81	895.00	.....	67.50
Members' tax.....	480.00	.....	.....	.....	.....	.....	.....	.....
Bureau of Insular Affairs.....	198.60	.....	.....	.....	.....	.....	.....	.....
Total.....	5,118.61	5,988.51	4,526.77	461.70	2,728.17	2,660.94	403.80	1,766.79
Disbursed.....	330.92	1,620.98	3,228.25	264.52	120.83	632.01	86.85	1.33
Transfer to capital fund.....	.....	.....	.....	131.81	.....	.....	.....	1,500.00
Balance:								
Cash.....	287.69	2,367.53	1,142.58	62.34	591.91	1,028.93	316.95	265.46
Invested income.....	4,500.00	2,000.00	457.94	.....	2,015.43	1,000.00	.....	.....
Total.....	5,118.61	5,988.51	4,526.77	461.70	2,728.17	2,660.94	403.80	1,766.79

Very respectfully,

S. F. EMMONS, *Treasurer.*

The treasurer's report was referred to an auditing committee consisting 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.

THEO. N. GILL.
WM. H. DALL.

REPORT OF TRUST FUNDS.

STATEMENT OF THE BOARD OF DIRECTORS OF THE BACHE FUND FOR 1905-1906.

The board of directors of the Bache fund herewith present, as a matter of courtesy to the Academy, the following statement:

Since the last stated meeting of the Academy, April, 1905, the directors have made the following appropriations:

1905.		
Sept. 18.	To Dr. H. C. Wood, for a study of the vaso-motor system of the lungs, with especial regard to the location of their centers and of the effects of drugs upon them.....	\$300
Oct. 7.	To Dr. Theodore Lyman, for a study of spectra of gases and metals in Schumann's short wave-length region.....	300
Nov. 27.	For the establishment of an American table in the laboratory at the Col d'Olen on Monte Rosa, in cooperation with the Elizabeth Thompson fund, which contributes a like amount.....	500
Dec. 5.	To Prof. Duncan S. Johnson, for researches on the development and ecology of the Piperaceae and Chloranthaceae of Jamaica, etc.....	400

Respectfully submitted,

S. C. CHANDLER.
H. P. BOWDITCH.
IRA REMSEN.

REPORT OF THE DIRECTORS OF THE BENJAMIN APTHORP GOULD FUND FOR THE ACADEMY YEAR 1905-6.

The directors of the Benjamin, Apthorp Gould fund present the following report:

Since the last stated meeting of the Academy, April, 1905, the following appropriation has been made:

1906.		
Mar. 6.	To Charles L. Doolittle, in continuation of his investigation with reflex zenith tube and zenith telescope, appropriations for which have already been reported in 1904 and 1905: present additional appropriation.....	\$500

Several applications which will doubtless receive favorable action are pending, but are not in shape for formal report at this time.

LEWIS BOSS.
SETH C. CHANDLER.

THE J. LAWRENCE SMITH FUND.

The trustees submit the following report:

In accordance with a request recently received from Professor Brush, I beg to submit the following report of work which I have done under the grant made me by the trustees of the J. Lawrence Smith fund:

By consent of the committee, granted March 14, 1905, the scope of the catalogue which I am preparing has been limited to the meteorites of North America. This involves the description of 235 falls, the number at present recognized from this area. The account of these in bulk I have practically completed, the copy reaching a total of 860 typewritten pages. This gives a comprehensive account of each separate fall and a study of its characters as reported in all published literature, together with a bibliography. There remains to me the task of condensing and connecting these various accounts into a systematized and readable whole and the statement of conclusions from the study. This work I am pushing as rapidly as possible.

I have also prepared maps as originally planned, showing the location and character of each fall. These are now complete and ready for publication, the total number being 36. The publication of these alone at the present time might serve a useful purpose, but on the whole it seems to me better to hold them until the publication of the catalogue.

Of the amount granted me there still remains unexpended \$90, all of which will doubtless be needed in the completion of the work.

Yours respectfully,

OLIVER C. FARRINGTON.

REPORT OF THE COMMITTEE ON SOLAR RESEARCH.

As stated in previous reports, a preliminary conference on cooperation in solar research was held, at the suggestion of this committee, in connection with the Congress of Arts and Science, at St. Louis, in September, 1904, where arrangements were made for the establishment of a permanent organization and for a second conference, which was held at New College, Oxford, September 27-29, 1905.

At the Oxford Conference the National Academy was represented by Messrs. Campbell and Hale. The following academies and societies also sent official representatives: International Association of Academies, Royal Society of London, Stockholm Academy of Sciences, St. Petersburg Academy of Sciences, Astronomical and Astrophysical Society of America, Royal Astronomical Society, Astronomical Society of France, Physical Society of France, Paris Academy of Sciences, American Physical Society, Amsterdam Academy of Sciences, German Physical Society, Solar Commission of International Meteorological Committee, Madrid Geographical Institute. Various observatories, not directly represented by societies, also sent delegates.

The following programme was carried out:

Wednesday, September 27.

10 a. m.:

1. Introductory proceedings.
2. Election of officers for the meeting.
3. Approval of programme.

10.45 a. m.:

4. Discussion on standards of wave length.
5. Discussion of cooperation in spectroheliograph work, including related spectroscopic investigations.

1 p. m.: Discussion of the Constitution of the Union.

Thursday, September 28.

10 a. m.:

1. Discussion of cooperation in measurements of the intensity of solar radiation.
2. Discussion of the spectroscopic determination of solar rotation.
3. Discussion of other matters brought forward by delegates.

Friday, September 29.

10 a. m.:

1. Place and date of next meeting.
2. Election of officers.
3. Appointment of committees.
4. Formal resolutions.

1 p. m.: Adjournment of the conference.

After a discussion on new standards of wave lengths, introduced by Professor Kayser, the following resolutions were adopted:

1. The wave length of a suitable spectroscopic line shall be taken as the primary standard of wave length. The wave length of this line shall be fixed permanently, and thereby define the unit in which all wave lengths are to be measured. This unit shall differ as little as possible from 10^8 meters, and be called the *Angström*.
2. Secondary standards are required at distances which should not be greater than 50 Angström units apart. These secondary standards should be referred to the primary standard by means of an interferometer method. The source of light should be obtained by means of an electric arc of from 6 to 10 ampères.
3. A committee shall be appointed to select the standards and to organize the determination of their wave lengths in terms of the primary standard in at least two independent laboratories.
4. The same committee shall be charged with the selection of tertiary standards which shall be at distances of from 5 to 10 Å. The wave lengths of these tertiary standards are to be obtained by interpolation with the help of gratings.

A discussion on cooperation in work with the spectroheliograph, including related spectroscopic investigations, was opened by Professor Hale. The following resolutions were subsequently adopted:

1. Cooperation is desirable in the various branches of solar research, such as visual and photographic observations of the solar surface, visual observations of prominences, and observations of the solar atmosphere with spectroheliographs of various types.

2. When an institution has collected and coordinated results from various sources, members of the union shall be requested to place their observations at the disposal of the said institution.

3. In the case of investigations which have not yet been thus collected and coordinated, special committees nominated by the union shall be charged with the work of collection and coordination. The committees will be requested to communicate the scheme and proposals to the executive committee, with a view of initiating a system of observations according to the scheme.

4. It is proposed forthwith to organize through the union such cooperation in two branches of research:

(a) The study of the spectra of sun spots.

(b) The study of the records, by means of the H and K light, of phenomena of the solar atmosphere.

5. The union lays special stress on the fact that, notwithstanding the obvious utility of cooperation in certain cases, individual initiative is the chief factor in a very large number. It is as much the duty of the union to encourage original researches as to promote cooperation.

The International Union for Coöperation in Solar Research was permanently established, and articles of the constitution of the union, suggested by the executive committee, were adopted with various amendments.

Professor Angström opened the discussion on cooperation in measurements of solar radiation. The following resolutions, proposed by Professor Schuster, were adopted:

1. In order to secure uniformity it is desirable that observations on the intensity of solar radiation in different localities shall be made as far as possible with the same type of instrument.

2. That for the present Angström's pyrheliometer be adopted as the standard instrument.

3. That it is desirable to obtain accurate comparisons between the records of Angström's pyrheliometer and other standard instruments, and that Mr. Abbot, Professor Callendar, Prof. Wladimir Michelson, and Mr. W. E. Wilson be asked to assist the union in this work.

4. That for the determination of the possible changes in the solar radiation power it is desirable to secure measurements of the intensity over limited ranges of the spectrum, which are not affected by absorption due to ozone, aqueous vapor, and carbonic acid.

5. That a committee be appointed to draw up a scheme of cooperation and proposals for the reduction of observations. That the committee be requested to communicate the scheme and proposals to the executive committee, with a view to initiating a system of observations according to the scheme.

6. That the union recognizes the great importance of measurements of the relative intensities of radiation, by direct photographs as well as by other methods, emitted by different parts of the solar surface, and desires to include such measurements in the subjects to be dealt with by the union.

A discussion on the spectroscopic determination of the solar rotation was opened by Professor Campbell, and the following resolution was adopted:

The union recognizes the importance of investigating the problem of solar rotation by spectroscopic methods, and desires to include this subject among those to be dealt with by the union.

The following additional resolutions were also adopted:

That the union request the International Association of Academies to allow itself to be placed at the head of the list of bodies constituting the union.

That the International Association of Academies be asked to agree to nominate one of the three members of the executive committee. The union suggests that the nomination of this member may conveniently be made by the leading academy, the nomination holding while the academy continues to act as leading academy.

That in the opinion of the Conference it would be desirable that countries which do not contain scientific bodies forming part of the union should organize solar research by forming committees which could cooperate with the union.

It was decided that the next meeting of the union be held at the Astrophysical Observatory of Meudon (near Paris), in September, 1907.

The executive committee of the union was constituted by the appointment of Professors Schuster (chairman), and Hale, with the understanding that the International Association of Academies would be requested to appoint the third member. The central bureau of the union is to be at the physical laboratory of the University of Manchester, under the direction of Professor Schuster, and the computing bureau of the union is to be at the University of Oxford, under the direction of Professor Turner.

The following committees were appointed:

(a) Committee on standards of wave length: Professor Kayser (chairman), Professor Ames, M. Fabry, Professor Michelson, and M. Pérot.

(b) Committee on solar radiation: Professor Ångström (chairman), Mr. Abbot, Professor Callendar, Doctor Julius, Professor Schuster, and M. Violle.

(c) Committee on cooperation in work with the spectroheliograph: Professor Hale (chairman), M. Deslandres, Professor Frost, Dr. W. J. Lockyer, Professor Ricciò, and Mr. Michie Smith.

(d) Committee on spectra of sun spots: Professor C. A. Young (chairman), Professor Belopolsky, Sir W. H. M. Christie, Fr. Cortie, M. Deslandres, Mr. Fowler, Sir N. Lockyer, Mr. Newall, and Doctor Woffler.

Full proceedings of the meeting, including the articles of constitution of the union and the various papers communicated, will be published in the Transactions of the International Union for Co-operation in Solar Research, a copy of which will be transmitted to the academy.

The admirable arrangements made for the meeting by Professor Turner and the cordial hospitality shown by New College, where all the delegates were entertained, and subsequently by the University of Cambridge, which the members of the union visited in a body, combined to render the Conference a very successful one.

Respectfully submitted.

GEORGE E. HALE, *Chairman.*

ELECTIONS.

ELECTION OF OFFICERS.

Messrs. Billings, Chittenden, Hale, Osborn, Welch, and Woodward were elected members of the council.

ELECTION OF NEW MEMBERS.

Messrs. Benjamin O. Peirce, William B. Scott, and Josiah Royce were elected members of the Academy.

ELECTION OF FOREIGN ASSOCIATES.

Wilhelm Ostwald, of Leipzig, and Hendrik Anton Lorentz, of Leiden, were elected foreign associates of the Academy.

DEATH

Two members of the Academy died during the year 1906; Samuel P. Langley February 27, and Samuel L. Penfield August 13.

Ludwig Boltzmann, of Vienna, a foreign associate, died September 6.

LIST OF PAPERS PRESENTED AT THE APRIL SESSION.

The Distribution of American Men of Science, J. McK. Cattell.

Recent Developments of Existential Graphs and their Consequences for Logic, C. S. Peirce.

Commelinaceae. Morphological and Anatomical Studies of the Vegetative Organs of Some North and Central American Species, Theo. Holm. (Presented by Theo. Gill.)

On the Classification of the Cidaridae, A. Agassiz and H. L. Clark.

Interference of Oviposition of a Sargasso Fish with a Flying Fish, Theo. Gill.

Faunal and Geological Succession in Eocene and Oligocene Basins of Rocky Mountain Region, H. F. Osborn.

Volcanic Ash in the Bridger Beds of Wyoming, W. J. Sinclair. (Presented by H. F. Osborn.)

Radio-Activity and Volcanoes, C. E. Dutton.

Cambrian Faunas of China, C. D. Walcott.

Recent Solar Investigations, George E. Hale.

Some Recent Solar Eclipse Results, W. W. Campbell and C. D. Perrine.

Feeble, Rapidly Alternating, Magnetization of Iron, M. I. Pupin.

Primary Standards for Temperature Measurements between 100° and 350°, J. M. Crafts.

Biographical Memoir of Admiral John Rodgers, Asaph Hall.

Biographical Memoir of George P. Marsh, W. M. Davis.

The Life History of Pterophryne, Theo. Gill.

ANNOUNCEMENTS.

The president announced that Mr. E. S. Dana had been appointed a member of the committee on the J. Lawrence Smith fund in place of Mr. George J. Brush, resigned, and Mr. Edward W. Morley was named as chairman of the committee.

He also announced the appointment of Mr. Henry F. Osborn as a member of the committee on the election of foreign associates.

The president announced that Mr. Arnold Hague had been appointed to represent the Academy at the quaternary celebration of the University of Aberdeen, Scotland.

AUTUMN MEETING OF THE ACADEMY.

SCIENTIFIC SESSION.

[Held in Boston, November 20 to 22, 1906.]

A scientific session for the reading of papers having been called by the council, the academy met in the new buildings of the Harvard Medical School, Longwood avenue, Boston, November 20, 21, and 22, 1906.

President Agassiz presided at the sessions and the following members were in attendance: Messrs. Barker, Barus, Bell, Billings, Boas, Brewer, Brush, Cattell, Chandler (C. F.), Chandler (S. C.), Chittenden, Comstock (George C.), Councilman, Crafts, Davis, Emmons, Farlow, Gooch, Goodale, Hague, Hale, Mark, Michael, Minot, Morley, Morse, Newcomb, Nichols, Noyes, Osborn, Peirce (C. S.), Pickering, Remsen, Richards, Scott, Trowbridge, Van Hise, Walcott, Webster, Welch, Wells, Woodward.

The following papers were presented:

A Few Notes Concerning Progress in Experiments Relating to Aerodromics. Alexander Graham Bell.

A Method for the Enumeration of Algebraic Invariants. William E. Story. (Introduced by A. G. Webster.)

Acoustic Measurements. Arthur G. Webster.

Vasomotor Relations. W. T. Porter. (Introduced by H. P. Bowditch.)

The Conductivity, Ionization, and Hydrolysis of Salts in Aqueous Solution at High Temperatures. Arthur A. Noyes.

Theory and Application of the Double Suspension Pendulum. R. S. Woodward.

The Minimal Proteid Requirement of High Proteid Animals. Russell H. Chittenden.

The Free Energy of Oxidation Processes. Gilbert N. Lewis. (Introduced by A. A. Noyes.)

Wave-Length Measurements in Wireless Telegraphy. George W. Pierce. (Introduced by John Trowbridge.)

Measurement of the Thomson Thermoelectric Effect in Metals. Edwin H. Hall. (Introduced by John Trowbridge.)

Analogy between Electrical Energy and Nervous Energy. John Trowbridge.

Continental Sedimentation, with Applications to Geological Climates and Geography. Joseph Barrell. (Introduced by W. M. Davis.)

Light of Extremely Short Wave Length. Theodore Lyman. (Introduced by John Trowbridge.)

The Eastern Slope of the Mexican Plateau. W. M. Davis.

Evidence of Desiccation during Historic Times Discovered in Chinese Turkestan in 1905-6. Ellsworth Huntington. (Introduced by W. M. Davis.)

Planetary Inversion and the Tenth Satellite of Saturn. William H. Pickering. (Introduced by E. C. Pickering.)

The Work of the Bruce Telescope. S. I. Bailey. (Introduced by E. C. Pickering.)

The Heat of Combustion of Benzol. Theodore W. Richards, L. J. Henderson, and H. L. Fevert.

The Atomic Weights of Nitrogen and Silver. Theodore W. Richards and George S. Forbes.

Structure of Richthofenia. Robert T. Jackson. (Introduced by E. L. Mark.)

On the Process of Fixing Characters in Animal Breeding. W. E. Castle. (Introduced by E. L. Mark.)

The Maturation of the Mammalian Ovum. E. L. Mark and J. A. Long.

The Marine Biological Station at La Jolla, Cal. E. L. Mark.

Reactions of Amphioxus to Light. G. H. Parker. (Introduced by E. L. Mark.)

The Absorption Spectra of Solutions in Relation to the Present Hydrate Theory. H. C. Jones. (Introduced by Ira Remsen.)

On the Salts of Tautomeric Compounds. S. F. Acree. (Introduced by Ira Remsen.)

The Temples of the Cross, of the Foliated Cross, and of the Sun, at Palenque, Mexico. Charles P. Bowditch. (Introduced by F. W. Putnam.)

Extent and Structure of the Stellar System. George C. Comstock. Tyrannosaurus. Upper Cretaceous Carnivorous Dinosaur. Henry F. Osborn.

Section of American Tertiaries. Henry F. Osborn.

Complete Mounted Skeleton of Fin-Back Lizard Neosaurus of the Peruvian. Henry F. Osborn.

Metabolism of Creatin and Creatinin. Otto Folin. (Introduced by H. P. Bowditch.)

Nature and Cause of Old Age. Charles S. Minot.

Phanerescopy, or Natural History of Signs, Relations, Categories, etc.: A method of investigating this subject expounded and illustrated. C. S. Peirce.

Heterogeneous Elements of the Continent as Factors in the History of North America. Bailey Willis. (Introduced by Charles D. Walcott.)

Present State of Knowledge as to Motions of the Terrestrial Pole. S. C. Chandler.

The Origin of the Ores of the Cobalt-Silver District of Ontario. Charles S. Van Hise.

Geological and Biological Study of the Cambrian Brachiopods. Charles D. Walcott.

The Catalysis of Sulphuric Acids. J. M. Crafts.

The Miocene Mammals of Patagonia. W. B. Scott.

Sun-Spot Spectra and their Bearing on Stellar Evolution. George E. Hale.

A Few Notes of Progress in the Construction of an Aerodrome with a Historical Introduction. Alexander Graham Bell.

The Use of the Statistical Method in the Systematic Study of Bacteria. Charles E. A. Winslow. (Introduced by A. A. Noyes.)

Biographical Memoir of Fairman Rogers. Edgar F. Smith.

BUSINESS MEETING.

[Boston, November 20 and 21, 1906.]

REPORT OF THE COMMITTEE ON COOPERATIVE RESEARCH IN CHEMISTRY.

The committee to which has been referred the plan of cooperative research in chemistry relating to the study of the equilibrium of chemical reactions, which plan was submitted to the Academy at its last meeting, offers the following report of progress:

The committee has taken under consideration the various aspects of the plan proposed, and has decided to express to the Academy its approval of the main features of it, and to recommend that the development of the plan be proceeded with. The committee is convinced that the line of investigation contemplated by the proposal is one of the broadest and most important fields of experimental research in chemistry now opened for cultivation, and that it is one which lends itself in an unusual degree to cooperation on the part of many investigators, even of those who may not possess unusual facilities or the highest experimental skill. Even though it should not prove practicable to secure a large measure of cooperation and though it should happen that no large addition to science directly result, yet the committee believes that the definite formulation and publication by the Academy of a systematic plan of research in this new field would, of itself alone, be a valuable contribution to the advancement of the subject, by drawing the attention of investigators in general to it and by bringing before them in a definite way the present frag-

mentary state of our knowledge of it and the directions in which that knowledge can be most effectively extended.

With respect to the ultimate securing of cooperation in the execution of the work, the committee recognizes the fact that this is of the nature of an experiment: but it believes that it is one well worth entering upon; for if even moderately successful, it would result, in the opinion of the committee, in a general stimulation of the research spirit in our institutions, and especially among the younger generation of chemists. In this connection, it may be mentioned that one of the methods of securing cooperation which the committee has considered as most likely to be effective would be to address, after the plan had been fully formulated, personal letters to those in charge of the chemical departments of various institutions, asking whether there were not members of their staffs who would like to participate in this general plan of research indorsed by the Academy by taking up the investigation of some special problem connected with it.

The committee therefore asks to be informed whether, in view of these considerations, it is desired that the committee prepare a more definite statement of the general considerations underlying the proposed subject of investigation, the present state of knowledge in regard to it, and an outline of a systematic plan to further research, with the understanding that this more developed plan be submitted to the Academy for its approval before proceeding to its publication or to the securing of cooperation in its execution. If this should be desired by the Academy, the committee respectfully asks that it be permitted, in the preparation and execution of the plan, to secure the assistance of Dr. G. N. Lewis, an investigator who has devoted himself successfully to work in this special direction, and that there be placed at the disposal of the committee the funds which have been generously offered to the Academy for this purpose by the trustees of the William E. Hale research fund.

ARTHUR A. NOYES.

EDWARD W. MORLEY.

THEODORE W. M. RICHARDS.

The report was approved and the committee instructed to take further steps to carry out its suggestions.

The original proposal, which was made to the Academy during the April session, is as follows:

COOPERATIVE RESEARCH IN CHEMISTRY

The principle of the second law of energetics that any change in the state of a system, whether physical or chemical, is capable of producing under the most favorable conditions a definite quantity of work is one whose importance has been extensively recognized within the last few years. This importance arises not only from the direct significance from a scientific and technical standpoint of this maximum quantity of work obtainable from any physical change or chemical reaction, but also from the fact that from its value alone can be directly computed the equilibrium conditions of the chemical reaction in question, the direction in which under specified conditions it will take place, and the electromotive force of any voltaic cell in which the reaction goes on reversibly. The hopes of the earlier thermochemists that the heat effect attending chemical reactions would enable us to predict the direction of the occurrence and their equilibrium have been shown both empirically and by the energy principles to be unfounded; but in this work quantity we have a reliable means of making such predictions and in it therefore a satisfactory measure of the hitherto indefinite conception of chemical affinity.

In spite of its great importance our present knowledge of the values of this maximum work in the case of specific chemical reactions is extremely limited and fragmentary. This condition has arisen not only from the fact that its significance has only recently been recognized, but also from the difficulties inherent in the experimental determination of its numerical values; for no general method is available similar to that used for determining heat effects by thermochemical measurements, but for each specific reaction a suitable method must be devised and worked out. Such methods, as far as our present knowledge goes, must be based on one of two principles—either upon the measurement of the electromotive force of some cell in which the reaction in question, and that alone, takes place, or on a determination of its equilibrium by chemical means—and in either case the study of a single reaction may constitute a small research.

For this reason the general solution of the problem with a completeness comparable to that already attained in the case of thermochemical data involves a vast amount of experimental investigation, and can be accomplished only very slowly unless the effort of many workers is concentrated upon it in a systematic way. This problem—one of the most important purely experimental ones of the chemistry of to-day—seems, therefore, to be one especially adapted to cooperative research, and one which the Academy could greatly promote by laying out a comprehensive plan of attack and using its influence to induce individual investigators to take up portions of the work. It has from this point of view the great advantage that the work would not consist of routine measurements made by a general method, but would offer to each researcher an abundant opportunity for the exercise of experimental ingenuity. Moreover, the percentage accuracy attainable and required would not be the highest, so that even those investigators who might not have great experience or the best facilities could participate in the work. And there would seem to be reason to hope from such a plan not only that the direct additions to scientific knowledge would be considerable, but that the spirit of research would be stimulated among chemists, especially the younger ones, throughout the country.

The president announced that Mr. George Hale, on behalf of the trustees of the William E. Hale fund, had offered to the Academy the sum of \$300, to be used in carrying out the objects of the committee on cooperation in chemical research, and that the gift had been accepted.

Announcement was also made that Mr. George F. Barker, on behalf of the Academy, had been appointed a delegate to attend the dedication of the new engineering building of the University of Pennsylvania on the 19th of October, 1906.

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APPENDIX C.

ORGANIZATION OF THE ACADEMY, 1906-7.

	Expiration of term.
AGASSIZ, ALEXANDER, <i>President</i>	April, 1907.
REMSEN, IRA, <i>Vice-President</i>	April, 1909.
NEWCOMB, SIMON, <i>Foreign Secretary</i>	April, 1909.
HAGUE, ARNOLD, <i>Home Secretary</i>	April, 1907.
EMMONS, S. F., <i>Treasurer</i>	April, 1908.

ADDITIONAL MEMBERS OF COUNCIL, 1906-7.

BILLINGS, J. S.	OSBORN, H. F.
CHITTENDEN, R. H.	WELCH, W. H.
HALE, GEORGE E.	WOODWARD, R. S.

COMMITTEES OF THE ACADEMY.

On nominations of new members.

- | | |
|--|---|
| <p>1. Mathematics and Astronomy.</p> <p>ABBE, C.
BOSS, LEWIS.
CAMPBELL, W. W.
CHANDLER, S. C.
COMSTOCK, G. C.
DAVIDSON, G.
ELKIN, W. L.
HALE, G. E.
HALL, A.
HILL, G. W.
HOLDEN, E. S.
MOORE, E. H.
NEWCOMB, S.
OSGOOD, W. F.
PEIRCE, C. S.
PICKERING, E. C.
WEBSTER, A. G.
WOODWARD, R. S.
YOUNG, C. A.</p> <p>2. Physics and Engineering.</p> <p>ABBE, C.
ABBOT, H. L.
BARKER, G. F.
BARUS, C.</p> | <p>2. Physics and Engineering—Cont'd.</p> <p>BELL, A. G.
COMSTOCK, C. B.
HASTINGS, C. S.
MENDENHALL, T. C.
MICHELSON, A. A.
MORLEY, E. W.
NICHOLS, E. L.
NOYES, A. A.
PEIRCE, B. O.
PICKERING, E. C.
PUPIN, M. I.
TROWBRIDGE, J.
WEBSTER, A. G.
WOODWARD, R. S.
WRIGHT, A. W.</p> <p>3. Chemistry.</p> <p>BARKER, G. F.
BRUSH, G. J.
CHANDLER, C. F.
CHITTENDEN, R. H.
CRAFTS, J. M.
DANA, E. S.
GIBBS, W.
GOOCH, F. A.</p> |
|--|---|

3. Chemistry—Continued.

HILGARD, E. W.
JACKSON, C. L.
JOHNSON, S. W.
MICHAEL, A.
MORLEY, E. W.
NEF, JOHN U.
NOYES, A. A.
REMSEN, IRA.
RICHARDS, T. W.
SMITH, E. F.
WELLS, H. L.

4. Geology and Paleontology.

AGASSIZ, A.
BECKER, G. F.
BRANNER, J. C.
CHAMBERLIN, T. C.
DALL, W. H.
DAVIS, W. M.
DUTTON, C. E.
EAMONS, S. F.
GILBERT, G. K.
HAGUE, ARNOLD.
OSBORN, H. F.
PUMPELL, R.
SCOTT, W. I.
VAN HISE, C. R.
WALCOTT, C. D.
WHITE, C. A.

5. Biology.

AGASSIZ, A.
ALLEN, J. A.
BOWDITCH, H. P.
BREWER, W. H.
BROOKS, W. K.
CHITTENDEN, R. H.
COUNCILMAN, W. T.
DALL, W. H.

5. Biology—Continued.

FARLOW, W. G.
GILL, T. N.
GOODALE, G. L.
HOWELL, W. H.
MARK, E. L.
MERRIAM, C. H.
MINOT, C. S.
MORSE, E. S.
OSBORN, H. F.
PRUDDEN, T. M.
PUTNAM, F. W.
SARGENT, C. S.
SCUDDER, S. H.
SMITH, S. I.
TRELEASE, WILLIAM.
VERRILL, A. E.
WALCOTT, C. D.
WELCH, W. H.
WHITE, C. A.
WHITMAN, C. O.
WILSON, E. B.
WOOD, H. C.

6. Anthropology.

BILLINGS, J. S.
BOAS, FRANZ.
CATTELL, J. MCK.
HOLMES, W. H.
JAMES, WM.
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., *Chairman.*
MICHELSON, A. A.
NEWCOMB, S.
PEIRCE, C. S.
COMSTOCK, C. B.
YOUNG, C. A.

WOODWARD, R. S.

On the Election of Foreign Associate.

REMSEN, IRA, *Chairman.*
BRUSH, G. J.
MITCHELL, S. W.
NEWCOMB, S.

OSBORN, H. F.

On Publication.

The PRESIDENT.

The HOME SECRETARY.
WALCOTT, C. D.

On Solar Research.

HALE, GEORGE E., *Chairman.*
CAMPBELL, W. W.
MICHELSON, A. A.
YOUNG, C. A.

TRUST FUNDS.

Board of Direction of the Bache Fund.

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

For researches in physical and natural science.

CHANDLER, S. C., *Chairman.*
BOWDITCH, H. P.
REMSEN, IRA.

Board of Trustees of the Watson Fund.

[1893, residual estate, \$18,666.88.]

For the promotion of astronomical research.

NEWCOMB, S., *Chairman.*
BOSS, L.
ELKIN, W. L.

The Henry Draper Fund.

[1885, \$6,000.]

Award of medal for important discoveries in astronomy.

NEWCOMB, S., *Chairman.*
HALE, G. E.
TROWBRIDGE, JOHN.
WRIGHT, A. W.
MICHELSON, A. A.

The J. Lawrence Smith Fund.

[1885, \$8,000.]

For the investigation of meteoric bodies.

MORLEY, E. W., *Chairman.*
DANA, E. S.
JOHNSON, S. W.
PUMPELLY, R.
REMSEN, IRA.

The Benjamin Apthorp Gould Fund.

[1897, \$20,000.]

For researches in astronomy.

HALL, ASAPH, *Chairman.*
BOSS, LEWIS.
CHANDLER, S. C.

The Barnard Medal.

BILLINGS, J. S., *Chairman.*
BOWDITCH, H. P.
CHANDLER, S. C.
JACKSON, C. L.
NEWCOMB, S.
NICHOLS, E. L.

The Wolcott Gibbs Fund.

[1893, \$2,673.17.]

For chemical research.

JACKSON, C. L., *Chairman.*
SMITH, EDGAR F.
REMSEN, IRA.

The Joseph Henry Fund.

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,
JANUARY 2, 1907.**

	Date of election.
ABBE, CLEVELAND	2017 I st. NW., Washington, D. C. 1879
ABBOT, HENRY L., U. S. A.	23 Berkeley st., Cambridge, Mass. 1872
AGASSIZ, ALEXANDER	Cambridge, Mass. 1866
ALLEN, J. ASAPH	American Museum, New York City. 1876
BARKER, GEORGE F.	3909 Locust st., Philadelphia, Pa. 1876
BARUS, CARL	Brown University, Providence, R. I. 1892
BECKER, GEORGE F.	U. S. Geological Survey, Washington, D. C. 1901
BELL, A. GRAHAM	1331 Connecticut ave., Washington, D. C. 1883
BILLINGS, JOHN S., U. S. A.	32 E. Thirty-first st., New York City. 1883
BOAS, FRANZ	123 W. Eighty-second st., New York City. 1900
BOSS, LEWIS	Dudley Observatory, Albany, N. Y. 1889
BOWDITCH, HENRY P.	Harvard Medical School, Boston, Mass. 1887
BRANNER, JOHN C.	Stanford University, California. 1905
BREWER, WILLIAM H.	418 Orange st., New Haven, Conn. 1880
BROOKS, W. K.	Johns Hopkins University, Baltimore, Md. 1884
BRUSH, GEORGE J.	14 Trumbull st., New Haven, Conn. 1868
CAMPBELL, WILLIAM W.	Lick Observatory, Mt. Hamilton, California. 1902
CATTELL, JAMES MCK.	Garrison, N. Y. 1901
CHAMBERLIN, THOMAS C.	University of Chicago, Chicago, Ill. 1903
CHANDLER, CHARLES F.	Columbia University, New York City. 1874
CHANDLER, SETH C.	Box 216, Wellesley Hills, Mass. 1888
CHITTENDEN, RUSSELL H.	Sheffield Scientific School, New Haven, Conn. 1890
COMSTOCK, CYRUS B., U. S. A.	124 E. Twenty-seventh st., New York City. 1884
COMSTOCK, GEORGE C.	Washburn Observatory, Madison, Wis. 1899
COUNCILMAN, WM. T.	Harvard Medical School, Boston, Mass. 1904
CRAFTS, JAMES M.	59 Marlborough st., Boston, Mass. 1872
DALL, WILLIAM H.	Smithsonian Institution, Washington, D. C. 1897
DANA, EDWARD S.	Yale University, New Haven, Conn. 1884
DAVIDSON, GEORGE	2221 Washington st., San Francisco, Cal. 1874
DAVIS, WILLIAM MORRIS	17 Francis ave., Cambridge, Mass. 1904
DUTTON, CLARENCE E., U. S. A.	Englewood, N. J. 1884
ELKIN, WILLIAM L.	Yale University Observatory, New Haven, Conn. 1895
EMMONS, SAMUEL F.	U. S. Geological Survey, Washington, D. C. 1892
FARLOW, W. G.	Harvard University, Cambridge, Mass. 1879
GIBBS, WOLCOTT	Newport, R. I. —
GILBERT GROVE K.	U. S. Geological Survey, Washington, D. C. 1883
GILL, THEODORE N.	Smithsonian Institution, Washington, D. C. 1873
GOOCH, FRANK A.	Yale University, New Haven, Conn. 1897

	Date of election.
GOODALE, GEORGE L.	Harvard University, Cambridge, Mass. 1890
HAGUE, ARNOLD	U. S. Geological Survey, Washington, D. C. 1885
HALE, GEORGE E.	Solar Observatory, Mount Wilson, Cal. 1902
HALL, ASAPH	Norfolk, Conn. 1875
HASTINGS, CHARLES S.	Yale University, New Haven, Conn. 1889
HILGARD, EUGENE W.	University of California, Berkeley, Cal. 1872
HILL, GEORGE W.	West Nyack, N. Y. 1874
HOLDEN, EDWARD S.	U. S. Military Academy, West Point, N. Y. 1885
HOLMES, WILLIAM H.	Bureau of American Ethnology, Washington, D. C. 1905
HOWELL, WILLIAM H.	232 W. Lanvale st., Baltimore, Md. 1905
JACKSON, CHARLES L.	6 Boylston Hall, Cambridge, Mass. 1883
JAMES, WILLIAM	95 Irving st., Cambridge, Mass. 1903
JOHNSON, SAMUEL W.	54 Trumbull st., New Haven, Conn. 1866
MARK, EDWARD L.	109 Irving st., Cambridge, Mass. 1903
MENDENHALL, THOMAS C.	Worcester, Mass. 1887
MERRIAM, C. HART	Department of Agriculture, Washington, D. C. 1902
MICHAEL, ARTHUR	Tufts College, Mass. 1889
MICHELSON, ALBERT A.	University of Chicago, Chicago, Ill. 1888
MINOT, CHARLES S.	Harvard Medical School, Boston, Mass. 1897
MITCHELL, S. WEIR	1524 Walnut st., Philadelphia, Pa. 1865
MOORE, ELIAKIM H.	University of Chicago, Chicago, Ill. 1901
MORLEY, EDWARD W.	West Hartford, Conn. 1897
MORSE, EDWARD S.	P. O. Box 268, Salem, Mass. 1876
NEE, JOHN ULRIC	University of Chicago, Chicago, Ill. 1904
NEWCOMB, SIMON, U. S. N.	1620 P st. NW., Washington, D. C. 1869
NICHOLS, EDWARD L.	Cornell University, Ithaca, N. Y. 1901
NOYES, ARTHUR A.	Massachusetts Institute of Technology, Boston, Mass. 1905
OSBORN, H. F.	American Museum of Natural History, New York City. 1900
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.	Observatory, Cambridge, Mass. 1873
PRUDDEN, T. MITCHELL	Columbia University, New York City. 1901
PUMPELLY, RAPHAEL	Gibbs ave., Newport, R. I. 1872
RUPIN, MICHAEL I.	Columbia University, New York City. 1905
PUTNAM, FREDERICK W.	Peabody Museum, Cambridge, Mass. 1885
REMSSEN, 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
SCOTT, WILLIAM B.	Princeton, N. J. 1906
SCUDDER, SAMUEL H.	Cambridge, Mass. 1877
SMITH, EDGAR F.	University of Pennsylvania, Philadelphia, Pa. 1899
SMITH, SIDNEY I.	Yale University, New Haven, Conn. 1884
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

	Date of election.
WHITE, CHARLES A.....	1908 13th st. NW., Washington, D. C. 1889
WHITMAN, CHARLES O.....	University of Chicago, Chicago, Ill. 1895
WILSON, EDMUND B.....	Columbia University, New York City. 1899
WOOD, HORATIO C.....	1925 Chestnut st., Philadelphia, Pa. 1879
WOODWARD, ROBERT S.....	Carnegie Institution, Washington, D. C. 1896
WRIGHT, ARTHUR W.....	Yale University, New Haven, Conn. 1881
YOUNG, CHARLES A.....	36 North Main st., Hanover, N. H. 1872

FOREIGN ASSOCIATES.

AUWERS, ARTHUR.....	Berlin.
BACKLUND, OSKAR.....	Pulkowa.
BAEYER, ADOLPH RITTER VON.....	Munich.
BECQUEREL, HENRI.....	Paris.
BORNET, EDOUARD.....	Paris.
BRÖGGER, W. C.....	Christiania.
DARWIN, SIR GEORGE.....	Cambridge.
EHRLICH, PAUL.....	Frankfurt-am-Main.
FISCHER, EMIL.....	Berlin.
GEIKIE, SIR ARCHIBALD.....	London.
GILL, SIR DAVID.....	Cape Town.
GROTH, PAUL VON.....	Munich.
HOFF, J. H. VAN'T.....	Berlin.
HOOKE, SIR J. D.....	London.
HUGGINS, SIR WILLIAM.....	London.
JANSSEN, J.....	Paris.
KELVIN, LORD.....	London.
KLEIN, FELIX.....	Göttingen.
KOCH, ROBERT.....	Berlin.
KOHLRAUSCH, FRIEDRICH.....	Marburg.
KRONECKER, HUGO.....	Berne.
LANKESTER, E. RAY.....	London.
LISTER, LORD.....	London.
LOEWY, MAURICE.....	Paris.
LORENTZ, HENDRIK ANTON.....	Leiden.
MENDELEEFF, D. I.....	St. Petersburg.
OSTWALD, WILHELM.....	Leipzig.
PFEFFER, WILHELM.....	Leipzig.
PICARD, EMILE.....	Paris.
POINCARÉ, HENRI.....	Paris.
RAMSAY, SIR WILLIAM.....	London.
RAYLEIGH, LORD.....	London.
ROSENBUSCH, H.....	Heidelberg.
STRASBURGER, EDOUARD.....	Bonn.
SUESS, EDOUARD.....	Vienna.
THOMSON, JOSÉPH JOHN.....	Cambridge.
VOGEL, H. C.....	Berlin.
VRIES, HUGO DE.....	Amsterdam.
ZIRKEL, FERDINAND.....	Leipzig.

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