# SCIENCE

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## *THE FRANKLIN BI-CENTENARY.*

THE celebration of the two-hundredth anniversary of the birth of Benjamin Franklin was held in Philadelphia in conjunction with the annual general meeting of the American Philosophical Society, on April 17 to 20, inclusive.

### TUESDAY EVENING, APRIL 17.

The opening session was held in Witherspoon Hall at eight o'clock and consisted of an address by Vice-provost Smith, of the University of Pennsylvania, in his capacity as president of the society. In welcoming the delegates and visitors President Smith outlined the history of the society, dwelling on those who, like its founder, attained distinction in electricity.

The various delegates from learned societies and institutions of learning, to the number of about 180, were next received and many of them presented more or less formal addresses.

In the name of the University of St. Andrews, its lord rector, Mr. Andrew Carnegie, conferred the honorary degree of doctor of laws upon Miss Agnes Irwin, dean of Radcliff College.

### WEDNESDAY, APRIL 18.

Meeting for the reading of papers on subjects of science, in the hall of the society, on Independence Square.

*Morning Session—10 o'clock.*

*The Statistical Method in Chemical Geology:* FRANK WIGGLESWORTH CLARKE, Sc.D., of Washington. (Illustrated by lantern slides.)

The statistical method in chemical geology was a development of his earlier work upon the relative abundance of the chemical elements. The average composition of the igneous rocks, as computed by Clarke and others, was compared with that of the sedimentaries. It was shown that in the decomposition of the igneous rocks, and the reconsolidation of the detrital products, the new rocks would consist of about five per cent. limestones, fifteen per cent. sandstones and eighty per cent. silicates, roughly classed together as shales. It was also shown that all of the sodium in the ocean and the sedimentaries would be furnished by the decomposition of a shell of igneous rock, completely enveloping the earth, less than one half mile thick. We thus have a statistical estimate of the total mass of the sedimentary rocks, and the proportions of their chief classes. Dr. Clarke also discussed, briefly, some of the uses which had been made of his former average for the igneous rocks, especially by Van Hise and by Joly. His criticisms were directed towards conservatism, and against drawing larger conclusions from the figures than their accuracy would warrant. The data need to be much more fully developed before any large use can be made of them.

*On a Possible Reversal of the Deep-sea Circulation and its Effect on Geological Climates:* Professor Thomas C. Chamberlin, of Chicago.

The preservation of a narrow range of temperature and a limited variation of atmospheric constituents throughout the millions of years of the biologic past was essential to organic evolution. Continued preservation for millions of years to come seems equally a condition precedent to an intellectual and spiritual evolution commensurate with the physical and biological evolutions that have preceded it. It has been customary to assign to the primitive earth a climate quite beyond the Miltonian conception of Gehenna in its fiery intensity and to forecast a final refrigeration scarcely inferior in its antithetic intensity. This is deduced from a gaseous nebula condensing through gravitation. Such a derivation has seemed to some of us inconsistent with the dynamics of the present solar system and an alternative view has been developed. This view involves a slow growth of the atmosphere to about its present volume, after which it was controlled by opposing agencies which maintained the narrow limits requisite. The agencies of *restraint* are molecular velocities, chemical combination and condensation. By virtue of the first, the lighter constituents are reduced to a minimum and all constituents are restricted within certain large limits. By virtue of the second, the chemically active factors are kept down to states of dilution compatible with organic evolution, while the inert elements have probably been permitted to increase steadily. By the third, the excess of water-vapor has been condensed into the ocean, which has probably increased rather than diminished through the ages. The postulated agencies of atmospheric *supply* are accessions from without and emanations from within, of which Vesuvius is just now giving us an impressive illustration.

Subsidiary to this control within narrow limits, pronounced variations must be recognized. In most geologic periods warm climates seem to have prevailed as high as 70° and 80° of latitude. How life of subtropical types could have survived the long polar nights is one of the most obdurate puzzles of the earth's climatology. But *between* the warm polar stages there were episodes of glaciation in strangely low latitudes. Extensive glaciation oc-

curred in India, Australia and South Africa in the later coal-forming stages of the Paleozoic era, the areas even lapping upon the Tropics of Cancer and Capricorn; yet figs and magnolias have grown in Greenland since. We are thus compelled to face oscillations ranging from subtropical congeniality within the polar circles to glaciation in low latitudes, and these in alternating succession, while none of the oscillation was permitted to swing across the narrow limital lines of organic endurance. There is little doubt that the ocean is one of the most potential agencies in controlling these oscillations and it is one of its climatic functions that invites our present attention. The carbonation of the ocean is subject to wide variations and the rapidity of this seems to be dependent chiefly on deep-sea circulation. In an endeavor to estimate the rate of this, it was found that the agencies that worked in opposite directions in promoting deep-sea circulation were very nearly balanced, whence sprang the suggestion that if their relative values were changed as much as geologic data imply, the direction of the deep-sea circulation might be changed, and that this might throw important light on some of the strange features of geologic climates.

The abysmal circulation is now dominated by polar agencies, as shown by the low temperature of the bottom waters even beneath the tropics. Cold waters creep slowly along the depths from the polar seas equatorward, where they gradually rise to the surface and return on more superficial routes.

The several influences of the winds, of atmospheric transfer of water, of differences in salinity and of differences of temperature, including freezing and thawing, were then discussed. Charts of the existing temperatures and salinities showed a close struggle between these opposing agencies. More saline but warmer waters both overlie and underlie less saline but colder waters. Computation of salinity-effects and temperature-effects also indicates a very close balance between the opposing agencies.

Now in the majority of geological periods the evidence of life indicates the absence of very low temperatures in the polar regions. Hence the inference that, at such periods, the balance would lie on the side of salinity and that therefore the deep oceanic circulation would be actuated by the dense waters of the evaporating tracts. These are supposed to have slowly descended and crept poleward, where they rose to the surface and gave their warmth to the atmosphere. Aided by the enshrouding mantle of vapors that must have arisen from such a body of water, it is conceived that the mild temperatures requisite for the maintenance of the recorded life through the polar nights may have been thus maintained.

*Elementary Species in Agriculture:* Professor HUGO DE VRIES, of Amsterdam, Holland.

*An International Southern Observatory:* Professor EDWARD C. PICKERING, of Cambridge, Mass.

A plan, possessing some novel features, for a telescope of the largest size was proposed, in which the best location, form of instrument, cost, administration and discussion of results were considered in turn. The best location in the world is desired, and is probably in South Africa, west of Bloemfontein, or in Peru. The relative advantages of reflectors and refractors were compared, with the conclusion that a reflector of seven-feet aperture and forty-five-feet focal length would be the best.

The great observatories of the world have each a plant costing two or three hundred thousand dollars, and an annual income of

about fifty thousand dollars. Capitalized, this would represent about a million and a half. For one third of this sum, or half a million dollars, the plan here proposed could be carried out with results which it is believed would advance astronomy in almost every department. The expense could be reduced by $100,000, or to $400,000, by giving the telescope to Harvard, which would then assume the cost of administration. The principal item, $250,000, would be required to provide a permanent annual income of $10,000. This would permit the telescope to be kept at work throughout every clear night, and in the proposed location almost every night would be clear. The remaining $150,000 would be spent on the telescope, and this estimate is based on the cost of the 24-inch reflector recently built for Harvard at an expenditure of $4,000. It was assumed that the expense of the drawings, plans and computations would increase as the first power, the hand and machine work as the square, and the material as the cube of the dimensions.

The special novelty of the plan was the method of discussing the results. While the principal work would be photographic, the use of the telescope visually, in various departments, was considered. The photographic results would be far greater than could be discussed by a single individual or institution. Therefore, it was proposed that an international committee should prepare a plan of work, and that copies of the photographs should be given to any one who could advantageously use them. Astronomers could doubtless be found in all parts of the world who would discuss these photographs, and could thus be furnished, without charge, with material of the highest grade, which could otherwise be obtained only at an expenditure of many thousands of dollars. So far as possible, they would be aided also by subsidies for paying salaries of assistants, for publication, etc. The donor would be guided in spending his money to the best advantage, not by a single astronomer, but by the astronomers of the world. His name, which would always be attached to the telescope and its work, would thus be known for all time, and throughout the world, rather than merely locally. It was urged that no better time could be found for inaugurating this scheme than when celebrating the memory of Benjamin Franklin, the greatest and most practical of American men of science.

*The Figure and Stability of a Liquid Satellite* (with lantern slides of diagrams): Sir George Darwin, K.C.B., F.R.S., of Cambridge, England.

*Form Analysis:* Professor Albert A. Michelson, of Chicago.

The analysis of forms of natural objects has been the subject of such careful and thorough treatment, that it would seem futile for one who can only claim to be an amateur in the science of morphology to attempt to add anything of real interest.

The work of Haeckel, to whom more than to any other, the greatest advance in the science is due, contains a very complete and detailed system of classification which applies to animate and inanimate forms; but with due deference to so great an authority, I would venture to propose some modifications in the nature of an extension of the accepted idea of *symmetry*.

The biologists generally restrict this idea to the forms ordinarily described as 'bilateral,' or 'dorsiventral' or to 'regular radial' forms. In a sense which among mathematicians is coming into use, the idea is extended to all forms in which congruence of parts is effected by any transformation which retains the essential character-

istics; but it would be a less radical departure if such transformations or 'operations' were limited to

A. Rotation (through 180°).
B. Reflection (in a plane).
C. Translation (in a straight line).

The corresponding subdivision of *symmetrical forms* would read:

A. Odd symmetrical.
B. Even symmetrical.
C. Rhythmic.
D. Partial. (Requiring at least two operations.)

Another modification which I should suggest is an extension of the idea of 'radial' symmetry to include forms which radiate from a point not in the center of the figure.

SYSTEMS OF SYMMETRY.

I. Radial Symmetry.
II. Axial Symmetry.
III. Plane Symmetry.

I. *Radial Symmetry.*

1. *Central.* (Radiant in center of figure.)
2. *Ovoid.* (Radiant in axis but not central.)
3. *Excentric.* (Radiant not in an axis.)

II. *Axial Symmetry.*

1. *Circular.* } (Corresponding points on the same
2. *Elliptic.* } perpendicular through axis.)
3. *Oval.* (Corresponding points not on the same perpendicular.)

III. *Plane Symmetry.*

1. Triplanar.
2. Biplanar.
3. Bilateral.

Unsymmetrical forms may be regular; and such may be represented by simple mathematical formulæ.

The study of form relations may appropriately include the graphs of analytical expressions, and the forms of physical phenomena—such as interference patterns; vortex forms of liquids, etc. These last often present close and suggestive analogies with biological forms.

The various kinds of symmetry and regularity were illustrated by lantern projections of forms selected from graphs of mathematical expressions, from physics, from crystallography and from botany and zoology. Most of these last were taken from Haeckel's beautiful 'Kunst-formen der Natur.'

Before reading his paper, Sir George Darwin presented to the society a medallion of Franklin made by Josiah Wedgewood, Sir George's grandfather.

*Executive Session—12:30 P.M.*

*Stated Business*—Candidates for membership were balloted for, and the following were elected as members of the society:

RESIDENTS OF THE UNITED STATES.

Hon. Joseph Hodges Choate, LL.D., D.C.L. (Oxon), New York.
Henry Herbert Donaldson, Ph.D., Philadelphia.
Russell Duane, Philadelphia.
David Linn Edsall, M.D., Philadelphia.
John W. Harshberger, Ph.D., Philadelphia.
Charles S. Hastings, Ph.D., New Haven, Conn.
William Francis Hillebrand, Ph.D. (Heidelberg), Washington.
Charles Rockwell Lanman, LL.D., Cambridge, Mass.
Franklin Paine Mall, M.D., LL.D., Baltimore.
Ernest Fox Nichols, D.Sc., New York City.
Hon. Elihu Root, LL.D., Washington.
Thomas Day Seymour, LL.D., New Haven, Conn.
Edward Bradford Titchener, M.A. (Oxford), Ph.D. (Leipsic), Ithaca, New York.
Otto Hilgard Tittmann, Washington.
Arthur Gordon Webster, Ph.D. (Berlin), Worcester, Mass.

FOREIGN RESIDENTS.

Adolf Engler, Ph.D., Berlin.
Dr. Hendrik Antoon Lorentz, Leyden, Holland.
Dmitri Ivanovitch Mendeleff, St. Petersburg.
Theodor Nöldeke, Ph.D., Strassburg.
August Weismann, Freiburg.

*Afternoon Session—2 o'clock.*

*The Present Position of the Problem Concerning the First Principles of Scientific Theory:* Professor JOSIAH ROYCE, of Cambridge, Mass.

*The Human Harvest:* President DAVID STARR JORDAN, of Stanford University, Cal.

*On Positive and Negative Electrons:* Professor H. A. LORENTZ, of Amsterdam.

*The Elimination of Velocity-Head in the Measurements of Pressures in a Fluid Stream:* Professor FRANCIS E. NIPHER, of St. Louis.

Experiments made on a railway train with a Pitot tube show that when the wind blows across the mouth of the tube, the rarefaction produced is greater than the compression when the mouth is directed towards the wind. When the mouth is directed at an angle of 60° with the wind, there is neither compression nor rarefaction. When thus set, a Pitot tube will respond to the actual pressure in a pipe carrying a fluid stream. Velocity effects are eliminated. An improved form of the disk collector previously described by the author was also described and the two collectors shown were presented to the society. This collector also eliminates velocity effects.

*Old Weather Records and Franklin as a Meteorologist:* Professor CLEVELAND ABBE, of Washington.

This paper emphasizes the fact that some of our earliest weather records are due to the influence of Benjamin Franklin, and that he himself must be recognized as the first of American meteorologists. From boyhood he distrusted the supernatural and the superstitious explanations of natural phenomena. The animus of his whole life was a searching study of the motives of men and the forces of nature. His meteorological work began with a daily record and accompanying explanatory notes. He entertained every plausible hypothesis and tested it by experiment, logic and analogy. His study of the lightning and thunder-storm by experimental methods, and his study of northeast storms by the collection of reports from all parts of the country (equivalent to the modern graphic daily weather map) were but a fraction of his many studies of the atmosphere.

The paper collects together some published and unpublished items illustrative of the great variety of work that Franklin did bearing on meteorology, closing with his study of the cold winter of 1783–4 in Europe, and the prediction (which was perfectly well verified) of the cold winter of 1786–7 in Pennsylvania and New England. This last effort, based on sound physics and logic, entitles him to be recognized as the first long-range forecaster whose methods were in complete harmony with the present state of physical science.

*Was Lewis Evans or Benjamin Franklin the First to recognize that our Northeast Storms come from the Southwest?* Professor WILLIAM MORRIS DAVIS, of Cambridge, Mass.

In 1747 Lewis Evans, of Philadelphia, prepared a description of the 'Middle British Colonies in America,' illustrated by a map, on which, among other explanatory legends, the following statement occurs: 'All our great storms begin to leeward; thus a NE storm shall be a day sooner in Virginia than in Boston.' This brief statement has been taken to be the earliest recognition, as it certainly is the first published statement, of the progressive movement of storms, on which the modern art of weather prediction so largely depends. A second edition of the essay and map was published in 1755; and as more topographical material had then been collected, the statement concerning storms above quoted was omitted. Evans's publishers were Franklin and Hare, and there is good reason for thinking that it was Franklin and not Evans who supplied the statement on the map about storms, along with some account of lightning and electricity; subjects which Evans does not treat elsewhere,

but which were just then much in Franklin's mind. A reference to the letters in Sparks's 'Life of Franklin' leaves no doubt on this point. It there appears that in 1747 Franklin wrote:

> We have frequently along the North American coast storms from the northeast, which blow violently sometimes three or four days. Of these I have had a very singular opinion for some years, *viz:* that, though the course of the wind is from northeast to southewest, yet the course of the storm is from southewest to northeast; the air is in violent motion in Virginia before it moves in Connecticut, and in Connecticut before it moves at Cape Sable.

It appears from the evidence of later letters that Franklin's first attention was called to this matter in connection with attempted observations on an eclipse of the moon which occurred in 1743, and which he failed to see because of the clouds of a northeast storm, yet which was seen by his brother in Boston, where the storm began somewhat later. From this simple hint Franklin followed up the matter with his customary acuteness, and established the point to his satisfaction. He seems to have added the statement to Evans's map with no claim whatever for recognition of his discovery; and to have allowed its erasure on the second edition of the map without remonstrance. Generous as he thus showed himself to the point of indifference, it is still fitting that we at this time should take pains to give credit where credit is due. Yet even if the source of the temporary item about storms is transferred to Franklin, the memory of Evans as a geographer need not suffer, for his descriptions of the 'Middle British Colonies' are really admirable, and show great power of observation and generalization.

*Notes on the Production of Optical Planes of Large Dimensions:* Dr. JOHN A. BRASHEAR, of Allegheny, Pa.

*A New Mountain Observatory:* Professor GEORGE E. HALE, Pasadena, Cal.

*Evening Session—8 o'clock, at Witherspoon Hall.*

*Franklin's Researches in Electricity:* Professor EDWARD L. NICHOLS, Ph.D., of Ithaca.

In the life of Franklin electricity was merely an episode. He was forty years of age at the time when the news of the discovery of the Leyden jar reached America and he appears to have taken up the subject as an amusement or hobby. That Franklin, whose investigations were all performed within a few years, should have become the foremost electrician of his time was extraordinary. The success of his 'Letters on Electricity,' which were translated into all the languages of Europe, was doubtless due in great part to the epigrammatic terseness, the clearness and simplicity of style, the naïve frankness and inimitable humor which characterize them.

Franklin's experimental achievements were confined chiefly to his observations on the powers of pointed conductors to discharge electrified bodies, his studies of the Leyden jar and his determinations of the character of the electrification of thunder clouds. In spite of his strongly utilitarian bent and his fondness for invention he was able to find in the field of electricity no application which could be of use to mankind. It is true that he invented the lightning rod, but this was a device for the protection of man from injury and not for the utilization of electricity.

That Benjamin Franklin should be the author of the one theory of electricity which, of all the views entertained on this subject by the men of his time, comes nearest to our twentieth century idea may seem strange, for electricity was with him merely a form of intellectual diversion into which he was drawn by accident in middle

life and which he soon abandoned for other and, as it seemed to him, more practical things. We need not, however, be astonished that he left his impress upon the science of his time. A man who in the middle of the eighteenth century rejected the doctrine of action at a distance and insisted upon the necessity of a universal medium pervading all space, and who, at the very zenith of Newton's fame, repudiated the corpuscular theory and thought of light as transmitted by a vibratory motion, must be recognized as possessing a native endowment unequaled by any of the intellects of his day.

*The Modern Theories of Electricity and their Relation to the Franklinian Theory:* Professor Ernest Rutherford, F.R.S., of Montreal.

Of the four days' celebration, one morning, that of Thursday, April 19, was given over to the University of Pennsylvania. It devoted that time to making the celebration memorable by the bestowing of honorary degrees upon distinguished men, Europeans as well as Americans. Dr. Hampton L. Carson, '71 C., '74 L., '06 LL.D., attorney-general of the commonwealth of Pennsylvania, made the oration of the day. After the academic procession had entered, the prayer was read by Rev. Dr. Alexander Mackay-Smith, Episcopal Bishop-Coadjutor of the Diocese of Pennsylvania. 'Alma Mater' was then sung, and the class of 1906 college presented a memorial tablet to Franklin, which will be placed on the walls of the Houston Club. It was presented through A. R. Ludlow, president of the class, and received by Vice-provost Edgar F. Smith, '99 Sc.D., '06 LL.D., in behalf of the university and the Houston Club. 'Ben Franklin' was sung, and then the honorary degrees were conferred. Provost Charles Custis Harrison, '62 C., made the presentation orations, and bestowed the degrees, Dr. Wharton Sinkler, '68 M., announcing the names of the recipients and escorting them, with Samuel F. Houston, '87 C., Joseph B. Townsend, Jr., '82 C., and George H. Frazier, '87 C., all of the board of trustees, as aides, to the provost. Vice-provost Smith was the first to receive his degree, doctor of laws. The provost's presentations of the degrees, with the degrees received, follow, in the order of presentation:

Edgar F. Smith—President of the American Philosophical Society. Worthy successor of Franklin, Rittenhouse, Jefferson, Bache. Eminent chemist; distinguished for his original work upon electrolysis. Vice-provost of the University of Pennsylvania. Humane. Beloved of God and men.—LL.D.

William Berryman Scott—Interpreter of world changes. Historian of the rocks and of past forms of life. Traveler over many lands, without the aid of the physicist; at times, however, using him, but not in accord with him. Lineal descendant of Franklin, and agreeing with him that sense is preferable to sound. Distinguished professor of geology and paleontology at Princeton University.—LL.D.

Edward Charles Pickering—Professor of astronomy and director of the Harvard College Observatory. 'It was on no earthly shore his soul beheld the vision,' but with reverent observation the stars in their courses have been, through him, a light to us from pole to pole. Student of the relation of stellar distance to the intensity of illumination. Distinguished founder of the first physical laboratory in America.—LL.D.

Hugo de Vries—King of the plant world. Foremost investigator. Research contributor to the knowledge of the physiology, heredity and cross-breeding of the vegetable kingdom. Distinguished also for his publications and reputation over two continents upon species variation. Professor of plant anatomy and physiology at the University of Amsterdam.—LL.D.

Albert A. Michelson—Head professor of physics in the University of Chicago. To be to-day considered the foremost physicist in the United States. Noted especially for his mathematical and experimental contributions upon the nature and properties of light.—LL.D.

Ernest Rutherford—McDonald professor of physics at McGill University, Montreal. First of

the physicists of Canada. Doubtless the leading authority in the world upon radioactivity, the latest and most important development in physical science.—LL.D.

EDWARD LEAMINGTON NICHOLS—Especially noted for his investigations on radiation and upon matter at low temperature. His researches have shed light upon the strange property of certain substances to become self-luminous by day or by night. Professor of physics at Cornell University.—LL.D.

WILLIAM KEITH BROOKS—Distinguished for his biological exploration of our Atlantic coast and of the West Indies; for the depth of his contributions to marine zoology; for his permanent studies in heredity and evolution and for his classical and philosophical essays thereon. Professor of zoology at the Johns Hopkins University.—LL.D.

WILLIAM PATERSON PATERSON—Professor of divinity in Edinburgh University and sometime professor of systematic theology at Aberdeen. Welcome to the privileges of a son of the University of Pennsylvania. From Aberdeen came Pennsylvania's first provost; from Edinburgh, our medical school—whose emblem has always been the thistle. Sincere teacher of the knowledge of things divine; comprehended briefly in that undying question: 'What does the Lord require but to do justly and to love mercy and to walk humbly.'—LL.D.

HENDRIK ANTOON LORENTZ—Facile princeps amongst the physicists of Holland, and peer of any of his scientific associates upon the continent of Europe. Noted especially for his work on mathematical physics and upon the 'electron theory.' Professor of mathematical physics in the University of Leiden.—LL.D.

ALOIS BRANDL—Professor of philology in the University of Berlin. Representative of the Batavian Society for experimental philosophy, a society of which Benjamin Franklin himself was a member. Shakespearean scholar. Student of 'the nature and history of man as disclosed by speech.' His personality as charming as his scholarship.—LL.D.

SIR GEORGE HOWARD DARWIN—Distinguished son of an illustrious father. Astronomer and mathematician. Plumian professor of astronomy and experimental philosophy at the University of Cambridge, England. Student of the effects of tidal friction upon the earth and moon. The name and fame of father and son will endure until 'Tideless sleep the seas of time!'—LL.D.

WILLIAM P. HENSZEY—Theoretical and practical engineer. Notable for his contributions to civilization, through his scientific work in the evolution of the modern American locomotive. Of great judgment and foresight in the solution of difficult mechanical problems. Through his efforts all the world becomes akin.—Sc.D.

JAMES GAYLEY—Noted for his contributions to the advancement of the science of analytical chemistry. Metallurgist. Combining in himself, in the highest degree, the rare qualities of scientific knowledge, and the power of transmuting this knowledge into practical results. Distinguished alumnus and trustee of Lafayette College.—LL.D.

HAMPTON L. CARSON—Able student. Master of legal, historical, constitutional and political science. Great power of orderly massing of facts. Attorney-General of the commonwealth of Pennsylvania. Loyal and devoted son of the University of Pennsylvania.—LL.D.

JOHN WILLIAM MALLET—Distinguished chemist of the University of Virginia, founded by Thomas Jefferson, one time president of the American Philosophical Society. Happy coincidence of the meeting of the chief chemist of the university founded by Jefferson and of the chief chemist of the university founded by Franklin—truly notable ancestors. His hitherto activity as chemist upon the scene of war has been devoted to the more faithful application of his great energy in the ways of peace.—LL.D.

*In Absentia*—GUGLIELMO MARCONI—Investigator, theoretical engineer, inventor. Born under the shadow of that ancient university, Bologna, in the land where dwells the Eternal City. Postmaster-general for thousands who 'go down upon the sea in ships,' and soon for the world.—LL.D.

SAMUEL DICKSON—Chancellor of the Law Association of Philadelphia. Learned in the law. Fit successor of Tilghman, Rawle, Ingersoll, Hopkinson and Sergeant—all college graduates, as he, of the University of Pennsylvania. Independent thinker.—LL.D.

ANDREW CARNEGIE—Lord Rector of the University of St. Andrews. Thou hast sought and thou hast found; thou hast knocked and it hath been opened unto thee; thou hast given of what thou hast received. World benefactor.—LL.D.

EDWARD VII.—King, Defender of the Faith, Emperor of India—Represented by the person of his Ambassador [Sir Henry Mortimer Durand, '05, LL.D,].—LL.D.

At the Court of St. James's, upon the twelfth day of August, 1763, His Majesty King George II. being present at the King's Most Excellent

Majesty in Council, it was ordered that the Right Honorable the Lord High Chancellor of Great Britain do cause Letters Patent to be prepared and passed under the Great Seal, authorizing the first provost, William Smith, to collect funds from all well-disposed persons for the assistance and benefit of the College, Academy and Charitable School in Philadelphia; and upon the ninth day of April, 1764, the Archbishop of Canterbury, together with Thomas and Richard Penn, addressed a joint letter to the trustees of the college, congratulating them upon the great success which had attended the efforts of the first provost, through His Majesty's Royal Brief.

The trustees of the University of Pennsylvania —the successors of the trustees of the same foundation—bearing in mind the interest which His Majesty, the then King of England, so graciously showed in the infant Institution in the Colony of Pennsylvania, now confer upon His Majesty, Edward VII., impersonating England, the highest degree in their power to bestow.

This royal throne of kings, this sceptred isle,
This earth of majesty, this seat of Mars;
This other Eden, demi-paradise;
This fortress, built by nature for herself,
Against infection, and the hand of war;
This happy breed of men, this little world;
This precious stone set in the silver sea,
Which serves it in the office of a wall,
Or, as a moat defensive to a house,
Against the envy of less happier lands;
This blessed plot, this earth, this realm, this England.

Then followed the address of Dr. Carson, which we have not space to print. It had to do not only with Franklin's achievements, but with that of all the noteworthy sons of Pennsylvania from his day to ours. 'Hail Pennsylvania' was sung, the benediction was pronounced, and Pennsylvania's official celebration of its founder was at an end.

In the absence of J. Hartley Merrick, '90 C., secretary of the board of trustees, Louis C. Madeira, '72 C., was master of ceremonies. Henry Budd, '68 C., was chief marshal, and the associate marshals were William H. Klapp, '76 M., '86 A.M.; Theodore M. Etting, '65 C., '79 L.; J. Willis Martin, '79 C.; H. S. Prentiss Nichols, '79 C.; H. Laussatt Geyelin, '77 C., '79 L.; Walter E. Rex, '75 L.; J. Wilks O'Neill, '77 C.; Ewing Jordan, '68 C., '71 M.; J. Somers Smith, Jr., '87 C.; Henry R. Wharton, '73 C., '76 M.; John H. Packard, '50 C., '53 M.; Frank M. Riter, '78 L.; William J. Taylor, '82 M.; John Douglass Brown, '79 C., '81 L.; Bernard Gilpin, '75 C., '78 L.; Charles Claxton, '79 C., '82 M.; William S. Wadsworth, '97 M.; Frank P. Prichard, '74 L.; Edward L. Duer, '60 M.; Charles F. Gummey, '84 C., '88 L.; William S. Ashbrook, '87 C.; and George M. Coates, '94 C., '97 M.

AT CHRIST CHURCH BURYING-GROUND, FIFTH AND ARCH STREETS, 4 P.M.

Ceremonies at the grave of Franklin under the auspices of the Grand Lodge of F. & A. M. of Pennsylvania. The delegates and members assembled in the hall of the society, on Independence Square, at 4 o'clock and proceeded to the grave of Franklin.

In honor of the occasion, the following organizations paraded to the grave:

The First Troop of the Philadelphia City Cavalry.
A battalion of United States Marines.
A battalion of United States Sailors.
The First Regiment of Infantry of the National Guard of Pennsylvania.
The Veteran Corps of the same regiment;
A provisional battalion of 800 United States Postmen.
The Veteran Firemen's Association.
A deputation from the Grand Lodge of Free and Accepted Masons of Pennsylvania.

The parade was under the charge of Col. Benjamin C. Tilghman, as grand marshal, and Major George E. Kemp, Major Charles T. Creswell and First Lieutenant Henry Norris as aides.

The parade formed on the west side of Broad Street, facing east, the right of the line being opposite the Masonic Temple,

and moved at 4 P.M. over the following route:

South on Broad to Market, passing to the east of the City Hall, east on Market to Twelfth, south on Twelfth to Chestnut, east on Chestnut to Fifth, north on Fifth to Arch, east on Arch to Fourth.

When the head of the column arrived at Fourth and Arch, the column halted and was formed to the right.

Wreaths were then placed on the grave of Franklin—

On behalf of the nation, by the President of the United States, through his specially appointed representative, Commander R. McN. Winslow, U.S.N.

On behalf of the state of Pennsylvania, by the governor of the state, through his specially appointed representative, Mr. Bromley Wharton, private secretary.

On behalf of the American Philosophical Society, by its president, Dr. Edgar F. Smith.

On behalf of the University of Pennsylvania, by Provost Charles C. Harrison.

On behalf of the Library Company of Philadelphia, by its presiding director, Mr. Edwin S. Buckley.

On behalf of the Pennsylvania Hospital, by its president, Mr. Benjamin H. Shoemaker.

On behalf of the Philadelphia Contributionship for the Insurance on Lives by Loss from Fire, by Mr. J. Rodman Paul, acting president.

On behalf of the Grand Lodge of Free and Accepted Masons of Pennsylvania, by the Right Worshipful Grand Master, George W. Kendrick, Jr.

On behalf of the Königliche Gesellschaft der Wissenschaften zu Göttingen, by its delegate, Dr. Emil Wiechert.

On behalf of the Königliche Preussische Akademie der Wissenschaften (Berlin), by its delegate, Dr. Alois Brandl.

On behalf of the Manchester Geographical Society, by its delegate, J. U. Brower.

A wreath was also deposited in the name of the Pennsylvania Society of the Daughters of the Revolution.

As the wreaths were placed upon the grave, a national salute was fired by the U. S. battle-ship *Pennsylvania,* anchored at the foot of Arch Street, and the troops in line presented arms, and the unarmed bodies in line uncovered.

Brief addresses were then made under the direction of the Grand Lodge of Pennsylvania, as follows:

Invocation, by Frank B. Lynch, D.D.
Franklin in Masonry, by George W. Kendrick, Jr.
Franklin as a Free Mason, by James W. Brown.
Franklin as a Diplomatist, by John L. Kinsey.
Franklin as a Scientist, by Peter Boyd.
Benediction, by Robert Hunter, D.D.

At the conclusion of the ceremonies, the parade again formed in column and the march was resumed south on Fourth Street to Walnut, and then west on Walnut to Broad Street, where the parade was dismissed.

At nine in the evening a general reception was given by the society to its friends and to the visiting delegates, at the Bellevue-Stratford.

FRIDAY, APRIL 20, AT THE AMERICAN ACADEMY OF MUSIC, 11 A.M.

The delegates, invited guests and members met in the foyer of the academy at 10:45 A.M. and proceeded in a body to occupy the seats assigned them.

*Addresses in Commemoration of Benjamin Franklin:*

'As Citizen and Philanthropist,' by Horace Howard Furness, Litt.D. (Cantab.).

'As Printer and Philosopher,' by President Charles William Eliot, LL.D.

'As Statesman and Diplomatist,' by the Hon. Joseph Hodges Choate, LL.D., D.C.L.

*Presentation of the Franklin Medal to the Republic of France* (in accordance with the Act of Congress), by the Honorable Elihu Root, Secretary of State (by direction of the President).

*Reception of the Medal,* by His Excellency, M. J. J. Jusserand, the French ambassador.

IN THE HALL OF THE SOCIETY ON INDEPENDENCE SQUARE.

*Meeting for the Reading of Papers on Subjects of Science, 3 P.M.*

*Repetition and Variation in Poetic Structure:* Professor FRANCIS BARTON GUMMERE, of Haverford, Pa.

The primitive form of poetry everywhere is verbal repetition in exact rhythm. The complicated forms of verse spring from this exact repetition by means of variation, which in some cases, notably the Anglo-Saxon, achieves a permanent and dominant principle. Curious survivals occur even in Shakspere. Other forms of poetry, however, move towards the freedom of prose.

*The Herodotean Prototype of Esther and Sheherazade:* Professor Paul Haupt, of Baltimore, Md.

In the ninth edition of the 'Encyclopædia Britannica,' Vol. XXIII., pp. 316–318, De Gœje showed that Sheherazade was identical with Esther. There is, however, one difference: Sheherazade is determined to save the daughters of her people at the risk of her life; her father tries in vain to dissuade her. Esther, on the other hand, hesitates; but her foster-father urges her to risk her life to save her people. The exchange of messages (Est. IV., 5–17) between Esther and her foster-father, which led to the execution of Haman, bears a striking resemblance to the exchange of messages between Phædymia and her father Otanes, as related by Herodotus (III., 68), which led to the assassination of Pseudo-Smerdis.

Just as the stories in the 'Arabian Nights' are accommodated to a framework, so Herodotus's history of Xerxes's invasion of Greece is but the framework for a vast mass of legendary, antiquarian and ethnological lore. The stories in the 'Arabian Nights' may be classified in three categories: fables, fairy-tales and anecdotes. The fables are ultimately Babylonian; the fairy-tales, Persian; and the anecdotes, Arabic. Some of the tales are evidently transformed myths.

The story of the antagonism between Haman and Vashti, on the one hand, and Mordecai and Esther, on the other, may ultimately be a nature-myth reflecting the victory of the deities of spring over the frost-giants of winter.

*Heredity and Variation, Logical and Biological:* Professor Wm. Keith Brooks, of Baltimore.

*Notes on a Collection of Fossil Mammals from Natal:* Professor William B. Scott, of Princeton.

The director of the Natal Geological Survey, William Anderson, Esq., has sent me for examination and report a series of mammalian bones, which were collected by him on the coast of Zululand, South Africa. Concerning the mode of occurrence of these fossils, Mr. Anderson writes me as follows:

> The fossils were scattered over a large outcrop of shales, which occurs below the level of ordinary low-water marks, and is only exposed under the exceptional circumstances of a strong southeasterly gale and a neaptide, when the large covering of sand is removed. Overlying this bed are a series of shales with a few scattered bones, and crustacean and fish remains. Above these a thin layer containing foraminifera and then a foot or so containing marine mollusca, which Mr. Etheridge referred to the Tertiary period; above this a thick series (probably over 100 feet) of false-bedded sands of various colors covered by the recent sand dunes.

So far, I have been able to make only a cursory examination of these fossils, which were much injured by their long journey and are still in the preparator's hands. They are heavy, dark in color and more or less completely mineralized. In character, the mammals are specifically South African and appear to represent a late Pliocene fauna. The species seem to be all different from those now living, though referable to recent genera. The list includes an elephant nearly allied to the modern species, a hippopotamus of very large size, a buffalo (*Bubalus*) and two or three antelopes. In addition to these mammals, the collection contains several fish and a very large crocodilian vertebra.

Interesting as these fossils are from many points of view, they are disappointing in that they throw little light upon the problems of faunal origins and migrations in the southern hemisphere.

*The Use of Dilute Solutions of Sulphuric Acid as a Fungicide:* Professor HENRY KRAEMER, of Philadelphia.

It is stated by Bloxam that finely divided sulphur is gradually oxidized and converted into sulphuric acid when exposed to moist air. It is well known that sublimed sulphur contains a certain amount of sulphuric acid. Not only is this true, but it is claimed that if the sublimed sulphur be not dried after washing it to free it of acid, sulphuric acid is again formed. Furthermore, it has been pointed out by Polacci that sulphur when mixed with the soil is changed directly into sulphuric acid.

As a fungicide and insecticide, sulphur is applied directly in the powdered form, or it is applied in the form of a paste to the heating pipes in greenhouses, or it is gently heated on a sand bath, when it is sublimed and distributed over the plants in a finely divided state.

The fact that sulphur is used in the several ways indicated led to the question as to whether sulphuric acid is not produced under these conditions and as to whether it is not the active agent, destroying the fungus but not injuring the host.

Experiments were first carried on to determine what compounds are formed when sulphur is slowly heated. An apparatus was constructed for heating the sulphur and collecting the gases formed, and it was found that when sulphur is slowly vaporized with access of air that as much as fifteen per cent. of the vaporized sulphur may be converted immediately into sulphuric acid, little or no sulphurous acid resulting.

It being thus pretty well established that sulphuric acid is formed under the conditions in which sulphur is used in greenhouses, another series of experiments was carried on to determine the strength of solution which would not be toxic to the host plant. It was found that practically under all conditions, including variation in temperature and susceptibility of different plants to the action of the acid, a solution containing approximately one part of sulphuric acid to 1,000 parts of water could be used as a spray without any injury to the plants. The solution is best applied late in the afternoon after first sprinkling the plants with water.

The efficiency of dilute sulphuric acid as a fungicide has been shown by applying it to roses which were badly affected with mildew. Plants growing outdoors as well as in the greenhouse have been treated successfully. The roses were uninjured by the acid solution and they immediately began to develop new leaves and young shoots entirely free from mildew after three to six applications on alternate days. The acid solution seems to exert a beneficial action on the plants apart from the fungicidal action.

Should subsequent experiments confirm these observations, the use of sulphuric acid will have certain advantages over the use of sulphur, as it does not discolor the foliage as sulphur does, its employment is more easily controlled, and it does not have the odor of the other compounds associated with sulphur.

*Franklin and the Germans:* Professor M. D. LEARNED, of Philadelphia.

While Franklin's importance as a cultural mediator between the German and English colonists in America has never been clearly recognized by the English, the Germans have given the highest praise to his services and perpetuated his name, rather than that of their most cherished

German names, in the first German college of the colonial time, Franklin Academy, founded at Lancaster in 1787.

Franklin had a large share in the printing of German works for the Germans in the Colonies, having been second only to Bradford and a close competitor of Christoph Saur. So German did his firm, Benjamin Franklin and Johann Böhn, become that his name was written Fränklin in the German fashion. Franklin's attitude toward the Colonial Germans finds various expression in his works. The earliest of these utterances is found in his *Plain Truth* (1747), where he calls them the ' brave and steady Germans.' In 1751 he comes out strongly against the upper Germans, calling them ' the Palatine Boors ' and classifying them among the ' tawny ' races. Again in 1753 he deplores their disrespect for their ministers and teachers and their unwillingness to become ' anglified,' or to adopt the English language, and their indifference in siding with the English colonists against the French, although he commends them for their industry and frugality. Franklin's relations with the continental Germans are illustrated by the honors he received at the University of Göttingen (1766) by the clever Jeu d'esprit of 1777, the 'Dialogue between Britain, France, Spain, Holland, Saxony and America,' and the letter ' From the Count de Schaumbergh to Baron Hohendorf,' etc., the latter being an interesting companion piece to Schiller's ' Kabale und Liebe.'

Another interesting illustration of Franklin's influence in Germany is found in a batch of some eighty unpublished German letters directed to him by Germans of all sorts advocating schemes and soliciting information and aid. These letters are soon to be published by the writer of this paper. The first tribute to Franklin, perhaps in any language, is that given by Herder, the great friend of Goethe at Weimar, in his 'Letters for the Furtherance of Humanity': 'The mind devoted to the true and useful, the teacher of mankind, the director of a great society of men.'

*The Use of High-explosive Projectiles:* Professor Charles E. Munroe, of Washington.

In 1885, the author discussed in Van Nostrand's *Engineering Magazine* various experiments made in testing the use of high explosives in projectiles, and in conclusion stated the conditions essential for efficiency. He has now reviewed the experiences of the intervening years and finds his conclusions of 1885 fully confirmed.

*Ammoniacal Gas Liquors:* Professor Charles E. Munroe, of Washington.

In preparing a report on the gas industry of the United States for the census of 1905 it was found that manufacturers gave the strength of the ammoniacal liquors in a great variety of units, such as degrees Twaddell, per cents. of $NH^3$ or ammonium sulphate and ' ounce strength,' the latter being the favorite. In an investigation looking toward finding a means of reducing these to a common basis it was found that 'ounce strength' as used in the United States has a different meaning from what it has abroad, for in adopting this method of measurement here it has been applied to the United States gallon instead of the Imperial gallon, for which it was devised. This tends to explain the apparent difference in the yields from coals in the United States as compared with European coals.

*Chromosomes in the Spermatogenesis of the Hemiptera Heteroptera:* Professor Thos. H. Montgomery, Jr., of Austin, Texas.

The spermatogenesis of forty species of this group was described in detail, with especial regard to the history of the

chromosomes. Chromosomes are classified into the following kinds: *autosomes,* the unmodified chromosomes, and *allosomes,* the modified chromosomes. Of the latter, two kinds may be distinguished in the Hemiptera: *diplosomes,* those that occur in pairs in the spermatogonia, and *monosomes,* those that occur single there. The diplosomes may conjugate in the synapsis stage and divide in the first maturation mitosis reductionally, in the second equationally, as previously described by the writer ; or they may divide in the reverse order with a conjugation in the second spermatocytes, as described by Wilson. Both kinds may occur in the same cell. The monosomes usually divide equationally in the first maturation division and do not divide in the second; more rarely they divide in the reverse order; in one species the monosome does not divide in either of these mitoses. The same species may have two kinds of monosomes as well as diplosomes. In 1901 the writer proved that the chromosomes occur in pairs in the spermatogonia, that of each pair one element is of paternal and one of maternal origin, and that in the synapsis stage is accomplished a conjugation of maternal with paternal elements. Here a still greater series of evidence is brought in support of this contention, showing that for almost all the species examined the determination of the pairs in the spermatogonia is facile; and further, evidence is now brought that the two chromosomes of a pair are not exactly similar in volume, but apparently constantly slightly different in this respect, sometimes also in form, so that it is possible to distinguish which is the paternal and which the maternal element. The sum total of the chromosomes of a cell, that is, of the chromatin and linin, must be regarded as forming a single nuclear element, of which the chromosomes, though they undoubtedly preserve their individuality, are only subdivisions; a particular chromosome represents a particular set of hereditable energies, the sum total of them all the energies of one individual, that is to say, the sum total of them when in the reduced number. This state of division of labor may be termed chromosome differentiation. In the Hemiptera there is given the possibility of following the behavior of any single chromosome through a great series of cell generations, as well as of deciding whether it be paternal or maternal, which brings us nearer the analysis of the hereditable substance than has been possible heretofore.

A banquet at the Bellevue-Stratford on Friday evening was the closing feature of a most memorable occasion.

## *SCIENTIFIC JOURNALS AND ARTICLES.*

DR. E. W. TAYLOR contributes to the June issue of the *Journal of Nervous and Mental Disease* an article on the clinical course and pathological anatomy of multiple sclerosis, illustrated by twelve complete case reports and a number of cuts showing the microscopical findings. He reaches the following conclusions: (1) The rarity of the disease in this country has been over-estimated. A more careful examination of atypical cases and a more open mind in diagnosis is desirable. (2) The importance of observing and properly estimating minor symptoms of the disease, particularly unexplained spasticity and ocular disorders, must be emphasized. (3) The etiology remains obscure. The pathological anatomy is still a hopeful field for study. Present evidence points towards a primary destruction of the myeline with either a secondary or coincident proliferation of the neuroglia. An exhaustive bibliography of the subject for the years since 1903 is appended. Dr. G. A. Moleen reports an interesting case of subcortical cerebral gumma, accurately localized in the comatose state, and Dr. Alfred Gordon follows with a brief contribution to the study of the 'paradoxic reflex.'