SCIENCE

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CONTENTS:

The Early Presidents of the American Association, I. (with plate): DR. MARCUS BENJAMIN...... 625
The History of the Beginnings of the Science of Prehistoric Anthropology, II: DR. THOMAS WILSON...... 637
A New Form of Pseudoscope: PROFESSOR R. W. WOOD...... 648
The Subdivision of Genera: PROFESSOR E. W. HILGARD...... 649
The Card Index of Experiment Station Publications: DR. A. C. TRUE...... 650
Scientific Books:—
West Virginia Geological Survey: PROFESSOR JOHN J. STEVENSON. *Grassman's Introduction à la géometrie différentielle:* PROFESSOR E. O. LOVETT. *Woodhull's Chemical Experiments; Smith's Laboratory Outline of General Chemistry:* PROFESSOR W. A. NOYES. *General. Books Received*...... 652
Scientific Journals and Articles...... 655
Societies and Academies:—
Biological Society of Washington: DR. O. F. COOK. *Section of Anthropology and Psychology of the New York Academy of Sciences:* PROFESSOR CHARLES H. JUDD...... 656
Discussion and Correspondence:—
Recent Work on Coccidæ: C. L. MARLATT...... 657
The American Physical Society: W. H...... 660
Scientific Notes and News...... 660
University and Educational News...... 663

MSS. intended for publication and books, etc., intended for review should be sent to the responsible editor, Professor J. McKeen Cattell, Garrison-on-Hudson, N. Y.

*THE EARLY PRESIDENTS OF THE AMERICAN ASSOCIATION.**

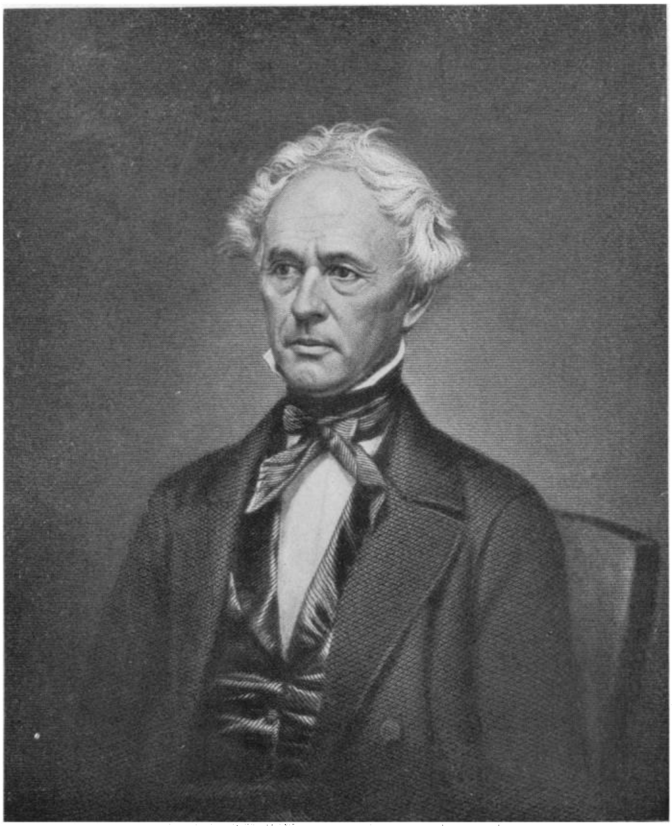
I.

FOR a second time in its history the Section on Social and Economic Science in the American Association for the Advancement of Science has chosen for its presiding officer one whose early training was that of a chemist. It had been my hope to present before you an address that should treat of certain phases of the development of industrial chemistry in the United States. The suggestion, however, made at the midwinter meeting in New York by Professor Putnam, that I prepare an account of the early history of the Association, appealed to me so strongly that I was very glad to yield to the wishes of the Council, who promptly accepted the recommendation of our distinguished President, and, therefore, I have the honor of addressing you on The Early Presidents of the American Association.

HISTORY.

The American Association for the Advancement of Science came into formal existence in the city of Philadelphia, on September 20, 1848. The prevalent fondness for genealogical research affords us an ex-

*Address of the Vice-President and Chairman of Section H—Anthropology—of the American Association for the Advancement of Science, Columbus, August 21, 1899.



WILLIAM C. REDFIELD.

cellent excuse for a brief discussion of its ancestry.*

For a century preceding the existence of our Association, Philadelphia had held foremost rank as a scientific center. It was in that city as early as 1743 that Benjamin Franklin, America's first great scientist, had made futile effort to form a society "of *virtuosi* or ingenious men residing in the different colonies to be called the American Philosophical Society." † That society, however, as is well known, did organize in 1769, and still survives, the oldest of scientific societies in the United States. An interesting evidence of the fact that Philadelphia was a Mecca to scientific men is the statement that Priestley, on his arrival in New York in June, 1794, declined to give a course of lectures in that city, and proceeded at once to Philadelphia, where he received a complimentary address from the American Philosophical Society.‡

In the early dawn of the new century came that wonderful development of science in New Haven, brought about by the influence of the elder Silliman, who, by the way, first studied chemistry in Philadelphia under James Woodhouse. In the year 1819, in the philosophical room of Yale College, there was organized the American Geological Society, of which, according to G. Brown Goode, our Association 'is essentially a revival and continuation.'§ "Its members," says the same authority, "following European usage, appended to their names the symbols 'M.A.G.S.,' and among these were many distinguished men, for at that time almost every one who studied any other branch of science, cultivated geology also."* If we accept the American Geological Society as our ancestor, it gives the American Association rank as the fifth oldest scientific body in the United States.

As knowledge grew and education advanced, the desire for frequent intercourse among men of science increased more and more, and in the rooms of the Franklin Institute in Philadelphia, on April 2, 1840, there was organized the Association of American Geologists. This society, which two years later became the Association of American Geologists and Naturalists, is officially recognized as our progenitor, and the record of the eight meetings is given in the preliminary pages of our annual volume of proceedings. Of the founders of that Association the venerable Martin H. Boyé still survives,† and in New York City, Oliver P. Hubbard, who served as its secretary in 1844, remains to us a living witness of the mighty events that have occurred in the golden era of science.

It will not be out of place, I am sure, to mention the influence of the National Institution for the promotion of science on the formation of our Association. It was that Institution, which in April, 1844, brought together in Washington City the first National Congress of scientific men—the first cosmopolitan assemblage of the kind which in any respect foreshadowed the great congresses of the American Association in later years.‡

* In *The Chautauquan*, Vol. XIII., p. 727, September, 1891, there is a historical sketch of The American Association for the Advancement of Science, by the present author, which may be of some interest to the student of the history of American science.

† The Origin of the National Scientific and Educational Institutions of the United States, by G. Brown Goode. Annual Report of the American Historical Association for the year 1889. Washington, 1890, p. 54.

‡ The Development of Science in New York City, by Marcus Benjamin. Memorial History of the City of New York. New York, Vol. IV., p. 415.

§ Goode, op. cit., p. 112.

* Goode, op. cit., p. 112.

† The *Scientific American*, Vol. LXXIV., p. 430, for December 12, 1896, under the title of 'A Pioneer of Science,' gives an interesting account of Martin H. Boyé with a portrait.

‡ The First National Scientific Congress (Washington, April, 1844) and its connection with the organization of the American Association. Report U. S. National Museum, 1897 (in press).

This Institution, so successful that it was perhaps the most powerful "agency in setting in operation the influences which led to the establishment of the Smithsonian Institution, the National Observatory, the National Museum and the Department of Agriculture, and in later years, of the National Academy of Sciences," * yet so unsuccessful that "the Smithsonian fund, which it aspired to control, was placed under other authority; the collections and manuscripts of the United States Exploring Expeditions were removed from its custody; the magnificent collection in natural history, ethnology and geology, which had accumulated as a result of its wonderful activity and enthusiasm, soon became a burden and a source of danger," † was abandoned by its founders and supporters, and finally in 1861 went out of existence by the termination of its charter. Its remarkable history has been told by G. Brown Goode in a paper in which he showed its connection with the organization of our Association. In closing he said of the American Association:

> The new society was born, and it is significant that the name first adopted was as nearly as possible a combination of the names of the two societies. The one contributed the first half of the name, 'The American Association,' the other the second half—'for the Promotion of Science.' The word advancement in place of promotion was substituted afterwards. ‡

The history of the Association is a task that must be left for other, more competent members to present to you. To me has been assigned the duty of briefly reviewing the career of that brilliant galaxy of men who have been chosen by you to preside over the meetings of the American Association for the Advancement of Science.

* Idem.

† Idem.

‡ Goode, First National Scientific Congress.

REDFIELD.

William C Redfield "who was the first to suggest the idea of the American Association in its present comprehensive plan, and the first to preside over its deliberations,"* was born at Middletown, Conn., on March 26, 1789. As a boy he received only the simplest rudiments of education, and at the age of fourteen was apprenticed to a saddler. At that time he evinced a remarkable fondness for books, and, we are told, that "he was denied even a lamp for reading by night much of the time during his apprenticeship, and could command no better light than that of a common wood fire in the chimney corner."† Through the interest of Dr. William Tully, a learned and distinguished physician of Cromwell, Conn., he was accorded the privilege of that good doctor's library, and chose Sir Humphrey Davy's Elements of Chemistry with which to occupy his leisure moments. In returning the book he surprised its owner by showing a thorough acquaintance with its contents, and in particular with the doctrine of chemical equivalents, which, he said, he had then met with for the first time.

On the completion of his apprenticeship, early in 1810, he made a long journey on foot to Ohio, passing through New York and northern Ohio, when "the sites of Rochester and Cleveland were both dark and gloomy forests, and Buffalo was a mere hamlet."‡ He returned to New England in the following spring, choosing on this occasion a more southerly route, through parts of Virginia, Maryland and Pennsylvania. This journey deserves special mention because it

* Address on the Scientific Life and Labors of William C Redfield, A.M., first President for the American Association for the Advancement of Science, delivered before the Association at their annual meeting in Montreal, August 14, 1857. By Denison Olmsted, with an engraved portrait on steel. Cambridge, 1858, p. 3.

† Idem, p. 5.

‡ Idem, p. 7.

was from the observations made by him then that he was able later to advocate with such remarkable power the great superiority of railroads to canals, and also the plan of a system of railroads connecting the waters of the Hudson with those of the Mississippi. In a pamphlet, which he issued in 1829, he startled the community by the boldness of his project. He says, referring to the territory east of the Mississippi:

This great plateau will, indeed, one day be intersected by thousands of miles of railroad communications; and so rapid will be the increase of its population and resources, that many persons now living will probably see most or all of this accomplished.*

To the scientific world Redfield, however, is best known by his development of the law of storms. Essentially his theory was that a storm was a progressive whirlwind. For years he kept his theory to himself, and it was not till accumulative evidence established in his own mind the correctness of his convictions that he gave to the world, through the *American Journal of Science*, his valuable series of papers on that science which we now dignify by the name of meteorology.

Through the long years of his life Mr. Redfield was actively engaged in business, having established a line of two barges between New York City and Albany, and it was only such time as could be spared from more important pursuits that he devoted to the higher cause of science. The fossils, the ripple marks and the rain-drops in the sandstones of Connecticut and New Jersey interested him, and the papers which he read before this Association towards the close of his career pertained to his studies in geology. He died in New York City on July 12, 1857.

HENRY.

The selection of Joseph Henry, in 1846, to be the guiding hand of the then newly established Smithsonian Institution, made him, perhaps the most conspicuous representative of American science of his time. Henry was born in Albany just a century ago, and there he grew up and was educated. As a student, as a teacher, and as a professor, he was connected with the Albany Academy, and in that institution he carried on those researches in electricity which made the electromagnetic telegraph of Morse possible. In other words, Henry was the first to construct and use an electromagnetic acoustic telegraph of a type similar to that which is at present more generally employed than any other form. The code of signals now in general use had not at that time been invented.* In referring to his researches Sir David Brewster says: "On the shoulders of young Henry has fallen the mantle of Franklin." † In 1832 he accepted a call to the chair of natural philosophy, in Princeton, and for fourteen years led the peaceful life of a college professor in a rural university town.

Then came the call to Washington, and dubious as to the future, he said: "If I go I shall probably exchange permanent fame for transient reputation." ‡ The path of duty was clearly defined, and yielding to the solicitation of his associates, such as Bache, Hare and Silliman, he accepted the appointment of secretary of the Smithsonian Institution. Of his career in Washington a contemporary says:

Called to administer the Smithsonian trust, his conscientious devotion gave it from the first the direction designed by the testator. His aim was to originate and disseminate. He scattered the seed broadcast, not through whim or favoritism, but on a matured plan. His

* Route of a Great Western Railway, 1829.

* Sketch of Joseph Henry, by G. Brown Goode, in The History of the First Half Century of the Smithsonian Institution. Washington, 1897, p. 134.

† Idem, p. 122.

‡ A Memorial of Joseph Henry, with an engraved portrait on steel. Washington, 1880, p. 276. Discourse of William B. Taylor.

place required a love of science, along with a talent for organization. He brought these to bear upon the origination of knowledge, and by his scientific sympathy and ready recognition of others of his guild, he commanded honest homage and became the director, helper, and umpire in scientific disputation. Did the War Department require his aid in meteorology? He gave the plan of weather signals. Did the Census Bureau ask his help? He planned the remarkable atlas as to rain-falls and temperature. Did the Coast Survey require scientific suggestions, or the Centennial Commissioners his judgment, or the new library and the 'School of Art' a friend and adviser; or the Light House board laws of sound for fogs, and cheaper and better illumination? He freely gave what was gladly welcomed. His institution gave Agassiz opportunity to study fishes, Baird, birds, and all students encouragement to investigate our American archæology and ethnology, as well as our fauna and flora.*

Those who are willing to know more of Henry's great work need only consult The Memorial Volume,† published by the Smithsonian Institution shortly after his death. I add the last sentences of Goode's sketch of him, which was published in the History of the First Half Century of the Smithsonian Institution:

What Franklin was to the last century, Henry is to this, and as the years go by his fame is growing brighter. The memorial service in his honor, held in 1878, in the hall of the United States House of Representatives, was a national event. In 1883 his monument in bronze, by the greatest of American sculptors, was erected by Congress in the Smithsonian Park. The bestowal of his name upon the unit of induction in 1893 was an indication of his foreign appreciation, while, as a still nobler tribute to his fame, his statue has been placed under the great rotunda of the National Library, the science of the world and of all time being symbolized by these two great men, Newton and Henry.‡

Beginning with 1850 the Association inaugurated the custom of holding a meeting in the spring of the year as well as one in the late summer. These earlier gatherings were held in the cities of the south and west, and the first of them, in March, 1850, was convened in Charleston, South Carolina, then a city of much scientific activity. Over this meeting Alexander Dallas Bache was chosen to preside.

BACHE.

Birth, education, and association combined to qualify Bache in an unusual degree for the many important duties to which he was called. He was the son of Richard Bache, one of the eight children of Sarah, the only daughter of Benjamin Franklin, and was born in Philadelphia in 1806. He was educated at the United States Military Academy in West Point and graduated at the head of the class of 1825 (of which he was the youngest member), with the unusual distinction of completing that rigid course of four years without receiving a single demerit. An appointment in the Corps of Engineers followed, and after serving a year as assistant professor of engineering at West Point, he was assigned to duty under Colonel Joseph G. Totten, in Newport, Rhode Island.

In 1829 he resigned from the army to accept the chair of natural philosophy and chemistry in the University of Pennsylvania, in Philadelphia, where he remained until 1843, leading a life of great activity, for he was a guiding influence in nearly every scientific movement in the city of his birth. He was appointed chairman of one of the most important of the committees of the Franklin Institute, and was chosen as the expounder of the principles of the Institute at its public exhibitions. He was an active member of the American Philo-

* Idem, p. 103. Address of Hon. S. S. Cox.

† A Memorial of Joseph Henry, Washington, 1880.

‡ The Smithsonian Institution, 1846–1896. The History of its First Half Century, Washington, 1897, p. 156.

sophical Society, and in his private observatory began that series of magnetic observations with which his name is so honorably connected.

His services in establishing the Girard College, of which he was the first president, and his development of the public school system of Philadelphia while filling the offices of principal of the high school and that of superintendent of the public schools, are best described in the statement that "the result of his labors in regard to the schools was the establishment of the best system of combined free education which had, at that time, been adopted in this country. It has since generally been regarded as a model, and has been introduced as such in different cities of the Union." *

Bache's great work, however, was in connection with the United States Coast Survey, to the superintendency of which he was called in 1843, and of his relation to that work I again quote from his biographer :

When Professor Bache took charge of the survey, it was still almost in its incipient stage, subjected to misapprehension, assailed by unjust prejudice, and liable, during any session of Congress, to be suspended or abolished. When he died, it had conquered prejudice, silenced opposition, and become established on a firm foundation as one of the permanent bureaus of the executive government. * * * He divided the whole coast line into sections, and organized, under separate parties, the essential operations of the survey simultaneously in each. He commenced the exploration of the Gulf Stream, and at the same time projected a series of observations on the tides, on the magnetism of the earth, and the direction of the winds at different seasons of the year. He also instituted a succession of researches in regard to the bottom of the ocean within soundings, and the forms of animal life which are found there, thus offering new and unexpected indications to the navigator. He pressed into service, for the determination of the longitude, the electric telegraph; for the ready production of charts, photography; and for multiplying copper-plate engravings, the new art of electrotyping. In planning and directing the execution of these varied improvements, which exacted so much comprehensiveness in design and minuteness in detail, Professor Bache was entirely successful.*

In Washington, as in Philadelphia, he was foremost in every movement, public or private, that tended towards the advancement of science. Besides being *ex-officio* superintendent of Weights and Measures, he was a member of the Lighthouse Board, and a regent of the Smithsonian Institution from its inception till his death. Nor can I omit mention of the fact that he was a Vice-President of the United States Sanitary Commission, and first President of the National Academy of Sciences. Professor Bache presided over the Charleston meeting in 1850, and also over the New Haven meeting in August, 1851, and over the Cincinnati meeting in May of the same year.

It is difficult at this time to determine when the unwritten law of the Association that a representative of the natural sciences should be chosen to succeed a representative of the physical sciences in the presidential chair came into existence, but with the election of Louis Agassiz, in 1851, as the successor of Bache, the principle was clearly indicated.

AGASSIZ.

With the possible exception of the elder Silliman, the influence of Louis Agassiz on the development of science in our country has been greater than that of any other single man. The extraordinary personal qualities of character as well as the talents and attainments of this great naturalist

* Eulogy on Professor Alexander Dallas Bache, late Superintendent of the U. S. Coast Survey, by Joseph Henry. Smithsonian Report for 1870, p. 98.

* Henry's Eulogy on Professor Alexander Dallas Bache, pp. 100, 101.

make any attempt of a brief sketch of his career almost impossible.*

The son of a Protestant clergyman, he was born in Switzerland, in 1807, and his early academic education was obtained in Bienne, Lausanne and Zurich, whence he passed to the great German universities of Heidelberg, Munich and Erlangen. Even in those days he was a leader. In Munich he was the presiding officer of the Little Academy, the members of which have since enrolled their names high on the tablets of fame. At the age of twenty-one, even before the doctor's degree had been conferred upon him, young Agassiz had secured 'a place among the best naturalists of the day'† by his work on the fishes of Brazil.

Delightful years in Vienna and Paris followed during which his dissipations were confined to the pleasures of association with the most distinguished men of his time, especially in Paris, where Humboldt was a conspicuous leader, and became his patron. Then, in 1832, he settled in Neuchatel as professor of natural history in the small college of that ever-charming little city. Students came to him; and among his associates of that time were Guyot and Pourtales, whom even the ocean could not separate from him. His 'Recherches sur les Poissons fossiles' in five quarto volumes, and his 'Etudes sur les Glaciers,' were given to the world during his residence in Neuchatel. The former is perhaps his most important contribution to natural science, and the latter a pioneer work in glacialogy.

In 1840 an invitation to deliver a course of lectures before the Lowell Institute in Boston was obtained for him through the interest of his friend, Sir Charles Lyell, and he agreed with Mr. John A. Lowell to give a course of lectures on the 'Plan of the Creation, especially in the Animal Kingdom.' He arrived in Boston in October, and in December delivered his first lecture. 'He carried his audience captive.'* From that time the well-worn 'Veni, Vidi, Vici' tells the story of his career in the new world. Enthusiastic audiences greeted him in New York, Philadelphia, Charleston, and elsewhere, and, yielding to the irresistible opportunities offered to him, he severed the ties that bound him to the land of his birth and accepted the chair of zoology and geology in the Lawrence Scientific School.

Guyot, his friend from boyhood, in speaking of the immense power he exerted in this country in spreading the taste for natural science and elevating the standard, says:

> How many leading students of nature are found to call themselves his pupils and gratefully acknowledge their great indebtedness to his judicious training? How many who now occupy scientific chairs in our public institutions multiply his influence by inculcating his methods, thus rendering future success sure.†

No better evidence of his success as a teacher is needed than that of the mere mention of his famous students. In addition to his son, Alexander, the names of Bickmore, Brooks, Clark, Fewkes, Hartt, Hyatt, Lyman, Morse, Niles, Packard, Putnam, Scudder, Shaler, Stimpson, Verrill, and Wilder, come readily to mind.

In this connection I want to quote from a letter of one of his students‡ who wrote me concerning his teaching as follows:

> The ideal of a young scientific student, and of every great teacher, is a devotion to scien-

*See Louis Agassiz. His Life and Correspondence, edited by Elizabeth Cary Agassiz, with portraits on steel, 2 vols. Boston, 1885.

† Biographical Memoirs of the National Academy of Sciences, Washington, 1886. Vol. II., p. 49. Louis Agassiz, by Arnold Guyot.

*'Life and Correspondence,' Vol. II., p. 496.

† Memoir by Guyot, p. 71.

‡ Dr. J. Walter Fewkes.

tific research for its own sake. Agassiz had that ideal extraordinarily developed, and on that account the student was drawn to him and felt in a corresponding degree a great influence on his life. Agassiz made many and important contributions to science, but the greatest of all was a life which embodied the ideal that scientific research is an unselfish study of truth for truth's sake. Every student who was brought in contact with Agassiz recognized this ideal, and was profoundly influenced by it.

The museum of Comparative Zoology in Cambridge, is his most conspicuous monument, but his influence, more powerful than bricks or mortar, will live forever.

A boulder from the glacier of the Aar marks his last resting place in Mount Auburn, and so 'the land of his birth and the land of his adoption are united in this grave.'*

The policy of holding two meetings a year was soon found to be unsatisfactory, and it was abandoned after the Charleston meeting in 1851. In consequence no spring gathering was held in 1852, and also no summer meeting was held during that year. It was not until July, 1853, that the Association again met, and then it was convened in Cleveland under the presidency of Benjamin Peirce.†

PEIRCE.

This distinguished mathematician, one of the greatest this country has ever known, was born in Salem, Massachusetts, in 1810. His father, whose name the son inherited, is best remembered as the historian and librarian of Harvard. In Cambridge the boy grew to manhood, and was graduated at Harvard in 1829 in the class that Oliver Wendell Holmes has so beautifully immortalized in one of his charming poems.

While in college he became a pupil of Nathaniel Bowditch, 'who made the prediction that young Peirce would become one of the leading mathematicians of this century.'* After graduating he began his career as a teacher and in 1831 returned to his *alma mater* as tutor in mathematics, becoming eleven years later Perkins professor of mathematics and astronomy, which chair he held until his death, 'when he had been connected with the university for a longer time than any other person except Henry Flynt, of the class of 1693.'†

His election to the presidency of our Association was probably a result of his connection with the United States Coast Survey, as in 1852 he had been assigned to the charge of the longitude determinations in that service. The successful prosecution of that work, in which he was associated with some of our most distinguished members, indicated him as the natural successor to the superintendency of the Survey itself on the death of Bache in 1867.

The paramount events of the civil war had, to a large extent, interfered with the regular work of the Survey, but under Peirce it was actively resumed. The plans laid down by his predecessor were taken up and the Survey extended to a great geodetic system, stretching from ocean to ocean, thus laying the foundations for a general map of the country that should be entirely independent of detached local surveys. With this object the great diagonal arc was extended from the vicinity of Washington to the southward and westward along the Blue Ridge, eventually reaching the Gulf of Mexico near Mobile. He also planned the important work of measuring the arc of the parallel of 39 degrees to join the Atlantic and Pacific systems of triangulation; and for determining geographical positions

* Life and Correspondence, Vol. 2, p. 783.

† See Benjamin Peirce. A Memorial Collection, by Moses King, Cambridge, 1881, p. 18, with an engraved portrait on wood.

* Cyclopedia of American Biography, Vol. VI., p. 701 New York, 1888. Article on Benjamin Peirce written by myself.

† Memorial Collection.

in States where geological or geographical surveys were in progress.

Only an astronomer can follow the mathematical intricacies of Peirce's remarkable announcement concerning the discovery of the planet Neptune.

This Planet [says President Hill] was discovered in September, 1846, in consequence of the request of Leverrier to Galle that he should search the zodiac in the neighborhood of longitude 325°, for a theoretical cause of certain perturbations of Uranus. But Peirce showed that the discovery was a happy accident; not that Leverrier's calculations had not been exact, and wonderfully laborious, and deserving of the highest honor, but because there were, in fact, two very different solutions of the perturbations of Uranus possible: Leverrier had correctly calculated one, but the actual planet in the sky solved the other; and the actual planet and Leverrier's ideal one lay in the same direction from the earth only in 1846. Peirce's labors upon this problem, while showing him to be the peer of any astronomer, were in no way directed against Leverrier's fame as a mathematician; on the contrary, he testified in the strongest manner that he had examined and verified Leverrier's labors sufficiently to establish their marvellous accuracy and minuteness, as well as their herculean amount.*

His greatest contribution to astronomy, however, was in connection with the rings of Saturn. He demonstrated that the rings, if fluid, could not be sustained by the planet, that satellites could not sustain a solid ring, but that sufficiently large and numerous satellites could sustain a fluid ring, and that the actual satellites of Saturn were sufficient for that purpose.

Peirce was a teacher, and his teaching is referred to by one of his students as 'the most stimulating intellectual influence I ever encountered.'† As an executive officer in charge of the coast survey, and also of the *American Ephemeris*, it is said that:

The reports of that survey and the tables of the *Ephemeris* have rapidly raised the scientific reputation of America, which, in 1843, stood in astronomy among the lowest of civilized nations, and is now among the highest—a change which was by no means ungrateful to Peirce's strongly patriotic feeling, and which he could not but know was as much due to himself as to any other person.*

As a mathematician it was said at the time of his death that "the late Professor Peirce's merits will rank with the marvellous achievements of Bernoulli, Euler, and Laplace."†

President Hill closes his sketch of Peirce with the following words:

While Professor Peirce has the tenacity of grasp, and power of endurance, which enable him to make the most intricate and tedious numerical computations, he is still more distinguished by intensity and fervor of action in every part of his nature, an enthusiasm for whatever is noble and beautiful in the world or in art, in fiction or real life; an exalted moral strength and purity; a glowing imagination which soars into the seventh heavens; an insight and a keenness of external observations which makes the atom as grand to him as a planet; a depth of reverence which exalts him while he abases himself. ‡

I prefer the stanzas of Holmes' Memorial poem, beginning with:

To him the wandering stars revealed
The secrets in their cradle sealed;
The far-off, frozen sphere that swings
Through ether, zoned with lucid rings;

The orb that rolls in dim eclipse,
Wide wheeling round its long ellipse,—
His name Urania writes with these,
And stamps it on her Pleiades. §

It was at the Toronto meeting just ten years ago that the Association was honored

* Thomas Hill in The Memorial Collection, p. 8.

† Thomas Wentworth Higginson, in The Memorial Collection, p. 31.

* *The Nation*, New York, October 14, 1880.

† *Boston Daily Advertiser*, October 7, 1880.

‡ The Memorial Collection, p. 11.

§ *Atlantic Monthly.*

by the presence of its then oldest living past president in the person of James Dwight Dana, who in 1854, presided over the meeting held in Washington.

DANA.

Dana was born in Utica, New York, in February, 1813, and as a boy showed a taste for natural science, making frequent excursions after minerals with his school companions. Attracted by the name of the elder Silliman, then at the height of his powers and reputation, he went to New Haven and entered Yale. As an undergraduate it is said that 'he made much progress in science, especially in his favorite study of mineralogy.'*

The influence of the master was irresistible, and he decided to devote himself to science, and, as if to confirm his decision, an opportunity presented itself even before he had graduated, for in 1833 he accepted an appointment as instructor in mathematics in the United States Navy. For more than a year he cruised in European waters, chiefly on the Mediterranean, devoting his leisure to studies of the interesting features of geology and natural history that presented themselves.

He returned to New Haven in 1836, and became an assistant to Silliman. It was at this time, in May, 1837, that he published the first edition of his System of Mineralogy. Scarcely had that work been given to the public than he received an invitation to become the mineralogist and geologist of the United States Exploring Expedition, about to visit the Southern and Pacific Oceans under Captain Charles Wilkes. In August, 1838, the expedition started from Norfolk, Virginia, and reached New York on its return in June, 1842. For thirteen years thereafter Dana devoted himself to the study of the material that had been collected, and to the preparation of his reports, of which those on the Zoophytes, the geology of the Pacific, and on the Crustacea were published.

*See James Dwight Dana, a biographical sketch, with a half-tone portrait, and bibliography, by E. S. Dana in the *American Journal of Science*, third series, Vol. XLIX., p, 329, May, 1895.

Meanwhile he accepted the appointment to the Silliman chair of natural history and geology in Yale, but did not assume the active duties of the professorship until 1855.

From this auspicious beginning his active connection with Yale continued until it was interrupted in 1890 by a serious illness, after which, failing strength and advancing years made it impossible for him to resume his professorial duties, and in 1894 he was made professor emeritus.

The year 1818 is conspicuous in the history of the development of science in this country by the founding of the *American Journal of Science*. From its inception until his death the name of Benjamin Silliman appeared on its title-page as senior editor. In 1846 to that name was added that of the younger Silliman and Dana as associate editors. Of these three Dana was the survivor, and from 1875 till his death he was its senior editor.

In 1893, on the occasion of his eightieth birthday, a congratulatory letter from his scientific colleagues in New Haven made mention of his editorial career as follows:

> The long series of volumes of this periodical are a noble monument of the extent and thoroughness of your labors as a naturalist.*

It is fortunate for American science that this journal has been handed down as a precious legacy to the grandson of its founder, Edward S. Dana, under whose able guidance, let us hope, that it may long continue.

Wherever mineralogy or geology is taught, the unsurpassed text-books on these subjects by Dana, hold easy supremacy. His

*SCIENCE, New Series, Vol. I., p. 489 ; May 3, 1895.

System of Mineralogy, first published in 1837 as a volume of 580 pages, passed to a second edition in 1844, a third in 1850, a fourth in 1854, and a fifth in 1866, when it had increased to 827 pages. The later editions were prepared by his son. To these must be added four editions of his smaller Manual of Mineralogy, the last of which appeared in 1887, and was a duodecimo volume of 518 pages. Of his mineralogy, Powell says :

Thus he was the first to give us a system of mineralogy ; but his work in this field did not end at that stage. He still pursued his investigations, collecting from many fields and drawing from the collections of many others in many lands, until at last he developed a new system of mineralogy, placing the science on an enduring basis. This accomplishment alone was also worthy of a great man, and by it a new science was organized on a mathematical, chemical and physical basis.*

The broader field of geology became his after his return from the exploring expedition, and he published his Manual of Geology in 1862. Of this work one of his colleagues says :

The treatment of strata and fossils from a chronological point of view as historical geology is a characteristic feature of this manual. The growth and development of the earth, its continents and seas, and the progress in the organic life on its surface, were thus unified into a special department of geology, the history of the earth and of its inhabitants, which was by other authors dealt with as formational, stratigraphic, or paleontologic geology.

He prepared four editions of this work, the last of which appeared early in 1895, shortly before his death. As with his mineralogy he prepared an elementary textbook of geology, of which two editions were published. Concerning his valuable work on geology, Powell said :

So Dana's Geology is not only a text-book of geology, but it is the hand-book for all National, State and local geologists, and all students in the field. It is the universal book of reference in that department of science. Other textbooks have been developed but no other handbook for America. It is a vast repository of facts, but all arranged in such a manner as to constitute a geologic philosophy. It is on every worker's table and is carried in the kit of every field observer. It has thus become the standard to which all scientific research is referred, and on which geologic reports are modeled.*

Besides the foregoing, Dana was the author of Coral Reefs and Islands, which he enlarged and published later as Corals and Corals Islands ; of The Geological Story Briefly Told ; The Characteristics of Volcanoes ; and The Four Rocks of the New Haven Region.

In conclusion Powell says of him :

Dana as a zoologist was great, Dana as a mineralogist was greater, but Dana as a geologist was greatest, and Dana in all three was a a philosopher ; hence, Dana's great work is enduring.†

The ninth meeting of the American Association was held in Providence, Rhode Island, and over that meeting John Torrey, 'chief of American botanists,'‡ presided.

TORREY.

Torrey was born in New York City in 1796, and was the son of Captain William Torrey, of the Continental army, from whom he inherited the much-prized eagle

* Memorial address on James Dwight Dana before the Scientific Societies of Washington, by John W. Powell, SCIENCE, New Series, Vol. III., February 7, 1896, p. 183.

* Powell, op. cit., p. 184.

† Idem, p. 184.

‡ Biographical Memoirs of the National Academy of Sciences, Washington, 1886, Vol. II., p. 267. John Torrey, by Asa Gray. In addition to the foregoing a sketch of Torrey accompanied by an engraved portrait on wood is contained in the *Popular Science Monthly*, Vol. III., p. 632. Also his portrait can be found in a History of the New York Academy of Science, by Herman Leroy Fairchild, New York, 1887.

of Cincinnati. His mother was also of an old New York family. The boy was educated in his native city, and from Amos Eaton he learned 'the structure of flowers and the rudiments of botany.'* An education must have a broadening influence, and as he grew in years his interest in botany extended to chemistry and mineralogy, and finally to medicine, in which he was graduated from the College of Physicians and Surgeons in 1818. The practice of his chosen profession was not altogether congenial to him, and turning again to botany he began his Flora of the Northern and Middle United States. He published a portion of this work in 1824, and then accepted an appointment as assistant surgeon in the United States Army in order to become professor of chemistry, mineralogy, and geology in the United States Military Academy at West Point.

His abilities as a teacher received ample recognition, for in 1827 he was called to the chair of chemistry and botany in the College of Physicians and Surgeons, which he held until 1855. In 1830 he accepted the professorship in chemistry in Princeton, which he retained until 1854. These various collegiate appointments were then made *emeritus*, for on the establishment of the United States Assay Office in New York, in 1853, he was called to the charge of that place and held it until his death, twenty years later.

Gray says:

> It must not be forgotten that he was for more than thirty years an active and distinguished teacher, mainly of chemistry, and in more than one institution at the same time; that he devoted much time and remarkable skill and judgment to the practical applications of chemistry, in which his counsels were constantly sought and too generously given.†

The foregoing quotation becomes especially significant when we remember that his botanical work, yet to be referred to, was accomplished in the intervals of his busy life. In 1836 he was appointed botanist to the State of New York, and in 1843 issued the two quarto volumes of which it has been so well said: "No other state of the Union has produced a flora to compare with this."* Prior to the organization of the special scientific bureaus in Washington, with their large staffs of competent specialists, it was the practice of the government to refer the material collected by exploring expeditions to those most competent to report on it, and the botany in those years for the most part was assigned to Torrey. He reported on the specimens collected by Captain John C. Frèmont in the expedition to the Rocky Mountains in 1845; on the plants gathered by Major William H. Emory on the reconnaissance from Fort Leavenworth, Missouri, to San Diego, California, in 1848; on the specimen secured by Captain Howard Stansbury on his expedition to the Great Salt Lake of Utah, in 1852; on those collected by Colonel John C. Frèmont in California, in 1853; on those brought back from the Red River of Louisiana, by Captain Randolph B. Marcy, in 1853; and those obtained by Captain Lorenzo Sitgreaves on his expedition to the Zuñi and Colorado Rivers, in 1854. Then followed his elaborate memoirs on the botany of the various expeditions connected with the Pacific Railroad Survey during the years 1855–1860; the Mexican Boundary Survey in 1859, and the Colorado River Expedition in 1861. It was this succession of magnificent monographs on the flora of North America that gained for him an imperishable reputation among the greatest of American botanists.

His associates have honored his name by giving it to certain species of shade trees, and so all round the world *Torreya taxifolia*,

* Gray, op. cit., p. 268.

† Idem, p. 273.

* Idem, p. 271.

Torreya californica, Torreya nucifera, Torreya grandis preserve his memory as green as their own perpetual verdure.*

MARCUS BENJAMIN.

U. S. NATIONAL MUSEUM.

(*To be continued.*)

THE HISTORY OF THE BEGINNINGS OF THE SCIENCE OF PRE-HISTORIC ANTHROPOLOGY.

II.

Paleolithic Age in the United States.

The existence of the paleolithic stage of culture in America has been doubted, and, indeed, strenuously denied by some of our scientists who are well up in archeology and prehistoric anthropology.

My somewhat extensive travels with long stops and continuous examinations of many of the localities in Europe occupied by paleolithic man, especially among the caverns of the Dordogne district; my personal acquaintance with most of the collections of paleolithic implements made in these countries; my association with the leading investigators and believers in paleolithic occupation, have fitted me in a degree to judge of the subject which it would be mock modesty on my part to deny; while my dozen years' service in the prehistoric department of the U. S. National Museum, gives me an acquaintance with the American specimens by which I may compare the specimens from the two countries in a peculiar manner which I hope is not without its value.

The original discovery of a paleolithic period was made in Europe. The determining characteristics of that period have been decided only in Europe, and it must be principally by comparison with the evidence there that we are to determine the existence of a corresponding period in America. This evidence is furnished (in Europe) largely by geology and by paleontology. As has been described, discoveries of the remains of man, either physical or industrial (technologic), have been made in, and belong to, quaternary deposits, determined either by the geologic strata in which they were found, or the paleontologic objects with which they were associated. This species of evidence is, to a considerable extent, lacking in America. The European conditions have been found to exist in but few localities; yet America is not entirely without instances. Dr. Koch found a mammoth skeleton in Missouri, associated with which were flint weapons of human manufacture. It and the weapons are now displayed in the Berlin Museum. Dr. Dickeson found at Natchez, Mississippi, the buried skeletal remains of a megalonyx superposed on a portion of a human skeleton. The human skeleton from Guadeloupe, now at Paris, was encased in coquina, a rock made of shells belonging to the quaternary, though not exclusively so. The Iron Man of Sarasota Bay, Florida, found by Judge John G. Webb, was completely fossilized and changed to limonite. A fossilized human calcaneum was found by Col. Joseph Wilcox, of Philadelphia, in the same neighborhood with a quaternary shell forming part of the mass. Three similar instances were found in the same country in separated localities, showing them to have been different individuals; some of these have been encased in bog iron ore, others in indurated sandstone apparently as solid as though formed at the bottom of the ocean. The Nampa Image has been cited as evidence of high antiquity of man in America, and while its genuineness has been questioned, the attacks upon it are far from being successful.

The Calaveras skull has been the subject of much hilarious scientific criticism bordering on contempt. The facts of its discovery should be subjected to painstaking and detailed investigation before the results of

* Gray, op. cit., p. 276.