JOSIAH PARSONS COOKE.

BY M. B.

Allusion has been made in earlier sketches of this series of distinguished American scientists to the remarkable influence exerted by the elder Silliman on those who were fortunate enough to come under his instruction. Of this class may be mentioned Josiah Parsons Cooke, the subject of this sketch. He was born in Boston, Mass., on October 12, 1827. His father was a distinguished lawyer, and for some years the oldest member of the Suffolk County Bar. Of his early fondness for science, the story has been best told in his own words. In 1859, before the Lowell Institute, in Boston, he said: "With one exception, the only course of lectures on chemistry before this Institute, previous to the one just concluded, were delivered by Professor Silliman, of New Haven, in the years 1839-43. At those lectures I was an attentive listener. Although a mere boy—one of the youngest of those present—I then acquired my taste for the science which has since become the business of my life. Returning, after so short an interval, to occupy the place of him who was thus unconsciously my instructor—I might add, my only instructor in chemistry—I know of no way in which I can pay a higher tribute to his worth, or to the usefulness of this noble charity, of which he was only the almoner, than by a simple statement of these facts."*

Prof. Cooke's father fitted up for him in the wood shed a small laboratory, and there he passed his holidays in making experiments.

Three great chemical inventions, that greatly interested him, occurred during these years, and he himself, referring to the first of these, says: "I remember distinctly the old tinder box, and a card of the first friction matches was one of my earliest toys." Soon after the first daguerreotypes, brought from Paris, were exhibited on Tremont Row, in Boston, and these, too, greatly excited his interest. Amateur photography was not so decided a craze then as it is now. Nevertheless, he soon acquired a knowledge of this new chemical art, and some of the earliest talbottypes taken in the United States were made by him, and he still retains the negatives of buildings on State Street long since replaced by others. In 1845, Schonbein announced his discovery of gun cotton, and when the news of this event reached Boston, young Cooke began his experiments with modern explosives.

He then entered Harvard College, from where he was graduated with high rank in 1848. At that time no practical instruction in science was given to the undergraduates, and chemistry was dismissed with a few lectures. He received no systematic instruction in this science, but having, as has been shown, acquired a fondness for it, continued its study at home.

The year following his graduation he spent in travel in Europe, and while there was appointed tutor of mathematics in Harvard. He entered on the duties of this place in August, 1849, and during the second term of this academic year he was asked to give a course of experimental lectures on chemistry to one of the college classes. There was no laboratory at that time in Cambridge, and no chemical apparatus; so that all of the illustrations given in these lectures were made with the material that he collected in the little laboratory at home.

At the close of the course, he was appointed instructor in chemistry, and in December, 1850, at the age of twenty-three, he became the Erving Professor of Chemistry and Mineralogy in Harvard College, a chair that he has since continued to hold. Although self-taught in that science which has since become his profession, still he has done more than almost any other one man to give to chemistry its proper status in the collegiate curriculum as a valuable disciplinary study entitled to a leading place in an effective system of liberal education.

After being appointed to this chair, he was given permission to spend six months in Europe for the purpose of study. This time he devoted chiefly to visiting chemical laboratories, in making himself familiar with the methods of instruction and in collecting apparatus.

In the autumn of 1851, a lecture room was assigned to him in the north end of University Hall, and in the cellar beneath he fitted up a laboratory, in which the first practical instruction, in chemistry was given to undergraduate students in an American college.

Only a limited election of studies was permitted at that time in Harvard, and students were only allowed to choose qualitative analysis as an extra course to their regular work. Still, a number of young men availed themselves of the privilege, among whom were Charles W. Eliot, now president of Harvard University, Alexander Agassiz, Theodore Lyman, and Frank H. Storer, professor of agricultural chemistry at the Bussey Institute; but, as the interest developed, the college authorities, recognizing the value of the study of practical chemistry, soon permitted the undergraduates to elect that subject for one year in place of French.

From these small beginnings the department has steadily grown, until it now offers the undergraduates as broad and thorough instruction in the various departments of chemistry, including mineralogy, as any similar institution in the country.

In 1857, the present laboratory in Boylston Hall was built with funds partly bequeathed by Nicholas Boylston and partly raised through the individual efforts of Professor Cooke among friends of the university in Boston.

The laboratory was enlarged in 1870, and at present, in 1887, there are over three hundred students working at its tables. Thirteen distinct courses of instruction are given, including every branch of chemical science, and three professors, one instructor, and three assistants are employed in teaching.

Although teaching has been the principal duty of Professor Cooke's life, still he has found time to devote himself continuously to original investigation. His best work has been in the direction of pure chemistry. Among the earliest of his papers was one "On the Relation between the Atomic Weights of the Chemical Elements," * in which it was first shown that when the elementary substances are classified in natural groups, their atomic weights and other physical qualities are related by regular differences, thus indicating the classification since more elaborately worked out by John A. R. Newland and D. Mendelejeff. This memoir received the highest encomiums of Sir John Herschel in his remarks on chemical science at the Leeds meeting of the British Association for the Advancement of Science in 1858.

Josiah P. Cooke

NATIONAL ACADEMY OF SCIENCES.

Among other important papers published by him may be mentioned "On Two New Crystalline Compounds of Zinc and Antimony, and on the Cause of the Variation of Composition in these Crystals;" "Crystalline Form not Necessarily an Indication of Definite Chemical Composition;" "Danalite (named after James D. Dana), a New Mineral Species from the Granite of Rockport, Mass.;" "Cryophyllite, a New Mineral Species of the Mica Family;" "The Vermiculites."

In 1877 he published an investigation on the atomic weight of antimony, which is one of the most exquisite and perfect pieces of chemical research ever executed. It received the commendation of chemists, both in the United States and Europe, and its results have been definitively accepted as correct, necessitating the rejection of earlier determinations made by Dexter, Dumas, and Kessler.

More recently he has been engaged on an investigation of the relation of the atomic weights of hydrogen and oxygen, the results of which will soon be published.

He has made many and important contributions to the forms of apparatus used in chemical and physical demonstration and research, with the cunning hand of a skillful experimentalist and manipulator.

He has shown great activity in the movement tending toward the substitution of scientific studies for Greek in the college curriculum. His influence has made itself felt by his able essays on this subject, and most practically by his pamphlet entitled "The Fundamental Principles of Chemistry" (Cambridge, 1884), in which he sets forth a new system of instruction in elementary chemistry.

The teaching of elementary chemistry, even when connected with laboratory instruction, has been hitherto chiefly limited to a mass of details in regard to the properties and the chemical elements with their compounds. In this new system he has confined the elementary instruction to the general laws and principles of the science, thus making the subject a more serious study and a better training in the principles of the inductive philosophy than it ever was before.

This manual, thus briefly described, was prepared in order to indicate the nature of the requisition in chemistry which may be offered to candidates for admission to the college, together with a certain amount of mathematics and physics in place of Greek.

In 1882 Professor Cooke received the degree of LL.D. from the University of Cambridge, England. He is a member of the leading scientific societies in the United States, and in 1872 was elected to the National Academy of Sciences. In 1876 he was elected an honorary fellow of the London Chemical Society, a distinction which in the United States is held by but one other chemist. He was elected Corresponding Secretary of the American Academy of Arts and Sciences in 1873, and since that time has edited fourteen volumes of their "Proceedings" and one volume of "Memoirs." He has likewise long been an associate editor of the *American Journal of Science*.

Professor Cooke's publications in book form include "Chemical Problems and Reactions" (Cambridge, 1857); "Elements of Chemical Physics" (Boston, 1860), which, to quote Professor Silliman, "is an elaborate treatise in advance of anything before attempted in this country, or, in fact, in our language;" "First Principles of Chemical Philosophy" (1868, revised edition 1882); and the "New Chemistry" (New York, 1872; revised edition, 1884). The latter, originally delivered as a series of lectures before the Lowell Institute and subsequently published in the "International Scientific Series," was the earliest consistent exposition of a uniform system of molecular mechanics, and its philosophy has been widely accepted, both in England and in Germany; and has been translated into most of the languages of Europe. His contributions to chemical science have been collected in a single volume entitled "Chemical and Physical Researches" (Boston, 1881). The course of lectures delivered on Sunday evenings in Brooklyn, in which he aimed to show that the argument for design is not invalidated by the theories of evolution, was published as "Religion and Chemistry; or, Proof of God's Plan in the Atmosphere and its Elements" (New York, 1864, revised edition 1880); and several of his graceful addresses have been collected as "Scientific Culture and Other Essays" (New York, 1881; with new edition 1885)

* Fisher's "Life of Benjamin Silliman," vol. ii., p. 325.

* "Memoirs of the American Academy," 1854.

Ink Formulæ.

The following formulæ are taken from Dieterich's Manual:

Red Copying Ink.—Dissolve 50 parts of extract of logwood in a mortar in 750 parts of distilled water without the aid of heat; add 2 parts of chromate of potassium and set aside. After twenty-four hours add a solution of 3 parts of oxalic acid, 20 parts of oxalate of ammonium, and 40 parts of sulphate of aluminum in 200 parts of distilled water, and again set aside for twenty-four hours. Now raise it once to boiling in a bright copper kettle, add 50 parts of vinegar, and, after cooling, fill into bottles and cork. After a fortnight decant. This ink is red in thin layers, writes red, gives excellent copies in brownish color, and turns blackish brown upon the paper.

Violet Copying Ink.—Dissolve 40 parts of extract of logwood, 5 of oxalic acid, and 30 parts of sulphate of aluminum, without heat, in 800 parts of distilled water and 10 parts of glycerine; let stand twenty-four hours; then add a solution of 5 parts of bichromate of potassium in 100 parts of distilled water, and again set aside for twenty-four hours. Now raise the mixture once to boiling in a bright copper boiler, mix with it, while hot, 50 parts of wood vinegar, and, when cold, put into bottles. After a fortnight decant it from the sediment. In thin layers, this ink is reddish violet; it writes dark violet, and furnishes bluish violet copies.

THE deepest well in this country is at Northampton, Mass., sunk by Belding Bros. & Co., silk manufacturers. It is 3,700 feet deep and 8 inches diameter. At a depth of 150 feet from the surface a sedimentary sandstone was struck, which continued the whole depth, and water was never obtained. At St. Louis there is a well 3,180 feet deep, which yields an abundance of sulphur water.