scientific research. In this direction three achievements may be mentioned: his notable discoveries in geometrical optics; "Hamiltonian equations," which are fundamental in discussions of dynamical problems; and his great works on quaternions, a subject of which he was the creator.

I wonder if it may not have been mainly due to association with Hamilton that Wordsworth's poems contain at least a dozen references, more, I believe, than made by any other poet, to mathematics and mathematicians. Most of these references are in "The Prelude," but there are others in "The Excursion" and in "Epitaphs translated from Chiabrera."

(To be concluded)

OBITUARY

CHARLES EDWARD MUNROE

THE death of Professor Charles Edward Munroe in his ninetieth year at his home in Forest Glen, Maryland, on the afternoon of December 7, 1938, marked the passing of a distinguished and most beloved American man of science. He was born in Cambridge, Massachusetts, on May 24, 1849, and his long career as student, teacher, consulting expert and investigator of chemistry spanned the entire period of modern industrial development.

Munroe's love of chemistry began early, and from first to last it was joyful, compelling and infectious. As a young boy he equipped a small chemical laboratory in an attic room, over the entrance of which, in the merry spirit that always stayed with him, he inscribed the words, "All hope abandon ye who enter here." Desirous of increasing his stock of chemicals, he went one day to the neighboring drug store of Dr. Abner Ham to buy an ounce of potassium cyanide. The venerable doctor peered down at the lad through his glasses and asked with surprise what he wished to do with so poisonous a substance. "To make experiments," replied the boy. Dr. Ham then questioned him and, finding that he had picked up an amount of chemical knowledge unusual for one so young, decided that what he needed most was not potassium cyanide but direction. He offered him therefore a position as helper and errand boy, together with the opportunity of making such chemical experiments as discretion and the resources of his store permitted. The proposal was eagerly accepted.

The zeal for chemistry, thus early aroused, accompanied Munroe into the Cambridge High School and then through the Lawrence Scientific School of Harvard, from which he graduated in the class of 1871 with the mark of *summa cum laude*. For the next three years he taught chemistry at Harvard in the courses of Professors O. Wolcott Gibbs and Josiah P. Cooke, of both of whom Munroe always spoke with admiring affection. Although there was a certain professional coolness between Gibbs and Cooke, Munroe was successful in maintaining cordial relations with both. In fact a cardinal trait of his character was a conciliatory spirit which made it impossible for him to become a partisan in the quarrels of his friends.

Among Munroe's chemistry pupils at Harvard was Harvey W. Wiley, of the class of '73, and between those two arose a deep and lasting friendship. Wiley, who was Munroe's senior by five years, was then pursuing a year of postgraduate study and being a B.A. of Hanover College had no intention of taking another degree. Munroe, however, persuaded him to try for a B.S. at Harvard, but the regulations required that he must first pass the examinations for each of the four college years. Wiley, after being duly coached by Munroe, had no difficulty in fulfilling this requirement, and he thereby attained the unique distinction of being promoted from freshman to senior year in the brief space of seventeen days. Helping Wiley to run this gauntlet of tests was jokingly referred to by Munroe as his greatest pedagogical achievement.

Munroe left Harvard in 1874 to accept the professorship of chemistry at the United States Naval Academy, where he remained until 1886. He then transferred his residence to Newport, where he served as chemist of the United States Naval Torpedo Station and War College until 1892. It was during this period that he conducted his famous researches on explosives. His fearless experiments in this field led to the invention of the smokeless powder called "Indurite" (U.S. Patent 489684) and to the discovery of the remarkable Munroe effect by which the outlines of a fragile leaf or photograph can be impressed upon a plate of the hardest steel by means of a powerful explosive. In 1892 he moved to Washington, where he served as professor of chemistry and dean of the Graduate School of George Washington University until his retirement as professor emeritus in 1918. He continued, however, to serve as consulting expert and chief explosives chemist of the U. S. Bureau of Mines until 1934, when failing health obliged him to resign the position.

Coincident with these main activities, Munroe discharged various miscellaneous public services which are too numerous to mention in detail. He was a member of the U. S. Assay Commission for 1885, 1890 and 1893 and consulting expert of the engineering board for the defense of Washington during the Spanish American War. His copious reports for the censuses of 1900, 1905 and 1910, as expert agent in charge of chemical

industries, are invaluable for their wealth of historical and statistical information. He served also at various times as consulting expert for the U. S. Geological Survey, the U. S. Forestry Service and the Civil Service Commission, and was chairman of the advisory committee of the American Railway Association for drafting regulations on the safe transportation of explosives. He was chairman of the Committee on Explosives of the American Society of Testing Materials and also of the Committee on Explosives Investigations of the National Research Council. His name is writ large in the history of the American explosives industry.

No less extensive were Munroe's services for the numerous scientific societies of which he was a member. In 1873 at the meeting of the American Association for the Advancement of Science in Portland, Maine, he was secretary of a group of distinguished chemists (among whom were seven future presidents of the American Chemical Society) who petitioned the association for the formation of a subsection of chemistry. This was a recognized feature of the association until 1881, when it was made a full section. Munroe was the last survivor of this original group of founders of Section C. He was also the last surviving charter member of the American Chemical Society (founded in 1876), which honored him with its presidency in 1898. His services to this body, of which he was a life member, were of the highest order. In the early days when the American Chemical Society, because of mismanagement, was threatened with disruption, no less than seven of its future presidents having resigned, it was Munroe who, adhering loyally to his membership, organized the first local section and the first general meeting of the society at Newport, which, with the other reforms that he helped to initiate, restored harmony to the shattered organization and set it for the first time on the path that led to its subsequent phenomenal growth. When collaborators were lacking to write the chapter on "Industrial Chemistry" for the fiftieth anniversary number of the *Journal of the American Chemical Society* in 1926 it was Munroe again who saved the day by voluntarily assuming this extra burden. He served continuously as associate editor on explosives for *Chemical Abstracts* from the first issue of this journal in 1907 until death terminated the activity of his pen.

In addition to the various domestic and foreign chemical societies to which he belonged, Munroe was a member of the American Association for the Advancement of Science, the American Philosophical Society and the American Academy of Arts and Sciences. He was a recipient of numerous honors, among which were a membership in the Turkish Order of Medjidieh and a decoration of the Order of Leopold from Belgium.

In his social relations, Munroe was a prince among men. Within his large circle of friends at the Cosmos Club (of which he was president in 1913–1914) cordiality and good will radiated from him as light from the sun. Like his old college chums, F. W. Clarke and H. W. Wiley, he had a jovial temperament, and those who were so fortunate as to join this famous trio of Harvard men in one of their festive gatherings will always remember the spontaneous flow of wit and merriment.

On June 20, 1883, Professor Munroe married Mary Louise Barker, daughter of the late Professor George F. Barker, also a charter member and past president of the American Chemical Society, and just fifty years later he and Mrs. Munroe, surrounded by their five children and numerous grandchildren, celebrated their golden wedding anniversary. Munroe's life was singularly happy and productive. He was the last brilliant example of the old school chemist who cultivated his science upon all its sides, who saw it steadily and saw it whole. To him may be applied those words of Ariosto, "Nature made him and then broke the mould."

C. A. BROWNE

RECENT DEATHS AND MEMORIALS

DR. HENRY VANPETERS WILSON, Kenan professor of zoology at the University of North Carolina and since 1891 head of the department until his retirement two years ago, died on January 4 in his seventy-sixth year.

DR. FABIAN FRANKLIN, professor of mathematics in the Johns Hopkins University from 1879 to 1895, later editor of the *Baltimore News* and associate editor of the *New York Evening Post,* died on January 8 at the age of eighty-six years.

DR. LOUIS ISRAEL HARRIS, health commissioner of New York City from 1926 until 1928, died on January 6 at the age of fifty-six years.

DR. WARREN KING MOOREHEAD, professor emeritus of Phillips Academy at Andover, Mass., and curator of its museum, died on January 5 at the age of seventy-two years.

PROFESSOR H. J. BAKER, director of the extension service for the New Jersey Agricultural Experiment Station at Rutgers University, died on January 6 at the age of fifty-three years.

DR. GEORGE BARGER, Regius professor of chemistry at the University of Glasgow, known for his work on alkaloids and the synthesis of thyroxin, died on January 6. He was sixty years old. Dr. Barger lectured at Cornell University and at the Johns Hopkins University in 1928.