environment. From the point of view of public psychology this is of vital importance.

We are making another departure, which can best be described by telling you that on the great entrance walls to the new African Exhibit there will be written the story of the development of life on the continent of Africa through tens of millions of years. We believe this plan will prove to be an example of popular education in zoology in its most effective form. Here again, as far as we know, no such ideas have ever been carried out by any other zoological park. The treatment we have in mind will not find its parallel in any museum. I must take this occasion, however, to express our deep gratitude to our sister institution, the American Museum of Natural History, for the invaluable help it has given us in the preparation of the material involved.

Now, as to scientific objectives. Perhaps we can best illustrate our intention of pressing forward with our scientific work on all fronts by informing you that in 1940 the Board of Trustees voted a larger amount of money for the encouragement of our scientific work than in any previous year in the history of the society. There is one new angle concerning which I wish to tell you. We are working on plans to make the society a clinical center, not only as regards the greater City of New York, but for the country as a whole, for the study of animal diseases in their relationship to human disease problems. Raymond Dochez, whom we have had the honor to elect to our Board of Trustees to-night, is, with many others, helping us in formulating this program. And we hope to gain the financial support during the current year which will enable us to get this program under way. Its significance in connection with human health of the future may well be greater than any of us can now foresee.

I have been speaking of plans at the Park. Do not think that we are lacking for many new ideas in regard to the Aquarium. The solid walls of that century-old building prevent the application of most of them. Only through the medium of a new Aquarium building can justice be done to the miracle of marine life, presented through modern exhibition technique.

The World's Fair already seems like yesteryear. Our Exhibit Building provided enjoyment and instruction to 399,000 visitors. This enterprise has proved of great value to the society in many different ways and should be a matter of lasting satisfaction to that generous group among our trustees who made it possible.

Our new general director, Mr. Jennings, with his able assistant director, Mr. Sweeny, is bringing to our problems not only the abilities which come from wide experience in the administration of a public institution, but also a high degree of intelligence and enthusiasm in connection with the development of our popular education and scientific objectives. It is not possible to do justice to the enthusiasm and creative work which is being done by our entire staff.

Mr. Jennings in his report has given you some idea of other activities which are going forward. The continuity of really liberal support by the city government will depend, obviously, upon how effectively we function as a public institution serving our millions of visitors each year. I remind you that we have an enormous annual visitor list, running to five million persons a year, far greater than that of any other institution of its kind in the greater city, or for that matter, in the country.

I wish also to express appreciation for the cooperation we are receiving from the city government. Commissioner Moses and his assistants in the Park Department are showing us the finest cooperation. The same, we are extremely glad to say, holds true for the attitude shown us by the mayor, the budget director and other city officials.

One word as to membership. I do not think you realize how you, yourselves, can help in drawing to us new members and friends. We greatly need that help. I wish also to tell you that at an early meeting of the board we intend to amend our by-laws to provide for a junior membership for children up to the age of 18, at a reasonable annual fee. We entertain great hopes in building up a following through the years to come, among the youth of the city and neighboring communities.[2]

# OBITUARY

## DAYTON CLARENCE MILLER

Things are where things are, and as fate has willed, so shall they be fulfilled.

—*Browning*

WITH sadness, the world of physics notes the passing of Dr. Dayton Clarence Miller, who died at his home in Cleveland, Ohio, on February twenty-second of this year.

Son of Charles Webster Dewey Miller and Vienna (Pomeroy) Miller, Dayton Clarence Miller was born in Strongsville, Ohio, on March 13, 1866. His father,

[2] In his closing remarks President Osborn stated that the Zoological Society of the future intended to place greater and greater emphasis, in connection with the unrivaled collections both at the Zoological Park and the Aquarium, upon the interpretation of the meaning of animal life—in other words, the extension by every means possible of the processes of popular education in zoology.

originally a farmer, later became a merchant, a banker and electric traction executive.

Dayton Clarence Miller attended Baldwin-Wallace College in Berea, Ohio, situated only a few miles from his birthplace. There he was graduated in 1886 with the degree of bachelor of arts and in 1889 with the degree of master of arts. During the last year of his studies at Baldwin-Wallace he was in charge of instruction in natural science. Having become interested in astronomy, he went to Princeton University, where for two years he studied astronomy with Professor Charles A. Young and also took courses in the department of physics. But it was astronomy to which he devoted most of his attention. Small of stature, the students would refer to him and Professor Young, as they proceeded to the observatory, as "big and little twinkle." He received the degree of doctor of science from Princeton in 1890, his thesis having been the computation of the orbit of a comet. In the autumn of the same year he became instructor of mathematics and physics at Case School of Applied Science and successively assistant professor and head professor of physics. He remained on the faculty of that school for fifty years, retiring from active service in June, 1940.

In 1893, Dr. Miller married Edith C. Easton, daughter of Francis Cory Easton and Susan (Robbins) Easton, of Princeton, New Jersey. Mrs. Miller, who survives him, was his constant companion, serving in many ways to aid him in his work.

It was not long after Dr. Miller began his work at Case School before his interest and enthusiasm for his subject, together with his rare teaching ability, enabled him to have the funds provided for the erection of a much needed building, the Rockefeller Laboratory of Physics. This structure, with its many unique features, was designed by Dr. Miller, and the fine experimental equipment, especially of standards and acoustics, was the result of his careful selection. The visitor's book in the laboratory, containing the autographs of famous physicists, is a testimony of his popularity. One day, in the early nineties, Dr. Miller remarked to the writer (one of his earliest students) that "Sound is a neglected branch of physics." This remark, perhaps, presaged the thorough and extensive experimental work in sound to which he devoted the major part of his life.

Although Dr. Miller felt that he had received his greatest inspiration from President McCosh and Professor Young of Princeton and Professor Edward W. Morley of Western Reserve University, it is perhaps true that his interest in research was due primarily to a fortuitous acquaintance with the latter. The Millers and the Morleys happened to find themselves living in the same building and eating three daily meals together. Small wonder, then, that Dr. Morley, working on the adjacent campus of Western Reserve University and recognizing Dr. Miller's experimental skill, soon asked him to collaborate in research, the principal one of which was an improved repetition of the Michelson-Morley Ether-Drift Experiment. Later, as is well known, Dr. Miller, alone, repeated the experiment many times, his efforts culminating with his painstaking observations on the top of Mt. Wilson in 1925–26. The number of individual interferometer readings made by himself was 200,000. Continually, he insisted that recognition should be given to the small positive result which he and both Michelson and Morley had observed. This result, he believed, was a sufficient refutation of the Einstein relativity theory.

But Dr. Miller's chief contributions were in the field of acoustics, his favorite subject. The phonodeik, which he invented, not only made visible the complex wave-forms of sound waves but magnified the amplitudes as much as 2,500 times. With this instrument and accessory apparatus, Dr. Miller conducted many researches concerning the tone quality of numerous musical instruments, of the voice and of other sources of sound. His determination of the velocity of sound waves in air, made with big guns during the first World War, is, perhaps, the most accurate yet made. He was frequently consulted with reference to the proper design or treatment of large auditoriums in order to improve their acoustic qualities. Among these may be mentioned the chapels of the universities of Chicago, Denison, Princeton and of Bryn Mawr College. The auditoriums of the National Academy of Sciences in Washington, D. C., of many churches, hospitals, theaters and schoolrooms and finally of Severance Hall, the home of the Cleveland Symphony Orchestra, also received his attention.

Dr. Miller was much interested in symphonic and operatic music. He composed about thirty pieces of music for the flute, piano and other instruments. His special interest in the flute, on which he was an excellent player, is well shown by the magnificent collection of over 1,400 flutes dating from earliest times to the present. This fine collection along with books, pamphlets, music, works of art, pictures, autographs and portraits, perhaps the finest in the world, he has given to the U. S. Government, where it will be fittingly exhibited in the Library of Congress in Washington, D. C.

In order to come into close contact with other workers, Dr. Miller traveled extensively to almost all the states of the union and fifteen times to Europe. His pleasing personality along with the gift of presenting his subjects simply to lay audiences contributed greatly to the popularization of science. He delivered over 500 popular lectures in the United States and

Canada. These lectures, experimentally illustrated, dealt with such subjects as x-rays, polarized light, radium, visible sound, ether-drift and the history of the flute. At the Lowell Institute, in 1914, he gave the course of eight lectures on "The Science of Musical Sounds." He also gave lectures in Paris, Berlin, Cambridge (England), the Royal Institution in London and the Franklin Institute.

An indefatigable worker, in addition to his contributions to scientific journals, Dr. Miller found time to write the following books:

1. "Laboratory Physics" (1903), a college manual which has passed through twelve editions.
2. "The Science of Musical Sounds" (1916).
3. "Boehm on the Flute and Flute-playing" (1908 and 1922).
4. "The Ether-Drift Experiment and the Determination of the Absolute Motion of the Earth" (1933).
5. "Anecdotal History of the Science of Sound" (1935).
6. "Catalogue of Books and Literary Material Relating to the Flute" (1935).
7. "Sound Waves: Their Shape and Speed" (1937).
8. "Sparks, Lightning, Cosmic Rays" (1939).

Of the many learned societies of which Dr. Miller was a member or fellow we note "The National Academy of Sciences," "The American Philosophical Society," "The American Academy of Arts and Sciences" and "The American Physical Society." Besides holding important offices in a number of the societies he was honored in 1917 by the award of the Longstreth Medal and in 1926 of the Elliott Cresson Gold Medal of the Franklin Institute for his work in acoustics. In 1925 he was awarded the American Association for the Advancement of Science prize for his paper on "Ether-Drift." In 1928 the Cleveland Chamber of Commerce bestowed on him its Distinguished Service Medal. Honorary degrees came to him from Case School, Western Reserve University, Baldwin-Wallace College, Miami University and Dartmouth College.

Constantly at work but never too busy to receive his callers and if possible to aid them, gentle and modest in manner, Dr. Miller leaves behind a host of students and friends who mourn his passing but rejoice that they had the opportunity to receive from him that intangible something called inspiration which they will never forget.

Courageous to the last, loth to let his friends know of the approaching end, of which he was becoming aware, he continued to go to the laboratory until the day before his death, rarely missing the occasion of daily lunching with his comrades. He had so lived that when his summons came, "sustained and soothed by an unfaltering trust," he approached his end "like one who wraps the drapery of his couch about him and lies down to pleasant dreams."

> The Moving Finger writes; and having writ,
> Moves on: nor all your Piety nor Wit
> Shall lure it back to cancel half a Line,
> Nor all your Tears wash out a Word of it.
> —*Omar Khayyám*

H. W. MOUNTCASTLE
WESTERN RESERVE UNIVERSITY

# SCIENTIFIC EVENTS

## THE ONE HUNDREDTH ANNIVERSARY OF THE ESTABLISHMENT OF THE ALEXANDER DALLAS BACHE MAGNETIC OBSERVATORY

A MEETING in commemoration of the life and work of Alexander Dallas Bache was held in Philadelphia on February 14–15, as a fitting observance of the one hundredth anniversary of the establishment by him of the first magnetic observatory in America. The program of the meeting was in part historical and in part a symposium on geomagnetism. The sessions were held at the building of the American Philosophical Society and in the chapel of Girard College.

Alexander Dallas Bache was a man of abundant energy, which overflowed in many directions. Born in Philadelphia in 1806, a great-grandson of Benjamin Franklin, he was graduated from West Point in 1825 at the head of his class, although its youngest member. He served with the Army Engineers at Newport, R. I., and in 1828, at the age of twenty-two years, was elected professor of natural philosophy and chemistry in the University of Pennsylvania. In 1836 he became the first president of Girard College, where he established his magnetic observatory in 1840. He served also as president of the Central High School and superintendent of schools of Philadelphia. In 1834 he was appointed superintendent of the U. S. Coast Survey, which position he held until his death in 1867. He was president of the American Association for the Advancement of Science in 1850 and of the American Philosophical Society in 1855. From 1863 to 1867 he was president of the newly organized National Academy of Sciences, in whose establishment he played an influential part.

In the historical part of the program, on the morning of February 14, Bache's various scientific connections were described by Dr. E. G. Conklin, of the American Philosophical Society, Professor E. P. Cheyney, of the University of Pennsylvania, Secretary Henry Butler Allen, of the Franklin Institute, Rear Admiral L. O. Colbert, of the U. S. Coast and Geodetic Survey, and Dr. Frank B. Jewett, of the National