SCIENCE

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CONTENTS:

OGDEN N. ROOD.

AFTER an illness of less than a week, Professor Rood died at his home in New York on Wednesday, November 12. At the time of his death he was the senior member of the faculties of Columbia University.

Ogden Nicholas Rood was born at Danbury, Connecticut, on February 3, 1831. His father was a Congregational minister, and his mother, Aleida Gouverneur Ogden, belonged to an old and aristocratic family of New York. When seventeen years of age he was sent to Princeton, where he was graduated in 1852. He had already exhibited marked aptitude for experimental science, and this fact decided his taking a course of post-graduate study at the newly organized Sheffield Scientific School in New Haven, where the two Sillimans, father and son, in conjunction with James D. Dana, had established a focus of American scientific activity. This course was crowned with the degree of master of arts, there being at that day little or no differentiation of scholastic degrees in this country.

In 1854 young Rood went to Europe, continuing his scientific studies at the universities of Munich and Berlin during four years, but without taking the doctor's degree. This was in nowise due to lack of fitness for it, but rather to his life-long

aversion for everything that savored of ostentation. Subsequently he refused repeatedly such honorary degrees as were offered him, yielding only during the last few years to the two institutions, Princeton and Yale, with which his early associations were strongest. In 1858 he returned to America with a German bride, and accepted an offer of the professorship of chemistry and physics in the Troy University, a denominational institution which had recently been organized in the immediate neighborhood of the better known Rensselaer Polytechnic Institute. Here Professor Rood remained five years. He resigned in 1863, and during the following year he accepted the chair of physics in Columbia College, which had just been made vacant by the withdrawal of Professor R. S. McCulloch. For thirty-eight years, including the best years of mature manhood, from thirty-three to nearly seventy-two, his name has been widely known in connection with this institution as one of its scientific staff. Of his early colleagues, Barnard, Joy, Egleston, Newberry, Peck and Chandler, three of whom organized the School of Mines, which is now the school of applied science in Columbia University, all but one have now passed away.

As a physicist Professor Rood gave but little attention to abstruse mathematical analysis. He was essentially an experimentalist, and one of great originality and skill. His period of greatest activity preceded the present day of extreme specialization. Much of his work belonged to the domain shared by the physicist, artist and psychologist. As a young man in Europe he had access to the best that was afforded in such art centers as Munich, Dresden and Berlin. He had a passionate love for art, and the study of the triumphs of Rubens and Titian in color was to him as engaging as the more exact work of Fraunhofer, Maxwell and Helmholtz. At his summer home in Stockbridge, Massachusetts, his vacations were devoted largely to recreation with brush and pencil, and many of his water-color sketches have elicited admiration at the annual exhibitions of the American Water Color Society in New York. He had a well-trained ear for music, and in physics his fondness for acoustics and optics was marked. As a lecturer his style was singularly clear, and his illustrations were well selected and happy. A popular lecture on 'Mysteries of the Voice and Ear,' delivered in 1873 before the Yale Scientific Club, was universally regarded as a model of its kind. Tyndall had just finished a series of lectures in America that aroused great public interest and created a demand that was well met by Morton, Mayer and Rood.

Soon after beginning his duties in Troy Professor Rood published in the *American Journal of Science* an article 'On Adapting the Microscope as a Goniometer and for Determining Index of Refraction.' This indicated the choice he had already made of experimental optics as a specialty. It was soon followed by papers on 'Circular Polarization by Cooled Glasses,' 'Contraction of the Muscles by Vibration,' 'On Probable Means of Rendering Visible the Circulation in the Eye,' and a criticism of 'A New Theory of Light' which had just been propounded by an Englishman, John Smith. His lifelong interest in physiological optics became well developed about this time, and he had an interested co-worker in his colleague, Professor Edwin Emerson. Among his papers on this subject was one 'On a Method of Producing Stereographs by Hand' (1861); others 'Upon Some Experiments Connected with Dove's Theory of Luster' (1861); 'On the Relation between our Perceptions of Distance and Color' (1861); and 'On some Stereoscopic Experiments' (1862).

Along with these laboratory studies in Troy Professor Rood conducted a series of out-door investigations which were published in 1860 under the title 'Experiments on the Forms of Elongated Projectiles.' He was fond of rifle practice, and in Troy at that time there was a rifle manufactory where probably the best weapons of this kind in America were made. He devised a special form of ballistic pendulum for measuring velocity, studied the relation between accuracy of flight and the rate of rotation of the projectile on its longitudinal axis, and investigated penetrative power as related to the form of the projectile, its initial velocity and the position of its center of gravity. Comparing his results with those attained in England and on the continent of Europe, he demonstrated the marked superiority of American rifled guns. The country was on the eve of civil war, and the investigation was of much more than theoretic interest.

While in Troy Professor Rood was active as an amateur photographer. In 1861 and 1862 he published papers 'On the Practical Application of Photography to the Microscope,' 'On the Investigation of Microscopic Forms by Means of the Images which they Furnish of External Objects,' and 'On the Study of the Electric Spark by the Aid of Photography.' About the same time he was the pioneer in the successful construction of fluid prisms of highly dispersive power for the study of the spectrum, attaining a degree of accurate definition far in advance of what had previously been accomplished with such prisms.

Professor Rood's demonstrated ability as an experimentalist and the reputation he had rapidly made by his researches were what determined his call to Columbia College in 1864 and his election to membership in the National Academy of Sciences during the same year. In New York he developed a long-continued research on the use of the revolving disk as a means of measuring very small intervals of time, still continuing his studies on the spectrum, and specializing on the quantitative analysis of the phenomena of color mixture and color contrast. But this did not prevent temporary excursions into other fields. In 1874 he published an 'Optical Method of Studying the Vibrations of Solid Bodies,' and during the same year he made quite an elaborate research 'On the Application of the Horizontal Pendulum to the Measurement of Minute Changes in the Dimensions of Solid Bodies.' The exactitude of this measurement is indicated by the statement that the probable error of a single measurement was reduced to about one twenty-millionth of an English inch, or roughly one three-hundredth of a wave-length of violet light.

The use of the revolving disk was specially applied to observations of the duration and multiple character of flashes of lightning and of disruptive discharges between the electrodes of induction coils and influence machines. Other investigators had estimated the duration to be, in some cases, as little as one millionth of a second. It was shown by Rood that this was far too small. The actual range of variation is of course great, but his experiments indicated that, for a Leyden jar connected with an induction coil, an average value was about one five-hundredth of a second.

In 1880 and 1881 Professor Rood devoted much attention to the study of vacuum pumps, his aim being not to increase their commercial efficiency, but to ascertain the limit of perfection attainable, even though with such expense of time as to interfere with ready availability. He modified and so improved the Sprengel mercury pump as to secure a vacuum much more nearly perfect than had been secured

by any of his predecessors. The commercial importance of the mercury pump had but recently been greatly enhanced by the introduction of vacuum bulbs for incandescent electric lighting. In one of these a vacuum of one millionth is sufficient. Crookes had attained a vacuum of one seventeen-millionth. Rood's improvements added scarcely anything to the cost of the pump, but he attained a vacuum estimated to be very nearly one four-hundred-millionth.

The results of Professor Rood's extended researches on color were collected by him into a volume, entitled 'Modern Chromatics,' which was published in 1879. This book at once became a standard, and has continued to be so to the present time. The author's style is so easy and clear as to be readily intelligible to the non-professional reader, but without any sacrifice of scientific truth. He frankly adopts the theory of color-vision propounded by Young and extended by Helmholtz, accepting it as the best working theory, whatever may be the difficulties based on purely psychological grounds. During the twenty-three years that have elapsed since the publication of this book the number of theories of color-vision that have been brought forward is so great that only professional psychologists can be expected to know them. If any one of them should ever be established, its adoption will not detract from the value of the present volume. Since 1890 the author has published two noteworthy papers on physiological optics, one on 'A Color System,' and the other on 'A Photometric Method which is Independent of Color.' In his hands, and also those of others, the 'flicker' photometer invented by him has yielded results quite comparable in accuracy with what is attainable by the use of instruments intended exclusively for comparison of lights of the same hue.

One of the last researches published by Professor Rood was on 'Regular or Specular Reflection of the Röntgen Rays from Polished Metallic Surfaces.' The experiments seemed to indicate that a small percentage of these rays may be reflected from polished surfaces, and that they consist probably of transverse waves like those of ordinary light, but of shorter length.

Professor Rood was essentially a student, devoted to pure science, and not in sympathy with the commercial spirit which has so long tended to deter American students from choosing science for a career. This fact caused him to appear to many as a recluse. But he always had a welcome for those who could understand his point of view; and the present writer remembers with keen pleasure the kindly words and generous encouragement accorded by the distinguished physicist to a young stranger who, more than twenty years ago, formed his acquaintance on the basis of two articles, just published, on physiological optics. The friendship thus started was never broken.

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INTERNATIONAL CONGRESS OF AMERICANISTS AT NEW YORK.

In accordance with the invitation of the American Museum of Natural History, extended through its President, Mr. Morris K. Jesup, and the Duc de Loubat, the Thirteenth Session of the Congrès International des Américanistes met in New York during the week from Monday to Saturday, October 20–25. The preparations for the meeting were under the auspices of the Committee on Organization, which consisted of Morris K. Jesup (President), the Duc de Loubat (Vice-President), M. H. Saville (General Secretary), Harlan I. Smith (Treasurer) and the following members representing learned and scientific institutions: Franz