Books

Millikan's Travels

THE AUTOBIOGRAPHY OF ROBERT A. MILLIKAN. **311 pp. Prentice-Hall, Inc., New York, 1950. $4.50.**

Robert Andrews Millikan is one of the most distinguished physicists in the world and his autobiography will interest not only the entire scientific world, but the reading public at large.

Millikan was born in 1868 in Illinois and grew up in Iowa. His parents were of New England pioneer stock and guided his childhood wisely. It was full of hard work and strenuous play in the vigorous, growing midwestern communities of that time.

Millikan attended Oberlin College and as an undergraduate student-teacher practically introduced the subject of physics there. His most time-consuming and remunerative activity at Oberlin, however, was as acting director of the college gymnasium. He later decided on physics rather than physical education for a career, but his youthful interest in sports has stood him well throughout life. Probably no scientist in modern times has reached the age of 82 with such a continuous span of health and strength with which to carry on his activities.

Millikan's Oberlin professors obtained a fellowship for him at Columbia University where he studied under the famous Michael Pupin. At Columbia University he received a thorough foundation in classical physics, and it was Pupin who made it possible for him to gain a much broader view of science by postdoctoral work at the Universities of Berlin and Göttingen in Germany. With characteristic thoroughness, Millikan first spent two months at Jena learning the language and then took a bicycle trip through Germany, Italy, and France to prepare himself for his opportunity to study with Nernst and other giants of the old Germany. During his stay at Berlin, x-rays were discovered by Röntgen, thus opening up the fields of atomic physics to which Millikan himself was later to make some of the greatest contributions.

During the summer between his years at Columbia, Millikan had gone to the new University of Chicago to study with Albert Michelson. Undoubtedly because of this acquaintance, Michelson invited him to join the physics staff at Chicago, ". . . an offer which caused me to take the next train from Göttingen to London. . . ." Millikan's first years at the University of Chicago were devoted almost entirely to the organization of physics courses. For this work he prepared physics textbooks that are still models of exposition. His *A First Course in Physics* (written with Henry G. Gale) was the fascinating and inspiring introduction to physics for countless thousands of people now engaged in professional careers in science. His association at Chicago with men like Michelson, George E. Hale, Frank B. Jewett, President Harper, James Breasted, George Birkhoff, Ostwald Veblen, and Charles E. Merriman led him quite naturally into a career as a research leader. It is refreshing and helpful for younger workers to read, however, that only after many discouraging attempts did his great researches on the determination of the electronic charge and his proof of the Einstein photoelectric law emerge. The graduate students who worked with him in these great achievements (Harvey Fletcher, H. D. Arnold, Karl K. Darrow, M. J. Kelley, and many more) include some of the outstanding leaders in the development of physics in America, especially in its industrial applications.

During World War I Millikan's energies and administrative genius were fully occupied in the war effort. Here his principal associates were George E. Hale and William H. Welch, and together they bore the chief responsibility for organizing and vitalizing the National Research Council which made such significant progress in proving to the armed services the value and need of the methods and men of science. Perhaps the greatest contribution in World War I was a start on the extremely difficult problem of submarine detection, although each of the services, and especially the air forces, were aided by the efforts of the National Research Council. The culminating achievement of the Hale-Millikan leadership was the building of the National Academy of Sciences headquarters in Washington which has since been the meeting ground for the nation's men of science and their government.

After the war, Millikan's association with George E. Hale and Arthur A. Noyes led to his decision to abandon his research career at the University of Chicago and transfer to the California Institute of Technology. Here his astonishing energy permitted him to carry on a full research program, in which his best known work has been on cosmic rays (so named by him), and in addition to create a great physics department in a technical college where the full potentialities of science for engineering have been realized. Under his leadership has grown an institution vital for the development of Southern California and the South West, and one which by the outbreak of World War II had become an important factor for the technological strength of the entire United States.

In retirement Millikan seems to be as active and energetic as ever, encouraging his younger colleagues in research and setting an example for the physicists of America in scientific leadership, human relationships, and the public service.

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Chips

COLOR HARMONY MANUAL (THIRD EDITION). **Edited by Egbert Jacobson, Walter C. Granville, Carl E. Foss. 37 charts containing 973 separate color samples; 51 pp. separate text. Container Corporation of America, Chicago, Illinois, 1948. $125.00.**

Collections of colored samples, systematically arranged according to various principles of manufacture or appearance, have frequently attained some popularity ever since Valentinum Boltz von Ruffach published his *Illuminierbuch* in 1549. That contained forty-seven pages on which each owner was expected to apply artists' colors