

IN A WORLD THAT LIKES LABELS, A MAN WHO CAN'T BE DEFINED

The Universal Man: Theodore von Kármán's Life in Aeronautics

Michael H. Gorn
Smithsonian Inst. P.,
Washington, D. C., 1992. 202 pp.
\$24.95 hc ISBN 1-56098-165-2

Reviewed by William R. Sears

Theodore von Kármán was the first director of the Guggenheim Aeronautics Laboratory of the California Institute of Technology—a position he held for about 25 years. He was born and raised in Budapest and was a graduate student and junior colleague of Ludwig Prandtl at Göttingen. Then he became the director of the aerodynamics laboratory at Aachen before accepting Robert A. Millikan's invitation and immigrating to the United States.

Under von Kármán's direction the Guggenheim Laboratory, familiarly known as GALT, quickly attained world recognition as a center of teaching and research in aeronautical engineering. Its director had a great influence upon engineering education in America, bringing into the discipline much greater use of scientific and theoretical methods. Clearly, Millikan's Caltech provided an ideal location for this kind of evolution in engineering. By the advent of World War II GALT's students were occupying positions of major responsibility throughout the expanding aircraft industry, and its ten-foot diameter wind tunnel was running two shifts to accommodate the testing of new airplane configurations for US and Allied companies. Von Kármán and his colleagues were engaged in the re-

search and development of propulsion rockets, work that blossomed into Caltech's Jet Propulsion Laboratory.

As the war progressed, von Kármán was called upon, especially by General Henry H. Arnold, for advice in scientific and technical areas. Together they founded advisory structures and brought together stars of the scientific community in committees and summer studies that had great influence on the organization, policies and character of the new US Air Force born after WWII.

International cooperation in science and engineering was apparently a lifelong goal of von Kármán. He was one of the founders of the International Union of Theoretical and Applied Mechanics after World War I. With influential friends and former students throughout the western world and powerful support in the Pentagon, he argued successfully for an Advisory Group for Aeronautical Research and Development—AGARD—under NATO. That he himself should be its director was a *sine qua non*. From its inception AGARD has, remarkably, never been involved in classified activities, not even publications. It has served as a kind of international in-group for those of us who pursue the aerospace sciences.

Von Kármán, of course, received much recognition and many honors during his brilliant career. He was the first recipient of the National Medal of Science; it was conferred on him, alone, by President Kennedy in 1963.

This biography, intended for non-technical readers, is the work of a professional historian: Michael Gorn was chief historian of the Air Force Systems Command. It is not the first biography of von Kármán. There is also an autobiography, *The Wind and Beyond*, dictated to Lee Edson, who completed it after the professor's death in 1963. Gorn has drawn considerably from it. The new biography is well documented: There are 28 pages of notes and a seven-page essay on sources. It is best in its detailed

accounts of von Kármán's coming to Caltech—involving Millikan, the Guggenheims, Paul Epstein and Prandtl—and of his work for the Air Force. The author has obviously had access to voluminous Air Force files; the record shows how von Kármán in his seventies labored day and night, sometimes in hotel rooms, writing and editing reports and opinions on future weapons and tactics.

Glimpses of von Kármán's famous personal charm and humor are scattered throughout the book. He had the kind of personality—and Hungarian accent—that attracted apocryphal absent-minded-professor jokes; to his credit Gorn does not mention any of these. He does relate one of my favorite stories: When a young man told von Kármán that he hoped to be "half as great an engineer," the professor asked me, "What do you think, Bill, is .5 a modest wish?" The book, sadly, reads .05 instead.

The title recognizes, with permissible exaggeration, how difficult it has been in a world that likes concise labels for its heroes to define von Kármán. There is a Von Karman Boulevard in Orange County, California. When I asked a taxi driver for whom it was named, he pondered and suggested, "One of the astronauts?" Astronauts, engineers, applied mathematicians, teachers, rocketeers, space-flight buffs, bon vivants, raconteurs, diplomats, the military, physicists: We all claim him.

Harriet Brooks: Pioneer Nuclear Scientist

Marlene F. and Geoffrey W.
Rayner-Canham
McGill-Queen's U. P., Montreal,
Canada, 1992. 168 pp. \$29.95
hc ISBN 0-7735-0881-3

The life of Harriet Brooks as depicted in this book makes for fascinating reading. The authors' main goal is to bring to the public's attention the life and contributions of Brooks, an ac-

William R. Sears is Professor Emeritus of Aerospace and Mechanical Engineering at the University of Arizona, Tucson. He was a graduate student and faculty colleague of von Kármán from 1934 to 1941 and a close friend and collaborator thereafter.

complished nuclear scientist. Nowhere in my studies as a nuclear scientist did I come across her name or any reference to her contributions to nuclear physics. Yet she had worked with Ernest Rutherford, J. J. Thompson and Marie Curie. I would like to briefly summarize the book in terms of the social environment regarding women in science during Brooks's lifetime and then describe some of the scientific achievements directly attributable to Brooks.

Brooks was born in 1876 in Ontario, Canada. She was among the small minority of women of her time who attended universities in North America. The popular thinking, substantiated by prominent scholars, was that academic pursuits were too stressful for women. The exceptional women who excelled in scientific studies were expected to dedicate their lives to the pursuit of knowledge. For women, marriage and family obligations were thought to be incompatible with academic pursuits. It was also believed that single women could not possibly publish as much as their (married) male counterparts.

Brooks's academic life was no different from the lives of her outstanding male colleagues. Each year of her studies at McGill University, she obtained standings of first-rank in general as well as honors courses. She won prizes for excellence in physics, mathematics and German. She was elected class president. Inspired by an energetic, prominent young scientist (Rutherford) in the very new field of nuclear science, she joined his research group and made several substantial contributions. Her career path included teaching positions at Royal Victoria College, Bryn Mawr College and Barnard College. She worked as the equivalent of a present-day postdoctoral fellow at the Cavendish Laboratory in Cambridge with Thompson and at the Curie Institute with Curie.

Brooks's research contributions were among the foundation blocks of nuclear science. For example, she was the first to show that the radioactive substance emitted from thorium was a gas and that it had a molecular weight of 40 to 100. This discovery was crucial to the determination that the elements undergo some transmutation in radioactive decay. Brooks, with Rutherford, was able to show that uranium gives off beta rays as well as alpha particles in its decay. They further showed that beta rays are negatively charged particles and that they have the same properties irrespective of their sources. Brooks made the first measurements of the

lifetime of ^{220}Rn from the alpha decay of ^{224}Ra . She also measured the lifetime of actinium B (^{211}Pb). Perhaps her most crucial work was the identification of the multiple decays taking place in sequence starting with radium, uranium and thorium.

In motivation, work and accomplishment Brooks's life was perhaps indistinguishable from the lives of male physicists of that time. There were, however, profound differences. Brooks was asked to resign from Barnard as a teaching and research faculty member after announcing her intention to become engaged. At the Cavendish Laboratory, she did not wish to participate in the normal confrontational mode of intellectual discourse. Although she published a large number of papers with Rutherford as well as by herself, she is not recognized or remembered, in some cases because she was a coauthor and in others because she was a sole author. Another contributing factor was her complete withdrawal from scientific and academic life following her marriage to another physicist.

I agree with the authors that it's a pity she never wrote an autobiography. We have no way of probing her personal feelings and getting a snapshot of the times as seen by this unusual woman. Of course, times have changed; studies have shown that academic pursuits are no more stressful for women than they are for men. Married women in science publish more frequently than their single counterparts in all areas.¹ Women are attracted to science for the very same reasons as men, and they are interested in the new frontiers of science just like men. The life of Harriet Brooks has confirmed my belief that all the essential ingredients are the same for men and women regarding their entrance into science; it's just that different ingredients are needed to sustain the women!

1. *The Outer Circle: Women in the Scientific Community*, H. Zucherman, J. R. Cole, J. T. Bruer, eds., W. W. Norton, New York (1991).

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A Different Sort of Time: The Life of Jerrold R. Zacharias

Jack S. Goldstein
MIT P., Cambridge, Mass.,
1992. 373 pp. \$35.00 hc
ISBN 0-262-07138-X

Jerrold Zacharias was a striking example of a single human being, gifted

with enough force of personality and vision, exerting a major influence on what happens in our huge and unwieldy society. Zacharias achieved his influence in at least two very different areas: defense policy and science education. He died in 1986, and some memories of him and his work are inevitably fading. It is gratifying, therefore, to have Jack Goldstein's fine biography to remind us of the kind of man he was.

Zacharias was born to a well-to-do family in 1905. His life as a physicist began when he became an undergraduate at Columbia University—one of two physics majors in the class of 1926!—and proceeded to earn a PhD in solid-state physics. Although he was a talented student, there was no possible place for him on the Columbia faculty. Isidor Rabi had been appointed an instructor there in 1929, which was already stretching the university's limits of ethnic tolerance toward Jews. Zacharias did manage to get a teaching position at Hunter College, which supported him while he embarked on atomic-beam research under Rabi's leadership. Goldstein paints a vivid picture of the excitement of that time, when Rabi used his creativity and theoretical strengths to refine and extend experimental techniques that he had learned in Otto Stern's laboratory. This effort culminated in the resonance method using radiofrequency fields. For Zacharias the focus was hydrogen, and out of this work came definitive measurements of the magnetic moment of the proton and the electric quadrupole moment of the deuteron.

The direction of Zacharias's life was transformed by World War II. He was swept into work on radar, following Rabi in late 1940 to what became the Radiation Laboratory at MIT. Goldstein describes how Zacharias's talent for translating ideas into accomplishments exhibited itself at this time, as he worked with Bell Laboratories engineers to implement the results of the Radiation Laboratory research on airborne radar. He emerged a confident leader, used to thinking big. On the academic side, he became a professor at MIT and head of the new Laboratory for Nuclear Science and Engineering, but the Cold War saw him becoming involved in a series of strategic studies concerning the application of WWII technologies, in particular nuclear weaponry and radar, to national defense.

For a while, in the 1950s, Zacharias got back into atomic-beam research, but the main outcome was not aca-