# ARTHUR R. VON HIPPEL

*1898–2003*

Elected in 1977

*"For pioneering in molecular engineering and in setting a pattern for interdisciplinary materials research."*

BY RUSTUM ROY

PROFESSOR ARTHUR R. VON HIPPEL, professor of electrophysics, founder and director of the Laboratory for Insulation Research, and Institute Professor at the Massachusetts Institute of Technology (MIT), died on December 31, 2003, in Weston, Massachusetts. He was a pioneer and champion of interdisciplinary studies at MIT, and his laboratory was an existence theorem for the value of interdisciplinary study and research in academia.

Dr. von Hippel was born in Rostock, Germany, on November 19, 1898. He married Dagmar Franck, daughter of the German physicist James Franck, in 1930; the von Hippels became naturalized American citizens on April 21, 1942. They had five children, Peter Hans, Arndt Robert, Frank Niels, Eric Arthur, and Marianne Margaret.

Professor von Hippel studied at the University of Göttingen, where he received the degree of doctor of philosophy in 1924. He spent three years doing research at the University of Jena, under Professor Max Wien, and then a year as a Rockefeller Fellow in physics at the University of California. He then returned to Jena for a year as Privat-Dozent. From 1929 to 1933, he was Privat-Dozent in Professor James Franck's Institute at the University of Göttingen. In 1935, he spent a year as professor at the University of Istanbul. From there, he went to the Niels Bohr Institute in Copenhagen, where he worked with Professor Bohr on dielectric breakdown.

In 1936, Dr. von Hippel moved to MIT as assistant professor of electrical engineering; he became associate professor in 1940 and full professor in 1947. In 1940, he founded the Laboratory for Insulation Research, which he directed until 1962, when it was merged into the APPA-funded, MIT Centre for Materials Science and Engineering. He retired officially in 1964 but continued working at MIT until 1980.

During World War II, von Hippel was a staff member of the MIT Radiation Laboratory and a member of its Coordination Committee and a member-at-large of the Office of Scientific Research and Development (OSRD). He was also the representative of OSRD on the War Committee for Dielectrics, which acted as an advisory board on service and supply problems. In 1948, in recognition of "outstanding services to his country," he was awarded the President's Certificate of Merit, the second highest civilian award.

Professor von Hippel was a fellow of the American Academy of Arts and Sciences, American Physical Society, American Association for the Advancement of Science, New York Academy of Sciences, and Washington Academy of Sciences and a member of the American Chemical Society. In 1952, he was appointed chair of the Conference on Electrical Insulation of the National Research Council. From 1964 to 1965, he was scientific advisor for the Office of Naval Research in Washington, D.C., and on October 27, 1965, he received the Superior Civilian Service Award from the Department of the Navy.

He was an active supporter of the founding of the first major interdisciplinary society, the Materials Research Society (MRS), by his MIT colleague, Professor Harry Gatos, and Professor Rustum Roy of Pennsylvania State University. Von Hippel participated in the organization's annual meetings in Boston until 1984. In 1976, MRS named its highest honor the von Hippel Award and named Arthur von Hippel the first recipient. Professor von Hippel was elected to the National Academy of Engineering in 1977.

Arthur von Hippel's academic and other interests were grounded in his family history, which has been traced back to the 14$^{th}$ century. Many of his ancestors were large land-holders

or served in the military. His grandfather Arthur was one of the first professors of ophthalmology, and his father Robert was a professor of criminal law at the University of Göttingen. Von Hippel had two older brothers, Ernst and Fritz, and a younger sister, Olga.

After grammar school, the young Arthur attended the Humanistische Gymnasium in Göttingen, for nine years, where he received a solid classical education that included nine years of Latin and six years of Greek, in addition to French and English, and an excellent background in science and mathematics. A teacher introduced von Hippel to a pre-WWI youth movement—the Wandervogel (migrant birds), a group that expressed its differences with the "class state." Members hiked through Germany and neighboring countries, sleeping in barns, helping with farm chores, rediscovering and collecting folk songs, cooking outdoors, and playing musical instruments. Abandoned houses and later, even old castles, were fixed up as homes for these transient groups of young people, who took a solemn pledge to live a life of purity, responsibility, and mutual helpfulness.

The first large-scale test of this oath came during World War I. Members of the Wandervogel, who were immediately identifiable by a colored string on their uniforms, made friends with each other, independent of rank. About 10,000 members of the youth movement, half its men, were killed in combat. Had they lived, von Hippel believed, World War II and the assumption of power by the Nazis might have been avoided. As university students, von Hippel, his brothers, and some of their friends organized what they called the Akademische Gilde, an alternative to the singing-drinking-dueling student fraternities of the time. In addition to creating a positive social environment and lifelong friendships for themselves, members also tried to enrich the lives of working-class children.

These formative experiences of his youth influenced von Hippel's motto, "We shall not be intimidated," a principle he lived up to throughout his life. He was both anti-Communist (he requisitioned an artillery battery to help put down a local Communist uprising during the post-World War I revolutionary

period in Germany) and openly anti-Nazi after they came to power (he once publicly refused to salute Hitler). And, despite the disapproval of some in his family (who later apologized), he married Dagmar Franck, who was Jewish, in 1930—a time when anti-Jewish feeling was already very strong in Germany. His professional models were James Franck and Niels Bohr, nonhierarchical academic leaders and socially responsible scientists. Another model was MIT president Karl Taylor Compton, whom von Hippel considered an ideal administrator.

Professor von Hippel pursued extensive studies in the fields of ferroelectrics and ferromagnetics, electric breakdown, dielectric polarization, rectifiers and photocells, gas discharges, and solid-state physics. He conducted pioneering research in the field of molecular science and molecular engineering, which he described as a "broad new discipline .... comprising the structure, formation, and properties of atoms, molecules and ions; of gases, liquids, solids and their interfaces; the designing of materials and properties on the basis of this molecular understanding; and their imaginative application for devices." Dr. von Hippel was particularly concerned with the future of this vital science and with the establishment of laboratories to promote its study by workers in industry as well as by university students.

Professor von Hippel was the author of *Dielectrics and Waves* (1954) and editor of several books on materials research, *Dielectric Materials and Applications* (1954), *Molecular Science and Molecular Engineering* (1959), and *The Molecular Designing of Materials and Devices* (1965). His final research was focused on identifying the role of water as a solvent in biological systems. This included the precise molecular meaning of terms applied to the liquid state (e.g., activity coefficients, hydration clouds, structure makers, and breakers).

Arthur von Hippel was much more than an academic. In 1919, when he left the German army, and, before turning to science, studied Renaissance art in Munich. Later, he drew on this background to visualize atomic and molecular structures (helped by his draftsman John Mara). He was intrigued, indeed "thunderstruck," by the art of Maurits Escher and its similarities to crystal structures. He championed the use of Lichtenberg fig-

ures, the patterns assumed by electrical discharges. (One is on display on the wall of the MIT/Kendall Square subway station in Boston.)

He was also in love with the American wilderness. After World War II, he realized a dream when he had a log cabin built on the bank of the Swift River at the edge of the White Mountains National Forest in New Hampshire. Contact with the natural world helped him retain his realistic outlook. In a 1969 interview, published two years later in the *Czech Journal of Physics*, the interviewer finished by asking von Hippel's views about the ethics of molecular engineering. He responded in part:

> Ours should be a "Golden Age." Instead, everywhere enters the jealousy of competition and the abuse of new knowledge. This is a major cause of the unhappiness of the present student generation in all parts of the world. They feel and we feel that there is not only matter and antimatter in the universe but spirit and antispirit and that we have to side with the spirit!

ACKNOWLEDGMENTS

Some of this material is taken from the NAE files and papers by Frank von Hippel and Markus Zahn.