



Herman P Rhoton

HERMAN PAUL SCHWAN

1915–2005

Elected in 1975

*“For contributions in biomedical engineering research,
education and the development of this field.”*

BY KENNETH R. FOSTER AND JOHN A. QUINN

HERMAN PAUL SCHWAN, a renowned scientist and pioneer in biomedical engineering, died at his home in Radnor, Pennsylvania, on March 17, 2005.

Schwan was born in Aachen, Germany, in 1915. As a gymnasium (high school) student, he found himself under a political cloud because of his liberal political views. He served briefly in the Reich Labor Service, an organization that combined quasi-military training and forced labor in an attempt to rehabilitate “politically immature” individuals. Certified as politically mature (a requirement for entry to a university), Schwan entered the University of Frankfurt, then, driven by the search for financial support, he moved to the Universities of Goettingen and Breslau, where he studied physics, mathematics, and engineering.

Unable to win a tuition waiver for graduate study because of his political views, he became a technician for Boris Rajewsky, the famous radiation biologist at the Kaiser Wilhelm (now Max Planck) Institute in Frankfurt. Rajewsky was a member of the Nazi party (Schwan thought for career reasons) and had sufficient political clout to keep Schwan out of the army. He assigned Schwan to study the electrical properties of tissues for the development of therapeutic applications of radio-frequency energy, an interest that Schwan pursued for the rest of his career. Schwan obtained his Ph.D., with distinction, in biophysics from the Uni-

versity of Frankfurt in 1940 and his professional doctorate (Dr. Habil.) in physics and biophysics in 1946.

After the war, Rajewsky was obliged to step down as institute director pending his appearance before a de-Nazification court, and Schwan, who had not joined any Nazi-related organizations, took over as associate director of the institute, now renamed the Max Planck Institute. In 1947, Schwan came to the United States, where his first job was at the Aeromedical Equipment Laboratory at the U.S. Naval Base in Philadelphia. He joined the faculty at the University of Pennsylvania in 1950. In 1952, he was appointed head of the Electromedical Division of the Moore School, and, in 1961, he became chairman of the Graduate School of Arts and Sciences Group on Biomedical Electronic Engineering. In 1972, he became chairman of the Bioengineering Department. He retired as the Alfred Fitler Moore Professor Emeritus in 1983.

Over the course of his long career, Schwan published more than 300 scientific papers, gave countless lectures, and received many honors. These included fellowships in the Institute of Electrical and Electronic Engineers (IEEE) and the American Association for Advancement of Science, membership in the National Academy of Engineering, and election as foreign member of the Max Planck Institute for Biophysics. He received three honorary doctorates (Universities of Pennsylvania, 1986; Kuopio, Finland, 2000; and Graz, 2001). He was awarded the Boris Rajewsky Prize for Biophysics (1974), IEEE Edison Medal (1983), IEEE Centennial Medal (1984), and d'Arsonval Medal of the Bioelectromagnetics Society (1985), as well as the first Otto H. Schmitt Award of the International Federation for Medical and Biological Engineering (2000). He was also an honorary member of the German Biophysical Society. An extended biography of Schwan can be found at http://repository.upenn.edu/be_papers/52/.

As a scientist, Schwan is best known for his many studies of the electrical properties of cells and tissues and the nonthermal mechanisms of interaction between fields and biological systems. He discovered or provided important theoretical insights into the large, low-frequency dielectric dispersion in biological ma-

terial, electrically induced forces on cells, and other such phenomena.

Schwan was also deeply concerned about the possible health effects of nonionizing electromagnetic fields. In 1953, he sent a letter to the U.S. Navy proposing a safe limit for human exposure to microwave energy of 100 W/m^2 (based on thermal analysis). This letter became the basis for exposure standards in the United States and elsewhere. In 1965, Schwan chaired the committee that established the first U.S. exposure limit for radio-frequency energy for the American National Standards Institute, which evolved into the present IEEE C95.1 standard. The U.S. standard was influential in the development of exposure limits around the world.

Schwan also played an important role in the development of the fields of biomedical engineering and biophysics. In the early 1950s, he served on numerous national and international committees helping to organize and promote professional societies. He was chair (1960) of the Institute of Radio Engineers Professional Group on Medical Electronics, the largest biomedical engineering society of its time, and helped guide the evolution of this and other groups into the present IEEE Society on Engineering in Medicine and Biology. Schwan held many leadership positions in the biomedical engineering sections of the American Institute of Electrical Engineering and Institute for Radio Engineering, the two engineering societies that eventually merged to form the IEEE. He was a founding member of the Biophysical Society, Bioelectromagnetics Society, and Biomedical Engineering Society and chairman of the American National Standards Institute committee that developed the first limit for human exposure to radio-frequency energy in the United States.

Schwan is survived by his wife (since 1949), Anne Marie Del Borrello, of Philadelphia, five children, and six grandchildren. He was a mentor to all of them, teaching them first and foremost to think for themselves and never to simply follow the crowd. A man of integrity, Schwan influenced not only his wife and children, but also his many students and colleagues.