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CHARLES PHELPS SMYTH
1895–1990

A Biographical Memoir by

BY WALTER KAUZMANN AND JOHN D. ROBERTS

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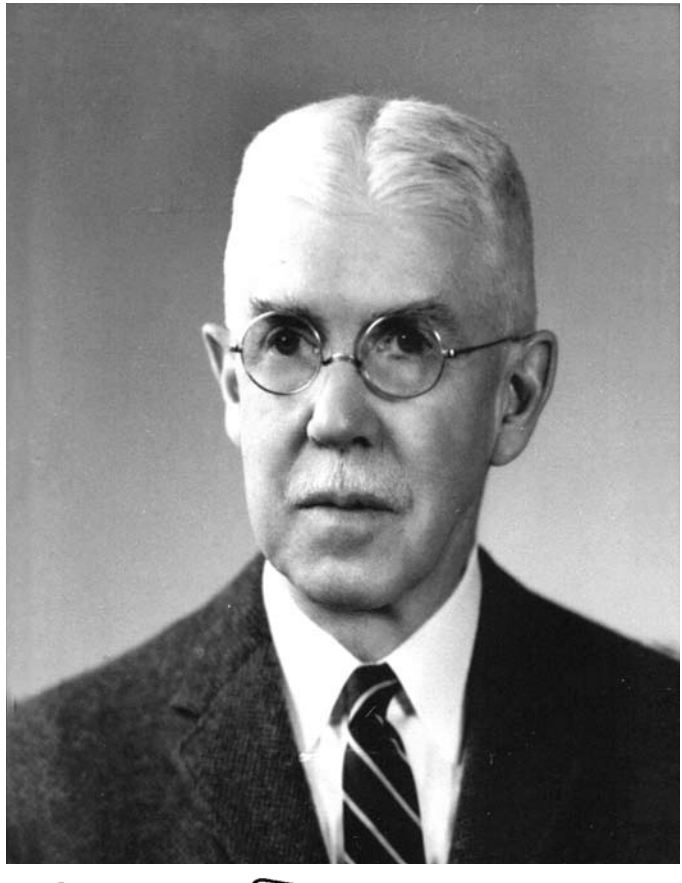
Biographical Memoir



Charles P. Smyth

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February 10, 1895–March 18, 1990

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Charles Phelps Smyth was born on February 10, 1895, in Clinton, New York, where his father, Charles Henry Smyth, was a professor of geology and mineralogy at Hamilton College. Princeton President Woodrow Wilson called Charles Henry to Princeton University in 1905. He served on the faculty as a professor of geology until his retirement in 1934 and played an important role in building Princeton's graduate program in geology. At the age of 10 Charles Phelps with his younger brother, Henry D., moved to Princeton. Here the members of the Smyth family—father, mother, and sons—lived out most of their remaining lives.

Charlie attended Miss Fine's School and Lawrenceville before entering Princeton University in the class of 1916. He graduated in chemistry with highest honors (he had been among the first group of students to be admitted to Phi Beta Kappa as juniors), and then stayed on for a year, receiving an M.A. in 1917. During World War I, he served in Washington, first with the Bureau of Standards, then as a first lieutenant in the Chemical Warfare Service. When the war ended he went to Harvard for graduate study. He received his Ph.D. in 1921; his thesis work was carried out in the laboratory of the eminent T. W. Richards on the thermodynamics of thallium amalgams. In Washington and at Harvard he came to know

a number of chemists at the beginning of illustrious careers, among them, "Jim" Conant, as he used to refer to him.

Smyth joined the Princeton faculty in 1920 as an instructor. This was a threshold time for important advances in chemistry; the role of electrons in chemical bonding was just beginning to be understood, and it was clear that developments in physics that had taken place in the two previous decades were going to play an important role in the development of chemistry. Smyth appears to have discussed the situation at some length with Karl Compton, then on the faculty of the physics department, where Smyth's brother Henry was working on his Ph.D. thesis under Compton. Peter Debye had already shown how molecular dipole moments were related to the dielectric constants of substances, and dipole moments could give extremely useful information about the distribution of electrons in molecules. With Compton's encouragement Smyth developed methods for determining dipole moments of common molecules from dielectric constants reported in the literature. Between 1923 and 1925 Smyth published five papers in the *Philosophical Magazine* and the *Journal of the American Chemical Society;* so began a lifetime of research on the dielectric properties of matter. In 1924 Smyth traveled to Europe and discussed plans for his research with Debye in Leipzig. He also came to know other prominent German scientists at this time, and this familiarity with the German scientific scene, strengthened by subsequent visits before World War II, had interesting consequences for Smyth at the close of the Second World War.

Returning to Princeton, and with the help of C. T. Zahn, a National Research Council fellow who had just received his Ph.D. in physics at Princeton, Smyth set up a laboratory for the measurement of dielectric constants. Stanley O. Morgan was the first of more than 50 graduate students who carried these measurements forward, extending them as new tech-

niques appeared (such as microwaves after World War II) and applying them to a great many fundamental problems in chemical structure and behavior. Many of these graduate students achieved positions of prominence in academia, government, and industry. By the time of his retirement in 1963 Smyth had achieved worldwide recognition as a leading expert in dielectric behavior and dipole moments.

Smyth was an important member of the group that under the leadership of Hugh Taylor placed Princeton at the forefront of developments in physical chemistry in the 1930s. Smyth continued writing after retirement, a long review paper appearing as late as 1982.

In addition to his World War I activity with the Chemical Warfare Service, Smyth devoted a considerable effort to public service during his lifetime. As conditions in Europe darkened with the rise of Hitler, he joined the U.S. Navy Reserve with the rank of lieutenant commander in 1937, but resigned in 1941. From 1943 to 1945 he worked on the Manhattan Project, mainly at Princeton.

As the war in Europe was drawing to a close in 1945, Smyth dropped out of sight for several months; he had joined the highly secret ALSOS mission, a small group of American scientists familiar with the German scientific community. This mission moved through Germany with the front lines of American troops (and on occasion even ahead of them), seeking to locate German scientists who had been associated with the German uranium (nuclear energy) effort. The U.S. government had naturally been deeply concerned over the state of the progress of the work, as well as the possibility that involved German scientists might fall into the hands of the Soviets. A dozen of the highest ranking of these German scientists (among them Hahn, the discoverer of nuclear fission, and Heisenberg, one of the founders of quantum mechanics) were, through the efforts of the ALSOS mission, "interned"

for some months in England before the American atomic bombs were dropped on Japan. Smyth reported that during this mission he had "ridden 10,000 miles in a jeep."

During the 1950s Smyth was active on advisory panels, serving as chair of the Advisory Commission for Fulbright Fellowships during 1950-1954 and on the Advisory Board for National Science Foundation fellowships. After his retirement he was a consultant to the Office of Naval Research (ONR) from 1963 to 1969 and from 1971 to 1978. For two years during 1969-1970 he lived in England as the London liaison scientist for the ONR. He was a visiting professor in Japan in 1965 and at the University of Salford, England, during 1974-1976.

Among his honors was the award in 1947 of the U.S. Army Medal of Freedom for his scientific intelligence work with ALSOS. In 1954 he was awarded the Nichols Medal of the American Chemical Society for his scientific contributions. He was elected to the American Philosophical Society in 1932 and to the National Academy of Sciences in 1955. At the American Philosophical Society, Charles served on its Council from 1968 to 1971 and the Committee on Nominations of Officers during 1970-1971. The University of Salford awarded him an honorary D.Sc. degree in 1970.

Charlie was a quiet man, rarely moved to anger and much liked by his students and colleagues. One episode illustrates the lively atmosphere of his research group. With a vacation approaching, the gregarious members of his group were looking forward to the break. Smyth arrived at the lab one morning and found one of his group trying to hit a tin can at 30 paces with a Civil War rifle. A second was painting a bogus impressionist picture, which he later succeeded in having hung in a Milan art galley. A third student was in court for speeding in an effort to find baby food for his small children. Charlie summed up the situation, saying,

"Well, I might as well go and climb Mt. Assiniboine"—and left for Canada.

It is said that Smyth's moustache was modeled after that of his thesis adviser, T. W. Richards, and his time at Harvard certainly strongly influenced his life style. His later years were enriched by his marriage to Emily Ellen Vezin in 1955.

Charles played tennis until well past his 60s and he loved the opera and walking in the mountains. But his real passion was for fly-fishing. He traveled and fished all over the world, and in his later years spent his summers in Montana. In the last years the annual trips between Princeton and Montana became more and more burdensome, and in 1987 Charles and Emily moved to live in Montana the year round. He died at his home in Bozeman, Montana, on March 18, 1990, at the age of 95.

Although Smyth was likely to be considered by his chemical colleagues purely as a physical chemist trained as such by T. W. Richards at Harvard, he could also be fairly regarded as a organophysical chemist very much in the same vein as Louis P. Hammett and C. K. Ingold, who applied first-rate physical principles in their research, but relied primarily on others or on commercial sources for organic compounds to study. A physical organic chemist is exemplified by Paul D. Bartlett, whose research group synthesized many complex organic compounds to test particular points of theory.

Smyth primarily studied the electrical properties of an enormous variety of organic molecules, determining these as a function of gas, liquid, or solid phases, electrical frequency, solvents, temperature, and in mixtures. In some sense his research was relatively narrow but was also amazingly rich in the way he applied it to contemporary issues in physical organic chemistry as they arose. A good example is provided by the rise of qualitative concepts often based on quantum theory, such as resonance (mesomerism), hyper-

conjugation, polar and inductive effects, steric effects, and the like, which became useful in the interpretation of the structures and reactions of organic chemistry. For many of the growing theoretical applications Smyth was able to apply his procedures in a very timely way to appropriate molecules and add credence, or not, to predicted observations based on applications of the specified concepts.

One of us (J.D.R.) began research on dipole moments to try to achieve similar objectives as an undergraduate at UCLA, and this effort relied heavily on Smyth's descriptions of the equipment and procedures needed to measure with the necessary accuracy the dielectric constants of the solutions of the desired substrates as well as the necessary information on the electronic and atomic polarizabilities. My 15 or so years of work on dipole moments at UCLA, MIT, and Caltech might have continued for a long time, except for an exposure to the rising field of nuclear magnetic resonance spectroscopy, which became an all-consuming research interest for the next 55 years. Nonetheless, in a visit to Princeton arranged by Donald Hornig, I had the privilege of meeting Charles Smyth. I was eager to talk to him about mutual research interests and express my appreciation for the enormous help I received from his earlier publications. I was greatly impressed with the depth of his knowledge and the warmth of his personality.

Smyth published some 260 papers, many being review articles on his findings and a very useful book on dielectric behavior of molecules. The choice of articles in the following publication list is rather arbitrary, but biased somewhat in favor of reviews to make it easier to locate specific periods of Smyth's research.

This memoir was written by the late Walter Kauzmann with respect to Smyth's personal and Princeton life, while J. D. Roberts contributed the discussion of the importance of Smyth's research in organophysical chemistry and the selection of references from his published work.

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