MEMORIAL RESOLUTION OF THE FACULTY OF THE UNIVERSITY OF WISCONSIN-MADISON ON THE DEATH OF PROFESSOR EMERITUS JOHN DOUGLASS FERRY

Emeritus Professor John Douglass Ferry, age 90, died peacefully in his sleep Friday night, October 18, 2002 at Hebron Oaks in Oakwood Village, Madison, following a brief bout with pneumonia.

John was born May 4, 1912 in Dawson, Yukon Territories, Canada, of American parents, and spent his first two years in log cabins in that immediate area. Most of his childhood was spent in small mining communities in northern California, Idaho, Washington, and Oregon. A child prodigy, he graduated with an A.B. degree from Stanford University at age 19, the first person to graduate with a straight A record in the history of the institution. He was married to Barbara (Mott) Ferry in 1944.

In spite of an "uneven" educational background at the grade and high school levels, which of necessity included a significant amount of home schooling, John completed his undergraduate work, majoring in chemistry, at Stanford in 1932. Following two years of graduate study and research on ultrafiltration of proteins with W. J. Elford and Sir F. M. Burnet at the University of London, he returned to Stanford, completing his Ph.D. in 1935, working in chemistry with George S. Parks. He then worked for one year with D. Spence, a rubber chemist who was the co-originator of vulcanization accelerators. For the next decade he held positions at Harvard University (instructor in Biochemical Sciences, 1936-38; fellow, Society of Fellows, 1936-41; research associate with the Medical School, 1942-45) and the Woods Hole Oceanographic Institution (associate chemist, 1941-45). At Woods Hole he worked on antifouling paints for marine applications, and at Harvard he was attached to the E. J. Cohn Project, which had as its overall objective the large-scale fractionation of human blood plasma to obtain serum albumin and other plasma proteins for clinical use by the U.S. Armed Forces. This work instigated a career-long interest in fibrinogen and fibrin and the general problem of blood coagulation; John and a colleague, Dr. Peter Morrison, developed several new products including a fibrin film, which was the first safe and effective surgical replacement for the dural membrane, greatly facilitating brain surgery. In 1946 he joined the faculty of the Department of Chemistry at UW-Madison as assistant professor; he was appointed full professor in 1947 and remained at Madison for the rest of his career. He served as department chairman from 1959 to 1967 and was appointed as Farrington Daniels Research Professor from 1973 until his retirement in 1982, after which he was professor emeritus until his death. After retirement he continued to be active in scientific research for about ten years and continued publishing papers until about one year before his death. He was interviewed as part of the Oral History Project of UW-Madison.

Professor Ferry was undoubtedly the most widely recognized research pioneer in the area of motions and motional dynamics in macromolecular systems studied by means of viscoelasticity measurements. He made an extensive and concentrated effort to determine experimentally the relation between the chemical structure of well-characterized samples and the resultant viscoelastic properties exhibited by them, both for naturally occurring macromolecules of biological importance and synthetic polymers. His fundamental studies of rubber, undiluted polymers, and polymer solutions provided the foundation in mechanical properties for polymer scientists. His book <u>Viscoelastic Properties of Polymers</u> first appeared in 1961 and rapidly became a standard reference for researchers in the polymer field. The second (1970) and third (1980) editions reflect the major advances in polymer theory and refinements in experiment that had occurred subsequently. These books generated enough worldwide demand to be translated into Japanese, Russian and Polish.

Professor Ferry's pioneering role in the development of rheology and understanding of the links' between viscoelastic properties and molecular structure has been so important that it is appropriate to list some of the major achievements of his research group during his 65 year career. Some of the most notable contributions to polymer dynamics are:

- The simple but key principle of reduced variables, giving mathematical form and physical basis for time-temperature superposition for polymer systems.
- Extensive, detailed and thorough studies of the viscoelastic properties of various well-characterized polymers to test the validity of the reduced variables concept and various statistical mechanical theories of polymer dynamics. Here the choice of polymers was critical, and frequently new instrumentation had to be developed in his laboratories in order to achieve the requisite frequency and temperature ranges.

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- A detailed examination of the relation between the temperature dependence of viscoelastic properties and free volume, which led to the development of the famous Williams-Landel-Ferry (WLF) equation. The paper reporting this work is one of the most frequently cited papers in the scientific literature.
- Use of concepts elucidated by the Rouse theory (dilute solutions) to link conformational dynamics and viscoelasticity to explain reduced variables; extension of Rouse theory to explain bulk polymer properties.
- Application of the extended Rouse theory to a study of the glass-to-rubber transition zone in viscoelastic properties for a series of methacrylate esters so that the influence of chemical structure and side-chain length could be explored. This showed that the relaxation behaviors were essentially identical except for effects caused by monomeric friction coefficient and fractional free volume differences for the different structures.
- Extensive studies of the role of entanglements in viscoelastic properties of bulk polymers and concentrated solutions that led to the explanation of the magnitude and breadth of the entanglement plateau. This work showed the importance of the molecular weight between entanglements in determining viscoelastic properties.
- Definitive experiments demonstrating the relation between small molecule diffusion in a rubber and the monomeric friction coefficient for the rubber molecules.
- Extensive high precision viscoelasticity studies of very dilute solutions for a wide variety of synthetic and biopolymers. These measurements were sufficiently precise to provide the first extensive, reliable extrapolations to obtain the infinite dilution properties required for quantitative tests of the elegant statistical mechanical theories then extant. These studies explored the effects of molecular weight, chain flexibility, side group size, long chain branching, solvent quality and charge screening in the observed viscoelastic properties.
- Development of unique, specialized, high precision instrumentation in his laboratories by collaborators. These instruments were essential in order to carry out the studies cited above.

John was the author or co-author of more than 350 scientific papers; research collaborators wrote an additional 35 papers reporting on their work in his laboratories. He was a founding member of the Rheology Research Center at UW-Madison, serving on its executive committee until 1984. He was a frequent visitor to or host of Japanese and French polymer scientists, and was one of three US scientists involved in greatly enhancing polymer science in Japan after World War II.

Throughout his career John received many national and international honors and awards, including membership in the National Academy of Sciences, the National Academy of Engineering, the American Academy of Arts and Sciences, the Eli Lily Award in Biological Chemistry of the American Chemical Society, the Colloid Chemistry Award of the American Chemical Society, the High Polymer Physics Prize of the American Physical Society, the Colwyn Medal of the Institute of the Rubber Industry, the Witco Award in Polymer Chemistry of the American Chemical Society, the Technical Award of the International Institute of Synthetic Rubber Producers, and the Charles Goodyear Medal of the Rubber Division of the American Chemical Society. He aided the scientific community in various capacities, including as chairman of the Committee on Macromolecular Chemistry of the National Research Council, as president of the Society of Rheology, as joint editor of the distinguished series "Advances in Polymer Science", and as editorial board member for five journals. He supervised more than fifty graduate students, and had more than thirty postdoctoral associates or visiting faculty from seventeen different countries working in his laboratories at UW-Madison.

John Ferry was equally well known and appreciated for attributes other than his scientific abilities and contributions. He was a true gentleman, a dedicated teacher and mentor who always had a genuine and abiding interest in and concern for all of his former students and collaborators. His gentle, patient, and quiet personality had an effect on all who were privileged to know and work with him. His reputation for absolute integrity and his uncanny ability to emphasize and encourage the best in others are attributes to which we all should aspire. Former students and colleagues have many fond memories of times spent at the Ferry home with John and his charming and vivacious wife, Barbara, a former chemist turned artist.

He is survived by his wife Barbara; his son John M. Ferry, professor of Earth and Planetary Science at Johns Hopkins University, Baltimore, Maryland; a granddaughter Dorothy L. Gilbertson, M.D.; and great-grand-daughters Morgan and Leila Dahdal. He was preceded in death by his daughter Phyllis L. Gilbertson, in 2000.

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