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Obituary

John Douglass Ferry (1912–2002)—a memorial tribute

J.D. Ferry

John D. Ferry, Emeritus Professor of Chemistry at the University of Wisconsin–Madison died in Madison on October 18. He was a pioneer in applying viscoelastic techniques for the study of motional dynamics in macromolecular systems. Early in his long and productive career he recognized that the unique physical properties of macromolecular polymeric materials were linked to their motions and configurations. Accordingly, he made an extensive and concentrated effort to determine the relationship between viscoelastic properties and the chemical structure of the macromolecular constituents of a polymer. This search included synthetic polymers of interest to the chemical sciences and industry, such as rubbers and polymer melts, as well as a naturally occurring biological polymer of great interest to the medical science world, fibrin. Collectively, these studies provided the foundation for his celebrated text, *Viscoelastic Properties of Polymers* [1], which became a widely read classic in the polymer chemistry field soon after publication of the first edition in 1961. This volume underwent two updates, the last in 1980. Much of the work by Ferry and many of his students, colleagues, and collaborators, was described in this book. The fact that it has been translated into three languages, Japanese, Russian, and Polish, is a tribute to its authoritativeness.

John Ferry was born in 1912 in the Yukon Territory of Canada. He spent his first two years living in log cabins in that area since his father was a civil and mining engineer specializing in prospecting for placer deposits. Those early experiences were summarized and annotated by Schrag and Landel [2] and also documented by John's mother Eudora Bundy Ferry, in her book *Yukon Gold: Pioneering Days in the Canadian North* [3]. He received the A.B. degree from Stanford University in 1932, and in 1929 had his name posted on a silver cup dedicated to the Outstanding Freshman Chemistry Student. John completed his Ph.D. in 1935, and had been assigned the problem of finding a glass transition in polyisobutylene. During the course of these studies he encountered the phenomena of non-Newtonian flow and viscoelasticity (creep and creep recovery), and these issues fig-

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ured prominently in his interests, including many of the studies that he subsequently carried out on fibrin.

In 1946 he joined the faculty in the Department of Chemistry at the University of Wisconsin in Madison where he continued to reside for the remainder of his career and for the remaining years of his life. By 1947 he had been promoted to the rank of Professor and then served as Departmental Chairman from 1959 to 1967. He was appointed the Farrington Daniels Research Professor in 1973 and he formally 'retired' in 1982, although retaining his office and an active research laboratory for several years afterward. He was a founding member of the Rheology Research Center at Wisconsin, and served on its executive committee until 1984. Both before and during his tenure in Wisconsin, he played a critically important role in the development of rheology and an understanding of the links between viscoelastic properties. He has left a significant imprint on the understanding of both the linear viscoelastic properties of polymeric systems and the physical origins of these properties in the conformations and motional dynamics of macromolecules. These numerous scientific achievements have been well summarized and annotated [2,4,5] and detailed to a large extent by John Ferry himself [6,7].

During his long and distinguished career John Ferry received many national and international awards and honors including membership in the National Academy of Sciences, the National Academy of Engineering, the American Academy of Arts and Sciences, the Eli Lilly Award in Biological Chemistry of the American Chemical Society, the Kendall Award in Colloid Chemistry of the American Chemistry Society, the Bingham Medal of the Society of Rheology, the Witco Award in Polymer Chemistry of the American Chemical Society, the Technical Award of the International Institute of Synthetic Rubber Producers, the Colwyn Medal of the Institution of the Rubber Industry, and the Charles Goodyear Medal of the Rubber Division of the American Chemical Society [6]. Among the many honors conferred upon him are included: honorary president of the Fifth International Congress on Rheology (Kyoto, Japan; 1968), Honorary member of the Groupe Francais de Rheologie (1972), Keynote Speaker and Guest of Honor at the New York Academy of Sciences Symposium on the *Molecular Biology of Fibrinogen* (1982) [2], Co-Chairman, Gordon Research Conference on Polymer Physics (1982), Honorary Member of the Japan Society of Rheology (1983), Institute of Materials Science Distinguished Lecturer, University of Connecticut (1987), Guest of Honor at the Symposium on Polymer Dynamics, University of Southern California (1990) [7].

At the beginning of World War II (1941–1945) Ferry was assigned to work at the Woods Hole Oceanographic Institute on developing antifouling paints for marine applications, and was also jointly assigned to Harvard Medical School to work at The Protein Foundation with the now famous E.J. Cohn group, whose studies were focused on the large scale fractionation of human plasma proteins. Ferry and his colleague Peter R. Morrison were supplied with fibrinogen-rich human Fraction I, one of the goals being to prepare materials that might be clinically useful. Of the many valuable outcomes of this work, especially as it involved aspects of fibrinogen conversion and fibrin polymerization, a practical product termed 'fibrin film' was developed. This material could be dried in vacuo, was stable in storage, and was used clinically as a shield that replaced the dural membrane of the brain in soldiers with head injuries. Another product of these investigations was 'fibrin foam', which was to be used as a biologically absorbable surgical hemostatic agent. Although these particular products fell into disuse for reasons that were largely unforeseeable at the time, it is most notable that their introduction for clinical use predated by approximately 40 years similar products that are now in common clinical use (Fig. 1).

Perhaps the most seminal of his achievements from that era concerned his idea on the polymerization of fibrin monomer units to form fibrils. This idea was the product of biophysical studies that had been carried out in conjunction with his colleagues at the Protein Foundation, coupled with his extraordinary ability to integrate this information with that from other sources. His proposition that fibrin monomers became aligned to form double-stranded fibrils '*by a lateral dimerization process with partial overlapping, resulting in two parallel*

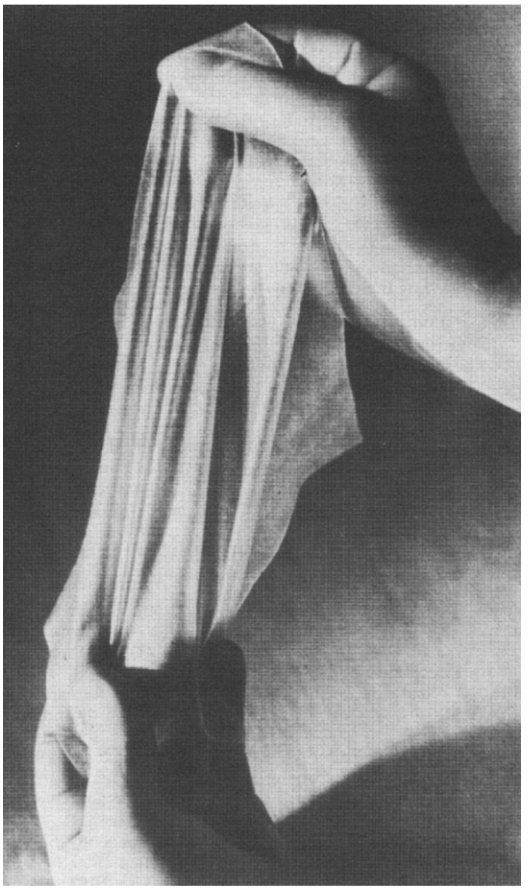

Fig. 1. Fibrin Film, plasticized with glycerol [8].

and end-to-end chains with staggered junctions' [9] became the theoretical basis for almost all subsequent models of polymerized fibrin. This idea has by now become an axiom.

In 1971, after a lapse of 15 years, his interests in the fibrinogen–fibrin conversion resumed, and in concert with students and post-doctoral colleagues he continued to make many important contributions, always in context with contemporary ideas [10]. These studies included investigations of the viscoelastic properties of fibrin clots that had been covalently ligated with factor XIIIa compared with those that had not been ligated, often supported by parallel flow birefringence, light and small angle X-ray scattering, and electron microscopic analyses. Even after his retirement in 1982 his appetite for this subject did not diminish perceptibly. He participated in Societal and group meetings on fibrin polymerization both in Madison, Milwaukee (1988 at the International Fibrinogen Workshop) and elsewhere (New York Academy of Sciences, 1982) [8]. He carried out an active correspondence with investigators interested in the fibrinogen to fibrin conversion including John Shainoff, John Weisel, Enrico Di Cera, and me, and he made himself readily available to those of us who sought him out in person to present their own results. He almost always offered insightful discussion, and written commentaries in the form of a letter usually followed. These reflected serious analytical thought on his part, as exemplified in a letter [11] that dealt with the differing views on the location of ligated γ chains in the fibrin polymer network, '*We are hampered by lack of any real theory connecting elasticity with structure. However, it occurred to me that DD-transverse has the possibility of a large extension under tensile strength if the D:E non-covalent bonds can yield under tensile strength. The enclosed sketch indicates what might happen if the double-stranded fiber opened up to support tension only through a sequence of covalent-bond-linked units. This would increase the length by a factor of approximately 1.8*'. To put that calculation in context with his own previous work he further wrote, '*Cross-linked* (*ligated*) *fibrin film recovers its original length after a stretch by a factor of 1.82*.'

His familiarity with new ideas related to fibrinogen was outstanding, and his ability to place these ideas in historical perspective was unparalleled. In another letter [12] he wrote, '*The paper on chloride ion by Di Cera, Weisel, et al. was quite startling. They seem to have made a convincing demonstration that various anions differ. It is somewhat sobering that it took fifty years for this to emerge. Someone should have been aware of the work by Jones and Dole that was cited—maybe it was mentioned somewhere in the bible by Cohn and Edsall, which unfortunately I gave away when I retired. But in the Cohn laboratory we always took the first approximation that interactions between proteins and small ions are governed by pH and ionic strength*'. He remained engaged in scientific dialogue almost until the time of his

death. Four days after his passing, John Weisel, who had sent Ferry his latest manuscript for review, received a letter from one of Ferry's colleagues stating that John had thought this was a most interesting manuscript and wanted to apologize since he would not be able to comment in detail in person.

John Ferry was an extraordinary scientist who was a patient and dedicated teacher and mentor. He was admired for his encyclopedic knowledge, his reputation for absolute integrity, his ability to bring out the best in other individuals, and for his linguistic and writing abilities. In any given generation, there is an occasional person who through his intellect, his imagination, and the ability to communicate, makes an indelible and important contribution to knowledge in his field. John Ferry was one of those people in the broad field of polymer chemistry and the biological field of the fibrin polymer. Those of us who knew him were privileged to have been able to interact with him, and all of us will remember him [13].

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[11] March 11, 1996 to MWM.
[12] May 17, 1997 to MWM. He wrote a letter on the same subject to Enrico Di Cera on June 2, 1999 in which he also discussed his wartime work on antifouling ship bottom paint in terms of the effects of chloride and nitrate ions. He closed with, '*But I did not think of chloride as such an active player in fibrinogen clotting*'.
[13] I am deeply indebted to John L. Schrag for providing me with so much information about John Ferry's life.

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