



AS Lodge

ARTHUR SCOTT LODGE

1922–2005

Elected in 1992

“For outstanding monographs and major developments in continuum mechanics, molecular theories of polymer flow, and high-precision measurement of rheological properties.”

BY R. BYRON BIRD, A. JEFFREY GIACOMIN,
AND DAVID S. MALKUS

AARTHUR SCOTT LODGE was born on November 20, 1922, in Liverpool, United Kingdom, and spent his childhood there. From 1941 to 1948, he attended Oxford University, where he earned his B.A. in mathematics and his M.A. and D.Phil. in theoretical nuclear physics. He subsequently did experimental work with radar for the Admiralty at the Clarendon Laboratory.

Arthur spent one year (1945–1946) working in the theoretical physics section of the Atomic Energy Division of the National Research Council in Montréal, Canada. This was followed by 12 years at the British Rayon Research Association in Manchester, UK, initially with Karl Weissenberg. Arthur had been introduced to Dr. Weissenberg by his thesis adviser, Professor Maurice Pryce, for which Arthur had been grateful; the introduction enabled him to enter the field of rheology when it was just beginning to blossom—the field he pursued throughout his research and teaching career.

From 1961 to 1968, Arthur held a lectureship in the Department of Mathematics at the University of Manchester Institute of Science and Technology. During those years, he took time out (1965–1966) to lecture and conduct research at the University of Wisconsin in Madison. This resulted in his being invited to return to Madison in 1968 as professor

of rheology in the Department of Engineering Mechanics, a position he held until he retired in 1991. From 1969 until 1991, he was founding chairman of the Rheology Research Center Executive Committee at the University of Wisconsin. Even in retirement, he continued to participate in the Friday seminars at the center. Overall, at Manchester and at Wisconsin, he directed the research of 18 graduate students.

Arthur was invited to the University of Wisconsin in response to his first book, *Elastic Liquids* (Academic Press, 1964; Russian edition, 1969; Japanese edition, 1975). In the opinion of Professor R. Byron Bird, this was the first book on rheology that clarified the structure of the subject and established the aims of the discipline. In addition, the "Lodge rubberlike liquid" constitutive equation was introduced and used to solve a wide variety of flow problems. This equation explained everything that could be reliably measured about the linear viscoelasticity of polymeric liquids at that time and for years to come. The book also included an exhaustive study of recoil and an explication of how other more complicated constitutive equations could be developed and tested.

In his second book, *Body Tensor Fields in Continuum Mechanics, with Applications to Polymer Rheology* (Academic Press, 1974), Arthur continued the development of the notion of "body tensors" and introduced techniques for solving classes of problems that had proven difficult to solve. The body-tensor formalism is closely related to the convected-component formalism of J. G. Oldroyd (presented in 1950). Arthur had described the relation between the two types of notation in 1951 and supplied the proof in 1972.

In his next, modest book, *An Introduction to Elastomer Molecular Network Theory* (Bannatek Press, 1999), Arthur presented original ideas about the molecular foundations of elastomer network theory. In the preface he stated: "The distinctive aim of the present textbook is to develop these tools from first principles, in as short, yet complete and self-contained, a form as possible to allow one to illustrate their use by presenting the assumptions and deriving the equations for the simplest form of the molecular network theory of elastomer elasticity." By "these

tools," he meant vector and tensor analysis, thermodynamics, and statistical mechanics. In this book, he went out of his way to define all terms and to choose his words carefully. As he liked to say, quoting Lewis Carroll (1872): "When I use a word," Humpty Dumpty said, in a rather scornful tone, "it means just what I choose it to mean—neither more nor less."

In addition to the three books described above, Arthur edited, with Michael Renardy and John A. Nohel, *Viscoelasticity and Rheology* (Academic Press, 1985).

A measure of Arthur Lodge's influence on the field of rheology is the number of terms that bear his name: the Lodge rubberlike liquid; the Lodge network model; the Lodge stressmeter; the Lodge-Meissner relation; the Higashitani-Pritchard-Lodge equation (for the hole-pressure error); and Lodge body tensors.

Arthur Lodge's talents and scientific contributions have been acknowledged in many ways: Fellow of the Institute of Physics, London (UK); Bingham Medal, The Society of Rheology; Visiting Professor, University of Stuttgart Institute of Plastics Technology; Byron Bird Award, College of Engineering, University of Wisconsin; "Citation Classic" for Elastic Liquids; Gold Medal, British Society of Rheology; Olaf Hougen Visiting Professor, Department of Chemical Engineering, University of Wisconsin; and member of the National Academy of Engineering.

Arthur was also involved in a variety of other activities. From 1970 on, he was a member of the Editorial Board of *Rheologica Acta*, and from 1973 to 1984 he was a member of the Working Party on "Structure and Properties of Commercial Polymers," International Union of Pure and Applied Chemistry (IUPAC) Macromolecular Division. In 1981, he formed the Bannatek Company, Inc., to manufacture "stressmeters" (USP 4,454,765, 4,141,252, 3,777,549), instruments used to monitor polymer properties by cleverly using the normal stresses of the polymers. The development of the stressmeter was a tribute to Arthur's skill as an experimentalist.

Most of Arthur's friends have at one time or another been victimized by his cleverly constructed, side-splitting limericks.

He was able to synthesize these literary gems in very short order, much to the enjoyment of all. Arthur's special hobby was piano, particularly the works of Schubert and other romantic composers. He also enjoyed playing chamber music and frequently collaborated with other musicians.

Arthur maintained a Web page devoted to controversial subjects. He particularly enjoyed challenging Darwin-like theories. Other topics he discussed included comparisons of science and religion, types of laboratory experiments, compost temperatures, zero-recoil for the "tube type" of polymer kinetic theories, and "unlikely events" theories.

Arthur and his wife, Helen, had three children: Keith (a professor of chemical engineering at the University of Minnesota-Duluth), Timothy (a professor of chemistry at the University of Minnesota in the Twin Cities), and a daughter, Alison, who lives in England. Their home in Madison was the site of delightful get-togethers for rheologists and students, musical groups, and literary events. The Lodges were always warm-hearted hosts, and their friends enjoyed many an afternoon and evening in their company. With Arthur's passing on June 24, 2005, we lost a solid scholar, a humorous and kindly gentleman, and a thoughtful teacher.

