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50. Henri Benoît

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Personalities in Polymer Science

H. Benoît

Honoring Professor Henri Benoît on his 75th Birthday

Few scientists had more **impact** on **polymer physics** and the polymer community than Henri Benoît. He was instrumental in defining and characterizing the **dimensions** of **macromolecules** *in solution* and *in the solid state* by pioneering such techniques as **gel permeation chromatography** and **neutron scattering.**

Henri Benoît was born in Montpellier, France on July 11, 1921 as the son of Jean-Daniel Benoît, professor of theology and Henriette, born Bois, a granddaughter of the well known chemist Charles Friedel of the University of Strasbourg.

Henri Benoît received his degree in physics from the Ecole Normale Supérieur de Paris in 1945. He then became an Assistant at the University of Strasbourg, where he started his scientific career in macromolecular science under the guidance of Professor Charles Sadron. He became a Research Fellow in 1949 (Maître de Conférences) and received his *docteur ès-science* degree from the University of Strasbourg in 1950. He was invited and accepted the position of a Research Associate at Harvard University where he worked from 1952 to 1953 in the laboratory of Professor Paul Doty.

In 1954, Henri Benoît was appointed Professor at the University of Strasbourg. At the creation of the new world-renowned "Centre de Recherche sur les Macromolécules (C.R.M)", he became Assistant Director and served under the director, Professor Sadron. In 1967, Henri Benoît became Director of the C.R.M. After 12 years as Director, he relinquished this position and assumed the position of a Senior Scientist at the C.R.M.

Henri Benoît has always been a fervent believer in the value of basic research and of the need to encourage young scientists to make their individual contributions and to pursue their own and individual scientific careers. Under his creative leadership the C.M.R, later called Institute Charles Sadron, became rapidly the most important macromolecular research center in Europe with the highest international reputation. His interesting and engaging personality made him loved not only in his own laboratory and in France, but also in Europe and throughout the world.

Henri Benoît's major contributions to polymer science have been in the characterization of macromolecules from both theoretical and experimental points of view. He has made notable contributions to the theory of light scattering and he is responsible for the experimental techniques that are now generally practiced. These studies have provided the appropriate interpretation of the scattering at large angles and have led to a better understanding of molecular anisotropy, of molecular aggregation and of segregation. In the case of block copolymers, the effects of copolymer composition (lengths and sequences) and their polydispersity have given new insights of in the interactions involving macromomolecular structures.

Professor Benoît was also in the forefront in the research of the application of gel permeation chromatography for polymeric systems and of the quantitative interpretation of this method. He developed the universally adopted calibration method, which permits the determination of the molecular weight of an unknown polymer (linear or branched) by measuring its retention volume and its solution viscosity. Under Benoît's stimulating leadership, model macromolecules: blocks, stars, and combs were synthesized and characterized. More recently, special attention has been devoted to ideal gels, i.e. gels with chains of the same length linked together by trifunctional and tetrafunctional units. Such gels, whose structure corresponds more closely to the theoretical model of ideal elasticity than the usual gels obtained by free radical polymerization, show very interesting mechanical, optical and swelling properties.

Henri Benoît saw as one of the first, probably the first, the potential of small-angle elastic neutron scattering as a fundamentally new way to study polymer properties. He played the leading role in establishing this new technique as central to our understanding of the conformation of polymer chains in bulk and in the liquid state. He used deuterated macromolecules dispersed in bulk polymers and showed that the chains obey Gaussian statistics and have the molecular dimensions that had been predicted earlier.

Henri Benoît's research accomplishments are published in nearly 400 papers, reviews and in several books. His most recent book, written with Julia S. Higgins is entitled "Polymers and Neutron Scattering". Henri Benoît is on the Editorial Board of several scientific journals: Advances in Polymer Sciences and, until recently, the Journal of Polymer Science (Physics Edition) and of Polymer.

Over many years Henri Benoît has been one of the most prominent personalities in science in France. He served on numerous national and international scientific bodies in France. He was a member of the Comité National de la Recherche Scientifique (C.N.R.S) from 1967 to 1975 and President of its Section of Molecular and Macromolecular Physical Chemistry from 1971 to 1975. From October 1980 until 1983, he was President of its Section of Physical Chemistry of Polymers and Biological Systems. In 1981, he became Director of the UER-Physical and Chemical Sciences of the Université Louis Pasteur at Strasbourg and is now Professor Emeritus.

Benoît has been President of the Division of Macromolecular Chemistry of the International Union of Pure and Applied Chemistry from 1971 to 1975. His great experience and sound advise were much appreciated in IUPAC activities as well as in the European Science Foundation of the CEE.

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The accomplishments of Henri Benoit have been recognized by his native France as well as by organizations in foreign countries. He received the Silver Medal of the C.N.R.S in 1961 and the Robin Prize of the French Society for Physics in 1978.

Henri Benoit has been an Officier de l'Ordre du Mérite since 1968, a Commandeur de l'Ordre des Palmes Academique since 1974, an Officier de la Légion d'Honneur since 1978, since 1986 a Commandeur de l'Ordre national du mérite. In 1983 he became a Correspondant de l'Academie des Sciences.

Benoit has been awarded honorary doctoral degrees from the University of Uppsala in 1971, from the University of Aberdeen in 1973 and from the Polytechnic Institute of Lodz in 1977.

Henri Benoit received the Gold Medal of the Czechoslovak Academy of Sciences in 1969, he became a Centennial Fellow of the American Chemical Society in 1976, received the Witco Award in Polymer Chemistry of the American Chemical Society in 1976 and the Ford Prize in High Polymer Physics of the American Physical Society in 1978. Henri Benoit also received the Alexander von Humboldt Prize in 1986 and the Frazer Price Memorial Award of the University of Massachusetts in 1979. He is also an Honorary Member of the Spanish Chemical Society since 1986 and received the medal of the Slovak Academy of Sciences in 1995.

In addition to his enthusiasm in science, particularly Polymer Physics, Henri Benoit is an avid and accomplished Cello player. He loves to take care of his house and garden in the family house he owns in the Cevennes (Malons in the South of France), a house that has been in this family for over 100 years.

Since 1945 Henri Benoit has been married to Maria-Thérèse Bigand. They have three children, Alain, Nicole and Eric. Two are University Professors and one is a scientist at the C.N.R.S.

This article was prepared by **Otto Vogl, Herman F. Mark Professor of Polymer Science**, Polytechnic University, Brooklyn, NY in cooperation with **Jeanne-Dominique Gass**, C.N.R.S, Montpellier, France