ChE educator

R. Byron Bird

Prepared by his
Wisconsin Colleagues
University of Wisconsin
Madison, WI 53706

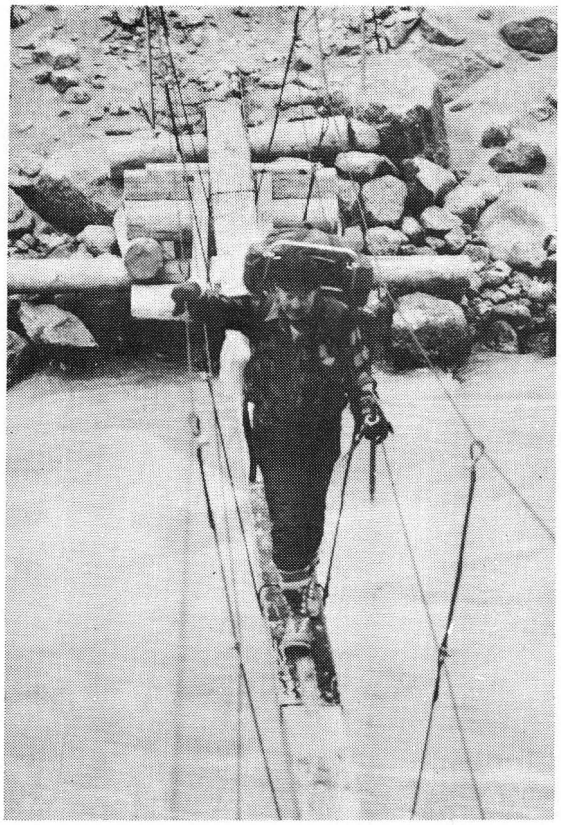
TO THE PROFESSION Bob Bird is known as an author and researcher, to the students at the University of Wisconsin as an excellent teacher and to others as a companion on numerous wilderness trips, a linguist and musician.

The son of a civil engineer, Bob received his B.S. in chemical engineering at the University of Illinois in 1947 and his Ph.D. in chemistry at the University of Wisconsin in 1950. After post-doctoral experience at the Instituut voor Theoretische Physica in Amsterdam, Holland, and The Theoretical Chemistry Institute at the University of Wisconsin, he joined the chemistry faculty at Cornell University. In 1953 he returned to Wisconsin to join the staff of the chemical engineering department where he has progressed through the faculty ranks and served as department chairman (1964-1968).

MOLECULAR THEORY OF GASES AND LIQUIDS

BOB'S INTRODUCTION TO transport phenomena began with his doctoral work with J. O. Hirschfelder at the University of Wisconsin on the calculation of transport properties of gases from intermolecular forces and post-doctoral research with J. de Boer at the University of Amsterdam on quantum effects in gases at low temperatures. This phase of his career culminated in the publication of a 1200-page treatise: *Molecular Theory of Gases and Liquids* by J. O. Hirschfelder, C. F. Curtiss, and R. B. Bird (1954), which brought together information on transport properties (viscosity, thermal conductivity, and diffusivity), equation of state, and intermolecular forces. This work was recently listed by *Current Contents* as the fourth most-cited book in physics and chemistry for the period 1961-1972.

A summer at the DuPont Experimental Station convinced Bob of the need for developing a textbook which would help engineers and applied scientists to understand and use the "equations of change" of transport phenomena.



Bob hiked for two weeks on Baffin Island, north of the Arctic Circle.

TRANSPORT PHENOMENA

A SUMMER AT THE DuPont Experimental Station convinced Bob of the need for developing a textbook which would help engineers and applied scientists to understand and use the "equations of change" of transport phenomena (the differential equations for conservation of mass, momentum, and energy as applied to multi-component fluids). After several years of research devoted to non-Newtonian fluid mechanics, non-Newtonian heat transfer, viscous dissipation heat effects, and multi-component diffusion, work was begun on the book *Transport Phenomena* (R. B. Bird, W. E. Stewart, E. N. Lightfoot, 1960); it was to go through 21 printings and 100,000 copies

in 18 years and was to be translated into Spanish, Italian, Czech, and Russian.

DYNAMICS OF POLYMERIC LIQUIDS

FROM ABOUT 1958 onwards Bob specialized in research on transport phenomena in polymeric liquids. These fluids cannot be described by the equations of classical fluid dynamics (i.e., the Navier-Stokes equations) since they do not have linear stress-rate-of-strain relations. This work comprised two main areas: the development of constitutive equations (i.e., expressions for the stress tensor), and experimental and theoretical studies of rheological behavior and fluid dynamics problems. The latter included flow in annuli, flow around spheres, performance of rolling-ball and falling-cylinder viscometers, viscous heating in cone-and-plate viscometers, percolation through porous media, squeeze-film lubrication, secondary flows in a disk-cylinder system, elongational flows, and converging flows. The long-range objective of this work was to develop methods of solving polymer flow problems utilizing fragmentary data on rheological properties obtained from viscometric and other experiments. In about 1968 Bird helped to found the Rheology Research Center at the University of Wisconsin, along with A. S. Lodge, J. D. Ferry, J. L. Schrag, and M. W. Johnson, Jr.

After 1968 Bird turned his attention to the kinetic theory of polymer solutions in order to investigate the connection between macromolecular structure and rheological properties. During this period two lengthy research publications appeared: the first (with H. R. Warner and D. C. Evans) summarized and extended the kinetic

R. B. BIRD PhDs

David R. Longmire	1957
Richard M. Griffith	1958
Arnold G. Fredrickson	1959
John C. Slattery	1959
Hsien-Wen Hsu	1959
James R. Brock	1960
Allyn J. Ziegenhagen	1962
Donald W. McEachern	1963
Thomas J. Sadowski	1963
Donald M. Meter	1963
Michael C. Williams	1964
J. Lloyd Sutterby	1964
Raffi M. Turian	1964
John D. Huppler	1965
Thomas W. Spriggs	1966
Edward Ashare	1967
Ian F. Macdonald	1968
Pierre J. Carreau	1968
Christopher T. Hill	1968
Chien Bang Wang	1969
Everette K. Harris, Jr.	1970
James F. Stevenson	1970
Harold R. Warner, Jr.	1971
Robert C. Armstrong	1973
Ole Hassager	1973
Roger J. Grimm	1977
Michael J. Riddle	1977
Moshe Gottlieb	1978
Robert K. Prud'homme	1978
Alberto Co	1978

FIGURE 1. Four former chairmen of the ChE department gather together on Jan. 18, 1968, for the 90th birthday of Professor Otto Kowalke (seated). Standing (left to right) are Professors Roland A. Ragatz, Olaf A. Hougen and R. Bryon Bird.

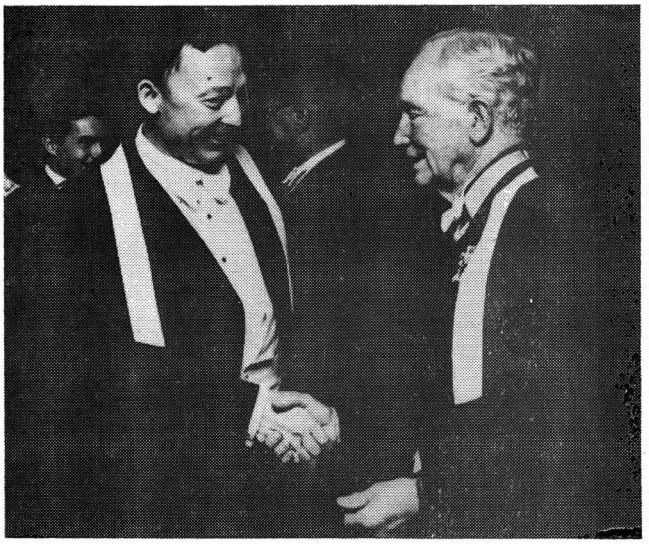


FIGURE 2. In the Aula of the Technical University of Delft two honorary doctors of engineering congratulate each other: RB[2] (left) and Ir. L. Schepers, formerly president of the Royal Dutch Shell Group and ex-president of the Board of Governors of the University (January 1977).

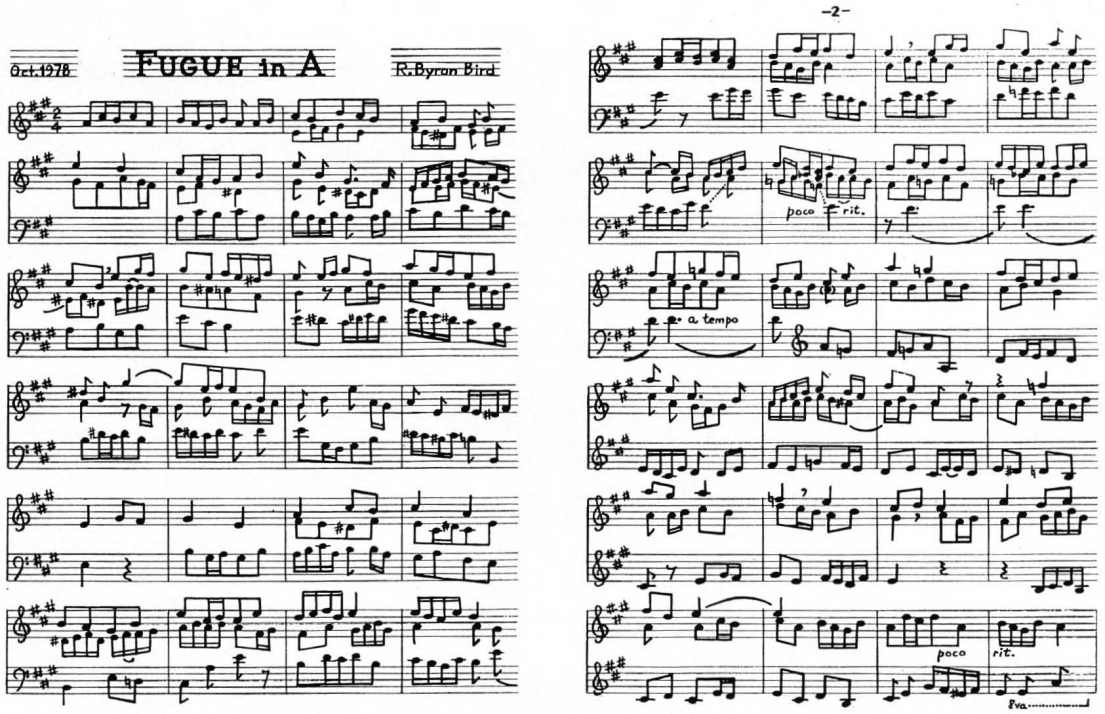


FIGURE 4. Bob Bird's composition, a four-part fugue.

theory of solutions where the polymer solute molecules are modelled as elastic or rigid dumbbells; the second (with C. F. Curtiss and O. Hassager) established a new phase-space statistical mechanical theory for polymer solutions which then provided the basis for further theoretical developments and detailed calculations. These two decades of research on continuum and molecular theories of polymer rheology culminated in the publication of an 850-page, two-volume monograph: *Dynamics of Polymeric Liquids, Volume 1—Fluid Dynamics* by R. B. Bird, R. C. Armstrong, and O. Hassager (1977) and *Volume 2—Kinetic Theory* by R. B. Bird, O. Hassager, R. C. Armstrong, and C. F. Curtiss (1977).

APPLIED LINGUISTICS

BOB HAS SIMULTANEOUSLY pursued a second major interest, namely, applied linguistics. Because of his research and teaching activities in The Netherlands, he became interested in the teaching of Dutch. This activity resulted in the publication of a graded and annotated series of short stories, essays, and poems by Dutch authors: *Een Goed Begin—A Contemporary Dutch Reader*, by R. B. Bird and W. Z. Shetter (1963, 1971). Then he turned his attention to the problems facing the scientist or engineer who wishes to translate technical material from Japanese to English. He first made an extensive study of the frequency of occurrence of various *kanji* (Chinese characters) in technical Japanese writings; then with this information at hand, he coauthored the first English-language reader on scientific Japanese: *Comprehending Technical Japanese*, by E. E. Daub, R. B. Bird, and N. Inoue (1975).

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For years Bob offered a course in the Dutch language and administered the graduate examinations in Dutch out of his office in the ChE Department. Nearly every Japanese visitor to the college is brought over to visit with this "gaijin" who speaks Japanese.

PROFESSIONAL RECOGNITION

BOB HAS RECEIVED wide recognition for his professional contributions. At Wisconsin he was named Burgess Professor in 1968 and then Vilas Research Professor in 1972. He was a Fulbright visiting professor and Guggenheim scholar at the Technische Hogeschool in Delft, Holland (1958), and a Fulbright lecturer at Kyoto and Nagoya Universities in Japan (1962-63). He received honorary doctor of engineering degrees from Le-

high University (1972), Washington University (1973), and the Technische Hogeschool Delft (1977). He was elected to the National Academy of Engineering in 1969. He was elected a Fellow of the American Physical Society in 1970 and Fellow of the American Institute of Chemical Engineers in 1972; he has received the William H. Walker, Professional Progress, and Warren K. Lewis Awards of the American Institute of Chemical Engineers, the Bingham Medal of the Society of Rheology, and the Curtis McGraw and Westinghouse Awards of the American Society of Engineering Education.

The undergraduate students in chemical engineering twice elected Bob as the best instructor.

DEVIL'S LAKE AND THE OGOKI

BOB REGULARLY SPENDS the weekends hiking in the lovely country-side near Madison, usually with a group of graduate students, a course called ChE 1000 convening at Devil's Lake and Governor Dodge State Parks. Often in midweek, he returns to his favorite spot on the cliffs of Devil's Lake to "recharge his batteries."

For nearly thirty years, Bob has spent part of each summer canoeing in the wilderness lake country of Ontario, Canada. Usually, these canoe trips are with graduate students from the department and occasionally with fellow professors in need of airing out.

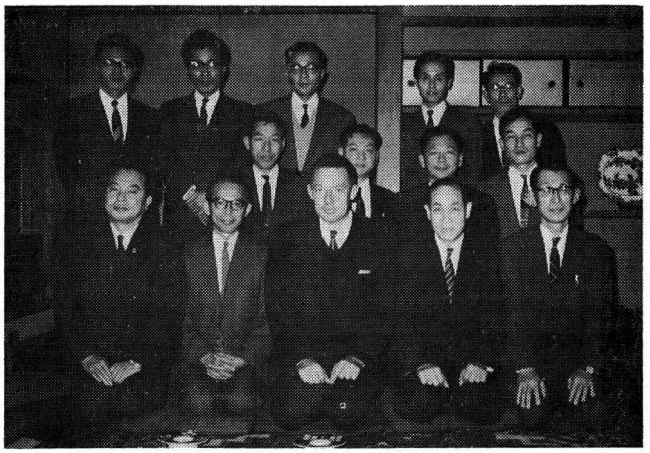

FIGURE 3. This is the "kinen-shashin" after a dinner at Nanpuro Restaurant in Kyoto with the U. of Kyoto ChE staff in October 1968. From left to right: 1st row, Profs. Toel, Yoshida, RB², Nagata, Linoya; 2nd row, Profs. Eguchi, Ito, Hiraoka, Yasunishi; 3rd row, Profs. Emi, Nakamura, Harada, Hotta and Okazaki.

Bob regularly spends the weekends hiking in the lovely countryside near Madison, usually with a group of graduate students, a course called ChE 1000 convening at Devil's Lake and Governor Dodge State Parks.

In 1971, Bob and five fellow canoeists travelled down the Coppermine River in The North West Territories of Canada, covering 320 miles of the tundra from Lake Rawalpindi to the Arctic Ocean.

In 1977, Bob, Ed Crosby, Phil Leider and Jim Welch hiked for two weeks in Pangnirtung Pass on Baffin Island, north of the Arctic Circle.

Bob also enjoys music composition and performance. The piano and organ provide him with hours of relaxation. His latest composition is a four-part fugue. (See Figure 4) □

ChE letters

RUTHERFORD CLAIMS ARIS IS IMPOSTER

Dear Sir,

A friend sent me a copy of your article about the notorious R. A. of Minnesota and I write in haste to protest this latest outrage upon my person. Not content with stealing half my accomplishments to bolster his own he adds insult to injury by allowing me to be treated as "mythical." Mythical, my foot! Why that's a picture of me at the baseball wicket during my recent goodwill tour of the colonies; it couldn't be Aris for he doesn't know whether the bat should be thrown above the shoulder and below the knee or vice versa, he thinks a sacrificial punt is a theological concept and a strike has something to do with industrial relations.

But I'm not writing chiefly to protest my authenticity nor even to expose the real imposter—his biography in Who's Who is pure fiction and his only real merit is that he has some good friends—but to make a simple correction. Much as, no doubt, Aris would like to claim credit for supervising Arvind Varma's Ph.D. work this would be preposterous. Even I who truckle with mash rather than mathematics and never fash myself about a proof unless there's '100' in front of it, know that it was Amundson with whom Varma worked—witness the long series of papers on the tabular reactor amongst others. Perhaps the confusion arose because Varma has been known to help Aris out; in fact they're currently editing a selection of Amundson's papers, a volume which I'm glad to hear will contain the Chief's early work on distillation.

In anticipation of the benefits of which,

I remain, Sir, your obedient servant,

Aris McPherson Rutherford
"The Sampling Port"
3a, Reflux Road
Glenlivet, Scotland