

This Week's Citation Classic

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Bird R B, Stewart W E & Lightfoot E N. *Transport phenomena.* New York: John Wiley and Sons, 1960. 780 p. [Dept. Chem. Eng., Univ. Wisconsin, Madison, WI]

This is the first textbook that appeared on transport phenomena. It presents systematically and interrelates momentum transport (fluid mechanics), energy transport (heat transfer), and mass transport (diffusional processes). The discussion is at three levels: molecular (transport properties), continuum (equations of change), and equipment (macroscopic balances). [The SCI® indicates that this book has been cited over 2,090 times since 1961.]

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"This book was prepared because of a need for instructing chemical engineers in the basic physics needed for understanding unit operations, chemical reactor performance, process control, polymer processing, etc. This increased physics background was required because of the growing importance of computer modelling and the emphasis on development of new industrial processes involving new materials and wider ranges of processing variables.

"The book was first published as a 'preliminary edition,' based on mimeographed notes prepared during the academic year 1957-1958.¹ Further material was prepared by myself while on Fulbright Lectureship in Holland in spring 1958.² The text was reworked during 1958-1959. The authors profited immensely from the comments from teachers and students who had used the preliminary edition and the Dutch notes. The entire manuscript was read aloud by the authors in a group to insure accuracy and consistency.

"Since we received considerable encouragement from Olaf A. Hougen, the book was dedicated to him in a 'secret message.' Read the first letters of the sentences in the preface. Another message is in the initial letters of the paragraphs in the postface. The Czech and Spanish editions also contain secret messages.

"We brought to this writing effort different backgrounds, prejudices, and objectives. I did my undergraduate work in chemical engineering, followed by graduate study in physical chemistry with J.O. Hirschfelder at the University of Wisconsin and postdoctoral research with J. de Boer at the Institut voor Theoretische Physica in Amsterdam. I coauthored a book dealing with thermodynamic and transport properties.³ A summer at the Du Pont Experimental Station served to emphasize the importance of the equations of change for many classes of polymer processing problems. W.E. Stewart had all of his training in chemical engineering (two degrees at University of Wisconsin, and an ScD at MIT). In his doctorate work with H.S. Mickley he gained insight into the use of boundary-layer theory in problems with simultaneous heat and mass transfer. Six years of experience at Sinclair on catalysis and reactor design provided additional experience which would be of great benefit in teaching transport phenomena. E.N. Lightfoot took his undergraduate and graduate training at Cornell University in chemical engineering. After several years with the Pfizer Company working on biochemical processing and fermentation operations, he joined the staff at the University of Wisconsin to organize a curriculum in biochemical engineering. With such differing backgrounds it is no wonder that we often had heated arguments, which invariably led to improvements in presentation, better illustrative examples, and clearer tabulations. Each of us has written an additional book in a related area."⁴⁻⁶

1. Bird R B, Stewart W E & Lightfoot E N. *Notes on transport phenomena.* New York: John Wiley and Sons, 1958. 455 p.
2. Bird R B. *Transportverschunselen in Stomende Media.* Holland: Hogeschool Delft, 1958. 86 p.
3. Hirschfelder J O, Curtiss C F & Bird R B. *Molecular theory of gases and liquids.* New York: John Wiley and Sons, 1954. 1219 p.
4. Lightfoot E N. *Transport phenomena and living systems: biomedical aspects of momentum and mass transport.* New York: John Wiley and Sons, 1974. 495 p.
5. Bird R B, Armstrong R C, Hassager O & Curtiss C F. *Dynamics of polymeric liquids.* New York: John Wiley and Sons, 1977, 773 p.
6. Stewart W E & Sorensen J P. *Collocation and parameter estimation in chemical reaction engineering.* New York: John Wiley and Sons. (In Press. 1980.)