

ard BSL is closer to an open text of which a leading example would be Batchelor's *Introduction to Fluid Mechanics*. This closed-end approach also, unfortunately, means that a number of things are left out. They include, for example, non-Newtonian fluids, multicomponent diffusion and simultaneous heat and mass transfer when discussing the traditional material and diffusion through membranes and in ionic solutions, turbulent diffusion and mixing in jets and plumes and multiphase flows when thinking of newer material of technical relevance.

Second, the authors begin with macroscopic balances that are the natural extension of the first chemical engineering course on material and energy balances and are the everyday tool used by the engineer. They are then used to derive the microscopic equations (although I find it unfortunate that after the conceptual effort involved in the derivation of the macroscopic equations, the authors were not willing to introduce the divergence theorem). Traditional books, like BSL, will derive them independently and lack some internal unity. The book also treats some of the approximations like boundary layer theory and ideal flow with great clarity while, again, leaving out completely the low Reynolds number hydrodynamics as applied, for example, to flow about a sphere. It should also be pointed out that in recent years a well-developed body of theory has appeared that allows the engineer to recognize the order of magnitude of the terms in an equation and make the approximations described above in a more or less scientific way. These techniques are, however, barely mentioned in association with the boundary layer discussion.

Finally, the book covers a number of applications to the design of equipment of industrial interest like flow in pipes, heat exchangers, and packed absorption columns. Comparison with a common book in unit operations would show, with the exception of the discussion of staged operations and distillation, a wide overlap with those texts. The missing parts correspond mostly to equipment description but not to fundamental concepts since the book provides enough tools to solve a large fraction of the problems found in unit operations textbooks.

End of the chapter problems are one of the strong points of the book. There are many short, numerically simple, attractive exercises that, while lacking overwhelming industrial flavor, will be of great help in the teaching of the subject. Missing, however, are problems discussing non-traditional chemical engineering applications of the methods to biochemical-biomedical, product engineering, or environmental situations. They would be desirable to broaden the outlook of the chemical engineering student. In summary, this is a

very good junior-level textbook that adds to the teaching of the subject as is traditionally known, but does not bring in any of either the new problems that are starting to fascinate chemical engineers or new techniques developed to deal with the old problems. It must, in that area, be supplemented from other sources to cover more advanced topics or to find the description of specific industrial equipment. □

WORKSHOP ON BIOTECHNOLOGY FOR THE MINING, METAL-REFINING AND FOSSIL FUEL PROCESSING INDUSTRIES

*by L. Ehrlich and David S. Holmes
John Wiley and Sons*

**Reviewed by
George T. Tsao
Purdue University**

Biotechnology is an old field which has taken on a great deal of new excitement since the 1970's due to the advances made in molecular genetics. There are those who consider biotechnology involves nothing else but genetic engineering and production of proteins for pharmaceutical uses. There are also those who prefer a broad definition of biotechnology to mean technology based upon biological activities of one type or another. Biotechnology and Bioengineering Symposium No. 16 is the proceedings volume of the workshop on "Biotechnology for the Mining, Metal-Refining and Fossil Fuel Processing Industries," held in May 1985 on the campus of Rensselaer Polytechnic Institute in Troy, New York. The workshop brought together many top experts in this field from different parts of the world to review biotechnological application in the metal-mining industry, the current state of the technology, the industry's and the government's view on the subject and the latest advances in molecular biology and the application of genetics and genetic engineering in the metal-mining industry. The volume should be a useful reference to those who have been working in this field; it should also serve as an informative introductory volume for technical managers, policy makers, life scientists, process engineers, and others who wish to quickly become somewhat knowledgeable on the subject.

While the volume may be an excellent review of biotechnology in the metal-mining industry, it does not address specifically what work may be important for the future advancement of this subject. This reviewer believes that a logical follow-up event could be a workshop on the identification of general and specific research needs in biotechnology for the metal-mining industry. □