We wish to thank Mr. H. J. Fearn for assisting with the biological assays.

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February 10, 1968

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Book Review

PRINCIPLES OF PHYSICAL CHEMISTRY FOR BIOLOGY AND PHARMACY. By L. Saunders. Pp. ix + 438 (including Index). Oxford University Press, London, 1966. 63s. U.K. only.

As this book is aimed at students of biology and pharmacy, it might be as well to emphasize at the start that it is an undergraduate textbook of physical chemistry, not of physical pharmacy or physical biochemistry. To achieve orientation and brevity, special criteria have been applied in selecting material and the result is an unusual but interesting balance between depths and shallows. Some topics have been skimmed over, others extensively treated and developed mathematically step-by-step to give a basis in the physics of chemical processes, particularly those of chemical kinetics, thermodynamics, electrochemistry, chromatography and physical methods of determining molecular size and shape, "topics . . . which are of greater interest in pharmacy and biology." The treatments are relatively simple and for students having a foundation in logarithms, series, differential and integral calculus, most of the steps should be recognizable. However, there are some situations in wave mechanics, entropy, distribution of energies, multiple partition and diffusion, in which more than the usual thin knowledge of mathematics is required and many will grope through these proofs and skip parts of them. Two appendices, on the mechanics of rotors and the distribution of molecular energies, are of more value to the good than the bad mathematician and will not help the laggards and gropers.

Thermodynamics is given as a general background throughout the text rather than as a separate entity and this is a praiseworthy feature. Usually the foundation is built upon energy interconversion and the first law, but here these topics are in the first chapter, in company with rather bald definitions of units and constants, and a 50 page interval deprives the section on work of expansion of gases of its appropriate antepast; some recapitulation would be valuable to condition the student to the thermodynamic approach and need not disrupt the otherwise excellent unity between kinetic theory and internal energy of gases.

A major problem is the assimilation of new and difficult concepts, such as entropy, free energy and chemical potential. They are better described here than in most textbooks, and a real attempt is made to give them meaning.

The conciseness of the treatment is often pleasurable but sometimes leaves a dry air, which could be relieved by inserting experimental results and worked examples at strategic points.

Comprehension would be improved by numbering and cross-referencing intermediate steps in proofs more generously (e.g., on pp. 55, 59, 113) and defining important conditions or limitations fully in words, as symbols may not be understood unless redefined in context or cross-referenced (e.g., $\Delta E = 0$ on p. 56). Nevertheless, arguments are clearly presented, diagrams very helpful (as in the explanation of maximum work on p. 57) and the text is on the whole a model of brevity and simplicity.

Included in some 400 pages are chapters on Atoms, Molecules and Chemical Bonds, Gases, Liquids, The Solid State, Solutions, Two-phase Systems and Surface Chemistry, Chemical Kinetics, Thermochemistry and Chemical Equilibrium, Electrical Conductivity, Potentiometry, Radiation and Molecules, Chromatography and Ion Exchange and Physical Methods for Studying Molecules. The last two chapters go beyond the usual by presenting in some depth the theoretical principles of separation methods and methods for size and weight determination of macromolecules, as well as the more expected topics such as spectroscopic, magnetic and other methods of determining molecular structure. Though these chapters present a useful summary, the emphasis and balance are not fully acceptable, the structure topics being less well done than the macromolecular ones. In four places on pp. 367–8, statements about the effect of mutual proximity of double bonds, auxochromes or aromatic rings on the position of maxima are liable to be misinterpreted and though some data and examples are quoted, the text stops short of perspicacity by failing to connect with ideas of electron delocalization or electron affinity, though such ideas are partially used in the discussions on Dissociation Constants and Dipole Moments. In fact little is added to the earlier discussion on ultraviolet, visible and infrared absorption in Chapter 12, where incidentally the near infrared is given as up to $30\,\mu$ rather than $2{\cdot}5\,\mu$ as is more usual. Surprisingly, little is said about gel separation based upon molecular size differences, an important new weapon in macromolecular biochemistry, though in compensation, enzyme kinetics and inhibition receive an unusually detailed treatment. There are also other brief references to biological phenomena, such as membrane potentials, buffers, Donnan equilibrium and chelation.

To a pharmacist, the sections on solution, disperse systems, interfaces, surfactants, micelles, and viscosity, though lucid, are inadequate, and while mention is made of some pharmaceutical aspects such as biological half-life of drugs and the prediction of decomposition rate, the book is somewhat short on specific pharmaceutical examples and applications. The 70 problems with answers, at the back, are useful and are mostly of a kind which can be solved by substitution if the correct equations are found (though no. 68 involves some guesswork about symbols). There is an adequate index and a useful bibliography but 4 pages of thermochemical data seem somewhat extravagant. The book is well-produced, contains some 140 line figures and has relatively few misprints, only three of which are serious (pp. 116–7, 211, 238). It can be recommended for its emphasis on mathematical principles and its careful explanations of important processes, which make it complementary to books on experimental techniques, applications and systems required to cover the needs of pharmacy and biology students.

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