

theses of multiple interactions of proteins with neutral molecules—with particular reference to serum albumins and haemoglobins, while chapter five is concerned with acid-base titration curves. Chapter seven deals with the binding of other ions of varying sizes and shapes such as long chain hydrocarbons with ionic terminal groups, dyes and small ions. The final chapter consists of a summary and conclusions. The discussions presented are thought provoking. Yet, occasionally questions are posed which could have been treated more fruitfully. For example, the unanswered question as to why the binding of a "small number" of long chain detergents results in large conformational changes with most proteins can be readily answered. For example  $10^{-3}$  M detergent is a far more potent initiator than urea of extensive unfolding of 0.1 per cent Bovine serum albumin (BSA). Assuming the molecular weight of BSA to be 66,500, a 0.1 per cent solution is equivalent to  $1.5 \times 10^{-5}$  M, thus involving a ratio of  $6.65 \times 10$  detergent molecules per molecule of BSA. This should be sufficient to rupture all the supporting hydrophobic associations of the BSA conformation by preferential bonding onto the detergent's hydrophobic groups; and this would be buttressed by the ionic groups of the detergent interfering with ionic linkages which assist native BSA conformations. In contrast, the activity of urea could be ascribed to the breaking potential of its water-structure—analogue to that proposed by Klotz<sup>1</sup> for the collagen  $\longleftrightarrow$  gelatin transformation which effect requires comparatively concentrated urea solutions.

The book suffers from numerous omissions and errata. Most of these have been rectified by a loose four-page addendum, but a number of others have not been noted, for example, on p. 87 traces of substances are referred to in terms of "1 or 2 moles/mole"; on p. 91, Table 4-2, the heading of the fifth column is confusing; and on p. 178, the carbon in arginine appears hexavalent. Other limitations of the book include the omission of discussion of the important part played by entropy changes of water extrusion in antigen-antibody equilibria and in virus RNA-protein associations.

In spite of these shortcomings—which no doubt will be rectified in future editions—the book is a useful addition to the literature on proteins. SHERRY LEWIN

<sup>1</sup> Klotz, I. M., in *Horizons in Biochemistry* (edit. by Kasha, M., and Pullman, B.) 543 (Academic Press, 1962).

## ELEMENTARY OCEANOGRAPHY

### Oceanography

An Introduction to the Marine Environment. By Peter K. Weyl. Pp. xvii + 535. (Wiley: New York and London, April 1970.) 110s.

THE author of this book has distinguished himself in several branches of science. After first working for some years as a nuclear physicist he was employed as a physicist in the chemical laboratory of a leading oil company. It was here that his interest in the sea was aroused as a result of his studies on sediments. Subsequently he transferred to the academic field where he had made noteworthy contributions as a professor, first of chemical and latterly of physical oceanography.

As might be expected from an author with such a broad range of interests, this is a lively book covering oceanography in its widest sense. The subject matter is divided into six principal sections. The introductory section deals chiefly with historical aspects and with cartography. The second section, which is the longest in the book (133 pp.), gives a chiefly descriptive and practically non-mathematical account of physical oceanography and meteorology. The third section is concerned with marine geology and topography, the section on continental drift

being particularly noteworthy. The fourth section is devoted to short reviews of chemical oceanography (principally the carbonate cycle) and of the geological history of the oceans. Next follows a section of approximately 80 pages in which are considered some of the diverse forms of life in the sea, their ecology and physiology. The concluding section of the book deals with some specialized aspects of the marine environment, including coral reefs, estuaries and deep ocean currents.

The book is written in a lucid style and gives an excellent integrated account of elementary oceanography suitable for both first year students and general readers, including those who have little knowledge of science. There are useful summaries at the end of each chapter and also lists of books for further reading. The various chapters are well illustrated with numerous photographs and figures. The standard of presentation is high and I noticed comparatively few errors. I should, however, like to point out the inaccuracy of Fig. 19-8 which purports to show the relative abundances of  $H_2CO_3$ ,  $HCO_3^-$  and  $CO_3^{2-}$  in seawater over the pH range 4-11!

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## MASSES OF ICE

### The Physics of Glaciers

By W. S. B. Paterson. (The Commonwealth and International Library of Science, Technology, Engineering and Liberal Studies: Geophysics Division.) Pp. viii + 250. (Pergamon: Oxford, London and New York, November 1969.) 35s, \$5.50 boards; 25s, \$4 flexi-cover.

THE reasons for the existence of glaciers, their general heat and mass balance, and the processes of glacier flow have been studied for a long time. They are of interest in themselves, and also because glaciers can serve as a model for other solid materials that flow such as the rocks of the Earth's mantle. Our understanding of the physics underlying these phenomena has been greatly increased by experimental and theoretical studies in the past two decades, and this little book provides an introduction to and a summary of this work.

The chapters deal with the processes by which snow is transformed into solid ice, the mass balance of glaciers, the energy exchange at a glacier surface, glacier flow (three chapters), glacier surges, the flow of ice sheets, the distribution of temperature in glaciers and ice sheets, the response of a glacier to changes in mass balance, and the relation between glacier variations and climate. It does not deal with the physics underlying the structural and textural details of glacier ice.

There is no other book in English which covers this material, and this volume does so in a very satisfactory manner. The material is well presented and should provide a useful reference text for libraries as well as a useful introduction for students of glaciers. Some parts of the book, particularly those concerned with glacier flow and on the response to changes in mass balance, demand some mathematical knowledge, but this is to be expected as without such analyses the book could at best be descriptive. As it is, this book, short though it is, should prepare the student for reading original research literature. Those unable to follow the mathematics in detail will still find the book most useful as a guide to what is now being done in theoretical glaciology.

The book carries many references to the original literature, though the bibliographic details are rather minimal, including neither titles of papers nor end page numbers. The use of the English word, "glacier", in the place names of glaciers in non-English speaking countries is against the best modern practice and leads to some inconsistencies (such as Skautbre and Austerdals for two