

project, and other chapters to his post-war concern with the application of science. In addition, Mrs. Arms has succeeded admirably in drawing a picture of the very human and warm hearted person that Simon was to all his colleagues.

Mrs. Arms had left the laboratory by the end of the war, and therefore scarcely does full justice to the last 10 years of Simon's life. These 10 years saw a remarkable development of physics at Oxford based on the group which Simon had set up before the war. Nearly all this work was a continuation and development of lines of research developed by Simon in the pre-war years. (The only conspicuous exception was the work of Prof. Bleaney's group on paramagnetic resonance, a topic that never really appealed to Simon!)

Simon's interest covered the traditional field of low temperature physics, including liquid helium, superconductivity, thermal conductivity, the attainment of very low temperatures by magnetic cooling, and the attainment of the micro-degree region by nuclear cooling. After the war his group made important contributions in all these fields. His own part is not to be measured solely by the number of his published papers, although that is considerable. From time to time it happens that, because of one man, a particular laboratory becomes for a few years an exceptionally exciting and stimulating place in which to work. Such was the Cavendish under Rutherford, and so for the low temperature physicist was the Clarendon under Simon. J. WILKS

INHARMONIOUS QUANTUM CHEMISTRY

Advanced Quantum Chemistry

Theory of Interactions between Molecules and Electromagnetic Fields. By Hendrick F. Hamerka. (Addison-Wesley Series in Advanced Physical Chemistry.) Pp. x + 277. (Reading, Mass., and London: Addison-Wesley Publishing Company, 1965.) 104s.

IN spite of the spate of new textbooks on chemistry one rapidly developing subject, the electric and magnetic properties of molecules, has not been treated adequately since Van Vleck's classical treatise in 1932. The development of new fields like laser spectroscopy now makes it desirable for chemists and physicists alike to approach the interaction between molecules and radiation through the quantum theory of the radiation field. Chemists would certainly welcome a simple and clear account of this theory with examples of its applications. If Prof. Hamerka's book succeeded in a modest way in fulfilling either of these aims it would deserve a warm reception; unfortunately it does neither, being disconnected in plan and erratic in execution.

By far the most useful chapters are 1, 6, 7, 11 and 12, which form a logically self-contained exposition of radiation theory in the style of Heitler. The step by step explanation of the quantization of the radiation field and of Heitler's integral equation is at first glance clear and convincing. It leads on gently from first order emission and absorption through second order processes, to radiation damping and line width theory. On careful reading, however, one's understanding is thwarted on almost every page by careless slips, inconsistencies of notation and even seriously misleading statements; although the task of checking these may be an educational exercise for the reader, they can scarcely be welcomed. More seriously, the author's decision not to discuss the Dirac equation or the logical relation between the Coulomb interaction and the quantized transverse electromagnetic field is regrettable. It makes the treatment of the Fermi contact interaction unconvincing (page 53), causes him to miss the connexion between the equivalent forms of the Kramers-Heisenberg dispersion formula (pages 205, 213),

and makes him omit the important resonance energy shift for the two identical atoms in an excited state. The later chapters particularly lack any overall review of recent work on the applications of the theory, apart from frequent references to further papers by the author himself.

Attached to the main framework we have chapters on perturbation theory, spin resonance, magnetic susceptibilities and the triplet state, which are patchy and do not reflect the relative importance of their topics. For example, Chapter 10 on triplet states is almost exclusively about the author's own work on spin-orbit interaction and forbidden transitions—a subject of limited interest. Nowhere in the book is there any coherent account of such fundamental topics as oscillator strengths and spectroscopic selection rules. There are, however, one or two illuminating accounts of isolated topics, like gauge invariance and the Thomas spin precession.

A convention, which is ripe for abolition, rules that texts on quantum chemistry must include a chapter on quantum mechanics. Hamerka's is disastrous. There is no logical thread; the usual cookbook of wave packets, electrons in boxes, and harmonic oscillators is presented chock full of inconsistent notation and inaccurate detail. The poor student who hacks his way through the jungle of spherical harmonics in the concluding section on angular momentum (page 36) would have done better to stick to Dirac.

A. D. MCLACHLAN

BIOLOGY OF THE SOUTHERN OCEAN

Biology of the Antarctic Seas II

Edited by George A. Llano. (Antarctic Research Series, Vol. 5. Publication No. 1297.) Pp. xi + 280. (Washington, D.C.: American Geophysical Union of the National Academy of Sciences—National Research Council, 1965.) \$12.

THIS elegant fifth volume maintains the high standard of presentation of this series and is devoted to a collection of papers on recent biological studies in the Southern Ocean and adjacent waters.

The first paper deals with the environment and presents a year's observations at a small field station on floating sea ice at the south-west corner of the Ross Sea. Temperature and salinity evidently remain very homogeneous throughout most of the year, but from October to December a dense growth of diatoms develops on the under-surface of the sea ice and profoundly affects the more variable properties of the water. The growth is such that the radiant energy is heavily attenuated and there is little development of phytoplankton until the ice melts and the settled diatoms become dispersed. The concentrations of dissolved oxygen in the upper 75 m increase significantly during the short summer season.

The second paper is concerned with the common starfish of the same region, and examines the reproductive periodicity in several populations of this organism in the Antarctic; an appendix re-evaluates some earlier observations on an Arctic Ophiuroid.

The oocytes of both species seem to take about 2 years to grow and evidently they spawn only once in the year. The main difference is that the Arctic species seems to spawn in spring and summer, whereas the Antarctic species spawns in winter. Wider aspects of the biology are also examined and it seems that differences in the availability of food to two populations some 20–30 km apart in the Antarctic are reflected not only in greater abundance but also in better condition at the more northerly locality.

The third paper examines primary production and phytoplankton abundance in the Scotia Sea and Weddell Sea and emphasizes once again the organic richness of the Scotia Sea. The observations were made on a single cruise and of course it is always possible that the position of the ship at a given time did not coincide with the

maximum of the annual cycle of phytoplankton production. It is particularly interesting to note, however, that even in these high latitudes (77° S.) the phytoplankton seem to show a diurnal variation in pigment content and photosynthetic ability, although this is evidently less marked than in the tropics.

The fourth paper deals with the systematic composition of the phytoplankton in the Weddell Sea and it appears that diatoms predominated in the populations. The Tintinnids are also dealt with and the following paper examines the distribution of Radiolaria, this time in bottom sediments. These are examined in the light of the geological history of Antarctic seas, as their distribution is closely influenced by the Antarctic Convergence. The onset of glaciation in Antarctica may have intensified the circulation, and thus affected the distribution of the fauna.

The final three papers in the volume deal diversely with midwater fishes and monogenetic trematodes, respectively from the Peru-Chile trench and New Zealand waters. The distribution of fish taken in Isaacs Kidd trawls in the Peru-Chile trench shows a faunal boundary at about 20° S., which affects some 20 per cent of the species present; other species evidently extend from tropical waters into the Antarctic. The monogenetic trematodes were collected from fish and several new species are described. The family Microcotylinae is completely reviewed.

The papers in this book cover diverse fields, but they exemplify some of the present activity in biological work in Antarctic seas and show the application of new techniques which are beginning to answer some of the problems posed by earlier studies. The papers from adjacent waters emphasize the continuity of the Southern Ocean and its biology with the adjacent seas to the north and show an important appreciation of the need to look at the polar waters not as an isolated entity but as a boundary region of the world's ocean.

R. I. CURRIE

ECOLOGY OF DIPTEROCARP FORESTS

Ecological Studies in the Mixed Dipterocarp Forests of Brunei State

By P. S. Ashton. (Oxford Forestry Memoirs, No. 25.) Pp. 75 + 37 plates + 17 tables + 70 figures. (Oxford: Clarendon Press; London: Oxford University Press, 1964.) 45s. net.

THE extensive lowland forests of the small state of Brunei in Borneo are rich in Dipterocarpaceae, which is the principal timber producing family of the area. The richness of the Brunei forests is demonstrated by the estimated 2,000 species of tree which exceed 12 in. in girth in the forests of Brunei. Until Dr. Ashton's studies in Brunei, the immense floristic richness of the area had been practically unsampled, a situation which made the work of the ecologist especially difficult. As a specialist in the taxonomy of the Dipterocarpaceae, Dr. Ashton is well equipped to tackle the formidable complexities of the Dipterocarp forests, especially since it is possible for the specialist to recognize species of this family from foliage characters alone—even from fallen leaves on the forest floor. Three years of intensive field work laid the basis of this publication, and during this period some 30,000 trees were enumerated and 13,000 specimens collected. The author nevertheless emphasizes that this is only a preliminary survey of this neglected territory.

The most interesting point about the methods used is that a quantitative analysis of the Dipterocarp forests was carried out using coefficients of similarity between different stands—a method originally developed by Bray and Curtis for forests in Wisconsin. Two areas were chosen, one on clay rich soils and the other on sandy soils. An acre was taken as the basic size of a plot and fifty plots were studied in each area. Only trees more than 12 in. in

girth were recorded, because the field and shrub layers, which consist mainly of saplings and seedlings, vary with the time since the last flowering of the trees above. An enormous amount of material is presented in the form of tables and figures, but much of this will only be understood by those already acquainted with the method used, and a previous knowledge of this is optimistically assumed.

Dr. Ashton emphasizes the important correlation between soils and the species which grow on them. Most species of Dipterocarpaceae seem to be restricted to certain soils. Special attention is therefore given to the soils of the Dipterocarp forests and other types of soil are mentioned for comparison. Differences in the soils are shown to affect the pH of leaf extracts as well as the reactions produced by precipitating agents on the proteins of fresh leaf extracts. The altitudinal distribution of Dipterocarps, at least below about 1,300 m, appears to be determined more by the soil than by other factors; anomalous altitudinal records of species result from the presence of suitable soils at those altitudes. Dr. Ashton therefore suggests that some "microtherm" species (as van Steenis has called them) may be confined to high altitudes on tropical mountains because their edaphic environment is confined to those regions. Edaphic factors in Brunei, as well as in Sarawak, have apparently obscured the altitudinal floristic zonation below 1,300 m such as that described by van Steenis for Java, where the floristic transitional zone coincides with edaphic transitions.

In classifying the forests Dr. Ashton found that the scheme applied by Symington to the Malayan forests in which main climax formations are distinguished does not apply to Brunei forests. A classification based on communities, although arbitrary for Brunei, appears to be the most useful type for practical purposes. A hierarchic system adopted from Braun-Blanquet criteria and based on fidelity and constancy rather than dominance is advocated.

There is an interesting discussion on the distribution of Dipterocarpaceae in relation to soils and geological history. Dr. Ashton opposes the view of Foxworthy and Merrill that the family originated in Borneo. The present abundance of Dipterocarp species in Borneo is considered a result of a secondary burst of evolution. Dr. Ashton supports Croizat's proposal that the Dipterocarps had an origin in Gondwanaland. The text ends with valuable recommendations on silviculture land use and especially on the establishment of permanent reserves in undisturbed primary forest for the purposes of future research and the conservation of rare species and for educational purposes. Three named areas are suggested for immediate preservation. It is to be hoped that these recommendations will not fall on deaf ears.

Dr. Ashton has produced a valuable and stimulating book on a highly complex subject. Several of the themes introduced deserve further development. He has demonstrated especially that the close correlation between the composition of rain forest and the underlying soils means that plant ecology, given a secure taxonomic basis, can be very important to surveys of the soils of large areas of jungle.

L. L. FORMAN

Pests of Stored Products

By J. W. Munro. (The Rentokil Library.) Pp. 234. (London: Hutchinson and Co. (Publishers), Ltd., 1966.) 42s. net.

THIS book, written by one of the first entomologists to acknowledge the importance of insect damage to stored products, is a fully illustrated account of the history and practice of pest control in this field. It directs attention to the effect of insect infestation on good-will in international trade and is of interest in tracing the development of this branch of economic entomology in Britain. It surveys steps taken abroad which have led, not only to a