

an important and well-written book. The question of the possible selective neutrality of most protein variation is one of the most interesting in contemporary biology. Kimura and Ohta have greatly refined the mathematical tools needed for tackling this problem, and have made us all much more critical in our attitude towards evidence in favour of selection. This book is a valuable account of their work.

BRIAN CHARLESWORTH

First Know Your Rocks

Petrology of the Igneous Rocks. By F. H. Hatch, A. K. Wells and M. K. Wells. Rewritten thirteenth edition. Pp. 551. (Thomas Murby: London, April 1973.) £7.40.

Most students of petrology will be familiar with "Hatch and Wells", which has enjoyed a long and honourable career as a student textbook since its first appearance in 1891. Even those nurtured on the rival "Harker" were (and indeed still are) advised, when sufficiently mature, to consult this work for its excellent account of igneous activity in the British Isles, although they may have been firmly directed to read no further. In this book the emphasis has always been placed firmly on a clear interpretative exposition of petrography based on evidence that can be gleaned from the rocks. Despite the esoteric temptations offered by some modern treatments or by the *art nouveau* of plate tectonics, the Wells family has adhered firmly to its belief that any appreciation of the global setting of petrology can only be achieved properly if the student first knows his rocks.

During the twelve years that have intervened between the twelfth and thirteenth editions, our knowledge of the evolution of the Earth's crust has been completely transformed: no less dramatic have been the advances in the fields of experimental petrology and geochemistry which have enabled a degree of certainty, hitherto lacking, to be given to petrogenetic theory. It is clear that these changes have been appreciated by the authors, although they have not exactly been swept off their feet. Although much of the otiose crystallographic material has been removed, surely it is petrographic mineralogy that is needed; all the structural mineralogy should have gone as well. A chapter on the geological setting of igneous activity has been added and those dealing with basalts, andesites, trachytes and rhyolites have been completely revised and extended. A new approach has been made to the vexed problem of rock classification and nomenclature. Although a satisfactory classification of silic rocks is presented,

no clear scheme is apparent for the intermediate and mafic varieties; a comprehensive classification table should have been included. New material has been added to other chapters where needed and references have been updated. All this has been achieved without substantially increasing the size: alas, the same cannot be said of the price.

In view of the extensive rewriting, it is a pity that the opportunity was not taken to increase the page size, for the book does not lie open well. References could have been found more easily and the appearance would have been improved if the numerous footnotes had been replaced by a full bibliography. It is pleasant to note that the fine micro drawings have been retained; these portray so much more clearly than do photomicrographs the textural features of the rocks. The treatment of chemical data is less satisfactory, for although many tables of rock analyses are included and the principles of both the CIPW Norm and Niggli values are explained, they are little used. Variation diagrams are treated very briefly, and although simple phase diagrams are introduced early in the book they are rarely used to explain the petrology.

In spite of these criticisms the authors deserve to be congratulated on presenting a well balanced, interesting and thoughtful modern account of igneous petrology written for the level of a second year student.

I. D. MUIR

Interstellar Scatter

Light Scattering Functions for Small Particles with Applications in Astronomy. By N. C. Wickramasinghe. Pp. 506. (Adam Hilger: London, 1973.) £12.

AFTER a short summary of observational evidence for interstellar dust and the extinction of electromagnetic radiation by that dust, followed by a similarly short account of the computational procedures used to calculate the efficiency factors for scattering, absorption and back-scattering and the forward directivity of scattering of spherical cylindrical and composite dust grains, the book goes on to detail these factors over a wide range of refractive and absorptive indices and radius of particle in wavelength units. Graphs of the results are given for selected cases. Specific computations are given for ice, iron and graphite and for composites with graphite and iron cores.

From this brief description it will be obvious that this is a book for the aficionado, even if these should include students of meteorology and colloid science, as claimed. It is a pity that computations were not given for the

currently favoured silicate material. Nevertheless, the book covers a very wide range of conditions and will be useful both for itself and as a spur for others contemplating similar computations.

The book is well and attractively produced, the tables being of tidily laid out computer output. Its main fault is the price, surprisingly high for a book of over 90% of photolitho content. The user will probably borrow his copy from his library, which ought to have one.

H. SEDDON

Hyperfine Structure

Theory of Hyperfine Structure of Free Atoms. By Lloyd Armstrong, Jr. Pp. ix+209. (Wiley: New York and London, March 1972.) £7.

TECHNICAL progress in atomic spectroscopy in the last twenty years, the development of highly monochromatic sources of radiation such as atomic beam frequency standards, masers and lasers, and sophisticated spectrometers capable of detecting transitions between individual atomic states, has allowed a great increase in the precision with which hyperfine interactions in free atoms can be measured. It is not surprising that there has been a corresponding development in the rigour and complexity of the theory to such an extent that it is now difficult for an active research worker to follow developments without reference to the original literature associated with several diverse fields. This volume represents what is probably the first comprehensive review of the theory of fine and hyperfine interactions. The interactions between the nucleus and the electrons are analysed using a consistent set of techniques and clearly defined approximations in such a way that the relationship between the theory of hyperfine interactions and the theory of atomic fine structure is stressed. The basic theories of angular momentum, second quantization, relativistic electrons and Lie groups are presented in the first place and then used to develop the theory of atomic structure and the hyperfine interaction. There is one chapter on the effects of external electric and magnetic fields and another concerned with higher order effects such as the hyperfine anomalies associated with nuclear structure and electric dipole moments. The final chapters deal with the hyperfine interactions in one electron and many electron atoms. The presentation is too sophisticated for the average experimentalist who will probably find some of the techniques used unfamiliar and difficult, but the volume will be of great help to the research worker and the graduate student who needs to study the subject in depth.

K. E. SMITH