

BOOK REVIEWS

Modern Crystallography

X-ray Crystallography: An Introduction to the Theory and Practice of Single-crystal Analysis. By G. H. W. Milburn. Pp. 217. (Butterworth: London, December 1972.) £6.

Chemical Crystallography. Edited by Monteath J. Robertson. Consultant Editor A. D. Buckingham. (MTP International Review of Science.) Pp. 346. (Butterworth: London; University Park: Baltimore, 1973.) £10; \$34.50.

THESE two books aim to bring crystallographers up to date in the application of their art to the discovery of the arrangements of atoms in crystals: Milburn's book on the methods, Robertson's on the results in recent years.

Milburn describes the experimental methods, both photographic and photon counter, by which the positions and intensities of the many diffracted beams of X rays from a crystal are measured, and guides the would-be structure solver through the various interpretative methods which have been evolved to convert the set of experimental data into a three-dimensional electron density map revealing the positions of the atoms. His book is essentially a handbook for students learning the art, and to this end the arrangement of topics broadly follows the lines of an actual investigation.

The preliminary chapter on basic concepts is more in the nature of a summary of what is to be found in standard textbooks of X-ray crystallography than a thorough exposition. It is too short and condensed for beginners; there are not enough diagrams, and some of those present are not very well drawn. Students starting on the subject would therefore be well advised to go elsewhere for the foundations. The rest of the book, however, should serve the student well; it contains a great deal of practical advice which should smooth the path of investigators handling crystals and diffraction apparatus for the first time and attempting the exacting art of interpreting the mass of experimental measurements.

The treatment of interpretative methods—the extraction of structure factors from the measured intensities, the unravelling of vector maps, the use of phase relations between different diffractions to build up a sufficiently comprehensive set of phases to lead to an approximate structure, the use of anomalous scattering in noncentrosymmetric crystals, and the refinement of approximate structures—is adequate, though the arrangement of the material

is sometimes less than ideal. For instance, the section on refinement comes before that on phase-relation methods of structure-solving, not at the end where it would be expected; and a wave diagram to explain the breakdown of Friedel's law in noncentrosymmetric crystals comes, not at the beginning of the section on anomalous scattering, but halfway through it, after the principal application has been considered. In short, the essential information is all there, but not always arranged to form a smooth logical course of instruction. It is also noticeable that the author relies more on algebraic formulations than on diagrams; this is a matter of personal taste—it would suit some students but not others.

The book edited by Robertson is a collection of essay-reviews on selected topics of chemical interest based on the results of crystal structure determinations in recent years. All are written by well-known specialists in their respective fields, and together they present an impressive body of achievement, underlining the very great contributions X-ray (and electron and neutron) crystallography has made to our knowledge of molecular structure and of the significance of geometrical factors in determining the properties of molecules and crystals.

Most of the chapters consist largely of brief mentions of series of structures; they will obviously be of great value to others working in the same or related fields. The average reader's interest is more likely to be engaged by the resulting generalizations in theories of chemical bonding, or the properties in relation to stereochemistry, or the methods and strategy of crystal structure determination. J. C. Speakman's account of hydrogen bonding covers the history of ideas on the forces involved, and illustrates several aspects of the phenomenon by suitable examples. B. A. Frenz and J. A. Ibers, in a chapter on the structural chemistry of transition metal complexes, choose two topics from this large subject—5-coordination, and nitrosyl complexes—and discuss the degree to which the results could have been anticipated from current theory, or failing this, by analogy with other known structures not yet adequately covered by theoretical concepts. A survey of investigations of crystal structures in the USSR by B. K. Vainshtein and G. N. Tishchenko shows the wide range of structure types which engage the attention of Russian crystallographers. S. C. Abrahams deals with cooperative phenomena in inorganic

materials—magnetic ordering, dielectric properties, the only recently recognized phenomenon of ferroelasticity, and superconductive materials.

There are three chapters on substances of biological importance. A. L. Mathieson, in a chapter on natural products, selects from this huge field the terpenes and steroids. Marjorie C. Harding's review of large-molecule substances includes examples of porphyrins and corrins, penicillins, cephalosporins and other antibiotics, peptides, sugars and nucleotides. Protein crystallography is dealt with by T. L. Blundell and Louise N. Johnson in what is one of the best essays in the book; the subject forms a more connected story than those of most of the other chapters, it is written in an engaging style, and the discussion goes beyond structure description to the relation between structure and function.

The chapter on "direct methods" by J. Karle and Isabella L. Karle stands apart from the rest in that it reviews the structures which have been solved by a particular type of procedure which has been developed in recent years, largely by the Karles themselves. By this procedure, which uses phase relations between different diffractions, it is now possible to solve quite complex structures without the aid of heavy atoms as phase markers. The structures reviewed here form an impressive array, testifying to the power of the method.

The impression given by this volume is of an explosion of information gained by crystallographic methods; the increasing availability of automatic diffractometers and large computers, together with the phase relation methods mentioned in the previous paragraph, have increased the scope and very much accelerated the work involved in crystallographic methods, while the increasing use of anomalous scattering effects has revealed the absolute configuration of many dissymmetric molecules.

CHARLES W. BUNN

The Responsible Brain

The Conscious Brain. By Steven Rose. Pp. 351. (Weidenfeld and Nicolson: London, May 1973.) £4.95.

THIS is an idiosyncratic book, which is a good thing. It is also a book which seeks to expose some of the social repercussions of brain research, which is another good thing. Steven Rose's main interests in the past few years have been the biochemical and neurophysiological basis of the brain's adaptability, and the social and political aspects of