

Molecular Structure

The Electronic Structure of Molecules: Theory and Applications of Inorganic Chemistry. By G. Doggett. (*The International Encyclopedia of Physical Chemistry and Chemical Physics. Topic 4. Electronic Structure of Molecules. Volume 3.*) Pp. xvi+172. (Pergamon: Oxford and New York, 1972.) £5.75.

DR GRAHAM DOGGETT is an experienced practitioner of theoretical chemistry, and he has written the present book to show how to calculate molecular wave functions, and how to use them in elucidating (or perhaps understanding) the geometrical shapes of molecules involving at least one atom heavier than neon. He writes clearly, and with authority. Moreover, he includes a discussion of several topics not often found in chemistry texts.

Indeed, this is not really an elementary text. It quite properly refers, time and again, to an earlier volume in the series, and assumes that the reader is familiar with simple ideas of *s,p* hybridization, electron pairing and straightforward theories of bonding. The real contribution of the book is in the role of *d* electrons. For example, in the chapter largely concerned with sulphur-containing molecules there is no reference to SH_2 , since this is similar to OH_2 . But there is a serious study of SF_6 and SF_4 , as well as PF_5 and PF_3 . (But why is there no account of sulphones and sulphoxides, where many interesting roles are played by the *d* electrons?)

Some readers will be glad to see a whole chapter devoted to the fluorides of xenon—a topic which has not yet found its way into most textbooks. But they may wonder why it was necessary to devote the greater part of the chapter to the valence-bond model, which—as the author quite properly says—is full of uncertainties—and only a smaller part to the molecular-orbital model.

The author shows a lively concern for the symmetry properties of wave functions, and the proper ways in which to incorporate chemical ideas of spin coupling. Indeed the first, and longest, chapter is almost wholly devoted to a useful discussion of how to set up molecular wave functions of appropriate spin and space symmetries. It is a pity that in the later chapters our mathematical techniques are so limited that full advantage cannot be taken of our knowledge of what a true wave function ought to look like. Perhaps in these matters the author is not quite fair to the use of Gaussian functions, whose very existence he does not specifically mention. But, all in all, this is a useful addition to the *Encyclopedia* of which it forms a part.

There is, however, one severe comment that must continue to be made,

though it has nothing to do with the author. This whole series is vastly too expensive. What student can afford £5.75 for a book of 172 pages, including the index? One could photocopy the whole affair for less than this. Why not paper covers, since surely we want to see as many copies sold as possible?

C. A. COULSON

Regeneration Miscellany

Regeneration in Lower Vertebrates and Invertebrates: II. By Margaret Egar. Pp. 167. (MSS Information Corporation: New York, January 1973.) \$15.

It is not quite clear what, or whom, this book is for. It reproduces eleven original articles published between 1967 and 1971 of which ten appeared in widely available journals. The provenance of the eleventh is not given. They are introduced by a very brief preface which, misleadingly, implies that regeneration in reptiles and in *Hydra* are among the topics covered. In fact all are on regeneration in amphibians—of limb, of tail or of lens. The cost is about 10 cents a page.

The articles themselves are specialized research reports, none is a review. They will therefore be of most interest to those whose interest has already been awakened. It is no criticism of the work reported to say that there seems to have been no particular object in selecting it for assembly in this way. The only editorial discretion that appears to have been exercised is the excision of the summary from some, but not all, of the articles.

To list the contents in full would be extravagant of space. The articles are by Egar and Singer, Tweedle, Lentz (limbs and their innervation), Tassara, Francoeur, Francoeur and Wilber (limbs) and Eisenberg-Zalik and Scott, Campbell and Jones, Reger, and Zalik and Scott (lens). They seem to me to range between the interesting and the very interesting.

D. R. NEWTH

Return of the Mind

Cognition in Learning and Memory. Edited by Lee W. Gregg. Pp. vii+263. (Wiley: New York and London, 1972.)

ANY discipline which deals with complex phenomena has to simplify to make progress. In recent history experimental psychologists, especially in the USA, have frequently over-simplified both the experimental situations which were intended to give reproducible data and the theories which accounted for and were tested by the data. Even when man was the direct subject of study the empirical situations often remained remote from his everyday experience and the theories were little more than theories of the data, rather than being

theories of brain function. The new wave has the title cognitive psychology and it is well represented by this volume which is the proceedings of a conference held in 1969 at Carnegie-Mellon University. It is typified by willingness to reintroduce terms like “mental”, “meaning” and “image”, to accept introspection as data and, above all, to treat man as man has always treated the world by hypothesizing complex processes underlying the directly observable behaviour, utilizing whatever techniques and analogies were available. The computer has been a powerful force in this change as a means of analysing data, as a rich source of metaphor and as a means of simulating models which in a purely verbal description would be unintelligible and incomprehensible (see Gregg's introductory chapter).

The title of the book somewhat belies its contents, for there is as much discussion of visual imagery, comprehension and problem solving as there is of learning and memory. Such distinctions are, however, less valid than they used to be, because, for example, language comprehension is increasingly seen as using the same kinds of process as those employed in problem solving, and visual imagery clearly plays a part in experimental situations which used to be called verbal learning.

One illustration of the increase in complexity can be found in the treatment of memory. As little as ten years ago there were heated debates as to whether there were one or two kinds of memory. Wickelgren, in this volume, finds it necessary to distinguish between three or four kinds of memory trace (differentiated by the time constants of decay functions) for each of sensory (visual, auditory and textual), motor and conceptual modalities with four different kinds of association through which information is stored and retrieved. The notion of “association”, by the way, is much more complex than that used in the past by stimulus-response psychologists, as it represents the operations of information processing systems and the complexities of the organization of our knowledge. Michon describes a couple of techniques used to elucidate such structures and Collins and Quillian summarize the work rising from a program by Quillian designed to comprehend written text by relating it to a semantic network filled with factual information. The model, although probably inappropriate in some regards, is complex in a plausible way. It does a reasonable job in predicting performance in tasks involving assigning a truth value to propositions such as “A canary is blue”, and accounting for why it takes longer to answer “false” to “An almond has a fortune” than “A pecan has a castle”. Other related theoretical developments can be found in *Organ-*