

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-*

isation and Memory, edited by Tulving and Donaldson (Academic Press, 1972).

Three chapters, by Bower, Simon and Chase and Clark, discuss the use of visual imagery in a variety of tasks. The differences between these writers, lying as they do in the nature of the underlying abstract representation in such tasks, illustrate the sophistication of the current approach and provide a link to studies in psycholinguistics. In the remaining chapter, Calfee, Chapman and Venezky present an analysis of the skills a child requires if it is to learn to read.

In the entire volume there is little or no reference to or concern with the biological substrate of the postulated processes. This seems quite proper since psychological descriptions are necessarily different from physiological, the latter providing only limiting conditions for the former (such as time of operation), and justification for separation of particular functions (as with evidence from aphasia). There is still simplification, of course, but as Gregg's excellently produced volume shows, current psychological theories are interestingly powerful.

JOHN MORTON

Palaeomagnetism

Palaeomagnetism and Plate Tectonics. By M. W. McElhinny. Pp. x+358. (Cambridge University: London, February 1973.) £8.50; \$27.50.

ALTHOUGH shorter and cheaper texts on palaeomagnetism have appeared in recent years, this is the first attempt at a comprehensive presentation since Irving's *Palaeomagnetism and its Application to Geological and Geophysical Problems*. Hence it is natural to assess McElhinny's book against the standard set by Irving's. Since 1964 when Irving's book was published a new and fuller understanding of the evolution of the present day ocean basins has been worked out in terms of sea floor spreading and the concept of lithospheric "plates" is now widely accepted. So it is particularly appropriate that a new book on palaeomagnetism should also deal at some length with the geometry of "plate tectonics".

The book comprises about 280 pages of text followed by an appended list of palaeomagnetic data, a very comprehensive list of references and a good index. The first 150 pages of text contain an account of the method and principles of palaeomagnetism of which the essentials are clearly explained and the subject matter well balanced. The second half of the book is more in the nature of a review of the author's interpretation of palaeomagnetic data at this point in time.

Beginning with a chapter on the present geomagnetic field, the book

goes on briefly to deal with palaeosecular variations and palaeointensities. In the next chapter some elementary theory of magnetism is given and the nature of the commonest magnetic mineral series found in rocks and the physical principles of rock magnetism are described. Methods and techniques involved in carrying out a piece of palaeomagnetic work — methods of measurement, of collection of samples, cleaning procedures, field and laboratory stability tests and statistical method are outlined in another chapter.

In a chapter on reversals, well established phenomena such as the arguments for and against field reversals as opposed to self reversals of natural remanence and the polarity time scale going back to 24 m.y. ago deduced from palaeomagnetic studies of dated igneous rocks and of cores of sediment from the ocean floor are described. Then the reversal pattern over the longer time scale is discussed. Recently, at the Twenty-fourth International Geological Congress held in Montreal last year, a sub-commission of the International Commission on Stratigraphy was set up for the purpose of advising on a magnetostratigraphic nomenclature and advanced a recommended set of unit terms and hierarchies in palaeomagnetic stratigraphy. This unfortunately differs from that presented in McElhinny's figure 72 purporting to illustrate the reversal time scale in the Mesozoic in that, for example, his so-called "intervals" should be called "periods". More important, however, there is a strong feeling among palaeomagnetists against allotting special names (as McElhinny has done) to these magnetic chronostratigraphic units first until we are really certain of their existence and second because it is undesirable to burden the student with yet another set of stratigraphic names to learn.

In the later chapters, the Neogene and Quaternary palaeomagnetic evidence relevant to the establishment of the axial dipole field hypothesis is assembled and evidence for a second order displacement of the dipole from the geocentre by the order of a hundred kilometres is presented. The inter-relationship between palaeoclimatic indicators and palaeomagnetic latitudes is dismissed in six pages in McElhinny's book whereas Irving devoted sixty pages to a discussion of this topic. This clearly reflects the different backgrounds of the two authors: McElhinny's background is physics while Irving's is geology, and this has had a notable influence on the form of the two books.

In the remainder of McElhinny's book, apparent polar wander curves for the various continents are described and then these data are synthesized and interpreted within the framework of the

concept of plate tectonics. The data are assembled, for the earlier part of the Phanerozoic, following a geographical pattern designed to demonstrate how Pangaea was formed by the fusion of pre-existing continental blocks.

Those who already have Irving's book and who wish to update their knowledge of the subject would find it cheaper to refer to one of the reviews of the subject presently available or which will undoubtedly appear from time to time in the near future. Those who wish to acquaint themselves with the situation in plate tectonics would be advised to consult a specialist book in this field such as Vacquier's recent publication. For those who do not own a book in palaeomagnetism, however, I recommend this as the best text available.

K. M. CREER

Experimental Epilepsy

Experimental Models of Epilepsy—a Manual for the Laboratory Worker. Edited by D. P. Purpura, J. Penry, D. B. Tower, D. M. Woodbury and R. D. Walter. Pp. 615. (Raven: New York. Distributed in the Eastern Hemisphere by North-Holland: Amsterdam, 1972.) Sfl.75; \$23.50.

IN compiling this volume dedicated to the memory of the late Don Esplin, the editors have had two stated goals. They have sought, on the one hand, to bring together in a single book a comprehensive description of the methods employed to produce various experimental models of epilepsy. To this end they have been more than successful, and the editors are to be congratulated. Twenty-four contributing experts in the field have described in detail the methods and techniques that they employ in models ranging from *in vitro*, isolated brain tissue to the light sensitive baboon.

Their second stated aim is that "the book be as critical in its approach as it is detailed in its methodology". Here the editors have fallen short of the mark. Specifically, the book suffers from two serious deficits, one a consequence of the other. They seem particularly grievous because the editors direct this book primarily to the "young investigator". The chief drawback of this volume is that it lacks a chapter devoted to a critical overview of the comparative relevance of particular models as they relate to particular experimental ends.

With the exception, perhaps, of the use of induced epilepsy as an "interfering technique" in the study of learning and memory paradigms, most experimental studies of epilepsy have at least as their covert intention a better understanding of human epilepsy. Perhaps the chapter which comes closest to filling this void is that of Jasper. In his chapter he briefly discusses the applicability of