

eighty-six distinct plane polychromatic colour groups, each one carefully illustrated by a coloured diagram. Loeb's analysis enables him to make illuminating comments on the Shubnikov "grey" groups, and also on the celebrated periodic colour patterns created by M. C. Escher.

It cannot be said that this book makes easy reading. In the first place Loeb does not clearly declare his premises and objectives, nor does he relate his point of view to the axioms of the classical theory. Certainly his generated monochromatic and dichromatic symmetries coincide with those previously discovered, but I can see no immediate mathematical reason why this should be so. In the second place his approach is entirely geometrical, resulting in a diffuse "chain of theorems" which provides little insight into the mutual implication of operators. Most interested students will probably translate this argumentation into algebraic terms in order to convince themselves that they really understand it. My final conclusion is that Loeb has produced an important original work, which may not make the impact it deserves owing to an inadequate presentation. M. A. JASWON

## Education

*Higher Education: an International Journal of Higher Education and Educational Planning.* Editorial Board: A. M. Ross, E. A. van Trotsenburg, H. J. Butcher, R. O. Berdahl, Noel J. Entwistle and G. L. Williams. Pp. 140. (Elsevier: Amsterdam, February 1972.) One volume of four issues per year: Personal subscriptions: Dfl. 42.00, £5.10. Subscriptions for institutes: Dfl. 77.00, £9.35.

THE growth of higher education in the past twenty years has made the market for books and magazines about it a large and growing one. In response to this market, a whole series of books and magazines have been supplied, of which the latest is *An International Journal of Higher Education and Educational Planning*, called *Higher Education*, of which the first number is now to be reviewed.

It is a thin and expensive production, and the first issue consists of four major articles. Two of them are, in effect, repetitions of work by fairly well-known people, Professor Eysenck and Professor Blaug, the one on psychology and the other on economics. Both of their articles are entirely predictable and present no new work. In the one case Professor Eysenck argues that psychological theory should be tested, and inevitably the testing leads to a confirmation of his views on extroverts and

introverts. Professor Blaug is a great believer in the market, and inevitably his work suggests that the market works well if it is made to work well.

The two other articles are more interesting. The first is an attempt to apply a systems approach to education in general, by Erich Jantsch, which covers a certain amount of territory that has been fairly well traversed in the past, but which systematizes this range of literature in a useful and interesting way. The last article, by Professor Carter, on the efficiency of universities, is a useful contribution to an analysis of the meaning of a whole series of controversial words. It covers much of the field that I have myself covered in other work. Naturally, I find it a good article because it confirms my own findings. JOHN VAIZEY

## Computing in Chemistry

*Computing Methods in Quantum Organic Chemistry.* By H. H. Greenwood. Pp. xi+213. (Wiley: New York and London, February 1972.) £5.50.

THE Hückel molecular-orbital method for dealing with planar conjugated and aromatic molecules was introduced in 1931; and it represented for many years the most successful and simple illustration of the use of wave mechanics in organic chemistry. At the present time several thousand papers are published each year using some form of this method to discuss some molecule or some property of a molecule of interest to organic chemists. There have been many books describing the basic theory; but none so far that goes into detail about the numerical and computational techniques to be used. Dr Greenwood's book remedies this defect.

The book is solely concerned with  $\pi$  electrons. It concentrates most of its effort on the simple Hückel theory; but after pointing out some of the limitations of this method, it devotes the last quarter of the pages to a consideration of the Roothaan equations which go beyond Hückel theory. This includes a few of the many simplifications associated with the names of Pariser, Parr and Pople (and others) which neglect most of the tiresome many-centre integrals and, by suitable parametrization, give good results both for ground and excited states.

Simple derivations are given for atomic charges, bond orders, free valences, reactivity indices, polarizabilities; and in each case these are immediately followed by the outline of a suitable program, written in Fortran II, which will evaluate the quantities numerically. There is also a discussion of dipole moments, and also of  $p\pi$ - $d\pi$

bonding. However, there is no account of any theory, such as those based on the extended Hückel or CNDO approximations, which attempts to include both  $\sigma$  and  $\pi$  electrons at the same time. The explanations are simple and straightforward: taken all in all, especially for those without access to the Quantum Chemistry Program Exchange facilities, this is a useful book.

C. A. COULSON

## Pteridophytes

*Pollen and Spore Morphology/Plant Taxonomy: Pteridophyta.* By G. Erdtman and P. Sorsa. Pp. 302. (Almqvist and Wicksell: Stockholm, 1971.) n.p.

IN spite of the title this volume is described in the authors' preface as presenting morphological data without taxonomic speculation; in nearly 200 pages all pteridophyte genera are listed alphabetically with data on selected species in brief note form. It is intended to be used as a completion of the pteridophyte part of Volume II (1957), and the list of genera has been updated (Copeland system). Cross-referencing to Volume II is thorough, but there seem to be slight lapses in assistance to the reader as in the case of *Hemitelia*. Reference is made to the many other works in which the appropriate spore descriptions may be found, but in this volume there are no line-drawing illustrations as in Volume II. A set of twelve plates (sixty figures) of scan photographs is included but they are not particularly impressive in most cases and the magnifications used appear to be random; the selection policy of illustrations in relation to those in Volume II is not clear. There is a useful table of genera (pp. 191-8), showing nature of aperture, presence of perine, and maximum size. There is a warning in the preface that not all determinations have been checked; this is, of course, a difficult but fundamental problem in such work if taxonomy is eventually to be involved.

Two other papers are included in the volume. John M. Pettitt on "Some ultrastructural aspects of sporoderm formation in pteridophytes" deals very briefly with heterosporous pteridophytes, providing seventeen excellent plates of electron micrographs. Barbro Gullvåg on "The fine structure of some pteridophyte spores before and during germination" presents twenty-three excellent electron micrographs with about ten pages of breathless scattered wisdom; it is interesting but editorially badly arranged. It is not clear why it should be included in this book rather than as a contribution to a regular journal in which normal referee comment would surely have improved the presentation.

N. F. HUGHES