

definitions happens at intervals in both the theoretical and experimental parts of the book but, given its ambitious scope, this could hardly have been avoided.

The next five chapters (432 pages) constitute the heart of the book. The first, dealing with positional disorder in inorganic compounds, covers in particular the currently important topic of superionic conductors such as an allotrope of AgI, and beta-alumina. (The authors say of AgI that "this singular crystal has often been described as consisting of fluid silver ions in a solid lattice of iodide ions, and even as a 'missing link' between the solid and liquid states".)

A long and illuminating chapter follows on orientational disorder in salts, pride of place going to ammonium salts and including a treatment of ferroelectric salts. This is followed by a clear dissection of the exceedingly involved polymorphs of ice, most of them created by high pressure, and the various descendants of Pauling's statistical mechanics of hydrogen bonds in ice are described.

Two chapters follow on molecular solids, with special emphasis on compounds (such as perfluorocyclohexane) which contain both fixed and labile constituents. Such compounds, called 'rotator phases' or 'plastic crystals', in which some ions exhibit extreme orientational disorder, have remarkable properties such as extreme softness and very rapid diffusion, at appropriate temperatures. Hydrogen and deuterium, various linear and non-linear molecules, and many other groups are analysed, and the chapter finishes with a valiant attempt to systematise the statics and dynamics of these variegated molecular groupings. The concept of a glassy crystal (in which disorder of ions on a sublattice is frozen in on cooling) is introduced. Long-chain monomer molecules are treated quite fully, but degrees of order in polymers are not discussed at all. A special feature in these chapters is the close attention paid throughout to the implications of thermal analysis and, in particular, of the entropy changes associated with order transformations.

A further chapter discusses clathrates (compounds such as  $\beta$ -quinol with large near-spherical structural voids that can be partially filled with 'guest compounds', which behave as independent non-interacting parasites on the host), channel compounds of urea and thiourea, and the metallic intercalates of graphite studied in recent years. An example of what can be deduced from entropy measurements is the authors' conjecture that cyclooctane molecules caught in thiourea channels undergo conformational changes, limited by the channel geometry, at sharply defined temperatures. It would be intriguing to know how polymer chains would behave if constrained within such a host.

The final chapter deals with inorganic

magnetic compounds, first in quantum-mechanical generality and then in taxonomic and specific detail. The reader is taken through the luxuriance of phenomena such as ferromagnetism, antiferromagnetism, spin waves, metamagnetism, helical spins, and their hybrids.

After this plethora, it is only proper to outline what the authors have omitted. As already mentioned, polymers are excluded. There is no reference to liquid crystals, that other missing link, which is a pity since, in terms of statistical mechanics, they show a temperature dependence closely similar to that of the Bragg-Williams theory of positional order in alloys or the standard theory of corresponding ferromagnetic states. These omissions are not explicitly justified; other omissions, such as a treatment of the structural implications of

non-stoichiometry, or ordering of point, line or planar defects, are made explicit in the Introduction, on the grounds that they have been well covered elsewhere.

One can quibble at the margins about omissions and undefined concepts, but the final impression left is of a *tour de force*, a synthesis which has no competitor. The book deserves the close attention of adventurous inorganic and solid-state chemists, solid-state physicists (especially theoreticians) and physical metallurgists. The printing is by facsimile reproduction of typescript, but is quite clear, and in view of its size and scope the book is not overpriced.

R. W. Cahn

R. W. Cahn is Professor of Materials Science at the University of Sussex, Brighton, UK.

## Pollination ecology revived

*The Principles of Pollination Ecology.* Third edition. By K. Faegri and L. van der Pijl. Pp. 244. (Pergamon: Oxford, 1979.) Hardback £12.50; paperback £7.50.

POLLINATION ECOLOGY is certainly not a new subject, having developed essentially during the eighteenth century and having been given new impetus by the work of Darwin in the nineteenth century. But it is a subject in which interest has lapsed somewhat until relatively recently, perhaps because its study has demanded patient and precise observation rather than more fashionable sophisticated experimentation. It may well be that this very fact is leading to a resurgence of interest in the subject, particularly on the part of the very considerable army of amateur bontanists in Britain. Already the energies of this eager body have been channelled into the detailed mapping of the British flora and now, under the auspices of the Botanical Society of the British Isles, information is being sought regarding the insect visitors to flowers.

In this academic climate, it is apt that Faegri and van der Pijl should launch a third edition of their classic survey of pollination ecology. The last edition was published in 1971 and since that time a great deal of new work has appeared in the literature. In their current bibliography about 30% of references date from this period, and this will indicate the extent of textual revision.

The book has retained its original arrangements, with chapters on general principles of abiotic and biotic

pollination, attractants, pollination and speciation, and so on; and then a series of detailed and illustrated case studies of particular plant species. The latter are particularly informative, although the drawings are sometimes so heavily stippled that structural clarity is lost. Simple line drawings would have been preferable.

In general, the text is turgid, probably because it is so heavily packed with examples and references. Although the bibliography is extensive and valuable, perhaps the book could have been improved from the point of view of undergraduate teaching if fewer examples had been dealt with in greater detail. The text generally lacks the diagrams that could have made many points more easy to grasp. Frequently an unreasonable familiarity with the literature is assumed and one is referred to the "well-known case of . . ." without further explanation. The full benefit of the text can certainly be obtained only with the backing of a good reference library.

In comparison with Proctor and Yeo's *Pollination of Flowers* (Collins: London, 1973) which, rather surprisingly, is not referred to in the bibliography, this book excels in its crystallisation of fundamental principles from a plethora of facts and observations, but falls short in its coverage of insect adaptations and in the quality of its illustrations. It is, however, a book which should stimulate further interest and research in an area of biology where plants and animals tend to interact to mutual benefit. For this reason alone it is a sadly neglected aspect of ecology which could prove a fruitful subject for practical teaching in undergraduate ecology courses. This book may lead to such developments.

Peter D. Moore

Peter D. Moore is Senior Lecturer in Ecology at King's College, University of London, UK.