only in the sense of observed or unobserved phases). $KNbO_3$ phase transitions are analogous to those of $BaTiO_3$. Only the two highest phase transitions of $NaNbO_3$ are JT transitions.

$RbIn(WO_4)_2$. Phase III of T_h symmetry is stable at lower temperatures than phase II of its subgroup D_{2h} symmetry. This fact can be explained by another chain of symmetry descent (D_{2h} and T_h must therefore not be in the same chain).

Explanations of phase transitions of other compounds may be understood very simply from Table 2. Some of them can be explained assuming either two- or three-dimensional irreducible representations of the O_h group in the same way. Our results indicate that the influence of excited electronic states decreases very steeply with excitation energy. The possibility of O_h and D_{6h} starting symmetries for the same compounds (explained here as a dynamical superposition of static structures at different conditions) is rare and may be caused by admixtures in crystals (*e.g.* phase V of $BaTiO_3$).

Concluding remarks

This theory is restricted only to the symmetry properties of individual compounds. It says nothing about the kinetics and gives only a limited amount of information on the thermodynamics of phase transitions. On the other hand, the theory is capable of explaining all the observed transitions and predicting all the possible symmetry changes during the phase transitions.

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Book Reviews

Works intended for notice in this column should be sent direct to the Book-Review Editor (R. O. Gould, Department of Chemistry, University of Edinburgh, West Mains Road, Edinburgh EH9 3JJ, Scotland). As far as practicable books will be reviewed in a country different from that of publication.

Acta Cryst. (1990). B**46**, 575–576

Biomineralisation: chemical and biochemical perspectives. Edited by S. MANN, J. WEBB and R. J. P. WILLIAMS. Pp. xiv + 541. Weinheim, New York: VCH Verlag, 1988. Price DM 274.00.

Biomineralization is the controlled formation of inorganic minerals (such as calcite, hydroxyapatite, magnetite *etc.*) by living organisms. The functions of these 'biominerals' are many and varied; ranging from the obvious protection and support provided by exoskeletons and skeletons, to the more intricate role of acting as gravitational and magnetic sensors. The physical and chemical properties of biominerals are therefore of great interest to researchers in fields as diverse as bioinorganic chemistry, materials science, geology, medicine and biology.

The increasing interest in biomineralization has resulted in the need for a comprehensive reference text on the subject. This book goes some way to filling this requirement. It is comprised of 15 chapters and is essentially a collection of reviews dealing with various aspects of current research into biomineralization. It begins with two chapters providing a useful introduction to the more general aspects of the control of mineral formation in biological systems: essential reading for a newcomer to the subject. This is followed by a number of chapters each of which deals in depth with a particular area of research on biomineralization. The subjects covered range from carbonate calcification in algae to studies on vertebrate tooth mineralization, with the appropriate emphasis placed on the organic matrices which control the mineralization process.

The analytical techniques which are now increasingly important in the study of biominerals, such as electron microscopy, EXAFS (extended X-ray absorption fine structure) and proton-beam analysis, are considered in the latter part of the book. A complete chapter is devoted to proton-beam analysis in which the basis behind techniques such as PIXE (proton-induced X-ray emission) is explained. The book ends with a consideration of the relevance of research into biomineralization to materials science and technology.

The editors have done a reasonable job in ordering the various contributions to the book in a logical way. In general the chapters are well planned, although with over 20 contributors there is, not surprisingly, some variation in standards and some of the chapters are hard going. Most chapters are well referenced, as one would expect from the

review style of the book. Figures and illustrations are of a high standard and complement the text well.

As a protein chemist, there is one particular chapter that I would single out for special mention and that is the chapter by Harrison *et al.* on the iron storage protein ferritin. The functional and structural features of ferritin are clearly explained, with the section on the protein structure beautifully illustrated and a delight to read. The book is worth acquiring for this chapter alone.

For those directly involved in research in the field of biomineralization, this book should be an essential purchase. For others interested in the subject, or in related areas, I would suggest that this book is an ideal reference text to have in a departmental library.

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A revolution in biotechnology. Edited by JEAN L. MARX. Pp. 227. Cambridge University Press, 1989. Price £25.00, US $44.50.

This is intended to be the first of a series of books on important scientific topics for the general reader that is being sponsored by the International Council of Scientific Unions (ICSU). The President of ICSU, John Kendrew, states in his Foreword to the volume that one of the important responsibilities of the ICSU is to bring to the notice of the public scientific advances that will significantly affect our lives or that will illuminate our knowledge of the world we live in.

The text is written by a team of experts for non-specialist readers, and is well illustrated. There are colour photographs too, a large fraction of which are molecular structures: *e.g.* the DNA double helix, carboxypeptidase, antibodies (on their own and interacting with a hypothetical viral particle) and poliovirus. X-ray crystallography is explained in six lines on page 8, in the context of how the DNA structure was determined by X-ray diffraction. This is the sort of book where the distinction between a fibre and a crystal is a minor detail! However, one can find fascinating facts such as the information that in the world market for enzymes, only three (glucose isomerase and two amylases) account for 50% of the turnover. Production of syrup from corn starch by this method saved the US about $1.3 billion in foreign exchange for imported cane and beet sugar in one year. Hence, the reader is being sold the benefits of science on an economic level as well as on other levels, such as the role of pharmaceuticals and medicines in maintaining an increasing world population with improved means of food production.

The scientific revolution brought about by the application of physical techniques in biology is the foundation of the biotechnology revolution. It provides an antidote to the fears generated by atomic weapons, and thus improves the way that the community views science and scientists and their role in society. So it is reasonable, therefore, that this book is, to an extent, of the wow/gosh variety. But some detailed self-criticism would not have gone amiss. After all, the economic benefits to the rich nations of using biotechnology as a means to reduce Third World imports, referred to above, is a two-edged sword. It would have been good to have seen some views expressed as to how foreign aid could be applied so that everyone could benefit economically from the biotechnology revolution. Similarly, words of caution are needed in areas such as the possible rate of progress of AIDS research, to avoid raising unrealistic expectations which the scientific community cannot fulfil. There are other awkward issues lurking too. How, for example, will all this new-found biotechnological expertise be used constructively to tackle Third World diseases such as sleeping sickness or malaria? In these cases, with some notable exceptions, there is insufficient financial incentive for the drug companies to do anything. Also, the possibility that biotechnology will be applied in biological warfare is a depressing thought.

This book therefore takes on a difficult task, and, for the first in a series, ICSU have done a reasonable job. It has provided information, and it advertises the benefits of science to government rather well. As for crystallography – well, a great deal has followed from W. L. Bragg's deduction of the structure of sodium chloride from Laue photographs! Crystallographers can be well pleased to see X-ray analysis and its results discussed in such a wide and useful context.

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