in the biosynthesis of a protein molecule. In the living cell, three different forms of ribonucleic acid (RNA) take their parts in this synthesis; one is the 'messenger' carrying instructions for the amino-acid sequence from the deoxyribonucleic acid (DNA) of the nucleus to the site of protein synthesis. The DNA carries the hereditary information of the cell and is copied at every cell reproduction. Our understanding of these processes is being built up from very diverse experimental studies. X-ray studies of DNA fibres have shown the helical structure of the molecules with paired purine and pyrimidine bases, and allowed Watson & Crick to suggest the mechanism of replication — so that the information contained in the sequence of bases may be passed on from parent to daughter cell. Suitably crystalline RNA fibres have more recently been obtained and have shown these molecules to be largely helical too. Isotopic tracer experiments have been used to follow the fate of different components of the protein and nucleic acid synthesising systems both *in vivo* and *in vitro*. Genetic studies on bacteria, with chemically induced mutations, have shown that the code word for one amino acid consists of three bases in the DNA chain; biochemical experiments are beginning to show which three bases constitute each code word.

Dr Perutz, in his second and third lectures, has drawn together and described in outline many of the key experiments in these different fields, and showed what is proved by each. It is a most useful survey, and fascinating to read; each argument must be closely and carefully followed, and probably much more material has been presented in this short space than the newcomer can hope to appreciate fully in one reading.

The first of the three lectures describes the results of the X-ray analyses of the crystal structures of the protein molecules myoglobin and haemoglobin, the interpretation of the electron-density maps at limited resolution, the detailed architecture of these large and biochemically important molecules, and the dependence of this architecture on their chemical constitution. The methods of the X-ray analysis are not discussed at all; in fact very little indication is given of the years of toil, on the part of Dr Perutz and his colleagues, which preceded these beautiful results, years during which the intermediate results were of interest to crystallographers but had very little significance for biologists. But now there is a wealth of information of great interest to biologist, chemist, and crystallographer, and it is a pleasure to hear (or read) Dr Perutz's account of this.

The book provides, therefore, an exciting introduction to molecular biology (for the beginner who already has some background of chemistry and biology), or, for the reader already familiar with a part of it, a good survey of the wider field and the relation of one development to another. (It is not intended, however, to be an exhaustive review.) There is an appendix outlining a few advances made since the lectures were given, and a useful list of references up to mid 1962.

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Dana's System of Mineralogy, Vol. III. 7th ed.

By C. FRONDEL. Pp. 334, with 114 figs. and 50 tables. New York, London: Wiley 1962. Price $7·95.

Volume III of *Dana's System of Mineralogy* contains a detailed description of the silica minerals, especially of quartz, which occupies about three-quarters of the contents. The rest of this volume is devoted to the remaining polymorphs, including the new synthetic high-pressure modifications, some of which have subsequently been discovered as natural minerals. The main concern of this handbook is the detailed description of the morphological, physical and chemical properties of the minerals in question. The crystal forms observed are broadly discussed. There is no doubt that this collection of data on a single chemical compound is most valuable for all scientific research on this subject. On the other hand the reviewer feels that the structural data are not treated quite in accordance with their general importance for all properties here discussed. The description of the structures and the mutual relations of the polymorphs is discussed in a formal manner only, *e.g.* the parameters of the atomic positions are given, but the important bond angle Si–O–Si is not mentioned. A more detailed crystal-chemical consideration of the minerals in question would therefore be highly desirable in the next edition.

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Globular protein molecules: their structure and dynamic properties.

By JACOB SEGAL, KÄTE DORNBERGER-SCHIFF and ANGEL KALAIDJIEV. Translated by ANTHONY WOOSTER. Pp. xiii+150. Berlin: VEB Deutsche Verlage der Wissenschaften. 1960. Price DM 19·80.

Many of us working on protein crystals have in the past speculated on the structure of protein molecules and have built models, more or less precise, which seemed to us to fit the known experimental properties of proteins. This book describes the development of one such model, 'the Faltentrommel' model, by a biologist, Jacob Segal, an X-ray crystallographer, Käte Dornberger-Schiff, and a biochemist, Angel Kalaidjiev. In this model, the peptide chains are imagined to occur in comparatively short lengths in proteins, packed anti-parallel to one another and connected by diketopiperazine bridges which involve the diamino and dicarboxylic acid residues. The sheet-like structure that results is folded round to form a drum, giving a central hole, which may have a quite irregular shape, in the molecule. Large molecules are thought to consist of a number of drum-like regions. Physical and chemical evidence, enzymatic behaviour and X-ray analytical data are discussed in relation to the model.

It seems to me, as I imagine it must to many other

X-ray crystallographers, that this theory is so completely excluded by the work of Perutz & Kendrew and their collaborators, that I find it difficult and saddening even to look at the book, much less can I face criticizing it in detail, as I could, on a number of grounds. But the fact that the authors do not themselves immediately come to my conclusions, in the Appendix which they write on the recent X-ray analysis of haemoglobin and myoglobin, raises an interesting general problem for X-ray analysts. *R*, when I last heard of it for myoglobin, was over 40%, and yet I do not doubt that the structure described by Kendrew and his collaborators is essentially correct. The coincidences between the electron-density distribution they find and that required by the α-helix peptide-chain configuration and protein and porphyrin chemistry seem to me extremely convincing. Add to these the low-resolution similarity between the chain structures of myoglobin and haemoglobin and the evidence becomes, to me, overwhelming. But it does not appear so to the authors of this book. Their difficulties call for careful consideration of the ways in which the evidence on complex structures is made available for critical examination. Should, for example, the whole electron-density map for myoglobin at 2 Å resolution be deposited in some central store?

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Books Received

The undermentioned works have been received by the Editors. Mention here does not preclude review at a later date.

Research in surface forces. Edited by B. V. DERYAGIN. Translated from the Russian (translator's name not given). Pp. vi+190. New York: Consultants Bureau, 1963. Price $27·50.

This publication, reproduced photographically from unjustified typescript, contains 28 papers presented at a conference on surface forces held in the U.S.S.R. in April 1960. The papers are divided into five parts, with the headings General problems in surface forces, Polymer adhesion, Surface forces in thin liquid films, Surface effects in dispersed systems, and Surface forces in aerosols. The subject is only of marginal interest to crystallographers, the paper by M. S. Metsik 'The role of surface forces in mica crystals' being the only one making detailed use of structural considerations.

Métallurgie physique. By BRUCE CHALMERS. Translated 'from the American' by G. DORZÉ and D. DUTILLOY. Pp. xviii+430, with 423 figs. Paris: Dunod, 1963. Price 68 F.

The English edition was published by Wiley. The French translation has a preface by Prof. P. Lacombe, but appears otherwise unchanged.

Special ceramics 1962. Edited by P. POPPER. Pp. xiv+482, with many figs. London and New York: Academic Press, for the British Ceramic Research Association, 1963. Price £5. 5*s*.

This book contains twenty-five papers presented at a symposium held in Stoke-on-Trent, England, in July 1962. In his preface the editor defines a special ceramic as a heat-resisting material without prospects of short-term commercial profitability. Once the materials become commercially established they 'appear to cease to be special but become electrical ceramics or refractories.' The materials index covers a little over two pages, and in it nitrides, borides, carbon and carbides, and compounds of heavy metals like thorium, uranium and tungsten are prominent.

X-ray methods are frequently mentioned, but none of the techniques appear to be novel. A paper by the editor on the formation of non-oxide coatings by pyrolysis mentions boron nitride white as analogous to carbon black.

Principles of zoological micropalaeontology. By VLADIMÍR POKORNÝ. Translated from the German by K. A. ALLEN and edited by J. W. NEALE. Pp. xvi+652, with 549 figs. Oxford: Pergamon Press, 1963. Price 84*s*.

This book forms volume X of the International Series of Monographs on Earth Sciences. The original Czech edition appeared in 1954, but the English translation has been made from the revised German edition of 1958. The book is well printed and well produced, and has nearly 60 pages of indexes. It will, however, be of interest to geologists and biologists rather than crystallographers. X-rays are mentioned in connexion with chemical composition and the distinction between calcite and aragonite.

Fragilité et fragilisation des métaux et alliages. By D. ADENIS and P. BLANCHARD. Pp. xvi+207, with 118 figs. Paris: Dunod, 1963. Price 38 F.

This book discusses brittleness and embrittlement of metals, a subject very important in the prevention of