science in our time is mainly due to the huge amounts of money that have been spent on big machines. What really makes science grow is new ideas' [Elders, F. (1975). *Reflexive Waters*, p. 85. London: Souvenir Press]. For example, Patterson and Harker formulated their vector functions before any mechanized methods for the summation of Fourier series became available. E. W. Hughes introduced least-squares refinement in the structure analysis of melamine, when it took him 2 days to set up the normal equation for 18 parameters and 100 *h*0*l* reflexions on an IBM Hollerith punched-card machine and the machine took about 4 h to solve them. Crystallographers worked out phase relations many years before it became possible to use them effectively.

I quoted only part of Popper's dictum. The full sentence reads: 'What really makes science grow is new ideas, *including false ideas*.' I have had plenty of those, but it consoled me to find myself in good company.

In her 1928 paper on the structure of the benzene ring Kathleen Lonsdale writes: 'the benzene ring is almost if not quite flat ... The substitution, therefore, of a flat benzene ring for the puckered rings in naphthalene and anthracene would not affect the periodicity in the **c** direction which is one of the most striking features of those crystals'. An accurate structure of benzene was not published until 36 years later, when Curry and Wilson studied solid benzene by neutron diffraction, showing the positions of the H atoms and determining the C–C distances with an error of only 0·007 Å, at −135°C. At −3°C their mean C–C distance is 1·392 Å compared to Lonsdale's first estimate of 1·45 Å at room temperature. This paper immediately follows Lonsdale's, making one forget how much time had to elapse before this simple and important structure could be accurately determined.

Glusker's section on protein structures begins with Bernal and Crowfoot's famous note to *Nature* describing the diffraction pattern of wet pepsin crystals. They declare: 'Peptide chains in the ordinary sense may exist only in the more highly condensed or fibrous protein, while the molecules of the primary soluble proteins may have their constituent parts grouped more symmetrically around a prosthetic nucleus'. I wonder what they meant by that.

Glusker's book bears out not only Popper's views about science, but also my own: Money has its uses, but most progress springs from talent.

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Structural studies on molecules of biological interest. Edited by G. DODSON, J. P. GLUSKER and D. SAYRE. Pp. xviii + 610. Oxford: Clarendon Press, 1981. Price £39.00.

This volume is a *Festschrift* dedicated to Dorothy C. Hodgkin on her 70th birthday. In similar compilations the contents may be of variable quality but in this case the contributions have a very high standard. This is not an impression you only get immediately, laying your hands on the book. This review was delayed for various reasons and I had to read the volume a second time leaving me with my original opinion that this is an unusually good *Festschrift*.

The number of Dorothy's pupils and co-workers is remarkably large. The Editors have invited them to contribute to the volume. The fact that many have chosen not to take part may be taken as an indirect indication of its high quality. Only high-standard original papers are presented rather than hasty write-ups of old material.

On the other hand, it is essential that a volume of this nature should have a fair amount of historical background. All of us who have the privilege of knowing Dorothy will no doubt agree with the late Professor J. M. Bijvoet when he states in the beginning of this volume: 'one always rejoices at expressing feelings of admiration and affection. In no case in which I have felt this more clearly than at this moment now that I can contribute to the homage of Dorothy Hodgkin'.

M. Perutz leads off the section on history with an important chapter on the early days of crystallography in the UK, followed by interesting reminiscences by D. C. Philips, D. Parker-Riley – Dorothy's first research student – and the man taking care of the Oxford laboratory for many years, F. Welch. Recollections from work in the US and in China are given by L. Pauling and Tang You-chi respectively.

Dorothy's first major contribution to organic chemistry came through her work with C. H. Carlisle on cholesteryl iodide. Her research stimulated the whole field which is elegantly reviewed in the volume by J. Dunitz. The pioneering studies of J. M. Robertson are also described.

All of this of course leads up to Dorothy's famous work on vitamin B_{12} – a landmark in crystallography. J. P. Glusker gives an introduction to the subject and finally sums up the results obtained so far. The first studies are described by J. H. Robertson who gives a fascinating account of the Oxford laboratory at that time. The very interesting correspondence between Dorothy and K. N. Trueblood at UCLA is included. This illustrates well what crystallographers outside the US had to go through before computers were generally available. The vitamin B_{12} part also contains descriptions of the largely parallel work at Princeton (J. G. White).

Many chapters stem from studies not directly in line with Dorothy's main research. The work on gramicidin S was, however, performed mainly in her laboratory (M. M. Harding) and that on histamine (K. Prout and R. Ganellin) was performed in close cooperation with her.

Work on molecules of various nature is included, *e.g.* a description of an oxo-bridged binuclear iron(III) complex (B. Kamenar and B. Kaitner), of the conformation of amides (K. Venkatesan and S. Ramakumar), of nucleoside-5-diphosphate (M. A. Viswamitra, S. K. Katti and M. V. Holm) and of some mercury compounds (D. Grdenić). In this section there is finally a paper on pharmacological questions (E. Shefter).

A part is also included on methods in crystallography, starting with data collection for large molecules (R. A. Sparks). Several papers here deal with anomalous dispersion which was used extensively in Dorothy's research (S. Ramaseshan and R. Narayan), even on such large molecules as lysozyme (G. A. Bentley and S. A. Mason).

D. Sayre describes the early development of direct methods to which he made important contributions. His role in the introduction of FFT to crystallography is mentioned

and its possibilities in the refinement of proteins is illustrated by N. Isaacs.

It is natural that a volume on Dorothy's contributions includes many papers on protein structures, as she has been involved in the development of the entire field. She has initiated and stimulated much work in the area and many leading crystallographers have spent some time in her laboratory. Examples are ferritin (P. M. Harrison), leghaemoglobin (B. K. Vainshtein) and penicillopepsin (M. N. G. James, I.-Nan Hsu, T. Hofmann and A. R. Sielechi).

Some papers deal with the relation between protein structures such as dehydrogenases (M. Adams, I. G. Archibald, J. R. Helliwell, S. E. Jenkins and S. W. White), actinidin and papain (E. N. Baker) and the symmetry of proteins (T. Blundell, T. Sewell and B. Turnell).

As expected for a *Festschrift* to Dorothy there is a section on insulin as she has devoted so much of her research to questions related to that molecule. Some crystallographic problems were described (M. Vijeyan) in the method section. In the main insulin part we find all aspects covered – precursors (D. F. Steiner), destabilizing agents (R. A. D. de Graaff), evolution (S. Falkmer and S. O. Emdin), semi-synthetic approaches (V. K. Naithani, H.-G. Gathner, E. E. Büllesbach and H. Zahn) and the main chemical synthesis (P. G. Katsoyannis). Other studies reported concern pharmakinetic work (M. Berger, H. J. Cüppens, J. G. Davies, P. A. Halban, S. M. Hoare, R. E. Offord, A. Lewill-Bentley and S. P. Talley), work on the hydrogen bonding in insulin (N. Sakabe, K. Sakabe and K. Susaki), and solution phenomena (D. Mercola and A. Wollmer). Two contributions dealing with largely the same insulin work as Dorothy's are reported from China by the Beijing Insulin Structure Research Group and by Zhang You-shang. The section adequately concludes with a comparison of different insulin structures (J. F. Catfield, S. M. Catfield, E. J. Dodson, G. G. Dodson, C. D. Reynolds and D. Vallaby) and the chemistry, structure and function of insulin (D. Brandenburg).

It is unavoidable that a review of this *Festschrift* becomes rather lengthy as the contributions cover so many aspects of science. The *Festschrift* should be in the possession of every crystallographer not only because of the outstanding contributions but also because it gives an excellent insight into one of the great eras of crystallography.

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Solid state reactions. Monographs in modern chemistry, Vol. 12. By HERMANN SCHMALZRIED. Pp. 254 (101 figures and 6 tables). Completely revised 2nd edition. Weinheim, Deerfield Beach (Florida), Basel: Verlag Chemie, 1981. Price DM 98.00.

A first edition of this book has already appeared in the German (1971), English (1974) and Polish languages but was not reviewed in *Acta Crystallographica*. This, second, edition has been thoroughly revised, enlarged and complemented in a number of sections; it follows the plan of the first edition, using the same chapter headings but with changes of detail. There are nine chapters and an idea of the scope of the book can be obtained from their titles: 1. *Short introduction to the bonding, structure and imperfections of solids* (10 pp.); 2. *Short introduction to solid state reactions* (8 pp.); 3. *Crystal defects* (18 pp.); 4. *Thermodynamics of point defects* (22 pp.); 5. *Chemical diffusion in the solid state* (34 pp.); 6. *Reactions in the solid state – ionic crystals* (37 pp.); 7. *Reactions in the solid state – metals* (38 pp.); 8. *Reactions between solids and gases or between solids and liquids with a solid reaction product* (33 pp.); 9. *Some technologically interesting solid state reactions* (37 pp.). In addition there are lists of symbols and units, author and subject indexes and an appendix (not in the first edition) of 18 problems. Some 450 literature references are distributed among the various chapters; about two thirds of these refer to sources written in English while most of the remainder come from the German literature. This broad coverage of the literature is to be welcomed. The first English edition had 214 pages so the present edition has been expanded by about 25% in content and is also more generously dimensioned than the first English edition.

The materials and reactions considered are taken entirely from inorganic and metallurgical chemistry; organic solid-state reactions, where a somewhat different approach would be required, are not considered. The range of topics covered is comprehensive but the number of reactions discussed is limited, with emphasis placed on in-depth, quantitative analyses. Thermodynamic aspects and matters of mass transport (diffusion) are stressed; although less attention is paid to structure and the role of defects, these are not ignored. The overall treatment is condensed and rather formal. The sometimes complicated symbolism is clearly typeset; I did not find any errors and the language is clear, with only a rare infelicity having escaped the editorial filter.

This book could serve as a very useful text in a high-level graduate course in solid-state chemistry, but I do believe that the instructor will find it necessary to provide an appreciable amount of assistance over the sticky patches. However, the efforts involved will be repaid – mastery of the subject matter of this book will give an excellent basis to anyone seriously interested in inorganic solid-state reactions.

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Structural aspects of biomolecules. Edited by R. SRINIVASAN and VASANTHA PATTABHI. Pp. xiii + 428. Madras: Macmillan India, Ltd, 1980. Price Rs 50.

This volume contains the text of 15 lectures which were delivered at the International Winter School on Current Trends in Biomolecular Structure, which was organized in Madras in January 1978. The lectures cover topics concerned with the chemical, structural and conformational aspects of biomolecules, obtained by the application of X-ray diffraction methods, optical and spectroscopic methods, and