International Union of Crystallography

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Executive Secretary

It is with deep regret that the death of Dr J. N. King is announced. Jim joined the Union as the first Executive Secretary in 1969 and gave loyal service until his untimely death on April 12 1993. He had known about his illness for about fifteen months but had continued working with remarkable fortitude almost until the end. A full obituary will appear in *Acta Crystallographica*, Section A in due course.

Book Reviews

Works intended for notice in this column should be sent direct to the Book-Review Editor (R. F. Bryan, Department of Chemistry, University of Virginia, McCormick Road, Charlottesville, Virginia 22901, USA). As far as practicable, books will be reviewed in a country different from that of publication.

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Electron diffraction techniques. Vol. 1. (**IUCr Monographs on Crystallography** No. 3.) Edited by JOHN M. COWLEY. Pp. xi + 584. Oxford: Oxford University Press, 1992. Price £50.00. ISBN 0-19-855558-X(v.1).

This volume was written to fulfill a need for a comprehensive work on various aspects of electron diffraction, given the significant developments that have taken place with this technique over the past two decades. The book is intended for anyone who wishes to begin using electron diffraction in research, either as a graduate student or as an experienced researcher. The list of contributors includes some of the most prominent contemporary workers in the field and a broad spectrum of topics is covered. In this, the first of two volumes, there are three chapters by the editor, J. M. Cowley: Chapter 1 (74 pp.), giving a general theoretical backgound and introducing the geometries of various electron diffraction modes; Chapter 3 (20 pp.), demonstrating the relationship between diffraction and image familiar to any electron microscopist; and Chapter 9 (26 pp.), discussing coherent convergent-beam diffraction and showing, among other things, how it is possible to scan thin crystals with electron-beam diameters smaller than the dimensions of a unit cell! C. J. Humphreys and E. G. Bithell (Chapter 2, 77 pp.) present a comprehensive overview of multiple-beam dynamical diffraction theory in its various formulations, and a practical Chapter 4 (43 pp.) by J. Barry shows how dynamical scattering calculations, mostly with the multislice method, would behave for typical problems. Fascinating uses of dynamical scattering are discussed by J. A. Eades in a very well written Chapter 7 (48 pp.) on unit-cell identification from details in convergent-beam discs and by J. C. H. Spence on how dynamical scattering can be used to determine accurate X-ray structure amplitudes and phases for certain inorganic crystals (Chapter 8, 79 pp.) and on how electron channelling can be used, *e.g.* to locate crystal impurities (Chapter 10, 68 pp.). There is also a section on gas electron diffraction by I. Hargittai (Chapter 11, 30 pp.) and an extensive review (Chapter 6, 97 pp.) by B. K. Vainshtein, B. B. Zvyagin and A. S. Avilov on how electron diffraction intensity data have been used for crystal structure determinations. The remaining Chapter 5 (4 pp.), by M. J. Carr, C. E. Lyman and J. M. Cowley, is a rather terse consideration of how electron diffraction signals can be used to identify unknowns - anticipating a fuller development of the theme in the forthcoming Volume 2. Finally, but significantly, there is a very nice Appendix containing Fourier-transform pairs of many functions commonly encountered in diffraction analysis.

As would be expected from the list of contributors, this volume is an authoritative treatment of uses of electron diffraction in contemporary studies of mostly inorganic materials. It is to be recommended particularly to materials scientists working with samples resistant to electron beams, who can benefit, for example, from the many uses of convergent-beam techniques that are impressively portrayed in the text.

The importance of dynamical scattering is a unifying theme for much of the book and it is quite interesting to see how it can be exploited to uncover information about unit-cell symmetry and even crystallographic phases. There is much material here that should also be of interest to the X-ray crystallographer and, given this possibility, some attention might have been given to incorporating terminology more familiar to X-ray diffractionists where overlapping interests are obvious. For example, in the interesting description of space-group determination in Chapter 7, some clarification of a somewhat unusual symmetry notation - *e.g.* $2_R mm_R$ - would have been useful, but everything is copiously referenced so that this information can be found. Similarly, in the description of the use of convergent-beam patterns for determination of crystallographic phases (Chapter 10), it would have been useful if the respective associations of the 'systematics' and 'non-systematics' three-beam interactions with the $\sum_1$ and $\sum_2$ three-phase invariants had been specifically stated. (Also, of course, the notion of structure invariants was originally introduced by H. Hauptman and J. Karle in 1953, which is not stated.) These are but minor points. In general, there is much to contemplate in this volume, which should be on the shelf of any electron diffractionist.

Excellent as the material included is, one may legitimately criticize this work for lack of a clearer treatment of the limits to carrying out *ab initio* structure analyses with electron diffraction intensity data, a consideration that has soured interactions between electron diffractionists and X-ray crystallographers for many years. We have, after all, recently witnessed a virtual rev-

olution in the use of 'electron crystallography' for such quantitative structure determinations, not only in the application to proteins, which is best known, but also to linear polymer structures and even to some inorganic materials. While it is quite proper to acknowledge the pioneering efforts of the Moscow group and to include a summary of their excellent work in a separate chapter, an inconsistent view of the underlying scattering theory results when the earlier models are compared to the more recent theoretical developments contained in other chapters. That is to say, the *n*-beam dynamical theory is correct for all materials (even organics), an impression not given by Chapter 6, where Blackman two-beam dynamical corrections are stated to be appropriate. On the other hand, discussion of *n*-beam theory in other chapters often gives the impression that a kinematical scattering approach is never useful, a viewpoint obviously contradicted by the success of many of the earlier studies of Vainshtein and his colleagues (not to mention those of their later disciples who now acknowledge the appropriateness of the *n*-beam theory). To be fair, Profesor Cowley does cite the computations of B. K. Jap and R. M. Glaeser, which establish the crystal-thickness limits for useful intensity data collection from organic samples. I feel, though, that the real usefulness of electron diffraction data for *ab initio* structure analyses may be obscured by the copious discussion of cases where it is obvious that multiple-beam interactions are most important. However, this oversight is a sin of omission, rather than of commission, and obviously due to research interests quite different from those of this reviewer!

Given that the authors of many of these chapters have been at the forefront of theoretical developments in electron diffraction and microscopy, this impressive volume is a very nice collection to have at hand - both as a reference and as a nucleus for research ideas. With the realization that the underlying theory can be used advantageously to design experiments, including intensity data collection for crystal structure analyses, to reveal structure at the atomic or molecular level, the many potential advantages of electron diffraction should remain an enticement to the whole crystallographic community.

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Books Received

The following books have been received by the Editor. Brief and generally uncritical notices are given of works of marginal crystallographic interest; occasionally, a book of fundamental interest is included under this heading because of difficulty in finding a suitable reviewer without great delay.

Accurate molecular structures, their determination and importance. (IUCr Monographs on Crystallography No 1.) Edited by A. DOMENICANO and I. HARGITTAI. Pp. xii + 590. Oxford University Press, 1992. Price £60.00. ISBN 0-198-55556-3. A review of this book, by Jack D. Dunitz, has been published in the February 1993 issue of *Acta Crystallographica* Section B, pages 145-146.

Structural and chemical analysis of materials. X-ray, electron, and neutron diffraction; X-ray, electron, and ion spectrometry; electron microscopy. By J. P. EBERHART. Pp. xxx + 545. Chichester, England: John Wiley & Sons, 1991. Price £95.00. ISBN 0-471-92977-8. A review of this book, by Noel W. Thomas, has been published in the February 1993 issue of *Journal of Applied Crystallography*, page 145.

Protein structure - new approaches to disease and therapy. By MAX PERUTZ. Pp. 326. Oxford, New York: W. H. Freeman, 1992. Price £32.95 (hardcover), £21.95 (paperback). ISBN 0-7167-7021-0 (hardcover), 0-7167-7022-9 (paperback). A review of this book, by Charles M. Grisham, has been published in the May 1993 issue of*Acta Crystallographica* Section D, page 355.

Synchrotron radiation crystallography. By PHILIP COPPENS, with contributions by DAVID COX, ELIAS VLIEG and IAN K. ROBINSON.. Pp. x + 316. London: Academic Press, 1992. Price £45.00. ISBN 0-12-188080-X. A review of this book, by Alan J. Leadbetter, has been published in the June 1993 issue of *Journal of Applied Crystallography*, pages 499-500.