Of the more recent developments in direct methods this book contains a remarkable contribution by Main, who introduced into *MULTAN*, as a systematization of older theories, a procedure that makes use of molecular structure. Apart from this there are some preliminaries on entirely new methods that we may expect in the near future: magic integers (Woolfson), matrix methods (Main) and a heuristic theory on the concept of neighborhoods (Hauptman).

A number of papers in both sections *A* and *B* cover the subject of partial structure, phase refinement and phase extension in proteins. Sayre's method (Sayre), the maximal-determinant method (Tsoucaris) and the methods that modify the electron density (Gassmann, Simonov, Collins *et al.*) all seem to show a capability of improving the resolution of protein electron-density maps, starting from about 2·5 Å resolution.

Section *B* contains papers on protein crystallography which are also very informative to the general crystallographer: data collection (Bassi), the handling of protein data (Dodson), isomorphous replacement (Dodson, Kartha, Ashida) and anomalous scattering (Srinivasan). The increasing importance of Patterson search procedures, especially for the larger protein structures and viruses, is reflected in papers by Tollin, Blow, Bricogne, Colman *et al.* (see also, for ordinary structures, a paper by Kutschabsky and Reck on the convolution-molecule method in section *B*). The use of molecular structure and of non-crystallographic symmetry, which have always been the basic ingredients of these methods (contrary to direct methods until recently), combined with data from isomorphous replacement, seems to be very effective in phase refinement and extension at lower resolution, especially in direct-space procedures.

Papers on coordinate refinement, with constraints, by least-squares or Fourier methods (Diamond, Steigemann *et al.*; Jensen, Freer *et al.*), on phase refinement at higher resolution by direct methods (mentioned above) and on model building (Diamond, Nagano) show the immense computational problems inherent in these methods, which have become highly important since more high-resolution data have become available.

Four major subjects can be distinguished in section *C*. The first is a study on electron diffraction of polycrystalline material by Imanov. Five papers give good insight into the problems and developments in the field of small-angle scattering. Special attention is given to collimation corrections (Schmidt, Walter), evaluation of scattered intensities from models of macromolecules (Söler), and acquisition of neutron data (Klesse). Fedorov introduces large-angle scattering.

Studies on Fourier syntheses and least-squares refinements permanently hold the attention of the crystallographer. The papers on symmetry considerations (Larson), anomalous dispersion (Larson) and fast Fourier transforms will assist every programmer in getting optimum efficiency in his programs. Rollett gives remarkable conclusions on convergence in least-squares techniques.

In the last part of this chapter, developments in program design and data-handling techniques have been gathered. Owing to the rapid developments in computer design during the last decade large program systems and data systems have been set up, and are at the disposal of the modern crystallographer. A great variety of information on program design for large computers is given by Sukarai, Hall, Stewart, Sasvári, Ahmed and Morimoto. Trends in minicomputer techniques are discussed by Sparks and Gabe, and the Cambridge data base by Motherwell.

The reviewer is pleased to recommend this book to crystallographers with interest in direct methods and protein crystallography. The subjects contained in the third part are of general interest to most crystallographers. As a continuation of the proceedings of foregoing Summer Schools it is a valuable book; it provides very useful information on principles and developments in crystallographic computing.

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Low-temperature X-ray diffraction: apparatus and techniques. By R. Rudman. Pp. xvi + 344, Figs. 71, Tables 9. New York: Plenum, 1976. Price US $42.00.

The title could have been '60 Years of Low Temperature X-ray Crystallography'. It may seem surprising that, although the first low-temperature measurements were made in 1917, the technique is still not regarded as standard in all laboratories. Some people, who have had their fingers frozen in the first attempt and have not tried again, may be encouraged to do so by studying this book.

There is a contrast between the, literally, hundreds of devices for cooling specimens for diffraction measurements and the rather small number of models of single-crystal goniometers, cameras and diffractometers or powder cameras and diffractometers now in use. If the solutions to a problem are many and various it does not mean that the problem is easily solved!

This book is comprehensive from 1945 and gives selected references to earlier work. There is an introductory chapter on the applications showing why, despite the difficulties, crystallographers wish to make low-temperature measurements. There is then a 74 page section on the gas-stream method and 54 pages on all the other methods, this division reflecting the relative preponderance of the former method. The ingenuity displayed is tremendous, from the complete enclosure of the X-ray output and detector at one extreme, to the use of minute cryogens at the other. While the book is about equipment for X-ray diffraction there has been considerable spin-off from neutron diffraction where the normal excellent engineering facilities found in atomic energy establishments and the greater size of neutron diffractometers have enabled a whole new range of devices to be made and later adapted for X-ray work. In general the smaller the equipment and cold chamber, the more economical it will be. There are numerous diagrams, some in Imperial and some in metric units and copious references to the original literature. There is a section on sample preparation and on how to collect the intensities and apply corrections, for example for absorption. In the 34 pages of the appendices details are given of methods of measuring temperatures, behaviour of cryogens, safety aspects and names of equipment manufacturers.

There is an alphabetical index at the back preceded by a most unusual and valuable bibliography. This has been generated on a computer and consists of a line-printer output in alphabetical order of the first-named author with a reference to the page or pages in the text. So far this is quite conventional, apart perhaps from the author's assurance that he has read all the original papers. In addition each reference has been given a number and one or two code numbers. The code number for apparatus consists of six digits each with a specific meaning; the first digit for example refers to the kind of sample, the second to the method of cooling, and so on. The other code number, 1–21, is for techniques and applications. There are keys to the bibliography on the six-digit code and by each of the six digits and on the other code. Thus it is possible rapidly to discover all the references to a particular technique for a particular kind of sample.

The author has succeeded in writing a definitive work on the state of the art of low-temperature X-ray diffraction at the present time. He has also ventured in a few pages to predict changes to be expected in the future. He confidently expects that the technique will become more or less universal in any well equipped X-ray laboratory, and in writing the book he has done his best to ensure that this prediction is fulfilled.

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