Foundations of a Field

Crystallography in North America. DAN MCLACHLAN, JR., and JENNY P. GLUSKER, Eds. American Crystallographic Association, New York, 1983 (distributor, Polycrystal Book Service, Western Springs, Illinois). xii, 480 pp., illus., + plates. $50.

This book clearly illustrates the tremendous contribution that x-ray crystallography has made and continues to make to a remarkably broad range of scientific endeavors. At the same time it provides insights into the process of scientific discovery and the impact of historical events on science and vice versa.

The book is divided into six sections, three of which (Accounts of Some Crystallographic Laboratories, In Memory of Some Past-Presidents [of the American Crystallographic Association], and Organizations of Crystallographers) will be of interest to historians of science as well as to crystallographers. The development of the field and the major contribution of U.S. investigators are clearly set forth.

The world wars disrupted the careers of some early leaders in this field and brought others into the front ranks of teams engaged in war-related research. Because of the restriction on the circulation of German journals in 1916, Albert Hull was unaware that independently of his own work Debye and Scherrer had also developed the powder diffraction method. William H. Zachariasen claimed it was "great fun . . . working New Year's Day and all holidays" identifying new plutonium complexes in order to understand the chemistry of the actinides. William Parrish describes the crash program to design high-precision equipment for cleavage of 60 million quartz elements per year for the radios being manufactured for use during World War II. Although Linus Pauling's political opinions earned him a Nobel Peace Prize, they prompted the U.S. government to withhold his passport for travel to England, preventing him from seeing the famous and crucial x-ray diffraction photographs of one form of DNA taken by Rosalind Franklin.

Many of these accounts are as entertaining as they are enlightening. Pauling describes how the earliest single-crystal studies provided the first evidence of the hydrogen bond and conclusive evidence of the staggered conformation of cyclohexane. G. A. Jeffery blends science, history, and humor in his description of 25 years of crystallography in Pittsburgh, with asides concerning the remedy for constipation recommended at an early American Crystallographic Association meeting in French Lick, Indiana, Kitaigorodski's prodigious command of languages and vodka, and the vagaries of government support. The excitement experienced by David Harker in initiating protein studies in the United States, and by Max von Laue in conceiving the theory of space lattice interference, is alive in their accounts written years later. The excitement and dynamics of national and international meetings are recounted again and again in these pages. A meeting of the American Society for X-ray and Electron Diffraction held at Lake George in 1947 appears to have been the incubation site for direct methods of structure determination. Martin Buerger's presentation of the implication diagram triggered a discussion about whether the diffracted intensities included information concerning the phases. David Harker assures this reviewer that he (and not Fankuchen) took the position that Buerger's work demonstrated that this must be the case. Harker went on to prove his assertion, and his work led in turn to the further development of the field by David Sayre, Herbert Hauptman, and Jerome Karle. Andrew Booth's account of the same meeting includes a description of his Atlantic crossing in the company of squalling infants, war brides, and an inebriated Anthony Eden. On his return trip customs officers discovered a corset in his luggage.

The next two sections of the book, Apparatus and Methods and Internal Properties of Matter, should be useful to an even wider audience. Many of the chapters are short courses on specific applications of diffraction technology in such subjects as material identification, defect analysis, and the influence of temperature and pressure variation on structural properties. These chapters could serve as supplements in physical chemistry courses and as sources of ideas for the application of new techniques to old and new problems. How techniques have evolved, what they have been used for, and where they can be further exploited are nicely outlined.

Chapters by Philip Coppens on electron density determination, Robert Reeber on phase transformation, John Cowley on high-energy electron diffraction, and Jack Williams on the uses of neutron diffraction to study hydrogen bonds are particularly well written.

The final section, Applications to Various Sciences, is made up of excellent short reviews illustrating the application of x-ray technology to specific topics, including examination of the elusive molecular structure of glasses, liquids, water, liquid crystals, clays, and magnetic materials. Although the book is generally well balanced, the crystallography of biologically active compounds, drugs, hormones, nucleic acids, peptides, and proteins is underrepresented. An additional 50 to 100 pages could justly have been added to cover the contribution of crystallography in this area.

Repetition, contentiousness, and self-aggrandizement have been kept to a minimum, and a remarkably high percentage of the authors have enjoyable writing styles. There are a couple of internal contradictions. I have it from a usually reliable, highly placed source that it was Robertson and not Patterson who wore the pajamas at the Penn State meeting. The answer to the question of who fathered the hydrogen bond seems to lie closer to Jerry Donahue's account than to Maurice Huggins's.

The editors have performed a great service to American crystallographers and the scientific community in general. The book embodies the sentiments expressed by two of the field's pioneers: "We must continue to make the effort to create in our own minds and if possible in the minds of our students a lively sense of the unity of our knowledge of solids" (Ralph W. G. Wyckoff). "May the American Crystallographic Association flourish as long as there are crystals to study and friendships to form between those trying to solve the same and kindred problems" (Paul P. Ewald).

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