

ously clear. A reader with little scientific or engineering background should have no difficulty in understanding the text, supported as it is with numerous well-chosen illustrations. Obviously the writers have had long experience in elucidating complex technical questions.

These very real virtues are, however, achieved at considerable cost. The clear, technically precise, and authoritative accounts produce an abstract, bloodless, and largely anonymous history; the scientists and engineers responsible for some very remarkable achievements are little more than names attached to ideas or artifacts. The general impression conveyed is one of inevitable technological progress with few evidences of misdirected efforts, scientific failures, or technical frustrations. Readers interested in the processes of scientific creativity or technological innovation will be disappointed in these pages.

This volume also demonstrates some paradoxical attitudes toward institutions. On the one hand readers interested in problems of research administration will find little of interest. There is a discussion of the various organizational changes that resulted in the creation of Bell Telephone Laboratories in 1925, and there is conventional praise of collaborative research. But we learn little or nothing about such critical matters as personnel recruitment, decision-making on research and development projects, and changing levels of support. On the other hand the volume demonstrates a degree of institutional myopia. To be sure, due credit is given to innovators outside the Bell System, but their role seems extraordinarily small. For example, the volume pays close attention to H. D. Arnold's crucial role in developing the modern vacuum tube, but there is little attention given to the work of others and no mention at all of the resulting tangled patent situation shortly after World War I that led to AT&T involvement in the formation of RCA.

The authors do develop one important institutional thesis. They characterize the close integration of operations, engineering, and manufacture as a "wise and productive move" (p. 1008). At a time when the federal government seeks to force AT&T to divest itself of Western Electric this is a most important point. The argument is often persuasive, but it would have been more persuasive coming from independent scholars writing with free access to Bell materials. The matter of materials presents one final disappointment. The bibliography and scattered footnotes refer almost exclusively to published materials. There are some

references to internal documents, but we are left with no clear indication of the richness (or poverty) of Bell archives for students of the history of American technology and industrial research.

This is obviously an important work. No one interested in the development of communications technology can afford to overlook it. It has provided clear and authoritative answers to some important questions. But the authors' range of interest was narrow. The Bell System could make a further contribution to the history of American technology if it would permit qualified scholars to use its archives to seek answers to some of the questions the authors of this volume chose not to ask.

KENDALL BIRR

*History Department,
State University of New York, Albany*

Biochemical Method

Protein Crystallography. T. L. BLUNDELL and L. N. JOHNSON. Academic Press, New York, 1976. xvi, 568 pp., illus. \$43. Molecular Biology.

Protein Crystallography will be welcomed by crystallographers, but, more important, I believe it will be readily comprehensible to protein chemists and enzymologists, with whom protein crystallographers enjoy important and fruitful collaborations.

The book is unique in that it gathers together in a highly readable form most of the important methodologies of protein crystallography, especially those which distinguish it from its older sibling, small molecule crystallography. Other crystallography textbooks have presented in considerable detail the material on symmetry, space groups, and principles of x-ray diffraction that is covered in two chapters of this book. Such textbooks have tended to gloss over the special features of proteins that lead to unique experimental problems—for example, the crystallization of proteins, the collection and processing of multiple large data sets, and the preparation of heavy atom derivatives. Knowledge of these and other specialized techniques had to be gleaned from journal articles, reviews, and attendance at the numerous protein workshops and by apprenticing oneself to a proven leader in the field. Now, for the first time, we have a comprehensive protein crystallography textbook, complete with a few hundred references, practical hints (such as where to buy crystal mounting tools), warnings

(don't ingest heavy atoms), illustrations (some of which reflect the authors' own research experiences), and an adequate theoretical background. The book can be used by a beginning student to learn the field and by an experienced protein crystallographer as a handy reference guide.

What about the noncrystallographer? A few chapters of the book can be read by those interested in a better perspective of the study of protein structure. The principles of protein structure are discussed, and summaries of the techniques used in x-ray and neutron diffraction and in electron microscopy are given. There are referenced tables of the enzymes studied by x-ray diffraction and a discussion of some of the results. In addition, the chapter on crystallization and the chapter on heavy atom preparation, with its extensive tables of binding sites, should provide invaluable information for protein chemists and enzymologists. Finally, it is a credit to the authors that the chapters on crystallographic techniques are written in such a way that someone outside the field could, if he or she so desired, learn more about the tool that has become so crucial to our understanding of molecular structure and function.

HELEN M. BERMAN

*Institute for Cancer Research,
Philadelphia, Pennsylvania*

Hard-Working Intact Muscles

Biomechanics and Energetics of Muscular Exercise. RODOLFO MARGARIA. Clarendon (Oxford University Press), New York, 1976. x, 146 pp., illus. \$15.75.

Despite its misleadingly comprehensive title, but as is made clear in the preface, the contents and style of this small book are very personal and relate mainly to the researches that Margaria (and his colleagues) have carried out in the last ten years in the Institute of Human Physiology of the Medical School of the University of Milan. Thus, although the book is intended to cover the fundamentals of the physiology of exercise, it has many large gaps. There is no mention, for example, of myosin and actin, of enzymes, of controls at the cellular level, of adenosine monophosphate (AMP) or cyclic AMP, of the significance of changes in the respiratory quotient for the energy available from a given amount of oxygen, or even of fat metabolism, without doubt by far the largest source of energy for low-level muscular exercise.

These gaps make it impossible to rec-