cal rearrangement. There are not enough simple examples to provide orientation and the complex problems discussed involve so many superimposed effects that it is hard to disentangle them. Perhaps the authors are here too close to their subject; several sections refer to the work of the first author who has made important contributions. The "real gas" of the title is one undergoing many complex processes, and the authors pull no punches in discussing it.

In view of the vast amount of theoretical physics, chemistry, and engineering which the authors have been required to master in the preparation of this book, it is not surprising to find some errors and misstatements. Examples of these are: an incorrect definition of the associated Legendre function (p. 13), incorrect statements about the term symbol (p. 29) and the parity (p. 35) of a many-electron atom, an incorrect definition of quantum statistics (p. 59), confusion between inverse and reverse encounters (p. 137), and confusion between the distance of closest approach and the impact parameter of a collision (p. 280). I noted very few misprints in the many equations, and the typography and printing are excellent. This book will have a significant influence on the curriculum of graduate engineering departments, and it will be widely read by physicists, chemists, and engineers in industrial and government laboratories.

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The Pawnee Culture

The Lost Universe. Gene Weltfish. Basic Books, New York, 1965. xxii + 506 pp. $12.50.

In 1875 the last Pawnee Indians left their aboriginal homeland in Nebraska and joined their previously migrated relatives in Oklahoma. The 1910 census listed 633 persons left of a tribe that had numbered close to 12,000 during the 1830's (p. 4). A viable, integrated culture had ceased to exist—a universe was lost.

Gene Weltfish has sought to rediscover this universe. Beginning in 1928, she has studied the language and used it to gather myths, tales, and the life experiences of informants who had known the old culture and the people who had maintained it. This material has been cross-checked by field observations and expanded with information from archeology, history, and ethnography into this quite detailed portrayal of Pawnee life during the course of a hypothetical year, 1867. Details of hunting, planting, ceremony, and ritual, as well as of tools, techniques, ideas, and behavior, form the warp on which she weaves the ordinary events of life to produce the fabric of Pawnee culture.

Weltfish intends this to be more than another good ethnography. She has studied Pawnee culture carefully and finds within it lessons for today. The Pawnee maintained an ordered society without any individual exercising power over another. No one gave orders. Theirs was a democracy without coercion, of consensus rather than majority rule. The Pawnee case, then, can be a possible source of solutions to modern problems.

> The Pawnee way is one of thousands of ways of life that mankind has developed. . . . A study of its ways and social interactions help us to throw into sharp relief our most widely accepted hypotheses on the nature of "the basic human character" and to test whether some of these assumptions are in reality universal human nature or rather limited modes of learned behavior that we have developed for needs that are now becoming obsolete (p. 12).

This thesis is examined in the introductory remarks and in a final chapter. The author briefly and thoughtfully explores the implications of her Pawnee study as these relate to family, home, and work in the face of the population explosion and increasing automation. The need, as she sees it, is for a reassessment of our evaluation of work, for a shift from a mercantilist to a humanist society, and for a modification of settlement patterns that will allow for better human relations. She offers a thought-provoking plan for "family oriented housing" that would provide urban apartment dwellers a physical milieu within which meaningful social interaction could develop. Whether or not these ideas provide the answers, the Pawnee culture, as presented in this volume, bears examination as we attempt to order our own way of life.

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European Biochemical Societies

Structure and Activity of Enzymes. A symposium (London), March 1964. T. W. Goodwin, J. I. Harris, and B. S. Hartley, Eds. Academic Press, New York, 1964. viii + 190 pp. Illus. $6.

In March 1964 the first meeting of the Federation of European Biochemical Societies was held in London. The 23 papers presented on what must have been a busy day in the middle of this meeting are collected in this small volume. The editors and publishers have done a good job of preparing a well-organized and carefully printed book in a reasonable period of time after the meeting, compared to many symposium reports; but one still wonders why, with the help of modern technology, such a volume cannot be published within two or three months after a meeting.

The organizers wisely limited the topics to a detailed consideration of three proteins—ribonuclease, chymotrypsin, and hemoglobin—and a discussion of active sites. The inclusion of hemoglobin in a symposium on enzymes was based on the useful principle that if not much is known about a subject, such as enzymes, it is desirable to consider something else about which more is known. This was a particularly good decision in this case, because the structure, dissociation into subunits, cooperative effects in the oxygen dissociation curve, and changes in structure and acid dissociation constants upon reaction with "substrate" (oxygen) of hemoglobin are all topics of great current interest in enzymology.

The most interesting and useful papers are those that summarize and interpret the important available data on a particular enzyme or protein. The first paper, a summary (by Richards) of present knowledge about ribonuclease, is an excellent example. Mathias, Deavin, and Rabin present kinetic data on this enzyme, which was obtained in their laboratory and is largely already published. Brief reports of amino acid sequence work on chymotrypsinogen and chymotrypsin are presented by Keil and Šorm, and by Hartley. Oosterbaan and Cohen give a short but useful summary of the considerable amount of information that is now available on the amino acid sequences near the active sites of the "serine" and "sulfhydryl"

esterases, and Harris gives a similar summary for a number of dehydrogenases that have sulfhydryl groups at the active site. It has recently been shown that a number of enzymes react with their substrates or coenzymes to form imines, which can be reduced with borohydride to stable derivatives of lysine; these are ably discussed by Fischer. Malmström and his co-workers give a short summary of the properties, including the recently discovered esterase activity, of carbonic anhydrase and describe some promising, but not yet very informative, x-ray work on a number of derivatives of this enzyme. Antonini gives a brief but lucid exposition of the important work of the Rome group on the Bohr effect of hemoglobin. In the remaining three papers, Guidotti, Huehns and Shooter, and Briehl describe the dissociation of hemoglobin into subunits and its relationship to the oxygen dissociation curve of hemoglobin.

The short communications, and the longer ones, which present experimental data from a particular laboratory in detail are often interesting, but the desirability of including such material in a volume of this kind is questionable. Most of this material has already been published, or will be published, in journals. Any new material not published in normal channels is likely to be missed by those who may follow the journals conscientiously, but do not happen to read this volume. Furthermore, such material is not subjected to the same standards of criticism by referees as that published in journals. A considerable fraction of the book is devoted to descriptions of x-ray analyses of enzymes at resolutions that are not sufficient to provide much significant information, and these reports are already somewhat dated after the detailed report on the x-ray structural analysis of lysozyme that Phillips presented to the Federation of American Societies of Experimental Biology this spring.

The book is useful in that it brings together a considerable amount of material on the limited number of topics covered and provides a representative cross section of our present state of knowledge in enzymology and certain aspects of protein structure. It is relatively free of the more speculative electron-pushing often found in volumes of this kind, and perhaps it is this that emphasizes to the reader how little we really understand about the way enzymes catalyze chemical reactions.

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Physics: On the Scope of Cosmic Ray Physics

Cosmic Ray Physics. A. E. Sandström. North-Holland, Amsterdam; Interscience (Wiley), New York, 1965. x + 421 pp. Illus. $15.

So wide a range of topics is now included under the heading "cosmic ray" that it is becoming increasingly more difficult for any single author to effect a uniform coverage within a single volume of reasonable proportions. It is also increasingly more difficult to review such a book, and I have therefore felt it necessary to draw on expert advice in some areas for which I would not claim firsthand experience and familiarity with the most recent literature. That Sandström has not achieved his objective of presenting a "survey of cosmic ray physics . . . that will serve as an introduction . . . also as a source of information" is therefore not surprising; what is disappointing is the extent of his failure.

The range of topics covered in this book and the amounts of space devoted to them do not reflect, I think, their relative importance in modern cosmic ray physics; specifically, to give only six pages to the primary charge spectrum, not even three to the primary energy spectrum, and no serious discussion at all to the relation between cosmic rays and radio astronomy, is to misjudge seriously their importance today.

If my comments were to be restricted to matters of balance, this review would constitute perhaps the weighing of one subjective set of values against another. Unfortunately, far more serious objections must be raised. In many areas, the text is worthless as a modern reference document. Major original contributions and review articles simply are not mentioned; among those omitted are the McDonald and Webber papers on primary protons and α-particles and their modulation through the solar cycle; papers by Earl and by Meyer reporting the discovery of primary electrons; review articles by Morrison [in the *Handbuch der Physik* (Springer, Berlin, 1961), vol. 46, No. 1, p. 1] and by Waddington (1960); and the major publication by the group at the Naval Research Laboratory, dealing with the primary charge spectrum (1961). There are other omissions. There is no mention of primary electrons, x-rays, or γ-rays. McIlwain's L-parameter gets no mention in the chapter on geomagnetic effects and barely a definition in the out-dated chapter on trapped radiations; none of the modern data from Massachusetts Institute of Technology gets into chapter 9, on air showers; there is inadequate discussion of the Minnesota and NASA work on the energy spectra of solar flare particles, except "very little is known concerning the rigidity spectrum" (p. 285) and a bare reference to the NASA solar proton manual; there is no mention of the NASA work on heavy nuclei observed during flares. In general, references for 1962 and 1963 are conspicuous by their paucity.

Those areas with which the author has greatest personal acquaintance, such as counter optics and time variations, are the most competently presented, but even in these the treatment is often incomplete. There is also some confusion in places, such as Table 2.1, which lists fluxes of L-nuclei but fails to state that some of these were obtained at northern latitudes, others much further south; there is considerable confusion in pages 23 through 29 where various meson effects are discussed, and especially on page 29 where the treatment of relativistic time dilation is at least original, if wrong.

These shortcomings are not trivial. They have come to light after detailed review by active research workers. What, in contrast, would happen to some other reader who, knowing nothing of cosmic rays, consults this book? Depending on the section he reads, he might well come away with an incomplete or out-of-date view, or he might be quite misinformed. I fail to see why this should be the case, and still less why competent reviewing and editing should not have had a more noticeable effect. How can this book be recommended?

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