Adventure in Mexico

Palenque. The Walker-Caddy Expedition to the Ancient Maya City, 1839–1840. DAVID M. PENDERGAST, Ed. University of Oklahoma Press, Norman, 1967. xvi + 213 pp., illus. $6.95.

Although students of Mayan civilization have all been aware of the existence of writings by Walker and Caddy, and of Caddy's pictures, very few of us have had the opportunity of acquainting ourselves with them. The publication of this account of the Walker-Caddy expedition is therefore most welcome. Pendergast has not limited himself to reproducing Walker's report and Caddy's diary and illustrations, but has diligently brought together all the information available about the expedition and its participants.

He begins with a brief review of the discovery of Palenque in the latter part of the 18th century and of the reports of early-19th-century visitors to the site. Then he presents a detailed study of the contrasting personalities of the two men who carried out the first official exploration—Walker the precise public functionary, and Caddy the romantic and artist, impatient of the demands of his role as a government representative.

The story of the expedition itself takes us back to an era when the tropical jungle was the symbol of adventure and when to discover remains of ancient civilizations was the great incentive of those who felt impelled to leave the comforts of city life for the excitement of inhospitable territory, in countries full of perils and surprises. Some years before the Walker-Caddy expedition, Dupaix and Waldeck had penetrated into the forests of Chiapas, and now John Lloyd Stephens from the United States, with his artist Frederick Catherwood, was preparing to rediscover pre-Columbian America in the forests and plains of Guatemala, Honduras, and Yucatan. Stephens and Catherwood were to reach Palenque only a few months after Caddy and Walker, and in the contemporary periodicals the two expeditions were regarded as a sporting competition not only between individuals but between England and its former colony.

What is most interesting in this book is not the description of Palenque—where Walker and Caddy spent only two weeks—but Caddy's diary notes about the journey from Belize to Palenque. Only ten pages or so are devoted to the buildings and bas-reliefs of Palenque, whereas 90 take the reader across the virgin forests and copious rivers, which the diarist describes with a fine faculty for observation and enjoyment. The account is absorbing; the reader follows every turn of events and every detail of the survey, recognizing the flora and fauna, being present at the encounters with the scattered inhabitants—English colonists, Negro and Indian peons—and joining in the hunting parties (the part of the tropical adventure most enjoyed by the English travelers).

Amidst his own observations Caddy intersperses historical notes, such as a summary of Juarros's history of the Itzaes, or brief references to the ideas then current concerning the Palencaños and their connections with the ancient Mediterranean world. Caddy's drawings of the Palenque reliefs do not approach Catherwood's in quality or fidelity, but his paintings—I suppose in watercolor—of the monuments and their partial covering of lush vegetation give a very good idea of how the Mayan ceremonial center would have looked more than a century ago.

Pendergast has earned our gratitude by his compilation of information about the expedition and the lives of the participants and by making their interesting story known. Thanks to him, a gap in Mayan historiography is now filled. The only criticism I would make—and it is a minor one—is that he has not included a glossary correcting, and where necessary explaining, the many errors Caddy made in Spanish and Mayan names.

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Newton on Calculus, Algebra, and Geometry

The Mathematical Papers of Isaac Newton. Vol. 2, 1667–1670. D. T. WHITESIDE, Ed. Cambridge University Press, New York, 1968. xxiv + 520 pp. $35.

Published works of Newton have been thoroughly familiar to scholars for very nearly two centuries, but much of the evidence concerning his early intellectual efforts has remained buried in a mass of archival material the extent of which has tended to dissuade potential researchers. Only quite recently have historians seriously taken up the challenge posed by the Newton archives, and among these the most faithful has been D. T. Whiteside, editor of *The Mathematical Papers of Isaac Newton,* planned as an eight-volume project. Volume 1, judiciously reviewed in detail in *Science* only a few months ago (13 Oct. 1967, p. 245), covered the formative years leading up to the tract on fluxions in 1666. The second volume, here reviewed more briefly, is just as deserving of high praise for the editing as was the first, but it affords less sense of excitement. In part this is inevitable in the second volume of a great enterprise, in part it results from the absence of a great discovery comparable to those of 1665–1666, the *annus mirabilis.* As Whiteside writes, "[Newton's] calculus investigations during the years immediately following are relatively spasmodic and jejune" (p. 163). True, in 1669 the important *De analysi per aequationes infinitas* (here appearing in the full Latin autograph with facing English translation) was composed; but this account of earlier discoveries has been well known, having appeared in print, in a somewhat revised form, in 1711. It is therefore the papers in algebra and geometry, making up the bulk of this second volume, which hold our interest.

The significance of this volume is immediately apparent in that, with the exception of *De analysi,* all of the Newton papers here reproduced make effectively their first appearance in print. "The dearth of accurate documentary information relating to this period of his development, surely the least known of all the Newtonian dark ages, has not made the task of editing easy" (p. ix). Whiteside nevertheless has set in admirable historical and mathematical perspective the pieces presented—the classification of cubics, the organic constructions of curves, Newton's notes on Kinckhuysen's *Algebra,* and the geometrical construction of equations, together with such related works as Leibniz's review of *De analysi* and Mercator's Latin translation from the Dutch of the Kinckhuysen *Algebra.* The work on cubics, concealed from the world for almost 30 years, confirms the impression gained from volume 1 that the young Newton felt a strong attraction to questions of order and structure. Having discovered a single organic construction covering all types of conic sections, he sought for cubics a classification analogous to the 2000-year-old

tripartite division of conics. While his contemporaries were fumbling with negative coordinates, Newton with consummate analytical skill graphed scores of beautiful new curves of third degree, later grouped into 72 species, in a systematic search for general curve properties.

This volume resembles its predecessor not only in the wealth of previously unpublished material, but also in the impeccable translations, the numerous illuminating notes, and the ample and perspicuous editorial introductions to the sections. The long-standing indebtedness of mathematicians to Newton is now complemented by the debt of gratitude which historians of mathematics owe to Whiteside.

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Physics: Six Reviews

High Energy Physics. Vol. 2. E. H. S. BURHOP, Ed. Academic Press, New York, 1967. xii + 483 pp., illus. $24.

This book, with contributions by nine authors grouped under six subject headings, is the second volume of a projected three-volume treatise edited by Burhop. The first volume was reviewed in *Science* last fall (13 Oct. 1967, p. 251). The reviewer commented unfavorably there on the basic concept of such treatises, the long delay in publication, the random selection of material in any one volume, and the exorbitant cost. I can only echo most of his sentiments. The authors of articles reviewing a specialized area in physics should think seriously about publication in the review journals, with their considerably speedier publication schedule, rather than in collaborative commercial volumes that are out of date before they appear. Some of the articles in the book under review warranted better treatment than they have received. Oh, the quality of the paper and the typesetting are excellent, but the articles were read and used by some of us one-and-a-half or two years ago when they appeared in preprint form, multilithed on poor-quality stock, but readable nonetheless.

The book begins with a 70-page article by R. Gatto on the present status of quantum electrodynamics. The discussion is comprehensive and authoritative, covering the low-energy, extremely precise experiments, as well as the information from high-energy experiments with electrons and positrons. The recent, but not the very recent, developments are included. For example, the revised value of the fine-structure constant occasioned by the important measurement of $2e/h$ using the Josephson effect, published almost a year ago, is not mentioned. This is no criticism of Gatto. However, it does illustrate the rapidity of developments and the desirability of timely reviews.

The next two articles treat the strong interactions of fundamental particles at high energies. L. Bertocchi and E. Ferrari in their 146-page survey attempt to cover the whole subject, reviewing the basic experimental facts, the elements of relevant theory, elastic and inelastic processes, and also the area of ultra-high energies. The other article, by A. C. Hearn and S. D. Drell, focuses on peripheral processes. Their 45 pages overlap parts of the Bertocchi-Ferrari article, but go into considerably more detail. The time lag to publication has, unfortunately, taken the edge off both these articles. When the first version of the Hearn-Drell article was written more than two years ago, it provided a review of a subject that had just undergone interesting and extensive development in both experiment and theory. But by now other reviews have appeared in the journals and in conference and summer-school proceedings. Bertocchi and Ferrari have included fairly extensive experimental information on all aspects of high-energy collisions, rather than merely selected illustrative examples. While the material is somewhat dated, it provides a useful starting point for an outsider or graduate student who wishes to apprise himself of the salient facts. The summary of theory is likewise a useful compendium of theorems and results.

The last 200 pages of the book contain articles on interactions at very high energies by J. M. Kidd (37 pp.), neutrino physics by L. Lederman (61 pp.), and hypernuclei by D. H. Davis and J. Sacton (90 pp.). Kidd's article gives a concise survey of the experimental information obtained from cosmic-ray interactions in photographic emulsions, including multiplicities, and energy and angular spectra of particles and photons. The interpretation is made chiefly in terms of the "two-fireball" model with properties of the excited baryons extrapolated from accelerator energies. One gets the impression that progress is slow and interpretation ambiguous. Nevertheless, until storage rings for protons are operative, ultra-high energies are available only with the cosmic radiation.

Neutrino physics, as a subject of its own, is less than ten years old. In fact, ten years ago, present-day neutrino physics would have been viewed as a pot-smoker's fantasy. Lederman gives a detailed review of the experiments done at Brookhaven and at CERN, as well as the cosmic-ray experiments in progress. Experimental details on the neutrino energy spectrum, the makeup of the detectors, and their positioning are covered along with the essentials of the theory. The facts, from the discovery of two kinds of neutrinos through to the momentum-transfer dependence of the form factors, are presented in a masterly fashion, as is an optimistic outlook for future neutrino experiments.

Hypernuclear physics is in a strange position. It is neither fish nor fowl. High-energy physicists do not look to it for valuable advances in their understanding of the interactions of fundamental particles. Nuclear physicists also see the field as something apart. Its main relevance for the fundamentals is the information it can provide on N–Λ and Λ–Λ interactions. For anyone wishing to learn of the latest work in this very specialized area, Davis and Sacton present a comprehensive survey of hypernuclei, discussing the experimental data on production, binding energies, and decay modes. They then interpret these facts within the framework of the model pioneered by Dalitz and Downs.

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Biological Control

Regulation and Control in Living Systems. H. KALMUS, Ed. Wiley, New York, 1967. viii + 468 pp., illus. $13.75.

Biologists have long recognized the central importance of regulation and feedback in living systems. Indeed, much of the research of the past half century has been aimed at describing and elucidating such mechanisms, and the results of such work are being rapidly incorporated into the corpus of biological science.

In addition to this essentially descriptive or "classical" approach to biologi-