can Church we hear a new story about what happened to a man who said that talk about witches, curses, and peyote is old superstition, that what matters nowadays is how to fix a television set.

The compilers achieve their goal of aiding the general reader in understanding Indian religion and mythologies and the philosophies embodied in the narratives. The book is a tour de force, and one can understand why they have been appointed "artists in residence" at a college.

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The Study of Plants

Textbook of Theoretical Botany. Vol. 3. R. C. MCLEAN and W. R. IVIMEY-COOK. With a section on genetics by Kenneth Lewis. Wiley, New York, 1967. x + 1108 pp., illus. $19.25.

This is the third volume of an advanced text intended to cover "the study of the plant from every point of view" (volumes 1 and 2 were published in 1951 and 1956). Perhaps botany students in Britain will buy a 3000-page text, but whether their counterparts in America will do so is open to doubt, particularly in these days of paperbacks and Annual Reviews. Furthermore, although this third volume is certainly written in good style, it is neither up to date nor documented.

There are three sections: Paleobotany (400 pp.), Genetics (200 pp.), and Physiology (480 pp.). Let it be said at once that there is nothing particularly "theoretical" about the book. It is as full of description and experiments as any other biological textbook; evidently the term "theoretical" is being used in the opposite sense to "applied." The section on paleobotany is indeed fully descriptive, and very well illustrated with both photographs and diagrams. Some of these are original, and it is obvious that the authors have personal knowledge of their subject. However, although the text is very readable, no concession is made to beginners, a rather intimate knowledge of plant anatomy being assummed. The Cordaitales, for instance, are described as "plants the stems of which had a distinctively coniferous type of anatomy, with little or no centripetal xylem and a broad zone of close-grained, secondary centrifugal wood with multiseriate tracheidal pitting like that of the living *Araucaria*." How many readers of this journal, I wonder, will form an immediate visual picture from this description? How many, indeed, have ever looked at sections of *Araucaria*, living or dead? Perhaps, in any case, it is time that paleobotanists gave up their traditional preoccupation with anatomy and devoted more attention to what we can deduce as to the conditions of life of ancient plants. The authors discuss world climates occasionally, especially in Pliocene and Quarternary times, but one misses any attempt to correlate form with environment. Stomata, for instance, which would be interesting in this connection, are mentioned (and figured) but once, although leaves and fronds constitute the bulk of the remains described. The exclusion of fossil algae, though no doubt necessary for the great sweep of coverage in time, space, and forms of the land plants, does make it harder to obtain an overall view of the process of plant evolution.

The section Genetics, contributed by K. R. Lewis of Oxford, is a rather complete account of the genetics and chromosomes of higher plants. Emphasis is on the "classical." A bow is made to modern biochemical genetics with a ten-page section on gene action, treating nutritional mutants in *Neurospora* and hemoglobin mutants in man, and with a comparable section on nucleic acids, giving the structure and mode of replication of DNA. But to say that "Indeed, considerable progress has been made towards determining which triplets code which amino acids" is to give a rather lackadaisical picture of the breakneck rate of discovery in this field. Cytoplasmic inheritance is treated briefly, but, as might be expected, since much of the material appears to have been written a good many years ago, the presence and role of DNA in plastids and mitochondria are not mentioned.

Unfortunately, the authors did not follow the lead of the second section and invite a plant physiologist to write the physiology; they chose to do it themselves. The result can be imagined; the "renaissance man" has no easier a time in botany than in any other science. McLean says in the preface, "Some may consider it rash for one who is not a professed physiologist to attempt to write on plant physiology." He is right. For one thing, approximately ten years seem to have elapsed between the writing of most of the text and publication. This means, for example, the exclusion of ferredoxin and the second photochemical reaction from the treatment of photosynthesis, and the ascription of ATP production in photosynthesis to oxidative phosphorylation in one paragraph and to true photophosphorylation in another. It limits the treatment of cytokinins to a paragraph, excludes all the work with C^{14}-labeling of auxins, and of course excludes too the now actively investigated question of the role of RNA in hormone action. Among other things, we learn, oddly, that the red-far-red reversibility of phytochrome "is only shown in presence of auxin"; that alcoholic fermentation differs from simple hydrolysis "only in degree, not in kind"; that the yellow *and red* colors of autumn leaves are due to lutein and carotene; and that among growth stimulants "pentaoxyanthraquinone is seven times more active than auxin." In addition to such quirks, important fields like the physiology of leaf abscission, fruit ripening, and the rooting of cuttings are totally omitted, yet space is found for a detailed treatment of Moewus' sex-substances in *Chlamydomonas*, now discredited. Unfortunately for the student, the statements made cannot be queried or verified, for although the genetics section does at least mention a dozen books, the physiology section includes not a single reference to a book or journal.

Perhaps the volume is worth while for its treatment of paleobotany.

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Problems in Atomic Physics

The Physics of Electronic and Atomic Collisions. Invited papers from the Fifth International Conference, Leningrad, July 1967. LEWIS M. BRANSCOMB, Ed. Published for the Conference General Committee by the Joint Institute for Laboratory Astrophysics, Boulder, Colo., 1968. xvi + 200 pp., illus. Paper, $7.

The original development of quantum mechanics was stimulated by unsolved problems in the field of atomic physics. When the principles of quantum theory were found to be applicable to nuclear phenomena, research in physics tended to become concentrated at the forefront of knowledge, which at that time was nuclear physics. Left behind in atomic physics were a host of difficult and challenging problems which could be characterized as many-body problems of inhomogeneous systems with a Coulomb interaction among the compo-

nents. The most difficult of these were ones involving the continuous spectrum of these systems, namely collision problems.

For several decades research in this area languished. The challenge of nuclear phenomena was the vogue, and relatively few research centers in the world devoted their energies to atomic physics. But because the problems of atomic physics were so interesting, and because of their technical importance for other areas of science and engineering, the field could not be denied indefinitely. In the 1950's a marked renaissance of interest in atomic physics in general, and especially in collision problems, took place.

An international conference in this field begun in 1959 has been meeting since then, with ever-increasing attendance. The volume under review is a compilation (in English) of the 15 invited papers from the fifth of these conferences. [The much larger volume of abstracts of contributed papers, edited by I. P. Flaks, has been published separately (available from the Four Continent Book Corporation, New York, $16).]

The collection of papers illustrates very well the two factors which stimulated the rebirth of atomic physics research. Five of the papers indicate the connection of atomic physics to aeronomy, astrophysics, plasma physics, and lasers. These not only describe how research on basic collision processes has extended knowledge in these fields but also discuss which reactions must be understood if this knowledge is to be carried still further. A physicist casting about for something to do can find material for a lifetime of activity in answering some of the questions raised in these papers.

Nine of the papers are on theoretical developments. These illustrate very well by their sophistication and depth the intellectual challenge of collision processes in atomic physics. Two of the most important developments, the obtaining of bounds on cross-sections and the close coupling approximation, were developed, surprisingly, in the context of atomic rather than of nuclear physics. Three of the nine papers are discussions of the contributed theoretical papers given at the conference. Although they make reference to these papers, they really constitute a statesmanlike overview of the state of theory in the field of atomic collisions at this time.

A surprise and a disappointment is the lack of adequate coverage of the experimental aspects of this field. Since the management of the conference was in the hands of the experimentalists and since experimentalists were adequately represented on the planning committee, the omission seems to be a surprising display of delicacy and self-effacement. This is but one of a series of meetings; it represents probably a statistical fluctuation of emphasis of no basic significance. Unfortunately, the one invited experimental paper is not up to the standards of the others in this volume and gives no indication of the scope and importance of experiment in collisional atomic physics.

The style of all of the papers is too broad for them to be of use in immediately transmitting useful information to the research specialist. However, to the student about to embark on research in this area, or to the practicing physicist who wishes to become more catholic in his outlook, the (often extensive) bibliographies make the possession of this volume more valuable than attending the conference.

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Elusive Specimens

In the Wake of the Sea-Serpents. BERNARD HEUVELMANS. Translated from the French by Richard Garnett. With drawings by Alika Watteau. Hill and Wang, New York, 1968. 648 pp., illus. $10.

Only staidly reductionist biologists are willing to categorically deny the existence or possibility of sea serpents, and they will receive little support from *In the Wake of the Sea-Serpents* by Bernard Heuvelmans. This exhaustive and possibly exhausting (if the reader approaches it with a closed mind) work is an examination of the question: "Are there or are there not in the sea one or more species of giant animals, elongated in shape and still unknown to science?" Who, in the face of all the evidence submitted (and summarized in a ten-page list of sightings from circa 1639 to 1966), would dare answer negatively such a question? Heuvelmans is not a retired sea captain compiling random notes of interest or writing hopefully under the influence of the spirits while meditatively puffing an Oom Paul pipe but a professional biologist who has, among other things, made a study of the dugong's teeth. True, he has also "at times made his living as a professional jazz singer," and this will doubtless be counted against him by those who must grab at all possible straws to deny the existence of still unknown monsters. Nevertheless the overwhelming evidence accumulated by Heuvelmans indicates that there is not just one elusive sea serpent, but several kinds of large creatures in the ocean still to be brought to the dissecting table. In fact, there appear to be at least nine kinds of such beasts.

Of these various kinds, the superotter, the merhorse, and the giant yellow-bellied tadpole seem most logical, and it may still turn out that the superotter and the long-necked sea serpent are simply the two sexes of the same animal (the author states that the long-necked and merhorse types cannot be considered sexual dimorphics of the same animal—his punch cards do not fall out that way). Such matters as sex and breeding receive little notice in this compendium of information, incidentally. One of the startling results of this thorough survey of the literature of sightings of large, unidentifiable monsters is the geographic distribution that comes to light. These beasts have not been sighted along any of the Pacific coast of South America or in the vast expanse of the southeast Pacific Ocean, nor are there recorded sightings anywhere in the North Pacific any distance from shore (the merhorse or cadborosaurus has often been sighted in British Columbia waters and near southern California and may be indigenous to the northeast Pacific). This raises the possibility that sea serpents are actually neritic creatures, not wide-ranging, deep-sounding animals, in which case they would certainly have been known to Captain Ahab and his pelagic ilk. Another possibility to be considered is that of mutual exclusion of large cetaceans and sea serpents, which suggests, in line with Gause's hypothesis, that some of these unknown animals may depend on the same food supply as the sperm whale. If that is the case, reduction of the sperm whale stock should be accompanied by an increase in sightings of these large and obviously alert creatures.

This scholarly work has been translated from the French by Richard Garnett, but the English version is not exactly the same book. The first volume of the French version was devoted to the kraken and the giant squid; this has been condensed to a single chapter, and additional sightings of sea serpents have been added. While it may be true,