

flashes repeatedly with telling observations upon the life of physics at the turn of the century. European professors, who earned enough to be members of the haute bourgeoisie, were shocked to discover that the wives of American colleagues often had to do their own housecleaning. On the other hand, in the United States everyone became an assistant professor, or so Sommerfeld once told a student, while in Germany, according to a sample analyzed by Forman, Heilbron, and Weart, a privatdozent had only about a 3 in 5 chance of obtaining a chair even after years of sacrifice. On the scientific side, perhaps the most expensive item in the well-stocked laboratory of the day was its 60 to 70 milligrams of radium, which at 250 to 300 marks a milligram was expensive indeed. Bespeaking the changing subject matter of physics, the new laboratory of 1900 was built without the traditional tower, previously deemed indispensable for experiments in free fall or pendulums. All the same, physicists of the day did pay enormous—later generations would say ridiculous—attention to insulating their new houses of research from vibration, including the vibration of nearby traction lines.

The rich statistical data here assembled constitute a benchmark for the history of physics in each of the nations surveyed, but the multinational scope makes this study especially arresting. In Germany, the United Kingdom, France, and the United States, the numbers of academic physicists per million of population or per milliard of national income were the same. And some American laboratories, notably the Jefferson Physical Laboratory at Harvard, enjoyed annual budgets comparable to that of the Cavendish. Yet America produced proportionately fewer papers than the leading European nations. Forman, Heilbron, and Weart candidly declare that they can say nothing on the basis of their study about "the relative contribution of each paper to the progress of physics, or about the existence and significance of national gifts and styles." Without the assessments made in this volume, however, the task of explaining the relatively low rank of the United States in world physics at the turn of the century would be all the more difficult. *Physics circa 1900* is not only a stimulating portrait of the discipline. It establishes a solid evidential foundation from which historians and sociologists may proceed to understand the perpetuation and diffusion of national styles, along with the social circumstances which make for intellectual vitality in physics.

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The X-ray Revival

Atomic Inner-Shell Processes. BERND CRASEMANN, Ed. Academic Press, New York, 1975. Two volumes. Vol. 1, Ionization and Transition Probabilities. xii, 468 pp., illus. \$47.50. Vol. 2, Experimental Approaches and Applications. x, 220 pp., illus. \$27.50.

Many problems of single and multiple inner-shell physics were left rather dangling when x-ray studies were largely abandoned in the years of World War II. New applications in condensed-matter physics, ion-atom collisions, astrophysics, and plasmas have now reexposed some of the unsolved problems and offered new tools for their treatment and new phenomenology tending to sharpen one's perceptions concerning them. In these two volumes Crasemann and the numerous contributing authors have aimed to expound key areas of the recent x-ray revival.

In the first volume, technical details of the experiments have been suppressed with good effect in permitting the data to be more quickly grasped. This is particularly evident in the chapter on ion-atom collisions (Richard). Several of the contributors to the volume are well known for work in calculation and modeling of inner-shell processes, and they provide treatments at a satisfying depth. The occasion of preparing chapters for this work has, moreover, led the theoreticians to an uncommon clarity of exposition. Thus, though most of the information in the chapters on charged-particle excitation (Madison and Merzbacher), photoionization (Cooper), and transition probabilities (Kelly) and energies (Larkins) is available in the literature, it is made considerably more accessible.

That some of the "hard" problems are now being grappled with to good effect is evident from Larkins's treatment of double-vacancy states and Åberg's discussion of coupled transitions. Both these phenomena need clarification before the taxonomy of x-ray satellites can be worked out. The newly revived interest in the extended absorption fine structure is not reflected in the book, however. The impetus in this area came from work with the intense x-ray beam from an electron storage ring, which was not completed in time for this book.

The second of the two volumes is oriented toward the experimental detail omitted from the first. Though the chapters are individually interesting, the volume as a whole is less successful. The contribution on proportional counter methods (Fink) is up to date and includes the recent work on

position-sensitive detectors. Likewise, electron spectrometry (Krause) is as well represented as it could be in a one-chapter summary. In this case literature, including texts, treatises, and reviews, is already available in abundance. On the other hand, the chapter on radioactive atoms (Rao) should really have been in the first volume, since it is mainly a data summary and review. The chapter on crystal spectroscopy (Cauchois and Bonnelle) provides a satisfactory summary of basics and some guidance through the literature, but it neglects recent instrumentation, such as channel-cut and monolithic monochromators, and makes little use of recent dynamical theory.

Missing altogether from the work is discussion of radiation sources or collision chambers. There are unique problems and interesting techniques associated with target systems for accelerators. There have also been developments that might have been covered pertaining to electron bombardment x-ray sources, rotating anodes (mentioned in Krause's chapter), crossed beams, and so on. Nowhere does one find discussion of the problems associated with the x-ray wavelength scale and its connection with the scale of binding energies. Another conspicuous omission has to do with synchrotrons and storage rings. Although only a fraction of the newer results could have been included, the sources were well characterized and were in use at a sufficiently early date.

These flaws aside, the volumes are an admirable effort. I would recommend them to anyone wanting to know where the x-ray business has gone since Compton and Allison and volume 30 of the *Flugge Handbook*.

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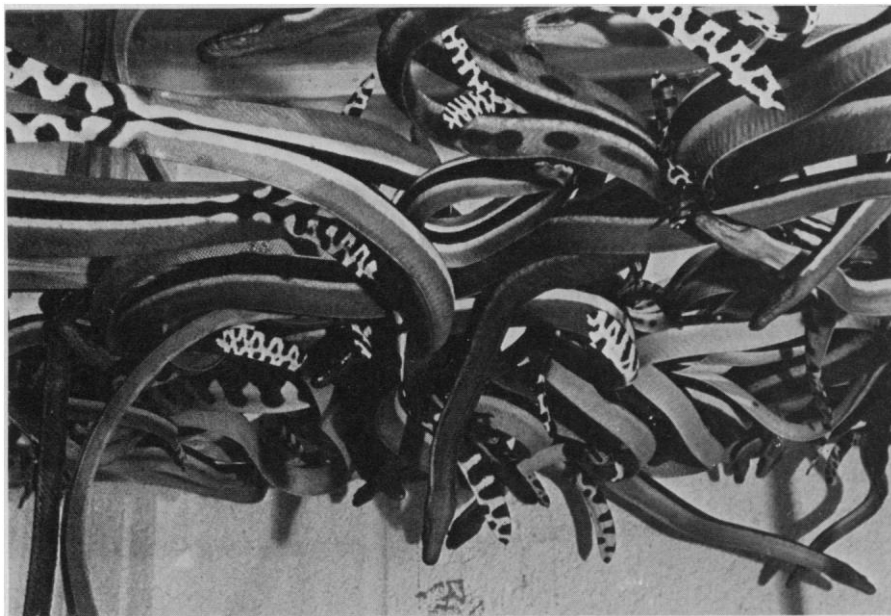
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Tropical Reptiles

The Biology of Sea Snakes. WILLIAM A. DUNSON, Ed. University Park Press, Baltimore, 1975. xii, 530 pp., illus. \$34.50.

For most of this century research on sea snakes was more or less confined to clinical studies of the effects and treatment of their bites, a considerable effort to isolate and define biologically active components and properties of the venom, some taxonomic work, and much natural history, most of it anecdotal. Our knowledge was for the most part erratic and defied generalization.

Recently, a number of investigators have examined sea snakes with the result



"An underwater or fish's eye view of *Pelamis* floating at the surface. Note the conspicuous coloration of the tail. This and the bright yellow ventral surface are probably a warning to potential predators." [Photograph by Dave Hamilton, *Pennsylvania Mirror*, reproduced from *The Biology of Sea Snakes*]

of a substantial upgrading of the quality and quantity of our knowledge. The present volume represents the work of 19 authors writing 23 chapters. Many of the contributors had the opportunity to collaborate on their sea snake research during two cruises of the *Alpha Helix*, in the eastern Pacific in 1970 and in tropical Australia in 1972-73.

The volume is encyclopedic in scope and will be the starting place for all sea snake research in the future. The papers are not uniform in scientific quality, and I had the feeling that in a few cases there just are not enough data to justify the writing. Among the better chapters are a detailed review of the serological relationships among a number of sea snake species and their elapid terrestrial relatives, by Minton and da Costa; a summary of the biochemistry of sea snake venoms, including the amino acid composition of a number of venom components, by Tamiya; and a thorough review of the diving physiology, including cutaneous respiration, which appears to be highly developed in sea snakes, by Heatwole and Seymour. In this last chapter the authors argue convincingly for the remarkable conclusion that essentially sea snakes have no unique physiological adaptations for diving and that many terrestrial reptiles basically are preadapted for marine existence. A chapter on clinical aspects of sea snake bites by Reid should be in every medical library. Cogger provides a comprehensive zoogeographic review of Australian sea snakes, with a useful comparison of his generic classification with those of the major previous systematic works by Smith, Voris, and McDowell.

The information contained in chapters 5 through 9, which discuss sea snake natural history along limited geographic sections of northern and eastern Australia, could have been included in Cogger's account, trimming the book somewhat.

A chapter by Punay on the commercial sea snake fisheries in the Philippines is full of interesting information, including a number of recipes for preparing sea snakes as aphrodisiacs. Unfortunately, Punay does not comment on their efficacy. He claims that 500,000 sea snake skins a year are exported from the Philippines for leather manufacture and calls for conservation measures.

Additional chapters discuss sea snake feeding behavior, fouling organisms, salt regulation, geographic distribution, predation, salt balance, and sense organs, among a variety of other subjects. Reproductive behavior generally receives little attention, although Heatwole in his chapter on attacks by sea snakes on divers indicates that he has seen courtship and mating. It is to be hoped that his information on the subject will be published.

There are a number of instances of poor editing. A statement that sea snake gall bladders are eaten to strengthen the eyes appears in a paragraph on reproduction. Some photographs are repetitious or unclear or contribute little information. *Enhydrina schistosa*, the species responsible for most human bites, is not illustrated. Many authors felt obliged to make some general comments about the pelagic species *Pelamis platurus*, creating a redundancy when this species is discussed in detail in a separate chapter.

Careful editing could have easily reduced the size and price of the volume without affecting its information content materially. Certainly this would have helped it reach a larger readership.

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Books Received

Adrenergic Neurons. Their Organization, Function and Development in the Peripheral Nervous System. Geoffrey Burnstock and Marcello Costa. Chapman and Hall, London, and Halsted (Wiley), New York, 1975. xii, 226 pp. + plates. \$22.50.

Advances in Child Development and Behavior. Vol. 10. Hayne W. Reese, Ed. Academic Press, New York, 1975. x, 254 pp. \$19.50.

Advances in Free-Radical Chemistry. Vol. 5. G. H. Williams, Ed. Academic Press, New York, 1975. x, 394 pp., illus. \$34.

Advances in Hydrospace. Vol. 10. Ven Te Chow, Ed. Academic Press, New York, 1975. xii, 418 pp., illus. \$39.50.

Advances in Metabolic Disorders. Vol. 8. Somatomedins and Some Other Growth Factors. Proceedings of a symposium, Hässelby, Sweden, Sept. 1974. Rolf Luft and Kerstin Hall, Eds. Academic Press, New York, 1975. xxiv, 438 pp., illus. \$35.

Advances in Neurosurgery. Vol. 2. Proceedings of a meeting, Bochum, Germany, Sept. 1974. W. Klug, M. Brock, M. Klinger, and O. Spoerri, Eds. Springer-Verlag, New York, 1975. xxii, 446 pp., illus. \$35.50.

All the Strange Hours. The Excavation of a Life. Loren Eiseley. Illustrations by Emanuel Haller. Scribner, New York, 1975. xii, 274 pp. \$9.95.

Amino Acid Metabolism. David A. Bender. Wiley-Interscience, New York, 1975. xii, 234 pp., illus. \$26.50.

Annual Reports in Inorganic and General Syntheses—1974. Kurt Niedenzu and Hans Zimmer, Eds. Academic Press, New York, 1975. xviii, 370 pp., illus. Paper, \$18.50.

Annual Reports on the Progress of Chemistry. Vol. 71, 1974. Section A, Physical and Inorganic Chemistry. Chemical Society, London, 1975. xvi, 370 pp., illus. \$22.50.

Annual Review of Microbiology. Vol. 29. Mortimer P. Starr, John L. Ingraham, and Sidney Raffel, Eds. Annual Reviews, Palo Alto, Calif., 1975. x, 610 pp., illus. \$15.

Applied Chemistry at Protein Interfaces. Papers from a symposium, Chicago, Aug. 1973. American Chemical Society, Washington, D.C., 1975. viii, 400 pp., illus. \$35.95.

Asimov on Chemistry. Isaac Asimov. Anchor/Doubleday, Garden City, N.Y., 1975. xvi, 302 pp., illus. Paper, \$3.50. Reprint of the 1974 edition.

Bacterial Metabolism. H. W. Doelle. Academic Press, New York, ed. 2, 1975. xiv, 738 pp., illus. \$39.50.

Benjamin Franklin. Scientist and Statesman. I. Bernard Cohen. Scribner, New York, 1975. 96 pp., illus. Cloth, \$6.95; paper, \$2.65. Based on article in *Dictionary of Scientific Biography*.

Biogeographica. Vol. 5. J. Schmithüsen, Ed. Junk, The Hague, 1975. viii, 164 pp., illus. Dfl. 40.

Biological Membranes. Twelve Essays on Their Organization, Properties, and Functions.

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