Little is known about how most bacterial toxins cause damage to host cells, and in many cases their role in bacterial metabolism is unknown. Advances made in biochemistry in the isolation and purification of proteins during the last three decades have provided tools for the study of microbial protein toxins. In many instances isolation and purification have revealed the existence of more than one toxin. For example, in the case of staphylococcal toxins, there are leukocidins with an F and with an S component, enterotoxins A, B, and C (and possibly D), and alpha and delta toxins.

Purified microbial toxins are antigenic, and serological and immunological tests have been developed for identifying and assaying them. With purified microbial antigens the pharmacologist or toxicologist can study the mode of action of the toxin, the microbial physiologist can determine the role of the toxin in the metabolism of the microorganism producing it, and the geneticist and cell biologist can elucidate the role of the gene and other cellular components in toxin production. Many microbial diseases were not recognized as being caused by toxin, and years elapsed between the discovery of the causative microorganism and the demonstration of toxin. Examples are plague (*Pasteurella pestis*), anthrax (*Bacillus anthracis*), and cholera (*Vibrio cholerae*).

Volume 1 of this work deals with general problems and approaches in the study of bacterial protein toxins. The authors of several chapters in volume 1 call attention to the lack of agreement concerning what constitutes a "toxin," the meaning of the term having been fixed in such a way that it has ceased to be of much practical value. One author suggests that "toxin" be replaced with "soluble bacterial antigen." It was the editors' intent to include in volume 2 a chapter on diphtheria toxin, which has been extensively investigated, and well-understood (with respect to site and mode of action) proteins that are liberated by bacteria. Masahiko Yonedo, who was to prepare this chapter, became ill and could not continue, and to avoid delay in publication the topic is omitted from volume 2A. A supplemental volume, 2B, devoted exclusively to diphtheria toxin and authored by Alwin M. Pappenheimer, Jr., is scheduled to appear in the near future. Volumes 2A and 3 contain a comprehensive description and analysis of what is known about each specific toxin as well as guidelines and directions for future work.

Bacterial protein toxins provide an exciting field of research, and these three volumes can be highly recommended to scientists in microbiology, immunology, biochemistry, pharmacology, and related fields.

GAIL M. DACK
494 Wing Park Boulevard,
Elgin, Illinois

Widely Used Drug

Actions of Alcohol. HENRIK WALLGREN and HERBERT BARRY, III. Elsevier, New York, 1970. In 2 vols. Vol. 1, Biochemical, Physiological and Psychological Aspects. Vol. 2, Chronic and Clinical Aspects. xxviii, 872 pp. $64.

Alcohol is the drug most widely used for nonmedicinal purposes and is the drug associated with the most serious social and economic consequences. These facts have led hundreds of scientists throughout the world to study various aspects of alcohol action in an effort to understand the factors leading to, the consequences of, and methods of reducing excessive consumption of alcohol. The result has been a literature so vast and multilingual that no one investigator has even a superficial acquaintance with it all. A critical analytic review of the scientific literature within a systematic framework has been very badly needed. *Actions of Alcohol* has come closest to filling the gap. The authors, whose respective expertise—Wallgren's being in physiology and biochemistry and Barry's in experimental psychology—represents the diversity of scientific disciplines involved in the study of alcohol use, have reviewed some 3641 sources in seven languages to provide the most detailed, comprehensive, and scholarly review of the literature to date. Effects of alcohol at the subcellular, the cellular, the organ, and the behavioral level are described.

Since many investigators working in this field entered it because of an interest in alcoholism, there is a tendency among them to view alcohol use as unique rather than as a special case of a more general set of drug-related phenomena. That is, rather than inquiring into the variables controlling alcohol self-administration, many investigators have designed their research around experimental models of alcoholism. Wallgren and Barry's review reflects this fundamental deficit in the literature.

When drugs are viewed as maintaining consequences for the behavior that has led to their use, families of experimental questions arise. These questions emerge from research with related behaviors and self-administration of other drugs. Many of these questions have not been asked concerning alcohol and only recently have been investigated as they relate to drugs in general. This difficulty is most apparent in those sections of *Actions of Alcohol* that deal with the behavioral effects of the drug. Little systematic framework within which to approach the behavioral literature dealing with alcohol is provided. This is an opportunity missed. The field needs conceptual guidance. In their concluding recommendations Wallgren and Barry plead for multivariate research at multiple levels of analysis. It is a pity that science seeks solutions in complexity when it lacks a conceptual framework within which to understand even the most basic phenomena.

All things considered, *Actions of Alcohol* is an important book. Its strengths at the biochemical, physiological, and cellular levels outweigh weaknesses in the treatment of behavior. It is a welcome and long overdue addition to the scientific literature.

TRAVIS THOMPSON
RICHARD A. MEISCH
Department of Psychiatry,
University of Minnesota,
Minneapolis

The Chiroptera

Biology of Bats. WILLIAM A. WIMSATT, Ed. Vol. 1, 406 pp. + plates, $25; vol. 2, xvi, 478 pp., illus. $26. Academic Press, New York, 1970.

In 1939, when G. M. Allen published his classic *Bats* (Harvard University Press), bats were little understood, even by biologists. For example, at that time the utilization of ultrasonic vocalizations for echolocation and communication was unknown. The best guess then available as to how bats managed to avoid obstacles in the total darkness of caves was that they were able to detect the echo of vibrations set in motion by the air currents generated by flight.

The past 30 years have seen a huge increase in knowledge about bats, perhaps greater than has occurred in any other field of mammalogy. Wimsatt, who with his students has been in the vanguard of the removal of the "mystery" from bats, conceived the idea of a multivolume work to provide an up-to-date summary of the biology of bats. The first two volumes have now appeared, and the list of contributors and the general excellence of the summaries are impressive.

Volume 1 contains 10 chapters. The first, "Bat origins and evolution" by Glenn L. Jepsen, in addition to summarizing the known fossil record includes an excellent series of stereophotographs of the earliest known bat, *Icaronycteris index*, a 50-million-year-old fossil from the Eocene of Wyoming. Robert J. Baker, in his chapter, tabulates known information concerning chromosome numbers and arrangements and relates this to classical bat taxonomy. Terry A. Vaughan provides a comparative anatomy of the major variations in osteology among the various kinds of bats, with special emphasis on adaptations for flight, and then provides similar information for striated muscles. A third chapter by Vaughan summarizes the functional anatomy of flight. Here again we are impressed by the diversity among bats, with styles of flight ranging from the "slow, highly maneuverable flight" of typical insectivorous bats to the flight of hoverers, fast fliers, and even "fly catcher" bats with "slow, delicate style of flight." The remaining chapters, on prenatal and postnatal development by Robert T. Orr, migration and homing by Donald R. Griffin, the ecology and physiological ecology of hibernation by Wayne H. Davis, thermoregulation and metabolism by Charles P. Lyman, and the urinary system by Robert M. Rosenbaum, all add further documentation of the extensive adaptive radiation in structure and habits evident in this group of mammals.

Volume 2 contains seven chapters. Six of these—"Integument and derivations" by W. B. Quay, "The central nervous system" by O. W. Henson, Jr., "Peripheral nervous system" by Quay, "The ear and audition" by Henson, "Vision, olfaction, taste" by Roderick A. Suthers, and "Pineal organ" by Quay—are summaries of the detailed morphology and function of various organs and organ systems. Chapter 7, "Bats in relation to the health, welfare, and economy of man," by Denny G. Constantine, summarizes the role of bats in diseases, including rabies, as well as their impact on fruit growing in the tropics and insect control and guano production throughout tropical and temperate climates. The terminal portion of the chapter summarizes control measures for vampire, fruit, and insectivorous bats.

From the foregoing summary of contents, it is obvious that these two volumes will be of interest not only to professional chiroptologists but to many others, including vertebrate zoologists, anatomists, physiologists, and public health workers. Each chapter includes an extensive list of references.

E. LENDELL COCKRUM
Department of Biological Sciences, University of Arizona, Tucson

Aerosols

The Dynamics of Aerocolloidal Systems. G. M. HIDY and J. R. BROCK. Pergamon, New York, 1971. xvi, 380 pp., illus. $27. International Reviews in Aerosol Physics and Chemistry.

This book is intended to be the first of a series of International Reviews on Aerosol Physics and Chemistry and so it seems particularly appropriate that it should concentrate on the mechanical properties of aerosols.

In their introduction the authors state that their aim is "to explore the dynamical behaviour of idealized aerosol particles in the light of modern developments in classical mechanics." With this objective in view, they deliberately neglect the detailed microscopic properties of aerosol particles—except insofar as they can be included in macroscopic parameters—and treat the particles as smooth, chemically inert spheres.

Having made this idealization, the authors proceed to a stimulating consideration of aerosols from the point of view of the kinetic theory of gases. As they point out, it is, however, difficult to follow this through to give a rigorous statistical treatment of the general case. Nevertheless, many cases of practical interest can be covered by making the simplifying assumption that the aerosol particles do not interact with each other directly, and so the authors go on to develop a statistical mechanical model for this special case. In this treatment they bring out very clearly the importance of the ratio of the size of the aerosol particles to the mean free path of a molecule in the suspending gas. They distinguish between the continuum regime, where the particles are very large compared to the mean free path of the molecules, and the other extreme, where the particles can simply be regarded as large molecules, and they discuss the difficult intermediate cases.

In the rest of the book, Hidy and Brock consider various special topics, such as heat and mass transport to aerosol particles, the diffusion of aerosols, and collisions between aerosol particles, using the basic framework established in the opening chapters. In each case they begin with a general mathematical formulation and then consider special cases which are of special interest or amenable to mathematical solution.

This approach is perhaps the greatest strength and weakness of the book. Obviously the generalized formulations have the advantage that they can be used by workers in different fields They are, however, necessarily highly mathematical, and considerable effort will often be required to obtain practical results. The authors are clearly aware of this difficulty and have deliberately included more detailed experimental and theoretical results and an extensive bibliography. These features should help to make this book of value, not only to students seeking a general understanding of aerosol mechanics, but also to workers concerned with practical problems involving aerocolloidal systems.

J. T. BARTLETT
Microbiological Research Establishment, Porton Down, Salisbury, England

Books Received

Animal Gametes (Female). A Morphological and Cytochemical Account of Yolk Formation in Oogenesis. Vishwa Nath. Asia Publishing House, New York, 1971. xx, 196 pp. + plates. $17.

Advances in Microbial Physiology. Vol. 5. A. H. Rose and J. F. Wilkinson, Eds. Academic Press, New York, 1971. x, 302 pp., illus. $14.50.

Aerodynamic Characteristics of Atmospheric Boundary Layers. Erich P. Plate. U.S. Atomic Energy Commission, Oak Ridge, Tenn., 1971 (available as TID-25465 from the National Technical In-

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