salism are of prime concern in the present volume. The first chapter, on insects and their endosymbionts (A. Koch), raises the possibility that insect symbiosis with other organisms may have existed since the Devonian, the time when the roaches and the termites separated from their common ancestor. Seven major types of insects that are permanent bloodsuckers have endosymbionts. Among these insects are the triatomid bugs that carry Chagas' disease. The means by which symbionts are transmitted to the offspring are diverse in insects; they include invasion of the egg. The chapter on insect ectosymbiosis (A. Hartzell) considers the cases of arthropod with arthropod, as in mites with army ants, ants tending their ant "cows," and the slave-making ants. The fungus-growing ants, found from 40°N to 44° (not 40°) S, are in a mutualistic type of symbiotic relationship with several species of fungi that are not found except in the ant gardens. Ectosymbiosis in Wood-Inhabiting Insects (H. Francke-Grosmann) deals particularly with ambrosia beetles and their fungi. A fungus isolated from ambrosia-beetle galleries is considered to be a true ambrosia fungus when it produces in culture the same stages it produces in the tunnels. Beetles and attine ants are quite different in their relations with their fungi. "The only action of the beetles that could be regarded as a true fungus culture is the preparation of special beds consisting of feces and wood frass." In contrast, the ants forage for substrate, add their saliva and fecal droplets to it, and, after it has been cut to size, then pick up pieces of the mycelium and plant them on the particle.

Ectosymbiosis in Aquatic Insects (A. W. Steffan) treats such internal symbionts as ciliate protozoa, nematodes, and acarines. In turn insects may live on or in Porifera, Bryozoa, and Mollusca. The diversity of insects being what it is, there are numerous examples of insect-insect relations. Avian Symbiosis (H. Friedmann) deals with bird-arthropod, bird-mammal, and bird-bird relations. All three animals may be involved, as in the African oxpecker feeding regularly on ticks on African big game. Intestinal microorganisms of ruminants and other vertebrates (B. H. Howard) are considered more on the biochemical basis than they have been in earlier studies. Herbivores have the greatest microbial activity and in fact may have evolved only because of their association with fiber-digesting microbes. Carbohydrate fermentation, nitrogen transformations, and lipid metabolism are considered, as is vitamin synthesis.

Each chapter has an extensive bibliography. The volume is worthwhile for this feature alone but goes far beyond in being a most useful consideration of a rapidly growing and complex field with infinite applications.

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Public Health Problem

Transmission of Viruses by the Water Route. Based on a symposium, Cincinnati, Ohio, December 1965. GERALD BERG, Ed. Interscience (Wiley), New York, 1967. 502 pp., illus. $15.

The symposium reproduced in this volume was held in search of answers to such questions as: What is the significance of viruses in water? What methods are available for quantitative detection of small amounts of viruses in large volumes of water? What answers are needed to protect the public health from the transmission of viral diseases? In an attempt to answer such questions, 68 highly qualified scientists, engineers, and sanitarians presented and discussed 31 papers covering the general topics of survival of viruses in wastes and waste water, the minimal infective dose of viruses, the quantitative recovery of viruses from dilute suspensions, and the epidemiology of transmitting viral diseases by water. Although the answers to many questions of public health significance can be found in the papers, other new ones were raised by the participants which indicate that our knowledge is far from complete on the survival and transmission of viruses in water.

Because of the unevenness of the writing in several chapters, and especially because of what is recorded in some of the discussion sections, there is a lack of continuity. The book is therefore not easy to read from cover to cover. But it will serve as a valuable reference volume, for it contains much worthwhile information that is difficult to find elsewhere without an extended search. Parts of the discussion sections could have been edited more extensively or deleted; one wonders what kind of controlled experiment in immunology, pathogenicity, or epidemiology the following statements represent: "Two years ago, 11 of my colleagues and I swam in a swimming pool which we had seeded with 10 $TCID_{50}$/ml of Sabin poliovirus 2. This level of virus was insufficient to infect any of us. Of course, we had all received Salk vaccine and at least some of us had received Sabin vaccine. If we could have seeded with perhaps 10,000 $TCID_{50}$ per ml, we might have had some infection."

Techniques are cited in the book that are capable of detecting in sewage and polluted water such agents as the poliovirus, the virus thought to be responsible for infectious hepatitis in man, and certain enteroviruses of animals. As these methods are improved it may be possible to monitor water routinely for viruses, as is now done for fecal bacteria from man and animals.

With the poor distribution of natural waters for drinking purposes in certain areas, and with the rapid growth of the population, it will soon become necessary to renovate and reuse the waste water of many communities. Thus we will need to know all we can on this topic of this symposium.

The book contains remarkably few errors, and its physical makeup is excellent.

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Books Received

Advances in Ecological Research. vol. 4. J. B. Cragg, Ed. Academic Press, New York, 1967. 323 pp. Illus. $13.50. Four papers.

Advances in Physical Organic Chemistry. vol. 5. V. Gold, Ed. Academic Press, New York, 1967. 428 pp. Illus. $19.50. Six papers.

Air Conditioning Engineering. W. P. Jones. St. Martin's Press, New York, 1967. 518 pp. Illus. $18.

Algebra. vol. 1. L. Rédei. Translated from the Hungarian edition. Pergamon Press, New York, 1967. 841 pp. Illus. $21.50. International Series of Monographs in Pure and Applied Mathematics.

Animal Toxins. An international symposium (Atlantic City, N.J.), April 1966. Findlay E. Russell and Paul R. Saunders, Eds. Pergamon, New York, 1967. 442 pp. Illus. $18.50. Forty-four papers.

Animals of the North. William O. Pruitt. Harper and Row, New York, 1967. 183 pp. Illus. $5.95.

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