as in a sense completed. What now happens to queuing theory, and to operations research (in which it has played an important role)? One of the most interesting aspects of the book under review is the light it casts on this question.

In his introductory lecture, Philip Morse (U.S.) suggests a promising line of growth by effectively invoking the Jacobi injunction: always invert. In present uses of the theory, the input and structure of the system are usually taken as given, in some convenient probability form, whether or not measurements or observations are available to establish their relevance. In the inverse uses, the characters of the input and structure would be inferred from the output. Of course, an extensive mathematical development, probably more difficult to carry out than the existing theory, is necessary.

In the third session of the conference, J. F. C. Kingman (U.K.) in an invited paper examines the heavy-traffic condition (that is, a condition close to the limit of stability of the system) with a view to finding an approximation of the performance of the system (the distribution of delays) which holds under more relaxed assumptions than the usual independence ones. For a single server and order-of-arrival service, he finds a remarkably simple approximation. For many servers and for other orders of service, there is an open field for hardy investigators. Finally, in the closing session, T. L. Saaty (U.S.) offers many nonmathematical remarks under the title "Ordering disorderly queues." The matters he mentions range from improving the condition of waiting rooms (more comfort) to improving the behavior of waiting people (more courtesy). In supermarkets, the multiple checkout lines seem to him less efficient and less equitable than a single line with first-come, first-served service to the idle checkers. Curiously, he does not consider the question of whether there may not be a critical queue size beyond which order is impossible, that is, beyond which the waiting line becomes a mob. It has been known for some time that telephone operators handling long-distance calls by ticket inevitably pass from order-of-arrival service to random service as the number waiting increases, and such transition in any service control may be expected to alter waiting behavior.

Aside from these glimpses into the future, the technical reader will be pleased to find a résumé, though a somewhat disjointed one, by R. Syski (U.S.) of the work of a pioneer in the theory, Felix Pollaczek, who at last receives the appreciation he deserves. The individual papers, which cannot be given detailed notice here, illustrate the variety of interesting uses of the theory.

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Antimicrobial Agents

Biosynthesis of Antibiotics. Vol. 1. J. F. SNELL, Ed. Academic Press, New York, 1966. 246 pp., illus. $10.

It is historically fitting in a volume devoted to the review of our knowledge of the biosynthesis of antibiotics that the first group of antibiotics to be discussed in depth is the penicillins and cephalosporins. In an excellent contribution, A. L. Demain reminds us that penicillin "still remains the most active and one of the least toxic" antibiotics. Advances in the biochemistry of fermentation and production methods are especially impressive when one reads that in the early stages of the development of penicillin it took over a year to accumulate enough for clinical trials. Today's cultures produce 5 milligrams per milliliter. Evidence for the biosynthetic origins of the β-lactam-thiazolidine ring nucleus common to all penicillins is reviewed. It is particularly useful to have the associated pathways of sulfur and carbon synthesis in cysteine and other pathways related to penicillin biosynthesis presented in parallel. A review of the "new penicillins," penicillinases, and the biosynthesis of cephalosporin C and its derivatives and mention of the use of particulate fractions bypassing permeability difficulties all make this chapter well worthwhile.

A concise and lucid chapter on the status of the biosynthesis of the tetracycline antibiotics is presented by R. H. Turley and J. F. Snell. The use of mutants in working out the probable steps of formation of 7-chlortetracycline from 6-methylpretetramide is of interest; it is evident that other mutant-selection techniques will be needed before the steps from acetate or malonate to naphthacenic intermediates can be worked out.

It is surprising that although the chemistry and the major sources of carbon atoms in the streptomycin molecule have been known for years, there is still no knowledge of the manner in which the individual units are linked together by *Streptomyces*. However, a clearer idea of the immediate precursors of the streptidine moiety and streptose has emerged from recent studies. J. D. Bu'lock reviews the biochemistry of the polyacetylenes, an interesting group of fungal compounds which have not reached the chemotherapeutic eminence of other antibiotics. The macrolides represent the final group of fascinating antibiotics covered in this book, and although they are relative "newcomers," considerable progress in the understanding of their chemistry and biogenesis is evident from the data given in the chapter by J. W. Corcoran and M. Chick.

The chapter on the "Preparation of radioactive antibiotics" is a useful source of material, although it would have been better placed at the end of the volume so that the reader would have first been informed about the biosynthetic pathways. The volume is well supplied with references and will provide many with a very useful condensation of current knowledge in this field.

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Organic Compounds

Carbohydrate Chemistry. EUGENE A. DAVIDSON. Holt, Rinehart, and Winston, New York, 1967. 447 pp., illus. $11.95.

The author indicates that a major stimulus for this work has been the need for a book on carbohydrate chemistry in which the principles of modern physical organic chemistry are applied to the properties and chemical reactions of the carbohydrates.

The principles of optical activity and of the spectroscopic methods of nuclear magnetic resonance, infrared, and optical rotatory dispersion, with some applications to carbohydrates, are well presented. The discussions of NMR and infrared are not illustrated with reproductions of spectra and their interpretation; the *tau* values and the infrared absorption bands for some important substituents are listed in tables, however. Aspects of the biochemistry of carbohydrates, including pho-

tosynthesis, glycolysis, the trichloracetic acid cycle, and several enzymic reactions of particular importance are discussed and well integrated, and polysaccharides are discussed effectively. Other attractive features of the book include abridged rules for carbohydrate nomenclature, useful general and specific references, and numerous summaries of important topics.

Along with these many strong points, there are a number of aspects which seriously detract from the book's usefulness. The theoretical discussions of optical rotatory power and NMR are inadequate for the advanced reader and too involved for the beginning student. The structure of D-glucose is developed fully. Although the structures of the monosaccharides may be gleaned through the illustrative examples, the author nowhere compares the structures of the pentoses, hexoses, or hexuloses. Many of the figures appear to have been drawn carelessly—Fig. 6.31 presents a conformationally inaccurate representation of 1,6-anhydro formation, for example—and few of the figures and tables are conveniently placed with respect to the applicable portions of the text. Although the author is aware of good carbohydrate nomenclature, a great many of the names used are inaccurate. Finally, the index is inadequate.

This book is basically a good book in carbohydrate chemistry, but its usefulness is somewhat decreased by the many errors, most of which are not of concept but of execution.

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Mammalian Behavior

Play, Exploration and Territory in Mammals. Proceedings of a symposium, London, Nov. 1965. P. A. JEWELL and CAROLINE LOIZOS, Eds. Published for the Zoological Society of London by Academic Press, New York, 1966. 294 pp., illus. $11.50.

Recent reports of many field studies of nonhuman primates have led to renewed efforts to examine systematically the naturalistic behavior of a wide range of other mammals. The proceedings of this symposium importantly advance these efforts. The contributors describe play in mammals; play, exploration, and territory in wild lions; aggressive play in polecats; exploration and fear in rats; exploration and play in children; home range in mammals; movements in small mammals; territory in carnivores; scent marking in Canidae; grouping and range in feral Soay sheep; dispersal of red deer; home range and agonistic behavior in the gray squirrel; group structure and movement of gelada baboons; and spatial organization of nutria. Most of the observations reported were made in the natural habitats of the animals, but some observations of behavior in captivity are included.

The symposium describes many other kinds of related behavior in addition to those suggested by the title; extensive observations of nutrition and feedings, aggressive and reproductive behavior, marking and signaling, population organization, and selective adaptations are reported. There are significant contributions to the subjects of population organization and control and the composition and structure of families, colonies, and groups of animals. Aggressive and defensive behavior and their associated functions are described for many of the species.

Each paper adds new observations to the general literature on free-ranging mammalian behavior. New problems are defined, and a few new methods and techniques are briefly described. For example, lemmings do not plunge blindly into lakes, but they, and nutria too, cross lakes when silhouettes of the opposite shore can be seen. Telemetry, radio transmission, and radioisotopic tracers are described as standard techniques for both tracing and recording the movements of small mammals.

The collected papers for the symposium do not develop a coherent theme. The contributions are somewhat irregular in scope and quality of treatment of the wide variety of subjects. Although new and extended information and new variations of patterns of movements of animals *in-space-over-time* are described, old definitions of "home range" are repeated too often. The relative exclusivity of mammalian home ranges and the existence of more than one focus of activity in definable ranges should be generally accepted. In contrast, the attention given to community and group ranges, life ranges, the effects of varied ecological contexts, and the evolutionary significance of behavior represents an important contribution of the book. Learning and conditioning mechanisms as possible explanatory concepts for territoriality are seriously neglected. The issue of defensive behavior as a criterion of territoriality continues in this symposium to receive too much attention relative to its importance in animal economy.

Play, exploration, and territoriality are kinds of behavior that are basic and general, but neglected, subjects of study. This well-designed book, with good abstracts and summaries for each chapter, emphasizes the importance of these activities, advances analysis and understanding of them, and once again calls attention to their biological significance.

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Organisms in Environments

Pollution and Marine Ecology. Proceedings of a conference, Galveston, Texas, March 1966. THEODORE A. OLSON and FREDRICK J. BURGESS, Eds. Interscience (Wiley), New York, 1967. 382 pp., illus. $12.

Other than the suggestion, by the author of the welcoming remarks, that support of pollution studies may be one of the largest categories of federal expenditure in the future, the problem presented by the increase in our capacity to influence our environment adversely was not examined in this conference. The implication of the proceedings, with several papers that are essentially basic ecology, is that studies of whole plants and animals in their settings are indeed returning to favor and that studies of unpolluted or natural conditions are desirable. Thus we find in this book the only recent essays on intertidal ecology on the Oregon coast and on subtidal ecology at Anacapa Island, and a 50-page summary by H. T. Odum of biological circuits and marine systems in Texas, together with the usual sorts of papers about indicators, trace substances, "parameters of pollution," and so on. The book is not a complete treatment for ecologists or pollution engineers, but it will be essential for both.

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