

anatomy of this system in the rat. Plasticity of the olfactory behavior of rat pups, along with an analysis of its cellular-metabolic basis, is described by the Shepherd group and presented in more detail in a chapter by Leon and co-workers. Striking and specific changes in the 2-deoxyglucose uptake in olfactory structures, particularly in the olfactory glomeruli, are produced by early odorant experience. More general anatomical studies of the results of early environmental manipulations are discussed by Greenough in terms of neuronal and synaptic survival and development.

The early plasticity of the olfactory system is but one of many neurobiologic mechanisms mediating the establishment of appropriate maternal-infant relationships. The possibility of breaking down and analyzing the complex web of these relationships is discussed convincingly by Hofer. Specific sensory modalities can be shown to have specific mediating effects, and different brain neurochemical systems may be differentially involved in certain sorts of maternal behavior. Numan focuses on the medial preoptic area in analyzing maternal behavior, whereas Pedersen and Prange emphasize oxytocin as an activator of such behavior. Rosenblatt shows that hormonal states characteristic of the end of pregnancy (high estrogen and declining progesterone levels) provide a sufficient condition to initiate maternal activity in the rat but that maintenance of this activity requires appropriate behavioral (nonhormonal) interactions between mother and pups.

A combination of genetic behavioral predisposition in primate infants with the experiential environment provided by maternal and group characteristics is analyzed in a chapter by Suomi. Genetically highly reactive infants may exhibit their behavioral predisposition only under certain conditions of stress. What is impressive is that the genetic and situational components of behavior are becoming susceptible to experimental analysis and modifications under conditions of controlled breeding and rearing in a primate model. How strong is the genetic factor? What hormonal and neural systems are involved in differential tendencies toward pathological behavior? What environmental conditions maximally elicit or prevent such behavior?

These examples illustrate the combined behavioral and biological approach of this book. The focus is on the relatively brief perinatal period when the complexity of the interaction between environment and organism is amenable to control and analysis. Some of the work presented does venture into the world of subhuman primate development, and indeed of behavioral prefer-

ence patterns in humans (Kagan, Reznick, and Snidman). Little effort is wasted throughout the book in spelling out parallels between the animal models and human development. The implicit relevance of the work presented and discussed emerges with greater force because of this restraint on the part of the authors. Certainly this book cannot and does not attempt to bridge the gap between molecular and cellular neuroscience on the one hand and the problems of optimizing the human educational process on the other. It does, however, embody an approach whereby neuroscience can illuminate the process of experiential modification of brain development and the behavior mediated thereby. Despite the perinatal focus of this book, it merits the attention of those concerned with the general problem of experiential modulation of behavioral capacity.

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Host-Microbe Interactions

Virulence Mechanisms of Bacterial Pathogens. JAMES A. ROTH, Ed. American Society for Microbiology, Washington, DC, 1988. xiv, 390 pp., illus. \$75; to members, \$55. From a symposium, Ames, IA, June 1987.

With the demonstration of an etiologic role for bacteria in anthrax by Robert Koch in 1876 and the acceptance of the formal criteria for separating pathogenic from nonpathogenic microorganisms, first proposed by Henle but now known as Koch's postulates, the examination of bacterial virulence began. These early investigators identified a number of pathogenic bacterial species and characterized several properties related to virulence. During these early years, the ability to confer a protective effect against a pathogenic strain of bacteria through the attenuation of the agent and the subsequent use of the altered strain as a vaccine was first described by Pasteur, without any knowledge of the host immune response. The experimental observations that documented the virulence of specific bacterial species were quickly followed by additional work describing the basic characteristics for a variety of microorganisms and numerous histopathologic descriptions of the damage caused during infection of a living host. Today, a broad variety of techniques that focus on both the suspect pathogen and the host response to infection are available. Many of these tools allow scientists to ex-

plore the mechanisms responsible for virulence at the cellular and molecular level. Indeed, our methods for defining host-microbe interactions have become so sophisticated that we often lose sight of the complex environment in which such interactions normally occur. As stated in the preface to this volume, "The biologic context must not be lost amidst the glamour of the new technologies."

This volume, from a symposium, attempts to integrate the knowledge of bacterial virulence gained through the use of modern molecular biologic and biochemical methods with a more traditional understanding of virulence at the functional level. It includes sections on adherence, colonization, and invasion, resistance to humoral defense mechanisms, resistance to cellular defense mechanisms, bacterial toxins, and strategies to overcome virulence. Each section contains an introductory overview and several chapters dealing with specific topics related to that functional area.

The first chapter, "Bacterial infection of mucosal surfaces: an overview of cellular and molecular mechanisms," by Lawrence Arp, is particularly well written and provides a theoretical basis for many of the interactions that lead to microbial attachment and penetration of these surfaces. Subjects covered include the physicochemistry of the glycocalyx, as well as fimbrial adhesins, mucosal receptors, and other factors that allow bacteria to adhere to the mucosal surface as the first step in invasion. In the same section the chapter dealing with colonization of the gut, by Rolf Freter, stands out as an excellent discussion of this complex ecosystem. Freter provides a great deal of data and a mathematical model that predicts bacterial population levels in a complex system, based on the ability to adhere. The use of this strategy is an important new technique for gaining a better understanding of microbe-host interactions *in vivo*.

The overviews of humoral and cellular defense mechanisms are, of necessity, descriptions of the various components of the host immune response. Some topics, such as antigenic shift, antigenic similarity, and iron uptake, are covered in several of the subsequent chapters in a somewhat repetitive manner. Not surprisingly, most of the chapters dealing with specific model systems include detailed discussions of various virulence mechanisms as they pertain to animal species other than humans. Although some of this information is applicable to human disease, much of it is not. Perhaps the greatest weakness of this volume is the absence within each section of any comparative information regarding various hosts or

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the importance of the virulence mechanism for other bacterial species, or any discussion of the spectrum of diseases to which each virulence factor contributes. Because the expression of many virulence factors is intimately coupled to the environment and host in which the organism resides, these omissions detract from the "big picture" and the value of this volume as a general reference text.

Despite the organizational vicissitudes noted above, this volume provides a great deal of valuable information. Each chapter is well referenced. The overview chapters offer a reasonable summary of current knowledge, and the chapters on particular model systems will be of interest to scientists working in these specialized areas. Roth's efforts to present information gained through the use of new technologies without losing sight of the big picture should be applauded, even though they have not been entirely successful.

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Books Received

Cognitive Science in Europe. Michel Imbert *et al.*, Eds. Springer-Verlag, New York, 1987. x, 236 pp. Paper, \$39.50. Recent Research in Psychology.

Combating Resistance to Xenobiotics. Biological and Chemical Approaches. M. G. Ford *et al.*, Eds. Horwood, Chichester, U.K., and VCH, New York, 1987. 320 pp., illus. \$114. Ellis Horwood Series in Biomedicine.

Combinatorial Geometries. Neil White, Ed. Cambridge University Press, New York, 1987. xii, 212 pp., illus. \$39.50. Encyclopedia of Mathematics and Its Applications, vol. 29.

Community and Evolutionary Ecology of North American Stream Fishes. William J. Matthews and David C. Heins, Eds. University of Oklahoma Press, Norman, OK, 1987. viii, 310 pp., illus. \$42.50. From a symposium, Knoxville, TN, June 1985.

Computers in Battle. Will They Work? David Bellin and Gary Chapman, Eds. Harcourt Brace Jovanovich, New York, 1987. xiv, 362 pp., illus. \$14.95

A Crowded Ark. Jon R. Luoma. Houghton Mifflin, Boston, 1987. xii, 209 pp. \$17.95.

Cycles of Fire. Stars, Galaxies and the Wonder of Deep Space. William K. Hartmann and Ron Miller. Workman, New York, 1987. 189 pp., illus. \$27.50; paper, \$14.95.

Cyclopenta[a]phenanthrenes. Polycyclic Aromatic Compounds Structurally Related to Steroids. Maurice M. Coombs and Tarlochan S. Bhatt. Cambridge University Press, New York, 1987. xviii, 266 pp., illus. \$69.50. Cambridge Monographs on Cancer Research.

Cytochromes c. Biological Aspects. Graham W. Pettigrew and Geoffrey R. Moore. Springer-Verlag, New York, 1987. xiv, 282 pp., illus. \$115. Springer Series in Molecular Biology.

Energy Resources in Science Education. D. F. Kirwan, Ed. Published for the ISCU Press by Pergamon, Elmsford, NY, 1987. xvi, 214 pp., illus. \$27.95; paper, \$15.95. Science and Technology Education and Future Human Needs, vol. 7. Based on a conference, Bangalore, India, Aug. 1985.

Entrepreneurial Science. New Links Between Corporations, Universities, and Government. Robert F. Johnston and Christopher G. Edwards. Quorum (Greenwood), Westport, CT, 1987. viii, 157 pp., \$37.95.

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