

Annual Review of Physiology 1994. Joseph F. Hoffman (ed.). Annual Reviews Inc., 139 El Camino Way, Palo Alto, California 94303-0897, P.O. Box 10139, USA. 1994. Volume 12. Price: USA \$ 48, elsewhere \$ 53. pp. 1094

This volume of *The Annual Review of Physiology*, carries 32 review articles in various branches of physiology. This book has a wide range of topics such as 'Synaptic transmission in the outer retina', 'Transgenic rats: New experimental models for the study of candidate genes in hypertension', etc. Researchers in various areas of Biochemistry and Molecular Biology are likely to find at least a few articles of their interest.

The section on cellular and molecular physiology has reviews on calmodulin, cAMP and cGMP-dependent protein kinases, modulation of ion channels by phosphorylation and Ca^{2+} and phosphoinositides as regulators of actin assembly. Sharron Francis and Jackie Corbin have provided an up to date review of our understanding of the structure and function of cyclic nucleotide-dependent protein kinases. Mechanism of regulation of enzyme activity, genes coding for these kinases, their chromosomal location and generation of various forms by alternative splicing are also discussed in this article.

In the review on 'Modulation of ion channels by protein phosphorylation and dephosphorylation' by I. W. Levitan, the author has described regulation of various ion channels, ligand gated as well as voltage gated, by various protein kinase signalling pathways. Like many other reviews in this volume this also is one of fundamental interest to workers in various areas of modern biology. 'Among the many potential molecular mechanisms for modulating the activity of membrane proteins such as ion channels, protein phosphorylation has been chosen by cells to play a particularly prominent part; this is because protein phosphorylation plays a central role in a wide variety of cellular, metabolic and signalling processes', argues the author.

The section on endocrine physiology includes four articles on the following topics: role of ATP in insulin action, Ca^{2+} and hormone action, regulation of protein synthesis by insulin, and phosphoinositide

phospholipases and G proteins in hormone action. In this last mentioned review J. H. Exton has critically reviewed the recent work on the regulation of phosphoinositide-specific phospholipases, (there are at least 16 isozymes) by various G proteins. This regulation by hormones involves an unexpected degree of complexity in that the phospholipases involved can be stimulated not only by the α -subunits of certain G proteins but also by $\beta\gamma$ complexes.

Under the category of special topics, there are three reviews on (1) control of Ca^{2+} release in functioning skeletal muscle fibre, (2) ryanodine receptor/ Ca^{2+} release channels and their regulation by endogenous effectors, and (3) structure and development of E.C. (excitation-contraction) coupling units in skeletal muscle. Comparative physiology section has two articles; (1) thermogenesis in muscle and (2) evolutionary physiology. Respiratory physiology and neurophysiology sections have three articles each.

Of particular interest are the articles under the section on cardiovascular physiology; all of these articles concern the use of molecular biology approaches. These are (1) Molecular genetic approaches to the study of human cardiovascular disease, (2) Complex models for the study of gene function in cardiovascular biology, (3) Insights into lipoprotein metabolism from studies in transgenic mice, and last but not least (4) Transgenic rats: new experimental models for the study of candidate genes in hypertension research. The last article also describes methods for generating transgenic rats. Although it is not known exactly which genes are involved, several candidate genes have been proposed to be related to hypertension. The advantages of using transgenic rats rather than transgenic mice for hypertension research are also discussed. Application of these techniques and targetting of new candidate genes for identification of the genetic basis will have implications for diagnosis and prevention of this disorder. From these and several other articles in this volume it is quite clear that molecular biology approaches have become an integral part of almost every area of research in biology including physiology.

The reviews in this volume are well written by the experts in their areas of research. These articles also provide many

references for more detailed reading.

GHANSHYAM SWARUP

*Centre for Cellular and
Molecular Biology
Uppal Road
Hyderabad 500 007, India*

Bacterial Pathogenesis: A Molecular Approach. Abigail A. Salyers and Dixie D. Whitt, American Society for Microbiology Press, Washington, DC 20005, USA. 1994. 418 pp. Price: £ 35.

Microbiologists endeavouring to delve deeper into the molecular biology of bacterial pathogenicity seem to have come of age. This is indicated by the publication of the first textbook on the molecular mechanisms underlying bacterial pathogenesis. Prior to its publication the only two other books (reviewed^{1,2} earlier) available on the subject were in the form of compilations of highly authoritative reviews addressed primarily, though not solely, to researchers in the field. This book fulfils the ardent need of the students and the teachers alike who wish to gain a fair degree of insight into the host-bacterium interactions at the molecular level. The text has been neatly divided into three parts—Part I: Introduction to host-parasite interactions (Chapters 1–8); Part II: Paradigms of bacterium-host interactions (Chapters 9–21); Part III: Future challenges (Chapters 22–28).

Part I, a prelude to the subject, presents an overview of an array of bacterial virulence factors which mediate pathogens' colonization and damage to the host (Chapters 1 and 2) and host defences meant to thwart these onslaughts (Chapters 3 and 4). The regulation of virulence factors (Chapter 5), though a part of this prelude, should have been dealt with in more detail as it would enable the readers, especially the students, to understand better several of the mechanisms discussed later in the book. It has been very thoughtful of the authors to include a chapter on experimental approaches to investigating host-bacterium interactions (Chapter 6). Caveats in this chapter would immensely help prospective researchers to select suitable animal models and appropriate molecular techniques while trying to

address specific problems related to molecular aspects of the life of bacterial pathogens. Chapters 7 and 8 bring out the practical importance – namely rational designing and development of newer vaccines and tackling antibiotic-resistant bacteria – of unraveling the molecular basis of bacterial pathogenesis.

Part II presents a detailed account of different paradigms of bacterium–host interactions, each exemplified by a group of pathogens having similar or related virulence strategies. The pathogens selected are fascinating examples of host–pathogen interactions.

The paradigms where exotoxin production is pivotal to pathogenesis and follows colonization by pathogen of the host surface have been illustrated by *Corynebacterium diphtheriae* (Chapter 9), *Streptococcus pyogenes* (Chapter 10), *Vibrio cholerae* (Chapter 12) and *Bordetella pertussis* (Chapter 13) whereas food-borne toxinoses due to *Clostridium botulinum*, *C. perfringens* and *Staphylococcus aureus* (Chapter 11) represent paradigms of disease without colonization. The molecular underpinnings of the well-understood aspects of their pathogenicity have been presented in detail. Molecular mechanisms underlying the newer aspects – superantigenic properties of staphylococcal and streptococcal toxins, toxic shock syndrome toxin-lipopolysaccharide (TSST–LPS) synergy, startling connections between botulin and tetanus toxins, discovery of Zot (zona occludens toxin) and Ace (Accessory cholera enterotoxin) toxins of *Vibrio cholerae* and autoimmune response to Fha (Filamentous Haemagglutinin) as a possible cause of neurological damage following *Bordetella pertussis* infection/vaccination – have been discussed briefly.

A novel mechanism involving host-cell-actin-mediated invasion and spread of pathogens has been discussed in context to *Shigella* (Chapter 14) and *Listeria monocytogenes* (Chapter 15) infections. The versatility of *E. coli* as a pathogen has been presented by focusing on its ability to cause an amazing variety of gastrointestinal (Chapter 16) and urogenital (Chapter 17) infections and the molecular bases thereof. This chapter also incorporates newer concepts such as virotyping and recent findings like RTX (repeats in toxin) toxins, Bfp (bundle forming pili), emergence of haemorrhagic *E. coli* (O157:B7 strain) and the possibility

of *E. coli* STa (stable toxin, subunit a) mimicking a normal hormone called guanylin.

Yersinia (Chapter 18) and *Salmonella* (Chapter 19) infections have been discussed as paradigms of host–pathogen interactions involving highly invasive bacteria. Besides discussing the molecular mechanisms of their virulence determinant; reasons underlying the unusually higher degree of invasiveness exhibited by *Yersinia pestis* and *Salmonella typhi* compared to their respective kins have been explored. Rechristening of ‘YOPS’ (*Yersinia* Outer-membrane proteins) as ‘yops’ and drastic revision of the earlier views about invasins, Ail (attachment-invasion locus) and Yad (*Yersinia* adhesion) as the important virulence factors of *Yersinia* spp. constitute important pieces of information. These chapters also introduce the readers to an entirely new, though totally speculative as yet, hypothesis of ‘antivirulence’ factors.

Many pathogens try to escape the onslaught of a host’s specific immune response by constantly changing their antigenic structure. *Neisseria gonorrhoeae* is an exquisite paradigm for such host–pathogen interactions. Chapter 20 discusses in detail the molecular mechanisms underlying antigenic variation, viz. homologous recombination, slipped strand mispairing and sialylation of lipopolysaccharides, and the consequent antigenic challenges it poses for the development of successful vaccines.

Interactions of *Pseudomonas aeruginosa* with the host constitutes yet another paradigm – that of opportunistic pathogens (Chapter 21). Why is *P. aeruginosa* an opportunist and not a frank pathogen? This question has been reasoned convincingly. The molecular bases of an array of its virulence factors, viz. adhesins, exoenzyme S, exotoxin A, elastase and alginate, have been presented succinctly. A brief reference to other important opportunists, namely, *Staphylococcus epidermidis* and *Bacteroides fragilis*, has also been made.

Part III, aptly entitled ‘Future challenges’, deals with those bacterial diseases for which very little is known about the host–pathogen interactions at the molecular level. These include gastric and duodenal ulcers (Chapter 22), pseudomembranous colitis (Chapter 23), Lyme disease and syphilis (Chapter 24), legionnaires’ disease (Chapter 25), tuber-

culosis (Chapter 26), streptococcal pneumonia (Chapter 27), and streptococcal sore throat, rheumatic fever and glomerulonephritis (Chapter 28). The authors have strived hard to provide whatever scanty information is available on the molecular underpinnings of various virulence factors of the etiologic agents responsible for these diseases, though most of the time the discussion remains centred around virulence factors *per se*. Apart from making the readers aware of the paucity of information in these areas, these chapters serve to identify several hurdles which must be surmounted before significant inroads can be made into the molecular biology of the pathogens implicated in these diseases. These chapters also bring into focus those areas of bacterial pathogenicity which await seminal discoveries and would serve best to beacon enterprising researchers, especially those of the pioneering kind.

Interestingly, even though the authors have scrupulously avoided incorporation of many bacteria, the book covers a full range of paradigms of host–pathogen interactions and incorporates information from the most authoritative sources only. As the division of the text is neat, the focus is pointedly sharp on the molecular mechanisms of bacterial pathogenicity.

The boxed highlights are an assemblage of interesting historical facts, astute epidemiological work-ups and recently reported novel findings which impart a good degree of liveliness to the book.

The authors have toiled hard to make the text extremely lucid and the presentation immensely readable. The questions given at the end of each chapter and their answers (Appendix 4) would serve the dual purpose of self-evaluation by the readers and of provoking original thinking on the subject.

This book will be of much use to students, teachers and researchers in diverse fields who, in any way, are concerned with the pathogenicity of bacteria.

-
1. Viridi, J. S., *Curr. Sci.*, 1993, **64**, 118–119.
 2. Viridi, J. S., *Curr. Sci.*, 1993, **65**, 798–799.
-

J. S. VIRIDI

Department of Microbiology
University of Delhi South Campus
Benito Juarez Road
New Delhi 110 021, India