

BOOK REVIEWS

Molecular Basis of Bacterial Pathogenesis. Vol XI. Barbara H. Iglewski and Virginia L. Clark, eds. The Bacteria. A treatise on structure and function series. Academic Press Inc., San Diego, California 92101, USA. 1990. 473 pp. Price: \$85.

The advent of molecular techniques has contributed immensely to our understanding of the molecular mechanisms underlying the regulation of virulence determinants in microbial pathogens. This volume containing twenty, in-depth chapters highlights some of the more extensively studied bacterial pathogens. The volume has been divided into four parts, viz. introduction (chapters 1-2), surfaces and colonization (chapters 3-11), invasion and intracellular growth (chapters 12-14) and toxins (chapters 15-20).

In chapter 1 titled 'The "Zen" of Bacterial Pathogenicity', Stanley Falkow of Stanford University presents an overview of the subject and contends that pathogenicity does not occur by chance. A logical question would be— is there a microbial design to outwit the defence systems of the host? Falkow's reasoning in this context is sure to stimulate the thinking of researchers working in this field and, help them perceive bacterial pathogenicity in an altogether different perspective. This may open new vistas for further investigation.

It has been very thoughtful of the editors to include a chapter on population genetics of bacterial pathogenesis (chapter 2). This will be of immense help to both population geneticists and medical microbiologists who wish to understand the role of this new discipline in epidemiology, origin of new pathogens, discovering cryptic species and, structure and function of virulence factors besides its important role in establishing the clonal nature of pathogens.

Capsules are perhaps the longest known bacterial virulence factors. Chapter 3 deals with the biosynthesis of polysialic acid capsule and the mechanism by which it helps the pathogen to evade the host's immune system. This has been discussed in reference to *E. coli* K1, a major cause of neonatal meningitis. The organization of *kps* gene cluster coding

for polysialic acid capsule and its regulation has been presented in only a summarized form and lacks details.

Adherence to host surface being an essential first step in bacterial pathogenesis, chapter 4 compares the molecular structure and adherence characteristics of N-MePhe pili of *Pseudomonas*, *Neisseria* and *Bacteroids*. P pili containing specialized adhesins enable *E. coli* to stick and colonize human uroepithelial surface. Chapter 5 summarizes our understanding of biogenesis and adhesin properties of P pilus. The structure, function and regulation of *pap* (P pilus) gene cluster have been contrasted with those of *fim* (type 1 pilus), *fae* (K88 pilus) and *fan* (K99 pilus) gene clusters. The authors present a strong case for conducting further studies on minor pilins and pilus-associated adhesins which may help in identifying epitopes for successful immunoprophylaxis.

Chapter 6 on environmental modulation of expression of virulence determinants is yet another example of the editors' thoughtfulness. The authors have selected very good examples such as osmoregulation of porin synthesis in *E. coli* and nutritional regulation of *vir* (*bv*) locus in *Bordetella pertussis* to illustrate their point. This chapter is sure to kindle further interest in the subject.

Pathogens often resort to antigenic variation to elude the immune system of their host. This important theme forms the focus of discussion in the next three chapters. Chapters 7 and 8 regard recombination between an expressed gene copy and a partially homologous silent copy as the molecular mechanism underlying antigenic variation of pilin and variable major proteins (VMP), two important virulence determinants of *Neisseria meningitidis* and *Borrelia* spp. respectively. However, genetic events between intragenic homologous sequences seem to underlie the antigenic variation of group A streptococcus M protein (chapter 9). M protein structure and its relatedness among different serological types has been discussed in terms of its importance for developing an antistreptococcal vaccine. Role of M protein in resistance to phagocytosis has been included. These chapters have been written fairly in detail and taken together constitute a marvellous review on

antigen variation in bacteria and its molecular basis.

Iron acquisition within host is an important aspect of bacterial virulence. Chapters 10 and 11 have been devoted to iron acquisition by *E. coli* and non-*E. coli* species respectively. While the former deals with the organization of aerobactin operon of virulence plasmid pCoIV-K30 and its regulation by *fur* (ferric uptake regulation) gene product, the latter describes the molecules responsible for iron uptake in a number of pathogenic bacteria, viz. *Salmonella*, *Shigella*, *Yersinia*, *Vibrio*, *Neisseria*, *Haemophilus* and *Mycobacterium*. To researchers interested in this field, these chapters will serve to provide valuable leads for undertaking further work on the subject.

The next two chapters discuss molecular biology of intracellular parasitism. Chapter 12 gives a detailed account of the molecular biology of pathogenesis by *Salmonella*, a facultative intracellular pathogen. An array of genes have been described with a view to identify target points which may serve as potential sites for developing *Salmonella* vaccines. Chapter 13, about an obligate intracellular pathogen-chlamydia, describes several chlamydial molecules which deserve consideration as putative virulence factors. The role of these factors, both in entry and EB-RB (elementary body-reticulate body) differentiation, has been discussed.

Chapter 14 tries to explain, with suitable evidences including some elegant electron microphotographs, that the highly invasive nature of *Treponema pallidum* is due to its ability to penetrate intercellular junctions. There are good sections on *T. pallidum* attachment and invasion of endothelial monolayers and, relationship of invasion to pathogenesis. A modified methodology for studying treponemal invasion has been included.

Toxins, as virulence determinants, have always occupied an enviable position. No wonder the last six chapters have been devoted to the study of various bacterial toxins.

Lipopolysaccharide (*endotoxin*) has three distinct regions: the lipid A, core oligosaccharide and O-specific antigen. While chapter 15 is about structure, toxicity and other biological (anti-tumour and adjuvant) properties of natural as well as synthetic lipid A and

its analogs, chapter 16 is primarily an account of the differential interaction of chemically diverse O-specific antigens with complement and its importance in bacterial killing/survival. These chapters will serve to provide enough information to anyone evincing more than a casual interest in lipopolysaccharide.

In chapter 17 molecular genetics of *ctx* operon (containing two cholera toxin genes, *ctxA* and *ctxB*) and its regulation by *toxR* and *toxS* genes has been dealt with in fair detail. An important feature of the chapter is the inclusion of a detailed discussion on coordinate regulation of virulence determinants. This has been done in relation to the expression of toxin coregulated pilus (Tcp) and accessory colonization factor (Acf). The model of coordinate regulation proposed for the virulence determinants of *Vibrio cholerae*, however, raises many new questions which have been posed by the authors very explicitly at the end of the chapter.

Chapter 18 is a comparative account of the molecular structure, genetic basis and regulation and, role in human disease of Shiga toxin and *E. coli* Shiga-like toxins (SLT-I, SLT-II, SLT-IIv). A detailed discussion implicating Shiga-like toxins in haemorrhagic colitis and haemolytic uremic syndrome makes it an interesting chapter.

In chapter 19, detailed genetics of staphylococcal epidermolytic, entero- and membrane-damaging toxins along with the role these toxins play in causation of the disease, has been discussed in the chronological order in which discoveries relating to each of these toxins were made. This enables one to view the subject of staphylococcal toxins in its entirety. The authors deserve complement for their lucid presentation of a topic of bewildering proportions.

Chapter 20 is of special importance as exotoxin A domain structure has been discussed in relation to the specific functional aspects of the molecule. This chapter will be of most use to those who wish to comprehend the complexity of molecular events underlying the genetics of exotoxin A synthesis and its regulation. A section which compares exotoxin A to diphtheria toxin does not take into account a host of other ADP-ribosylating toxins.

This volume is an extremely valuable

collection of up-to-date articles dealing with almost all facets of pathogenic process and presents a very coherent insight of the molecular basis of bacterial pathogenesis. Most of the systems discussed represent fascinating models of host-pathogen interaction. Many complex aspects of the subject have been discussed in a fairly lucid style.

A very positive feature of the volume is that each chapter has a fairly detailed introductory section which gives an overview of the topic under discussion. Thus, this volume will be of use not only to those interested specifically in molecular mechanisms of bacterial pathogenesis but also to those interested in general aspects of virulence determinants in pathogenic bacteria.

A sufficiently good number of scrupulously selected references have been included at the end of each chapter making it a truly reference work. On the whole this volume is an important landmark in our endeavours to delve deep into the realms of bacterial pathogenicity, in man's perpetual quest for complete control of microbial pathogens.

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New Trends in Biotechnology. N. S. Subba Rao, C. Balagopalan, S. V. Ramakrishna, eds. Oxford and IBH Publishing Co. Pvt. Ltd., 66 Janpath, New Delhi 110 001. Rs 495, 434 pp.

Biotechnology has made rapid advancement during the past one decade. Now many technologies developed using biological systems find excellent applications. This has led to both commercialization of many of the technologies so developed and an interest in the basic research which leads to further development of newer technologies with wider applicability. The progress in biotechnology is due to the development of technologies like recombinant DNA technology, hybridoma technology, artificial synthesis of proteins and DNA, immunology, culture of both animal

and plant cells and tissues, protoplast technology and somatic cell hybridization, *in vitro* fertilization in both animal and plants, methods to overcome incompatibility barriers and techniques for embryo rescue after wide crosses in plants so as to produce hybrid between distantly related plant species, nitrogen fixation and micorrhizal associations, sericulture, aquaculture, etc. The amount of knowledge acquired in basic sciences during the past half a century is tremendous. Application of the newly developed technologies in the background of this knowledge on basic sciences, specifically those relating to the structure and function of living systems, has led to many novel areas of their application. There are many books available on different areas under biotechnology. Some of them are of a general nature and there are quite a few of them on specific areas giving in-depth information. This book, "New Trends in Biotechnology" is an addition to the literature available on biotechnology.

This book is the proceedings of a national symposium on the same theme held at Trivandrum on the 3rd and the 4th of June, 1988. In this book the works presented in the symposium are arranged under five headings, viz. General, Crop productivity, Crop protection, Nitrogen fixation and micorrhiza and Bioconversion.

Under the heading 'General' there are two excellent articles, one on 'Biotechnology and molecular biology of silk synthesis' by K. P. Gopinathan and the other on 'Strategies for field application of bioinoculants for augmenting food and fuel production' by N. S. Subba Rao.

In the section of 'Crop productivity', there are articles encompassing works on various tissue culture techniques for increasing crop production, viz. clonal multiplication, shoot tip and meristem culture, direct and via callus regeneration of plantlets, androgenesis, protoplast technology, etc. on plantation crops, herbaceous plants and woody perennials.

Under the section 'Crop protection', an article on 'Biotechnology for crop protection' by Panicker and Panicker gives an interesting account on biotechnological approaches for crop protection from pests, diseases, weeds, cropping without fertilizer, resistance to freezing