

electric projects during the recently elapsed few decades. Still demand for land is unabated with increasing human population, and thus pressure continues to mount on forests to meet the food requirement. Jhum cultivation when practiced under a sufficiently long cycle of 40–50 years allowed the regrowth of forests and maintained the ecological balance. But with the shortening of Jhum cycle to only 4–5 years, the recovery of the land has severely gone down and consequently degraded sites have mushroomed. Two major questions are pertinent in this context: a) how could the organic yield be sustainable in the agroecosystems (Jhum) so that not only the economy of the farmers is maintained, but also the diverse food need of the people is met, and b) what could be the possible package of prescriptions to revert back the degraded lands, created by Jhum, to their original forest status? In the third section entitled 'Management Implications', the author has discussed several strategies to answer the first question. The second one however remains unanswered and offers a challenging opportunity to the ecologists to do more on this line in the years to come.

On the whole, the book, which is a potentially fascinating compendium of about two-decade long experience of the author and his research team on various aspects of shifting cultivation, offers a few more new insights over those published previously by the author through about 150 papers cited in the reference section. Yet, this endeavour would have been more informative and ingenious had the work on several other aspects, notably, dynamics of microbial populations during succession on the Jhum fallows, which is in fact investigated by a number of workers particularly at the North-Eastern Hill University, Shillong, been solicited. Nevertheless, the book would not only be a useful review of the background information, but also a wealthy reference guide for researchers, especially those making a dent in this field. Finally, as rightly emphasized by the author with zeal in the foreword, that this study is though location-specific as well as problem-specific to the north-eastern hill areas of India, the concepts and principles involved may have wider applicability for re-developing traditional societies else-

where, particularly in the humid tropics.

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**Molecular Biology of Bacterial Infection: Current status and future perspectives.** Hormaeche, C. E., Penn, C. W. and Smyth, C. J., eds. Society for General Microbiology Symposium 49, Cambridge University Press, Cambridge CB2 1RP. 1992. 329 pp. Price: £ 55.

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Studies aimed at unravelling the molecular basis of bacterial pathogenesis are no more in their infancy and seminal contributions are being made in this area. The book under review presents a timely account of such contributions made in the recent years. The fifteen-odd reviews included in this volume can be classified into six groups, viz. methodological aspects of molecular approaches to studying bacterial pathogenicity, environmental-factor-dependent regulation of virulence determinants, antigenic variation, toxins, intracellular parasitism and miscellaneous aspects.

There are two reviews on methodological aspects. Finley outlines the various molecular genetic techniques such as recombinant DNA technology, transposon mutagenesis, suicide plasmids, etc. and dwells upon some of the limitations of these methods when applied to the study of bacterial pathogenesis. He, however, suggests several strategies to overcome these limitations. In the second review Foster analyses retrospectively several important studies which employed molecular genetic techniques to study bacterial pathogenicity and identifies some equivocalities therein, suggesting, at the same time, ways to improve the objectivity of future studies. He also points out several leads work along, which must be undertaken to answer certain missing links in our understanding of the pathogenicity of some well-known bacterial pathogens. This review is the most critical in the volume and will be of immense utility to researchers as it would help them identify and avoid pitfalls, in both the experimental

designs and interpretation of results, when employing tools of molecular biology to the study of bacterial pathogenicity.

The recognition, in the recent years, that expression of virulence determinants is modulated in a co-ordinated manner in response to changes in the environment, has greatly expanded the intellectual horizons of our understanding of the mechanisms of bacterial pathogenicity. This modulation is accomplished through the two-component signal transduction systems and serves to provide expression to virulence determinants at appropriate time. Dorman and Ni'Bhrain discuss environmental modulation of both the dedicated virulence regulons such as those regulated by ToxS/ToxR (*Vibrio cholerae*) and bvgS/bvgA (*Bordetella pertussis*) and, regulons having roles in commensal as well as pathogenic life of bacteria such as those regulated by EnvZ/OmpR and phoP/phoQ systems. Regulon networking and, role of DNA topology and nucleoid-associated proteins in regulation of gene expression have been discussed. In the same context Cornelis presents a working model for the temperature and, temperature and calcium controlled regulation of *YadA* (*Yersinia adhesin A*) and *Yop* (*Yersinia outer membrane protein*) gene expression respectively. Taken together the two articles constitute an excellent review on the global regulation of gene expression and its implications in bacterial pathogenesis.

Antigenic variation is the pathogens' answer to extensive defence repertoire of mammalian immune system. It not only allows the pathogens to escape the host's specific defense, but also helps them fine-tune their virulence factors by optimization of receptor-ligand interactions. Three groups of investigators discuss this important subject from three separate aspects. While Robertson and Meyer focus on variation and regulation of expression of bacterial fimbriae, Smyth and Smith discuss the molecular mechanisms which underlie such antigenic and phase variation. Moxon and Maskell view this subject in particular reference to variable LPS epitope expression in *Haemophilus influenzae*. To sum up: the mechanisms which determine antigenic and phase variation include intragenomic and intergenomic homologous recombination (e.g. *Neisseria*

*gonorrhoeae* type 4 pili), site-specific recombination via the inversion of control elements (e.g. *Salmonella typhimurium* flagella and *E. coli* type 1 fimbriae), recombination via oligonucleotide repeats (e.g. opacity-associated proteins of *N. gonorrhoeae*) and deletions and additions of nucleotides in homopolymeric sequences (e.g. *B. pertussis* fimbriae and size variant surface lipoproteins (Vlps) of *Mycoplasma hyorhinis*). Phase variation without DNA rearrangement and dependence on methylation status of Dam (deoxy adenosine methylase) sites within UAS (upstream activating sequence) region as seen for Pap (pyelonephritis associated pili) fimbriae of *E. coli* has also been included. Genetic organization of fimbriae of other pathogens, viz. enterotoxigenic *E. coli*, *Moraxella* sp., *Pseudomonas aeruginosa* and *Vibrio cholerae* has also been included. Taken together these articles constitute an exhaustive and lucid review of the molecular mechanisms which underlie antigenic variation in bacterial pathogens.

Bacterial toxins, for most part, are considered to be elements of unequivocal virulence. Interestingly, neither of the two reviews on bacterial toxins incorporated in this volume deal with this attribute. It has been very thoughtful of the editors to include, instead, some unconventional aspects of toxins. Hewitt *et al.* discuss superantigenic activities of bacterial toxins. There is an indepth account of the interaction of staphylococcal enterotoxin, a superantigen, with variable region of  $\beta$ -chain of TcR (TcRV $\beta$ ) and MHC class II antigens. Other superantigens namely minor lymphocyte stimulating (Mls) antigens and *Mycoplasma arthritidis* mitogenic (MAM) toxin have been dealt with briefly. Superantigen-induced clonal anergy and clonal deletion have been discussed from the point of their therapeutic potential. In the second article, Wren reviews comparatively the most recent molecular studies on structure and interaction with receptors, of the members of three families of enterotoxins, viz. cholera toxin (CT) and *E. coli* heat-labile toxins (LT-Is, LT-IIIs), Shiga toxin (ShT) and Shiga-like toxins (SLT) and, the *Clostridium difficile* enterotoxin, toxin A. This

review meticulously brings out that mechanisms which underlie specific carbohydrate (receptor)-protein (toxin) interactions are bound to be exceedingly complex.

Some life styles of pathogenic bacteria are still poorly understood and the molecular underpinnings of these are not known at all. In a short review, Kaufmann and Flesch discuss life within phagocytic cells. This is an important article as it introduces the readers to some of the newer aspects of the whole gamut of intraphagocytic survival of pathogens such as potential role as virulence factors of heat shock proteins produced in response to intraphagosomal stress and, role of interleukins and cytotoxic T lymphocytes as terminators of intraphagocytic infections. Penn discusses chronic infections, latency and the carrier state, and contends that avoidance and suppression of the host's immune system by the pathogen, minimal immunogenicity of these organisms and antigenic variation, which apparently seem to explain latency, chronicity and carrier state, may not necessarily be the mechanisms which underlie these phenomena. Slow growth of the pathogens *in vivo* and minimal damage to host, instead, are the essential elements of latency, chronicity and carrier state. This review is remarkable for its indepth reasoning and range of the pathogens discussed.

The miscellaneous group includes one review each, on development of gut microflora, recent developments in the evolution of pathogenic bacteria, molecular biology of epithelial cell invasion and, development of *Salmonella* vaccines.

The various factors such as chance, selection and local immune system which dictate the composition of a host's intestinal microflora and its protective role termed as 'colonization resistance' has been discussed by Van Der Waaij. Review by Sansonetti illustrates, using shigellosis as paradigm, the role of bacterial invasins, host integrins and induced (directed) phagocytosis in the process of epithelial cell invasion. Intracellular movement and cell to cell spread of *Shigella flexneri* has been discussed in the light of recent findings about contact haemolysin and polymerization of host-

cell actin filaments. Molecular evolution is a knotty area. Achtman and Hakenbeck discuss several recent observations which illustrate the importance of horizontal genetic exchanges in the evolution of pathogenic bacteria. This is quite different from Kimura's well known, though controversial, neutral theory of molecular evolution. The last review in the book highlights the practical implications of studying the molecular biology of bacterial infections. In this review Chatfield *et al.* discuss how such studies have been pivotal in the development of a new category of vaccines usually termed as *Salmonella* vaccines. However, the authors also discuss, in no uncertain terms, the obstacles which must be surmounted to make these vaccines a reality.

All the reviews incorporated in this volume have been written by individuals who are the acknowledged current experts of their respective fields. This is clearly reflected in the lucidity with which each of the reviews has been written and presented.

Almost all major aspects of bacterial pathogenicity have been discussed. Inclusion of some of those aspects of virulence factors which ordinarily are not included in works dealing with bacterial pathogenicity constitutes an appreciative feature of this volume.

This volume has been written with the aim to provide a state-of-the-art reference work for researchers in the areas of bacteriology, medical microbiology, infection, epidemiology and, vaccine and drug development. This is clearly borne out by the bibliographic references as most of the cited literature appeared in the last four to five years. This volume would also serve as an excellent source book for teaching an advanced course on bacteriology and medical microbiology.

On the whole this compilation of highly authoritative reviews would go a long way in providing further impetus to research in the area of bacterial pathogenicity.

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