

Book Reviews

Plant-Microbe Interactions Volume 1: Molecular and Genetic Perspectives, by Tsune Kosuge and Eugene Nester (eds), 1984, Macmillan Publishing Company, New York, 444 p.

There is mounting evidence that higher plants cannot grow and reproduce optimally without associated microorganisms. Hence, plant microbiology is an important subdiscipline of microbial ecology, focusing on the dynamic interactions between microbes and plants. Recent breakthroughs in the understanding of the biochemistry and molecular biology of these interactions may make it possible to develop new strategies for improving crop productivity. For instance, the discovery that bacterial DNA can integrate into and be expressed in plant cells has catalyzed research in agricultural biotechnology designed to improve crop yields by enhancing plant-microbe interactions such as plant disease resistance or nitrogen fixation.

This text is intended to be the first in a series of biennial volumes on plant-microbe interactions, focusing on the molecular aspects and including those which are beneficial (e.g., symbiotic nitrogen fixation) and detrimental (plant diseases). The book is organized into 5 sections: overview, approaches and tools for plant microbiology research, molecular biology of recognition phenomena, plant response to the environment, and strategies for biological control. The first chapter, by Beringer and Johnson, is a welcomed introduction of concepts and terminology in plant-microbe interactions. This chapter also describes the general usefulness of genetic analysis to study genes involved in plant-microbe interactions. The second chapter, by Dunke, presents an overview on factors of pathogenicity, including adhesion, colonization of the host, toxins, and enzymes as determinants of pathogenesis. The third chapter, by van Ethen and Kistler, focuses on an interesting and critical review of how regulation of certain pathogen gene products determines the outcome of plant-microbe interactions. Examples selected include degradative enzymes, cyanide dehydratase, pisatin demethylase, pectolytic enzymes, and enzymes involved in production of phytohormones and phytotoxins. The next important chapter, by Gilchrist, discusses the gene-for-gene concept and indicates that the time is ripe to address this central hypothesis on pathogenicity using modern molecular biology techniques, since the conventional genetic techniques have not yielded the molecular basis for resistance genes. A criticism of this chapter is that it fails to identify oligosaccharides and polysaccharides of the invading microbe as important messengers of biological activity on the host plant in the discussion of cell-cell communications.

Four chapters on critical discussions of methodologies and tools to study

plant-microbe interactions are helpful, particularly suited for the graduate student entering this fascinating field. Topics covered include new approaches to identify plant viruses, genetic engineering methodologies, development of vectors used to induce genes into plants and microbes, methods to select mutants, and finally genetic engineering of plants.

Lippincott's chapter on host-microbe recognition is provocative, addressing the important concept of recognition events occurring at multiple steps culminating in symbiosis or disease. Considered are toxic and tropic responses, contact adhesion, and post-contact recognition.

The discussion on experimental approaches to study microbial adhesion to plants is, however, duplicated in the subsequent chapter by Pueppke. This chapter critically addresses the evidence for and against the importance of bacterial adsorption to plants in symbiotic and pathogenic associations. Some problems with this chapter should be avoided in future volumes of this series. The major flaw is inaccurate discussion of data published before the review was written, e.g., the design of experiments to detect monovalent (not just multivalent) lectin, or the examination of multiple varieties of plants and multiple strains of bacteria (not just one) for evidence of host lectin-*Rhizobium* interactions. Several of the arguments against the role of lectins in recognition are based on a lack of data available at the time of writing, e.g., presence of lectins in roots, binding of lectin to rhizobia only at pHs that would be incompatible with infection, etc. However, the reader should be made aware that many of these gaps have since been filled and clarified. In the most dramatic case, the strongest argument against the lectin-recognition hypothesis was Pueppke's important discovery of soybean lines which lack seed lectin yet produce roots that are nodulated normally. However, a more in-depth study of this system using molecular biology techniques has established that these rare soybean lines are mutated in the seed lectin gene but, nevertheless, still possess a separate gene controlling lectin synthesis in their roots which continues to function. Thus, because cellular recognition is a very active field of study, the full value and accuracy of reviews on this subject are unfortunately short-lived.

The chapter on genetics of *Rhizobium* nodulation by Long is very well written. However, the reader must again recognize that this field has advanced significantly during the last 2-3 years, at least doubling the volume of important findings in this important area.

This is followed by informative chapters on the biochemical responses of the host to wounding and induced disease resistance. Next, a lengthy chapter is devoted to a broad-based treatment of plant tumorigenesis incited by bacteria, viruses, fungi, and insects. I found it interesting to read the section addressing the many remaining unanswered questions regarding *Agrobacterium*-induced tumors, particularly the infection process and mechanisms of T-DNA incorporation into the host cell.

The final section of the book is devoted to biological control, which continues to grow as an important direction of future research in plant microbiology. The chapters include discussions of ecological interactions among microbes on the phyllosphere (competition, hyperparasitism, adaptations), exploitation of "hypovirulent" pathogens to displace more virulent pathogens on plants, and a

hypothetical model for cross-protection of viral pathogens. Although important subjects in their own right, these chapters seem out of place in this book since they lack molecular and genetic perspectives.

Overall, I recommend this as one of several primer texts for graduate students entering this fascinating field of plant microbiology (an equally useful competitor is Verma & Hohn's Plant Gene Research series, vol. 1 "Genes Involved in Microbe-Plant Interactions" published 1984 by Springer Verlag). An important suggestion for improvement of future volumes would be for the editors to more critically integrate the chapters and eliminate excessive duplication of subject matter in different chapters. I look forward to reading the second volume sequel, which has just been received.

Dr. Frank B. Dazzo
Dept. of Microbiology
Michigan State University
East Lansing, Michigan 48824
USA

The Bacterial Cell Surface, by Stephen M. Hammond, Peter A. Lambert, and Andrew N. Rycroft, 1984, Croom Helm, London and Sydney.

This book on the structure and function of bacterial cell components could prove to be a useful introductory text if the reader were forewarned not to rely too much on the authors' interpretations of some specific functions and generalizations, but rather to use the book as a guide to the more well-established aspects of bacterial surface structures. This is not to say, however, that the book contains countless factual errors. The authors, in order to pack an enormous amount of information into slightly over 200 pages, have been forced to rely on limited examples and many generalizations. This has resulted in a few somewhat misleading statements. Whereas these do not detract from the general usefulness of the book, there are other, more serious, errors of fact, particularly in the last three chapters which deal with the functions of surface components. One feels that these errors were avoidable.

To the authors' great credit, the book is written concisely which makes for easy, enjoyable reading. The diagrams, figures, and tables are clear and informative and the limited references were up to date at the time of publication. This is particularly true of the first three chapters which deal with surface structures. These chapters suffer far less from the tendency of oversimplification found in the rest of the book.

The book is recommended with reservations and may be most useful in courses where errors in the text can be corrected.

G. W. Jones
Department of Microbiology and Immunology
University of Michigan Medical School
Ann Arbor, Michigan 48109, USA