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Genes Involved in Plant Defense

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Preface

Many fungi and bacteria that associate with plants are potentially harmful and can cause disease, while others enter into mutually beneficial symbioses. Co-evolution of plants with pathogenic and symbiotic microbes has lead to refined mechanisms of reciprocal recognition, defense and counter-defense. Genes in both partners determine and regulate these mechanisms. A detailed understanding of these genes provides basic biological insights as well as a starting point for developing novel methods of crop protection against pathogens. This volume deals with defense-related genes of plants and their regulation as well as with the genes of microbes involved in their interaction with plants.

Our discussion begins at the level of populations and addresses the complex interaction of plant and microbial genes in multigenic disease resistance and its significance for crop protection as compared to monogenic resistance (Chap. 1). Although monogenic disease resistance may have its problems in the practice of crop protection, it is appealing to the experimentalist: in the so-called gene-for-gene systems, single genes in the plant and in the pathogen specify the compatibility or incompatibility of an interaction providing an ideal experimental system for studying events at the molecular level (Chaps. 2 and 4). Good progress has been made in identifying viral, bacterial, and fungal genes important in virulence and host range (Chaps. 3–6). An important aspect of plant–microbe interactions is the exchange of chemical signals. Microbes can respond to chemical signals of plant origin. This is exemplified by *Agrobacterium* which recognizes plant wound substances and responds by expressing a set of virulence genes (Chap. 7). Plants, on the other hand, recognize substances of microbial origin, so-called elicitors, and these induce an array of defense genes. Chapter 8 discusses the type of elicitor molecules involved, the perception of elicitors by the plant cells, and the transduction of the elicitor signals. The identification of genes induced in plants in the response to potential pathogens and elicitors is a rapidly developing field, and techniques for gene transfer into plants are being used to establish the function of these genes and their regulation. Included in this groups are genes encoding "pathogenesis-related" proteins (Chap. 9), antifungal hydrolases (Chap. 10), thionins (Chap. 11) and key enzymes in the phenylpropanoid pathway leading to the synthesis of several types of phytoalexins (Chap. 12) and lignin (Chap. 13).

The plant's defense against microbes is a much-studied and rapidly evolving topic. We hope that this volume, with its combination of current views of epidemiologists, biochemists and molecular biologists and with its emphasis on both plant and microbial genes, will provide a useful framework for future studies. We thank the authors for their excellent contributions and stimulating treatment of this interesting field. We also give special thanks to Sue Thomas who helped us in preparing the volume.

Basel, January 1992 Thomas Boller and Frederick Meins, Jr.

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