

---

# Preface

More than 50 years ago, Flor (*1*) proposed a model to describe plant–pathogen interactions based on genetic studies with flax and the flax-rust pathogen. His “gene-for-gene” model predicted that plant resistance would occur only when a plant possesses a dominant resistance gene (R) and the pathogen expresses the complementary dominant avirulence gene (Avr), conferring strain specificity. An alteration or loss of the plant resistance gene or the pathogen Avr determinant leads to disease in the host. The R gene products are hypothesized to act as receptors for the products of the Avr locus. As a result of intense research in the last 10 years, it is now well established that Flor’s model still holds true for many host–pathogen interactions.

We now know that components of innate immune systems in both plants and animals share many conserved features (*2*). Most notably, they sense the presence of pathogen-associated molecular patterns, which represent conserved molecular structures, and Avr factors. Many plant bacterial pathogens use type III secretion systems to secrete proteins into host cells, where they can affect host cell metabolism and, in some cases, be detected by intracellular R proteins. In contrast, little is known about the identity, production, and secretion of pathogen-associated molecules detected at the cell surface. The first three chapters in *Plant–Pathogen Interactions: Methods and Protocols* describe methodologies being used to identify and characterize such pathogen-associated molecular patterns or Avr factors from bacteria, and the plant responses they trigger. Chapters 4 and 6 describe methods for identifying and characterizing such molecules from oomycete and fungal pathogens.

Identification of many of the first R genes was carried out by positional cloning approaches, which establish linkage of plant resistance to markers whose physical location in the genome is known. Over the last few years, major advances in plant genomics have made positional cloning in rice and *Arabidopsis* much more efficient. These methods and resources are described in Chapters 5 and 7.

Advances in genomics and proteomics led to new methods to identify genes and proteins that are potentially involved in resistance-signaling pathways. Microarrays, which consist of dense arrays of oligonucleotides attached to a solid surface such as glass, are increasingly being used as more complete arrays are produced and analytical tools are becoming easier to use. For deep transcriptome analysis, robust long-serial analysis of gene expression and massively parallel signature sequencing are the methods of choice. Of the proteomic methods, the

yeast two-hybrid system employs yeast to identify proteins that interact with a particular “bait” or plant-signaling protein. Another method applies proteomic techniques to investigate posttranscriptional changes by enriching for specific proteins before two-dimensional gel separations. These approaches are described in Chapters 8–13.

Viral-induced gene silencing and RNAi silencing can be used to quickly assess the function of a particular protein in plant leaves or plant roots. These strategies and their molecular mechanisms are described in Chapters 14–16.

The review Chapters 17 and 18 describe methods for engineering resistance to plant viruses and demonstrate the utility of this approach for development of virus-resistant crop plants of value for agriculture.

In summary, *Plant–Pathogen Interactions: Methods and Protocols* gathers together some of the key methods used in studies of plant–pathogen interactions and includes chapters describing how this knowledge is being used to develop new strategies for disease control. We hope you find it useful.

***Pamela C. Ronald***

## References

1. Flor, H. H. (1971) The current status of the gene for gene concept. *Ann. Rev. Phytopath.* **9**, 275–296.
2. Ellis, J., Dodds, P., and Pryor, T. (2000) Structure, function and evolution of plant disease resistance genes. *Curr. Opin. Plant Biol.* **3**, 278–284.



<http://www.springer.com/978-1-58829-448-7>

Plant-Pathogen Interactions

Ronald, P.C. (Ed.)

2007, XII, 248 p. 24 illus., Hardcover

ISBN: 978-1-58829-448-7

A product of Humana Press