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Book Review: Plant Infectious Agents

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Plant Viruses

Plant Infectious Agents. Viruses, Viroids, Virusoids, and Satellites. HUGH D. ROBERTSON, STEPHEN H. HOWELL, MILTON ZAITLIN, and RUSSELL L. MALMBERG, Eds. Cold Spring Harbor Laboratory, Cold Spring Harbor, N.Y., 1983. x, 230 pp., illus. Paper, $23. Current Communications in Molecular Biology. From a conference, Feb. 1983.

Traditionally, few biochemists and molecular biologists have investigated plant viruses. The number who do has increased during the past decade, however, because of the discoveries of new and unusual viruses, unsuspected properties of well-known viruses, and viroids, which are smaller than viruses. This book of summaries of reports given at a meeting contains many ideas, some results, and a little history and methodology. The ideas and results are current, and some of them have not been published elsewhere. The emphasis is on the molecular biology of plant viruses, and most work on this aspect of the subject is included. Other aspects, such as pathology, epidemiology, and control, are not covered. There is some repetition among reports, and there are a few errors, but neither are serious drawbacks.

Among the pathogens of most interest to molecular biologists are the viroids, which are small infectious RNA's about 250 to 400 nucleotides long. Viroids cause serious plant diseases, such as potato spindle tuber, citrus exocortis, and cadang cadang of coconut. There are no cures, and prevention is the only known control. Similar disease agents have not yet been found in animals. Viroids apparently do not code for proteins or polypeptides. The mechanism by which they cause disease is unknown, though it has been postulated that they interfere with messenger RNA splicing or some regulatory process. Multimeric forms, possibly replicative intermediates, have been found in infected cells, and DNA polymerase II has been implicated in their replication. The demonstration by Diener and his colleagues that cloned complementary DNA dimer of potato spindle tuber viroid is infectious opens the way for studying the effect of directed base changes on their function.

Virusoids are small RNA's with a structure similar to that of viroids, but they are always associated with a larger viral RNA. Three of the four known virusoids are reported to be necessary for the replication of the larger RNA and to be a part of the virus genome. The fourth virusoid appears to be more like a satellite, that is, an extra RNA associated with a virus that is only able to replicate in cells infected by the virus. Virusoids have only been known for a few years and have been found only in Australasia. They have already been sequenced by Symons and colleagues, but information on their biological activity is incomplete.

DNA-containing plant viruses were not discovered until the late 1960's, and only a few of them have been described. Along with the Ti plasmid of *Agrobacterium tumefaciens*, they are considered as possible vectors for introducing DNA into plants. Cauliflower mosaic virus is representative of the single group with a double-stranded DNA genome. It has circular double-stranded DNA with one gap in one DNA strand and two gaps in the other. However, a supercoiled form in a minichromosome-like structure found in infected cells has no gaps and serves as the template for transcription of four RNA's. One of these RNA's is genomic-sized and may be a replicative intermediate. Cauliflower mosaic virus thus has similarities to the animal retroviruses and possibly to hepatitis in having both RNA and DNA stages in the replication of its genome. Absence of a DNA replication origin will limit its usefulness in recombinant DNA technology.

The single-stranded DNA plant viruses are the gemini viruses. They have two genomic DNA's of similar size, except those from Australia, which have only one. Perhaps the Australian tradition for unusual flora and fauna extends to viruses.

This book also contains research reports on some of the better-known plant viruses. Notable is the recent progress in the purification of template-dependent, virus-specific RNA-dependent RNA replicases from plants infected with brome mosaic and cowpea mosaic viruses, the confirmation of mutations induced in maize by barley stripe mosaic virus, and encapsidation of chloroplast RNA transcripts in pseudovirions of tobacco mosaic virus. As many as nine subgenomic RNA's of tobacco mosaic virus have been reported, but published evidence for some is scanty, and Zaitlin and coworkers suggest that six may be artifacts. These and other observations promise progress in studies of interactions of plant viruses and their hosts.

An appendix contains 15 base sequences of plant viruses, viroids, virusoids, and satellites.

This is not the book to go to for exhaustive coverage or detailed experimental protocol, but it is excellent for a concise version of recent developments in the molecular biology of plant viruses.

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