PREFACE

The year 1962 marks the first discovery of a fungal virus, in cultivated mushroom (Hollings, 1962)[1], and is considered the birth date of fungal virology. The belated discovery of mycoviruses may reflect the fact that latent infections are common. There were, however, some clues to suggest the existence of fungal viruses prior to 1962, for example, the discovery in 1959 of the transmissible disease of *Helminthosporium victoriae* thought to have a viral etiology. This year, 2012, we celebrate the 50th anniversary of the discovery of mycoviruses, and it is indeed timely to prepare a thematic issue on mycoviruses for the *Advances in Virus Research* (AVR).

Considerable progress in our knowledge of mycoviruses has emerged during the past 50 years. Fungal viruses occur widely in all major taxa of fungi and they have diverse genomes including positive-sense single-stranded RNA (classified into five families: *Alphaflexiviridae*, *Barnaviridae*, *Gammaflexivirida*, *Hypoviridae*, and *Narnaviridae*), double-stranded RNA (also classified into five families: *Chrysoviridae*, *Endornaviridae*, *Partitiviridae*, *Reoviridae*, and *Totiviridae*), and recently geminivirus-like circular ssDNA genomes (unclassified).

Although progress in molecular characterization of mycoviruses was fast and plentiful information was generated on the diversity of genome organization and relationships to viruses of other organisms, only limited progress was made in understanding their biology including host range, infection and replication processes, and their interactions with their hosts. A major reason for this was the fact that fungal viruses are not readily amenable to conventional infectivity assays. However, recent technological advances allowed for transfection of fungal protoplasts with purified virions or with full-length viral transcripts and transformation with full-length cDNA clones of viral RNA. These developments allowed for the completion of Koch's postulates and for expanding the host ranges of desired mycoviruses as well as for engineering mycoviruses for improved biological control potential. The development of a hypovirus reverse genetics system, the first for a mycovirus, is credited for much of the progress in this aspect.

Studies of viruses that infect phytopathogenic fungi are gaining in strength and intensity because of the current convincing evidence that mycoviruses are

[1] Hollings, M. 1962. Viruses associated with a die-back disease of cultivated mushroom. Nature (London) 196, 962-965.

responsible for debilitation and/or hypovirulence phenotypes in many economically important plant pathogens. From agricultural perspectives, mycoviruses may contribute to sustainable agriculture as biological control agents. Presently, control of plant pathogenic fungi is a formidable task because of the lack of appropriate disease control strategies. In addition to the health hazards and the risks to the environment, the use of fungicides is often cost prohibitive.

Study of virus/host interactions is a main area of modern virology. With the recent advances in fungal genomics and availability of mycovirus reverse genetics systems, it is now possible to use mycoviruses as tools to explore the physiology of their fungal hosts. Some fungal virus systems have contributed not only to the study of mycoviruses but also to the study of many areas in biology including virus–host cell interactions and general virology. The best example here is the yeast Saccharomyces cerevisiae virus-L-A (ScV-L-A), the prototype of the family *Totiviridae* and the best-studied dsRNA mycovirus biochemically and at the molecular and structural levels. The discovery of the yeast killer phenotype and establishing that secreted killer proteins are encoded by satellite dsRNAs depended on ScV-L-A for replication, and encapsidation have substantially strengthened our knowledge in many areas of biology and provided deeper understanding of essential cellular mechanisms such as posttranslational preproprotein processing in the secretory pathway.

The ability to purify well-characterized mycoviruses, particularly those in the families *Chrysoviridae*, *Partitiviridae*, and *Totiviridae* in good quantity and high quality, encouraged the collaboration between structure biology and mycovirology laboratories, and as a result, novel mycovirus capsid structural features were revealed.

In summary, the more we know about fungal viruses, the more we discredit the idea that all viruses are evil. Mycoviruses are indeed the good guys and hold great promise for exploitation as biological control agents. Mycovirus-encoded killer toxins are becoming more interesting with respect to possible applications in biomedicine and production of transgenic plants with broad resistance to plant pathogens. Furthermore, mycoviruses are of common occurrence in endophytic fungi with potential exciting mutualistic roles in the complex interactions with endophytes and plants. These topics and others are discussed in this volume of AVR by the world leaders in the field of fungal virology.

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Said A. Ghabrial
Editor