

Viruses of Microorganisms

<https://doi.org/10.21775/9781910190852>

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Caister Academic Press
Norfolk, UK

www.caister.com

British Library Cataloguing-in-Publication Data
A catalogue record for this book is available from the British Library

ISBN: 978-1-910190-85-2 (paperback)

ISBN: 978-1-910190-86-9 (ebook)

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Cover design adapted from a composite image of living *Chrysochromulina parva* CCMP291 cells (bright-field microscopy; 100x magnification) together with infected cells undergoing lysis (false-coloured TEM thin sections; 12,000x direct magnification). Steven M. Short and Beata Cohan of the University of Toronto Mississauga created the original image. See *Chapter 10* for information on viral infections of *C. parva*.

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Preface

The timing of our taking on the editing of this monograph, *Viruses of Microorganisms*, is of interest as it both was and was not associated with seemingly related events. The first event was our editing of the 2012 monograph, *Bacteriophages in Health and Disease* (CABI Press). It was both well into the editing of that book, and to our knowledge without connection, that Caister Academic Press suggested that we take on the editing of this new volume. We assume that the editing of previous books on viruses and specifically phages by one of us (Abedon) is what motivated the connection, and it clearly was our idea that this be a second joint editing effort, so we accept that no strange coincidences were at work in our being asked to take on (yet) another editing task.

What was strange was the specific subject of this text. For a number of years prior to our being tagged with this new editing task, both of us had been intimately and some might argue excessively involved in the founding of a professional society that ultimately would come to be named the International Society for Viruses of Microorganisms (see ISVM.org). This society, as we were being contacted to write on this very subject, did not yet exist and indeed neither of us had published (at that point) on anything beyond bacteriophages. Because viruses of a specific type of microorganism (bacteria) were our primary research interests (Hyman and Abedon, 2009, 2012a, 2015), there is no reason to assume that either of us knew much virology beyond that of these 'phages'. So here we have what clearly was complete coincidence – ISVM and this monograph – but just as clearly we should assume that the concept of 'Viruses of Microorganisms' must have been in the air.

What followed, in turn, was as not coincidental as can possibly be. Prior to taking on the task of pulling together a book on a subject, one which at best we possessed only tangential familiarity, we decided to write on that very subject. The result, to our knowledge, is the very first in-depth review of the concept of viruses of microorganisms (Hyman and Abedon, 2012b). This article was piloted as a poster at the Viruses of Microbes 2012 meeting, which further convinced us that the article needed to be written. While in terms of timing, it should seem 'obvious' that the editing of this book was our plan all along, as the review was published in 2012, but in fact it was the poster and review that stemmed from the book rather than the other way around. And even worse, in terms of establishing cause and effect, although in the Spring of 2012 we were pondering the writing of a review, on something, we in fact had not yet hit upon just what that something might be. It was only in preparation for going out to eat Chinese food, at Sue Min's (formerly of Wooster, Ohio), that the idea of writing such a review was hatched. Over that dinner it was decided that this indeed would be a good thing to do, and we then spent the month of May, 2012, doing the writing and extracting the tables for the poster.

We, of course, were not alone in building on this theme. In addition to the series of Virus of Microbes meetings which have taken place in Europe (Paris in 2010, Brussels in 2012, Zurich in 2014, and Liverpool in 2016), there has been a recent special issue on viruses of microbes published in the journal, *Viruses* (http://www.mdpi.com/journal/viruses/special_issues/viruses_microbes). Thus, we feel that now is perhaps an ideal moment to take a step

back to summarize the totality of the field, i.e. with a multi-authored volume on just this subject, the viruses of microbes or, more formally and reflecting the name of the associated society, the *Viruses of Microorganisms*.

In this volume, which inspired that review, we begin with a chapter that was inspired by that review, that is, considering just what distinguishes viruses of microorganisms from viruses in general. We follow this with a chapter, by Evelien Adriaenssens, that is both comprehensive and basic to what viruses of microorganisms are. This chapter is so comprehensive and basic that we considered it to be what essentially is now a co-introductory chapter. These introductions are then followed by chapters which set out the context of viruses of microorganisms, in terms of their evolution and particularly their ecology as well as environmental microbiology. In other words, what is 'out there'. The next section of the book then examines specific categories of viruses of microorganisms including the viruses of domain Bacteria (a.k.a. bacteriophages or phages, but also bacterial viruses), the viruses of domain Archaea (in the more modern literature usually described as archaeal viruses), and the many categories of viruses of microbial members of domain Eukarya.

While viruses of domain Archaea and Bacteria unambiguously are all viruses of microorganisms, domain Eukarya consists of a combination of microorganisms (especially although not necessarily exclusively single-celled eukaryotes), macroorganisms (animals, plants, many fungi, and a fair number of quite large protists), and organisms that are not necessarily easily categorized as microorganisms versus macroorganisms (especially

various fungi and protists that are of intermediate size and/or complexity). Although clearly these lists and distinctions ought to be sufficient, we nonetheless can add as well what can be described as viruses of viruses, that is, viruses whose hosts consist solely of virus-infected cells, here called virophages.

Lastly are various 'application' chapters. First is a chapter about the roles of viruses of microorganisms in biotechnology. Mostly the latter has involved phages, but as we learn more about other viruses this will likely change. This theme is then expanded beyond just phages in terms of the potential for the use of viruses of microorganisms as anti-microorganism agents. Smaller fleas... can be the enemies of our enemies, and therefore viruses of unfriendly microorganisms can be our friends! Lastly is a chapter describing techniques, especially as used to characterize viruses of microorganisms ecologically.

We are hopeful that you will find this book helpful, and that you will come to find the viruses of microorganisms as fascinating as we do.

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