

VIRUS EVOLUTION: CURRENT RESEARCH AND FUTURE DIRECTIONS

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BOOK REVIEW

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Virus Evolution: Current Research and Future Directions. S. C. Weaver, M. Dennison, M. Roossinck, and M. Vignuzzi (editors). Caister Academic Press, Poole, UK. 2016. 366 pp. Paperback ISBN: 978-1-910190-23-4, Ebook ISBN: 978-1-910190-24-1. £159, US \$319.

Review by Denise A. Marston

This is a highly informative book that summarizes recent advances in virus evolution in a comprehensive yet accessible manner. Traditionally monopolized by a few human pathogens such as human immunodeficiency virus (HIV), Hepatitis C, and influenza virus, the virus evolution field has recently expanded to include the viruses that cause emerging zoonoses such as severe acute respiratory syndrome, Middle East respiratory syndrome (MERS), dengue, and Ebola. Edited by world-renowned viral evolutionists, this book benefits from 12 chapters, all written by prominent scientists within the relevant subject matters.

The initial chapters are particularly commendable as introductory material; the first addresses why viruses have high mutation rates and how they can be quantified and then discusses the implications for disease emergence and control. The second chapter is an excellent introduction to viral informatics, including where to find related resources such as viral sequence databases and analytical software. Clearly, there is something for everyone in these chapters; although aimed

at the novice, even the most experienced viral evolutionist can glean something.

Preconceived notions of the contents and focus of this book are not disappointed. For example, there is a good smattering of the old faithful viruses (i.e., HIV, Influenza A, and Ebola virus). However, there are some welcome surprises, such as Chikungunya virus and parvovirus, which help to keep the reader's attention. Chapter 10, "Paleovirology: The Study of Endogenous Viral Elements," is one of the more interesting chapters, suggesting viruses are much older than previously realized. Likely to become a firm favorite in future virus evolution books, here it is modestly introduced, providing examples across the seven main groups of viruses classified by the Baltimore system. This rapidly expanding field has capitalized on the overall expansion of high throughput sequencing technologies, utilizing host genomic data to identify endogenous viral elements, which ultimately are the closest we have to 'fossils' of contemporary viruses.

Whether readers of the *Journal of Wildlife Diseases* should invest in this book is a matter of context. One could argue that viruses are the most abundant and genetically diverse entities, present and ultimately 'parasitic' in all major domains of life, evolving over hundreds of millions of years to the enormous expanse observed today, and hence the content is applicable to every reader. Indeed, I would venture so far as to say that chapters within this book would inform and inspire wildlife disease professionals to better appreciate and understand the evolutionary strate-

gies of their favorite viruses or perhaps those that affect their most-liked wildlife populations. Perhaps more importantly, reading this book would broaden any wildlife virologist's knowledge due to the inclusion of plant viruses and bacteriophages. Inevitably, there are evolutionary models and some more-complex population genetic modelling that required greater focus and introspection, but these topics are introduced clearly and in manageable amounts, encouraging the reader to continue reading and rewarding their persistence with tangible evidence explaining why these models are so beneficial for consideration. For example, understanding that MERS has infected so many people—not because the R_0 is high but because multiple cross-species transmissions have occurred. Without exception, each chapter is written with accessibility to all readers in mind. More difficult concepts are concisely explained and the English is to a high standard (albeit American English!). Chapter 6, “Evolution of Viral Virulence: Empirical Studies,” stretched the limit of my focus. Arguably, this is one of the more pivotal chapters, relating evolutionary theories to empirical data, fulfilling the brief to include both animal and plant viruses—yet it lost me (the reader) amongst the pages.

One distinct advantage of this book is the independence of each chapter from the others, bound together as a collection of individual chapters, which readers can dip in and out of ad hoc, rather than a book which must be read in its entirety for comprehension. The design of each chapter, consisting of an abstract, an introduction, and main content followed by concluding remarks, which in the main address the future directions, provides a certain familiarity and uniformity across the

book without appearing repetitive. Apart from Chapter 11, “Population Genetic Modelling of Viruses,” which did prewarn the reader of an indulgent focus on Influenza A virus, the breadth of viruses discussed is impressive. I couldn't help but enjoy finding a sprinkling of references to my favorite virus (rabies virus). At first, the inclusion of plant viruses seemed a little forced. The chapters which incorporated plant and animal viruses in the context of a common theme were more successful than chapters that focused entirely on only one or the other.

In general, this book is an easy read and is suitable for a wide audience with an interest in virus evolution. This book is a valuable resource for the up-to-date references alone. For the wildlife disease-focused animal virologists among us, I suggest reading the plant virus chapters when the mood strikes you. I found myself curiously interested in the difference between plant and animal viruses. For example, why would persistent plant viruses still go to the effort of encapsidating virions when they transmit vertically? I can visualize this book sitting next to *Fields Virology* (Knipe et al. 2013), quite confidently, in many students' and professors' offices alike.

LITERATURE CITED

- Knipe DM, Howley PM, Cohen JI, Griffin DE, Lamb RA, Martin MA, Racaniello VR, Roizman B, editors. 2013. *Fields Virology*, 6th Ed. Lippincott Williams and Wilkins, Philadelphia, Pennsylvania, 3177 pp.

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