

## Book Review

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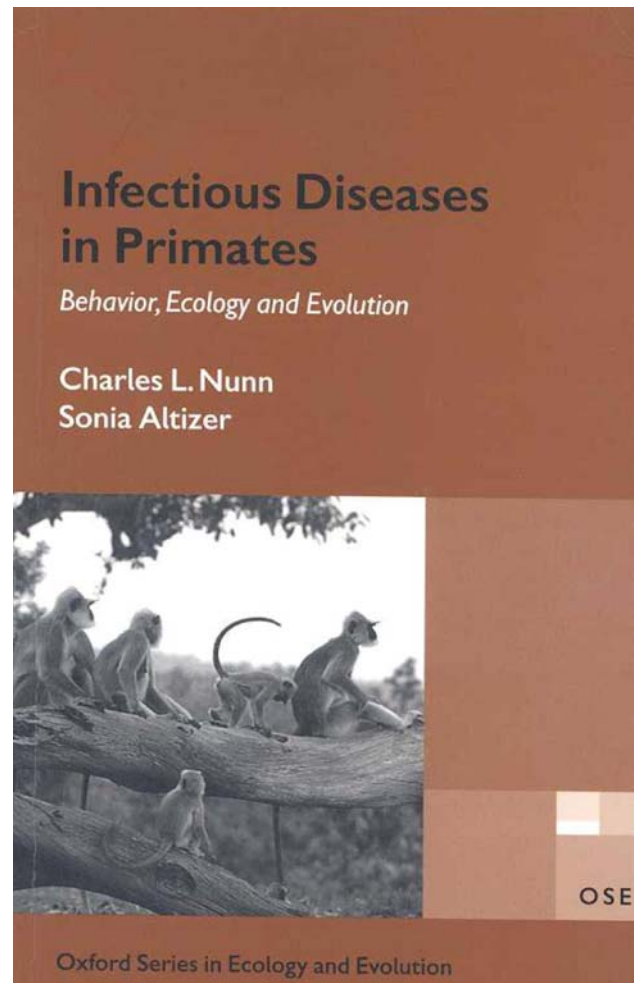
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**INFECTIOUS DISEASES IN PRIMATES: BEHAVIOR, ECOLOGY AND EVOLUTION, CHARLES L. NUNN, SONIA ALTIZER, 2006, NEW YORK: OXFORD UNIVERSITY PRESS, ISBN-10: 0198565852, ISBN-13: 978-0198565857**

In the not-too-distant past, infectious diseases in nonhuman primates were seen as something akin to a tornado: a “natural disaster” that occasionally swept through populations, destructive but transient and defying prediction. Charles Nunn and Sonia Altizer’s new book, *Infectious Diseases in Primates*, shows just how far our understanding has progressed. Supported by case studies and comparative phylogenetic analyses, their central thesis posits that infectious disease is a major force in primate evolution. Selective pressures imposed by pathogens, Nunn and Altizer argue, account for a significant proportion of the variation in morphology, physiology, and behavior that has evolved across the exceptionally diverse mammalian order Primates.

The nine chapters of this logically structured book will appeal to ecologists, evolutionary biologists, primatologists, and especially to students in these fields seeking a better understanding of disease biology, epidemiological principles, and comparative evolutionary analyses. Early in the book, the authors offer a concise overview of the biological diversity of parasites—the term “parasite” used here and throughout their book in its true ecological sense, referring



to the full range of microbial taxa (e.g., viruses, bacteria, helminths, protozoa) as well as some “macrobes” (e.g., biting arthropods), that reduce the fitness of their hosts for

their own benefit. Subsequent chapters summarize the structure and function of the mammalian immune system, and give historical and methodological overviews of fundamental concepts in infectious disease epidemiology, evolution, and mathematical modeling.

Even early on, it's apparent that this book represents a significant departure from previous treatments of the subject or from the taxon-by-taxon texts characteristic of the clinical sciences. Notable past works such as Brack's *Agents Transmissible from Simians to Man* (1987), for example, offered an encyclopedic overview of the range of agents known to infect or infest nonhuman primates, with emphases on biological characteristics, pathology, clinical signs, and treatment. Nunn and Altizer veer significantly away from the "laundry list" approach by interspersing their summaries of basic host and pathogen biology with sections linking these concepts to primate evolutionary ecology, behavior, and sexual selection.

The sixth chapter, "Infectious Disease and Primate Social Systems," is particularly synthetic, arguing powerfully that infectious disease has helped drive the evolution of such fundamental aspects of primate sociality as group size, group composition, and mating systems. By explicitly elevating infectious disease to the status of a major force in primate socioecology, Nunn and Altizer hope to create a paradigm shift that recognizes the significance of infectious disease in shaping the evolution of primate social systems. A complex vision emerges in which infection joins the "usual suspects" of resource competition, predator avoidance, and anti-infanticide strategies, either as a modifying effect or in some cases as a factor on par with these more traditional evolutionary drivers of primate sociality.

Chapter 7, "Parasites and Primate Conservation," revises the "disease as natural disaster" paradigm by focusing on infection as a cause of wildlife population declines. The chapter begins with the well-known example of Ebola, to which the recent deaths of thousands of lowland gorillas in central Africa may be attributed (Bermejo et al., 2006). Here, the authors draw on examples from both primate and nonprimate systems to illustrate how wild primate populations might respond to endemic and epidemic infection in the context of anthropogenic habitat disturbance and altered contact rates with humans and their domestic animals. Again, the chapter has an evolutionary bent, highlighting comparative research by the authors on pathogen diversity in threatened versus nonthreatened primate species and as a predictor of evolutionary diversification rates across primate lineages. The authors offer conservation

recommendations relevant to surveillance, management, captive breeding, ecotourism, and veterinary intervention, and they succeed in capturing the range of options available, if not, perhaps, in delineating a concrete course of action for choosing among them.

The eighth chapter links earlier concepts about nonhuman primate infection to human health and evolution, offering a comparative evolutionary biologist's perspective on themes at the interface of disease and human society, many of which were first popularized by Jared Diamond's *Guns, Germs, and Steel* (Diamond, 1987). An important thesis of this chapter is that the nature of human societies makes the epidemiology and evolution of infectious disease qualitatively different between humans and nonhuman primates, and that the manifestations of this difference are far-reaching, from the scale and severity of our epidemics to the spiciness of our cuisines. Subsequent sections on Darwinian medicine, comparative patterns of parasitism in contemporary human societies, and zoonoses of primate origin round out this concept.

One of the greatest strengths of this book is its recurring attempt to define key testable hypotheses and areas for future research. This theme reaches its apex in the final chapter, where the authors present a litany of approaches that could potentially elucidate the effects of infectious diseases on six key areas of primate biology and conservation. Nunn and Altizer's hypotheses and predictions successfully highlight the major gaps in our understanding of how infectious disease might influence all things primate, although sometimes too generally to be helpful. For example, pleas for "intensive studies that span considerable time frames" or "basic and applied research combined with public health activities and educational efforts," are hard to argue with but equally apparent and difficult to implement.

Aside from its overall logical structure and thoughtful content, the book contains informative figures, tables, and boxes in most chapters. The boxes describing comparative phylogenetic analyses in Chapter 3 and the mathematical modeling approaches described in Chapter 4 are particularly well done; this is not surprising considering the authors' strengths in modeling and the comparative method. These elements will be particularly useful for students who may be unfamiliar with the methodological approaches that Nunn and Altizer favor.

One important caveat is that this book is unlikely to satisfy students of the clinical sciences seeking a reference text on primate pathogens and their individual characteristics, despite the fact that its title might suggest otherwise.

Indeed, because of its heavy emphasis on evolutionary ecology and comparative phylogenetic methods, it might more appropriately (if less economically) have been entitled *Comparative Evolutionary Ecology of Parasitism in Primates*. In this sense, the book is as almost as much an endorsement for the utility of comparative phylogenetic methods in ecology as it is a synthesis of knowledge on primate infectious disease. For readers not sharing the authors' particular enthusiasm for primates, the book will be appreciated as a case study in the utility of the comparative method for elucidating an important aspect of the biology of a diverse but phylogenetically nonindependent set of taxa.

Conversely, field primatologists might also be disappointed by the overall shortage of case studies from wild primates. The authors have had to borrow from the literature on other taxa to illustrate many important themes, which leaves one wondering at times whether enough is really known about primates in particular to justify such a grand synthesis. Of the primate examples that are cited, a disproportionate number come from the early work of Freeland in the late 1970s and early 1980s (e.g., Freeland, 1976), whose hypotheses about the role of infection in primate sociality seem to have had a strong influence on the authors' thinking. Other minor shortcomings are the book's heavy reliance on examples from eukaryotic

parasites and viruses (bacteria are underrepresented) and the lack of color illustrations. In the end, however, these concerns are quite minor.

*Infectious Diseases in Primates* is a structured and thoughtful synthesis of a field that has never before been unified. Considering the work of the small but significant number of scientists who have studied topics at the interface of primate sociality and infectious disease over the last three decades, it would be inaccurate to say that the field defined here by Nunn and Altizer is in its infancy. However, given the gaps in our knowledge that this book helps elucidate, it would also be incorrect to say that the field has come of age. On the whole, the publication of this book marks, if not the birth of a new field, its transition from childhood into adolescence.

## REFERENCES

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