

that other commitments limit these opportunities. Thus, they advise spending two days just observing before starting manipulative experiments and continued note-taking on natural variation during experiments for better results interpretation and refinement of future experiments.

While this book is certainly just a launching point, it covers a wide range of topics that are relevant to the beginning ecologist and provides a nice list of references where the interested reader can get more (and more specific) information on various topics. Some techniques beyond the novice level arise (partial regression coefficients, goodness-of-fit tests), but mention of these are brief and further references are provided. While someone in the field for years might not learn a tremendous amount of new information from this book, it is a fast read and a good reminder of important principles often overlooked in the daily grind. I found a few gems that surprised me (e.g., losing measurement precision to get as large a sample size as possible is fine, the central limit theorem of probability will fix the sloppiness as long as the errors are unbiased), and the writing style and content is invigorating and encouraging, never boring. I think the authors have succeeded in their goal of providing a useful, concise handbook to performing ecological investigations.

I give this book 5 frogs for undergraduates and beginning graduate students interested in ecology; 3 frogs for a general scientific audience.



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## EVOLUTION

**The Evolving World.** By David P. Mindell. 2006. Harvard University Press. (ISBN 0674021916). 341 pp. Hardcover. \$24.95.

Mindell's book presents the ubiquity of evolutionary theory in everyday life over six chapters. The first chapter details the history of science and its frequent collisions with popular culture. He recounts the histories of heliocentrism, germ theory of disease, and evolution. By providing the history of the first two, the reader is in a position to accept the history of the latter, evolution, as no different from any other scientific revolution.

Chapter 2, a la *The Origin of Species*, details the history of humans and selective breeding in domesticated plants and animals, and pathogens. Biogeographical maps

suggesting the geographic origin of the species and the direction of spread are provided for each species discussed.

Chapter 3 covers the role of evolution in public health and medicine. He presents a mini-lesson in phylogeny describing the kinds of evidence used to construct the hypotheses of relatedness, and he shows their usefulness: "Accurate identification of closest known relatives for new pathogens enables initial hypotheses about the pathogen's basic life history, as these traits tend to be shared among close relatives. This includes identification of likely host species, their geographic distribution and favored habitats, as well as the pathogen's likely mechanisms of reproduction and transmission." (p. 98-99).

West Nile Virus, Ebola, Influenza A (responsible for the 1918 epidemic), HIV, and anthrax are discussed at length, accompanied by phylogenies. Each pathogen's phylogeny is a full page, and includes a line drawing of the pathogen, a world map indicating its point of origin, and factoids regarding its evolutionary history, adaptations, dispersal mechanism, recent evolution, and how best to minimize its presence in human populations.

Virulence is described as varying with dispersal mechanisms. That is, a pathogen spread by human contact, such as AIDS, tends to be relatively less virulent than one dispersed by a vector such as malaria. Extremely virulent HIV strains are selected against, as they would die with their host before having a chance to spread to another host and reproduce. In contrast, virulent malaria is not a negative selecting agent, because mosquitoes carry the pathogen from host to host; the host does not have to be mobile, they can be confined to a bed. Thus, natural selection explains the differing evolutionary paths of these pathogens. This informs disease control strategies.

Other concepts discussed include antibiotic resistance, the role of microbes in chronic diseases and directed evolution of molecules—a process analogous to selective breeding. A "population" of DNA or RNA molecules is assessed for ability to synthesize a therapeutic protein. The best performing molecules are selected and nucleotides shuffled. Again the population is assessed, and again the best performers selected. This is repeated until a reliable level of protein production is reached.

Chapter 4 discusses the roles of phylogeny, biogeography, and molecular ecology in deciphering biodiversity and thus informing conservation practices. The fifth chapter seems to veer off course a bit. Here the metaphorical use of evolution in human culture is discussed. Religion and language have both

evolved, but not by the same mechanisms as life has. Mindell goes to great pains to point how the two kinds of evolution can be analogous while emphasizing the differing mechanisms. The final chapter highlights the intersection of politics and justice with the application of evolutionary principles. The history of the intelligent design movement's efforts to gain a foothold in public schools is recounted. Several examples of the use of DNA evidence to convict or exonerate suspects are presented. Eugenics is described as a misinformed movement where inadequately understood scientific concepts were applied to a cultural phenomena leading to inevitable failure. He drives home the point that one cannot be selective regarding the realities of evolutionary theory and its applications. "Those who deny the tenets and findings of evolution, however, must also deny or ignore a large and growing body of applied evolutionary science." (p. 292).

While the intent of the book is noble, it is not clear who the intended audience is. If it is the general public, there is a likelihood the phylogenies and sentences like "Reversion to virulence is not an issue because the chimeric entity does not carry the full virulent pathogen genome, and contamination with other source pathogens is obviated because the construct" (p. 139), will be lost on them. However, the opening chapter recounting some history of science might be informative. On the other hand, if the intended audience is the biology major, then much of the book's content becomes redundant. For example, Chapter 2 is a recap of *The Origin of Species*, with which most biology majors are already familiar. Discussion of the development of vaccines, rapid evolution of viruses, and DNA evidence in court cases is also old news.

Mindell, a working scientist, should be applauded for this attempt to make evolutionary theory applications apparent. He observes that even if people don't realize the far reaching implications of evolutionary theory, they still benefit from it unwittingly. He compares that to not understanding the theories that explain how our cars work, yet we still benefit from using them. If the general public could assume this attitude toward evolutionary theory, continued progress in biological sciences is certainly assured. Secondary and college teachers of biology and biology majors will find parts of this book tedious and other parts astutely informative.



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