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Resource Review

The Origin of Species Revisited

Speciation
By Jerry A. Coyne and H. Allen Orr
Sunderland, MA: Sinauer Associates, Inc. (2004)
480 pp. $89.95

Although the origin of species has been widely debated since the publication of *The Origin of Species* (Darwin, C. [1859]), we still know remarkably little about the process of species formation. However, what we do know is contained within a new book: *Speciation* by Jerry A. Coyne and H. Allen Orr. The study of speciation has come in and out of vogue with evolutionary biologists in the last century, resulting in a dearth of books on the topic after seminal works such as *Genetics and the Origin of Species* (Dobzhansky, T. [1937]. New York: Columbia University Press), *Animal Species and Evolution* (Mayr, E. [1963]. Cambridge, MA: Belknap Press), *Modes of Speciation* (White, M.J.D. [1978]. San Francisco, CA: W.H. Freeman and Company), and *Plant Speciation* (Grant, V. [1981]. New York: Columbia University Press). However, the past two decades have seen an explosion of interest in the question of how new species are formed. The recent work on speciation has utilized theory, ecology, genetics, molecular biology, and comparative studies, and these broad approaches have contributed greatly to our knowledge of the process of speciation. *Speciation* is the first book that summarizes and synthesizes this recent work from different fields while maintaining a keen historical perspective on the major questions about the origin of species.

Coyne and Orr begin with an explanation of the recent progress in the field which sets the tone of the book: "In our view, recent progress in speciation largely reflects a shift from a fascination with nebulous and untestable ideas to empirically tractable ones. It is this shift, we believe, that has allowed the field to attain scientific maturity" (p. 6). In *Speciation*, they thus emphasize the need for empirical data both from the laboratory and from nature and also promote testable hypothesis. In particular, they highlight the power of comparative studies to reveal patterns of speciation not seen by studying a single group of taxa.

Speciation is incredibly well organized and clear, unlike the process of speciation itself. Each chapter begins with a historical perspective that helps to frame the questions and controversies. For a great example, see Chapter 10 on the "extraordinarily tortuous history" (p. 353) of the theory of reinforcement. In all chapters, this historical view is then followed by a review of the relevant literature covering a wide range of disciplines and organisms. In particular, Chapters 3 and 4 very nicely address the controversy surrounding the role of biogeography in speciation. To discuss the allopatric, parapatric, and sympatric models of speciation, Coyne and Orr eloquently outline the theory, laboratory experiments, and data from nature that support and/or refute the different models. Helpful tables and figures are also scattered throughout the book, providing overviews and drawing attention to experimental data.

The field of speciation research can be a contentious one, and Coyne and Orr never shy away from stating their opinions on hotly debated issues such as the definition of a species, although most topics are presented in a balanced manner. For example, Chapter 1 contains a strong defense of Mayr's biological species concept; however, they acknowledge its weaknesses and present eight alternative species concepts in the appendix. Despite presenting both sides of an argument, statements like "it is hard to see how the data at hand can justify the current wave of enthusiasm for sympatric speciation" (p. 178) or "unlike many of the questions that we have considered up to now, we believe that this one has been answered" (p. 383) are scattered throughout the book, leaving no doubt in the reader's mind as to the opinions of the authors. This makes the book fun to read and should provoke readers to access the primary papers, read them critically, and form their own opinions.

Coyne and Orr are *Drosophila* geneticists, and the book does reflect their biases. Nonetheless, their ability to explain theory and experimental data from many different fields and organisms shows an impressive breadth of knowledge. Their own research bias is exemplified by the inclusion of a separate chapter on the genetics of postzygotic isolation, a research area that has occupied both authors for many years. However, this is an important area of research and recent work provides "direct molecular evolutionary data [that] now support one of the central tenets of the neoDarwinian view of speciation—that reproductive isolation results from natural selection within species" (p. 319).

A major strength of the book is that Coyne and Orr draw attention to unanswered questions to stimulate future research. This is an excellent resource that a new graduate student or postdoc entering the field can use to see where there are opportunities for novel research and creative approaches. Some of the questions mentioned that I found particularly intriguing, but that are difficult to answer, are: Why are there species? What traits facilitate rapid speciation? Why does polyploidy play a greater role in plant speciation than in animal speciation?

Although *Speciation* provides a great overview and introduction to these types of questions for a graduate student or newcomer to the field, the depth and breadth ensure that it will still be useful for a seasoned evolutionary biologist working in the field. I am sure I will continue to pull it off my shelf on a regular basis. In fact, for a recent journal club in my laboratory, I used Coyne and Orr's discussion of Haldane's Rule both as initial background reading and as a source for primary papers on the topic.

I found it very helpful when they included a short summary at the end of each chapter or section that summarized the key evidence and conclusions and offered questions for future research. For example, the

conclusions sections at the end of Chapter 4 on sympatric speciation and at the end of Chapter 11 on the relative contributions of selection versus genetic drift were particularly good. Unfortunately, not every chapter had an overall conclusions section. For example, Chapter 6 on behavioral and non-ecological isolation mechanisms ends with a summary of gametic isolation, but not the other isolating mechanisms discussed in the chapter.

The authors of *Speciation* hope that their book will stimulate a new generation of scientists to pursue answers to outstanding questions in the field through their own experiments and observations. I hope that this future work will necessitate an updated version of *Speciation* and that Jerry Coyne and Allen Orr will be willing to summarize and comment on the next fifteen years of work as lucidly as they have the last one hundred and fifty.

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