



Toward a Comparative Biology

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thetic reception than those of the unfortunate Chambers. Chapter 6 analyzes the dispute between Owen and Lyell on the fossil record, describes the quarrel between Owen and Huxley, and sets the stage for the main event: the publication of the *Origin*.

In Chapter 7, Ruse offers his own version of the development of Darwin's ideas. He reviews the impact of the *Beagle* voyage, the progressive unfolding of evolutionary themes in Darwin's notebooks, the notorious delay in the writing of the *magnum opus*, and finally the *Origin* itself. More complete treatments of these matters are available elsewhere—for example, in Michael Ghiselin's admirable book *The Triumph of the Darwinian Method*. Yet, in giving the main lines of a story that has often been told in more detail, Ruse is not simply repeating what everybody knows. The story gains from its setting. Because he has so carefully described the various contexts—scientific, religious, philosophical and political—Ruse is able to show the familiar facts of Darwin's career in a new light.

Chapters 8 and 9 are devoted to the impact of the *Origin*. Ruse first considers the scientific disputes which followed the publication of Darwin's work. Particularly interesting are the discussions about the efficacy of natural selection and the geological difficulties which Darwin faced. In Chapter 9, Ruse examines philosophical criticisms of the theory of evolution, and, of course, the worries about religion. The chapter concludes with a fascinating account of the social structure of British science which reveals the ways in which Darwinism quickly took hold. In this section, as in the treatment of religion, Ruse is able to draw on his previous delineation of the attitudes and alliances of the period to make clear why the protagonists adopted the stances they did.

Unalloyed praise is cloying. So let me turn to some criticisms. My chief complaints concern Ruse's handling of philosophical issues. I think that Ruse is inclined to overestimate the influence that the philosophers, notably Herschel and Whewell, had on Darwin. It is true that Darwin used the philosophical jargon of his day. But, like most scientists, then as now, he thought out his methodology for himself, and then tied it to whatever respectable philosophical views he could find. I think that Ruse goes further astray in trying to impose upon the *Origin* the type of theoretical structure that he takes to be present in good science. By doing so, he fails to expose the character of Darwin's "long argument."

From a historical perspective, the least satisfactory part of the book seems to me to be the discussion of Richard Owen. Owen's complicated ideas have not received the attention that they deserve, and Ruse should be praised for his attempt to provide a concise summary of Owen's position. The trouble is that Owen's concept of archetype is too flexible, its links to biological subdisciplines too various, for a quick explanation to succeed. In presenting Owen's ideas, Ruse relapses into atypical obscurity.

These complaints do not detract from the value of the book. To write a readable account of the major episode in the history of biology is an enterprise pregnant with possibilities for disaster. Ruse has managed to be clear without being simplistic, to avoid pedantry without tolerating inaccuracy. The flaws I have noted are relatively minor, matters of emphasis rather than serious errors. This book provides a splendid introduction to the Darwinian revolution from which the biologist, the historian, the philosopher and the general reader can profit. It is truly Darwin for everyone.

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TOWARD A COMPARATIVE BIOLOGY¹

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The past twenty years have witnessed a resurgence of interest in systematics and biogeography, but much of the work has not been in the spirit of the "New Systematics" of the 1940s and 1950s. Rather than addressing questions of process, many recent systematists have returned to the fundamental issue

¹ *Systematics and Biogeography; Cladistics and Vicariance*. Gareth Nelson and Norman Platnick. Columbia University Press, New York, 1981. xi + 567 p. \$35.00.

of pattern in nature. How are patterns recognized, catalogued, and classified? Are there general patterns?

Many evolutionary biologists, especially those interested in processes of evolution, have tended to ignore much of this recent work. But surely all evolutionary biologists must be familiar with the terms "pheneticist," "cladist," and "evolutionary systematist," and with the fact that debates have raged for over two decades in the pages of *Systematic Zoology*. Simpson's "Principles of Animal Taxonomy" (1961),

Sokal and Sneath's "Principles of Numerical Taxonomy" (1963), Hennig's "Phylogenetic Systematics" (1966), Mayr's "Principles of Systematic Zoology" (1969), and Croizat's "Space, Time, Form: The Biological Synthesis" (1964) are the points of departure for most of the debates. I am sure that many have shared my dismay at the polemical nature of the discussion. I know that as a result of style of argument alone many evolutionary biologists have decided to shun the entire area of enquiry, or to deftly apply a label loaded with implications: "pheneticist," "New York cladist," "taxonomist," etc.

There have been attempts to explain just what all the fuss is about, but up till now none have been effective. With the publication of this masterful book the field at last has a treatise that deals with fundamentals and the very essence of the arguments. Nelson and Platnick have produced a work of scholarship that demands the attention of all biologists who use the comparative method. This is a book of lasting value, and one that rises above trivialities and personalities to deal with some of the most basic questions in evolutionary biology.

The authors are concerned with patterns in nature—how to recognize them, how to categorize them, how to display them, and how to generalize from them. There is virtually nothing concerning evolutionary processes in this book, and, indeed, it is apparent that the authors believe that pattern recognition and classification are necessary preliminary steps to studying processes.

Comparative biology—the study of organismic diversity—is defined as comprising three aspects: space, time, and form. The authors recognize four subdisciplines—*systematics* (apparently incorporating comparative anatomy and any other area of study that generates data concerning organisms), which is concerned with form in the broad sense, but secondarily with time; *biogeography*, concerned with space and secondarily with time; *embryology*, concerned primarily with time and secondarily with form; *paleontology*, concerned with time, but also with form and space. The first chapter of the book deals with comparative biology and defines the questions and methods of analyses pursued in the book. This chapter is essential for understanding what follows. In it the vocabulary of the book is introduced and we become aware that the authors truly consider the book to be about first principles. I do not find this to be a book of advocacy, and that is apparent almost from the beginning. Rather, it is a treatise on logic and history as applied to issues many of us have taken for granted.

To a large degree this is a book about dendrograms. The first appears on p. 14, and they are present, in one form or another, on over 200 more pages. There are 42 on p. 452 alone! The distinction between phyletic trees (which depict "aspects of evolutionary genealogies") and cladograms (which depict "structural elements of knowledge") is basic, and it is cladograms which are stressed. The treatment is general, clear, and direct. The authors are careful to make explicit the direction the discussion will

take. Definitions are concise and generally unambiguous, so that statements such as "a phyletic tree is a concept derived from and subsidiary to, a cladogram" (p. 17) essentially are not debatable. The authors transcend previous treatments of cladograms to deal with them in new and far more general ways.

There are only eight chapters in the book: an introduction, three chapters on form (nearly 270 pp.), a short chapter on time (dealing with the biogenetic law), and three chapters (about 180 pp.) on space. Two of the chapters (3 and 7) are analytical and technical, and require special discipline even to read (as the authors make explicit in their Preface).

I thoroughly enjoyed the historical accounts (basically chapters 2 and 6), which I found to be well written, well illustrated, and pertinent to the subject of the book. Special attention is given to analysis of the logic of early biologists, and it is surprising how "modern" many of them were. One gains respect for many of the early workers, such as de Candolle.

The analytical chapters present methods in such excruciating detail that one is reminded of a map with a scale 1 km = 1 km! Component analysis, introduced by Nelson a few years ago, is here developed fully. This is a method of determining the information content, in essence, of cladograms and classifications. The treatment is non-mathematical, by direct example, and does not go beyond four taxa because of the staggering complexity. Despite the complexity the importance of this method is evident. Surely it is possible to present it in a more general way than in these tedious chapters.

Specific examples from systematics and biogeography are examined in two chapters. These treatments are useful in showing how methods of the authors might be put into practice, but it is surprising how few "good" examples exist.

The book abounds in controversial and thought-provoking issues. I will mention just a couple. The time is ripe, it is said, for systematists to move away from large samples (individuals, taxa, and characters) and to concentrate on small ones. Then one can do component analysis and estimate the probability of occurrence of replicated components by chance alone. On another topic the authors argue that biogeography has wrongly been used as evidence in favor of evolution. They argue that biogeography has not been shown to be evidence for or against evolution in any sense.

Much material from previous publications of both authors, but especially from Nelson's work, is incorporated into this book. I was frustrated by the decision to use a short list of selected references. This list does not include a single paper by either author, and no attempt has been made to trace the debates of the last 20 years. I suspect the authors felt that a fresh start was necessary, but the treatment is unorthodox in this respect.

Readers will be relieved to discover that arguments in the book are maintained on a high plane, without the often boisterous, hypercritical, personal invective that has typified much recent literature. Those with sensitive egos will have them bruised

from time to time, but the style of argument is refreshingly direct and impersonal. Nelson's penchant for rhetorical questions is evident throughout the book, but I do not find it annoying. Technically the book is well produced.

While I consider this book to be a significant contribution to evolutionary biology, it is difficult for me to give explicit reasons. One has the feeling that the book offers a general correction of methodological and logical errors made by most of us in the past. It is an attempt to force us back on course, but it only hints as to where we are going. There is no final summing up, no look into the future. In a brief Epilogue to the final biogeography chapter, the authors observe that while organisms display a bewil-

dering array of characters (and they have effectively shown how complex analysis of cladograms can be), perhaps the world is simple after all. Might there be a single general cladogram of taxa, they ask, and might there be a single general cladogram of areas of the world? It is this kind of generality that apparently is the ultimate goal. Good luck!

I would hope that evolutionists would become familiar with this book. The technical sections can easily be skipped by non-specialists, and so many general issues are discussed that whether one agrees or disagrees with the authors, contemplation of the topics discussed can only have a salutary effect. This book makes one think.