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Ernst Mayr: What evolution is

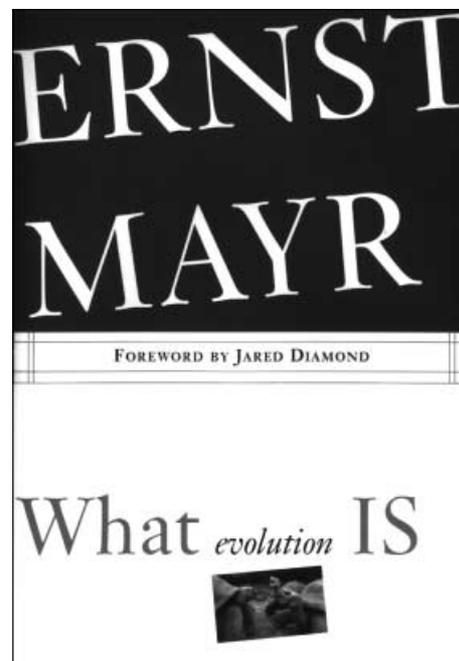
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Ernst Mayr, author of hundreds of primary scientific articles and two dozen books, participated mightily in the establishment of modern views of evolutionary change. His book *What Evolution Is* summarizes the work of many scientists over more than one century. Mayr suggests that it is “very questionable whether the term ‘evolutionary theory’ should be used any longer. That evolution has occurred and takes place all the time is a fact so overwhelmingly established that it has become irrational to call it a theory.” He writes that “evolution is the name of a process in nature the occurrence of which can be documented by mountains of evidence [...I discovered over the last 140 years that nobody has been able to refute.” (In other words, Mayr refers to scientific inquiry and information, a consensus that has accrued since Charles Darwin’s seminal work on the origin of species.)

Many details of evolution are still to be resolved and their explanation may be controversial. But, like the sphericity of our planet and the heliocentricity of the solar system, evolution is a concept undeniable to reasonable people unless they hold fundamentalist religious beliefs. Intrinsically, evolution is a complex idea with many components. Each can be separately demonstrated; Darwin’s central contribution was to integrate the scientific discoveries into a comprehensible and comprehensive view of the history and current behavior of living matter.

Darwin based his theory on two facts: (a) the irrefutable and measurable tendency of all populations of organisms to grow and reproduce at enormous rates, and (b) the unsustainability of this population growth that inevitably leads to relative reproduction and survival of descendants and therefore to natural selection. As Mayr puts it, “natural selection is really a process of elimination.” In addition, the presence of demonstrable inherited variation on which selection acts can be shown



in any population, whether of bacteria, pineapples, apicomplexan protists, mammals or *Botrydium*. Direct observation of fossils in the sedimentary rock record has made it possible to document the results of evolution over thousands to millions of years.

Mayr dedicates the book to the naturalists from whom we have learned so much, “from Aristotle to the present”. His erudition and comprehensive style are as impressive as they are unusual in most modern scientific texts, especially those so succinct as this. Mayr claims his book is meant to engage three kinds of readers: members of the literate public who want to know about the evolution of life and how it has occurred but can find only highly technical or polemical accounts; those who accept the concept of evolution but doubt that the Darwinian modes of change can really explain it; and those creationists who “want to know about the current paradigm of evolutionary science if for no other reason than to be

able to better argue against it". To this end, he includes handy "boxes" in which the kernels of complex arguments are presented. The appendices include criticisms that have been made of evolutionary theory. Some two dozen of the most commonly asked questions about evolution, which appear with short answers, augment his 11-page glossary. The ten pages of references include only broadly based comprehensible books. To me, this work is both of great interest to the general reader and to students of all levels.

Although Mayr expects to convert no one, he hopes to provide a concise, well-organized, reader-friendly account of evolution. He thinks none is currently available and I agree. So well does he do this that his new book is probably the best reference for anyone wishing to know the status of evolutionary ideas. The concept that all life on Earth shares common descent from earlier ancestors is explained and documented with evidence from related fields of science. The breadth and integrated nature of the narrative is reminiscent of comments from Mayr's own lectures. According to Mayr, any scientist who writes a research article must be a specialist; yet no one who identifies himself as an evolutionist can possibly be *only* a specialist. This is because evolutionary thought and analysis encompass

superficially unrelated fields and require critical evaluation and integrated thought.

Most of Mayr's examples of speciation, variation, geographical isolation, development and embryology are from zoological sources. They tend to be drawn from a vast literature on terrestrial vertebrates, with which Mayr is extremely familiar. Although the amount of space in the book dedicated to, for example, biochemistry, microbiology, *hox* genes and their role in development, molecular biology, and polyploidy in plants is small, these topics are also mentioned. I do not agree with several of his glossary definitions such as those for biota, entropy, recombination and symbiosis. I note omissions of certain terms encountered in the text such as "fitness" and "prokaryote". An occasional reference is missing. These minor flaws only reflect the difference between the best academic publishers and the more hurried nature of commercial publication. Yet Mayr's useful and balanced narrative of what Jared Diamond in his preface calls "the most profound and powerful idea to have been conceived in the last two centuries", written by one of its most competent and prolific practitioners, does just what it set out to do: explain what evolution is.