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## ERNST MAYR'S VIEW OF EVOLUTION

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Evolution is the most profound and powerful idea to have been conceived in the last two centuries. It was first developed in detail with the 1859 publication of the book *On the Origin of Species*, by Charles Darwin, who enjoyed a long and incredibly productive life. While Darwin's professional career began with a round-the-world biological collecting trip on which he embarked at the age of 22 aboard the HMS *Beagle*, he had already been devoted to outdoor natural history as a boy.

A great deal new has been learned about the workings of evolution since Darwin's day. Wouldn't it be wonderful if Darwin himself, a clear and forceful writer, as well as the greatest biologist of his generation, could write for us a new book on the status of evolutionary thought today! Of course that's impossible, because Darwin died in 1882. Ernst Mayr's *What Evolution Is* (2001) is the next best: it has been written by a man who is one of the greatest biologists of our own day, who has also enjoyed a long and incredibly productive life, and who is also a clear and forceful writer.

To place Ernst Mayr in perspective, I'll relate an experience of my own. In 1990 I carried out the second bird survey of the Cyclops Mountains, a steep, high, isolated range rising from the north coast of the tropical island of New Guinea. The survey proved to be difficult and dangerous, because of the daily risks of falling off the steep slippery trails, of getting lost in the dense jungle, of exposure in the cold wet conditions, and of potential conflicts with local people on whom I depended but who had their own agendas. Fortunately, New Guinea had by then been "pacified" for many years. Local tribes were no longer at war with each other, and European visitors were a familiar sight and were no longer at risk of being murdered. None of those advantages existed in 1928, when the first bird survey of the Cyclops Mountains was carried out. I found it hard to imagine how anyone could have survived the difficulties of that first survey of 1928, considering the already-severe difficulties of my second one in 1990.

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That 1928 survey was carried out the then-23-year-old Ernst Mayr, who had just pulled off the remarkable achievement of completing his Ph.D. thesis in zoology while simultaneously completing his pre-clinical studies at medical school. Like Darwin, Ernst had been passionately devoted to outdoor natural history as a boy, and he had thereby come to the attention of Erwin Stresemann, a famous ornithologist at Berlin's Zoological Museum. In 1928 Stresemann, together with ornithologists at the American Museum of Natural History in New York and at Lord Rothschild's Museum near London, came up with a bold scheme to "clean up" the outstanding remaining ornithological mysteries of New Guinea, by tracking down all of the perplexing birds of paradise known only from specimens collected by natives and not yet traced to their home grounds by European collectors. Ernst, who had never been outside Europe, was the person selected for this daunting research program.

Ernst's "clean-up" consisted of thorough bird surveys of New Guinea's five most important north coastal mountains, a task whose difficulties are impossible to conceive today, in these days when bird explorers and their field assistants are at least not at acute risk of being ambushed by the natives. Ernst managed to befriend the local tribes, was officially but incorrectly reported to have been killed by them, survived severe attacks of malaria and dengue and dysentery and other tropical diseases plus a forced descent down a waterfall and a near-drowning in an overturned canoe, succeeded in reaching the summits of all five mountains, and amassed large collections of birds with many new species and subspecies. Despite the thoroughness of his collections, they proved to contain not a single one of the mysterious "missing" birds of paradise. That astonishing negative discovery provided Stresemann with the decisive clue to the mystery's solution: all of those missing birds were hybrids between known species of birds of paradise, hence their rarity.

From New Guinea, Ernst went on to the Solomon Islands in the Southwest Pacific, where as a member of the Whitney South Sea Expedition he participated in bird surveys of several islands, including the notorious Malaita (even more dangerous in those days than was New Guinea). A telegram then invited him to come in 1930 to the American Museum of Natural History in New York to identify the tens of thousands of bird specimens collected by the Whitney Expedition on dozens of Pacific Islands. Just as Darwin's "explorations," sitting at home, of collections of barnacles were as important to Darwin in forming his insights as was his visit to the Galapagos Islands, so too Ernst Mayr's "explorations" of bird specimens in museums were as important as his fieldwork in New Guinea and the Solomons in forming his own insights into geographic variation and evolution. In 1953 Ernst moved from New York to Harvard University's Museum of Comparative Zoology, where even today he continues

to work at the age of 97, still writing a new book every year or two. For scholars studying evolution and the history and philosophy of biology, Ernst's hundreds of technical articles and dozens of technical books have been for a long time the standard reference works.

But in addition to gaining insights from his own fieldwork in the Pacific and from his own studies of museum bird specimens, Ernst has collaborated with many other scientists to extract insights from other species, ranging from flies and flowering plants to snails and people. One of those collaborations transformed my own life, just as the meeting with Erwin Stremann transformed Ernst's life. While I was a teenaged schoolboy, my father, a physician studying human blood groups, collaborated with Ernst in the first study proving that human blood groups evolve subject to natural selection. I thereby met Ernst at dinner at my parents' house, was later instructed by him in the identification of Pacific island birds, began in 1964 the first of nineteen ornithological expeditions of my own to New Guinea and the Solomons, and in 1971 began to collaborate with Ernst on a massive book about Solomon and Bismarck birds that we completed only this year, after thirty years of work (Mayr and Diamond 2001). My career, like that of so many other scientists today, thus exemplifies how Ernst Mayr has shaped the lives of twentieth century scientists: through his ideas, his writings, his collaborations, his example, his lifelong warm friendship and his encouragement.

Yet evolution needs to be understood not only by scientists, but also by the general public. Without understanding at least something of evolution, one has no chance of understanding the living world around us, human uniqueness, genetic diseases and their possible cures, and genetically engineered crops and their possible dangers. No other aspect of the living world is as fascinating and full of riddles as is evolution. How can one explain the remarkable adaptation of every species to its chosen niche? Or the beauty of birds of paradise, butterflies, and flowers? How can one explain the gradual advance from the simplest bacteria three-and-a-half billion years ago to dinosaurs, whales, orchids, and giant sequoias? Natural theologians had raised such questions for hundreds of years, but were unable to find any other answer than the hand of a wise and almighty creator. Eventually, Darwin argued that the fascinating world of life had gradually evolved by natural processes from the simplest kinds of bacteria-like organisms, and he backed up his claim by presenting a well-thought-out theory of evolution. Most importantly, he also proposed a theory of causation, the theory of natural selection.

Although the basic idea that evolution was responsible for biological diversity became widely accepted almost immediately after 1859, more specific aspects of evolution remained controversial for the next eighty years. Throughout this period there were constant disagreements about

the causes of evolutionary change, about how species originated, and about whether evolution was a gradual or discontinuous process. The so-called Evolutionary Synthesis of 1937-1947 brought widespread consensus, and the molecular biology revolution in the ensuing years continued to strengthen the Darwinian paradigm and its support among biologists. Although numerous attempts were made in these years to propose opposing theories, not one of them has been successful: all have been thoroughly refuted.

Increasingly, it was realized that the Darwinian paradigm was important not only for explaining biological evolution, but more broadly for understanding our entire world and the human phenomenon. This led to a remarkable outburst of publications dealing with all aspects of evolution. By now, about a dozen convincing refutations of the claims of the creationists concentrate on presenting the massive evidence for the fact of evolution. Specialists can now consult three superb texts of evolutionary biology, those by Futuyma (1998), Ridley (1997), and Strickberger (2000), which in more than 600 pages deal with all aspects of evolution in the utmost detail. These books provide an excellent education in the facts and theories of evolutionary biology.

Yet the available literature, excellent as it is, leaves a gap: our lack of a mid-level account of evolution, written not just for scientists but for the educated public, with special emphasis on explanations of evolutionary phenomenon and processes. This is the area where Ernst Mayr's *What Evolution Is* excels. We are lucky that after a lifetime of writing for scientists, Ernst has now distilled his unparalleled experience for the public. Every major evolutionary phenomenon is treated as a problem that requires an explanation. Ernst often makes use of the history of failed earlier explanations to bring out the nature of the ultimate correct solution.

Also very helpful is Ernst's organization of the subject matter into three parts: (A) the evidence for evolution, (B) the explanation for evolutionary change and adaptation, and (C) the origin and meaning of biodiversity. A separate chapter, on the history of mankind, presents very successfully the evolution of humans and their precursors (hominids), which arose as "just another" group of apes. That chapter includes novel ideas, such as a suggested cause for the sudden drastic increase of brain size in the evolution from *Australopithecus* to *Homo*, and a suggested source of altruistic behavior.

For what audience is Ernst's *What Evolution Is* particularly suitable? One can answer: for the audience of everyone interested in evolution—particularly for anyone who really wants to understand the underlying causes of evolutionary change. Technical details, such as those dealing with the latest discoveries of molecular biology, are omitted because they can be found in detailed texts of evolution as well as in any modern biology text.

*What Evolution Is* will be an ideal text in a course on evolution for non-biologists. Paleontologists and anthropologists will welcome this book because of its emphasis on concepts and explanations. Ernst's lucid writing makes the subject of evolution accessible to any educated layperson.

Darwinism has become so fascinating in recent years that now every year at least one new book is published with the word "Darwin" in the title. It will greatly help the readers of such volumes to evaluate the claims made there by consulting *What Evolution Is*. Darwinian thinking, particularly the principle of "variation and selection (elimination)," is now widely employed in the humanities and social sciences. Those who employ it will find *What Evolution Is* a useful guide.

I can summarize my views on Mayr's *What Evolution Is* by saying that anybody with even the slightest interest in evolution should own and read this book. You will be richly rewarded. There is not better book on evolution. There will never be another book like it.

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