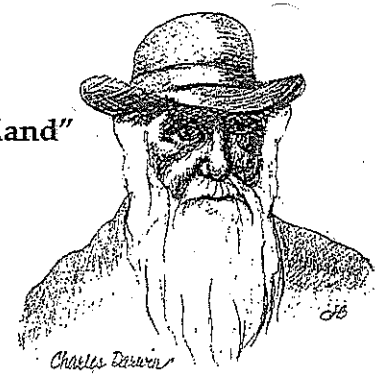
"Darwin and 19th Century Victorian England"
David Bisno



Who Is Darwin ?

Ernst Mayr

HISTORICAL PERIODS are dominated by distinct sets of ideas which, taken together, form a well-defined *Zeitgeist*. Greek philosophy, Christianity, Renaissance thought, the Scientific Revolution, and the Enlightenment are examples of sets of ideas that dominated their historical period. The changes from one period to the next are usually rather gradual; other changes—more abrupt—are often referred to as revolutions. The most far-reaching of all these intellectual upheavals was the Darwinian revolution. The worldview formed by any thinking person in the Western world after 1859, when *On the Origin of Species* was published, was by necessity quite different from a worldview formed prior to 1859. It is almost impossible for a modern person to project back to the early half of the nineteenth century and reconstruct the thinking of this pre-Darwinian period, so great has been the impact of Darwinism on our views.

The intellectual revolution generated by Darwin went far beyond the confines of biology, causing the overthrow of some of the most basic beliefs of his age. For example, Darwin refuted the belief in the individual creation of each species, establishing in its place the concept that all of life descended from a common ancestor. By extension, he introduced the idea that humans were not the special products of creation but evolved according to principles that operate everywhere else in the living world. Darwin upset current notions of a perfectly designed, benign natural world and substituted in their place the concept of a struggle for survival. Victorian notions of progress and perfectibility were seriously undermined by Darwin's demonstration that evolution brings about change and adaptation, but it does not necessarily lead to progress, and it never leads to perfection.

Furthermore, Darwin established the basis for entirely new approaches in philosophy. At a time when the philosophy of science was dominated by a methodology based on mathematical principles, physical laws, and determinism, Darwin introduced the concepts of probability, chance, and uniqueness into scientific discourse. His work embodied the principle that observation and the making of hypotheses are as important to the advancement of knowledge as experimentation.

Darwin would be remembered as an outstanding scientist even if he had never written a word about evolution.

Who was this extraordinary man, and how did he come to his ideas? Was it his training, his personality, his industry, or his genius that accounts for his success? Indeed, as we shall see, all were involved.

Immediately upon finishing his studies Darwin received an invitation to join *H. M. S. Beagle* as naturalist and gentleman companion of Captain Robert FitzRoy. FitzRoy had been commissioned to survey the coasts of Patagonia, Tierra del Fuego, Chile, and Peru to provide information for making better charts. The voyage was to be completed within two or three years but actually lasted five. The *Beagle* left Plymouth on December 27, 1831, when Darwin was twenty-two years old, and returned to England on October 2, 1836. Darwin used these five years to their fullest extent. In an eminently readable travelogue (*Journal of Researches*) he tells about all the places he visited—volcanic and coral islands, tropical forests in Brazil, the vast pampas of Patagonia, a crossing of the Andes from Chile to Tucuman in Argentina, and much, much more. Every day brought unforgettable new experiences, an invaluable background for his life's work. He collected specimens from widely different groups of organisms, he dug out important fossils in Patagonia, he devoted much of his time to geology, but most of all he observed aspects of nature and asked himself innumerable questions as to the how and why of

natural processes. He asked "why" questions not only about geological features and animal life, but also about political and social situations. And it was his ability to ask profound questions and his perseverance in trying to answer them that would eventually make Darwin a great scientist.

In spite of being desperately seasick every time the ship encountered rough weather, Darwin managed to read a great deal of important scientific literature that he brought along on the voyage. No scientific work was more critical to his further thinking than the first two volumes of Charles Lyell's *Principles of Geology* (1832), which not only gave Darwin an advanced course in uniformitarian geology—a theory that changes in the earth's surface have occurred gradually over long periods of time—but also introduced him to Jean Baptiste Lamarck's arguments for, and Lyell's arguments against, evolutionary thinking.

When Darwin boarded the *Beagle* he still believed in the fixity of species, as did Lyell and all of his teachers at Cambridge. Yet during the South American phase of the *Beagle* voyage Darwin made many observations that greatly puzzled him and that shook his belief in the fixity of species. But it was really his visit to the Galapagos in September and October 1835 that provided him with the crucial evidence, even though—being preoccupied during his stay with geological researches—he did not at first realize it. However, nine months later, in July 1836, he penned these words in his diary: "When I see these islands in sight of each other and possessed of but a scanty stock of animals, tenanted by these birds but slightly differing in structure and filling the same place in nature, I must suspect they are varieties . . . if there is the slightest foundation for these remarks, the zoology of the archipelagoes will be well worth examining: for such facts would undermine the stability of species" (Barlow 1963).

After his arrival in England in October 1836 Darwin sorted his collections and sent them to various specialists to be described in the official account of the *Beagle* expedition. In March 1837, when the celebrated ornithologist John Gould insisted that the mockingbirds (*Mimus*) collected by Darwin on three different islands in the Galapagos were three distinct species rather than varieties, as Darwin had thought, Darwin first understood the process of geographic speciation (Sulloway 1982; 1984): that a new species can develop when a population becomes geographically isolated from its parental species. Furthermore, if colonists derived from a single South American ancestor could become three species in the Galapagos, then all the species of mockingbirds on the mainland could have been derived from an ancestral species, and so could have, at an earlier time, the species of related genera, and so forth. Numerous statements in Darwin's writings confirm that from the spring of 1837 on he firmly believed in the gradual origin of new species through geographic speciation, and in the

theory of evolution by common descent (see Chapter 2). But another year and a half would pass before Darwin figured out the mechanism of evolution, the principle of natural selection. This happened on September 28, 1838, as he was reading Malthus's *Essay on the Principle of Population*

How could one man achieve so much in a lifetime, particularly considering the constraints imposed by his illness ? Only by retreating into the quiet of the countryside, refusing to accept most offered offices or memberships on committees, and, through the generosity of his father, living on his inherited income was Darwin able to complete his task. Yet Darwin was not a recluse. He kept in touch with the scientific world through an extensive correspondence and occasional visits to London, and he was a devoted husband and dedicated father to his ten children.

Darwin was described by his contemporaries as an extraordinarily modest, gentle person who went out of his way to avoid hurting anyone's feelings. He worked so hard because he had an unquenchable thirst for learning, not in order to get advancement or honors. In his publications he was a scientist's scientist. He did not write for the general public; when some of his works had great popular success, he was always astonished.

Darwin's method was actually the time-honored method of the best naturalists. They observe numerous phenomena and always try to understand the how and why of their observations. When something does not at once fall into place, they make a conjecture and test it by additional observations, leading either to a refutation or strengthening of the original assumption. This procedure does not fit well into the classical prescriptions of the philosophy of science, because it consists of continually going back and forth between making observations, posing questions, establishing hypotheses or models, testing them by making further observations, and so forth. Darwin's speculation was a well-disciplined process, used by him, as by every modern scientist, to give direction to the planning of experiments and to the collecting of further observations. I know of no forerunner of Darwin who used this method as consistently and with as much success.

That Darwin was a genius is hardly any longer questioned, some of his earlier detractors notwithstanding. But there must have been a score of other biologists of equal intelligence who failed to match Darwin's achievement. What is it that distinguishes Darwin from all the others? Perhaps we can answer this question by investigating what kind of scientist Darwin was. As he has said, he was first and foremost a naturalist. He was a splendid observer, and like all other naturalists he was interested in organic diversity and in adaptation. Naturalists are, on the whole, describers and particularizers, but Darwin was also a great theoretician, something only very few naturalists have ever been. In that respect Darwin resembles much more some of the leading physical scientists of his day. But Darwin differed from the run-of-the-mill naturalists also in another way. He was not only an observer but also a gifted and indefatigable experimenter whenever he dealt with a problem whose solution could be advanced by an experiment.

I think this suggests some of the sources of Darwin's greatness. The universality of his talents and interests had preadapted him to become a bridge-builder between fields. It enabled him to use his background as a naturalist to theorize about some of the most challenging problems that pique our curiosity. And, in the face of widespread beliefs to the contrary, Darwin was utterly bold in his theorizing. A brilliant mind, great intellectual boldness, and an ability to combine the best qualities of a naturalist-observer, philosophical theoretician, and experimentalist—the world has so far seen such a combination only once, and it was in the man Charles Darwin.