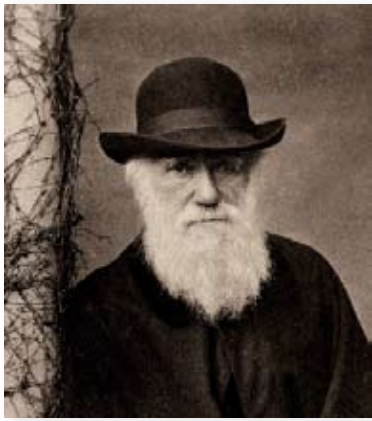


THE BICENTENNIAL OF GIANTS



Charles Darwin

The dawn of the era of science

—by Ilse Genovese

At age 28, Charles Darwin scribbled the first tenet of his grand theory—“one species does change into another.” Twenty years later, after amassing a huge number of specimens and many data, he let the genie—his radical theory about evolution—out into the world.

He took his idea on evolution to the public in 1859, in his treatise *On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life*. This book not only ranks among the most important books ever published; it remains, 150 years after its debut, scientifically relevant.

“Darwinism” is well and alive today partly because Darwin recognized that there are “far more important researches” in the distant future that will build on his theory.

Discoveries in three fields in particular—geology, genetics, and paleoanthropology—illustrate the power of his ideas as well the gaps in his knowledge.

Darwin would have been amazed, for example, to learn that the continents are in constant, crawling motion. The term “genetics” wasn’t coined until 1905, long after Darwin’s death in 1882. And though the

first fossil recognized as an ancient human—the Neanderthal Man—was discovered in Germany just before the *Origin of Species* was published, Darwin possessed no knowledge of our ancestral family tree.

Yet, all these discoveries were made because scientists followed a central organizing principle of life on Earth first laid out by Darwin.

Darwin took several detours before deciding firmly on natural history. He began his search for a career by training as a physician but after discovering “no taste for doctoring,” he decided to become an Anglican priest. However, when an opportunity presented itself in 1831 to be part of a survey of South American coastlines as an unpaid naturalist, the newly ordained priest grasped it with an unbridled eagerness.

During the five years Darwin spent in South America, he discovered new species, both living and extinct, and immersed himself in biogeography, the study of where particular species live, and why.

On return to England, he busied himself publishing scientific works on the formation of coral reefs and animal species he had encountered during the expedition. And slowly, but inexorably, an unorthodox idea took hold in his mind.

“I am almost convinced,” Darwin wrote to a fellow naturalist in 1844, “quite contrary to opinion I started with, that species are not immutable.”

Still, he hesitated to voice his thoughts publicly. Instead, he sought their further validation in the study of domestic animal breeding and the distribution of wild plants and animals. “Natural selection,” he would argue, “is not unlike the artificial selection practiced by a breeder trying to enhance or eliminate a trait.”

Despite this frenetic research, Darwin might never have published his theory on evolution were it not for Alfred Russel Wallace*, a young naturalist

working in the Amazon and later in the Malay Archipelago.

Wallace had developed his own theory of evolution, albeit not as well articulated as Darwin’s. He sent his manuscript to Darwin for comments, and that spurred the older man to act.



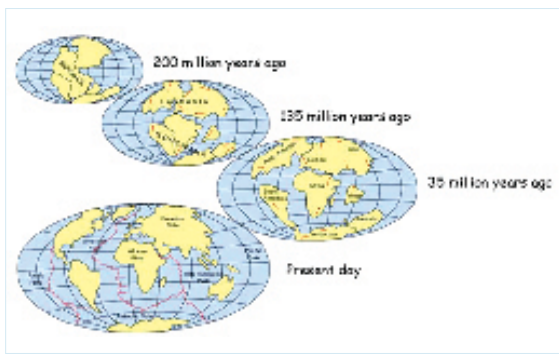
Darwin had an essay he had written in 1844 read together with Wallace’s manuscript at a meeting of the Linnean Society in London in July of 1858, and later that summer published. In faraway Indonesia, Wallace was “delighted.” He was “honored that his work was considered worthy” to be included alongside that of Darwin.”

The joint publication went almost unnoticed, but when Darwin published his revolutionary ideas on evolution a year later in *On the Origin of Species*, all hell broke out.

Rivals called attention to gaps in his evidence, including what would come to be known as “missing links” in the fossil record, and prominent clergymen and politicians condemned the work as heretic.

“Is man an ape or an angel?” asked Benjamin Disraeli in 1864 at a conference. “I, my lord, am on the side of the angels,” said the future prime minister of England. “I repudiate with indignation and abhorrence those newfangled theories.”

One of the puzzles that dogged Darwin was the age of the Earth. “Thompson’s views on the recent age of the world have been for some time



one of my sorest troubles,” wrote Darwin to Wallace in 1869.

William Thompson, a physicist and a contemporary of Darwin’s, calculated that the planet was unlikely to be more than 100 million years old, and Darwin’s own son, George, an astronomer, fixed the Earth’s age at well under this figure. Half a century later, geologists concluded (based on radioactive decay of elements) that the Earth was billions of years old—4.5 billion years, according to the latest studies. Darwin would have been relieved: there was ample time for evolution to have accounted for the great diversity of life on Earth.

Modern geology has helped solve another puzzle that troubled Darwin—the existence of similar species on different continents. A point in case, why do the emus of Australia, the ostriches of Africa, and the rheas of South America all have the same distinctive sternum? The shocking truth is these “sister” species developed on once contiguous continents. The discovery, in the 1960s, that the continents shifted apart due to plate tectonics was nearly as audacious as evolution itself.

One issue that Darwin acknowledged in the *Origin of Species* but never deeply explored—except in his study of the Galápagos finches—is a process dubbed “speciation” or multiplication of species in response to environmental factors. Another area that he did not explore in any great detail was the mechanism of inheritance. This study was begun during his era by Gregor Mendel, an Austrian monk who studied the transmission of such traits as flower color and seed texture in peas.

Mendel was cognizant of Darwin’s work on natural selection—he had an annotated copy of the *Origin of Species* among his possessions—but he never connected the dots, namely that his “units of inheritance carried the variation upon which Darwinian selection acted,” said Michael Ruse, a historian and philosopher of science at Florida State University.

It was left to comparative genomics to make that connection. Scientists can now track, DNA molecule by DNA molecule, the mutations of traits that had occurred. The diagram Darwin once drew in an attempt to explain the difference in beaks among the Galápagos finches has inspired research on a much more detailed tree of life—that of the human species. Using both DNA sequence data and traditional anatomical and behavioral characteristics, scientists working on the Encyclopedia of Life project have taken

great strides in tracing precisely the evolutionary relationships among thousands of species.

Modern science has yielded evolutionary surprises that Darwin (and his age) would have been hard put to accept. Rice has twice as many genes than a human being? [37,000 compared with 20,000.] Genes can be passed even between individuals of different species? [This is how resistance to antibiotics spreads from one strain of bacteria to another, for instance.] Evo-devo? Homeotic genes? [The biology of how a fertilized egg matures; and the genes that dictate where legs or arms or eyes will form.]

And what of one particular evolution that Darwin, the unabashed evolutionist, would take a long time to explore publicly? *The Descent of Man* was eventually, and reluctantly, written. There’s no such reluctance now. The Human Genome Project, completed in 2003, has yielded a multitude of data which are now being analyzed at the finest level of detail to detect and describe signs of natural selection in human beings.



This unprecedented look at our own autobiography has just begun. But ultimately, it will be as revelatory as Newton’s description of the mathematics of motion 322 years ago, or the unlocking of the atom’s secrets that began in the late 1800s. [Facts from an article by Thomas Heyden entitled “What Darwin Didn’t Know. Source of images: <http://mikuly.wordpress.com>; www.classroomatsea.net; <https://www.nhms.com.uk>]

*In 1979, by a young law school graduate named Robert Heggstad bought a lovely rosewood cabinet in an antique shop in Arlington, Va. In 2007, after moving the cabinet from home to home, he decided to research its contents prior to a sale. He found a specimen collection of butterflies, beetles, moths, and shells once belonging to Alfred Wallace, the other foremost naturalist of Darwin’s era.