Darwin: An exhibition at the American Museum of Natural History

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Exhibition runs until May 29, 2006. AMNH, located at Central Park West at 79th Street in Manhattan, is open daily from 10 a.m. to 5:45 p.m.

The *Darwin* exhibition currently on display at the American Museum of Natural History (AMNH) in New York City is a powerful and noteworthy event that should be seen by as many people as possible.

The exhibition opened on November 19 and will remain at the museum until May 29, at which point *Darwin* will travel to the Museum of Science in Boston, the Field Museum in Chicago and the Royal Ontario Museum in Toronto, Canada. In 2009 the exhibition will be housed at the Natural History Museum in London, to coincide with the celebration of the bicentenary of Darwin's birth and the 150th anniversary of the publication of *On the Origin of Species*.

For those who have been affected by the barrage of commentary about the alleged "gaps" in the theory of evolution through natural selection, and the claim that the monumental work of Charles Darwin and those who came after—men and women who established biological evolution as one of the great scientific achievements of the past thousand years—constitutes merely a "theory" (as this word is understood in its vulgar, nonscientific sense), the exhibition will, indeed, be an eye-opener.

That is its great strength. The exhibition does not condescend to its audience, but rather assumes a widespread interest and curiosity about these issues in the general population. In presenting the life and work of the great nineteenth century British naturalist in an accessible, comprehensive, but not oversimplified way, the exhibition's creators have assembled a massive body of material and theoretical evidence which attests to the veracity of the theory of evolution through natural selection, both as Darwin elaborated it in 1859 and in its modern form.

There is such an embarrassment of riches when one considers the multidisciplinary evidence—in comparative anatomy, geology, paleontology, genetics and molecular biology—for the truth of evolutionary theory that the exhibition's curators felt obliged in the end to assuage religious sensibilities. More will be said about this later in this article.

The *Synopsis* of the exhibition reads: "Charles Darwin's evolutionary theory is central to science and is the foundation to all modern biology. Yet, outside the scientific community, the theory has been the subject of controversy that extends from the time of the publication of *The Origin of Species* nearly 150 years ago to the present day."

Despite this reference to current controversies, Dr. Niles Eldredge, the museum's curator-in-chief of the Hall of Biodiversity and the principal organizer of the exhibition, has stated that the convergence of *Darwin*'s opening with the well-publicized attempts to suppress the teaching of Darwinian evolution in American schools in favor of the creationist "intelligent design" hypothesis is merely a coincidence.

The claim that Darwinism has always been controversial (for whom?), while true (at least in this country), can serve to obscure the fact that the present-day attacks on evolutionary theory are unprecedented in their ferocity and are being used to spearhead an assault on all of science and on the scientific world-view.

Moreover, the current attack on evolution is sanctioned at the highest levels of the Bush administration. Coincidence or not, the chilling effect of the medievalist ideology being promulgated by the Bush administration and the religious fundamentalist wing of the Republican Party, as well as the Vatican, is expressed in the absence of any corporate sponsorship for the *Darwin* exhibition.

It is astonishing that an exhibition highlighting the life and achievements of the greatest natural scientist in history, and staged in arguably the most important natural history museum on the planet, should receive no backing from corporate trust funds or institutes that have in the past subsidized such educational projects. This in itself points to the extent of the intellectual and cultural decay of the American ruling elite.

The American Museum of Natural History is a remarkable venue. It seems to go on and on in an endless profusion of rooms and exhibits, so that you are never quite sure if, in the course of a lifetime, you could succeed in viewing the whole thing. This writer has visited the museum many times, first as a small child and then as a student. Now, much later in life, I go there as often as possible.

The museum is a compendium of the history of life on this planet—its origin, evolution and wondrous diversity. It has the largest entomological (insect) collection in the world, as well as one of the world's largest collections of fossils.

Large sections of the museum are devoted to chronicling the natural and cultural history of our species, and it has always been a center for scientific research in innumerable fields related to anthropology and the natural sciences. The artistic recreations behind the glass-enclosed exhibits are, by themselves, wonderful achievements, as appealing and interesting as the natural history and science they depict.

The AMNH was established in 1869, just 10 years after the revolution in science launched by the publication of Darwin's *On the Origin of Species*. It can, therefore, be stated without fear of contradiction that the notion that both life and human society are products of an evolutionary process is a founding conception of the museum, its *raison d'être*.

The museum has been a center for the education of generations of children and adults, and this fact alone indicates the real motivation behind the lack of corporate sponsorship for the *Darwin* exhibition. The current crop of intellectual mediocrities that populate the ruling elite in this country are opposed to the very spirit of mass education and enlightenment upon which this great museum was founded.

There is a subversive aspect to all great scientific accomplishments. With each new discovery or clearly elaborated conception, another nail is driven into the coffin of superstition and preordination. The fact of evolution—that all organisms, including humans and human society—are the interconnected products of a long process of development and transformation, gradual for the most part but sometimes surging forward, raises fundamental questions about the nature of human consciousness and its ability to comprehend this process, and, as a consequence, the ability of men and women to change the conditions of their lives, without recourse

to spirits or nebulous forces.

Hence the attempt by a ruling elite that has run out of ideological justifications for its existence to limit the scope and reach of the *Darwin* exhibition. So, as excellent as the current exhibition is, one can only imagine how comprehensive and compelling it would have been had it received the financial backing that such an important scientific undertaking deserves.

Charles Darwin was an extraordinary individual, and the exhibition presents in detail the course of his remarkable life. The young Darwin was not a dedicated student. His father, a prominent physician, had hoped that his son would devote himself to the ministry or medicine, but the young naturalist was more interested in collecting insects, mainly beetles.

His mother, Susannah York, was the daughter of Josiah Wedgewood, the founder of Wedgewood porcelain. Both the Darwins and the Wedgewoods were representatives of the progressive-minded wing of the English upper-middle-class, whose political views included a strong anti-slavery component.

Evidently, Charles inherited an insatiable curiosity, as well as an eccentric streak, from his grandfather, Erasmus, who quite independently developed his own ideas regarding the evolution of life. The exhibition's section, *World Before Darwin*, explains that while the notion of evolution had already been advanced by such luminaries as the French naturalist Jean-Baptiste Lamarck, who subscribed to the now discredited idea of the inheritance of acquired characteristics, the prevailing view of life was the Biblical notion that the immense varieties of animals and plants inhabiting the earth were all independently created by God. All living things were part of a *scala naturae*, the "great chain of being," with humans perched at the top.

Here the exhibition, in this writer's opinion, could have probed more deeply. For while it is true that the religious notion of a Biblical creation predominated, a developing science, spurred forward by an emerging European capitalism with a global economic and political appetite, was finding chinks in the armor of religious dogma.

The discovery of the fossil remains of extraordinary creatures now extinct, termed *dinosaurs*, or "terrible lizards," by the renowned comparative anatomist Richard Owen, and the classification system of Carl Linneaus (1707-1778), which, despite the idea of the God-given uniqueness of human beings, placed our species squarely in the same taxonomic category as chimpanzees and orangutans, had already raised questions about the real history and interconnectedness of life on the planet.

In addition, the work of researchers such as Georges-Louis Buffon (1717-1788), James Hutton (1726-1797) and Charles Lyell (1797-1875), the founder of modern geology and Darwin's contemporary, contributed to a growing understanding that the earth was far more ancient than the well-known edict of Archbishop Ussher, based on a reading of the Bible, that the earth was less than 5,000 years old.

More to the point is the fact that Darwin's great contribution, what the late evolutionary biologist Ernst Mayr referred to as Darwin's placing of science on a firmly secular foundation, had its roots in the overthrow of the religious notion of the immutability of the universe, a revolution in human thought that had its source in the work of Copernicus and Galileo centuries earlier.

Darwin's passion for the natural world ultimately steered him towards the experience that would forever change his life—the five-year voyage of discovery (1831-1836) as naturalist on the HMS Beagle. During this period, sailing ships with Union Jack unfurled were traversing the globe at the bidding of a burgeoning British empire. A positive byproduct of this rapid and often violent expansion was the discoveries made along the way by scientists with wide-ranging interests. Thomas Henry Huxley, the founder of modern biology, later to be dubbed *Darwin's* "bulldog"because of his steadfast defense of Darwin's evolutionary conclusions, made a similar voyage 10 years later.

The *Darwin* exhibition has placed on view a wide range of specimens and recreations, along with extensive text explanations that illuminate the inner turmoil that these discoveries provoked in the young naturalist, as his creationist preconceptions came into conflict with discoveries that clearly challenged the notion of the immutability of species. At times, reading these explanations, although beautifully and clearly written, proved challenging, all the more so because of the large crowds attracted to the exhibition. Here, *Darwin* would have benefited from a portable audio narration.

Life on the Beagle must have been arduous, as well as dangerous. A model of the vessel shows that it was surprisingly small. Cramped quarters, rough seas (the Beagle sailed around Cape Horn) and the overpowering stench of specimens being dissected and preserved no doubt created a putrid environment at times. Darwin must have welcomed the extensive layovers in South America, the Galapagos Islands and Australia.

It was during these stopovers that Darwin began to entertain the notion that species adapt and change. While in South America, Darwin discovered fossils of extinct mammals that seemed to be gross distortions of currently living forms—giant armadillos, sloths and a large mammal, dubbed Toxodon, unlike anything alive today. Among the types of mammalian fossils collected by Darwin was the glyptodont, an extinct giant armadillo, on display in the exhibition.

Darwin also examined the rhea, clearly a South American version of the African ostrich. Later he would observe a similar bird, the emu, in Australia. The exhibition recounts an amusing tale, in which Darwin, predicting that he would also discover a pigmy rhea, left for the Beagle disappointed, only to discover after he had eaten half the bird at dinner that it, indeed, truly existed.

But it was on the Galapagos Islands that Darwin found a definitive refutation of the creationist notion of immutability, which strengthened his embryonic idea, later to be one of the cornerstones of his evolutionary theory, that all species are linked by common descent. Here Darwin discovered a diversity of finches, birds adapted to different island habitats, each a separate species but having a strange resemblance to one another and to mainland species—an indication that they had all arisen from a single common ancestor that had somehow made it to the islands. He also discovered two different species of iguana, one adapted to a terrestrial environment, the other aquatic—both found nowhere else, but clearly related to South American species.

For Darwin, the religious notion that all species of animals and plants were created by God *in situ* became increasingly untenable. His Beagle voyage led him to develop several insights into the origin and diversity of organisms. Darwin concluded that all species are, in fact, related; that living species are connected to extinct forms through common descent, and that geographical isolation contributed to the evolution of species, even under conditions where the environments were similar.

What accounted for both the similarities and the differences? Why was there a rhea in South America, an emu in Australia and an ostrich in Africa? Darwin concluded that only geographical isolation resulting in evolution from an original common descendant could explain this anomaly.

At the same time, it was becoming increasingly clear to Darwin that the environment, Nature, played a central role in spurring forward adaptation and change within species. He would later predict that there existed on the island of Madagascar an insect possessing an impossibly long nectar-sucking proboscis capable of retrieving the sweet substance from a particular species of orchid. Such an insect was discovered 40 years after Darwin's death.

The section of the exhibition entitled *The Idea Takes Shape* is particularly strong and fascinating. Darwin's ideas about the origin and evolution of species, notwithstanding the plethora of new discoveries that

profoundly shook his earlier preconceptions, were not the result of an epiphany, but rather the product of extensive and painstaking analysis, experimentation and critical thought, albeit by a genius.

This process of accumulating an enormous body of factual evidence, which would prove essential in the defense of theories Darwin knew would be subjected to vitriolic attack, began from the moment he returned in 1836 up to the publication of *On the Origin of Species*, and continued for the remainder of his life.

The exhibition demonstrates that shortly after his return from the Beagle voyage, Darwin's ideas about the unity of species through common descent had already taken shape in an almost finished form. In 1837, in one of his early notebooks, there is a drawing of an evolutionary tree, entitled "transmutation." The design of this phylogenetic diagram is remarkable in its insight, and shows that he was already dealing with the questions of variation and the process of speciation.

Darwin was sharpening his understanding of the role of variation within a species, a labor that would make him the world's authority on barnacles, a first-class selective breeder of orchids and doves, and a botanist, whose work in determining how hermaphroditic flowering plants (flowers having both male and female parts) solved the problem of preventing self-pollination that would limit a species' variability shed additional light on the importance of the palette of species variation upon which nature selected those individuals best adapted to propagate their line.

Darwin's conclusion was revolutionary and dialectical: That while a species is a distinct entity, reproductively isolated, to use modern biological terminology, it is composed of individuals that are each unique. "Variation is the key to understanding how species change," Darwin wrote.

By 1842, Darwin had added the second vital component to his theory of evolution—natural selection: The idea that nature determines the path of species development, as well as the emergence of the new and the extinction of the old. However, reticent as always, Darwin waited. It was only after another naturalist, Alfred Russell Wallace, working in the East Indies, revealed that he had also arrived at natural selection as the driving force of evolution that Darwin was compelled to finally publish his imperishable work in 1859.

The book initially created a firestorm of controversy. The *Origin* was both vigorously defended and vilified, but was welcomed by the class-conscious British working class of the mid-nineteenth century. This section of the exhibition's text reads: "In a surprisingly short time the storm passed—at least for scientists. Evolution by natural selection became a part of their language, integral to scientific work."

Another interesting, but often overlooked, fact was the cordiality between Darwin and Marx. A piece of text from the exhibition states: "Political scientist Karl Marx read and reread the *Origin of Species* in the early 1860s. While there is no truth to the story that Marx wanted to dedicate his own *Das Kapital* to Darwin, a copy of the book inscribed by Marx 'on the part of a sincere admirer' was in the study at Down (Darwin's House) when Darwin died. In thanking Marx for the book, Darwin wrote: "I heartily wish I was more honestly worthy to receive it by understanding more of the deep and important subject of political economy."

The exhibition continues with an appreciation of the important work Darwin carried out after 1859 to firmly establish the truth of the evolutionary theory advanced in the *Origin.* Darwin never doubted the correctness of his elaboration, even though he felt pangs of guilt akin to "confessing a murder," a reference to his abandonment of church teachings on the immutability of species.

Twelve years after the publication of the *Origin*, Darwin published *The Descent of Man*, in which he put forward for the first time the notion of an African origin for humankind.

In 1872, he published a remarkable work, *Expressions of the Emotions in Man and Animals*. In this book, which was the first of its kind to use actual photographs, Darwin linked the facial expressions associated with human emotions with the way in which similar expressions appear in higher animals, thus, once again, connecting our species with the rest of life. It should be noted parenthetically that, at about the same time, American anthropologist Lewis Henry Morgan (*Ancient Society*) was doing similar work, showing the relationship between human intelligence and animal "instinct."

The exhibition concludes with an extensive explanation of modern evolutionary theory, a synthesis of Darwinian evolution through natural selection with Mendelian genetics and molecular biology. This part of the exhibit is especially strong—a concise affirmation of the preponderance of evidence for the evolution of life on this planet.

So why do Eldredge and the other organizers of the exhibit, who should be commended for making an important contribution to the education of masses of people on this vital question, feel compelled to mollify and reassure those holding strong religious convictions that there really exists no conflict between the scientific world view, exemplified by the work of Charles Darwin, and that of religion? One scientist, in the short video presentation on religion, actually expresses his belief in a "personal God."

Scientists, of course, are entitled to their beliefs, even if they are incongruous with the essential theoretical foundations of their life's work. Nevertheless, such religious avowals, in the context of the mass of material presented by the exhibition upholding a materialist and nonreligious world view, are, on their face, discordant and out of place.

There is an element of desperation in the incessant attempt of the creationists and "intelligent design" advocates to remove Darwinism from school science curricula. Time is not on their side! With each new discovery—whether it be a fossil dinosaur clearly exhibiting feathers, a hominid human ancestor that brings us to the brink of the transformation from quadrupedal ape to bipedal human, or a genomic map that further illuminates the interconnectedness of life—evolutionary theory, and human knowledge of the natural world, is enriched and strengthened.

Darwin, however, said it best in the last paragraph of his *On the Origin of Species*: "There is a grandeur in this view of life ... from so simple a beginning, endless forms most beautiful and most wonderful have been, and are being, evolved."