

Original Article

Getting Our History Right: Six Errors about Darwin and His Influence

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Abstract: The Darwin Exhibition created by the American Museum of Natural History is the centerpiece of the bicentennial of Darwin’s birth. It opened in November 2005 and will circulate to a number of museums before terminating at the London Natural History Museum in February 2009. The Exhibition is also a major contributor to online instruction about evolution for schools. The quality of the Exhibition’s narrative is accordingly of some significance. This paper argues that the narrative is the legendary history that dominates public opinion. The legend has been thoroughly disassembled by historical research over recent decades. My criticism is organized as six theses. (1) Publication of the *Origin* was not a sudden (“revolutionary”) interruption of Victorian society’s confident belief in the traditional theological world-view. (2) The *Origin* did not “revolutionize” the biological sciences by removing the creationist premise or introducing new principles. (3) The *Origin* did not revolutionize Victorian public opinion. The public considered Darwin and Spencer to be teaching the same lesson, known today as “Social Darwinism”, which, though fashionable, never achieved dominance. (4) Many biologists expressed significant disagreements with Darwin’s principles. (5) Darwin made little or no contribution to the renovation of theology. His public statements on Providence were inconsistent and the liberal reform of theology was well advanced by 1850. (6) The so-called “Darwinian revolution” was, at the public opinion level, the fashion of *laissez-faire* economic beliefs backed by Darwin and Spencer’s inclusion of the living world in the economic paradigm.

Keywords: Darwin Exhibition, Darwin bicentennial, Darwin legend, evolution history, secularization

Introduction

The celebration of Charles Robert Darwin’s bicentenary (February 12, 2009) has already commenced in the grand manner with the Darwin Exhibition created by the American Museum of Natural History in New York. It “explores the extraordinary life and discoveries of Charles Darwin”, the public is told, “whose striking insights in the 19th century forever changed the perception of the origin of our own species as well as the myriad other species on this planet and launched modern biological science. Visitors of all ages will experience the wonders Darwin witnessed on his journey as a curious and adventurous young man aboard the *HMS Beagle* on its historic five-year voyage (1831–1836) to the Galapagos Islands and beyond” (www.amnh.org/exhibitions/darwin).

The Exhibition opened in November 2005. It will tour major museums in the United States and Canada before coming to rest in the Natural History Museum, London,

where the official ceremonies will be held. This itinerary reflects the linkage of the Exhibition with key science organizations (the American Association for the Advancement of Science, the National Science Foundation, the National Academy of Sciences, the Royal Society), as well as with other major natural history museums, particularly the Museum of Paleontology, University of California, Berkeley. The Exhibition is also the gate to extensive online teaching materials covering biology instruction for all school grades, available at the AMNH and UCMP web sites:

(www.amnh.org/education/resources/exhibitions/darwin/index.php;

<http://copusproject.org>;www.paleoportal.org/;

<http://evolution.berkeley.edu/evosite/evohome.html>). The Exhibition's Curator, Niles Eldredge, states that the Exhibition is especially directed to school children, to provide them evidence of evolution. My visit convinced me that the Exhibition's team has made the complex story tangible by fusing it with the life of the great naturalist. We see the hero on his celebrated voyage, and through his life at Downe, including a reproduction of the study in which he wrote the *Origin*. The gift shop offers many mementoes, from finger puppets of the man to a costly reproduction of the *Beagle*. The Founding Father comes alive. Might this have something to do with our contest with creationists? It does, as we shall see.

Given the Exhibition's top position in the science hierarchy, one would expect glowing reviews. Representative is biologist Robert Dorit's comment in the *American Scientist Online*: "His genius lay not, as heroic reconstruction would have it, in his ability to observe the natural world without preconceptions. Rather, Darwin's ability to discern the incompatibility of existing theories of organic change with the observations he was compiling led to the breakthrough. Once the new theory of organic change began to take shape in his mind—descent with modification through the action of natural selection—the natural world became one vast testing ground. This exhibit is intellectual history at its most thrilling, as we witness Darwin, with his deceptively simple new theory, make a whole set of predictions about the living world. Equally exciting is Darwin's revisiting of well-established observations in paleontology, embryology, comparative anatomy and biogeography, now seen afresh in light of his growing confidence in his theory" (Dorit, 2005, www.americanscientist.org/template/BookReviewTypeDetail/assetid/49582t).

My initial encounter with the Exhibition was its website. As a historian currently writing a book on evolution in the 19th century, I promptly identified the Exhibition as hagiography—"intellectual history at its most thrilling", as Dorit deftly put it. But an edifying story isn't necessary factually sound. The profusion of historical studies over the past three or four decades has added enormously to the documentation of Darwin's work, his life, his cultural milieu, and the numerous evolutionists whose very existence is unknown in the legend (Hull, 1983; Glick, 1988; Kohn, 1988; Hodge and Radick, 2003). We are well advanced toward a factually reliable picture of this decisive period of science history. My objective is to promote the dissemination those results by showing that and how they are at variance with the Exhibition's tale.

It is an important fact that the legend was created in Darwin's lifetime by a small circle of admirers, as Janet Browne and others have shown (Barton, 1998; Browne, 2002;

Caudil, 1994; Moore, 1991). One of the coterie, Thomas Huxley, penned this classic statement: “[Darwin] found a great truth trodden underfoot, reviled by bigots, and ridiculed by all the world; he lived long enough to see it, chiefly by his own efforts, irrefragably established in science, inseparably incorporated with the common thoughts of men, and only hated and feared by those who would revile, but dare not. What shall a man desire more than this?” (Huxley, 1968, p. 244). The author of this mantra was among the many who did not ridicule evolution. Indeed, none of his Amalekite-smiting statements is factually warranted. Another devoted admirer, George Romanes, endorsed Huxley’s (and Darwin’s) idea that prior to Darwin there was no evolutionary thought of consequence. He declared: “It was the theory of natural selection that changed all this, and created a *revolution in the thought of our time*, the magnitude of which in many of its far-reaching consequences we are not even yet in a position to appreciate; but the action of which has already wrought a transformation in general philosophy, as well as in the more special science of biology, that is *without parallel in the history of mankind*” (Romanes, 1892, p. 259; italics in the original).

Huxley and Romanes wrote these statements in their hero worship mood. They knew, in some part of their minds, that their statements were inconsistent with Darwin’s acknowledgement, in the Historical Sketch prefixed to the 3rd edition of the *Origin*, of evolutionary investigations prior to his book. The skeptical Huxley had extensive discussions about evolution with the fervently believing Spencer for years prior to 1859. Moreover, both disciples authored criticisms of Darwin’s theory that they leave unmentioned in their encomia. Yet they were among the principal creators of the Darwin legend. The Exhibition replicates most of their misrepresentations. I formulate my criticisms as six theses of rebuttal directed toward the core of the legend.

Thesis 1

The publication of the *Origin* was not a sudden (“revolutionary”) interruption of Victorian society’s confident belief in the traditional theological world-view. Instead, it was another step, albeit a big one, toward a popularly understandable scientific naturalism, including the idea of our primate origins, that was well in place by 1850.

The Exhibition states that “before Darwin’s time, humans were not considered to be part of the natural world” (www.amnh.org/exhibitions/darwin/beforedarwin/animal.php). It depends on who you ask: the Buddha, Aristotle, St. Paul, or Descartes. The implication of this ill-wrought claim is denial that evolutionary theory was extensively developed before Darwin embarked on his *Beagle* voyage (1831). Not so. Notable contributors were Louis-Constant Prévost, Louis-Melchior Patrin, Jean-Baptiste Lamarck, Julien-Joseph Virey, Jean-Baptiste-Julien d’Omalius d’Halloy, Bory de Saint-Vincent, Ducrottoy de Blainville, Etienne Geoffroy Saint-Hilaire (Corsi, 1988b). Most of these scientists argued for the key “Darwinian” theses of common descent from an initial few organisms, gradual modification and extinction over great ages driven in part by the struggle for existence, geological uniformitarianism, and the primate origin of the human species. Some, notably the physicist Patrin, argued that life originated abiotically. Darwin’s library aboard the *Beagle* included Bory de Saint-Vincent’s influential seventeen volume *Dictionnaire*

classique d'histoire naturelle (1822-1831). Of particular relevance are the *Dictionnaire's* articles on biogeography, which set forth the concept of adaptive radiation, citing studies of African islands, especially Madagascar (Corsi, 1988b). The Exhibition highlights Darwin's encounter with biogeography in the Galapagos; live iguanas and a large tortoise are on show. It rejects the common error that Darwin hit upon the evolutionary idea in the Galapagos via recognition of adaptive radiation. It states the established view that the Galapagos evidence was a transition that matured to the evolution conviction two years later, after Darwin had studied the specimens and consulted a taxonomist. However, the Exhibition confounds an episode of biographical significance with a moment of significance in the unfolding theory of evolution (Darlington, 1960; Løvtrup, 1987). The misrepresentation is easily corrected by referencing the *Dictionnaire* on adaptive radiation and noting that Darwin had this volume aboard ship.

This example of corrected exaggeration can be multiplied indefinitely by attending to the culture of his times. Thus, in 1828 the phrenologist George Combe published the *Constitution of Man*. It was an instant bestseller and became a perennial bestseller (350,000 copies sold by 1900, a popularity exceeded by no other book written in 19th century Britain). The book's drawing card was its naturalist account of human behavior, together with advice on how to improve one's health and social condition, in pointed disregard for religious upbringing (Chadwick, 1975). This prototype of life style management contributed more to the secularization of British popular cultural than anything authored by evolution popularizers, with the possible exception of Ernst Haeckel.

The Exhibition tirelessly champions Darwin's discovery of natural selection. Alas there is the inconvenience that the concept was first published by the Scottish arboriculturalist Patrick Matthew ("the natural law of selection") in 1831, months before the *Beagle's* departure. Shortly after the publication of *Origin*, Matthew stepped forward to claim priority (Dempster, 1996). Darwin graciously acknowledged, and included Matthew among the thirty-four authors acknowledged in the Historical Sketch. The Exhibition makes no mention of Matthew.

In 1836, Edward Blyth published three closely argued natural history essays in which he introduced the concept of natural selection in the form today called "stabilizing selection" (Eiseley, 1979). Blyth, long a member of Darwin's circle of sources, endorsed evolution after the *Origin* was published. The Exhibition makes no mention of Blyth. Between 1833 and 1838, nine books by leading scientists and mathematicians, collectively called *The Bridgewater Treatises*, were published. Their aim was to reconcile knowledge of nature and natural laws, including facts invoked by evolutionists, with faith. Their intention was to spread public understanding of the natural sciences while deflecting the corrosive influence of materialism and evolutionary speculation that by 1840 had spread to the popular press (Corsi 1988a; Yeo, 1993). The authors minimized the role of miracles, and none defended the literal interpretation of Genesis against the findings of geology. But none defended evolution.

In 1844 Robert Chambers anonymously published his bestseller, *Vestiges of the Natural History of Creation*, which presented a vigorously argued, uncompromising naturalist account of evolution that included our descent from primates. It was an instant

success, and sold 26,000 copies in the UK between 1844 and 1860. It was translated into German and Dutch, and sold well in the United States. It also aroused a furious denunciation, by scientists and theologians, combined with a defense of natural theology. Chambers, pleased by the mother lode of curiosity that he had struck, responded forcefully in a companion volume, *Explanations*. Despite its wide appeal, from the palace to the factory floor, from a few scientists to the free thought press, historians long misrecognized this major event in the cultural uptake of the evolution idea. This neglect has been rectified by James A. Secord's comprehensive documentation of the book's assimilation, *Victorian Sensation* (Secord, 2000). The Exhibition ignores this major step forward in the history of Darwinism. *Vestiges* is mentioned only to dismiss it as a "wildly speculative book" while briefly noting its popularity. Its popularity could be underlined by noting that in 1860 the showman P.T. Barnum displayed a "freak", Zip the Pinhead, who was styled "the missing link" between apes and savages. Darwin's writings could not have been the inspiration of the missing link idea. But the *Vestiges* might well have been.

In a series of publications in the 1850s, Herbert Spencer argued for gradualist evolution as a contrasting theory to the biblical story, and introduced, in 1864, "survival of the fittest" as the core meaning of evolution. The phrase was quickly adopted by Wallace and Darwin, since natural selection, they believed, misleadingly suggests a selecting agency. Spencer is omitted from the Exhibition's story.

In 1855, Wallace published an essay on the geographical distribution of species that strongly implied evolution. He made the implication explicit in an 1858 essay that he sent to Darwin. The concordance of Wallace's essay with his own concept of natural selection astonished and dismayed Darwin, for he feared that his priority had been destroyed. However, Darwin's friends arranged joint publication of the Wallace paper and a paper by Darwin by the Linnean Society as co-discoverers of natural selection, but with Darwin assigned priority. Although these well-known facts are acknowledged by the Exhibition, they are lost in its numerous salutes to Darwin as the originator of natural selection. Darwin's originality is also heightened by the Exhibition's failure to record that by 1859, the evolution idea was fashionable in progressive circles in much of Europe, America, even Russia and Japan (Darlington, 1960; Himmelfarb, 1968; Kohn, 1988; Moore, 1991).

Thesis 2

The *Origin* did not "revolutionize" the biological sciences by removing the creationist premise or introducing new principles. On the contrary, *Origin* had little effect on the hard biological sciences because they were already mechanistic and experimental. Darwin's naturalist investigations did not contribute significantly to the experimental biology of his day.

The Exhibition states that evolution by natural selection is the "foundation for all modern biology" and that Darwin "launched modern biological science" (www.amnh.org/exhibitions/darwin/intro/). The first of these statements is a philosophical thesis; the second is historical. I shall consider the second, which contains the germs of the answer to the first.

During Darwin's lifetime, the books of naturalists and geologists enjoyed good

standing with the general public, many of whom were enthusiastic amateurs (Jardine, Secord, and Spary, 1996). This was a different world from “real” science, which was the kind of thing exemplified by Lord Kelvin, the maestro of the transatlantic cable, and Louis Pasteur, the legendary father of the germ theory of disease.

Pasteur practiced experimental, lab-based biology, whose focus was cellular biology, microbiology, biochemistry, and neurology, using constantly innovating experimental equipment and techniques. This research poured forth a stream of practical and profitable innovations, the most celebrated being improved vaccination and sanitation, including pasteurization of milk. Pasteur didn’t include evolutionary factors in his research because he didn’t deem them to be relevant. He wrote nothing about evolution and did not include an evolutionary component in the Pasteur Institute. A similar story may be told of other eminent experimentalists of that time. Germany’s leading cell pathologist and doyen of medical science, Rudolph Virchow, opposed Ernst Haeckel’s attempt to Darwinize biological science. The same is true of embryologist Wilhelm His, who strongly criticized Haeckel’s recapitulation theory. In France, neurologist Paul Broca and anatomist Claude Bernard fit a similar pattern.

Gregor Mendel’s experiments on hybrid garden peas (*Pisum sativum*) and his formulation of the quantitative laws of segregation and independent assortment illustrate the difference between hard science and naturalist investigations. Darwin conducted breeding experiments, but they targeted mechanisms well established in the literature. He did not discover a new mechanism. His theory of inheritance, Pangenesis, was not original and critics claimed that it collapses from its inconsistencies. Mendel’s classic paper makes no mention of evolutionary hypotheses, but he believed that his proof of particulate inheritance refuted Darwin’s gradualist assumption (Bishop, 1996; Challender, 1988). This major scientific event—the only discovery of quantitative biological laws in the 19th century—is ignored to make space for the unsupported claim that Darwin’s “plant research demonstrated the power of evolution by natural selection” (www.amnh.org/exhibitions/darwin/work/grand.php). Darwin discovered a stunning profusion of adaptations, and made many suggestions about phylogenetic relations (Leach and Mayo, 2005), but he did not prove a single phylogeny or prove a single case of speciation by natural selection. Indeed, by 1900 the only fossil-based phylogeny generally accepted was the evolution of the horse (Gayon, 1998). These facts are ignored. The Exhibition also ignores the Pangenesis theory and its influence on Darwin’s shift to substantial Lamarckian explanation in the 5th and 6th editions of *Origin*. Indeed, it implicitly denies Darwin’s Lamarckism by baldly stating that “Charles Darwin offered the world a **single, simple scientific explanation for the diversity of life on Earth**: evolution by natural selection” (www.amnh.org/exhibitions/darwin/evolution/) [bold face in original].

Darwin’s conception and practice of science remained in the naturalist mode that he acquired on his voyage. He took no particular interest in lab-based experimental biology. His measuring tool was a seven-foot ruler calibrated by the village carpenter, and his microscope was an antiquated low resolution, single lens Smith and Beck, which is on display in the Exhibition. There is a brief reference to its obsolescence, and references to his amateur way of doing science (“...armed with jars and biscuit tins...”), but Exhibition

visitors are not encouraged to wonder how science conducted in this manner could have “launched” the experimental biological sciences of his day. The contrast might be put this way. It is doubtful that Darwin made a discovery of Nobel Prize caliber, whereas Louis Pasteur made at least two such discoveries. One, his experimentally ingenious disproof of supposed experimental evidence for spontaneous generation, was directly relevant to evolutionary principles. Darwin’s views on spontaneous generation were vague and uninformed by acquaintance with experimental evidence (Browne, 2002).

Thesis 3

The *Origin* did not “revolutionize” Victorian public opinion. Public perception considered Darwin’s message to be about the same as Herbert Spencer’s, known today as “Social Darwinism”, which, though fashionable, never achieved dominance.

The London Crystal Palace Exhibition of 1851 was a benchmark of the times. The power to invent, to transform, to replicate, to conquer space and time was exuberantly celebrated. The millions who flocked to this gala pageant of progress relished the euphoria of change, expressed in the many machines and domestic improvements on display in a building which was itself a marvel of design and construction. The site covered 19 acres and the Palace was 1848’ long by 436’ wide. It housed 13,000 exhibits (Briggs, 1979).

The Exhibition featured reconstructions of the enormous Megalosaurus dinosaur and the Iguanodon, along with marine reptiles and Paleozoic animals. These displays expressed the fascination with the flora and fauna of the New World that became fashionable thanks partly to the voyage of Joseph Banks on *HMS Endeavor* (1768-1771). Banks returned with 2500 new species and used his influence as long-term President of the Royal Society to encourage public interest in natural history. Paintings and drawings of flora, fauna, and natives, together with hobbyist engagement in botany, zoology, fossils, and geology, became common among the middle class (Jardine, Secord, and Spary, 1996). The expansion of the penny press also carried this fascination to the working class.

Public interest in voyages of discovery and natural history were an aspect of Europe’s profound reorientation stemming from the discovery of the New World and the growth of commerce. The expectation of dramatic change reached an apex in the French Revolution, whose equality doctrine meant freeing slaves and emancipating women. The first statements of feminism stem from that period.

It was a woman, Mary Shelley, who wrote the first science fiction novel, *Frankenstein, or, The Modern Prometheus* (1818). Its “science” was inspired by electrical experiments on the nervous system. Its moral dimension explored the Promethean impulse to disregard traditional moral limits on human action. Her husband, the poet Percy Bysshe Shelley, published, as an undergraduate, a radical tract, *The Necessity of Atheism* (1811). His Oxford mentors rewarded him with expulsion (Priestman, 2006).

Darwin disclosed that the economist Thomas Malthus’ mathematical illustration of the necessity of the struggle for existence inspired his concept of natural selection. Patrick Matthew and Alfred Wallace also acknowledged that connection. The first economist to study the *Origin* was its French translator, Clémence Royer, who chose the title, *De l’Origine des espèces, ou Des Lois du progrès chez les êtres organizes*. She stated that “the

doctrine of Darwin is the rational revelation of progress, pitting itself in its logical antagonism with the irrational revelation of the fall” (Clark, 1984, p. 162). For her, natural selection expressed in the organic world the competitive theory of accumulation discovered by Adam Smith. A similar position was developed a decade previous by *Vestiges* and by Herbert Spencer, beginning with his tract, *Social Statics* (1850). Consistent with his radical individualism, Spencer forcefully advocated the equality of women in *Social Statics*—long before J.S. Mill’s classic advocacy in *The Subjection of Women* (1869) and before Darwin’s qualified endorsement in the *Descent of Man* (1871).

Thesis 4

Many leading naturalists and biologists made significant criticisms of Darwin’s work. This includes Gregor Mendel, who believed that his discoveries refuted Darwin’s premises about the heritability of traits, and Thomas Huxley, who rejected natural selection.

The Exhibition promotes an extreme version the triumphalist legend. Viewers are told that the “*Origin of Species* caused a sensation, not only in Britain but around the world ... The book sold out of stores the first day; the country’s largest circulation library made the *Origin* a selection...and in a surprisingly short time, the storm passed—at least for scientists. Evolution by natural selection became part of their language, integral to scientific work” (www.amnh.org/exhibitions/darwin/work/world.php).

The important substantive claim here is the purported broad acceptance of natural selection among scientists. The claim helps prompt belief that Darwinism enjoyed a social consensus. But before addressing that issue, a few details. The *Origin* came fifteen years too late to arouse a “sensation”; *Vestiges* had done that. Darwin’s publisher, John Murray, anticipated a modest demand and printed only 1200 copies. The claim that it sold out of bookshops “the first day” is incorrect. It sold out to *retailers* on the first day of its *prepublication* offering. To appreciate what this means, note that it was Murray’s *smallest* prepublication sale of five books he offered. The largest prepublication sale was 7600 copies; the smallest, other than *Origin*, was 2500 copies (a biography of the abolitionist Sir Fowell Buxton) (Peckham, 1959). The prize for sensation of the year should go to Edward FitzGerald’s translation of *The Rubiayat of Omar Khayyam*. The author was a 12th century Persian mathematician, scientist, and poet. The *Rubiayat* is an ode to irreligion and nihilist aestheticism. The literary *avant garde* seems to have stolen the march on the more staid scientists.

Now to the substantive issue. It is well established that while evolution was widely accepted by 1870, natural selection was not widely accepted *among scientists*; the general public, by contrast, felt no need to distinguish between the theories of Darwin, Spencer, and others.

Darwin’s scientific apologists made serious criticisms. George Romanes believed that he had not explained the origin of species, only the origin of variation. He made good the lapse by proposing a mechanism that he called “physiological selection” (Forsdyke, 2001). Romanes’ assessment has since been reiterated by leading biologists. Today, speciation is recognized as a distinct research question. The striking fact that the *Origin of*

Species apparently failed to explain the origin of species should be highlighted by an exhibition bound by historical data and a sense of science history's many examples of unvalidated claims.

For Darwin and Patrick Matthew, artificial selection was a special case of natural selection. Alfred Wallace denied that connection. He also denied Lamarckian selection, and even sexual selection, despite Darwin's major study of it. Finally, he denied that the human mind could have derived from primates; only spiritualism, he believed, could explain it (Fichman, 2004).

Thomas Huxley rejected natural selection because it denied saltation events ("macromutations" in current terminology) and because it was inconsistent with the fossil record of long durations of no evolutionary change (descent of like from like). Huxley also rejected Darwin's proposal that classification be based on descent. It could only be based, he believed, on anatomical-morphological traits, along the lines of Karl von Baer's *Bauplan* (Desmond, 1997). This position, as Huxley's critics pointed out, is very close to Richard Owen's archetype idea, on which Huxley was fond of pouring odium.

Ernst Haeckel, Darwin's chief promoter in Germany, and from the 1880s also in England, believed that natural selection was a conservative principle only (stabilizing selection in current terminology). Organic novelty he ascribed to Lamarckian inheritance. This view was shared by numerous 19th century naturalists (Jepson, 1949). Haeckel attempted to implement Darwin's concept of classification based on phylogeny, which was to be read from the observations of comparative embryology, resulting in the "biogenic law" that ontogeny recapitulates phylogeny. The law was stoutly resisted by rival embryologists, and lost its plausibility by about 1920 (Gould, 1977).

Fleeming Jenkin, Francis Galton, Carl Wilhelm Naegeli, and St George Mivart made extensive criticisms of Darwin's theory. Naegeli argued that numerous traits and functions had no adaptive function and hence could not be explained by natural selection. Jenkin and Galton rejected Darwin's blending theory of inheritance. Since it reduces variation by half in every generation, in a few generations reproductive communities would consist of nearly identical organisms lacking the variability needed for evolution. Mivart argued that only macromutations could account for evolution of structures or functions, such as wings, that had no function until they were fully developed. Mendel's experimental design and his two laws assume particulate inheritance.

In the 5th edition of *Origin*, Darwin responded to critics. He conceded that he had underestimated "useless variability" and had believed that adaptive variations "might be preserved much oftener than I now see is possible or probable". He also ascribed a greater weight to Lamarckian inheritance ("use and disuse") than he had in previous editions. On this basis, Samuel Butler, in *Luck or Cunning as the Main Means of Organic Evolution* (1887), argued that Darwin had no other theory than Lamarckism, a view shared by Darwin's mentor, Charles Lyell. Eccentric though it is, this view is an important historical datum because of its prominence in the French response to Darwin (Persell 1999).

Thesis 5

Darwin made little or no contribution to the renovation of theology. His public

statements on Providence were inconsistent and the liberal reform of theology, including rejection of the divinity of Christ, was well advanced by 1850.

Although the corrosive influence of Darwinism on conventional religious belief is widely claimed to be its most novel and potent cultural influence, the facts speak overwhelmingly against it.

England in 1850 had been exposed to two centuries of enlightenment, including its own progeny—Thomas Hobbes, John Locke, the Deists, David Hume, Adam Smith, the Utilitarians, George Combe, J.S. Mill (Chadwick, 1975). The French influence, in addition to the evolutionists previously mentioned, included the materialist Baron d’Holbach, a host of socialists, and Auguste Comte. The German impact can be narrowed to one influential author, David Friedrich Strauss, whose *Life of Jesus Critically Examined* was translated in 1846. Strauss treated Jesus as a historical person and Christian belief as a symbolic representation of the meaning of salvation. His translator was Marian Evans, aka, the novelist George Eliot, who collaborated with Herbert Spencer in editing the *Westminster Review*. They were members of a progressive circle that included Thomas Huxley, William B. Carpenter, George Lewes, J.S. Mill, H.G. Atkinson, and Harriet Martineau. Martineau published in 1851 *Letters on the Laws of Man's Nature and Development*, which projected freethinking humanism as the culmination of millennia of cultural improvement. She was the translator of Comte’s *Positive Philosophy*.

Humanism had also penetrated the clergy. Just months after the publication of the *Origin, Essays and Reviews* appeared. It consists of seven essays by Anglican clergymen whose common theme is that Scripture should be interpreted as a historical document like any other, meaning that divine inspiration is not credited as an authorial source and that miraculous stories are treated as moral allegories—the doctrine espoused by David Strauss. It also means that inconsistencies are identified and that damage done to authoritative meanings by textual variants are acknowledged. In this way theology is brought into line with the “creed of science” (Chadwick, 1975; Corsi, 1988a; Graham, 1881; Romanes, 1892). One contributor was Baden Powell, Savilian Professor of Geometry at Oxford, who for two decades had promoted evolution. He said of the *Origin* that it “must soon bring about an entire revolution in opinion in favor of the grand principle of the self-evolving powers of nature” (Corsi, 1988a, p. 284). Another contributor, Frederick Temple, became a bishop and eventually Archbishop of Canterbury (Shea and Whitlam, 2000).

Darwin’s public statements on the implications of his theory for theology and for religious belief are meager. Often in the *Origin* he contrasts special creation with his own explanation, and dismisses the former. But the concluding words of the *Origin* postulate a theistic cosmic order. When his friend Asa Gray, the Harvard botanist and clergyman, wrote a defense of his theory against accusations of atheism, Darwin was delighted. The 3rd edition of the *Origin* commends Gray’s defense; Darwin had the latter published in England at his own expense. The *Descent of Man* presents a naturalistic account of human evolution, including denial that the God idea is innate. Darwin was responding to Wallace, who, much to his unease, denied that primate origins could explain the human mind.

When Darwin’s published statements on the Deity are assembled and compared, they express conventional humanist optimism about a future free from religious dogma.

Most were made *after* secular evangelists such as Chambers, Spencer, Royer, Huxley and Haeckel had fashioned evolution into an aggressive attack, labeled “the creed of science”, on traditional belief. Only in his *Autobiography* (1880) did Darwin go public with the agnosticism that appears frequently in his correspondence. When all of his comments are brought together, they sum as a statement of liberal thought on religion and morality, including rejection of atheism and creationism, equivocation as to whether there is a providential order, reluctance to offend believers, especially his own family, and retention of church membership (Browne, 2002; Darlington, 1960; Desmond, 1997; Himmelfarb 1968).

The Exhibition triumphantly proclaims that Darwin’s “revolutionary theory changed the course of science and society”. Which society? What changes? Rather than attending to Darwin’s contribution to secularization, as I have done, the Exhibition offers a video of half dozen biologists who simply assert the compatibility of religion with Darwinian evolution. Not all religion, however: Intelligent Design is firmly, if politely, dismissed. My response to this gambit was surprise verging on astonishment. If contemporary opinion is relevant, how can today’s atheist crescendo be ignored? Is it to avoid shocking the religious among the visitors? Fine-tuning the educational mission probably explains it. Compatibility is the position of the AAAS, the NAS, and the instructional materials at the UCPM and AMNH websites. Compatibility puts pressure on creationists by asking, What’s all the fuss about? School kids are likely to find this a reasonable position, especially if they warm to Darwin’s personality. But the position cuts two ways: why not teach compatibility in the classroom? The online instructional materials address this issue, at least indirectly, but I shall not deal with it here.

Having emphasized the broad-based secularization of British society and its sources prior to the *Origin*’s publication, I cannot leave this subject without considering important counter-evidence. I refer to the testimony of many contemporaries, some of whom were evolutionists long before 1859, who nevertheless hailed the *Origin* as having affected a “revolution” in their thought. For Baden Powell, it was the wonder of Darwin’s comprehensive argument for natural selection as evolution’s mechanism. For Wallace it was the depth and scope of Darwin’s argument, which he believed far surpassed his own powers. For Francis Galton, it was this: “The publication in 1859 of the *Origin of Species* by Charles Darwin made a marked epoch in my own mental development, as it did in that of human thought generally. Its effect was to demolish a multitude of dogmatic barriers by a single stroke, and to arouse a spirit of rebellion against all ancient authorities whose positive and unauthenticated statements were contradicted by modern science” (Bulmer, 2003, p. 55). This testimony, I suggest, provides the core reason for Darwin’s high reputation among the informed. The Galton who read the *Origin* had long abandoned “a multitude of dogmatic barriers”. Nevertheless, that writing brought it all together and equipped him with an evolutionary vision. It was a “revolution” because it revealed a new conceptual world. This observation resolves the longstanding ambivalence about how to evaluate Patrick Matthew’s priority. We may comfortably credit Matthew, Blyth, Darwin, and Wallace with the independent discovery of the natural selection *concept*, while yet crediting Darwin with a uniquely forceful interpretation of the *evidence* for evolution. That

was his central achievement. And it is a major scientific achievement.

Thesis 6

The Darwinian Revolution was, at the public opinion level, the fashion of free trade economics backed by the perception that Darwin and Spencer had extended that paradigm to all of living nature. This fashion enjoyed prominence in much of Europe and the United States, but began to fade around 1900. It was in no sense analogous to the Copernican revolution, with which it is often compared.

A soothing aphorism circulates today declaring that “the only thing Darwinism has in common with Social Darwinism is the name”. The Exhibition expresses this view, maintaining that Social Darwinism is a misuse of a “purely scientific theory for a completely unscientific purpose” and that Darwin was “passionately opposed to social injustice and oppression” (www.amnh.org/exhibitions/darwin/evolution/darwinism.php). This is a drastic distortion of historical fact. Social Darwinism figures as the core of Darwinism in the *New York Times* obituary. The article declared: “The central principle—his opponents call it a dogma—of Mr. Darwin's system is “natural selection,” called by Herbert Spencer “the survival of the fittest,” a choice which results inevitably from “the struggle for existence.” It is a law and fact in nature that there shall be the weak and the strong. The strong shall triumph and the weak shall go to the wall. The law, though involving destruction, is really preservative” (*New York Times*, April 21, 1882, p. 1). After describing the inevitable Malthusian struggle for existence among living organisms, the obituary asserts that survival isn't due to chance, but to superior adaptation that creates new, improved species. The Social Darwinist message is conveyed in the statement: “In this struggle the multitudes are slain and the few survive”. Lesson: The Sermon on the Mount is out-of-date.

A few months after Darwin's death, Herbert Spencer arrived in New York. The hosts for his American tour were leading academics and his celebrity admirer, the industrialist Andrew Carnegie, who preached the free market practice that made him king of steel. “While the law of competition may be sometimes hard for the individual”, Carnegie was fond of saying, “it is best for the race, because it ensures the survival of the fittest in every department” (Carnegie, 1889, p. 655). Carnegie drew no distinction between the theories of Darwin and Spencer.

Spencer's leading American disciple was the Yale sociologist, William Graham Sumner, who was influential among industrialists. Other Social Darwinists were the Harvard geneticist Charles B. Davenport, founder of the Eugenics Record Office and first director of the Cold Spring Harbor Laboratory, paleontologist Henry Fairfield Osborn, Director of the American Museum of Natural History (1908-1935) and President of the Second International Eugenics Congress which convened at the AMNH, President Theodore Roosevelt, Supreme Court Justice Oliver Wendell Holmes, and the Anglo-American crusader for Planned Parenthood, Margaret Sanger (Franks, 2005; Osborne, 1968; Rice, 1929).

In France, Clémence Royer figured among Social Darwinists. In England and Germany, the market economy cutting edge of American Social Darwinism was subdued or

replaced by the notion of government-led eugenics. Among the British leaders were Darwin's sons Francis, George, and Leonard, his cousin Francis Galton, Galton's disciple Karl Pearson, the geneticist R. A. Fisher (whose patron was Leonard Darwin), J.B.S. Haldane, and Julian Huxley. In Italy the leader was the criminologist Cesare Lombroso. In Germany there were many, including that nation's leading Darwinist, Ernst Haeckel, who wrote: "The cruel and unsparing "struggle for existence," which rages—and naturally must rage—everywhere in the biosphere, this unceasing and inexorable *competition* of all living creatures, is an undeniable fact; only the chosen minority of the privileged fit ones is in the condition to survive successfully this competition, while the great majority of the competitors must necessarily perish miserably" (Weikart, 2004, p. 80). The Exhibition is silent about these facts, perhaps because their bare mention undermines the categorical denial of any connection between Darwin and Social Darwinism.

Darwin's personal connection with the free market is the large fortune he accumulated as an investor and the bank partnership he bought his son William (Browne, 2002). He also carefully controlled household expenditures and kept a detailed account of outgoings. That Darwin was "passionately opposed" to injustice is consistent with his strong disapproval of slavery, his distress on witnessing animal cruelty, and his unfailing concern for others. Nevertheless, Darwin subscribed to the belief, integral to the 19th century concept of progress, in the hierarchy of racial difference, with Caucasians at the peak and savages at the bottom, coupled with the belief that the bottom layer was in the process of extinction. This is intimated in the *Origin's* subtitle, *Or the Preservation of the Favoured Races in the Struggle for Life*. He supported, as most English progressives did, the Union in the Civil War until a U.S. warship boarded a British merchant vessel to remove Confederate emissaries to the British court. The Crown strongly protested this putative act of war and Darwin, fearing war, withdrew his support for President Lincoln (Milner, 2005). Darwin also publicly supported vivisection, despite his sympathy with the anti-vivisectionist sentiment.

Mention must be made of the pundit and science fiction novelist, H. G. Wells, who studied biology under Thomas Huxley. In his *Anticipations* (1901) he envisioned the New Republic of the Twentieth Century, which would be based on the Malthusian insight about the unavoidability of intense competition. The New Republic will program procreation to improve physical and mental qualities. It will identify inferior human stock (which Wells styles "The Abyss"), minimize their reproduction, and eventually eliminate them altogether. Here's a sample of Wells' persuasion: "And how will the New Republic treat the inferior races? How will it deal with the black?... the yellow man?... the Jew?... Well, the world is a world, and not a charitable institution, and I take it they will have to go. ... The ethical system of these men of the New Republic ... will be shaped primarily to favour the procreation of what is fine and efficient and beautiful in humanity... And the method that nature has followed hitherto in the shaping of the world, whereby weakness was prevented from propagating weakness... is death. ...The men of the New Republic... will have an ideal that will make the killing worth the while". ... "Euthanasia of the weak and sensual is possible and I have little doubt that it will be planned and achieved" (Wells, 1902, pp. 299-302).

In the same year that Wells imagined this future, the *New York Journal* published an editorial response to news that the 20th Kansas Division massacred 17,000 inhabitants of a town during the Philippines revolt. The author, who was the *Journal's* owner, William Randolph Hearst, declared: "The weak must go to the wall and stay there. . . . We'll rule in Asia as we rule at home. We shall establish in Asia a branch agent of the true American movement towards liberty" (Langer, 1950, p. 219).

Finally, Clémence Royer's introduction to her French translation of the *Origin* is uncompromisingly Social Darwinist. She stated Wells' position four decades in advance of *Anticipations*: "What is the result of this exclusive and unintelligent protection accorded to the weak, the infirm, the incurable, the wicked, to all those who are ill-favored by nature? It is that the ills which have afflicted them tend to be perpetuated and multiplied indefinitely; that evil is increased instead of diminishing, and tends to grow at the expense of the good" (Weikart, 2004, p. 89).

Social Darwinism was defeated in U.S. universities by a coalition of sociologists and anthropologists, with the help of some geneticists, especially Herbert Spencer Jennings. It was defeated in the human application of the biological sciences when the naturalist basis of Darwinian theory was superseded by experimental biology armed with genetics.

Conclusion

The Exhibition treats the Darwinian Revolution as a single process dating from the *Origin's* publication until today. The implicit idea is that science moves ever forward in a continuous line of accumulating evidence. But when that idea is tested against observed practice, the straight line transforms into a non-linear landscape of exotic shapes, with numerous dead ends and dramatic battles, whose direction at any point in time is contested. It is generally known, for example, that rise of genetics around 1900 created a sense that Darwinism was in "eclipse", although that assessment was fiercely contested by self-styled "true Darwinians", such as Karl Pearson (Bowler, 1992). A recent study of this period by the French scholar Jean Gayon concludes in that "post-Darwinian evolutionary theory was characterized by a profound confusion" (Gayon, 1998, p. 177). My corrections of the Exhibition's history are a synopsis of that condition. Contrary to the Exhibition, science is more a polyarchy than a unity; what counts as proved varies in time and with the outcomes of struggles to control podiums (Lightman, 1997). A telling example: Not long ago, the American Museum of Natural History, through its eminent, long-serving director, lent its weight to eugenics (Osborn, 1969), but today it shuns eugenics as bad science and worse ethics. Good science one day; bad science another. Recognition that the flow of social norms also affects scientific opinion offered as authoritative is fundamental to understanding how science works.

The revision proposed here assigns Darwin's contributions to 19th century evolutionary investigations based on paleontology and natural history, supplemented by plant and animal physiology. As theories of "descent with modification", they presupposed a theory of inheritance. But there was no experimental theory of inheritance and the fossil record was invoked to support opposite readings, although continuous evolution prevailed

in the legend. Ironically, the Exhibition's curator is co-author of the contemporary version of discontinuity, styled "punctuated equilibrium", which is given a low key mention in the Exhibition. But Eldredge's latest book on the topic, *Darwin: Discovering the Tree of Life*, is available in the Exhibition bookshop.

The basis for a scientific theory of evolution, on the revision I propose, commences with Mendel's 1866 paper on plant hybridization, taken in context with the rapid advance of cellular biology and other experimental life sciences in the post-1850 period. In the 1900-1920 period, these initially separate strands merged into a more or less integrated theory of cells, chromosomes, genes, and inheritance. With the publication of R. A. Fisher's *Genetical Theory of Natural Selection* (1930), population genetics emerged as a calculus treating genes as abstract variables, thereby enabling an evolutionary theory independent of empirical mechanisms of phenotypic variation and change. This perspective received its classic popularization in Richard Dawkins' *The Selfish Gene* (1976). Dawkins ignored selection mechanisms other than natural selection, e.g., random drift, neutral theory, population structures, endosymbiosis, horizontal gene transfer, and epigenesis. He, and Neo-Darwinians generally, also ignored the molecular evidence showing that genomes, particularly eukaryotes, defy natural selection logic (e.g., the C-value paradox and the interspersal of non-coding genes in coding gene sequences). Molecular methods have discovered a new class of data on phylogeny and a vast new store of data on phenotype variation, thereby enabling research on the new evolutionary domain, epigenesis. Major discoveries and conceptual innovation are to be expected (Carroll, 2005; Depew and Weber, 1996; Kirschner and Gerhart, 2005; Mattick, 2004).

Darwin's contribution to the empirical evidence and comprehension of evolution was massive. But Exhibition's representation of him as the father of contemporary theory is off the mark: even Mendel is now obsolete. My primary concern, however, is with the Exhibition's devotion to the legend at the expense of fact. As a cadre who bear a public trust to get the facts right, we are obliged to correct misrepresentations directed to schools at a time when evolution is under challenge. Besides, science history that includes the quirks, baseless claims, cheating, and battles is more engaging than the sanitized history meant to instill unquestioning acceptance.

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