

# What Darwin Disturbed

## The Biology That Might Have Been

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### ABSTRACT

The launch of a revolutionary new scientific theory represents a rare occasion on which the apparently cumulative development of science might be influenced by particular events. Yet in the case of the Darwinian revolution it is often claimed that the theory of evolution by natural selection would have emerged more or less inevitably, given the scientific and cultural circumstances prevailing in mid-Victorian Britain. This essay challenges that claim by arguing that if Darwin had not been there to write his *Origin of Species* the subsequent development of biology would have occurred along a line that steadily diverged from the sequence of events we actually experienced. There would certainly have been an evolutionary movement in the late nineteenth century, but there would have been no selection theory to disturb the progressionist assumptions of the time. A totally non-Darwinian evolutionism might not have generated the challenges that led to the emergence of modern genetics in the early twentieth century, resulting in a very different understanding of the relationship between development, heredity, and environment.

IT HAS OFTEN BEEN ARGUED that the theory of evolution by natural selection was “in the air” in mid-Victorian Britain—that it would have emerged more or less inevitably, given the scientific and social developments of the time. But recent historical work has generated major problems for this thesis. We now realize that Darwin’s theory of natural selection was widely rejected in the later nineteenth century. In this sense, the revolution in biology in the post-Darwinian era was, as I have argued elsewhere, non-Darwinian.<sup>1</sup> But is that claim tantamount to suggesting that Darwin made no difference at

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<sup>1</sup> See Peter J. Bowler, *The Eclipse of Darwinism: Anti-Darwinian Evolution Theories in the Decades around 1900* (Baltimore: Johns Hopkins Univ. Press, 1983); and Bowler, *The Non-Darwinian Revolution: Reinterpreting a Historical Myth* (Baltimore: Johns Hopkins Univ. Press, 1988). I am referring here only to Darwin’s natural selection theory, not to the whole of his theorizing. His other major evolutionary proposal, the tree of life idea, was just as distinctively Darwin’s but was widely taken up in nineteenth-century biology. On the originality of Darwin’s tree of life proposal see Jonathan Hodge, “Against ‘Revolution’ and ‘Evolution,’” *Journal of the History of Biology*, 2005, 38:101–121, esp. pp. 114–118. For the reconstruction of the evolutionary tree of life

all? Should we conclude—to put the question counterfactually—that, had Darwin never published the *Origin*, the post-1859 era would, sooner or later, have taken on exactly the same, non-Darwinian character that it actually took on? Here I want to suggest that Darwin did make a difference, but not in the way that we might first have thought. My analysis will proceed in two steps. I first make the case for Darwin's uniqueness, arguing that, without his influence, it is very difficult to see how the theory of natural selection could have come to play a role in the evolutionism that, as historians now agree, developed out of scientific and cultural trends established well before 1859. I then explore the consequences of subtracting Darwin from an imaginary world where the space for a theory of evolution within late nineteenth-century science was occupied solely (instead of largely) by non-Darwinian ideas. An evolutionism completely free of Darwin's influence would, I suggest, have shown interesting differences from the one that emerged under that influence. Biology without Darwin might well have ended up pretty much where it is today in terms of the overall content; but we would think very differently about the relationship between the different parts of that science and about our own relationship to it.

What follows is counterfactual history exploring a particular science and era; but there is a general lesson here for the counterfactualist historian of science. Most attempts to imagine an alternative history to the one our world actually experienced are centered on military history. It is easy to imagine how a crucial battle could have turned out differently, and if it had, the whole history would immediately have been switched onto an entirely different course. Very often, a quite trivial event in the battle can be imagined to have triggered a cascade of consequences that affect the whole outcome. My own introduction to the genre was Ward Moore's 1955 novel *Bring the Jubilee*, in which a time traveler accidentally interferes with a key event in the battle of Gettysburg, thus reversing what was supposed to be a Confederate victory in the battle and the war. But military history is a misleading model in one sense because it focuses on changes that have both a rapid and a fundamental effect. My suggestions for the Darwinian revolution imply a less drastic switch to a new track whose divergence from the actual course of history builds up slowly over time as the consequences of a key change only gradually add up to produce a major effect. The changes are also more subtle—it's not a question of there being no evolutionism if Darwin didn't write the *Origin of Species*, but of the kind of evolutionism that developed being different, with all sorts of consequences for how biological concepts and their social implications were understood and prioritized. In a sense, this is a very Darwinian vision of history, one in which the whole process is open ended and small events (such as a species accidentally crossing a geographical barrier) can have major consequences for all subsequent developments.<sup>2</sup>

#### WITHOUT DARWIN, NO THEORY OF NATURAL SELECTION

The historiography of the Darwinian revolution employed at the time of its centenary assumed that not only evolutionism but Darwinian natural selection theory itself was an

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in the post-Darwinian era see Bowler, *Life's Splendid Drama: Evolutionary Biology and the Reconstruction of Life's Ancestry, 1860–1940* (Chicago: Univ. Chicago Press, 1996).

<sup>2</sup> A similar approach was suggested by John Waller, "Evolution's Inside Man," *New Scientist*, 20 Aug. 2005, 187:43–44; see also my letter in response: Peter J. Bowler, "World without Darwin," *ibid.*, 17 Sept. 2005, p. 16. For a classic sample of alternatives see Robert Cowley, ed., *What If? The World's Foremost Military Historians Imagine What Might Have Been* (New York: Simon & Schuster; London: Macmillan, 1999). See also Ward Moore, *Bring the Jubilee* (London: Heinemann, 1955).

inevitable outcome of the way science and Western culture were developing in the 1850s. The various components that Darwin built into the *Origin*—studies of the fossil record, geographical distribution, artificial selection, population—were available to anyone at the time, and sooner or later someone would have put them together. The emphasis on struggle and competition was merely a reflection of the prevailing ideology of the time. But here we encounter the first problem with the inevitability thesis: Was it the science or the culture that made natural selection theory inevitable? One could argue that it was a kind of double inevitability, but I can't help feeling that the two sides of the thesis are incompatible. If the science was enough, then the role of ideology cannot have been all that important, as those who opposed Robert Young's Marxist analysis liked to argue.<sup>3</sup> And if ideology was all, why was it so important to have a book like the *Origin* to break an apparent logjam in the scientific community?

To avoid this historiographical morass, let us look at what Darwin did and ask the very simple question: Was there anyone else in a position to do exactly the same? My answer is a resounding "No." The conventional response by proponents of the inevitability thesis is that the codiscovery of natural selection by Alfred Russel Wallace shows that the theory was "in the air" at the time. But there were significant differences between Wallace's 1858 version of the theory and the one that Darwin had been developing.<sup>4</sup> Even on the most sympathetic reading of Wallace, he was (and remained) uninterested in the analogy Darwin saw between natural and artificial selection, so that important element would have been missing from any form of evolutionism he might have initiated. We must also remember that Wallace was in the Far East when he developed his theory and did not return to England until 1862. His 1858 paper had very little impact, even when coupled with Darwin's hastily prepared summary, and it would have been several years before Wallace could have put together anything on the scale of the *Origin*. Who knows what would have happened in the meantime?

There are other candidates for the honor of discovering natural selection, but none seem plausible as replacements for Darwin on the big stage. Once we begin to think carefully about Darwin's career, we see that he did indeed put together a unique set of scientific and more general interests. Few expert naturalists would have taken animal breeding seriously as a research topic at the time. Few had Darwin's hands-on experience in the study of geographical distribution, and although this topic pushed Wallace toward evolutionism, Joseph Dalton Hooker took some time to be persuaded by Darwin. The study of barnacles might seem like a typical project in morphology and taxonomy, but Darwin's determination to quarry the research for information on variation was unique. So many of Darwin's other interests were also somewhat idiosyncratic: this is why the later part of his career includes botanical studies that don't fit in with the contemporary morphological tradition. T. H. Huxley was a poor Darwinian (by modern standards), despite his ideologically motivated enthusiasm for the theory. He never accepted natural selection as the

<sup>3</sup> Robert M. Young, *Darwin's Metaphor: Nature's Place in Victorian Culture* (Cambridge: Cambridge Univ. Press, 1985); for an alternative that ignores ideology see Ernst Mayr, *The Growth of Biological Thought: Diversity, Evolution, and Inheritance* (Cambridge, Mass.: Harvard Univ. Press, 1982).

<sup>4</sup> For an overview of ideas on the relationship see Malcolm Jay Kottler, "Charles Darwin and Alfred Russel Wallace: Two Decades of Debate over Natural Selection," in *The Darwinian Heritage*, ed. David Kohn (Princeton, N.J.: Princeton Univ. Press, 1985), pp. 367–432. For further discussion of Darwin-Wallace "convergence" and natural selection theory's inevitability or otherwise see Gregory Radick, "Is the Theory of Natural Selection Independent of Its History?" in *The Cambridge Companion to Darwin*, ed. Jonathan Hodge and Radick (Cambridge: Cambridge Univ. Press, 2003), pp. 143–167, esp. pp. 149–150.

principal mechanism of evolution and continued to look for processes that could shape variation along definite lines.<sup>5</sup>

We also need to think carefully about the ideological component of Darwin's own ideas. However powerful the individualist political philosophy articulated by Herbert Spencer, there was nothing to compel a scientist to take it as a model for nature. And when Spencer did articulate an extension of his ideology into biology, it was based more on Lamarckism than on natural selection. Darwin picked up his enthusiasm for Malthus's principle of population at an early stage in his career and worked with it throughout the next several decades. If we follow Adrian Desmond and James Moore, the selection theory was a product of the pessimistic atmosphere of the 1830s, not the more comfortable 1850s.<sup>6</sup> To acknowledge a role for laissez-faire ideology in Darwin's thinking does not support the claim that he was merely articulating the ideology of his time in a way that anyone else could have done. Wallace formulated his version of the theory much later—and while committed to a very different political agenda. Darwin used the logic of Malthusianism in a particular way that was not characteristic of his time.

Could we imagine that the selection theory would never have been proposed (something that would delight its opponents who insist that it is bad science)? To formulate the theory of natural selection, one needed to combine an awareness of variability within a population, a sense of the "hardness" of heredity, an awareness that overpopulation leads to a shortage of resources and hence to a struggle for existence, and a recognition that success in this struggle would depend on gaining an adaptive advantage as determined by the local environment. But who else would have been in a position to put all these elements together? It is striking to consider the impact of Darwin's natural selection theory on researchers who were not themselves in a position to formulate the theory. Would the careers of, say, August Weismann, Francis Galton, Karl Pearson, and Hugo De Vries have moved along the trajectories we associate with them if there had been no theory of natural selection under debate? While of course one can never be sure about such alternative worlds—the great problem with counterfactual history—I suspect that all of these men would have gone off in different directions in their research lives, with none of them creating a selection theory of his own.

#### WITHOUT NATURAL SELECTION THEORY, PROGRESSIVE EVOLUTIONISM—BUT WITH A SOFTER SOCIAL EDGE

Again, in the actual world, much late nineteenth-century evolutionism was non-Darwinian in character. Darwin convinced everyone that the basic idea of transmutation should be accepted, but natural selection was generally regarded as an inadequate theory. Most of his contemporaries preferred to believe that evolution must be directed toward a predetermined goal. The claim that selection is based on "chance" reflects this fundamental objection. The preferred theories of the later nineteenth century were Lamarckian or orthogenetic, reflecting the adaptive and nonadaptive wings of a more general viewpoint in which the development of the embryo was seen as a model for evolution. Very often these theories presented evolution as a process in which lines advance in parallel toward

<sup>5</sup> See, e.g., Michael Bartholomew, "Huxley's Defence of Darwinism," *Annals of Science*, 1975, 32:525–535; and Mario A. Di Gregorio, *T. H. Huxley's Place in Natural Science* (New Haven, Conn.: Yale Univ. Press, 1984).

<sup>6</sup> Adrian Desmond and James Moore, *Darwin* (London: Joseph, 1991).

the same goal, thereby circumventing the logic of Darwin's model of the branching tree. The revolution established an evolutionary worldview, but it did not establish a Darwinian evolutionism (in the modern sense of the term) at the time.

If the *Origin of Species* merely triggered the adoption of a generalized evolutionary worldview, it played a more limited role than the one ascribed to it in the older historiography. This leads me to ask what would have happened if Darwin had not been there to write his book. I think most scholars familiar with the period would expect that there would have been a transition to the evolutionary paradigm sometime during the 1860s. It would not have involved the dramatic debates witnessed in our own time line because the most contentious aspect of Darwin's thinking would not have been introduced into the debate. The transition would have been a continuation of processes we see already occurring in the 1850s, as people reacted to the theory proposed in Robert Chambers's *Vestiges of the Natural History of Creation* and became gradually less concerned about the idea that creation unfolded by law rather than by miracle. In James Secord's analysis of the response to *Vestiges*, Darwin is seen as merely completing the revolution initiated by Chambers.<sup>7</sup>

What factors would have helped this transition? Herbert Spencer would presumably have written his *Principles of Biology* whether or not the *Origin* had been published. He had long been committed to Lamarckian evolutionism, and his book as we know it devotes much more attention to that theory than to Darwinism (although of course he would not have coined the iconic phrase "survival of the fittest"). Spencer would still have stressed the role of competition for resources, but its purpose would be to promote self-improvement and the development of new characters that would be passed on to the next generation. In Germany, Ernst Haeckel would have moved toward an evolutionary viewpoint, also based on Lamarckism but stressing competition between races and species rather than between individuals. Naturalists and the general public would have accepted a worldview based on progressive evolution and competition, but in a Lamarckian context.<sup>8</sup>

The cultural implications of this evolutionary worldview would be very similar to those we are familiar with, because much of what we call "social Darwinism" could have been articulated without the inspiration of Darwin's theory. Spencer's philosophy of self-help Lamarckism and the whole apparatus of race theory, including the idea of race competition, would be readily available. One factor that would have been missing in the non-Darwinian universe is Darwin's emphasis on inheritance at the individual level and his analogy with artificial selection. What this might have meant for the emergence of the eugenics program in the later nineteenth century is an interesting point to which I will return. More ominously still, I think it could be argued that without Darwin's emphasis on the "survival of the fittest" and his articulation of the view that progress required the actual elimination of the unfit, the whole tenor of these ideas would have been less disturbing (to our modern sensibilities) than they were. By making death a creative force in nature—a vision taken up far more readily outside science than within—Darwin may indeed have

<sup>7</sup> James A. Secord, *Victorian Sensation: The Extraordinary Publication, Reception, and Secret Authorship of the Vestiges of the Natural History of Creation* (Chicago: Univ. Chicago Press, 2000).

<sup>8</sup> Recent studies of Spencer and Haeckel include, respectively, Mark Francis, *Herbert Spencer and the Invention of Modern Life* (Ithaca, N.Y.: Cornell Univ. Press, 2007); and Mario A. Di Gregorio, *From Here to Eternity: Ernst Haeckel and Scientific Faith* (Göttingen: Vandenhoeck & Ruprecht, 2005).

unwittingly helped to unleash the whirlwind of hatred that is so often associated with his name. Unfortunately, there is no space to explore this issue here.<sup>9</sup>

**WITHOUT NATURAL SELECTION THEORY, A UNIFIED SCIENCE OF HEREDITY AND DEVELOPMENT—AND A LESS HARSH EUGENICS**

The debates centering on Darwin's theory played an important role even in the thinking of those who rejected it. Would the idea of evolution by saltations—a key factor in the development of hereditarian ideas by De Vries, William Bateson, and Thomas Hunt Morgan—have seemed so attractive had it not been perceived as the perfect alternative to Darwinism? I suggest that without the complex of arguments raised against the selection theory by Fleeming Jenkin and many others in the 1860s and 1870s, these later anti-selectionist positions, and the hereditarian ideas that they inspired, might not have emerged. These critical reactions to selection theory did little to clarify the available models of natural selection. The effect was rather on the critics themselves, who, in their attempts to show that the theory was inadequate, ended up focusing their attention on the distinctively Darwinian issues of variation and heredity in a non-Lamarckian context.

Until recently, Darwin's critics on heredity were portrayed as having exposed the weakness of any model of selection not based on particulate inheritance. Historians now know that this was a far too simplistic analysis. The models of selection proposed by Darwin and later by Pearson were quite plausible, even though they employed a non-Mendelian concept of heredity. But the critics didn't accept this; and to demonstrate their opposition they had, again, to fight on territory defined by Darwin's theory. Energy was thus directed to the problem of individual variation and the inheritance of such differences. In a world where Darwin's theory was under discussion, these issues could not be ignored (as they might well have been in a world where that theory was not under discussion). The more life scientists later in the century continued to circle around these issues, the more they were led either toward a reappraisal of selection (Pearson and W. F. R. Weldon) or to saltationism and genetics (almost everyone else). On the "winning," genetics side, the result was a science of heredity so concerned with the phenomena of transmission of traits across generations that it lost contact with the question of how those traits emerged embryologically. My argument is that, without the challenge and inspiration provided by Darwin, these events might never have taken place.<sup>10</sup>

By supposing a Darwinless past, we can imagine something different: a "revolt against morphology" at the end of the nineteenth century that did not result in the almost-complete separation, just described, between the studies of heredity and embryology that characterized our own post-Darwinian biology (although even then the split occurred mainly in the English-speaking countries, where Darwin's influence was arguably strongest). Going further, it is probable that without Darwin's influence, the concept of the genetic code would have emerged not from within a rigidly hereditarian viewpoint (as in fact it did), but from studies of development arising seamlessly out of the late nineteenth-century

<sup>9</sup> See, e.g., Richard Weikart's controversial book *From Darwin to Hitler: Evolutionary Ethics, Eugenics, and Racism in Germany* (New York: Palgrave Macmillan, 2004). For a balanced introduction to the scholarly debates on Darwinism and its social impact see Diane B. Paul, "Darwin, Social Darwinism, and Eugenics," in *Cambridge Companion to Darwin*, ed. Hodge and Radick (cit. n. 4), pp. 214–239.

<sup>10</sup> Space limitations make it impossible to document these claims adequately, but for my own views see Peter J. Bowler, *The Mendelian Revolution: The Emergence of Hereditarian Concepts in Modern Science and Society* (London: Athlone; Baltimore: Johns Hopkins Univ. Press, 1989).

approach to the embryo. There would, indeed, have been a smooth transition from saltationism to the idea of mutation. Biologists might well have recognized the complex role of DNA as a trigger for development, without ever having imagined that it served as a simple blueprint for the whole organism. The struggle to emancipate genetics from its oversimplified origins, which has taken up so much of our biologists' time and attention through the later twentieth century, and which still drives the debates over the role of evo-devo today, would have been sidestepped. The resulting synthesis might have the same components as those we now recognize as essential for our understanding of development, but we would have very different ideas about their implications.

This brings us back to the broader relationships between biology and ideology. In our world there was a surge of enthusiasm for the idea of "hard" heredity in the 1890s, raising the question of whether there was such cultural pressure in that direction then that, with or without Darwin's example, scientists would have been all but forced to come up with the idea of hard heredity. If so, then the scenario I have just outlined becomes implausible, and something like modern genetics would have emerged in biology at this point, even if there had been no prior debates over heredity inspired by opposition to the selection theory. And yet, it might still have been the case that, without Darwin's influence, things would have been subtly different—and possibly better. Consider eugenics. Might there have been nothing like eugenic ideology in the later nineteenth and early twentieth centuries? That would make perfectly good sense if we thought that the ideas provided by science actually fueled the construction of a corresponding ideology. But it is often the case instead that ideologies find legitimation in whatever science happens to be around. Just as, in the case explored above, a Darwinless world dominated by an ideology of struggle might well have exploited Spencerian Lamarckism rather than Darwinian natural selection, so a Darwinless world dominated by hereditarian ideas might have had a eugenics, but not in quite the same form as we experienced it. Much eugenic thought was based on a concern for racial purity, which is not a particularly Darwinian concept (most Lamarckians were committed to the idea of distinct racial types). One can imagine a world moving from social Darwinism to eugenics without the need for a particulate theory of heredity, although once again the absence of the Darwinian focus on the need to eliminate the unfit may have mitigated some of the harsher applications of the doctrine.<sup>11</sup>

#### CONCLUSION

Philosophers committed to a realist view of scientific knowledge might argue that since the scientist is merely exploring and describing an existing natural world there can be no room for alternative histories of how that exploration takes place. Life really did evolve by natural selection; and when the appropriate amount of information became available, that theory would be propounded and accepted. External factors such as religious beliefs might delay its acceptance, but the theory itself would be proposed when the logic of scientific discovery made it inevitable. But external factors can affect scientists' priorities and thus lead to a situation where one theoretical avenue is explored while another, apparently equally available, is neglected. The situation becomes even more fluid if we see

<sup>11</sup> For background see Paul, "Darwin, Social Darwinism, and Eugenics" (cit. n. 9), esp. pp. 229–231. Excellent books on the history of eugenics include Diane B. Paul, *Controlling Human Heredity: 1865 to the Present* (Amherst, N.Y.: Humanity Books, 1995); and Daniel J. Kevles, *In the Name of Eugenics: Genetics and the Uses of Human Heredity* (London: Penguin, 1985).

scientific theories as models of nature, not pure descriptions: rival models might be constructed when a new avenue of research opens up, each having some advantages (and also some disadvantages) in terms of the opportunities it offers. We know that several rival models of evolution were possible, because they were actually tried out. The realist might once have argued that the theory of natural selection would eventually triumph because it was the “right answer.” But now that the advocates of evolutionary developmental biology (evo-devo) are challenging the hegemony of the modern Darwinian synthesis the situation looks more fluid. If the end result turns out to be a wider synthesis including elements of both Darwinism and evo-devo, the sequence within which the various elements were established would surely have some effect on the end product.<sup>12</sup>

Much of what I have said will seem ridiculous to some. Darwin did develop and publish his theory, and that’s an end to it. But I hope my exploration of the possible alternatives in a world without Darwin will encourage us to think about issues that must concern any historian of science—and indeed any historian who hopes to provide something more than a description of what actually happened. Can a single individual, at least on rare occasions, put together a theory that no one else at the time could have thought of—and then persuade contemporaries to take at least parts of it seriously? Can such a unique idea become associated with broader trends in a way that conceals some of its more radical implications for a considerable period? And if the whole theory eventually becomes accepted, how significant might the initial arguments *against* those radical elements be in paving the way for the later developments? I have suggested that taking Darwin out of the equation would affect not so much the short-term emergence of evolutionism in the late nineteenth century but, rather, the later developments that made possible the creation of genetics and the “modern synthesis.” There would have been a non-Darwinian revolution, perhaps slightly delayed, but not a Mendelian revolution in anything like the form we know it. To suggest that Darwin did make a difference is to challenge the claim that science has to develop in a sequence predetermined by the natural phenomena waiting to be discovered. I am no radical social constructivist, but I do want to leave room for a human element in how we create our understanding of nature. To me, the possibility that there are occasional branching points in history where the actions of a single person can make a long-range difference is an important component in leaving room for that human element in the scientific enterprise. Without it, science really is open to the allegation that it is no more creative than stamp collecting.

<sup>12</sup> I have many problems with Ron Amundson’s *The Changing Role of the Embryo in Evolutionary Thought* (Cambridge: Cambridge Univ. Press, 2005), but his suggestion that a challenge to the authority of the Darwinian synthesis requires us to rethink the history of evolutionism is entirely appropriate. A useful recent volume in this connection is Manfred D. Laubichler and Jane Maienschein, eds., *From Embryology to Evo-Devo: A History of Developmental Evolution* (Cambridge, Mass.: MIT Press, 2007).