Perspectives

Anecdotal, Historical and Critical Commentaries on Genetics

Darwin and Darwinism: The (Alleged) Social Implications of *The Origin of Species*

H. Allen Orr¹

Department of Biology, University of Rochester, Rochester, New York 14627

ABSTRACT

Most scientific theories, even revolutionary ones, change the practice of a particular science but have few consequences for culture or society at large. But Darwinism, it has often been said, is different in this respect. Since the publication of *The Origin of Species*, many have claimed that Darwinism has a number of profound social implications. Here, I briefly consider three of these: the economic, the political, and the religious. I suggest that, for the most part, these supposed implications have been misconstrued or exaggerated. Indeed, it is reasonably clear that the chain of implication sometimes primarily ran in the opposite direction—from, for instance, economics and political theory to Darwinism.

THE appearance of *The Origin of Species* launched one of the greatest, and most justly celebrated, revolutions in the history of science. But in the 150 years since the appearance of Darwin's book, many scholars, scientists, and pundits have claimed that Darwinism did more than revolutionize biology. Darwinism, they claim, also had a number of social and cultural consequences: economic and political, medical, eugenic, educational, and religious. Some of these consequences are to be applauded and others regretted, but all, it is said, can be traced to important strands of thought in *The Origin of Species*. One of the ironies of modern history would thus seem to be that the close scientific study of pigeons, mockingbirds, and barnacles could have such consequences.

But while the case for the scientific importance of Darwinism is incontestable, the case for its presumed social and cultural consequences is far more complex and, in places, dubious. Here I consider three of these supposed consequences: the economic, the political, and the religious. Because the economic and religious cases have been widely discussed, I focus on the political one. I should note that I am not an expert on economics, political theory, or religion, but a biologist. Perhaps fortunately, then, little that I have to say is new but reflects the efforts of many social scientists and historians. Because their ideas seem little known among biologists, they may be worth recounting here.

THE ECONOMY OF NATURE

In the decades that followed the publication of *The Origin of Species*, it was often suggested that Darwin's work had implications for the economic order. Darwinism, it was said, demonstrated the effectiveness of competition and provided a defense of capitalism. This claim is, at best, only partly true. As many have emphasized, the full story is far more complex and interesting.

There is, of course, an obvious analogy between competition in biological and economic systems. As Darwin showed, in organisms, order emerges not from design but from the unplanned actions of many independent agents: some organisms are built, behave, or look in one way while other organisms are built, behave, or look in other ways. Some of these phenotypes perform well in the present environment and so prosper, leaving many progeny, while other phenotypes perform poorly and so leave few or no progeny. Because only so many slots are available in any ecological niche, the logic of natural selection ensures that the better-adapted types slowly but surely displace the less well adapted. Surprisingly—and we are perhaps too familiar with the Darwinian argument to appreciate how counterintuitive it is—these relentless and messy bouts of competition give rise to the intricate order that we find throughout the biological world: the bird's wing, the Krebs cycle, and the human brain.

Similarly, in capitalist economies, order emerges not from the efforts of any central planner but from the actions of many independent agents in a market. Some businesspeople choose to produce product *x* and

¹Address for correspondence: Department of Biology, University of Rochester, Rochester, NY 14627. E-mail: orr@mail.rochester.edu

others choose to produce product y . Consumers choose whether to buy x , y , neither, or both. In the end, some products sell while others do not. The businesspeople producing the former flourish while those producing the latter perish. Surprisingly—again, we are perhaps too familiar with the phenomenon to appreciate how counter-intuitive it is—this relentless and messy competition gives rise to the order that we find in the economic world. No one person or agency plans how many pencils must enter my home city, Rochester, New York, to supply its residents; the market ensures that the right number arrives.

Since Darwin's day, this similarity between biological and economic competition has been used to justify various forms of capitalism, especially laissez-faire capitalism. Although the consequences of such an economic system may sometimes be unpleasant, the market, so the argument goes, merely echoes the dictates of nature. Competition efficiently sorts the fit from the unfit, the productive from the unproductive. Moreover, the marketplace, like the "economy of nature" that Darwin spoke of, is capable of almost unimaginable creativity. Without it, for example, you would have no iPhone or Prius; indeed, you might have no pencil. Taken to their extreme, Darwinian defenses of laissez-faire capitalism shaded into arguments for full-blown Social Darwinism of the sort often associated with Herbert Spencer: competition in human society may be ruthless but it is natural, inevitable—and defensible scientifically.

Such biological defenses of capitalism were misleading in at least two respects. First, although the similarities between biology and economics have received much attention, some economists argue that they are mostly superficial. LANDSBURG (1993, chap. 8), for example, emphasizes that Darwinism lacks any analog of market prices. And market prices represent the mathematical heart of economics: without them the fundamental theorems of welfare economics are unavailable, and efficient allocation of resources cannot be expected. Given the central role of market prices in economics and the absence of their analog in Darwinism, the similarities between economics and biology may be close enough to suggest metaphors but perhaps not enough to sustain a theory (or, presumably, to justify an economic order).

Second, to argue that Darwinism implies capitalism misses the historical reality that the chain of implication may well have run in the other direction. As many have pointed out, the idea of natural selection was probably suggested, directly or indirectly, by the economics of the Victorian age. The industrial revolution had proved the power of capitalism, creating vast wealth from English manufacturing (see ROSENBERG and BIRDZELL's 1987 *How the West Grew Rich* for a fascinating account of the emergence of European capitalism.) It is well known, of course, that both Charles Darwin and Alfred Russel Wallace claimed that the idea of natural selection occurred to them after reading the English economist

THOMAS MALTHUS's (1798) *Essay on the Principle of Population*. But Darwin was steeped, both socially and intellectually, in a capitalist world. He was born into and married into a wealthy family; he was, later in life, a savvy stock investor; and he was familiar with the ideas of the leading Scottish economists and moral philosophers, including Adam Smith, David Hume, and Dugald Stewart (SCHWEBER 1977, 1978, 1980; see also BROWNE 1995 and 2003 for the definitive biography of Darwin). As LEWONTIN (2009, p. 20) has argued, the historical connection leading from capitalism to Darwinism is strong:

[w]hile the nineteenth-century theory that some rose and some fell in society depending on their personal strengths and weaknesses is often referred to as "social Darwinism," we would be much more in agreement with historical causation were we to call Darwinism "Biological Competitive Capitalism." The perceived structure of the competitive economy provided the metaphors on which evolutionary theory was built.

While the link between what would come to be called social science to natural science seems fairly clear in this case, it obviously cannot be used to question the independent cogency of the theory of natural selection. How a theory is arrived at is, after all, orthogonal to whether it is right. (Or, as philosophers of science often put it, the context of discovery is distinct from the context of justification.) Nonetheless, it's tricky to see how an economic situation that suggested a biological theory can be simultaneously justified by that theory, an objection that goes back at least to Engels. In any case, folk sociology probably reveals as much as scholarly history here. It seems clear enough that what happened in the case of Darwin and economics is that developments in the social sciences suggested an idea in the natural sciences, which—given the greater prestige of the natural sciences at the time—was conveniently reflected back into social policy as providing independent justification.

BURKE, OR REFLECTIONS ON THE REVOLUTION IN BIOLOGY

Although the alleged economic implications of Darwinism are well known, some of the broader (and, again, alleged) political implications are less so, at least among biologists. Acceptance of Darwinism is now often associated with liberal politics, but this is partly a consequence of the struggle over creationism, a struggle that, at least in its "intelligent design" form, is recent and mostly American. Through much of its history and much of the world, Darwinism has had vaguely conservative connotations. One of the most fascinating aspects of this story concerns the part played by gradualism in both Darwinism and conservative political philosophy.

To Darwin, the challenge of adaptation was that of simultaneously reforming and preserving a species. A species must be able to change those aspects of its

phenotype that require improvement without thereby wrecking the intricate arrangement of parts that characterizes any living thing. Darwin and his intellectual heirs concluded that the answer to this challenge was change that is gradual. In a phrase, successful change must be evolutionary, not revolutionary.

The biological basis of this conclusion involves the interaction of natural selection with mutation. Although Darwin did not, of course, understand the Mendelian (much less molecular) nature of inheritance, he understood that heritable changes could range from slight to large, with anything between. He also understood that changes of different magnitudes had different likely fates. To Darwin, large changes were, almost by definition, monstrous. They were nearly always deleterious and so could not provide the material for adaptive evolution. On the other hand, small heritable changes—Darwin’s “individual differences” or “slight differences”—were far more likely to be useful to evolution. Indeed, these small changes are “highly important to us as they afford material for natural selection to accumulate” [DARWIN 1859 (1979 Ed.), p. 102]. In the end, Darwin offered a thoroughly gradual theory, one in which natural selection is “daily and hourly scrutinizing, throughout the world, every variation, even the slightest . . . silently and insensibly working, whenever and wherever opportunity offers, at the improvement of each organic being” [DARWIN 1859 (1979 Ed.), p. 133].

The notion that small mutations are the stuff of adaptive evolution was later formalized in one of the founding documents of the modern synthesis, RONALD FISHER’S (1930) *The Genetical Theory of Natural Selection*. There, Fisher offered what later became a standard argument in the defense of gradualism, his so-called geometric model of adaptation. Arguing that the essence of adaptation is that organisms must conform to the environment in many ways and that mutations have nearly universal pleiotropic effects, Fisher showed mathematically that mutations of small phenotypic effect are more likely to be beneficial than are those of large phenotypic effect when appearing in a high-dimensional (many-character) organism. Roughly put, Fisher showed that large changes to a complex system are likely to have disastrous side effects: even if these changes were to improve some part that needs improvement, they will likely worsen other parts. Small changes to a complex system, on the other hand, have a reasonable chance of improving a part that needs improvement while simultaneously preserving, or affecting only subtly, the rest of the system. Just as Darwin insisted, then, evolutionary change must be gradual and its basis micromutational (see TURNER 1985 and ORR 2005 for more on this history). Evolution must take baby steps.

This biological argument might, by analogy, seem to have political implications, for society is also an immensely complex system that has taken shape through

millennia. And large changes to this system are likely to obey a law of unintended consequences. While improving *x*, they might worsen *y* and *z*. Only small changes are likely to both improve *x* and preserve the integrity of the rest of the system. Indeed, the analogy is sufficiently close that Darwinism might seem to provide a kind of existence proof of the necessity of slow, cautious change in politics. Darwinism would thus seem to suggest a conservative political philosophy. This argument has a surprisingly rich history (*e.g.*, HAYEK 1984; ARNHART 2005) and can still be heard occasionally (for a recent popular example, see GEORGE WILL 2009).

Once again, however, the claim of cultural implication is partly misleading. And, once again, the reason is the same: the historical influence likely ran at least partly in the other direction—from political theory to biology. To understand this, it helps to note that the political argument has two components. First, social institutions are the product of a kind of cultural evolution. And second, social change, to be successful, must be gradual.

The first component has been discussed by many scholars, most famously Friedrich Hayek, the economist and Nobel laureate. Hayek argued that social, political, and economic arrangements often arise not from the labor of single minds or the deliberations of professional planners but from the experiences and interactions of humans over millennia (*e.g.*, HAYEK 1952). And the solutions arrived at, for example, social institutions and ethical mores, are often superb; indeed, our cultural inheritance frequently includes features superior to those that could be arrived at by purely rational means. HAYEK (1984 and elsewhere) argued that these evolutionary ideas were championed by several “pre-Darwinian Darwinians,” including Bernard Mandeville and a number of Scottish economists and moral philosophers. Although some charge that HAYEK pushed his claim of parallels between political theory and Darwinism too far (see the exchange between CALDWELL 2001 and HODGSON 2004), it would certainly seem that pre-Darwinian political theorists considered something resembling social evolution.

The second component of the argument—the necessity of gradual change in complex systems—can also be found in pre-Darwinian political thought. In my own reading, I have been struck by the similarity between Edmund Burke’s arguments for the wisdom of gradual change in politics and Darwin and Fisher’s arguments in biology. Burke (1729–1797), an Irish political thinker and member of Parliament, is best remembered as a father of modern conservative political philosophy. Shaken by the turmoil that followed the revolution in 1789, BURKE (1790) produced his best-known work, *Reflections on the Revolution in France*. Although no hidebound reactionary (he was sympathetic to American independence), Burke argued that events in France proved the dangers inherent in dramatic change to

long-established social order. A few quotations from his writings suffice to capture his reasoning:

We must all obey the great law of change. It is the most powerful law of Nature, and the means perhaps of its conservation. All we can do, and that human wisdom can do, is to provide that the change shall proceed by insensible degrees. This has all the benefits which may be in change, without any of the inconveniences of mutation. Everything is provided for as it arrives. This mode will, on the one hand, prevent the unfixing old interests at once: a thing which is apt to breed a black and sullen discontent in those who are at once dispossessed of all their influence and consideration. This gradual course, on the other side, will prevent men long under depression from being intoxicated with a large draught of new power, which they always abuse with a licentious insolence. But, wishing, as I do, the change to be gradual and cautious, I would, in my first steps, lean rather to the side of enlargement than restriction [letter to Sir Hercules Langrishe included in BURKE (1826)].

...

At once to preserve and to reform is quite another thing. When the useful parts of an old establishment are kept, and what is superadded is to be fitted to what is retained... But you may object—"A process of this kind is slow. It is not fit for an assembly, which glories in performing in a few months the work of ages. Such a mode of reforming, possibly, might take up many years." Without question it might; and it ought. It is one of the excellencies of a method in which time is among the assistants, that its operation is slow, and in some cases almost imperceptible (BURKE 1790, pp. 164–165).

...

By a slow but well-sustained progress, the effect of each step is watched; the good or ill success of the first gives light to us in the second; and so, from light to light, we are conducted with safety through the whole series. We see that the parts of the system do not clash. The evils latent in the most promising contrivances are provided for as they arise. One advantage is as little as possible sacrificed to another. We compensate, we reconcile, we balance (BURKE 1790, pp. 165–166).

...

[T]he change is to be confined to the peccant [errant] part only; to the part which produced the necessary deviation; and even then it is to be effected without a decomposition of the whole civil and political mass... A state without a means of some change is without the means of its conservation. (BURKE, 1790, pp. 19–20)

To an evolutionary biologist, the most striking aspect of Burke's argument is that it often assumes nearly the same form as Darwin's and Fisher's. First, successful change in a complex system must be incremental. Second, at least part of the reason involves what a geneticist would call pleiotropy: the likelihood of deleterious side effects when change is drastic (the "evils latent in the most promising contrivances").

We know that Darwin read Burke during the critical years in which he developed his theories of evolution (SCHWEBER 1977, 1978; DARWIN 1996), although it is unclear if this reading included Burke's *Reflections*. We

do know, however, from his M and N notebooks, that Darwin was deeply interested in the origins of human social order (see SCHWEBER 1977, especially section 5). I know of no direct evidence that Fisher read Burke; for example, Fisher's personal library contained no work by Burke (see the bibliography of his library at <http://digital.library.adelaide.edu.au/coll/special/fisher/fishlib.html>). It seems likely, however, that Fisher was familiar with Burke's thought, given that Fisher was both superbly educated and a political and cultural conservative (YATES and MATHER 1963; BOX 1978). (T. S. Eliot's famous declaration that "I am an Anglo-Catholic in religion, a classicist in literature and a royalist in politics" could have been uttered almost as easily by Fisher.) In any case, my point is not that Darwin or Fisher were necessarily influenced directly by Burke—one need not be a professional historian of ideas to know that matters are rarely so simple—but that the idea of the necessity of gradual change in complex systems was in the air, particularly in conservative circles.

The irony is that Darwin and Fisher's argument for gradualism in biology may not be as compelling as it first seems for two reasons. For one thing, as evo-devo researchers often emphasize, the modularity of genes and organisms may mean that mutations can affect particular structures and tissues but not others; *i.e.*, the problem of pleiotropy is tamed. Furthermore, most beneficial mutations are lost accidentally when they first arise, and this problem grows more severe as mutations have smaller phenotypic effects. As KIMURA (1983) emphasized, the result is that adaptive evolution is more likely to involve mutations of intermediate phenotypic effect, not the micromutations of Darwin and Fisher (see also ORR 1998). I leave it to others to judge the validity of Burke's argument for gradualism in politics.

SCIENCE AND RELIGION: CONFLICT AND COMPLEXITY

Finally, I turn to the best known of the cultural consequences of Darwinism: its effect on religious culture. This topic is so complex and has been so much discussed that I can do little more than briefly sketch the main currents of thought. The idea that Darwinism clashed violently with religion, especially Christianity, is, of course, common. This clash is thought to represent one battle, although an important one, in the presumably interminable war between science and religion. But to what extent is this popular picture of history correct? (Note that our question is historical, not philosophical. We ask not whether science and religion, as a matter of principle, conflict but whether they, as a matter of history, did.)

While there can be no doubt that science and religion have had their difficulties, which have sometimes been severe, the popular view of perpetual warfare between

the two unfortunately derives mostly from discredited works of history, in particular J. W. Draper's (1874) *History of the Conflict Between Religion and Science* and A. D. White's (1896) *A History of the Warfare of Science With Theology in Christendom*. Although immensely influential, these books were deeply flawed. (Draper's book is almost hysterically antipapist.) A new generation of serious scholarship—produced by leading historians of science, including JOHN HEDLEY BROOKE (1991), RONALD NUMBERS (2006, 2009), PETER HARRISON (1998), and DAVID LINDBERG (1992)—has arrived at a view of the history of the interaction of science and religion that differs profoundly from that of Draper and White. In the now well-known words of BROOKE (1991, p. 321), these historians have concluded that “[t]here is no such thing as *the* relationship between science and religion.” In some places and at some times, science and religion have conflicted (*e.g.*, the Galileo affair, although even here matters were more complex than they first appear). In other places and times, they have lived in harmony (*e.g.*, the Church was a leading patron of astronomical research). And, just as often, science and religion have been indifferent to each other (*e.g.*, Pauling's discovery of beta-sheets caused little stir in Sunday schools). Among historians, this view, the so-called “complexity thesis,” has largely displaced the traditional view of perpetual conflict that most of us grew up with and that, unfortunately, still characterizes popular discussions of science and religion.

Turning to the particular encounter between Darwinism and religion, matters are especially complex. For many believers, Darwinism clearly provoked a crisis of faith. But this reaction was not universal. While some European and American Christians were appalled by Darwinism, others were indifferent, and yet others were pleased that this new science forced the church to abandon literalist readings of the book of Genesis (see BROOKE 1991, chap. 7 and 8, and LINDBERG and NUMBERS 2003). [The history of biblical literalism is itself complex, with some historians, *e.g.*, HARRISON (1998), arguing that literalism became a preferred method of scriptural interpretation only during the Reformation; the Church fathers and early theologians, *e.g.*, Augustine and Origen, often eschewed literalism, favoring allegorical readings.] Even among those disturbed by Darwinism, the reasons often differed, with some abhorring the idea of human relatedness to apes, others alarmed by the role that Darwinism accords to chance, and others fearing the moral implications of a materialist science of humankind.

More recent interactions between Darwinism and religion have also been complex. A number of Christian denominations have accommodated themselves to Darwinism. The Roman Catholic, Episcopal, and United Methodist churches, among others, have endorsed the theory of evolution and/or its teaching in schools. This alone represents a remarkable cultural development.

Other churches, particularly those that are more fundamentalist, have loudly opposed Darwinism.

To make matters worse, some believers have embraced intelligent design creationism. This species of creationist thought asserts that, while evolution by natural selection may occur, it cannot account for all the apparent design inhering in organisms or for the whole of the history of life on earth. Instead, some intelligent agent (which may or may not be coincident with the Judeo-Christian Creator) played a part in the origins of organismal design. The ensuing clashes between evolutionary biologists and proponents of intelligent design, particularly Michael Behe and William Dembski, have received much attention and have been reviewed elsewhere (PENNOCK 1999; NUMBERS 2006). Perhaps more important, American courts have struck down attempts to introduce intelligent design creationism into the biology classrooms of public schools as a violation of the Establishment Clause of the First Amendment to the U. S. Constitution. An especially important case, *Tammy Kitzmiller, et al. v. Dover Area School District, et al.*, heard in a U. S. District Court, involved the attempted introduction of intelligent design into ninth-grade science classes in Dover, Pennsylvania. Judge John Jones's lengthy (and blunt) ruling, widely available on the internet, is well worth reading. Given the acceptance of Darwinism by many mainstream religious organizations as well as recent legal decisions, history would not seem to be on the side of those who stubbornly cling to what the philosopher PHILLIP KITCHER (2007) rightly calls “dead science.”

Turning from history to theology, evolutionary arguments have, now and then, been enlisted in campaigns against religion generally and theism particularly. The most recent of these campaigns, that of the so-called New Atheists, has gained a great deal of attention. Richard Dawkins's book, *The God Delusion*, has perhaps come to represent the movement. Although this is not the place to enter into this difficult topic, it is not entirely clear that there was much new in the New Atheism: the arguments for or against theism are mostly ancient. And, to the extent that the New Atheists did offer novel arguments, a number of philosophers and biologists, myself included, expressed doubts about their cogency. (It does not follow, of course, that their conclusion is necessarily wrong; in any case, other philosophers and biologists have defended their views.)

Certainly, Darwinism, together with several other areas of science, demands rejection of anything resembling biblical literalism, but rejecting literalism is not equivalent to enjoining atheism. In the end, the recent skirmishes over science and religion might resolve in two ways that respect the facts of science. First, the public might come to embrace evolution and to abandon religious belief. This would represent a triumph for both Darwin and Dawkins. Second, the public might come to accept evolution but to retain

religious belief, accommodating its faith to the Darwinian heterodoxy. This would represent a triumph for Darwin but a failure for Dawkins. My own guess is that the second course is far more likely, particularly in the United States and especially given the pro-evolution statements issued recently by many religious organizations. But only time will tell.

In summary, our brief survey of the supposed cultural consequences of Darwinism itself conforms to a kind of complexity thesis. Some of these consequences appear real, others real but exaggerated, and still others misleading. This is perhaps unsurprising. The appearance of *The Origin of Species* came as a great shock to Victorian culture and many, in the wake of the Darwinian revolution, felt their world to be upended. Darwinism, they concluded, perhaps hastily, had changed everything. Moreover, among those with a political or cultural agenda, the temptation to overextend or otherwise exploit a scientific theory can be strong (if often unconscious). In any case, it should be obvious that even the most revolutionary of scientific theories need not have uniformly revolutionary implications for all aspects of our lives.

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