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The Darwinian Revolution

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theory was consilient. He once wrote of the *Origin* as "one long argument from the beginning to the end" (1969, p. 140), and in an important sense it is. Having derived his mechanism, Darwin applied it to many subdisciplines like behavior, paleontology, and biogeography. The theory as a whole has a fanlike appearance, with natural selection functioning as a Whewellian *vera causa* (see fig. 24).

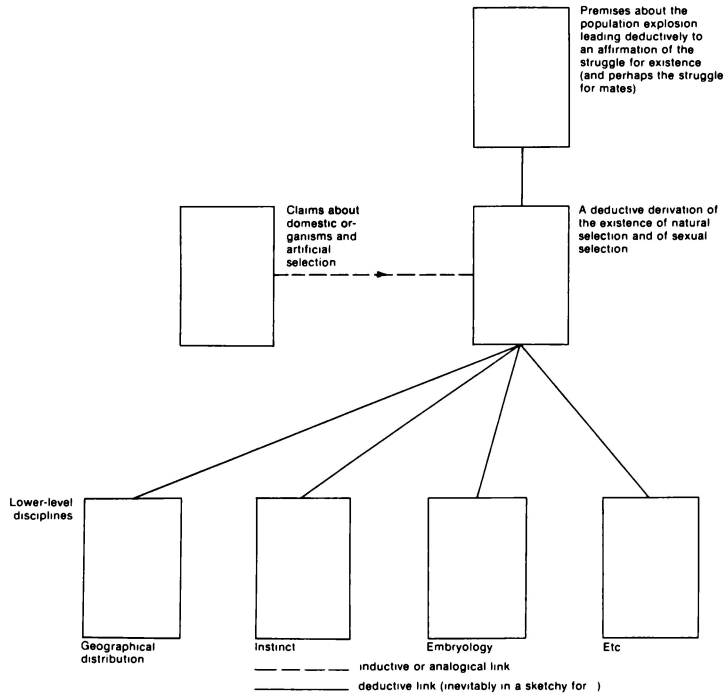

Figure 24. The three key structural elements of Darwin's theory: (1) the empiricist *vera causa*, from artificial selection; (2) the deductive core, leading to natural selection; (3) the rationalist *vera causa*, unifying the lower-level disciplines beneath natural selection. The diagram simplifies Darwin's theory: for instance, all the subsidiary mechanisms are ignored, as are some subsidiary disciplines. Also, the exact links between the core and the rest of the theory were to be questioned.

Darwin's Predecessors

In the final chapter I shall present an overall analysis of the Darwinian Revolution. But, with Darwin's theory fresh in our minds and before our view has been clouded by contemporary reactions to the *Origin*, let us briefly compare Darwin with his predecessors. We can already draw a

major conclusion from our study. Without denying that earlier public evolutionists, particularly Chambers, may have prepared the way for Darwinism, we can see it would be a mistake to think that the most significant intellectual continuity in the Darwinian Revolution existed among those one would label "evolutionist.

One suspects that Darwin was eased toward evolutionism by the ideas of his grandfather and of Lamarck. Darwin shared causal speculations with them and with the later evolutionists Chambers and Spencer, specifically about the inheritance of acquired characteristics: there may well have been a direct link between Darwin and the first two on this. Generally speaking, all the evolutionists including Darwin were united by a burning urge to bring organic origins under normal, unbroken law. But after this there is almost total difference between Darwin (and Wallace) and those who publicly accepted evolution before them.[13] In no sense can Darwin be seen as the natural climax of a chain of evolutionists, even if we consider his seminal work as coming in the late 1850s rather than fifteen to twenty years earlier.

Consider Lamarck for a moment. He supported continuous spontaneous generation. He saw a constantly repeating procession up the chain of being, with—allowing for a few side trips—a progression to man. He saw a balance in nature. He was relatively uninterested in the fossil record. He had no notion of selection, and his mechanism of evolution concentrated entirely on the individual. He found species something of an embarrassment. On all these absolutely critical matters Darwin differed drastically. He had no place for spontaneous generation. He saw evolution as a nonrepeatable process. He saw divergence as fundamental. He did not see progress to man. He saw a struggle for existence. He was fascinated by the fossil record. He discovered selection, and his mechanism of evolution necessarily concentrated on the group and on intrapopulation differences. And he had a carefully developed theory of the origin of species.

Much the same tale of difference can be told for the other evolutionists like Chambers and Spencer. (I exclude Wallace, who really does stand with Darwin.) Perhaps the extent to which Darwin differed from his fellows can be most dramatically illustrated by the ways he and Chambers dealt with the Galápagos fauna. Darwin, we know, explained the finches as common stock from mainland founders, molded on the various islands by different selective forces. He explained the absence of mammals in terms of difficulty in reaching the islands (Darwin 1859, pp. 393–95). For Chambers, however, who learned about the Galápagos fauna from Dar-

win's writings, the finches represented separate lines that had evolved independently, though in a parallel way, from different ancestors up from the sea. Absence of mammals showed that there had not yet been time for them to evolve from the present inhabitants (Chambers 1844, pp 161–63; Hodge 1972). The two explanations could not be more different. Not only were there no sequential links from Chambers to Darwin (the reverse was true, since Chambers got his facts from Darwin), conceptually they were worlds apart. Even when someone like Spencer grasped the significance of some concept important to Darwin, such as calculations of Malthus, he did so only to show how we are all evolving into Englishmen, at which happy point Malthus will become irrelevant!

Darwin and the *Origin* therefore were not the natural culmination of a long line of evolutionists and their writings. Yet Darwin and his work did not spring from nowhere. For direct links, as well as intellectual sympathies, we must look primarily to the scientific group from which he came. Above all, we see in Darwin the influence of Lyell. We know that Darwin's geology was Lyellian through and through, and the same is largely true of his attack on the organic origins problem, even though he was doing just what Lyell could not do. Darwin as geologist satisfied all three of our divisions of Lyellianism, and as might be expected we find that the evolutionist Darwin was a complete actualist. He wanted to explain the origin of organisms by causes of a kind we see about us at present, in both the domestic and the natural worlds. Similarly, Darwin was a uniformitarian. He wanted no causes of an unknown intensity Thus, after some initial speculating (itself a function of Lyellian worries), he wanted no supersaltations creating new species at a leap. His link to steady-statism was more tenuous. In the inorganic world he accepted it entirely and believed it ultimately fueled evolution. In the organic world Darwin was in one sense going against Lyellian steady-statism, but in other senses he was not. He was not a normal progressionist: for him, progression was almost incidental and evolution could (and sometimes did) go against it. Also, Darwin, like Lyell, saw new species appearing and old disappearing on a fairly regular, continuous basis. Even here he did not break completely with his mentor.

Darwin was Lyellian in other respects too; for example, in his suppositions about the imperfections of the fossil record, in seeing the fossil record as pertinent to evolution, and in recognizing that speculations about spontaneous generation do the evolutionist no good. (Reactions to Chambers must have convinced Darwin of his own wisdom on this score;

but his intention not to touch spontaneous generation predates Chambers.) And, Lyell apart, Darwin drew from others in his group: from the philosophers of science he learned methodology; from all the members he learned the importance of adaptation. And he also drew on those the group admired and championed, as in embryology and in understanding the significance of the fossil record. Of course there were also nonscientific influences on Darwin, particularly from his family (Gruber and Barrett 1974). But all this influence-tracing is not an attempt to deny Darwin's own genius. Even in 1859 the *Origin* was a fine achievement. That Darwin did most of the work nearly twenty years earlier is remarkable. But Darwin had antecedents and influences, and we can find them if we look in the right direction.

But enough of the *Origin*'s past. Let us turn to its future.