CHAPTER 8

Darwin's Metaphysics of Mind

Robert J. Richards

My theory would give zest to recent & Fossil Comparative Anatomy, & it would lead to study of instincts, hereditary & mind hereditary, whole metaphysics.

Darwin, Notebook B, 1837

Our image of Darwin is hardly that of a German metaphysician. By reason of his intellectual tradition—that of British empiricism—and psychological disposition, he was a man of apparently more stolid character, one who could be excited by beetles and earthworms but not, we assume, by abstruse philosophy. Yet Darwin constructed a theory of evolution whose conceptual grammar expresses and depends on a certain kind of metaphysics. During his youthful period as a romantic adventurer, he sailed to exotic lands and returned to construct a theory that attacked the citadels of orthodoxy. In the long process of theory construction, he explored difficult philosophical questions—for instance, the nature of reason and the mind-body problem. Moreover, he founded that theory on something like a concept of absolute mind, echoing from afar ideas propounded by such German Romantic scientist-philosophers as Friedrich Schelling and, more proximately, Alexander von Humboldt.

In this essay, I will explore the metaphysical grammar that underlay Darwin's theory. This grammar structured the way he joined the various parts of his conception and reveals itself most perspicuously in the metaphors that he constantly deployed to articulate his ideas. He used these tropes, certainly, to make his ideas come alive for his readers. But as he constructed his theory, he also employed the more significant of them to explain to himself the nature of his slowly developing notions. In particular, he came to understand human mind, productive nature, and his special explanatory device of natural selection all with the indispensable aid of particular metaphors and similes. In what follows, I will first consider specifically his developing ideas about rational mind, its animal origins and human embodiment, and then turn to what might be called the concept of absolute mind, a concept that structured his general theory of evolution by natural selection.

HUMAN MIND

Darwin recognized from the beginning of his theorizing about the transmutation of species that he would have to include human beings within the ambit of his considerations. Should he allow man to escape the net of his hypothesis, our species would drag the Creator back into the picture—something that Darwin had no intention of permitting. This is not to say that he initially denied the work of a Creator God. He recognized the need for a divine shove to get the world spinning; but during his travels in South America he was conscious of the absence of a benevolent personal power, when, for instance, he watched young Indian women being slaughtered by ignorant Spanish soldiers because "they breed so." This kind of experience caused him to ask himself: "Who would believe in this age in a Christian civilized country that such atrocities were committed?"[1] Not that Darwin had a particularly high estimate of the intellectual or moral worth of the natives. As he viewed the naked, paint-smeared Fuegians, whose language seemed little better than the guttural cries of a beast, he reflected that "one can hardly make oneself believe that they are fellow creatures placed in the same world."[2] From his experience of the extremes of human behavior during his *Beagle* voyage (1831–36), Darwin came to perceive a gradation among human beings, from the Fuegians who seemed so like the animals, through the hardly more civilized gauchos, to his own messmates aboard the *Beagle.* Yet while on the voyage, he had not yet come to the view that there might be a transition from animals to man.

During the few months after he returned from his journey, Darwin did become convinced that species were not stable; and with this conviction, he quickly began to explore questions of instinct, mind, and, as he termed it, the "whole metaphysics."[3] He moved fairly rapidly from considerations of anatomical similarities among animals to cognitive comparisons between animals and man; and so he came to rest the divinity of man on the shoulders of monkeys: "He is Mammalian—his . . . origin has not been indefinite—he is not a deity, his end <<under present form>>will come, (or how dreadfully we are deceived) then he is no exception.—he possesses some of the same general instincts, <as> & moral feelings as animals.—they on other hand can reason—but Man has reasoning powers in excess. Instead of definite instincts—this is a replacement in mental machinery—so analogous to what we see in bodily, that . . . it does not stagger me."[4]

In coupling human mind in train with animal mind, Darwin followed out one deeply embedded track of the philosophical legacy of British empiricism, namely the contention that rational activity consisted in the manipulation and association of faint sensory images, something of which even animals were capable. His grandfather, in *Zoonomia,* endorsed this sensationalist view of reason, and Darwin followed in his progenitor's footsteps. Also like Erasmus Darwin, Charles became a reader of David Hume.[5]

Darwin picked up Hume's *Inquiry concerning Human Understanding* in August of 1838, just after he had read Malthus's *Essay on Population.* In accord with Hume and his grandfather, Darwin considered, as he jotted in his Notebook N, that "[r]eason in simplest form probably is simple comparison by senses of any two objects—they by VIVID power of conception between one or two absent things—reason probably mere consequence of vividness & multiplicity of things remembered & the associated pleasure as accompanying such memory."[6] If reason were only the comparison of recalled sensory images, then animals would be as capable of reason—at least in a rudimentary way—as any Fuegian. And looking in the other direction, reason in its elemental form seemed little different than animal instinct. As a mental disposition, instinct was a set of cognitive impulses that led to stereotyped behavior in a species—for example, weaverbirds that innately knew how to tie the peculiar knot that held their nests together. Instinct might then be considered a rather rigid pattern of mental structures and reason a more flexible pattern that allowed an animal to accommodate to environmental contingencies—or at least this is the way Darwin thought about these mental powers.[7]

If animals possessed mental faculties—both instincts and modest rational abilities—the question became significant: What was the connection between mind

and brain? After all, a Humean analysis of reason takes place on a phenomenal plane, but Darwin was also deeply interested in reason's assumed biological substructure. Instinct seemed clearly a biological trait, since it could be inherited and modified through breeding. Thus when two varieties of dog, each with different hunting instincts, were mated, their offspring would show not only anatomical features common to both parents but also a mixed repertoire of instincts.[8] Such evidence demonstrated that mental structures were heritable in a way no different than anatomical structures. But if heritable, they had in the first instance to be located in some physical traits. The brain, Darwin assumed, was their locus.

In this early period of theorizing (1838–42), Darwin attempted to clarify exactly the relation between mind and its neural substrate. He reflected, for instance, on the way in which drunks suffering from delirium tremens could still perform wobbly mental acts without much consciousness—an example that might be familiar to one who had voyaged across oceans and messed with rough-hewn sailors. But even considering what he himself might do out of well-worn habit suggested to Darwin that behavior could be mentally controlled without conscious attendance. Evidence of this kind indicated that instinct—which was, after all, only inherited habit—resulted from certain brain patterns. This meant that the extraordinary instincts of animals could be wrested from the Empyrean, where many natural theologians found their origin, and brought back to earth. Instincts were due to the modifications of a quite mundane brain. "A train of thought, action &c will arise from physical action on the brain," and so, as he concluded, this "renders much less wonderful the instincts of animals."[9]

Despite the close connection of instinct and thought with the brain, Darwin yet regarded their mental existence as distinct from their source in brain. But how to conceive it? He tried several metaphors to help conjure with the connection between mind and body. The brain, for example, might secret thoughts as the liver secreted bile.[10] Or better, thought might be a *force* of the brain comparable to the gravitational attraction that bodies exerted on one another.[11] Darwin rather liked the proportional comparison of thought to brain with gravitational force to matter. He performed several thought experiments—so to put it—to stabilize the metaphor further. For instance, he let free-floating ideas drift through his mind; he then would try to hold one simple idea in consciousness (say, the idea of the color red); and finally he would engage in abstract thought to solve a problem. In this progression, he noted that these tasks required increasing effort.[12] Since he felt a sliding degree of effort while moving from one kind of cognitive performance to another, this suggested that mentality was indeed like a force of

the brain. And so in this respect, ideas were quite analogous to other forces in the physical world.[13]

Such thought experiments led Darwin along a path toward a traditional conundrum: How can we distinguish the mental state of dreaming from that of being consciously awake? His metaphor of force gave him a tentative solution. He decided that dreaming required virtually no effort but that consciousness demanded a continuing effort to compare present with past ideas. The active effort of comparing indicated that real work was being done. Hence degree of effort might well be a sign that Descartes's daemon was not beguiling us.[14]

Darwin's thought experiments also led him to ponder the nature of the imagination, which almost seemed like dreaming. Yet, on reflection, he recognized that his own thinking about various aspects of his theory abounded in imaginative constructions; they were actually doing work. He came to regard such "castles in the air" as a propaedeutic to real scientific discovery. This, I believe, is an important aspect of Darwin's own science and worth lingering over. As I will show in a moment, imaginative constructions lie at the root of his thought about evolution and decisively control aspects of his theory. In his Notebook M, he reflected, with a modicum of humor, on the nature of these castles in the air and their relation to the development of scientific hypotheses: "Now that I have a test of hardness of thought, from weakness of my stomach, I observe a long castle in the air is as hard work . . . as the closest train of geological thought—the capability of such trains of thought makes a discoverer, & therefore . . . such castles in the air are highly advantageous, before real train of inventive thoughts are brought into play."[15]

Darwin may have derived his attitude about the importance of imaginative constructions from reading both Charles Lyell's *Principles of Geology* and Humboldt's *Personal Narrative of Travels to the Equinoctial Regions of the New Continent*. Both treatises employ imaginative scenarios to provide reasonable suppositions concerning events of the past. And through the dexterity of their telling, these imaginative stories gradually become insinuated in the reader's mind as sound evidence. For instance, in the space of a few pages of the second volume of the *Principles,* Lyell begins virtually every paragraph with such locutions as "Let us next imagine a few cases of the elevation of land . . . ," "Let us next suppose . . . ," "We will imagine the summits . . . ," and so on throughout his volumes.[16] By use of these inviting castles in the air, Lyell argued ingeniously for his theory of geological uniformitarianism, a theory that Darwin adopted to secure his own proposals. Lyell's powerful example could not but convince the young naturalist of the importance of imagination for guiding reason. His own practice in the *Origin* would demonstrate how such imagination not only stabilized reason but also gave it a distinct trajectory.

Darwin's construction of imaginative thought as a quasi-physical force brought him only so far in his effort to understand the mind-brain relationship. He, like many philosophers before him, arrived at an impasse. He could not go any further in parsing the relationship—though for his purposes, he need not have gone any further. He concluded that all we could really say about the mind-body connection was that "thought & organization run in a parallel series."[17]

DARWIN'S "MATERIALISM"

During the late 1830s, while constructing the fundamental features of his theory, Darwin was quite aware of the philosophical and theological implications of his conception of mind. Since human mental traits were comparable to those of animals, differing only in degree, he felt assured that his theory of transmutation could indeed bring humans within its purview.[18] By employing the resources of a moderate Humean perspective, which regarded both instinctive cognition and reason as constituted by sensory images in more or less fixed patterns, he could smooth the way for charting the development of the human species out of animal species. But this meant that certain kinds of traditional language used to describe the human mind would no longer be applicable, particularly language that carried a theological burden—the term *soul,* for instance. Since such locutions were not used for animals, there was no longer justification, Darwin concluded, for using them to refer to human beings.[19]

Darwin recognized that his conception of human mind would be labeled by some as materialistic, a designation that was often used synonymously with *atheistic.* In this early period, Darwin was certainly no atheist, nor even yet an agnostic; and he did not want to leave himself liable to the charge of irreligion. In his notebooks, he cautioned himself: "To avoid stating how far I believe in Materialism, say only that emotions, instincts, degrees of talent, which are hereditary are so because brain of child resembles parent stock."[20] Not only was this modest conclusion safe, but it recognized his own unsettled beliefs about mind. At the phenomenal level, he maintained that little difference existed between animal instinct and animal reason and that animal reason differed only in degree of complication from human reason. He did affirm that ideas were related to brain in a deterministic fashion—maybe the relationship was like force to matter; yet the exact nature of the connection eluded him, as it still does us.

From this early period through the first few years after the publication of the *Origin of Species* in 1859, Darwin remained a theist, if a rather weak-kneed one.

He did not think his sort of materialism of mind necessarily led to atheism or even precluded an afterlife—though he did not explore these issues with any logical rigor. Rather, his whole theory, as he initially constructed it, had a teleological orientation, an orientation that gave succor to the more orthodox conception of a God-driven universe, in which he still believed. As he put it around 1839 in a rather inchoate passage: "This Materialism does not tend to Atheism . . . we are steps towards some final end—production of higher animals—perhaps, say attribute of such higher animals may be looking back. (Therefore, consciousness, therefore reward in good life."[21] Darwin thus held that the growth of consciousness—that is, the production of the higher animals—was the final cause of the transmutational process. A higher consciousness, according to the above quoted passage, may look back to its roots in animal life; but it may also look forward to a divine reward for a good life. The notion that we would be rewarded in an afterlife slowly faded from Darwin's system of belief. What did not fade, however, was his assumption of a teleological orientation for the evolutionary process. The last few lines of the *Origin of Species* reiterate the idea that the purpose of the "war of nature" has been "the production of the higher animals."[22] For Darwin, it was what was left of divine purpose after God took leave. Nature came to inherit the mantle of the recently departed deity, displaying almost all of the divine powers—omniscience, benevolence, creativity, and wisdom. This is but to say that Darwin came to conceive of nature as possessed of something like absolute mind.

ABSOLUTE MIND AND THE EVOLUTIONARY PROCESS

From the beginning of his theorizing, Darwin employed mind as a model for understanding the evolutionary process. In the initial pages of his first transmutation notebook, begun in 1837, he queried himself: "Each species changes. Does it progress. Man gains ideas. The simplest cannot help—become more complicated; & if we look to first origin there must be progress."[23] Here the progressive character of mind became a way of understanding the progressive character of species development.[24]

Also in this early notebook, Darwin employed a cognitive device to explain species adaptation. He had, in his pre-Malthusian work, proposed that species alteration would occur as the result of the direct effects of the environment—hence animals in colder climates would produce heavier coats. He quickly realized, however, that direct environmental impact could hardly shape organisms to their surroundings in an intricate manner. In mid-1838, he suggested, alternatively, that an-

imals might develop habits that, if practiced over many generations, would become instinctive—that is, manifested without learning. These instincts, he believed, would then come slowly to change anatomy. In this way, mind—expressed in acquired habit and instinct—could produce adaptations that more finely fitted an animal into its environment. So, for example, Darwin considered how habit might modify the foot of the jaguar: "Fish being excessively abundant & tempting the Jaguar to use its feet much in swimming, & every development giving great vigour to the parent tending to produce effect on offspring—but whole race must take to that particular habit.—All structures either direct effect of habit, or hereditary & combined effect of habit."[25] Animal mind, then, could adapt individuals of a species to their particular surroundings, and these adaptations would be delivered to descendants through inheritance. Even after having arrived at his principal device of evolutionary change—natural selection—Darwin never abandoned inherited habit as an auxiliary mode of alteration, and he also advanced it as a source of variation on which natural selection might operate.

It is often assumed that when Darwin read Malthus in late September 1838, the idea of natural selection dropped fully formed from his brain. Certainly the idea of natural selection had enough analytic simplicity to make it seem an all-or-nothing affair. Thomas Henry Huxley, on reading the *Origin of Species,* exclaimed, "How extremely stupid not to have thought of that!" The apparent simplicity of the idea has often led critics to identify Darwin's natural selection with later formulations by neo-Darwinians. But the idea came slowly to Darwin, and then in the guise of a kind of preternatural intelligence, a kind of absolute mind.

The best way to show this and to indicate how natural selection was modeled, not on some machinelike operation, but on mind, is to begin with its formulation in the *Origin* and then excavate its deeper strata. In what follows, I will move back to the manuscript Darwin was working on when he received that fateful letter from Alfred Russel Wallace in 1858 and then further back to the essays of 1842 and 1844, when he first sketched out his ideas at length.

In the fourth chapter of the *Origin,* Darwin describes natural selection in contrast to man's selection:

> Man can act only on external and visible characters: nature cares nothing for appearances, except in so far as they may be useful to any being. She can act on every internal organ, on every shade of constitutional difference, on the whole machinery of life. Man selects only for his own good; Nature only for that of the being which she tends. . . . If may be said that natural selection is daily and hourly scrutinizing, throughout the world, every variation, even the slightest;

> rejecting that which is bad, preserving and adding up all that is good; silently and insensibly working, whenever and wherever opportunity offers, at the improvement of each organic being in relation to its organic and inorganic conditions of life.[26]

Several aspects of this description of natural selection reveal a deeper conception, namely something like absolute mind as operative in nature. First, note that when Darwin says nature seeks "the good of the being which she tends" and aims at the "improvement of each organic being," we want to know what or who is the *being* to which he refers. It cannot be the individual organism, which, strictly speaking, is not improved by nature, though its offspring might be. Moreover, does nature seek the improvement of *each* organic being, as Darwin says? Hardly, since most organic beings will be destroyed by natural selection. Nature, at least as the language of this passage suggests, must be aiming at an ideal end that transcends the individual—something only a mind might do. Throughout the *Origin,* but particularly in the last paragraph of the book, Darwin indicates this ideal end, this final cause of the whole evolutionary process, to be the production of the higher animals. This means that death and destruction are the agents, the necessary agents, for realizing the greater good that nature *intends.*

Natural selection, in the passage just quoted, has a vision that can penetrate into the very fabric of life, detecting the slightest variation and then selecting that variation for the good of the creature—or at least its descendants. This is, as Darwin portrays it, an altruistic act, unlike man's selfish choices. The actions of natural selection are thus hardly that of a machine, even a very powerful Manchester spinning loom—or of mute, blind causal forces.

The passage in the *Origin* has its progenitor in the manuscript that Darwin put aside in 1858 when he got Wallace's letter describing a similar theory of species transmutation. In that manuscript, which was to be called "Natural Selection," his formulation of the comparable passage ran:

> [Man] selects any peculiarity or quality which pleases or is useful to him, regardless whether it profits the being. . . . See how differently Nature acts! She cares not for mere external appearance; she may be said to scrutinize with a severe eye, every nerve, vessel & muscle. . . . Can we wonder then, that nature's productions bear the stamp of a far higher perfection than man's product by artificial selection. With nature the most gradual, steady, unerring, deep-sighted selection,—perfect adaptation to the conditions of existence.[27]

As we move down through the compositional strata, we see ever more clearly that natural selection takes on intellectual qualities. Here selection is "deep-sighted" and able to produce perfect adaptations—again, certainly out of the range of possibility for any machine.

The *Origin*'s description of natural selection has yet further depths, which are revealed in the essays of 1842 and 1844, the first extensive renditions of his theory. Darwin had a fair copy made of his 1844 essay, so as to bequeath it to posterity should he die before having a chance to write a proper book. At this level, the metaphorical formulation stands clear—but a formulation whose grammar controlled the structure of the mature theory. Darwin wrote:

> Let us now suppose a Being with penetration sufficient to perceive differences in the outer and innermost organization quite imperceptible to man, and with forethought extending over future centuries to watch with unerring care and select for any object [i.e., for any purpose] the offspring of an organism produced under the foregoing circumstances; I can see no conceivable reason why he should not form a new race (or several were he to separate the stock of the original organism and work on several islands) adapted to new ends. As we assume his discrimination, and his forethought, and his steadiness of object, to be incomparably greater than those qualities in man, so we may suppose the beauty and complications of the adaptations of the new races and their differences from the original stock to be greater than in the domestic races produced by man's agency.[28]

A comparable image can be found in Darwin's first essay (1842) elaborating his theory.[29] He initially used these tropes of a powerful intelligence to explain natural selection to himself, to work out his understanding of this burgeoning idea. And it is patent from their residual expression in the manuscript "Natural Selection" and in the *Origin of Species* that the structure of the metaphor still controlled his understanding and the development of his general theory. Indeed, so embedded in the theory were the implicit features of the metaphorical image that when Wallace suggested to him that he replace the term *natural selection* with Spencer's formulation "survival of the fittest," he declined.[30]

One could argue, of course, that Darwin's metaphor of a powerful mind doing the selecting in nature was only a rhetorical device meant to make the idea easier for his readers to digest. One might, therefore, wish to distinguish Darwin's expression in the *Origin* from what the theory *really* entails. This would be to suggest, however,

that the real theory was some timeless Platonic entity rather than a creature of history. I believe that Darwin's theory is enmeshed in his expression of it, not floating in some third world that only the likes of Karl Popper or Imre Lakatos—or Michael Ruse—might communicate with.[31] And, of course, it is the idea of natural selection grounding its actual expression that has controlled the further articulation of the general theory.

If Darwin's metaphorical construction of natural selection is more than a *façon de parler,* then it should make a difference in his theory, distinguishing his actual theory from what it might have been if natural selection were to be understood in the way a neo-Darwinian might construe it. There are, I believe, four general features of the theory that might have looked rather different had Darwin rendered natural selection in the denuded, anemic terms of the modern scientist.

The first difference concerns Darwin's notion of creation through law. From the early notebooks through the essays and the *Origin,* Darwin held that the rise and development of creatures occurred through natural laws. Yet in the essay of 1842, he emphasized the difficulty of conceiving of natural law as having the requisite power to fashion the most intricate contrivances. Law could have this power, however, if it were the legislation of a superior mind. As he put it in the essay: "Doubtless it at first transcends our humble powers to conceive laws capable of creating individual organisms, each characterized by the most exquisite workmanship and widely extended adaptations. It accords better with [our modesty] the lowness of our faculties to suppose each must require the fiat of a creator, but in the same proportion the existence of such laws should exalt our notion of the power of the omniscient Creator."[32] The point here is that the only kinds of laws capable of producing the infinitely fine adaptations exhibited by creatures—insofar as we could comprehend such laws—were those established by mind.

Phillip Sloan (in chapter 7 of this volume) has observed the distinction Darwin made in his early theorizing between the laws governing the inanimate universe and those operative in the organic world. The basis of the distinction was ultimately located for Darwin in the intentions of the divine mind. While Darwin muted the distinction in the *Origin,* Sloan clearly shows that it still continued to operate in the actual articulation of the theory. Thus the entire evolutionary system, as Darwin proposed it in the first edition of the *Origin,* was predicated on mind, on intelligence.

The second feature of Darwin's general theory that the metaphorical rendering of natural selection has generated is the conception of selection as operating gradually and by minute increments. If natural selection performed like a Man-

chester spinning loom, the product would not have been fine damask—or the exquisite eye of the vertebrate. But if natural selection had preternatural intelligence and could see into the very depths of a creature, was ever watchful, and always selected the best variations, no matter how small, then something like the vertebrate eye might gradually result. Thomas Henry Huxley, Darwin's great friend and champion, insisted on the machinelike character of selection—and he also maintained, consequently, that the evolutionary process occurred hesitatingly and saltationally. Darwin, by contrast, assumed the process to be slow, gradual, and fine.[33] The machine analogy simply did not form part of Darwin's initial conception of the evolutionary process—indeed, the very word *machine* in any of its forms appears only once in the *Origin,* hardly what you would expect if mechanism were a fundamental assumption for understanding the operations of living nature.

A third contribution of Darwin's metaphor to his theory has to do with the contrast with artificial selection. The absolute intelligence implicated in the metaphor helps explain a very curious claim Darwin made about speciation in the *Origin,* one that no modern evolutionist would accept, namely that large numbers of a given species in one location promote, per se, faster evolution. This claim is based on the successful practice of breeders. Darwin observed in the *Origin* that artificial selection would work more swiftly if breeding stocks were large, since "variations manifestly useful or pleasing to man appear only occasionally, [so] the chances of their appearance will be much increased by a larger number of individuals being kept."[34] Some pages later, he reintroduced this condition as one necessary for the success of natural selection: "A large number of individuals, by giving a better chance for the appearance within any given period of profitable variations, will compensate for a lesser amount of variability in each individual, and is, I believe, an extremely important element of success."[35] Of course, Darwin is right. With large flocks, the absolute number of favorable variations ought to increase. But the proportion of favorable to unfavorable (or neutral) variations should remain constant; and, indeed, large flocks will be even more subject to the phenomenon of swamping out (when favorable varieties breed with unfavorable). Only if natural selection acts intelligently and with foresight will large numbers avail. And this is what Darwin assumes.

Other aspects of Darwin's theory would likely be different were natural selection really the result of blind mechanism. Let me conclude with one final feature of the theory, already adumbrated, that clearly demonstrates the intentional, mental character that Darwin ascribed to natural selection. If natural selection were endowed with supreme intelligence, we would expect it to act for ends, for goals.

And this was precisely the way Darwin understood it to operate. In the preceding section, I cited his remarks, in 1839, to the effect that the evolutionary process was "stepping towards some final end—production of higher animals." He retained this conception during the two decades he worked on his theory. In the concluding paragraph of the *Origin,* he exclaimed that all the death and destruction imposed by natural selection aimed at a final cause, which was "the most exalted object which we are capable of conceiving, namely the production of the higher animals."[36] Evolution for Darwin was progressive and goal directed, which it certainly would not be if it were merely the result of blind causes clashing by night.

In later years, Darwin's metaphysical assumptions—or at least their overt expression—faded as critics teased them out and held them up for inspection (see chapter 7 of this book). But during the formative period of his theory construction, when the fundamental features of that theory were established, those assumptions formed the deep grammar of his conception, controlling what the theory was capable of asserting. Today, we understand the evolutionary process differently. Darwin's formulation of the operations of natural selection is not ours. We are neo-Darwinians, which, needless to say, Darwin was not.

NOTES

1. Charles Darwin, *Charles Darwin's Beagle Diary,* ed. R. D. Keynes (Cambridge: Cambridge University Press, 1988), 180.

2. Ibid., 222.

3. Charles Darwin, Notebook B (MS p. 228), in *Charles Darwin's Notebooks, 1836–1844* (hereafter *Notebooks*), ed. Paul Barrett et al. (Ithaca, N.Y.: Cornell University Press, 1987), 227.

4. Darwin, Notebook C (MS pp. 77–78), in *Notebooks,* 263. Single-wedge quotes indicate Darwin's deletions, double-wedge quotes his insertions.

5. I have discussed the sensationalist epistemology of Erasmus Darwin and Charles's debt to this grandfather in greater detail in Robert J. Richards, *Darwin and the Emergence of Evolutionary Theories of Mind and Behavior* (Chicago: University of Chicago Press, 1987), 31–40, 105–6.

6. Darwin, Notebook N (MS p. 21e), in *Notebooks,* 569.

7. Darwin, Notebook D (MS p. 118), in *Notebooks,* 371: "It is less wonderful that childs nervous system should build up its body, like its parent, than that it should be provided with many contingencies how to act—so with the mind. The simplest transmission is direct instinct & afterwards enlarged powers to meet with contingency."

8. Darwin, Notebook N (MS pp. 43e–44e), in *Notebooks,* 574–75.

9. Darwin, Notebook M (MS pp. 81), in *Notebooks,* 538.

10. Darwin, "Old and Useless Notes" (MS pp. 37), in *Notebooks,* 614.

11. Ibid. (MS pp. 37, 39), in *Notebooks,* 614, 616.

12. Darwin, Notebook M (MS pp. 89–92), in *Notebooks,* 540.

13. Darwin, "Old and Useless Notes" (MS p. 41v), in *Notebooks,* 618

14. Darwin, Notebook M (MS p. 103), in *Notebooks,* 544.

15. Ibid. (MS pp. 34–35), in *Notebooks,* 527.

16. Charles Lyell, *Principles of Geology,* 3 vols. (London: Murray, 1830–33). For the sentences cited, see 2:163–67.

17. Darwin, "Old and Useless Notes" (MS p. 41v), in *Notebooks,* 618.

18. He had a more difficult time with man's moral character but finally came to several ingenious resolutions to the problems of moral evolution. See Richards, *Darwin,* chs. 2 and 5.

19. Darwin, "Old and Useless Notes" (MS p. 36), in *Notebooks,* 613–14.

20. Darwin, Notebook M (MS p. 57), in *Notebooks,* 532–33.

21. Darwin, "Old and Useless Notes" (MS p. 37), in *Notebooks,* 614.

22. Charles Darwin, *On the Origin of Species* (London: Murray, 1859), 490.

23. Darwin, Notebook B (MS p. 18), in *Notebooks,* 175.

24. That Darwin's mature theory was progressive I have argued at some length in Robert J. Richards, *The Meaning of Evolution: The Morphological Construction and Ideological Reconstruction of Darwin's Theory* (Chicago: University of Chicago Press, 1992), ch. 5.

25. Darwin, Notebook C (MS p. 63), in *Notebooks,* 259.

26. Darwin, *Origin of Species,* 83–84.

27. Charles Darwin, *Charles Darwin's Natural Selection: Being the Second Part of His Big Species Book Written from 1856 to 1858,* ed. R. C. Staufer (Cambridge: Cambridge University Press, 1975), 224–25.

28. Charles Darwin, *The Foundations of the Origin of Species: Two Essays Written in 1842 and 1844 by Charles Darwin,* ed. Francis Darwin (Cambridge: Cambridge University Press, 1909), 85.

29. See ibid., 6.

30. Charles Darwin to Alfred Russel Wallace (July 5, 1866), in *Life and Letters of Charles Darwin,* ed. Francis Darwin, 2 vols. (New York: D. Appleton, 1891), 2:229–30. Darwin did introduce the designation "survival of the fittest" in the fifth edition of the *Origin,* though without abandoning "natural selection." See *The Origin of Species by Charles Darwin: A Variorum Text,* ed. Morse Peckham (Philadelphia: University of Pennsylvania Press, 1959), 163–65.

31. I have discussed the liability of the Platonic interpretation of theories in Robert J. Richards, "The Epistemology of Historical Interpretation: Progressivity and Recapitulation in Darwin's Theory," in *Biology and Epistemology,* ed. Richard Creath and Jane Maienschein (Cambridge: Cambridge University Press, 2000), 64–88.

32. Darwin, *Foundations,* 52.

33. Thomas Henry Huxley, "The Origin of Species" (1860), in his *Darwiniana,* vol. 2 of *Collected Essays* (London: McMillan, 1893), 77: "Mr. Darwin's position might, we think, have been even stronger than it is if he had not embarrassed himself with the aphorism, '*Natura non facit saltum,*' which turns up so often in his pages. We believe . . . that Nature does make jumps now and then, and a recognition of the fact is of no small importance in disposing of many minor objections to the doctrine of transmutation." Huxley remarked on his differences with Darwin in a letter to William Bateson: "I see you are inclined to advocate the possibility of considerable 'saltus' on the part of Dame Nature in her variations. I always took the same view, much to Mr Darwin's disgust, and we used often to debate it." See Thomas Henry Huxley to William Bateson (February 20, 1894) in *Life and Letters of Thomas H. Huxley,* 2 vols., ed. Leonard Huxley (New York: D. Appleton, 1900), 2:394.

34. Darwin, *Origin of Species,* 41.

35. Ibid., 102. See similar claims made on 105, 107, and 125.

36. Ibid., 490.