INTELLIGENT THOUGHT

SCIENCE VERSUS THE INTELLIGENT DESIGN MOVEMENT

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FRANK J. SULLOWAY

Why Darwin Rejected Intelligent Design

THERE IS CONSIDERABLE IRONY in the fact that Charles Darwin was at one time enthralled by the theory that all species are intelligently designed—a theory he later sought to banish from science in his *Origin of Species* (1859). Popularized in the seventeenth century in works such as John Ray's *The Wisdom of God Manifested in the Works of the Creation* (1691), this doctrine sought to unite a celebration of God's handiwork in the Creation with the pursuit of natural science. Such theologically inspired arguments reached their apogee a century later in the writings of William Paley. A clergyman like Ray, Paley set out his influential ideas in *Natural Theology; or, Evidences of the Existence and Attributes of the Deity, Collected from the Appearances of Nature* (1802). The many proofs he adduced in favor of intelligent design, including such examples as the hinges on bivalve shells and the plumes that facilitate wind dispersal of certain seeds, fascinated and convinced young Darwin.

Natural Theology is constructed around the analogy of a watchmaker, a metaphor borrowed from previous advocates of the design doctrine. Imagine, Paley suggests, that you are walking across a heath and suddenly encounter a

watch lying on the ground. After close inspection of the watch, you would be compelled to conclude that such an intricate device could not have been constructed otherwise in order for it to work. It is only reasonable to assume "that the watch must have had a maker: that there must have existed, at some time and at some place or other, an artificer or artificers who formed it for the purpose which we find it actually to answer, who comprehended its construction and designed its use." In the case of living organisms, Paley continues, the evidence for design is even stronger, "in a degree which exceeds all computation," and he concludes: "The marks of *design* are too strong to be gotten over. Design must have had a designer. That designer must have been a person. That person is GOD."

The efforts by Ray, Paley, and others to unite natural history with theology were among the inducements that inclined Darwin, at the age of eighteen, to look favorably on a career in the church. Sent by his father two years earlier to study medicine at Edinburgh University, Darwin had found himself uninspired by this profession and revolted by the sight of operations, which at that time were conducted without the benefit of anesthesia. Worried that his son might turn into "an idle sporting man," Darwin's father, a successful physician, proposed that he attend Cambridge University in preparation for becoming an ordained minister. "Considering how fiercely I have been attacked by the orthodox," Darwin later reflected on this youthful career decision in his 1876 *Autobiography*, "it seems ludicrous that I once intended to be a clergyman."

At Christ's College, Cambridge, Darwin was assigned the same rooms that Paley had occupied more than a half century earlier. Paley's *Evidences of Christianity* (1794) and his *Principles of Moral and Political Philosophy* (1785) were among the books selected as examination topics for Dar-

win's BA degree in 1830. Darwin studied these works diligently, as he later recalled in his *Autobiography*:

> I am convinced that I could have written out the whole of the *Evidences* with perfect correctness, but not of course in the clear language of Paley. The logic of this book and as I may add of his *Natural Theology*, gave me as much delight as did Euclid. The careful study of these works, without attempting to learn any part by rote, was the only part of the Academical Course which, as I then felt and as I still believe, was of the least use to me in the education of my mind. I did not at that time trouble myself about Paley's premises; and taking these on trust I was charmed and convinced by the long line of argumentation.

On the very day of publication of the *Origin of Species* three decades later, Darwin reiterated his praise for Paley in a letter to his neighbor in Downe, John Lubbock: "I do not think I hardly ever admired a book more than Paley's *Natural Theology*: I could almost formerly have said it by heart." Even after the *Origin* had finally turned the tide in thinking about the theory of evolution and had introduced Darwin's even more controversial mechanism of evolutionary change—natural selection—Darwin was still subject to the compelling lure of the design doctrine. The Duke of Argyll reported a conversation he had had with Darwin on this issue during the last year of Darwin's life. The Duke had maintained that he could not look upon certain adaptations, such as those found in orchids, "without seeing that they were the effect and the expression of Mind. I shall never forget Mr. Darwin's answer. He looked at me very hard and said, 'Well, that often comes over me with overwhelming force; but at other times,' and he shook his head vaguely, adding, 'it seems to go away.'"

What triggered Darwin's dramatic change of mind about the origin of species was his five-year voyage around the world on HMS *Beagle*, and especially his five-week visit to the Galápagos Islands in September and October 1835. Legend has it that Darwin underwent a eureka-like conversion to the theory of evolution during this brief visit. Shorn of the legend, the actual story of Darwin's conversion, which did not occur until after his return to England a year and a half later, tells us far more about how science is really done, especially how theory guides observation and prepares the mind, and how dogged persistence is required to transform controversial theories into widely accepted facts.

While in the Galápagos, creationist theory primed Darwin in key ways for what he observed and understood there. Just as important, this theory also dictated what he failed to observe and understand. Commenting on his extensive efforts to collect specimens on Charles Island, the second of the four islands he visited, Darwin recorded in his personal journal, "It will be very interesting to find from future comparison to what district or 'centre of creation' the organized beings of this archipelago must be attached." He was clearly trying to reconcile the new and strange creatures he was encountering in this remote archipelago with the prevailing creationist paradigm. According to this theory, different "centers of creation" explained why the earth's flora and fauna differed from one region to another—for example, between continents. What is apparent from Darwin's reference is that he did not yet realize that such a tiny portion of the globe as the Galápagos archipelago might actually be its own "center of creation."

Today, as a result of Darwin's change of scientific heart, the Galápagos are widely recognized as a classic laboratory of evolution in action, and hence (to use the pre-Darwinian

terminology) as a unique center of creation in their own right. In significant part, the islands owe their biological celebrity to the fact that they are geologically young (about 3 million years old, although former islands, now eroded down and submerged beneath the sea, date back as much as 17 million years).[1] Based on his own geological observations, Darwin correctly realized that life in these distant islands had been given a new beginning. As he later reflected on this insight in his *Journal of Researches*:

> Seeing every height crowned with its crater, and the boundaries of most of the lava-streams still distinct, we are led to believe that within a period geologically recent the unbroken ocean was here spread out. Hence, both in space and time, we seem to be brought somewhat near to that great fact—that mystery of mysteries—the first appearance of new beings on this earth.

Certain unexpected facts about the Galápagos undermined the credibility of any creationist solution to this "mystery of mysteries." In particular, each island in the Galápagos group has evolved many of its own distinct species over time, following the stocking of the islands by chance colonists who managed to arrive there from the Central and South American mainland, almost 600 miles away. Darwin was first alerted to this possibility by Nicholas Lawson, the vice-governor of the islands, whom Darwin

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[1] See D. M. Christie et al., "Drowned islands downstream from the Galápagos hotspot imply extended speciation times," *Nature* 355 (1992):246–48; and R. Werner and K. Hoernle, "New volcanological and volatile data provide strong support for the continuous existence of Galápagos Islands over the past 17 million years," *Int. J. Earth Sci.* 92 (2003):904–11.

encountered on Charles Island. As he reports in his *Journal of Researches*, Lawson insisted that "the tortoises differed from the different islands, and that he could with certainty tell from which island any one was brought." Unfortunately, Darwin did not at first pay sufficient attention to the vice-governor's testimony, in part because of an error in the contemporary zoological literature. Like other naturalists, Darwin was under the mistaken impression that the Galápagos tortoise, which was at that time classified under the misleading scientific name *Testudo indicus*, was not native to the Galápagos but had been transported there by buccaneers or perhaps oceangoing Polynesians, from islands in the Indian Ocean, where similar forms of giant tortoise are found. Only after Darwin's return to England did it become clear that these two were separate species.

There was a second reason why Darwin initially overlooked the vice-governor's remarks about the tortoises. Creationist theory held that species can and do change in response to local environments. Like an elastic band that resists being stretched, any departure among varieties from the supposedly immutable specific type was thought to be a temporary deviation, maintained by unusual ecological conditions. Darwin therefore appears to have concluded, during his Galápagos visit, that possible island-to-island differences among the giant land tortoises were no more remarkable than if introduced goats were also to differ from island to island in characteristics like color and size. Such local differences were readily interpretable as short-term perturbations somehow induced by transport to new and demanding environments.

As a result of his creationist perspective on species and varieties, Darwin—astonishingly, from our modern evolutionary viewpoint—failed to collect a single specimen of giant tortoise for scientific purposes during his Galápagos

stay. After he had left the archipelago and was sailing to Tahiti, Darwin had one last opportunity to rectify this collecting oversight. The *Beagle* had stocked forty-eight tortoises from San Cristóbal, the first of the four islands Darwin had visited. As they sailed across the Pacific, Darwin and his fellow shipmates gradually ate their way through the evidence that was later, in the form of hearsay, to revolutionize the history of science. The carapaces of those forty-eight tortoises, which could have been compared with other specimens at European museums, were unfortunately all thrown overboard with the rest of the *Beagle*'s garbage.

This same creationist mindset helps to explain why Darwin at first failed to understand the most famous Galápagos exemplar of evolution in action—namely, Darwin's famous finches. Fourteen species of finches have evolved in the Galápagos Islands, from an ancestral form now known to be a member of the *Tiara* group (grassquits), which is found in Central and South America.[2] Over the last 2 million years or so, this evolutionary process has resulted in such impressive adaptive radiation into diverse ecological niches that some of these fourteen Galápagos species are not particularly finchlike in appearance. Although four of the fourteen species feed on seeds, as finches generally do, another two species feed on the fruits, flesh, and flowers of cactus. Seven additional species are primarily insectivorous, and one very remarkable species feeds almost exclusively on leaves. It is not surprising, then, that Darwin was fooled by some of these finches into thinking they were not finches at all but the species that they had come to mimic through a process known as convergent evolution. In his specimen notebook,

[2] See K. Petren, B. R. Grant, & P. R. Grant, "A phylogeny of Darwin's finches based on microsatellite DNA length variation," *Proc. Roy. Soc. Lond. B* 266 (1999):321–29.

for example, he listed the warbler finch as a "Wren"—which is what this bird, to an untrained eye, appears to be. Similarly, he listed the small cactus finch, which has a long pointed bill for getting at the fruits and flowers of the *Opuntia* cactus, as a member of the Icteridae, which is the family of meadowlarks and orioles.

So confusing was the case of the Galápagos finches that Darwin did not grasp, at the time of their collection, that all these birds were closely related or that the peculiarly large number of species in this one avian group might result from their having evolved on different islands. He therefore made no effort to label his ornithological collections by island, something he was later to regret when he finally surmised the evolutionary origins of this peculiar group of birds. Nor did Darwin have the opportunity to observe these finches in sufficient detail to realize that their beak sizes and shapes were closely related to their diets, an important insight that the legend wrongly ascribes to him.

Despite being armed with an inadequate theory during his Galápagos visit—a theory that served to undermine his collecting methodology by focusing his attention on the Galápagos as part of a presumably larger center of creation, Darwin was too good a naturalist not to notice that the four mockingbird specimens he collected, each from a different island, were either distinct varieties or separate species. Not being an expert in ornithology, Darwin was unsure just what to make of this anomaly, but he did record localities for these four specimens. In July 1836, nine months after his Galápagos visit, Darwin reflected on this unusual case of the mockingbirds and recalled as well what he had been told about the tortoises:

> When I see these Islands in sight of each other, & possessed of but a scanty stock of animals, tenanted by these birds but

> slightly differing in structure & filling the same place in Nature, I must suspect they are only varieties. . . . If there is the slightest foundation for these remarks the zoology of Archipelagoes—will be well worth examining; for such facts would undermine the stability of Species.

The key to interpreting this famous passage—which broaches the Darwinian revolution only to back away from it—is the phrase "I must suspect they are only varieties," a presumption that Darwin understood to be fully consistent with creationist theory. What kept Darwin from taking the crucial step from scientific orthodoxy to heterodoxy at this point in the *Beagle* voyage was a lack of critical information about proper ornithological classification, which would only become available to him back in England through access to museum collections and especially the judgments of expert ornithologists, who were much more familiar than Darwin was with the defining features of species and varieties in the particular Galápagos taxa he had collected. Faced with an absence of crucial information to resolve the issue, Darwin continued to give a nod toward the prevailing creationist assumption that variation within immutable species can lead to new varieties or subspecies that are adapted to local environments. Despite any doubts Darwin may have entertained on this subject during the remainder of the *Beagle* voyage, this scientific position was perhaps the most responsible one for him to have taken at that time.

Darwin returned to England on October 2, 1836. Three months later, he deposited his *Beagle* collections of birds with John Gould, the ornithological expert at the London Zoological Society. Gould, who was in the process of becoming famous for his beautifully illustrated monographs on birds of the world, immediately realized the extraordinary nature of Darwin's Galápagos specimens and analyzed

and described them first, ahead of the other birds from the *Beagle* voyage.

Darwin did not obtain a full report on Gould's findings until early March 1837, when he moved from Cambridge to London. After the two men had discussed these findings in detail, Darwin's life and scientific thinking were never the same. Gould informed Darwin that three of his four specimens of Galápagos mockingbird were distinct species, new to science and different from all known mockingbirds. Gould also informed Darwin that his collection included thirteen or possibly fourteen species of very unusual finches, all so closely related that Gould had placed them in a single new group. As for the land birds as a whole, twenty-five out of twenty-six were judged to be new to ornithology and unique to the Galápagos, something Darwin could not have known without access to the museum collections and previously published descriptions available to Gould. All of a sudden, following Gould's taxonomic analyses, the Galápagos Islands had become their own distinct "center of creation." Darwin now found himself confronted by the problem of the origin of species in a way he had not when he was visiting those islands.

Darwin appears to have been stunned by Gould's conclusions. He quickly realized that if Gould was right about the mockingbirds (and Darwin apparently pressed him on this point, to be absolutely certain), the supposedly immutable barrier that exists between separate species had somehow been broken by these birds, isolated on the different islands of the Galápagos group. Gradual evolution through geographic isolation was the only plausible explanation, unless one believed that God, like an obsessive-compulsive gardener, had gone from one island to the next in the Galápagos group whimsically creating separate but

closely allied species intended to fill the same ecological niches. As for the much more complex case of the finches, once Gould had convinced Darwin that these birds were all closely related, based on the simpler and more compelling case of the mockingbirds, Darwin was able to see the finches in a radically new light. As he later observed in his *Journal of Researches*: "Seeing this gradation and diversity of structure in one small, intimately related group of birds, one might really fancy that from an original paucity of birds in this archipelago, one species had been taken and modified for different ends." Only now did he appreciate the extent of his previous oversight in failing to label the bulk of his Galápagos birds by island. Such evidence, he realized, would help to account for why so many different species of finches lived there.

Fortunately, Darwin knew that three other collectors on the *Beagle* (Captain FitzRoy, FitzRoy's steward Harry Fuller, and Darwin's own servant, Syms Covington) had also collected specimens in the Galápagos. All of these specimens turned out to have been labeled by island; significantly, it was the nonscientists on the *Beagle*, who were not as theory-driven as Darwin, who recorded the scientific evidence that Darwin, based on a creationist approach, had considered superfluous. After his meeting with Gould, Darwin diligently sought out this locality information, and he later used it to support his case about the mockingbirds and tortoises, although the evidence was still uncomfortably tenuous. Fortunately, additional sources of information over the next two decades, drawn in part from reports about other oceanic archipelagoes, would transform this suggestive evidence into incontrovertible fact.

Jolted by the Galápagos results, and struck by similar evidence about geographic distribution that began to emerge

from taxonomic judgments about his South American collections, Darwin began a search in the spring of 1837 for a mechanism that would explain not only evolutionary change but also the most elusive puzzle about species—their highly adaptive nature. As he later recorded in a private journal: "In July [1837] opened first note book on 'Transmutation of Species'—Had been greatly struck from about Month of previous March on character of S. American fossils—& species on Galapagos Archipelago. These facts origin (especially latter) of all my views."

Based on the evidence of the Galápagos mockingbirds, Darwin now understood that geographic isolation was a crucial part of the answer to how species transform themselves over time. But isolation, although it could account for the origin and multiplication of new species over time, was insufficient to explain the often remarkable adaptations that species manifest to local environments. After exploring and rejecting a number of hypotheses about evolutionary change, Darwin happened to read, in September 1838, the 1826 edition of Thomas Malthus's *Essay on the Principle of Population*. Malthus argued that populations have an inherent tendency to grow geometrically. Yet, in nature, the food supply is limited, so most offspring do not survive, being killed by predators, famine, and diseases. On reading Malthus's book, Darwin immediately realized that in the ever-present struggle for existence, slight variations of a beneficial nature would tend to be naturally selected, leading to increased survival and hence an increase in adaptive traits, just as the breeder of domesticated animals achieves desired traits by selecting the qualities that are esteemed in these animals. "Here, then," Darwin remarked in his *Autobiography*, "I had at last got a theory by which to work." Here also was a credible answer to William Paley—one entailing a natural (as opposed to supernatural) expla-

nation of adaptations. Natural selection, Darwin realized, was none other than Paley's designer, an equivalence that later led Darwin sometimes to personify this evolutionary process, as in this celebrated passage from the *Origin*: "It may be said that natural selection is daily and hourly scrutinising, 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."

Inspired by the striking evidence from the Galápagos Islands, and armed with his novel theory of natural selection, Darwin began to reexamine the basic assumptions of creationism and to compare the predictions one would make based on these two radically different theories. The more extensive his reexamination became, the more he realized that the theory of intelligent design, which gave creationism its scientific legitimacy, was overwhelmingly contradicted by the available evidence. Darwin's reassessment reached its culmination twenty-two years later in *On the Origin of Species by Means of Natural Selection*, a book that Darwin himself aptly characterized toward the end as "one long argument." It was as much an argument *against* creationism, and especially against the validity of intelligent design, as it was an argument *for* evolution, as Ernst Mayr has noted in his 1991 book, *One Long Argument: Charles Darwin and the Genesis of Modern Evolutionary Thought*. Although Paley is mentioned only once in the *Origin*, his specter is everywhere apparent in Darwin's repeated arguments highlighting the lack of truly intelligent design in nature.

Not surprisingly, the evidence about geographical distribution, particularly about oceanic islands and their biolog-

ical relationships with the nearest continents, plays a substantial role in Darwin's argument. The numerous problems that such islands raised for creationism had been surprisingly overlooked prior to Darwin's discussions of the subject, and this powerful class of evidence was the only topic to which Darwin devoted two whole chapters in the *Origin*. The Galápagos, for example, are home to various species of animals and plants closely allied to those from the neighboring American continent, yet the environmental features of these islands do not at all resemble those of the nearest parts of the continent, which are tropical. By contrast, the harsh volcanic environment of the Galápagos does closely resemble that of the Cape Verde Islands, 400 miles west of Africa. Yet the Cape Verdean flora and fauna are most strongly allied to species living on the African mainland, not to those in the Galápagos. Why would a Designer, Darwin asked, place two completely different creative stamps—one African and one American—on species that live in nearly identical environments and fill similar ecological niches? Creationist theory, he argued, ought to predict that such island species would either be identical or closely allied, based on the similar environments to which they are supposedly adapted by intelligent design. But the true circumstances are "utterly inexplicable on the ordinary view of independent creation of each species." By contrast, anyone who accepts the theory of evolution would expect precisely this sort of evidence.

In the *Origin*, Darwin extended this general argument about oceanic islands to include so-called relict populations on continents, such as the blind organisms (rodents, reptiles, insects, crustaceans, and fish) that live within deep caverns. Almost no environments, Darwin argued, could be more similar than the habitats that characterize such cavern systems, because these caverns are insulated from major

changes in temperature, humidity, and the seasons. Yet blind cave animals, which often have rudimentary eyes that serve no purpose, are not closely allied to one another around the world. Instead, these organisms most closely resemble the surface-dwelling organisms on each of the continents where the caverns are found and from which their denizens have been derived by evolution. In short, such facts about relict populations do not admit of a rational explanation in terms of the theories of independent creation and intelligent design. Such facts do, however, agree with the expectations derived from evolutionary theory.

Islands like the Galápagos focused Darwin's attention on another class of facts inimical to the theory of intelligent design. Remote oceanic islands have very skewed faunal distributions. Absent from such island populations are large terrestrial mammals as well as amphibians (frogs, toads, and newts). Yet bats, which can reach oceanic islands by flight, are regularly found to inhabit the islands of every major ocean. The physical conditions of such islands, Darwin maintained, cannot explain the absence of amphibians and large terrestrial mammals, for when such animals have been introduced to oceanic islands—and Darwin presented relevant evidence in the *Origin* from numerous island localities—they have generally flourished "so as to become a nuisance." Although creationism and intelligent design supplied no explanation, such facts were perfectly consistent with colonization by accidental transport. As Darwin noted, amphibians and their eggs are easily killed by immersion in salt water. By contrast, reptiles, which are often found on remote islands, are much better able to survive extraordinary ocean journeys.

The ease with which exotic animals and plants, brought by occasional visitors and colonists, have become naturalized on remote islands provided Darwin with another example

of a fundamental weakness in design theory. Almost everywhere that animals and plants have been introduced to ocean islands, the introduced forms have largely exterminated the native forms. When Darwin visited the Galápagos in 1835, this pernicious process had just begun, so he could refer to the looming problem there only in general terms. Commenting on the extreme tameness of the birds and animals in these islands—a disposition that allowed them to be easily killed by the colonists for food or sport—Darwin remarked, "What havoc the introduction of any new beast of prey must cause in a country, before the instincts of the indigenous inhabitants have become adapted to the stranger's craft or power." In support of this Galápagos observation, Darwin drew in the *Origin* on cases of oceanic islands that had been colonized much earlier. Of New Zealand he noted that the endemic organisms were "now rapidly yielding before the advancing legions of plants and animals introduced from Europe," and the original and highly endemic flora of Ascension Island, he reported, was all but extinct.

Had the native animals and plants on those islands been specially designed by God for residing there, surely they ought to have prevailed over introduced organisms, which were presumably designed to live elsewhere. In contrast, evidence showing the consistent superiority of introduced forms was fully in accord, Darwin argued, with the theory of evolution by natural selection, because natural selection acts only on organisms as they compete with one another within local communities. Hence this evolutionary process "will produce perfection, or strength in the battle for life, only according to the standard of that country." Remote islands, which typically have a meager collection of denizens compared with mainland ecological communities, have generally experienced less intense selection over time, and

their residents "often yield, as we see they do yield, to the inhabitants of another and generally larger country."

Once Darwin began to catalog instances of imperfect design in nature, more and more examples came to his attention through the revealing lens of evolutionary theory. In the *Origin* he provided scores of additional examples, drawn from biological domains such as morphology, classification, and embryology. The ultimate message in his relentless critique was simple: Any theory of the origin of species had to account not only for adaptations but also for their frequent imperfections. The main problem with the creationist doctrine was the copious evidence of poor design. To account for such evidence, Paley and his predecessors had to assume that their imagined Watchmaker was somehow lacking in foresight and sometimes just plain derelict or even malicious. Darwin, of course, was careful not to push that argument too far, lest he offend his more theologically minded readers. But he did allude more than once in the *Origin* to the dark side of intelligent-design doctrine; for instance, he noted that it seemed preferable to explain the behavior of baby cuckoos ejecting their foster siblings from the nest, or parasitic wasps injecting their eggs into caterpillars (which are then devoured alive by the larvae) as "small consequences of one general law, leading to the advancement of all organic beings" rather than as the outcome of "specially endowed or created instincts." Privately he was more forthcoming. To botanist Joseph Hooker he wrote in 1856, "What a book a Devil's Chaplain might write on the clumsy, wasteful, blundering low & horridly cruel works of nature!"

Ultimately, what Darwin's transformation from creationist to evolutionist reveals about him—and about science generally—is that the best science is conducted in the service of a really good theory. Darwin's own scientific

methodology was remarkably modern for a period when Baconian induction—supposedly letting the facts speak for themselves, independently of any theory—was the predominant scientific philosophy. Although Darwin sometimes implied that he was a Baconian scientist in his methods—doubtless to assure people of his efforts to be unbiased—he was anything but a Baconian in practice; throughout his long career he employed what is known as the hypothetico-deductive method, by which hypotheses are used to generate predictions and to guide the collection of relevant evidence—information that is then used either to confirm or reject the hypotheses.[3]

During the *Beagle* voyage, Darwin was guided by creationist theory. As a result of his fateful Galápagos visit and certain other voyage experiences, he discovered that this theory led to false expectations—and also encouraged, as one unfortunate consequence, inappropriate collecting methods. The deeper Darwin probed, the more he realized that creationist theory was abundantly contradicted by the available biological and paleontological evidence. So he rejected this theory and eventually developed a better one, the theory of evolution by natural selection. He then turned this new theory on the same set of phenomena he had once sought to explain by means of creationism and its explanatory handmaiden, intelligent design. Patiently, over the next two decades, Darwin sifted through scientific journals, old tomes about voyages of exploration, gardeners' magazines, and numerous other sources of scientific data and also continually prodded his colleagues for pertinent facts—all in a search for evidence that could be used

[3] See especially M. T. Ghiselin, *The Triumph of the Darwinian Method* (Berkeley and Los Angeles: University of California Press, 1969).

to test his theory against the creationist doctrines he had imbibed prior to the *Beagle* voyage.

In 1859 Darwin's revolutionary argument was startling to many, and it provoked great controversy on publication. But it eventually carried the day, as Darwin's scientific contemporaries, following in Darwin's footsteps, addressed the many problematic theoretical issues, highlighted by abundant empirical evidence, that he had raised in the *Origin*. In doing so, most of them realized, just as Darwin had, not only that intelligent design fails to explain anything that cannot be fully explained by natural selection but also—and far more damningly—that whatever this theory does claim to explain, it explains badly or not at all.

In current debates about intelligent design, it is often asserted that this theory is unscientific because it is untestable. The real problem with this doctrine, however, is that numerous straightforward tests have overwhelmingly failed to support it. In lucid and cogent prose, Darwin's "one long argument" in the *Origin of Species* tells us not only why he was personally compelled to reject intelligent design but also why any well-informed person ought to reject it.

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