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Inside the Human Genome: A Case for Non-Intelligent Design

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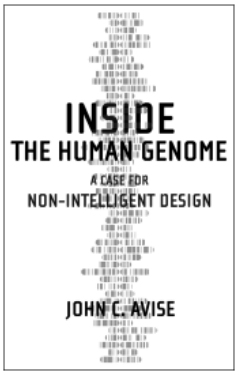
PALEY'S FOLLY—THE TRUE STORY OF THE HUMAN GENOME

Inside the Human Genome: A Case for Non-Intelligent Design. John C. Avise. Oxford University Press, 2010. 240 pp., illus. $19.95 (ISBN 9780195393439 cloth).

Poor William Paley. In 1802, when he first published his seminal book *Natural Theology,* all that he could point to as "*Evidences of the Existence and Attributes of the Deity*" (the book's subtitle) was drawn from the anatomy and natural history of plants and animals. To be sure, by the standard of its day, that evidence was more than enough. The good Reverend Paley's skillful writing and exceptional knowledge of anatomy and physiology helped him fashion an enticing argument: that the functional complexity of living creatures could be explained only by a process of design. The source of that design, of course, was a wise and powerful creator. To Paley, the existence of organs of extreme perfection, such as the eye and the ear, the elegant structural engineering of the skeletal system, and even the instinctive habits of birds and insects, were evidences of the hand of the designer in every aspect of life on Earth. What greater proof might one hope for of the creator's beneficence than the physiological perfections of his various creations?

Charles Darwin, inspired as he was by Paley's skill and scientific understanding, came to see things differently. Nature, in Darwin's view, wasn't perfect at all. Rather, it was filled with what he would come to describe as the "clumsy, wasteful, blundering low and horridly cruel works of nature" in an 1856 letter to botanist Joseph Hooker. To Darwin, the imperfections of living organisms were not the result of blundering incompetence on the part of their creator but the unavoidable result of the process of evolution by natural selection. In short, where Paley was transfixed by the superficial perfection of life's design, Darwin saw more deeply into the flawed reality of life, and found its explanation in the workings of evolution.

Today, many of Paley's modern heirs are certain that he'd be delighted by another level of perfection in living organisms—the organization of their genomes. Advocates of "intelligent design" (ID) wax eloquent about the complexity of the genome and the careful design of genes, proteins, and biochemical pathways. Surely in the age of molecular genetics Paley's argument is even stronger, given the perfection of the human genome. Right?



Well, not really. In fact, not even close, as John C. Avise's book *Inside the Human Genome: A Case for Non-Intelligent Design* points out. Avise, a professor at the University of California, Irvine, makes the case against ID by drawing broadly from the harsh realities of the human genome. Whereas ID advocates love to spin generalities about the informational complexities of the genome, like Darwin, Avise looks much deeper. Distilling some of the key findings of the Human Genome Project, Avise dares to show his readers what's really going on with our DNA—and it isn't pretty. The titles of three of his chapters capture the essence of his thesis: "Fallible Design," "Baroque Design," and "Wasteful Design." No elegant perfection is found here—just a bunch of slap-dash mechanisms that break down, mess up, and fail with astonishing regularity. Hardly the work of a master designer.

Avise's catalog of what's wrong with our genome is extensive. No fewer than nine tables of genetic disorders grace the pages of this book, each attributed to flaws in the design of our genome, caused by factors such as mobile genetic elements, abnormal expression of microsatellite regions, genomic imprinting, and so on. Raw data abound, but in Avise's hands, never become boring or tedious. Quite the contrary, this catalog of imperfection adds to the weight of his argument and becomes a burden far too great for the proponents of ID to bear. By the end of this brief, well-written book you may wonder how you've been lucky enough to survive to adulthood, but not for a second will you attribute this achievement to the perfection of design. Bottom line: The human genome belongs to Darwin, not Paley.

Avise is perceptive enough to recognize that theology permeates the ID movement, and therefore a scientific argument alone is not enough to make the case for evolution's non-intelligent design of our genome. Fittingly, theology pervades this book as well, centering on the problem of theodicy, how the reality of pain and suffering can be reconciled with the image of a kind and loving God. Going so far as to quote Jesus on the cross ("my God, my God, why hast Thou forsaken me?"), Avise targets the core theological problem of ID: If living things have been fashioned by a compassionate creator, then why do so much suffering and death arise directly from his handiwork? Could a better genome have been designed to avoid these problems? Avise certainly thinks so, and he even provides a list of six changes that would have made the human genetic system more efficient and less prone to disease. It's a wonderful list of logical and sensible improvements, a plan for genuinely intelligent design that bears little relation to our deeply imperfect genetic system.

Given the continuing assaults on science education in the United States

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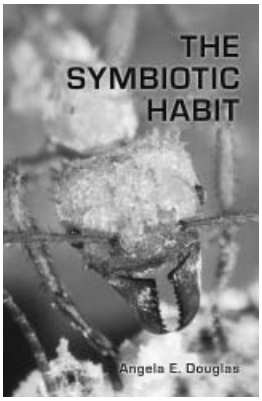
and other countries, *Inside the Human Genome* is a timely and important work. Significantly, it does not fall into the trap of demonizing religious thought as hopelessly antithetical to science. Echoing the sentiments of geneticist Francisco Ayala, the author describes evolution as a form of "philosophical salvation" to theologians as a means of helping them approach and possibly solve the problem of theodicy. This suggestion may earn Avise the scorn of those who see religious faith as the primary problem facing the scientific enterprise today, but it is nonetheless a sound and sensible response to those who fear evolution primarily for its religious implications. It also makes good philosophical sense.

I harbor no illusions that this fine book and its depictions of the non-intelligent design in the human genome will make the ID movement go away. Its hard-core advocates will no doubt shrug off the flaws and wasteful imperfections of the genome and find a way to cling to the concept of design despite the facts. As one of them once told me, "We all know that the Ford Edsel was a badly designed car, but it was still designed." Nonetheless, the ID movement has advanced, in part, by publicly promoting a buffed-up pseudoscientific caricature of our genetic makeup that emphasizes its complexity, grace, and elegance. As Avise has clearly shown, like the other claims of the design-creationist movement, this caricature bears no resemblance to reality.

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SYMBIOSIS

The Symbiotic Habit. Angela E. Douglas. Princeton University Press, 2010. 214 pp., illus. $45.00 (ISBN 9780691113418 cloth).



Angela E. Douglas, a professor of insect physiology and toxicology at Cornell University, begins *The Symbiotic Habit* by asking the reader to look out the window and recognize that every organism is a product of symbiosis: green plants, plant-eating vertebrates, and even all eukaryotic cells. But this book is about far more than the ubiquity of symbiosis; Douglas discusses the evolutionary and ecological factors that lead to the establishment and maintenance of symbiosis, and emphasizes the effects of symbiosis as a process on ecological communities and the evolution of organisms.

In the preface, the author explains that the book is motivated by three developments: (1) molecular and genetic techniques that have permitted the investigation of symbiosis at a level not previously possible; (2) a conceptual shift from symbiosis as a reciprocal exchange of benefits to one in which a controlling partner manages conflict between symbionts; and (3) increasing recognition of applied importance of symbiosis for environmental, agricultural, and human health. *The Symbiotic Habit* weaves these three themes into a narrative that integrates case studies from a broad range of taxa and ecosystems with general concepts that transcend individual taxa or habitats. Although Douglas's specialty may be insects, she draws key examples from a variety of taxa and ecosystems—she presents a more than ample discussion of symbioses involving plant, microbial, and marine taxa to reinforce the broad importance of symbiosis for life on Earth and to keep the interest of the general reader. Overall, I found the book readable and quite insightful.

Douglas notes that a vexing aspect of the study of symbiosis is the many ways the term is defined and the topic delineated by different scientists. She works through this issue in an early chapter, explaining the lack of a universally agreed upon definition yet not dwelling on what might be an esoteric topic for some readers. Given the breadth of the spectrum to which the principles of symbiosis most likely apply, one might wonder whether any restrictions from the general dictionary definition (she cites as "an association between different species from which all participating organisms benefit") have much use. Regardless, Douglas makes it clear that by "symbiosis" she refers only to organisms that have significant direct physical contact, as the increased intimacy of such relationships implies a more closely intertwined fate that is not the case in looser associations. The author acknowledges, however, that a rigid definition based on a specific duration of contact is unrealistic, and she quite intentionally provides examples of mutualistic interactions that do not (by her definition) appear to be strict symbioses to illustrate general principles. I found this refreshing and a major strength of the book that increases its utility to a broad readership. What emerges is a common thread from many of the concepts that apply to symbioses between intimately associated organisms to ecological and evolutionary aspects of looser associations among free-living species.

That said, *The Symbiotic Habit* addresses phenomena unique to intimate symbioses such as those that are intracellular. As someone who is most familiar with interactions among macroscopic, free-living organisms, I nonetheless found fascinating the sections on genomic deterioration and assimilation of symbionts, including the limits to assimilation and speculation as to why some symbionts may never be fully assimilated. Even the

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