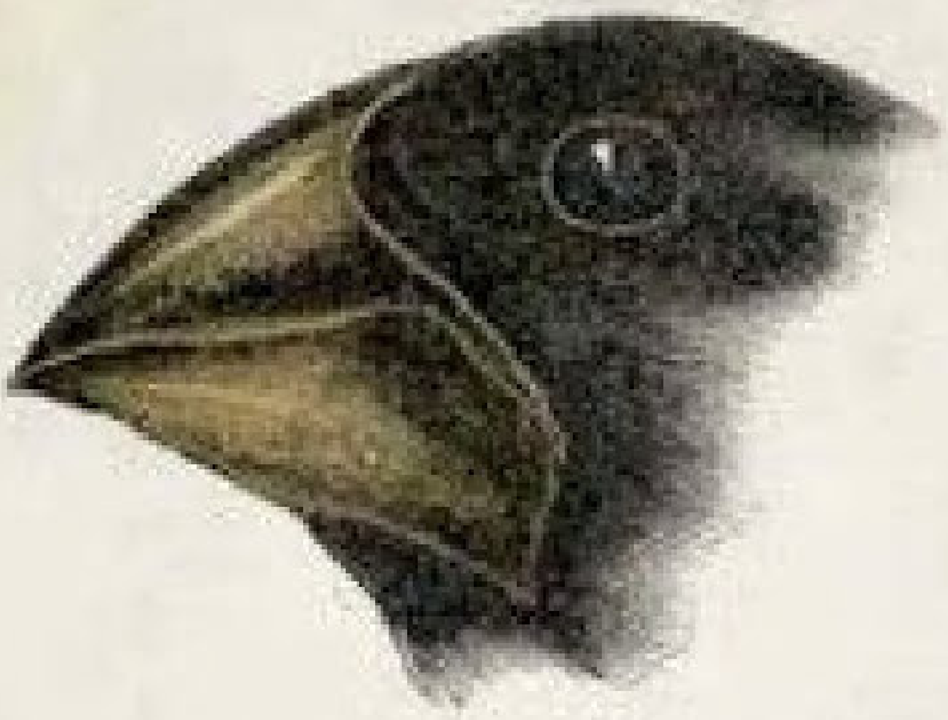
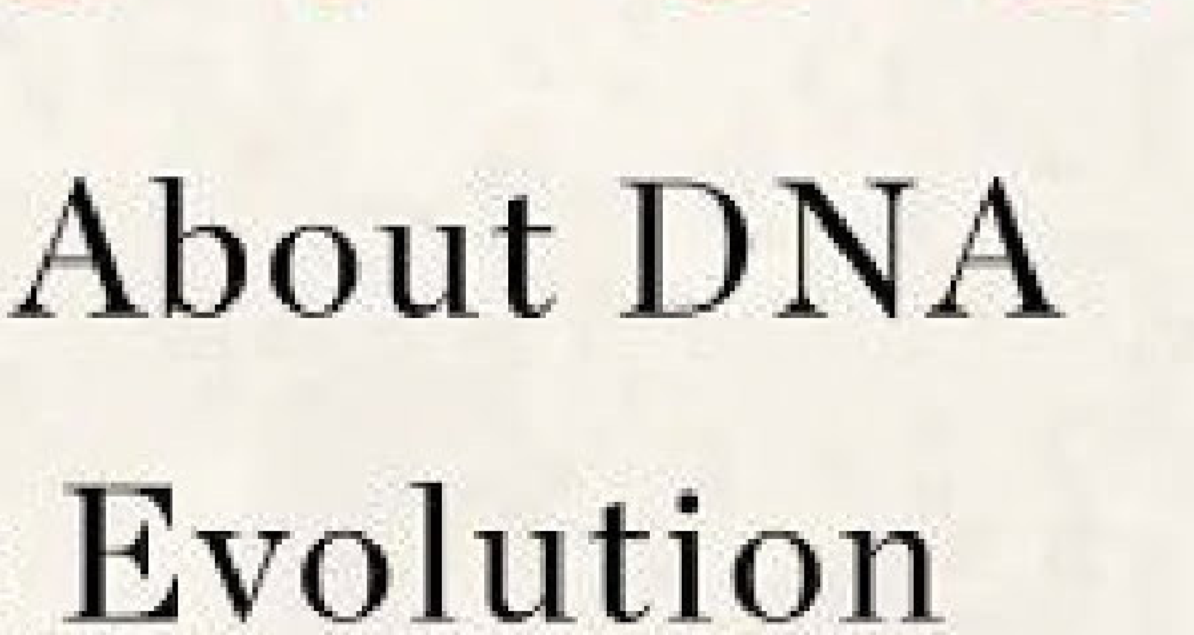



DARWIN *Devolves*

The New Science About DNA That Challenges Evolution

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Introduction

When I was a kid I would lie awake some nights pondering existential questions: What is thought? Why am I me? How did the world get here? I admit I was a peculiar boy, but over time I found that nearly all my friends had asked themselves such questions too. It seems to come naturally with having a mind. Most of the time we're distracted with everyday activities—TV, school, dinner. But once in a while, in a quiet moment, we realize that something completely different must have happened to give rise to what we call ordinary life.

Later I learned that not only young people ask that last question; young civilizations do too. Discussion of the enigma of where nature came from goes back as far as there are written historical records and, with a few lulls, has continued strongly up to the present. Yet despite the long and varied history of discourse, all *particular* positions on the topic can be considered to be elaborations on either of just two *general* mutually exclusive views: (1) contemporary nature, including people, is an accident; and (2) contemporary nature, especially people, is largely intended—the product of a preexisting reasoning mind.

I will argue in this book that recent progress in our understanding of the molecular foundation of life *decisively* supports the latter view. To help frame the issues we'll consider later, let's first briefly recall a few highlights of what earlier writers thought about nature and purpose.

Throughout History

The first person known to have discussed the likelihood of teleology—purpose—in nature was a Greek named Anaxagoras, who was born about the year 510 BCE in a region that's now part of Turkey.[1] He thought, roughly, that the elements of matter originally were chaotic, fragmented, and mixed, but were then purposely arranged into their present form by *nous*, the Greek term for "mind." His student Diogenes of Apollonia was even more explicit: "Without an intelligence it would not be possible that the substance of things should be so distributed as to keep all [nature] within due measure."

Now, remember, we're looking back on an era when the elements were thought to be earth, air, fire, and water; little was known then about the composition and properties of nature beyond what could be seen with the naked eye. What's more, the very ability to frame the right questions and deal with fair objections was still rudimentary. It turns out that the basic question nearly all reasoning people (even kids) ask, "Whence nature?" is much more involved than its length might suggest. Finding a good, justified answer necessarily depends on our understanding of both nature and logic. In turn, that means the answer depends on progress in both science and philosophy.

The epitome of science in the classical world was arguably the work of the second-century Roman physician Galen, who had a very definite point of view on the origin of nature. In his book *On the Usefulness of the Parts of the Body*, which provided a sophisticated functional analysis of its subject matter, Galen concluded that the human body is the result of a "supremely intelligent and powerful divine Craftsman," that is, "the result of intelligent design."[2]

Not everyone in ancient times, however, was on board with that claim. Rejoinders to design included types of arguments we still see today, such as that a good designer wouldn't allow humans to suffer and that no designer would make such foul creatures as moths and snakes. A contrarian school of thought called atomism held that nature was composed of just atoms and void and that occasionally by serendipity atoms would aggregate into something larger. Like a primitive form of Darwin's theory, the argument continued that if perchance the aggregate formed an organism that could survive, then it survived; if not, it didn't; so it's no surprise that we now see what we see, you see. Critics retorted that they never saw particles coming together by chance to form even a simple house, let alone an enormous complicated universe.

When Christianity appeared, the design view gained a new source of support. The second-century Christian writer Tertullian pointed to perceived workmanship in the forms and functions of insects. The contemporary theologian Origen argued that the skill needed to construct animals indicated the highest intelligence. The great fourth-century philosopher-theologian Augustine of Hippo shared such views and added his own points, including that: (1) we see only facets of the design mosaic, and so can't fairly judge the whole; (2) the structures of the smallest creatures are as wonderful as those of the largest; and (3) humans are more remarkable than other animals because they possess reason—mind itself.

Over the next thousand years the topic was put on the back burner, perhaps because, with the establishment of Christianity as the dominant religion of the West, the designedness of nature was a widely shared view rather than a matter for dispute. However, the accelerating progress of both science and philosophy from the Middle Ages onward rekindled discussions. The sixteenth-century English philosopher Francis Bacon urged science to rely on inductive reasoning in its work and to separate itself from philosophy. (The two had overlapped considerably until then. In fact, what we now call "science" was then called "natural philosophy.") The eighteenth-century Scottish philosopher David Hume attacked inductive reasoning in general and the design argument in particular. He argued that, in order to think that *our* world was designed, we would need to have much experience examining *other* worlds that had been designed. Since we have no such experience, he concluded, the design argument is not justified. Several decades later, the Anglican clergyman William Paley, ignoring Hume and drawing on sophisticated work in biology, presented the watchmaker argument (discussed in Chapter 3)—widely considered to be the strongest, most detailed case for design up until his day.

About sixty years later Charles Darwin parried Paley's argument. He proposed that there was a hitherto unrecognized natural process that, over a very long time, could imitate the results of purposeful design—namely, natural selection acting on random variation. That contention obligated design proponents to dispute its plausibility at an intricate biological level, so the depth and breadth of knowledge required for meaningful discussion skyrocketed. In practice, although most biologists of his day were skeptical of Darwin's proposed mechanism of evolution, the very broaching of a seemingly plausible nondesign explanation led most scientists to abandon the idea of a discernible purpose in the structures of life, so few were left to argue the point.

Recall, however, that the state of the design argument depends on our understanding of science and logic, which has accelerated explosively since Darwin's day. The development of analytical philosophy in the early twentieth century encouraged much more rigorous arguments; advances in formal logic and probability theory, such as Bayes' theorem, made that easier.[3] What's more, not all scientists had abandoned design. Among them was Alfred Russel Wallace, who, along with Darwin, is credited with being the cofounder of the theory of evolution.

Wallace thought that much of nature showed strong evidence of purpose, as he forcefully conveyed in *The World of Life: A Manifestation of Creative Power, Directive Mind and Ultimate Purpose*.[4] In other words, in modern parlance, *the very cofounder of the theory of evolution was an intelligent-design proponent*. In 1910 the chemist Lawrence Henderson first noticed that the environment of the earth was remarkably fit for life,[5] and, despite naive early ideas about the likelihood of life on Mars and elsewhere, exploration showed space to be desolate. Subsequent progress concluded that it's not just our world—the physics and chemistry of the whole universe is astonishingly fine-tuned for intelligent life on earth.[6] And, of course, as I'll emphasize in this book, in the late twentieth and early twenty-first centuries biology unexpectedly discovered astounding sophisticated machinery at the molecular foundation of life.

I will contend that, for any who agree that they themselves have a mind (no, not everyone agrees, as we'll see in the final chapter) and whose mind is open on the question, those twentieth-century advances—together with even more crucial twenty-first-century ones that we'll explore—should *definitively* settle the broad basic issue in favor of design. Additional details of particularized claims, of course, remain open for lively disputation.

A Winding Road

But first a necessary digression to explain how I came to disagree with most contemporary scientists on this pivotal subject. Imagine my surprise a while back when I opened an academic journal called *Biology & Philosophy* and spotted this sentence: "To see the point quite palpably, note that Stalin, or Osama bin Laden, or Michael Behe, or your favorite villain is also . . ."[7] The man who included me in that rogues gallery was Alexander Rosenberg, R. Taylor Cole Professor of Philosophy at Duke University—a fellow I've never met. His article had precious little to do with me. The line was an offhand remark in the course of arguing that the well-known philosopher Daniel Dennett—a founding member of the New Atheists—was something of a wimp, because in his books he didn't clearly spell out the utter nihilism that Rosenberg saw as a consequence of Darwin's theory.

It was a silly remark but, unfortunately, it does accurately reflect the hostility felt by a large chunk of academia toward those of us who publicly argue the case for purpose in nature. (Notice that the overt insult was passed along by the reviewers of the article and the journal editor.) We might see ourselves as just trying to puzzle out those existential questions that kept us awake at night as kids. But folks such as Rosenberg seem to envision peasants with torches and pitchforks marching on their faculty offices. We might just be wondering what the evidence of nature really shows. But "since nihilism is true,"[8] too many academics think there's nothing to think about; therefore contrary views must be dishonest. So before we begin the book I want to try to head off such charges of bad faith. To show that I come by my views honestly, let me very briefly recount the history of my own thinking.

I was born into a large Roman Catholic family and, like all of my brothers and sisters, attended Catholic grade school and high school. Unlike some Christian denominations, the Catholic Church never had much of a problem with evolution. I remember being taught about it in seventh grade by Sister David Marie. The important point, she stressed, is that God created the universe, life, and humanity. How he did that, whether quickly or slowly, employing natural law or not, was up to him, not us, and our best evidence these days shows that evolution is correct. That view was perfectly fine with me. In fact, although I wasn't aware of it then, it had been the predominant understanding in Catholic circles for a long time. For example, the 1909 *Catholic Encyclopedia* has a lengthy scholarly article on evolution that makes a number of crucial distinctions, including a distinction "between the [basic] theory of evolution and Darwinism."[9] Plain "evolution" was no big theological deal. But framing it as necessarily nihilistic, as Alexander Rosenberg and many others do, was tantamount to denying Christianity. Even as a boy I had plenty of reasons to believe in God that had nothing to do with evolution.

When I went off to Drexel Institute of Technology (now Drexel University), I decided to major in chemistry, specifically because I wanted to know how the world *worked*; I wanted to know what made things tick. Since everything is made of chemicals, then chemistry seemed to be the obvious choice. During my college years I had a summer "co-op" job in a biochemistry lab at the Department of Agriculture research facilities near Philadelphia, where I became fascinated with the chemistry of life. Senior year at Drexel I took a course on evolutionary biochemistry to learn how it all came together.

During graduate studies in biochemistry at the University of Pennsylvania and postdoctoral work at the National Institutes of Health, I had no qualms about standard evolutionary theory and would occasionally (and smugly) tease friends who did. I remember one day at the NIH chewing over the Big Questions with a fellow Catholic postdoc, Joanne (her brother was a priest), who was in the same lab I was. Talk turned to the origin of life. Although she and I were both happy to think life started by natural laws, we kept bumping up against problems. I pointed out that to get the first cell, you'd first need a membrane. "And proteins," she added. "And metabolism," said I. "And a genetic code," said she. After a short time we both looked wide-eyed at each other and simultaneously shouted, "*Naaaahh!*" Then we laughed and went back to work, as if it didn't really matter to our views. I suppose we both thought that, even if *we* didn't know how undirected nature could begin life, *somebody* must know. That's the impressive power of groupthink.

After three years at my first job as an assistant professor at Queens College in New York City, my new wife, Celeste, our firstborn daughter, Grace, and I moved to Bethlehem, Pennsylvania, where a new job awaited at Lehigh University. Several very busy years later I paused to read a book that startled me and changed my view of evolution. *Evolution: A Theory in Crisis* by Michael Denton, a geneticist and medical doctor then teaching in Australia, offered no solution to the riddle of life, but pointed out numerous serious problems for Darwin's theory at the molecular level that I had never even heard about—even though I was a biochemistry professor whose goal in entering science was to understand how the world worked! At that point, when I thought back, I realized I had never heard any of my teachers critique Darwin's theory in all of my science studies.

I got mad. Over the following months I spent much time in the science library trying to find papers or books that explained in real detail how random mutation and selection could produce the exceedingly intricate systems routinely studied by biochemistry. I came up completely empty. Although many publications would pay homage to Darwin and a few would spin "Just So" evolutionary tales, none spelled out how his mechanism accounted for complex functional systems. Vague stories had kept me satisfied in the past, but no longer. Now I wanted real answers.

At that point I concluded that I had been led to believe in Darwin's theory not because of strong evidence for it. Rather, it was for sociological reasons—that simply was the way educated people were expected to think these days. My professors hadn't been intentionally misleading—that was the framework in which they thought about life too. But from then on I resolved to decide for myself what the evidence showed.

When one starts to treat Darwinism as a hypothesis about the biochemical level of life rather than as an assumption, it takes about ten minutes to conclude it's radically inadequate. It takes perhaps another ten minutes to realize that the molecular foundation of life was designed, and for effectively the same reason that Anaxagoras, Galen, and Paley reached the same conclusion for visible levels of biology (although, because of progress in science and philosophy, the argument is now necessarily much more detailed and nuanced than their versions): the signature of intelligent activity is the arrangement of disparate parts to fulfill some purpose. The molecular parts of the cell are elegantly arranged to fulfill many subsidiary purposes that must blend together in service of the large overall purpose of forming life. As we'll see in this book, *no* unintelligent, undirected process—neither Darwin's mechanism nor any other—can account for that.

With the aid of the then newfangled internet, over the years I met other academics who had had experiences roughly similar to mine, who had been perfectly willing to accept Darwinian evolution, but at some point realized with shock that the larger theory was an intellectual facade. Like me, most had religious convictions, which freed them from the crippling assumption that—no matter what the evidence showed—unintelligent forces simply *must* be responsible for the elegance of life. Some of us banded together under the auspices of the Seattle-based think tank Discovery Institute, the better to defend and advance the topic of intelligent design (ID), to which we had become dedicated.

In conversations with them I discovered that, as a biochemist, I had ideas to contribute that the others did not. At the urging of Phillip Johnson, then a professor of law at the University of California–Berkeley, I set about writing a book that in 1996 became *Darwin's Black Box: The Biochemical Challenge to Evolution*. Except for answering extravagant Darwinian claims or attacks on ID,[10] I thought I was done with writing at that point. But the rapid progress of science in the subsequent decade allowed further arguments to be made. In 2007 those became *The Edge of Evolution: The Search for the Limits of Darwinism*, which, as the title suggests, tried to locate the point in life where what can be explained solely by unintelligent forces is reached. (One common confusion of critics is to think that ID argues *everything* is planned. That's not the case. Chance is an important, if superficial, feature of biology.) Again I thought I was done, but even greater unanticipated progress in biology over the past ten years has spurred me to write this book.

Where We're Headed

The firm conclusion I've drawn over the past decades is this:

despite occasional questions and bumps along the road, the greater the progress of science, the more deeply into life design can be seen to extend. In Darwin's own day, the mid-nineteenth century, scientists wondered whether there was sufficient variety in nature's creatures to fuel his theory. After DNA and proteins were discovered in the late twentieth century, a pressing question was whether Darwin's mechanism—natural selection acting on random mutation—could account for even the biochemical level of life and the sophisticated molecular machinery unexpectedly discovered there.

As science rapidly advanced in the early twenty-first century, large studies showed only surprisingly minor changes in genes under severe selective pressure. And as we'll see in this book, now several decades into the twenty-first century, ever more sophisticated studies demonstrate that, ironically, random mutation and natural selection are in fact fiercely *de*volutionary. It turns out that mutation easily *breaks* or *degrades* genes, which, counterintuitively, can sometimes *help* an organism to survive, so the damaged genes are hastily spread by natural selection. Strangely, in the space of a century and a half Darwinism has gone from the chief candidate for the explanation of life to a known threat to life's long-term integrity.

Here's how we'll proceed. The two chapters of Part I introduce major problems facing *any* theory attempting to account for life. In Chapter 1 I'll emphasize a philosophical difficulty—the question of *how* we know what we claim to know. The second chapter of Part I throws down the gauntlet. It describes biological systems of astonishing elegance and complexity that demand explanation; many of them were discovered as recently as the new millennium. Part II examines a number of ideas that have been offered as answers, from Darwin's own theory to the most recent non-Darwinian accounts of evolution such as neutral theory and natural genetic engineering. We'll see why, although they may account for some features of life, they all are severely limited in scope.

Part III (Chapters 6 through 9) compiles pertinent evidence from numerous studies on a wide range of species by many insightful investigators. These studies have only become available in the past few decades due to rapid advances in laboratory techniques that closely examine the molecular level of life. The studies indicate that not only is the Darwinian mechanism *de*volutionary; it is also self-limiting—that is, it actively *prevents* evolutionary changes at the biological classification level of family and above. After Part IV (described below), the Appendix reexamines criticisms by top scientists and others of my earlier arguments for intelligent design from the clarifying perspective of more than twenty years later.

The failure of Darwin's mechanism as an explanation for the evolution of all but the lowest levels of biological classification reopens the primordial question of what *does* account for the elegance and complexity of life. My answer appears mainly in Part IV (the final chapter). There I defend the reality of *mind*—a necessary foundation of science itself—and argue that, for its own sake, science must *explicitly* acknowledge mind's existence. Once the reality of mind is affirmed, the explanation for life follows easily. In brief, although chance surely affects superficial aspects of biology, the newest evidence confirms that life is the intended work of a mind and that that work extends much more deeply into life than could previously be seen.

Part I

Problems

Chapter 1

The Pretense of Knowledge

The polar bear (*Ursus maritimus*) is the modern world's largest land carnivore, but size and strength don't ensure an easy life. The approximately twenty-five thousand animals are solitary creatures, except of course during mating season when they come together so females can birth an annual litter of one or two cubs. The bears endure dark, bitter winters and perpetually frigid ocean waters as they hunt a diet of chiefly seals. It is a difficult yet majestic role in nature, for which they are superbly adapted.

Ever since its classification as a separate species in 1774, it was realized that the polar bear is closely related to the almost equally huge brown bear (*Ursus arctos*). At first the polar bear was placed in a separate genus. But when it was discovered that the two species could mate successfully, they were both placed, together with the smaller North American black bear (*Ursus americanus*), in the genus *Ursus*. The earliest fossil of a polar bear is over one hundred thousand years old. The species is estimated to have branched off from the brown bear hundreds of thousands of years before that.

Although Charles Darwin didn't mention them in his 1859 masterwork, *On the Origin of Species*, the polar bear is a wonderful illustration of his theory of evolution by random variation and natural selection. Like other examples Darwin did cite, the giant predator is clearly related to a species that occupies an adjacent geographical area, while just as clearly differing from it in a number of inherited traits. It is easy to envision how the polar bear's ancestors might gradually have colonized and adapted to a new environment. Over many generations the lineage could have become lighter in color (making the bears less and less visible to their prey in snowy environments), more resistant to the cold, and more adapted to the sources of food in the Arctic, a process in which each step offered a survival advantage over the previous one.

Yet a pivotal question has lingered over the past century and a half: How *exactly* did that happen? What was going on within the bodies of the ancestors of the modern polar bear that allowed them to survive more effectively in an extreme climate? What was the genetic variation upon which natural selection was acting? Lying hidden deep within the genome of the animal, the answers to those questions were mysteries to both Darwin and subsequent generations of scientists. Only several years ago—only after laboratory techniques were invented that could reliably track changes in species at the level of genes and DNA—was the genetic heritage of the Arctic predator laid bare. The results have turned the idea of evolution topsy-turvy.

The polar bear's most strongly selected mutations—and thus the most important for its survival—occurred in a gene dubbed APOB, which is involved in fat metabolism in mammals, including humans.[1] That itself is not surprising, since the diet of polar bears contains a very large proportion of fat (much higher than in the diet of brown bears) from seal blubber, so we might expect metabolic changes were needed to accommodate it.

But what *precisely* did the changes in polar bear APOB do to it compared to that of other mammals? When the same gene is mutated in humans or mice, studies show it frequently leads to high levels of cholesterol and heart disease. The scientists who studied the polar bear's genome detected multiple mutations in APOB. Since few experiments can be done with grumpy polar bears, they analyzed the changes by computer. They determined that the mutations were very likely to be *damaging*—that is, likely to degrade or destroy the function of the protein that the gene codes for.

A second highly selected gene, LYST, is associated with pigmentation, and changes in it are probably responsible for the blanching of the ancestors' brown fur. Computer analysis of the multiple mutations of the gene showed that they too were almost certainly damaging to its function. In fact, of all the mutations in the seventeen genes that were most highly selected, about half were predicted to damage the function of the respective coded proteins. Furthermore, since most altered genes bore several mutations, only three to six (depending on the method of estimation) out of seventeen genes were free of degrading changes.[2] Put differently, 65 to 83 percent of *helpful*, *positively selected* genes are estimated to have suffered at least one *damaging* mutation.

It seems, then, that the magnificent *Ursus maritimus* has adjusted to its harsh environment mainly by degrading genes that its ancestors already possessed. Despite its impressive abilities, rather than *e*volving, it has adapted predominantly by *de*volving. What that portends for our conception of