

Intelligent Design and the End of Science

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Abstract. In his recent anthology, *Intelligent Design Creationism and Its Critics*, Robert Pennock continues his attack on what he considers to be the pseudo-science of Intelligent Design Theory. In this critical review, I discuss the main issues in the debate. Although the volume's rhetoric is often heavy and the articles are intentionally stacked against Intelligent Design, it touches upon many interesting topics in the philosophy of science. I conclude that, *contra* Pennock, there is nothing intrinsically unscientific about Intelligent Design. At this stage, however, it remains more of a provocative idea than a research program. Whether design theorists can bridge this gap is still very much in question. In any case, the debate serves as a case study for such classic problems as the nature of scientific explanations, theory change, the demarcation problem, and the role of metaphysical assumptions in the development of science.

Everyone believes in evolution. Really. You, me, the head of our biology department, and every Baptist Sunday School teacher in America believes in evolution. The problem is that "evolution" is highly ambiguous. Everyone believes, for example, that bacteria are becoming increasingly resistant to antibiotics. Populations of harmful germs have evolved to the point where they are no longer easily killed by drugs that were once effective. That's evolution. And everyone believes that species, like Darwin's finches, undergo change over time due to environmental pressures and natural selection. That's evolution too.

What then is there to argue about in this 800-page anthology?¹ Well, not everyone believes that natural processes can produce the kind of information found in DNA. Others argue that the evidence for macroevolution only seems weighty to those who toe a particular philosophical line. There are many fronts on which to fight because the big tent of Evolution contains

¹This paper began life as a book review of *Intelligent Design Creationism and Its Critics: Philosophical, Theological, and Scientific Perspectives*, ed. Robert T. Pennock (Cambridge, Mass.: MIT Press, 2001). All parenthetical references in this article refer to Pennock's volume. A version of the paper was presented at the Eastern Division meeting of the Society of Christian Philosophers, November 2002.

such a wide variety of concepts: mutation, drift, natural selection, speciation, common ancestry, various forms of naturalism, and so forth. No one rejects each of these, but the main issue under contention is seldom clear. Some think the main issue is about the Bible: whether Genesis should be interpreted in a certain way (and whether this is *really* the prime motivation behind the Intelligent Design (ID) movement, no matter what anyone says to the contrary). Some think it is primarily scientific: either (i) what counts as science and what does not, or (ii) whether the data are better explained by neo-Darwinism or by some rival theory that employs teleology. Some think it is philosophical: which metaphysical shaping principles are/should be allowed in science. Some think it is theological: whether and how God acts in the cosmos. Finally, many critics think it is about political power: “IDC [intelligent design creationism] is a theological movement crafted to win a particular political goal—initially, getting their form of special creation into the public school science classes—in what IDCs take to be the key strategic game in the ‘culture wars’” (650). A large part of coming to understand this debate is figuring out what exactly is being disputed. Straw men are common.

I.

Let us begin with Pennock. His choice of terms suggests that what follows is not a typical exchange of scholarly views. When he describes his target as Intelligent Design *Creationism* (other critics use “neo-creationism”—“neo-creo” for short), he intends to convey that the new generation of ID advocates are really just old-style young-earth creationists (YEC) in new garb. This has rhetorical value insofar as YEC is generally taken to be intellectually bankrupt. “Creationist” is thus used pejoratively against anyone, it seems, who is skeptical of neo-Darwinism, much the way pro-choice advocates obstinately refer to their opponents as “anti-choice.” Since Pennock considers ID to be ultimately a political cause, it need not be given the minimal respect one usually finds in academic circles. (One wonders if Professor Pennock would take offense if he were regularly labeled a “Darwinian fundamentalist” or “atheistic evolutionist.” But I digress.) A perusal of the table of contents shows thirty-seven articles in the collection; twelve are written by ID advocates and twenty-five by critics. The pro-ID articles are taken from semi-popular sources, while several of the critical pieces were written especially for this anthology. Only twice are ID advocates given a chance to respond, but the critics always get the last word. If there was any question whether this would be a balanced treatment of the issues, that doubt is dispelled in the first article. This book is

not designed to engage the opposing side, but rather to put down an insidious movement.

Just how insidious is shown in Barbara Forrest's historical overview. With a tone like that of an investigative reporter, Forrest quotes from an "internal CRSC [Center for the Renewal of Science and Culture] document, titled 'The Wedge Strategy,' that surfaced from an anonymous source in March, 1999" (3). According to this document, the ultimate goal of the Wedge is to overthrow the naturalistic hegemony and replace it with something a bit more friendly to theists. And like all good revolutionary movements, Forrest sees this one as having a clear plan. Among other things, "CRSC creationists have taken the time and trouble to acquire legitimate degrees, providing them a degree of cover both while they are students and after they join university faculties" (38), which implies that people join the ID movement *and only then* decide to get their doctorates as a means for advancing their sinister Wedge Strategy. Just like modern terrorists, their M. O. is to "blend more smoothly into the academic population" (39). There is no biographical information to support these claims, but shadowy figures like these are just the kind of extremists who *would* do something like that. Forrest's goal is to reveal the "deep" motives behind ID, all in a what-they-don't-want-you-to-know tone.

Similar concerns are expressed in an exchange between Pennock and Alvin Plantinga over whether ID should be taught in schools or universities. The educational community, in Pennock's view, should guard the gate against militant creationists. They are "ideologues who 'know' in advance what is the 'absolutely true' answer to the question of origins . . ." (774). He contrasts this with the scientifically minded Darwinist who simply wants to promote right thinking. When it comes to public schools, teachers should never teach creationism since they ought never teach what is false, no matter what the majority wants or believes. Now that YECs have begun teaching their children at home and ignoring Darwinism, he suggests that "stricter oversight [might be] necessary in such cases" (757). When it comes to college students, on the other hand, we expect them "to begin to hone their critical and evaluative thinking skills, and to develop (disciplined) independence of mind. At this stage it can be quite appropriate and instructive to discuss creationist views, so that students can come on their own to see what is wrong with them" (757). So independence of mind is to be cultivated, so long, of course, as students do not come to independently reject Darwinism. (Didn't Henry Ford once say that his customers could buy a car in whatever color they want, so long as it was black?) As Plantinga points out, most of this just begs the question, treating neo-Darwinism as if it were on a par with arithmetic.

No doubt, most ID advocates are motivated in part by religious concerns. For many, it is not just a question about science; it is about religion and naturalism with Darwinism as its vanguard. (There are agnostics who favor ID as well, for example, philosopher Todd Moody, but this is a tiny minority.) With all this attention to underlying motivation, two glaring questions remain: what place do these demographic discussions have in an anthology for scientists, philosophers, and their students? And should one care about why someone wants to present an argument? Assume that there is a dedicated pool of IDers out there getting doctorates and donating money, all in accord with some master Wedge strategy. Pennock's and Forrest's implication is that, because of this religious and/or political impetus, ID is all the more doubtful. But as any good logic student knows, this is an informal fallacy, a circumstantial *ad hominem*. When leaders of teachers' unions speak out against school vouchers, they are doubtlessly motivated to some degree by self-interest. Is this psychological fact grounds for dismissing their arguments? Of course not; the arguments have to be judged on their merits regardless of their source. Perhaps Forrest, Pennock, and others who continually play this card are equally incensed when well-funded feminists or African-Americans get doctorates with the hope of giving a voice to their views within the academy. Either way it does not matter, at least when it comes to assessing their arguments. Rational people—and philosophers in particular because they know better—ought not rely on rhetorically powerful fallacies in order to defeat their opponents.

II.

If one can filter out this annoying bluster, what remains is a very interesting collection. Let us begin with the scientific arguments, the best of which comes from biochemist Michael Behe. So far as I can tell, Behe has no *a priori* theological or philosophical qualms with Darwinism. Instead, he believes he has found a property in biological systems that cannot be explained by prevailing evolutionary thought. Now that the internal workings of biological systems are known down to a molecular level, we find that many have what Behe calls "irreducible complexity." The basic idea is found in, of all places, Darwin's *The Origin of Species*: "If it could be demonstrated that any complex organ existed which could not possibly have been formed by numerous, successive, slight modifications, my theory would absolutely break down."² Behe claims to have found them:

²Charles Darwin, *The Origin of Species*, 6th ed. (New York: New York University Press, 1988), 154.

A system which meets Darwin's criterion is one which exhibits irreducible complexity. By irreducible complexity I mean a single system which is composed of several interacting parts that contribute to the basic function, and where the removal of any one of the parts causes the system to effectively cease functioning. An irreducibly complex system cannot be produced gradually by slight, successive modifications of a precursor system, since any precursor to an irreducibly complex system is by definition nonfunctional (247).

The idea is that an irreducibly complex system only performs its function as a whole. Without each of the parts fitted together just so, the system would be useless. But useless systems are not chosen by natural selection since they do not improve the fitness of an organism. The challenge then is how mutation and natural selection could ever produce a system that, until all the parts are present and working together, confers no competitive advantage. Before the whole starts working, there is nothing there for natural selection to select. By analogy, Behe argues that mutation and natural selection could never produce a mousetrap. Few, if any, of the individual parts are useful on their own. Useless mechanisms cannot get a foothold in the gene pool via natural selection with the hope that one day they might be useful when put together. And even if each of the parts were by chance individually useful, it is not clear how they could be incrementally co-opted into an intricately functioning whole. Nonetheless, examples of irreducibly complex systems abound, several of which are spelled out in detail in Behe's book, *Darwin's Black Box*.³

Such systems are at the very least an unsolved problem for neo-Darwinism. Behe goes on to suggest another explanation: design. Irreducibly complex structures have the look and feel of the "purposefully arranged" objects we normally call "machines." He does not deny that mutation, natural selection, and even common ancestry have a part to play in the grand evolutionary scheme. He does deny that these undirected components of evolution are sufficient in themselves to explain the sorts of things biochemists have directly observed. In one way or another, design, purpose, and teleology must be allowed to return from scientific exile.

The other major challenge to neo-Darwinism comes from mathematician-philosopher William Dembski. Phillip Johnson's piece on genetic information sets up the basic problem. Biologists have recognized that the distinction between software and hardware in computers also applies to

³Michael J. Behe, *Darwin's Black Box: The Biochemical Challenge To Evolution* (New York: Free Press, 1996).

biological systems. DNA contains information that is distinct from the medium that encodes it. Therefore, two distinct explanations are needed: (i) how the material medium came to be, and (ii) how this material came to be encoded with the specific information it contains. Since naturalistic evolution refuses to recognize intelligent causes, biologists assume that the medium and the information must be produced by mutation and natural selection. Having barred the notions of design and purpose, neo-Darwinism is the only game in town.

Dembski claims that naturalistic causes cannot produce the kind of information found in biological systems, namely, complex specified information (CSI). The argument is applicable to both the origin and evolution of life. CSI starts with the machinery of Shannon information, the same type used by electrical engineers to design communications systems. Dembski borrows the idea that the greater the number of possible messages encoded, the greater the information in a given message. Say Smith receives the coded message "alpha gamma." How much information does it contain? It depends. What is the space of all possible messages? Perhaps there are just two possibilities: $\langle \text{alpha, gamma} \rangle$ and $\langle \text{gamma, alpha} \rangle$. Or perhaps there are six: $\langle \text{alpha, gamma} \rangle$, $\langle \text{beta, gamma} \rangle$, $\langle \text{delta, gamma} \rangle$. . . Smith's message would contain more information in the latter case since the message has been selected from a larger space. So when Dembski talks about complex information, that means a very high amount of information, a code selected from a vast probability space. There is a very low probability of randomly selecting any particular code from this space, just as there is a very low probability of getting a particular sequence of numbers from a thousand rolls of a pair of dice.

Specification is a trickier notion, one that Dembski has continued to hammer out.⁴ In Shannon information theory, engineers intentionally ignore the content of the message. The content—what it means—is independent of how much information the message bears. But intuitively we know that some message strings are more important than others. Dembski's favorite illustration is an archer standing in front of a blank wall. Consider every point on the wall as being equally likely to be hit. If the archer shoots and hits some arbitrary point, it tells us nothing about his or her skill since anybody can hit the wall. Still, a message telling us where the arrow hits (for instance, coordinates $\langle x_1, y_1 \rangle$) contains a lot of (Shannon) information given the large number of other points that might have

⁴See William Dembski, *No Free Lunch: Why Specified Complexity Cannot Be Purchased without Intelligence* (Lanham, Md.: Rowman & Littlefield, 2002), 15–8.

been hit. What if we first paint a bull's eye around one point and the archer hits that point? A message conveying these new results contains the same amount of Shannon information. Yet clearly there is something special about that point; we now know how talented the archer is. The difference is that we can refer to that very point independently of its coordinates by the description "the point at the center of the bull's eye." The point can be specified in a shorthand way that does not make reference to the entire space of possibilities or the exact coordinates of the point in that space. So then, an instance of CSI contains high Shannon information that is also specified.

From there, Dembski's argument is quite simple. All known examples of CSI originate from design. Nature has never created *de novo* nor increased the CSI of any organism. Nature can produce random sequences, like the static on a television screen. Nature can also produce regular sequences, like the orbit of a planet. But no combination of chance and natural law, Dembski argues, can increase CSI. Hence, we should take CSI as a reliable indicator of design. For an intuitive application, consider the extraterrestrial signal heard by Jodi Foster's character in the movie *Contact*. A long string of prime numbers contains CSI; it is neither random nor regular. Since the string came from space, she makes the correct inference: this is a sign of nonhuman intelligence. Nature cannot produce a long, complicated sequence that conforms to a specified pattern. After all, if the static on your television did happen to spell out HELP, what would you conclude?

The truly big question, then, is whether life is specified. Happily for Dembski, others have already made this case. According to Richard Dawkins, "Complicated things have some quality, specifiable in advance, that is highly unlikely to have been acquired by random chance alone. In the case of living things, the quality that is specified in advance is . . . the ability to propagate genes in reproduction" (564). That is why the Human Genome Project is such a large endeavor. DNA contains a massive amount of CSI. If living systems do contain CSI, says Dembski, then it did not get there naturalistically. Somehow or other, a designer is involved.

The challenges presented by Dembski and Behe fit a familiar pattern in the history of science. While working within the framework of a successful theory, scientists often happen upon anomalies, observations that conflict with how things should be according to the theory. Researchers then have three options. The first is to deny that the new data are a problem. This was the case in 1989 when University of Utah chemist B. Stanley Pons announced the detection of a fusion reaction at room temperature, so-called "cold fusion." Given the strength of modern nuclear physics, physicists were extremely skeptical about these reports. At most, they were willing to concede that something unexpected might have happened in that Utah lab,

but it would be explained in time using standard physics. This illustrates another important fact: highly successful theories earn the right to issue promissory notes when faced with anomalies. When the orbit of Uranus was shown to violate Newton's laws, no one believed that the most successful theory in the history of science had been disproved. Instead most physicists believed that future observations would fix the problem, which is exactly what happened once Neptune was discovered.

If new data fail to vindicate the current theory, the next option is revision. When the retrograde motion of the planets presented a problem for geocentric astronomy, epicycles were added to the models. Even today, changes to Big Bang cosmology are being pondered to account for a variety of observations.

The third option is to scrap the theory in favor of a rival. When mere revisions are unavailable or too ad hoc, there is often a change of theory. The great scientific revolutions—heliocentrism, special relativity, quantum mechanics—are the most prominent examples, but theory change with much smaller scope is common (for example, the acceptance of strange attractors in nonlinear dynamics).

When faced with a set of anomalies, which option should a scientist choose? Although introductory texts give the impression that all this should be neatly sorted out by applying "the scientific method," there is no algorithm or law of logic that dictates which is *the* rational choice. As W. V. O. Quine has taught us, any set of beliefs—including one's favorite theory—can be kept immune from refutation so long as suitable changes are made elsewhere. As a rule of thumb, scientists favor conservatism: if revising the theory can take care of the problems (option 2), that is preferable to theory change (option 3).

III.

So then, irreducible complexity and CSI are presented as anomalies in light of modern evolution. What does the neo-Darwinian say in response? Some of the authors included, like philosophers Branden Fitelson, Chris Stephens, and Elliot Sober, directly rebut the design inference from CSI. Philosopher Philip Kitcher and zoologists Matthew Brauer and Daniel Brumbaugh allow that some mild revisions to evolutionary theory might be necessary. For example, the mechanisms responsible for diverging taxa might be different from that responsible for microevolutionary change within a species. Most of the critics (including Dawkins, evolutionary biologist George C. Williams, and philosopher Peter Godfrey-Smith) believe that neo-Darwinism already contains adequate answers to Behe and Dembski, although a

few promissory notes must be included. Their aim is to show how naturalistic processes can produce irreducible complexity and CSI.

To do so, some begin with the fact that genes are not in one-to-one correspondence with macroscopic properties, a phenomenon called “pleiotropy.” A gene that governs the development of some trait that does confer positive survival value might also produce a trait that is neutral or negative, thus “useless parts.” Furthermore, genes are sometimes duplicated so that redundant copies exist in the genome. Since genes are subject to mutation, useless traits and redundant genetic information can change from one generation to the next. If the trait or subsystem already has a specific function, it can change into something new. Most of the time these random changes will hinder survival. Those fortunate individuals with helpful mutations tend to do better in the wild and pass these genes on to their descendants. These useful modifications then spread through the gene pool. Further mutation can improve the function of primitive systems. In short, “the causal processes of mutation and natural selection provide a way for a population of organisms to accumulate useful bits and pieces of biological machinery—the products of very occasional good luck in mutation’s products” (592).

The change of function reply is key in answering Behe. Although there are several specific examples of evolutionary pathways for complex systems (for example, the evolution of fish “antifreeze” in the Antarctic [317–9]), they all follow the pattern of Kitcher’s answer to the bacterial flagellum:

It’s a common theme of evolutionary biology that constituents of a cell, tissue, or an organism, are put to new uses because of some modification of the genotype. So maybe the immediate precursor of the proud possessor of the flagellum is a bacterium in which all the protein constituents were already present, but in which some other feature of the cell chemistry interferes with the reaction that builds the flagellum. A genetic change removes the interference (maybe a protein assumes a slightly different configuration, binding to something that would have bound to one of the constituents of the flagellum, preventing the assembly) (263–4).

Evolutionary biologists see this pattern as “ubiquitous at all scales of the organism” (318–9). The random processes in evolution (primarily gene duplication and mutation) make it possible for existing biological bits to fall together fortuitously so as to produce a new, complex system. Behe is correct that once the system is up and running, removing any single part would disable its current function. But, the critics point out, that fact alone says nothing about the ability of evolutionary processes to create such a system.

The reply is the same to Dembski. Consider an example. The three-dimensional structure of any given protein P seems to contain CSI. Given the space of all the possible protein configurations, P will inevitably have complex information in Dembski's sense. P is also specified. The specification is found in whatever function the protein performs. How can such a structure be produced other than by design? Again, proteins in individual organisms can evolve from one generation to the next. These random processes allow a species to explore the configuration space of proteins. Most mutations will be either neutral or harmful to the organism. Given enough tries, however, a useful structure like P can emerge. So long as it performs some useful function, the organism will tend to thrive somewhat better than its competitors. The role of intelligence is played by the "blind watchmaker" of natural selection. P is the "right" answer to this computational problem insofar as it helps the organism to survive. Thus we find CSI in nature, all within the conceptual boundaries of Darwinism.

How good is this reply? To the advocate of ID, the most important word in Kitcher's quote is "maybe." For each evolutionary just-so story, the question remains: is there any evidence for this? Kitcher anticipates this move:

Of course not. That is to shift the question. We were offered a proof of the impossibility of a particular sequence, and when one tries to show that the proof is invalid by inventing possible instances, it's not pertinent to ask for a reason to think that those instances exists. If they genuinely reveal that what was declared to be impossible isn't, then we no longer have a claim that the Darwinian sequence couldn't have occurred (264).

He then adds the standard optimistic note: we "simply [have] an open problem of the kind that spurs scientists in any field to engage in research." Is this question-begging, or merely a case where a successful theory has earned the right to wait for the details to be found?

The answer depends on the strength of Behe's conclusion. In the article in this anthology, his claim is absolute: "An irreducibly complex system cannot be produced gradually by slight, successive modifications of a precursor system. . . ." Hence Kitcher's reply is on the mark, showing that it is possible to account for irreducibly complex systems in neo-Darwinian terms. Behe's article, however, predates his primary work, *Darwin's Black Box*. There the argument is more precisely couched in probabilistic terms:

Even if a system is irreducibly complex (and thus cannot have been produced directly), however, one can not definitively rule out the possibility of an indirect, circuitous route. As the complexity of an

interacting system increases, though, the likelihood of such an indirect route drops precipitously. And as the number of unexplained, irreducibly complex biological systems increases, our confidence that Darwin's criterion of failure has been met skyrockets toward the maximum that science allows.⁵

Since Behe himself acknowledges that irreducibly complex systems can occur via indirect (that is, change of function) routes, and since Kitcher quotes from *Darwin's Black Box*, his reply looks like a straw man. A just-so story is not an adequate answer.

This highlights the problem of not allowing ID advocates to reply to their critics in this collection. Dembski and Behe are fully aware of the counterexamples offered. They know about mutation, gene duplication, natural selection, change of function, and so forth. Nonetheless, Dembski denies this process creates CSI. Behe argues that, even with all of the Darwinian machinery added up, it is still extremely unlikely that all of the irreducibly complex features of the cell can be accounted for in standard evolutionary terms. Neither accept the promissory notes that future research will reveal the unexplained details. In broad terms the two sides argue this way.

ID critic: After 150 years of success stories, neo-Darwinism is among the best theories in modern science. Behe and Dembski present *prima facie* anomalies, but we have rebutted these challenges in orthodox Darwinian terms. Of course there are unresolved problems, but that is true for any research program. Past successes indicate that we should be optimistic and that these will be explained in due time. In contrast, you, the ID creationist, have given us no positive evidence in favor of your theory; you have merely attacked our own. Until you produce some solid data in your favor, you fail to meet your burden of proof.

ID advocate: True, neo-Darwinism is the dominate theory and there is much in it that no one wishes to dispute. However, Dembski has given an argument that Darwinian mechanisms cannot produce CSI, something we see in every biological system. In addition, Behe argues that those same mechanisms might possibly produce irreducibly complex systems, but this mere possibility is too thin for a scientific explanation. So then if you, the ID critic, wish to rebut our view, then give us something more than appeals to future discoveries. Don't

⁵Behe, *Darwin's Black Box*, 40.

merely tell just-so stories about how it might have all happened. Give us some evidence that it did. Until that time, you fail to meet your burden of proof.

And so both sides cast down the gauntlet, waiting for the other to meet its burden. Neither side seems willing to bite. The critic continues to provide biological “counterexamples” (really, just plausible Darwinian scenarios) to Behe and Dembski. The ID theorist continues to show just how unlikely these scenarios are. Some might see this as a standoff between rival theories, but ID is still on the fringe of science trying to gain ground. Unless the ID argument is advanced somehow, it does not appear that their challenge will be taken seriously by the scientific community.

Let us consider a loose end. When Dembski and Behe conclude that teleology is the best explanation for biological complexity, are they arguing for a mere revision of current theory or a change of theory? Again, it depends on the source. In Behe’s article, he lists a number of factors that “have affected the development of life,” including “common descent, natural selection, migration, population size,” and many more (255). He then adds, “the fact that some biochemical systems were designed by an intelligent agent does not mean that any of the other factors are not operative, common, or important.” From this point of view, design seems merely to be another mechanism on the list, one that is needed in light of new discoveries. Critics are quick to point out that although it is just one more item, it is a big one. Adding this particular mechanism to the list requires a change not merely within evolutionary biology, but in the methodology of science itself.

IV.

At this point, the debate begins to drift toward philosophy. Although the fossil record and the extrapolation from limited data to macroevolution may be criticized, says law professor Phillip Johnson, the real issue is not hard science. No matter what anomalies are brought to light, neo-Darwinists will never accept design because they are wedded to a philosophical position that bars it: naturalism. On this view, the only things that exist are part of nature itself and are within the domain of the natural sciences. If this philosophical bias is removed, Johnson argues, the “overwhelming evidence” for Darwinism looks much less overwhelming. True, modern evolution is the best naturalistic theory of origins in the marketplace of ideas. But the market is fixed. ID is not allowed to challenge the dominant theory; it is instead labeled “creationism,” which is by definition non-science. The question is

whether neo-Darwinism is the best explanation *simpliciter*, not merely the best naturalistic explanation.

Johnson misses a crucial distinction in all this, according to Pennock. If science presupposed ontological naturalism, Johnson would have a point. In that case, scientists would be imposing the metaphysical doctrine that nature is all that exists. What modern science is actually committed to, however, is methodological naturalism (MN), an approach that takes certain procedures to be the most reliable means for gathering information about the world. Science is empirically based and always open to revising its theories if new observations require it. Pennock argues that scientists employ naturalism as a fruitful methodological assumption. If a supernatural deity could tinker with the laws of nature, the laws could not be trusted. Induction itself would be useless for scientists who believed in unpredictable divine intrusions (88).

As Johnson rightly quips in response, “No doubt this caricature explains why no science was done in the century of Newton,” as if theistic scientists could not come to grips with nomic generalizations (100). Philosopher of biology Michael Ruse gives a less hyperbolic defense of MN. According to Ruse, biologists are not claiming that God had no role in creation, but rather that such a claim is not science. Scientists *qua* scientists are not qualified to talk expertly about God, just as one would not expect Stephen Hawking to present a campus lecture on constitutional law. The best argument for MN is this: it works! Like other shaping principles in science, MN is fruitful and has earned the right to be kept in place (378). This is why ID is resisted even in the face of anomalies and intractable questions, like the origin of life. MN pushes scientists to keep working toward concrete explanations, which, says Ruse, no one would have done if the ID approach had been taken.

In principle, most of this is fine with Johnson. So long as scientific claims are stated as conditionals, for example, “if naturalism is true, then neo-Darwinism is the best explanation for the data,” there is no problem. If these naturalistic presuppositions were worn on evolution’s sleeve, it would be clear that whole classes of rival theories are never given the chance to emerge. Scientists do not talk this way, however. They claim, says Johnson, that they have discovered truths; naturalistic evolution is “a fact.” Yes, replies Pennock, and rightly so. Scientists do discover truths about reality, although MN places limits on what kinds of truths those might be. Non-naturalistic facts, if there are any, will not be caught in the scientist’s net.

Very well, but Pennock misses the point. It is not the empirical discoveries that spark controversy, but rather the extrapolations and the promise that future research will answer all. ID advocates want to know if biologists

have really *discovered* that naturalistic mechanisms are responsible for macroevolution. If so, it is not discovery in the usual sense, as when someone discovers a new species of frog.

ID critics typically use MN as a kind of demarcation criterion: what counts as science and what does not (see, for example, Ruse [365]). ID advocates, like Johnson and Plantinga, treat naturalism as a bad metaphysical shaping principle used to restrict the development of scientific theories. That there are such shaping principles is undeniable. The uniformity of nature, the simplicity of fundamental laws, and mechanistic causation each play a role in determining “good science.” The crux of Einstein’s long-running dispute with Niels Bohr over the completeness of quantum mechanics had nothing to do with the empirical adequacy of the theory. Einstein believed that fundamental theories must be deterministic. The irreducible randomness in quantum mechanics violated this shaping principle. The issue was worth fighting for since the education of the next generation of physicists was at stake.

For Plantinga, the main question in the debate over ID is which metaphysical/theological principles will be allowed to shape modern science. Like Johnson, he agrees that from a naturalistic point of view, Darwinism is the best overarching explanation for observations in genetics, paleontology, and so on. But why should a non-naturalist, a theist in particular, settle for the best naturalistic explanation? Theists believe that God created the universe and that God might have brought about this present world in many different ways: from a common ancestor more or less like Darwinian evolution, in seven days à la YEC, or via Augustinian “seeds” where creation is given the ability to bring about new things over time. It is not clear, Plantinga argues, that Darwinian evolution is the best explanation given the full range of options open to the theist. Without God, evolution is much more probable since there are no other options. With God, it has less antecedent probability since there are other viable explanations. Instead of compartmentalizing knowledge, Plantinga thinks that theists should bring to bear everything they know when forming scientific explanations. Religious beliefs might not play a big role in science, but if they are relevant, they ought not be barred from consideration.

Critics charge that once the door of science is opened to theology, it will fragment into Hindu science, Jewish science, Shiite science . . . you get the idea. By enforcing MN and making scientists act like naturalists, science is restricted to truths we can all agree on (more or less): empirical observations, mathematics, logic, and a few other principles. Plantinga would conditionally accept this, so long as all other metaphysical assumptions are expunged from science as well. No more presupposing physicalism

in cognitive science, for example. No more assuming that the laws of nature are the same here as they are outside of our solar system. The list goes on. Philosophers are well aware, however, that this sort of science-without-metaphysics was the failed project of logical positivism. No one wishes to raise that particular banner again. Plantinga's alternative is to allow different camps to pursue science under their differing metaphysical assumptions and see where it leads. His point is that it would still be science, just not a naturalistic science.

One might think that this is the hill that all theists would defend from their critics. Instead, advocates of ID find that they must fight on two fronts. There are, of course, the naturalistic critics like Pennock, Dawkins, and Ruse. More surprising are theists such as Howard Van Till, Ernan McMullin, Nancey Murphy, and Arthur Peacocke, who claim that ID is misguided on both scientific and theological grounds. They argue that an omnipotent, omniscient being would not create a world that needs to be adjusted from time to time. Although some are careful not to use the "Infinite Clockmaker" image, their theological intuitions are not much different from Leibniz's in his famous dispute with Samuel Clarke:

If *active force* should diminish in the universe by the natural laws which God has established, so that there should be need for him to give a new impression in order to restore that force, like an artist's mending the imperfections of his machine, the disorder would not only be with respect to us but also with respect to God himself. He might have prevented it and taken better measures to avoid such an inconvenience, and therefore, indeed, he has actually done it.⁶

To use Van Till's terms, God made a world with full "functional integrity." All the seeds for producing just this sort of world were planted in the cosmos at the beginning. There is no need for God to intervene in the processes of the natural order. Moreover, it is improper (and perhaps impious) to use God as part of a scientific hypothesis, as if the Almighty were on a par with quarks. An empirically based science has no access to the acts of God. (One might wonder, then, on what basis Stephen J. Gould knew that God would never have designed the panda's thumb the way that it is [676]. I ignore that complication for now.) In Van Till's and McMullin's view, if ID advocates were not so taken with a naïve reading of Scripture, especially the early chapters of Genesis, the science would not be an issue.

⁶*The Leibniz-Clarke Correspondence*, ed. H. G. Alexander (Manchester: University of Manchester Press, 1956), 29.

The only interpretation that apparently is not considered naïve is taking Genesis as pure myth carried over from pre-literate times. This is one of the more confusing parts of the exchange. When McMullin and Van Till discuss the poor biblical scholarship (“folk exegesis”) of the ID camp, one wonders whom exactly they have in mind. In his reply to Plantinga, Van Till says, “I heartily agree with those biblical scholars who conclude that the concept of special creation (immediate formation of creatures not genealogically related) is *not* biblically warranted” (151). Van Till seems to imply that Plantinga and others are closet YECs. So far as I can tell, all but one of the authors in this collection accepts the Big Bang, a twelve to fifteen billion-year age for the universe, and even some form of common ancestry. (What ID denies is that mutation and natural selection are solely responsible for speciation and common ancestry.) There is an annoying false dilemma that runs through many of these interpretive debates. Either one believes that Genesis is a quaint story or that person is a (or has been befuddled by) YEC. Philosopher Roy Clouser is the only critic who explores some of the middle ground. Still, few are as extreme as Peacocke, who seems to hold that all theological doctrines should be open to revision in order to “make any sense to our contemporaries” (483).

As for the question of divine intervention in the natural order, the main camps have changed little since Newton’s time. There are conflicting convictions among theists about what God would and would not do. If humans had unlimited ability and resources, we would build cars and computers that never deteriorate or require maintenance. The Leibnizian view is that since the universe is God’s creation, then by analogy he would do likewise. God does not tinker. Others see the creation along the lines of a musical instrument or a garden. The point is not merely to make music or vegetables, but to interact and participate. If that is one’s guiding metaphor of divine action, then ID is less theologically odious. I see no way to reconcile these conflicting intuitions.

The next two objections are closely related. The first is that ID is a “science stopper” since every difficult question can be answered with “because that’s how God did it.” If this move were allowed, it would hinder science from pressing on to better explanations. The second is, I believe, the biggest concern among theistic ID critics: ID trades on a God-of-the-gaps mode of explanation. That is, theistic science only comes into play when there are gaps in our knowledge, when scientists do not have an explanation for some phenomenon. For example, I once had a conversation with a seminary student about atoms. He said, “you know they still don’t know how protons are held together in the atom. Like charges repel each other.” In context, the implied conclusion was clear: God does it. If we had

had that conversation forty years earlier, he might have been on to something. Physicists did not yet know about the short-range strong and weak forces inside the nucleus of an atom. With the advent of the “standard model” in high energy physics, that explanatory gap was closed. This illustrates the danger of using God as a theoretical entity. As scientific knowledge advances, the gaps are systematically eliminated.

Van Till and Peacocke are particularly sensitive about such reasoning. In their view, when gaps are used to argue for the existence of God but then closed by advances in science, theism is weakened. Yet, they argue, this is precisely the ID approach. ID arguments show that naturalistic evolution cannot account for X, where X is a member of a long list of purported anomalies. Irreducible complexity and CSI are just the most recent and sophisticated examples. ID advocates then conclude that the only way to account for X is design. Although officially this need not be supernatural design, there is no doubt that many in the ID camp believe the designer is God.

Behe and others work hard to defuse this objection. If the gaps were merely epistemic—say a lack of evidence—then the critics would be correct. Rather than arguing from ignorance of natural causal mechanisms, ID theorists say there is evidence that a designer acted in such-and-such a way. When Behe discusses the cell and Dembski the bacterial flagellum, they are trying to present positive grounds for inferring design, not merely pointing out evidentiary gaps. The same schema is found in Plato’s dialogues. Socrates has arguments for the existence of unchanging Forms, including their observed instantiations. A question arises: how did these abstract, immaterial entities come to interact with the material world? Plato believed that it would have taken an intelligence that is itself neither Form nor part of the material world, the demiurge. Should this be characterized as filling a gap of ignorance or positing a being to explain the phenomena?

Perhaps the answer depends on what one can do with the posited entity. When twentieth century physicists noted that radioactive β -particle emission violated conservation laws, there was an explanatory gap. They proposed the existence of a new particle, the neutrino, to explain the discrepancy. No one seems to have objected that this particle-of-the-gaps approach might weaken high energy physics. The neutrino was, after all, undetected not undetectable, and experimentalists vindicated the hypothesis within thirty years. This is not true for all theoretical entities, however. The pilot wave in Bohm’s version of quantum mechanics cannot be detected, even in principle. And although there is a theoretical basis for what resides within the core of a black hole, this is also beyond all possible observations. There are many other examples.

Gap arguments and posited explanatory entities are common in science and elsewhere. Why, then, is there such an abhorrence of gap-like arguments among some theists? I believe the answer is rooted more in history than in logic. There is the perception that theists have often been burned when God has been used in this way. Gaps *have* closed and the forerunners of today's ID movement were hurt in the process. Moreover, there is the perceived danger of a slippery slope. Once God is used to explain some phenomena, he can be used to explain any phenomena. Is such a slide inevitable? Although intuitions run strong on this issue, history indicates not. After all, up until the twentieth century, most of the well-known names in science were theists. Newton and Maxwell both employed gap and/or design arguments, but neither seemed tempted to reach for the God hypothesis when the going got tough. In my view, the science-stopper objection is an effective scare tactic and will continue to be used. Still, one would like to see an argument rather than these end-of-science predictions.

Once the rhetoric is stripped away, ID is found to have rebuttals to every objection examined thus far (even if those rebuttals were not always given space in this anthology). The main ideas have been widely disseminated, and the three foundational books, *Darwin on Trial*,⁷ *Darwin's Black Box*,⁸ and *The Creation Hypothesis*,⁹ have been out for some time. There is a group of scientists, philosophers, and other academics committed to ID who understand the issues and fully believe that it at least deserves a chance (that is to say, a few grants and the academic freedom to pursue the program openly within research institutions). In chapter 6 of Dembski's latest book, *No Free Lunch*, there is a full outline of how an ID research program might go.

V.

Even so, there remains one undeniable problem: there have been no significant, concrete scientific advances spawned by ID. Design theorists are hesitant to make detailed design claims and settle instead for showing how known facts can fit into a broader ID context. This is progress, but a limited kind. Philosopher Kelly C. Smith is correct: "If creationism is to ever accumulate positive evidence, then it must . . . take a particular position with

⁷Phillip E. Johnson, *Darwin on Trial*, 2nd ed. (Downers Grove, Ill.: InterVarsity Press, 1993).

⁸See note 3 above.

⁹*The Creation Hypothesis: Scientific Evidence for an Intelligent Designer*, ed. J. P. Moreland (Downers Grove, Ill.: InterVarsity Press, 1994).

particular hypotheses . . .” (720). Falsifiability may not be what it used to be in the philosophy of science, but the idea that theoreticians have to stick their necks out is still important. Without new predictions or at least a truly novel explanation that can help guide the research of bench scientists, ID will remain on the fringes.

There are, to be sure, interesting challenges presented by Behe and Dembski. But these have not prompted even a mild revision of neo-Darwinism, let alone sparked a theory change. Moreover, as every critic seems obliged to mention, there is a glaring lack of peer-reviewed science publications in which ID plays a pivotal role. This lack of traction in the scientific community can be excused to some degree. Conservatism is yet another shaping principle of modern science; radical ideas are often rejected. (After all, would you want to be the first journal editor to allow publication of a pro-ID article? See Behe’s first-hand account at http://www.arn.org/behe/mb_response.htm.) It also seems to me that criticism over journal publications is used selectively. Physicist Stephen Wolfram eschewed the journals when publishing his tome, *A New Kind of Science*,¹⁰ because of its revolutionary ideas. I have yet to see a book review in which Wolfram is beaten with the no-peer-review stick.

Nonetheless, even the most dedicated ID apologist must admit disappointment on the pure science front. Why are so few scientists picking up the baton? This problem was clear at an ID conference I attended in May, 2001.¹¹ Most of those in attendance were either pro-ID or at least willing to give it a fair hearing. The most anticipated talk, by Paul Nelson, was to include a description of cutting-edge ID research. When the list was finally revealed, it turned out that the new research either (i) consisted in more minor anomalies undermining Darwinism, or (ii) was research that could be easily incorporated into ID thought, even though the researchers themselves did not hold that view. Articles in the first group contained examples much like those used to explain irreducible complexity—cases that are hard to account for in terms of natural selection. Articles in the second relied heavily on the concepts of design and complexity, but always within an orthodox, evolutionary framework. Although Nelson presented these as reasons for optimism, it seemed to have the opposite effect. The audience of mostly scientists and philosophers recognized that these papers were not the core of an ID-motivated research program.

¹⁰Stephen Wolfram, *A New Kind of Science* (Champaign, Ill.: Wolfram Media, 2002).

¹¹*Design, Self Organization, and the Integrity of Creation*, Seminars in Christian Scholarship, Calvin College, May 2001.

Johnson and Plantinga argue that this is not necessarily fatal. One need not have a true theory in hand to see that another one is false. For example, say there was a track-and-field competition this afternoon. For the one hundred meter finals, let P_1 = "The runner in lane 1 wins," P_2 = "The runner in lane 2 wins," and so on for six lanes. Suppose further that after the race, the only fact I have heard is that the runner in lane 3 sprained his ankle coming out of the blocks. I therefore infer that $\sim P_3$, even though I am not in a position to believe P_1, P_2 , etc. I need not know the truth in order to know that P_3 is false. For an example closer to the mark, Del Ratzsch argues that if we discovered a bulldozer on the moon, we would correctly infer that it was the product of design and not natural forces even if there were no candidates for the designer, that is, even if there were no non-naturalistic rival theory in hand to explain it.

These arguments are fine so far as they go. If ID advocates are out to provide inductive arguments where the conclusion is "X is not the product of naturalistic forces," then Plantinga and Johnson are correct. One need not have an alternative explanation for X in hand in order to have reason to believe that X could not have been formed via the known laws of nature.

But this is clearly not the only goal. A successful ID program would bring about a change of theory. The most prominent change would be the rejection of naturalistic evolution, opening the field to a new theory within Plantinga's theistic science. The rules for theory rejection and change are somewhat different than when one considers concrete hypotheses such as P_{1-6} . There the absence of a justified hypothesis about the outcome of the race was not a problem. P_3 was rightly rejected with the evidence in hand. When we move to the level of full-blown scientific theories, however, things are not so simple. In my view, the history of science shows that a widely held theory is seldom if ever rejected without a rival theory available to replace it. No matter how many anomalies a given theory might face, scientists will find creative ways to revise it so long as there is no alternative. Epicycles can always be added to save the phenomena. Unless, as one design-friendly physicist recently put it, ID can give scientists something to do at the bench, it will remain sterile. Poking holes in the naturalistic paradigm will not bring about theory change; a legitimate, tangible alternative is needed.

One might argue, as Behe does, that things are just as bad for the other side. Despite all the Darwinists in well-funded research labs, there are still no detailed, testable models for how mutation and natural selection could produce the complex structures of life. A disputed claim, yes, but let us grant this argument for the moment. It still remains the case that neo-Darwinism is the reigning theoretical framework for biology and that science

favors revision over replacement. Current theory becomes entrenched if the theory is widely held and has had some measure of success. Even if all sides agreed with Behe's assessment, so long as the challenges can be rebutted or revisions made to accommodate them, Darwinism will keep its place. The only way out, again, is to offer a framework with the promise of comparable explanatory power.

Why, then, should anyone take ID seriously? If Pennock's dichotomy were correct—creation vs. evolution—there would be little reason. Were Johnson *et al.* the only critics of Darwinism, suspicions about agendas and proselytizing would sound less forced. One would wonder whether it really is about Genesis and prayer in schools rather than science and metaphysics. The fact is that ID advocates are not alone. As McMullin points out (181–2), there are naturalists who present some of the same anomalies and conclude that the reigning theory is deficient as it stands. This heterogeneous bunch of skeptics believes that new concepts and mechanisms are needed over and above those recognized by most biologists. This is by now old news, but the list starts with paleontologists like Niles Eldredge who have pushed evolutionary theory to include punctuated equilibrium. His cohort, Stephen J. Gould, had also tried to rehabilitate the notion of macromutation and Goldschmidt's "hopeful monster." Biophysicists like Stuart Kauffman (self-organization, auto-catalysis) and Stephen Wolfram (automata theory) have, in Wolfram's words, "come to have some sympathy with creationists . . . Natural selection isn't everything, after all."¹² In molecular biology there are Brian Goodwin (morphogenesis), Michael Denton (biocentricity), and others who believe that Dawkin's blind watchmaker cannot account for specific instances of "directed mutation" (593). Scientists like these (good credentials, no obvious agenda) who have left the pure Darwinian fold make an outsider, like myself, wonder whether the emperor is not so well attired after all. ID is more revolutionary than any of the new ideas just mentioned, and so has an even steeper road to climb in order to be taken seriously. Still, if the Darwinian foundations are sufficiently eroded by these diverse critics and the grand framework collapses, it is hard to say how things will emerge after the revolution.

Pennock and others are also a bit too sanguine that the wall of methodological naturalism can keep supernatural design at bay. Even if teleology, purpose, and design are currently ruled out of biological bounds, it need not always be so. One could argue that getting rid of these concepts opened

¹²"Is this Man Bigger than Newton and Darwin?" *Telegraph.co.uk*, May 15, 2002 (<http://www.telegraph.co.uk/connected/main.jhtml?xml=/connected/2002/05/15/ecfwolf15.xml>).

the door for modern biology in the first place. Why let this monster back in after a century and a half of successful banishment? The short answer is that it might be necessary. The critics who wield MN to divide science from non-science in essence limit the concepts theorists may use. The demise of both nineteenth and twentieth century positivism warns against this sort of presumption. Theories have a way of trampling on artificial philosophical boundaries, no matter how well motivated. Pennock himself recognizes that the methods used in science are subject to change (85). He should realize that MN is not sacrosanct. As Kitcher put it in an earlier (and much better argued) book, "postulating an unobserved Creator need be no more unscientific than postulating unobserved particles."¹³ There is no magisterial board that may rule on what counts, now and forever, as science. More importantly, one cannot say what explanatory resources science might need in the future. Naturalists and theistic evolutionists are entitled to place a bet as to how things will develop, but they cannot dictate the terms of that development.

Where this anthology fits in the overall debate is easy to say: it is a book for the annoyed Darwinist who wishes to remove the bothersome creationist gum from his or her naturalistic shoes. If one is looking for ammunition with which to attack ID, this is the book for you. If one is looking for a balanced, scholarly exchange, that book has yet to appear. Perhaps the Dembski/Ruse collection now in the works will be closer to the mark.

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¹³Philip Kitcher, *Abusing Science: The Case Against Creationism* (Cambridge, Mass.: MIT Press, 1983), 125.