

Design or Chance?

By Dan Falk

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A pseudoscientific challenge to evolutionary theory – “Intelligent Design” – is raising questions about the origin of life and sparking debate in academia.

On the grassy slope in front of the provincial parliament buildings in Victoria, British Columbia, a unique floral message, directed toward the city’s harbour, greets thousands of visitors every summer. A series of red-and-yellow flowerbeds spells out “Welcome to Victoria” in ten-foot-high letters. Stephen Meyer saw it for the first time a few years ago, as his ferry pulled into the B.C. capital -- without his glasses, however, the message was a blurry pattern on the boundary between visual “noise” and a recognizable series of English words. “I popped my glasses on, and suddenly made a design inference,” recalls Meyer, a philosopher at the Discovery Institute, a conservative Seattle-based think-tank. “The arrangement of flowers is very improbable, and that makes us suspicious that maybe it was designed.”

Meyer has chosen his words carefully. *The Design Inference* is the title of a controversial book by William Dembski, a colleague of Meyer at the Discovery Institute. In its pages, dense with mathematics and symbolic logic, Dembski sets out guidelines for distinguishing chance events from those which imply design. At a basic level, of course, all of us make such distinctions every day. The flowery message in Victoria is obviously the product of landscape architects and gardeners; it was clearly designed. Toss a coin 100 times: If you get about 50 heads and about 50 tails, you assume the result is the product of chance; if you get 100 heads, you conclude that someone has tampered with the coin, imposing a “design” on the outcome. In more complex situations, the decision is more difficult: An archeologist discovers an irregular circle of stones: Was it the product of natural geological forces, or the work of an ancient civilization? A student paper has a sentence that matches the work of another writer: Was it

chance, or plagiarism? These are difficult questions, but Dembski claims to have worked out a set of rules that can separate design from chance. And he isn't afraid to apply those rules to the thorniest question of all -- the question of how life arose on Earth.

What Dembski confronts with mathematics, biochemist Michael Behe argues with microbiology. In *Darwin's Black Box*, Behe contends that certain microscopic structures within the cell are too complex to have been produced by Darwinian evolution. The two lines of reasoning fit together like peas in a pod: Dembski's design inference sets the ground rules for detecting design, while Behe applies those criteria to specific systems at the level of the cell. Together, they conclude that the natural world is laden with signs of design, as surely as the letters that spell "Welcome to Victoria" testify to a human planner. It's a controversial conclusion -- and it has re-kindled the debate over the origin and development of life on our planet, under the label "Intelligent Design."

Proponents of Intelligent Design see their work as revolutionary -- a long-overdue liberation from the shackles of traditional science. For researchers like Dembski and Behe, the old way of seeking scientific answers -- the search for material, or naturalistic, explanations -- is inadequate; it fails to account for the complexity and order visible in the world around us. (As Dembski has put it, "Naturalism is the disease. Intelligent Design is the cure.") Acknowledging the role of Intelligent Design, they say, is the first step toward a new and more complete picture of the universe. Critics -- and they abound -- are not impressed. They see the Intelligent Design movement as a thinly-veiled attempt to bring God, now disguised as an "intelligent agent," back into science classrooms, and dismiss the work of Dembski and Behe as bad science and bad theology. It's the old creationism, they argue, dressed up in the jargon of pseudoscience for the new millennium's first round of evolution-bashing.

Yet the Intelligent Design movement may be gaining momentum. It has already spawned a series of popular books: Dembski landed the prestigious Cambridge University Press as his publisher for *The Design Inference*; Behe's book, published by Simon & Schuster, spent months at the top of Amazon.com's list of titles on evolution. The design question has been

dissected at academic conferences from Berkeley to Yale, with fiery debates drawing some of the biggest names in academia. And, of course, there's a virtual avalanche of articles supporting Intelligent Design -- and arguing against it -- on the Internet. The scientific community may sneer at the notion of Intelligent Design, but they cannot ignore it.

The Intelligent Design movement may claim to be a new, but arguments based on "design" are as old as philosophy itself. The "argument from design" has a long track record. Its clearest expression came in 1802, when William Paley, an English theologian, wrote a treatise called *Natural Theology*. If you find a stone while walking through the woods, Paley wrote, it's just a chance occurrence -- for all you know, it may have always been there. But suppose, instead, you find a watch: Unlike the stone, the watch could hardly be a natural occurrence; it must have had a maker. And what about the plants and animals that we see in the natural world? For Paley, they pointed even more persuasively to a designer -- in this case, the Christian God. "Every manifestation of design, which existed in the watch," Paley wrote, "exists in the works of nature."

Just 50 years later, however, Charles Darwin seemed to destroy Paley's argument. After spending five years on board the H.M.S. Beagle, studying flora and fauna from around the world, Darwin came to an inescapable conclusion: Life -- even complex, seemingly-designed plants and animals -- are the product of a natural process called evolution. Similar organisms evolved from common ancestors, and complex creatures evolved from simpler forms of life. The question of human origins was still too controversial when Darwin penned *On the Origin of Species* in 1859, but he soon concluded that man, too, was the end result of millennia of natural selection. Over the last century and a half, the evidence in favour of Darwin's theory has only grown: Data from DNA studies, from the geographic distribution of species, and most of all from the fossil record -- all of it supports the theory of evolution. With some later additions from the fields of microbiology and genetics, Darwin's theory has become one of the cornerstones of science, the central organizing principle uniting all of biology.

The implications of Darwin's theory, however, have always made some people uneasy -- especially those who see a conflict between evolution and traditional religious teachings. If nature really operates blindly, through natural law, what role is left for God? Does it make sense to believe that God created man in His image? Some scientists, like British zoologist and writer Richard Dawkins, have bluntly answered "no" to those questions. In his book *The Blind Watchmaker*, Dawkins relegates Paley's design argument to the philosophical dustbin: "Natural selection, the blind, unconscious, automated process which Darwin discovered, and which we now know is the explanation for the existence and apparently purposeful form of all life, has no purpose in mind," Dawkins writes. "If it can be said to play the role of the watchmaker in nature, it is the *blind* watchmaker."

Of course, not all religious believers were troubled by the theory of evolution. Many people quickly accepted the notion that species change over time, even embracing the idea that men and apes have a common ancestor. Even the majority of Christians managed to reconcile their faith with the idea of biological evolution. For many believers, evolution is simply a tool that God -- seen more as a grand architect than a mechanic -- used in creating life. Even the Pope recently acknowledged that evolution is "more than just a hypothesis."

Yet some conservative Christian groups, particularly in the United States, never found such a reconciliation, and, just over a century ago, the movement known as "creationism" was born. Creationists rejected evolution, instead arguing that living creatures -- and in particular, human beings -- were created directly by God, in their present form. The movement burst onto the world stage with the famous "Scopes Monkey Trial" in 1925, when John T. Scopes, a high school teacher in Dayton, Tennessee, was charged with teaching evolution in his biology class, in violation of a state ban. (Scopes was found guilty and fined \$100, though the Tennessee Supreme Court later threw out the conviction on a technicality. The state dropped its ban on teaching evolution in 1967.)

Creationism has strengthened and weakened several times over the last 75 years, but recently it's been in the headlines again. In 1999, the Kansas Board of Education removed

evolution from the state's science curriculum (though it bounced back last year after three creationist board members lost their seats). Creationists in other U.S. states have forced school boards to put disclaimers on biology text books, cautioning students that evolution is "just a theory." And the new White House could have the pendulum swinging back to the creationist side; according to a recent article in the *New York Times*, George W. Bush "does not believe in evolution" (though the author did not quote Bush directly on the matter).

The latest war of words erupted in September, when the U.S. public broadcaster, PBS, aired a seven-part TV series on evolution. Even before the first episode was broadcast, the Discovery Institute created a website mocking PBS for producing "the magnum opus of a dying theory." (With a URL that includes both "evolution" and "pbs," the Institute's anti-evolution site may get more electronic "hits" than PBS's official site.)

Creationism has changed with the times -- evolving, one might say, to keep pace with scientific discovery. Indeed, practitioners of Intelligent Design don't like to be called creationists; they say their arguments come from the laboratory, not the pulpit. Few of them insist on a literal interpretation of Genesis, and -- faced with overwhelming geological evidence -- they rarely argue about the age of fossils or the age of the Earth. Many of them even acknowledge that evolution is part of the explanation for the current diversity of life.

Michael Behe, who helped spark the Intelligent Design movement with his book *Darwin's Black Box*, says he was a devoted Darwinian until the evidence from microbiology forced him to re-think his commitment to evolution and natural selection. Behe, who teaches biochemistry at Lehigh University, argues that certain biological structures, composed of dozens of separate but perfectly-matched parts, are so complex that they defy a Darwinian explanation. He coined a phrase to describe these structures, saying they display "irreducible complexity."

Behe points to blood-clotting mechanisms, immune systems, and cellular-transport mechanisms as examples of irreducible complexity in the biological world. But his favourite example -- the poster child for irreducible complexity -- is the "bacterial flagellum," a tiny,

propeller-like structure that some bacteria use for propulsion. Behe says the flagellum has to have all of its many component parts before it can function. But natural selection can only gradually make an organism more complex, and it can only do so if each newly-added part confers some kind of advantage. But, according to Behe, a partially-formed flagellum does nothing -- and therefore couldn't have been produced by Darwinian evolution. In the final chapter of his book, he wrote that the flagellum and other similarly complex structures send us "a loud, clear, piercing cry of 'design.'"

Not surprisingly, Behe's theory came under fire from biologists as soon as it was published. The most common counter-argument is that Behe has misunderstood how natural selection operates. If evolution was required to bring together all of the flagellum's individual parts at once, it would indeed seem miraculous -- but, say Behe's critics, that's not how natural selection works. Instead, nature brings together a few of the individual parts that happen to be suited to some other function; the flagellum's propulsion system only emerges later, when all the parts are in place.

"The whole notion of irreducible complexity doesn't stand up to scientific analysis," says Kenneth Miller, a biologist at Brown University. "When you analyze the parts of these [structures], you find that most often, the individual parts -- or small assemblies of two or three of them -- do indeed have function. And because the individual parts have function, they can indeed be produced by Darwinian natural selection."

Behe and Miller have squared off over the irreducible complexity issue many times since Behe's book was published in 1996. Last year, they were the top draw at a conference called "Design and its Critics" held at Concordia University in Mequon, Wisconsin. As the two researchers traded arguments and counter-arguments, it seemed as though both men had an endless supply of comebacks. Behe: *No scientific papers have shown how structures like the bacterial flagellum have formed by Darwinian processes.* Miller: *Yes, they have, in the last two years -- after the release of your book.* Behe: *But those papers lack the detailed description required to show a Darwinian mechanism.* Miller: *Perhaps that's true of the flagellum, but only*

because scientists are only now probing its chemistry in detail; for other complex biochemical machines, the Darwinian process that produced them have indeed been found. Believe it or not, the argument even spilled out into the hardware of the pest-control industry: Behe likes to compare the flagellum to a mousetrap -- take any of its parts away, and you won't catch any mice. No, says Miller: Even if you just have the "spring" part of the mousetrap, you could still wedge a piece of cheese between its top and bottom prongs, preserving a limited mouse-catching ability.

Behe's mousetrap analogy is clever but pointless -- we all know that mousetraps don't evolve naturally -- and Miller's rebuke is both silly and redundant. Miller, however, has a far stronger point -- namely, that the argument for irreducible complexity has never been put forward in a peer-reviewed scientific journal or presented at a biology or biochemistry conference. Irreducible complexity "has never really been presented to a scientific audience for criticism," says Miller. And there's a good reason for that -- such arguments simply "wouldn't stand the criticism," Miller says. The structures that Behe labels as irreducibly complex are "in fact are nothing of the sort."

The popular science journal *Scientific American* was equally critical: Behe has given "an old argument, both arrogant and deeply unsatisfying. Theologians as well as scientists might blanch at the notion that we owe our inner workings to an ambiguous designer who controlled only those aspects of evolution that Behe deems inexplicable." A reviewer for the prestigious journal *Nature* was also unimpressed: "*Darwin's Black Box* is a work of advocacy whose creationist ancestry is revealed by both its rhetoric and its failure to deal honestly with the evidence for evolution."

And what of William Dembski's "design inference"? His argument is based on something he calls the "explanatory filter" -- a way to filter out the best explanation for a given observation. Ultimately, he says, everything we see can be explained through necessity, chance, or design. Consider that series of 100 coin-flips: For each coin toss, you get either a heads or a tails; that much is necessity. Toss the coin, and say it comes up heads: Simply a matter of chance. Only when it keeps coming up heads, toss after toss, do we suspect design; at that point,

the explanatory filter has ruled out any alternative.

For Dembski, however, there's an important difference between those results which are merely improbable and those which point to design. With the coin toss, there's a probability of one-half that each particular flip will come up heads or tails. With 100 tosses, the probability of getting any particular sequence of heads and tails is one-half multiplied by itself 100 times: Do the math, and you get a probability of one in 1.3 million trillion trillion. A staggeringly low probability -- but note that it's the same probability for each possible sequence, from a random string of heads and tails to the 100-heads result. So why does the latter imply design? The answer, says Dembski, is that the string of 100 heads matches a pattern that we recognize as artificial. It matches a "specified" pattern, to use Dembski's term, and he dubs the 100-heads result as an example of "specified complexity." And -- this is the crux of his argument -- specified events of small probability -- like the hundred-heads coin toss -- can be assumed to defy chance. Such events, he says, indicate design.

The coin-toss argument seems cut-and-dry, but the search for specified complexity in living organisms is a more complex problem. It requires what Dembski calls a "bridge concept" linking the mathematics to a given physical or biological system -- and that, he says, is where his work and Behe's link up. Behe's idea of irreducible complexity, Dembski says, is an "embodied form of specified complexity." In other words, Behe's research -- including his analysis of the beloved bacterial flagellum -- supports Dembski's design inference perfectly. "We're looking at arrangements of matter, features of the world, which could not have come about spontaneously through natural causes," says Dembski. Such features "require an intelligence."

The Design Inference garnered at least one favourable review, in the now-defunct magazine, *The Sciences*. "Leaving the question of evolution aside," wrote mathematician Keith Devlin, "Dembski's theory has made an important contribution to the understanding of randomness -- if only by highlighting how hard it can be to differentiate the fingerprints of

design from the whorls of chance.” The journal *BioScience* was less impressed, dismissing Dembski’s argument as “a mix of trivial probability theory and nonsensical inferences.” The reviewers for the journal *Philosophy of Science* were equally critical: “Dembski’s account of design inference is deeply flawed,” they wrote. “Neither creationists, nor evolutionists, nor people who are trying to detect design in nontheological contexts should adopt Dembski’s framework.” (Recently, bad reviews have been the least of Dembski’s worries. Last year, he was removed as director of the Michael Polanyi Center, a philosophy-of-science research center at Baylor University, after a controversy erupted on campus over the legitimacy of the Intelligent Design movement. Dembski remains on the faculty of the Texas university, where he teaches philosophy.)

Many biologists see Intelligent Design as a throwback to William Paley and his watchmaker argument. “It’s something new and it’s something old at the same time,” says philosopher Michael Ruse, who teaches at Florida State University. “Intelligent Design is certainly being tarted up in the language of modern science, but I would say that ultimately it goes back to the ‘argument from design,’ which can be found in Plato, Aquinas, and certainly in people like Paley.” For Ruse, Intelligent Design isn’t just bad science -- it’s also weak theology, placing unreasonable restrictions on God’s creativity. “To try to suggest that God couldn’t do things through natural selection or through evolution seems to me to be horrendously limiting” to God’s power, he says. Intelligent Design “fails as much, if not more, on theological grounds as on scientific grounds.”

For many biologists, the idea that complex structures point to design is simply bad science. But critics of the Intelligent Design movement are concerned for another reason, too: As the reviews of Behe’s book suggest, they’re also deeply suspicious of the *motives* behind the movement. Admittedly, Intelligent Design theorists rarely make explicit references to God; but, say the critics, that’s just part of their clever strategy: Since U.S. courts won’t allow mention of God in science classrooms, maybe a theory that only *suggests* a divine being -- a theory that refers only to an “intelligent agent” -- will have a better chance of qualifying as science.

The standard argument is that evangelical Christians see evolution as the first step toward a purposeless, materialist, Godless universe. Perhaps by bringing us closer to apes and monkeys, evolution carries us farther away from the divine -- farther from a Creator who made us in His image. And creationists focus on the school system because young people are especially vulnerable; if our children are taught that human beings are just animals, pretty soon they'll be behaving like animals. An extreme view? Perhaps -- but Americans need look no farther than their House of Representatives to find an endorsement. After the 1999 killings at Columbine High School in Littleton, Colorado, the House majority whip, Tom DeLay, warned the American people that such violence was inevitable as long as "our school systems teach children that they are nothing but glorified apes, evolutionized out of some primordial soup of mud."

Is Intelligent Design really a theological or argument? Michael Behe, the biologist behind "Irreducible Complexity," says he's motivated by science, not religion. He's certainly no fundamentalist. He *is* a practising Roman Catholic -- but then, so is Ken Miller, on the evolution side of the debate. Behe restricted his discussion of God to the final chapter of *Darwin's Black Box*, urging readers to draw their own conclusions as to the identity of the "designer" behind Intelligent Design. When I interviewed him, he even suggested -- with a straight face -- that the "designer" could have been an alien race from another planet (though that was clearly not his first choice). "Intelligent Design only takes you so far," Behe says. "It certainly not an argument for the existence of God. Although, certainly, most people will probably conclude that the designer is God. And I myself believe the designer is God."

William Dembski, the mathematician and philosopher, also plays down any specific religious implications of his work. When I asked him what role God played in the Intelligent Design movement, he replied: "God need not enter into this discussion. In fact, Intelligent Design has no commitment to theism as such." That, he said, sets the movement apart from the old creationist arguments of the 70s and 80s. "Creation is always a theological doctrine," he says. In contrast, "if you're doing Intelligent Design you're not doing theology. There's no commitment."

It's true that Dembski's first book, *The Design Inference*, was rather technical, and had no listing for God in its index. But his next two books, put out by the Christian publishing house InterVarsity Press, tell a different story. Their pages are full of references to God, and in particular to Christ. In his book *Intelligent Design: The Bridge Between Science and Theology*, Dembski says that "Christ completes scientific theories" and that "Christ transforms the world, and pervades the scientists' domain of inquiry."

Even if you believe the Intelligent Design theorists' claim that their work has no explicit link to the Christian God, many of those who have embraced their work certainly do see a connection. As the journal *BioScience* pointed out, Dembski's list of acknowledgements in *The Design Inference* reads "like a who's who of the creationist movement," adding that the book is "endorsed on the back cover by two people from the same universities where he matriculated." Phillip Johnson, an outspoken Creationist and author of *Darwin on Trial*, frequently uses the work of William Dembski and Michael Behe to support his arguments. And Behe's book, *Darwin's Black Box*, was chosen by the magazine *Christianity Today* as its "book of the year."

Eugenie Scott, director of the National Centre for Science Education, sees Intelligent Design as a movement rooted primarily in a set of religious beliefs. Instead of embracing a God who works through natural law, Scott says, the creationists are pushing for a more personal, active God. "The anti-evolution movement is really a function of religious ideology," she says. "I don't argue with theologians about which view of God is correct -- but quit whacking a perfectly good science to promote your theological view."

Just as Darwinians accuse creationists of having a conservative Christian agenda, however, creationists accuse Darwinians of being anti-God. Many of them see Richard Dawkins as the top religion-basher, calling his book *The Blind Watchmaker* an endorsement of atheism. And Dawkins isn't the only target. They also cite physicist Steven Weinberg, famous for saying "The more the universe seems comprehensible, the more it also seems pointless," and Harvard biologist Richard Lewontin, who says it's the duty of science to make people "reject irrational and supernatural explanations of the world... and to accept a social and intellectual apparatus,

Science, as the only begetter of truth.”

Of course, not all scientists are atheists; Miller, for example, made it clear in his 1999 book *Finding Darwin's God* that he believes in the traditional Christian Deity. Evolution, Miller says, takes nothing away from a benevolent, loving God. He also believes that young people should learn religious values in school -- but not in science class. And, perhaps most importantly, he doesn't think that the theory of evolution makes human beings any less special. “We are the first organisms in the history of this planet to be able to contemplate our own origins,” says Miller. “Our intelligence, our brains, our ability to communicate -- sets us apart from everything that lives on this planet now, and everything that ever has lived on it. Are we animals? You bet. Are we mere animals? Absolutely not. There *is* something special about our species.”

Intelligent Design is not the first attack on evolution, and it won't be the last. In fact, Miller is surprised that Darwin's 150-year-old theory doesn't spark even more debate. “The *Origin of Species* is controversial for the same reason that you can go into a bar and start a fight by saying something about somebody's mother,” muses Miller. “It concerns our own origins, it concerns where we come from. And that's near and dear to the hearts of many people. And therefore it has stirred, and will continue to stir, strong emotions.”