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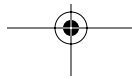
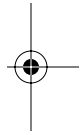
INTELLIGENT DESIGN

What is intelligent design?

THINK OF MOUNT RUSHMORE—what about this rock formation convinces us that it was due to a designing intelligence and not merely to wind and erosion? Designed objects like Mount Rushmore exhibit characteristic features or patterns that point us to an intelligence. Such features or patterns are *signs of intelligence*. Proponents of intelligent design, known as design theorists, are not content to regard such signs as mere intuitions. Rather, they insist on studying them formally, rigorously and scientifically.

Intelligent design is the science that studies signs of intelligence. Note that a sign is not the thing signified. Intelligent design does not try to get into the mind of a designer and figure out what a designer is thinking. Its focus is not a designer's mind (the thing signified) but the artifact due to a designer's mind (the sign). What a designer is thinking may be an interesting question, and one may be able to infer something about what a designer is thinking from the designed objects that a designer produces (provided the designer is being honest). But the designer's thought processes lie outside the scope of intelligent design. As a scientific research program, intelligent design investigates the effects of intelligence and not intelligence as such.

What makes intelligent design so controversial is that it purports to find signs of intelligence in biological systems. According to Francisco Ayala, Charles Darwin's greatest achievement was to show how the organized complexity of organisms could be attained without a designing intelligence. Intelligent design therefore directly challenges Darwinism and other naturalistic approaches to the origin and evolution of life. Design has had a turbulent intellectual history. The main difficulty with it in the last two hundred years has been discovering a conceptually powerful formulation of design that will fruitfully advance science. What has kept design outside the scientific mainstream since the rise of Darwinism is that it





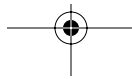
lacked precise methods for distinguishing intelligently caused objects from unintelligently caused ones.

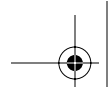
For design to be a fruitful scientific concept, scientists have to be sure they can reliably determine whether something is designed. For instance, Johannes Kepler thought the craters on the moon were intelligently designed by moon dwellers. We now know that the craters were formed by blind natural processes (like meteor impacts). It's this fear of falsely attributing something to design only to have it overturned later that has prevented design from entering science proper. But design theorists argue that they now have formulated precise methods for discriminating designed from undesigned objects. These methods, they contend, enable them to avoid Kepler's mistake and reliably locate design in biological systems.

As a theory of biological origins and development, intelligent design's central claim is that only intelligent causes adequately explain the complex, information-rich structures of biology and that these causes are empirically detectable. To say intelligent causes are empirically detectable is to say there exist well-defined methods that, based on observable features of the world, can reliably distinguish intelligent causes from undirected natural causes. Many special sciences have already developed such methods for drawing this distinction—notably, forensic science, cryptography, archeology and the search for extraterrestrial intelligence (SETI). Essential to all these methods is the ability to eliminate chance and necessity.

Astronomer Carl Sagan wrote a novel about SETI called *Contact*, which was later made into a movie starring Jodie Foster. The plot and the extraterrestrials, of course, were fictional, but Sagan based the SETI astronomers' methods of design detection squarely on scientific practice. In other words, real-life SETI researchers have never detected designed signals from distant space, but if they encountered such a signal, as the film's astronomers did, they too would infer design. Why did the radio astronomers in *Contact* draw such a design inference from the beeps and pauses they monitored from space? SETI researchers run signals collected from distant space through computers programmed to recognize preset patterns. Signals that do not match any of the patterns pass through the "sieve" and are classified as random.

After years of receiving apparently meaningless "random" signals, the *Contact* researchers discovered a pattern of beats and pauses that corresponds to the sequence of all the prime numbers between 2 and 101. (Prime numbers are divisible only by themselves and by one.) That grabbed their attention, and they immediately detected intelligent design. When a se-





quence begins with two beats and then a pause, three beats and then a pause, and continues through each prime number all the way to 101 beats, researchers must infer the presence of an extraterrestrial intelligence.

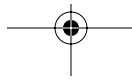
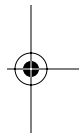
Here's why. Nothing in the laws of physics requires radio signals to take one form or another, so the prime sequence is *contingent* rather than necessary. Also, the prime sequence is a long sequence and therefore *complex*. Note that if the sequence lacked complexity, it could easily have happened by chance. Finally, it was not just complex, but it also exhibited an independently given pattern or *specification*. (It was not just any old sequence of numbers but a mathematically significant one—the prime numbers.)

Intelligence leaves behind a characteristic trademark or signature—what I call *specified complexity*. An event exhibits specified complexity if it is contingent and therefore not necessary; if it is complex and therefore not readily repeatable by chance; and if it is specified in the sense of exhibiting an independently given pattern. Note that a merely improbable event is not sufficient to eliminate chance: flip a coin long enough and you'll witness a highly complex or improbable event. Even so, you'll have no reason not to attribute it to chance.

The important thing about specifications is that they be objectively given and not just imposed on events after the fact. For instance, if an archer fires arrows into a wall and then we paint bull's-eyes around them, we impose a pattern after the fact. On the other hand, if the targets are set up in advance ("specified") and then the archer hits them accurately, we know it was by design.

In determining whether biological organisms exhibit specified complexity, design theorists focus on identifiable systems—such as individual enzymes, metabolic pathways, molecular machines and the like. These systems are specified in virtue of their independent functional requirements, and they exhibit a high degree of complexity. Of course, once an essential part of an organism exhibits specified complexity, then any design attributable to that part carries over to the organism as a whole. One need not demonstrate that every aspect of the organism was designed; in fact, some aspects will be the result of purely natural causes.

The combination of complexity and specification convincingly pointed the radio astronomers in the movie *Contact* to an extraterrestrial intelligence. Specified complexity is the characteristic trademark or signature of intelligence. It is a reliable empirical marker of intelligence in the same way that fingerprints are a reliable empirical marker of a person's presence. Design theorists contend that blind natural causes cannot generate





specified complexity. (See parts two and three. For a full theoretical justification see my 2002 book *No Free Lunch*.)

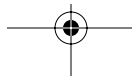
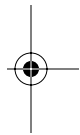
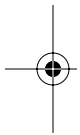
This isn't to say that naturally occurring systems cannot exhibit specified complexity or that natural processes cannot serve as a conduit for specified complexity. Naturally occurring systems can exhibit specified complexity, and nature operating without intelligent direction can take preexisting specified complexity and shuffle it around. But that is not the point. The point is whether nature (conceived as a closed system of blind, unbroken natural causes) can *generate* specified complexity in the sense of originating it when previously there was none.

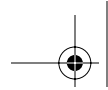
Take, for instance, a Dürer woodcut. It arose by mechanically impressing an inked woodblock on paper. The Dürer woodcut exhibits specified complexity. But the mechanical application of ink to paper via a woodblock does not account for the woodcut's specified complexity. The specified complexity in the woodcut must be referred back to the specified complexity in the woodblock, which in turn must be referred back to the designing activity of Dürer himself (in this case, deliberately chiseling the woodblock). Specified complexity's causal chains end not with blind nature but with a designing intelligence.

Biochemist Michael Behe connects specified complexity to biological design with his concept of *irreducible complexity* (*Darwin's Black Box*, 1996). Behe defines a system as *irreducibly complex* if it consists of several interrelated parts for which removing even one part completely destroys the system's function. For Behe, irreducible complexity is a sure indicator of design. One irreducibly complex biochemical system that Behe considers is the bacterial flagellum. The flagellum is an acid-powered rotary motor with a whiplike tail that spins at twenty thousand revolutions per minute and whose rotating motion enables a bacterium to navigate through its watery environment.

Behe shows that the intricate machinery in this molecular motor—including a rotor, a stator, O-rings, bushings and a drive shaft—requires the coordinated interaction of at least thirty complex proteins and that the absence of any one of these proteins would result in the complete loss of motor function. Behe argues that the Darwinian mechanism faces grave obstacles in trying to account for such irreducibly complex systems. In *No Free Lunch*, I show how Behe's notion of irreducible complexity constitutes a special case of specified complexity and that irreducibly complex systems like the bacterial flagellum are therefore designed.

It follows that intelligent design is more than simply the latest in a long





line of design arguments. The related concepts of irreducible complexity and specified complexity render intelligent causes empirically detectable and make intelligent design a full-fledged scientific theory, distinguishing it from the design arguments of philosophers and theologians, or what has traditionally been called *natural theology*. According to intelligent design, the world contains events, objects and structures that exhaust the explanatory resources of undirected natural causes and can be adequately explained only by recourse to intelligent causes. Intelligent design demonstrates this rigorously. It thus takes a long-standing philosophical intuition and cashes it out as a scientific research program. This program depends on advances in probability theory, computer science, molecular biology, the philosophy of science and the concept of information—to name but a few. Whether this program can turn design into an effective conceptual tool for investigating and understanding the natural world is for now the big question confronting science.

