An Introduction to Intelligent Design

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Intelligent design—often called "ID"—is a scientific theory that holds that the emergence of some features of the universe and living things is best explained by an intelligent cause rather than an undirected process such as natural selection. ID theorists argue that design can be inferred by studying the informational properties of natural objects to determine if they bear the type of information that in our experience arises from an intelligent cause.

Proponents of neo-Darwinian evolution contend that the information in life arose via purposeless, blind, and unguided processes. ID proponents argue that this information arose via purposeful, intelligently guided processes. Both claims are scientifically testable using the standard methods of science. But ID theorists say that when we use the scientific method to explore nature, the evidence points away from unguided material causes, and reveals intelligent design.

Intelligent Design in Archaeology and Forensics

ID is in the business of trying to discriminate between strictly naturally/materially caused objects on the one hand, and intelligently caused objects on the other. A variety of scientific fields already use ID reasoning. For example, archaeologists find an object and they need to determine whether it arrived at its shape through natural processes, so it's just another rock (let's say), or whether it was carved for a purpose by an intelligence. Likewise forensic scientists distinguish between naturally caused deaths (by disease, for example), and intelligently caused deaths (murder). These are important distinctions for our legal system, drawing on science and logical inference. Using similar reasoning, intelligent design theorists go about their research. They ask: If we can use science to detect design in other fields, why should it be controversial when we detect it in biology or cosmology?

Here is how ID works. Scientists interested in detecting design start by observing how intelligent agents act when they design things. What we know about human agents provides a large dataset for this. One of the things we find is that when intelligent agents act, they generate a great deal of information. As ID theorist Stephen Meyer says: "Our experience-based knowledge of information-flow confirms that systems with large amounts of specified complexity (especially codes and languages) invariably originate from an intelligent source—from a mind or personal agent."[1]

Thus ID seeks to find in nature reliable indications of the prior action of intelligence—specifically it seeks to find the types of information which are known to be produced by intelligent agents. Yet not all "information" is the same. What kind of information is known to be produced by intelligence? The type of information that indicates design is generally called "specified

complexity" or "complex and specified information" or "CSI" for short. I will briefly explain what these terms mean.

Something is complex if it is unlikely. But complexity or unlikelihood alone is not enough to infer design. To see why, imagine that you are dealt a five-card hand of poker. Whatever hand you receive is going to be a very unlikely set of cards. Even if you get a good hand, like a straight or a royal flush, you're not necessarily going to say, "Aha, the deck was stacked." Why? Because unlikely things happen all the time. We don't infer design simply because of something's being unlikely. We need more: specification. Something is specified if it matches an independent pattern.

A Tale of Two Mountains

Imagine you are a tourist visiting the mountains of North America. You come across Mount Rainier, a huge dormant volcano not far from Seattle. There are features of this mountain that differentiate it from any other mountain on Earth. In fact, if all possible combinations of rocks, peaks, ridges, gullies, cracks, and crags are considered, this exact shape is extremely unlikely and complex. But you don't infer design simply because Mount Rainier has a complex shape. Why? Because you can easily explain its shape through the natural processes of erosion, uplift, heating, cooling, freezing, thawing, weathering, etc. There is no special, independent pattern to the shape of Mount Rainier. Complexity alone is not enough to infer design.

But now let's say you go to a different mountain—Mount Rushmore in South Dakota. This mountain also has a very unlikely shape, but its shape is special. It matches a pattern—the faces of four famous Presidents. With Mount Rushmore, you don't just observe complexity, you also find *specification*. Thus, you would infer that its shape was designed.

ID theorists ask "How can we apply this kind of reasoning to biology?" One of the greatest scientific discoveries of the past fifty years is that life is fundamentally built upon information. It's all around us. As you read a book, your brain processes information stored in the shapes of ink on the page. When you talk to a friend, you communicate information using sound-based language, transmitted through vibrations in air molecules. Computers work because they receive information, process it, and then give useful output.

Everyday life as we know it would be nearly impossible without the ability to use information. But could life itself exist without it? Carl Sagan observed that the "information content of a simple cell" is "around 10^{12} bits, comparable to about a hundred million pages of the *Encyclopedia Britannica*."[2] Information forms the chemical blueprint for all living organisms, governing the assembly, structure, and function at essentially all levels of cells. But where does this information come from?

As I noted previously, ID begins with the observation that intelligent agents generate large quantities of CSI. Studies of the cell reveal vast quantities of information in our DNA, stored biochemically through the sequence of nucleotide bases. No physical or chemical law dictates the order of the nucleotide bases in our DNA, and the sequences are highly improbable and complex. Yet the coding regions of DNA exhibit very unlikely sequential arrangements of bases that match

the precise pattern necessary to produce functional proteins. Experiments have found that the sequence of nucleotide bases in our DNA must be extremely precise in order to generate a functional protein. The odds of a random sequence of amino acids generating a functional protein is less than 1 in 10 to the 70th power.[3] In other words, our DNA contains high CSI.

Thus, as nearly all molecular biologists now recognize, the coding regions of DNA possess a high "information content"—where "information content" in a biological context means precisely "complexity and specificity." Even the staunch Darwinian biologist Richard Dawkins concedes that "[b]iology is the study of complicated things that give the appearance of having been designed for a purpose."[4] Atheists like Dawkins believe that unguided natural processes did all the "designing" but intelligent design theorist Stephen C. Meyer notes, "in all cases where we know the causal origin of 'high information content,' experience has shown that intelligent design played a causal role."[5]

A DVD in Search of a DVD Player

But just having the information in our DNA isn't enough. By itself, a DNA molecule is useless. You need some kind of machinery to read the information in the DNA and produce some useful output. A lone DNA molecule is like having a DVD—and nothing more. A DVD might carry information, but without a machine to read that information, it's all but useless (maybe you could use it as a Frisbee). To read the information in a DVD, we need a DVD player. In the same way, our cells are equipped with machinery to help process the information in our DNA.

That machinery reads the commands and codes in our DNA much as a computer processes commands in computer code. Many authorities have recognized the computer-like information processing of the cell and the computer-like information-rich properties of DNA's language-based code. Bill Gates observes, "Human DNA is like a computer program but far, far more advanced than any software we've ever created."[6] Biotech guru Craig Venter says that "life is a DNA software system,"[7] containing "digital information" or "digital code," and the cell is a "biological machine" full of "protein robots."[8] Richard Dawkins has written that "[t]he machine code of the genes is uncannily computer-like."[9] Francis Collins, the leading geneticist who headed the human genome project, notes, "DNA is something like the hard drive on your computer," containing "programming."[10]

Cells are thus constantly performing computer-like information processing. But what is the result of this process? Machinery. The more we discover about the cell, the more we learn that it functions like a miniature factory, replete with motors, powerhouses, garbage disposals, guarded gates, transportation corridors, CPUs, and much more. Bruce Alberts, former president of the U.S. National Academy of Sciences, has stated:

> [T]he entire cell can be viewed as a factory that contains an elaborate network of interlocking assembly lines, each of which is composed of a set of large protein machines. ... Why do we call the large protein assemblies that underlie cell function protein machines? Precisely because, like machines invented by humans to deal efficiently with the macroscopic world, these protein assemblies contain highly coordinated moving parts.[11]

There are hundreds, if not thousands, of molecular machines in living cells. In discussions of ID, the most famous example of a molecular machine is the bacterial flagellum. The flagellum is a micro-molecular propeller assembly driven by a rotary engine that propels bacteria toward food or a hospitable living environment. There are various types of flagella, but all function like a rotary engine made by humans, as found in some car and boat motors. Flagella also contain many parts that are familiar to human engineers, including a rotor, a stator, a drive shaft, a U-joint, and a propeller. As one molecular biologist writes, "More so than other motors the flagellum resembles a machine designed by a human."[12] But there's something else that's special about the flagellum.

Introducing "Irreducible Complexity"

In applying ID to biology, ID theorists often discuss "irreducible complexity," a concept developed and popularized by Lehigh University biochemist Michael Behe. Irreducible complexity is a form of specified complexity, which exists in systems 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."[13] Because natural selection only preserves structures that confer a functional advantage to an organism, such systems would be unlikely to evolve through a Darwinian process. Why? Because there is no evolutionary pathway where they could remain functional during each small evolutionary step. According to ID theorists, irreducible complexity is an informational pattern that reliably indicates design, because in all irreducibly complex systems in which the cause of the system is known by experience or observation, intelligent design or engineering played a role in the origin of the system.

Microbiologist Scott Minnich has performed genetic knockout experiments where each gene encoding a flagellar part is mutated individually such that it no longer functions. His experiments show that the flagellum fails to assemble or function properly if any one of its approximately 35 different protein-components is removed.[14] By definition, it is irreducibly complex. In this all-or-nothing game, mutations cannot produce the complexity needed to evolve a functional flagellum one step at a time. The odds are also too daunting for it to evolve in one great mutational leap.

The past fifty years of biological research have showed that life is fundamentally based upon:

- A vast amount of complex and specified information encoded in a biochemical language.
- A computer-like system of commands and codes that processes the information.
- Irreducibly complex molecular machines and multi-machine systems.

Where, in our experience, do language, complex and specified information, programming code, and machines come from? They have only one known source: intelligence.

Intelligent Design Extends Beyond Biology

But there's much more to ID. Contrary to what many people suppose, ID is much broader than the debate over Darwinian evolution. That's because much of the scientific evidence for intelligent design comes from areas that Darwin's theory doesn't even address. In fact, much evidence for intelligent design from physics and cosmology.

The fine-tuning of the laws of physics and chemistry to allow for advanced life is an example of extremely high levels of CSI in nature. The laws of the universe are complex because they are highly unlikely. Cosmologists have calculated the odds of a life-friendly universe appearing by chance are less than 1 in $10^{10^{\wedge}123}$. That's ten raised to a power of 10 with 123 zeros after it—a number far too long to write out! The laws of the universe are specified in that they match the narrow band of parameters required for the existence of advanced life. This high CSI indicates design. Even the atheist cosmologist Fred Hoyle observed, "A common sense interpretation of the facts suggests that a super intellect has monkeyed with physics, as well as with chemistry and biology."[15] *From the tiniest atom, to living organisms, to the architecture of the entire cosmos, the fabric of nature shows strong evidence that it was intelligently designed.*

Detecting Design in Biology Using the Scientific Method
In the field of biology, however, here is how we can use the scientific method to detect design:

- ***Observation:*** Intelligent agents solve complex problems by acting with an end goal in mind, producing high levels of CSI. As Stephen Meyer explains, in our experience, systems with large amounts of specified complexity—such as codes and languages—invariably originate from an intelligent source. Likewise, in our experience, intelligence is the cause of irreducibly complex machines.
- ***Hypothesis (Prediction):*** Natural structures will be found that contain many parts arranged in intricate patterns that perform a specific function—indicating high levels of CSI, including irreducible complexity.
- ***Experiment:*** Experimental investigations of DNA indicate that it is full of a CSI-rich, language-based code. Cells use computer-like information processing systems to translate the genetic information in DNA into proteins. Biologists have performed mutational sensitivity tests on proteins and determined that their amino acid sequences are highly specified. The end-result of cellular information processing system are protein-based micromolecular machines. Genetic knockout experiments and other studies show that some molecular machines, like the bacterial flagellum, are irreducibly complex.
- ***Conclusion:*** The high levels of CSI—including irreducible complexity—in biochemical systems are best explained by the action of an intelligent agent.

One can disagree with the conclusions of ID, but one cannot reasonably claim that it is an argument based upon religion, faith, or divine revelation. It is based upon science.

ID design has scientific merit because it is an empirically based argument that uses well-accepted methods of historical sciences in order to detect in nature the types of complexity that we understand, from present-day observations, are derived from intelligent causes. When we study nature through science, we find evidence of fine-tuning and planning—intelligent design—from the macroarchitecture of the entire universe to the tiniest submicroscopic biomolecular machines.

Good ID Websites for More Information:

ID Portal: www.intelligentdesign.org

IDEA Student Clubs: www.ideacenter.org

ID News Site: www.evolutionnews.org

ID Podcast: www.idthefuture.com

Responding to Theistic Evolution:
www.faithandevolution.org

Discovery Institute's ID Program:
www.discovery.org/csc

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[2.] C. Sagan, "Life," in *Encyclopedia Britannica: Macropaedia Vol. 10* (Encyclopedia Britannica, Inc., 1984), 894.

[3.] D. D. Axe, "Extreme Functional Sensitivity to Conservative Amino Acid Changes on Enzyme Exteriors," *Journal of Molecular Biology*, 301:585-595 (2000); D. D. Axe, "Estimating the Prevalence of Protein Sequences Adopting Functional Enzyme Folds," *Journal of Molecular Biology*, 1-21 (2004).

[4.] Richard Dawkins, *The Blind Watchmaker* (New York: W. W. Norton, 1986), 1.

[5.] S. C. Meyer et. al., "The Cambrian Explosion: Biology's Big Bang," in *Darwinism, Design, and Public Education*, J. A. Campbell and S. C. Meyer eds. (Michigan State University Press, 2003).

[6.] B. Gates, N. Myhrvold, and P. Rinearson, *The Road Ahead: Completely Revised and Up-To-Date* (New York: Penguin Books, 1996), 228.

[7.] J. Craig Venter, "The Big Idea: Craig Venter On the Future of Life," *The Daily Beast* (October 25, 2013), accessed October 25, 2013, www.thedailybeast.com/articles/2013/10/25/the-big-idea-craig-venter-the-future-of-life.html.

[8.] See C. Luskin, "Craig Venter in Seattle: 'Life Is a DNA Software System'," (October 24, 2013), www.evolutionnews.org/2013/10/craig_venter_in078301.html.

[9.] R. Dawkins, *River Out of Eden: A Darwinian View of Life* (New York: Basic Books, 1995), 17.

[10.] F. Collins, *The Language of God: A Scientist Presents Evidence for Belief* (New York: Free Press, 2006), 91.

[11.] B. Alberts, "The Cell as a Collection of Protein Machines: Preparing the Next Generation of Molecular Biologists," *Cell*, 92: 291-294 (February 6, 1998).

[12.] D. J. DeRosier, "The Turn of the Screw: The Bacterial Flagellar Motor," *Cell*, 93: 17-20 (April 3, 1998). Note: DeRosier is not pro-ID.

[13.] M. J. Behe, *Darwin's Black Box: The Biochemical Challenge to Darwinism* (Free Press 1996), 39.

[14.] Transcript of testimony of Scott Minnich, *Kitzmiller et al. v. Dover Area School Board* (M.D. Pa., PM Testimony, November 3, 2005), 103-112. See also Table 1 in R. M. Macnab, "Flagella," in *Escherichia Coli and Salmonella Typhimurium: Cellular and Molecular Biology Vol. 1*, eds. F. C. Neidhardt, J. L. Ingraham, K. B. Low, B. Magasanik, M. Schaechter, and H. E. Umbarger (Washington D.C.: American Society for Microbiology, 1987), 73-74.

[15.] Fred Hoyle, "The Universe: Past and Present Reflections," *Engineering and Science*, pp. 8-12 (November, 1981).