DNA, Information, and the Signature in the Cell

Where did we come from? Heather Zeiger uses Stephen Meyer's book Signature in the Cell *to logically show that the best answer is an intelligent cause—God—rather than natural causes.*

Where Did We Come From?

Where did we come from? A simple question, but not an easy answer. Darwin addressed this question in his book, *On the Origin of Species*. Although he never really answered how the universal common ancestor first came to life, he implied that it was from natural causes. In this article, we are going to look at Darwin's method of deducing occurrences in the past based on observations we see today. This is now referred to as the *historical* or *origins science* method. We will find that purely naturalistic causes fall short of explaining what we know about DNA, but intelligent design seems to be a promising alternative. Then we will look at scripture and see how Christians can use these evidences for design to talk about who that designer is. We will be using Stephen Meyer's new book, *Signature in the Cell,* to guide us on the science and method of approaching this question.

Charles Darwin's book, *On the Origin of Species* discusses his theory on how natural selection acts on living things so that the fittest organisms for a particular environment survive, and how this process eventually leads to novel species and body plans. Implied in his work is the notion that all living things came from nature and from natural causes. So his presupposition is that life must have first come from impersonal things like matter and energy. Because of this, origin-of-life scientists have been trying for years to demonstrate how life may have come from non-life.

Let’s try to figure out how a cell could form from purely naturalistic processes. Better yet, since we now know that natural selection acts on random mutations within the genome, let’s focus in on DNA, the instruction booklet for the cell. Without DNA, cells would not function.

DNA is part of a complex information-processing systems{1} DNA is a long, helical structure found inside the nucleus and mitochondria of the cell. It is made of a four-molecule alphabet arranged in a very specific order. This sequence is like an instruction book telling the cell what parts to use to build a protein. But this instruction book needs to be de-coded with other proteins. The difficult thing is that proteins are needed to make more DNA, but DNA is needed to make proteins. And the cell cannot function without proteins. This means that the first DNA molecule must have been made differently than how it is made today.

DNA is a very complex information processing system. In fact, Bill Gates has compared it to a computer program but far, far more advanced than any software ever created.{2} DNA is more than just an improbable sequence of bases; it is functional. It tells the cells what to do. So the question we really need to answer is, how can this kind of information arise in the first place?

Origins and Operations Science

We are investigating what science can tell us about the origin of life. Did we just come out of a chemical soup, or was it something else? First, we need to answer this question: How did DNA, the body’s instruction book, first get here? In order to answer the question, we need to decide what method to use to investigate this question. Since we are looking at the science, we should use the scientific method. However, we need to make a distinction between approaching something that is a re-occurring, testable phenomenon, and a singular event in the

past.

As a scientist, I usually work in the area of *operations science*. This is the type of science we learn in school. You start with a hypothesis, then you conduct an experiment to test your hypothesis. Repeat your experiment several times, collect data, and make conclusions about your hypothesis. Operations science deals with regular, repeatable things that can usually be described by mathematical formulas. Oftentimes, operations science is looking at some kind of naturally occurring process.

But there is another type of science that forensics experts and archeologists use. It is called origins science. Origins science determines what caused a singular event in the past. The role of origins science is to first determine if something was caused by chance, natural laws, or intelligence. For example, one could find a rock formation that looks very similar to a human head. Was this formation caused by chance and natural laws, such as wind and rain wearing away the rock? Or was it caused by intelligence? Did someone carve the rock to look this way?

Origins science operates under a different set of rules than operations science because the event in question has already happened, and it is not a reoccurring, observable phenomenon. The best that we can do is look at clues to give us a reasonable guess as to what might have happened. In *Signature in the Cell*, Meyer uses origins science to determine if DNA is a result of chance, natural laws, or intelligence:

> *Thaxton and his colleagues argued that inferring an intelligent cause was legitimate in origins science, because such sciences deal with singular events, and the actions of intelligent agents are usually unique occurrences. On the other hand, they argued that it was not legitimate to invoke intelligent causes in operations science, because such sciences only deal with regular and repeating phenomena.*

> *Intelligent agents don't act in rigidly regular or lawlike ways, and therefore, cannot be described mathematically by laws of nature.{3}*

DNA replication happens all of the time, but it requires proteins. But proteins are made by instructions from DNA. So the first DNA molecule must have been made in a special, atypical way, meaning it qualifies as origins science. Origins science allows for singular acts of intelligence to explain certain phenomena.

This means we need to investigate, using origins science, how the first DNA molecule with its information-carrying capacity was produced.

What Are the Possibilities?

DNA is the code for life. If we determine where it came from, then we are one step closer to determining the origin of life. Let's look at the typical origin of life theories posed by scientists as our first step in our origins science method, and see where theories are lacking or where they are helpful. Two things these theories all have in common is that they presume no designer, but only natural causes, and none of them can explain the origin of information.

The first option is that DNA might have arisen by chance. When scientists talk about chance, they are not saying that some entity called Chance did something. They mean random chemical shuffling, and out of that came DNA. But it's not good enough to explain how random chemicals came together. Think of scrabble pieces. To say that DNA came about by chance would be similar to saying that someone shook a bag of scrabble pieces and threw them on the floor and it spelled out a sentence. And this would not be just any sentence, but step-by-step instructions on how to build a cellular machine. Chance is not a good explanation for the origin of DNA, because the

probability of getting something as specified and complex as DNA is well beyond the accepted probability of zero.

The other option is DNA might have come about because of necessity or natural law. Maybe there is some chemical or natural reason that forced the DNA molecules to form. Two examples of this type of origin of life theory are *self-organization* and *biochemical predestination*. The idea behind both of these is that the molecular alphabet in DNA arranged itself because of chemical properties or environmental factors. Unfortunately, scientists have found that the molecules in DNA do not chemically interact with each other because they are stuck to a phosphate backbone, not to each other.{4} On top of that, there isn't even a chemical attraction between these DNA sequences and the protein parts they code for (known as a *codon*). Since there is not a self-organizing motivation for this, and there is not an environmental factor that would favor certain combinations over others, necessity seems to fall short of explaining the functional information of DNA.

Some scientists propose that it is a combination of chance and necessity. The most popular origin of life models are based on this theory. However, Stephen Meyer shows in his book that the two most popular models, the *RNA-first world* and the *Oparin* model, do not explain how functional information first arose. Ultimately these theories boil down to claiming that random chance causes functional information.

So if all of the naturalistic theories of origin of life fall short, then perhaps we should expand our options to theories that allow for intelligent agents.

What if We Allow Intelligence?

It seems that all of the naturalistic explanations for the origin of life fall short of accounting for the information-

rich molecule, DNA. As Meyer points out, apart from DNA and the machinery in cells, such specified information is not found anywhere in the natural world.{5} The only time we see these properties is in human language and writing. So if DNA has the properties of something that was designed, then why not entertain the idea that it was designed?

Today design is not permitted as an explanation in science. However, historically, this has not been the case. In fact, it was a belief in an intelligible and coherent world created by God that motivated early scientists such as Newton, Boyle, and Pascal.{6} However, after the Enlightenment (mid-1700s), many scientists started operating under different assumptions. They assumed that only natural causes, such as chance and necessity, are permitted to explain observations.

Flash forward to Charles Darwin's time (1860s). Darwin looked at presently acting conditions to extrapolate back to the origin of all living things. He saw that environmental factors select for certain traits, such as beaks on finches. And he saw that things like dog breeding will select for certain desired traits. He therefore concluded that maybe the various animals and body plans came from conditions similar to this. He named this selective force, this breeder, natural selection. This was based on what Darwin knew in the 1850s, and some assumptions about intelligent causes influenced by Enlightenment thinking. At that time Darwin knew nothing about DNA. It would not be discovered until the 1950s.

Stephen Meyer discusses how presently there are no known natural causes for the kind of functional information we see in DNA. The only place we see this is in human language and writing. So perhaps we cannot assume natural causes. Maybe DNA arose by intelligent design. Furthermore, experimental efforts to try to produce DNA or RNA in the lab show that a chemist or a computer programmer must be involved in the experiment in order to obtain functional information. Natural selection cannot act as a breeder, because it does not have the end goal

in mind.

Intelligent Design is a strong possibility for explaining the origin of DNA. It is something that we see in operation today. And it is experimentally justified.

What Does This Have to Do with Christianity?

We have been looking at the properties of DNA and how it has all of the characteristics of a written code. Using the methods of origins science that Stephen Meyer used in *Signature in the Cell*, we can conclude that intelligent design is the best explanation for the origin of DNA. Intelligence is causally adequate to produce a code like DNA. It is observable, in the sense that today intelligent agents produce codes. And any experiments that try to reproduce DNA seem to require the input of information by an intelligent agent to make anything meaningful. This is why Meyer calls DNA the signature in the cell. However, the science alone cannot tell us whose signature it is, so we need to look elsewhere for that. That's where Christianity comes in.

As Christians we believe that God reveals himself through general and special revelation. General revelation is God revealing things about himself in nature. Think of it like God's fingerprints on creation. Special revelation is what God has specifically revealed in the Bible. If we want to find out whose signature is in the cell, we need special revelation to inform us on that. And the Bible says this much. Right before Paul says that creation reveals the attributes of God in Romans 1:18-20, he says it is the gospel that brings salvation in verses 16 and 17.

From the science it is reasonable to say DNA first arose by intelligent design. DNA is one of many extra-Biblical clues pointing us to a designer. This evidence, taken with many

other extra-biblical evidences such as the fine-tuning of the universe for life, the moral law on our hearts, and even the way that we know gravity works the same today as it did yesterday, makes one suspicious that there must be a designer. Now take the evidences for the authority of Scripture from archeology and the Bible's internal structure and consistency and we have many reasons to believe that this designer is the God of the Bible. As Paul says in Romans 1, "His invisible attributes, namely, his eternal power and divine nature, have been clearly perceived, ever since the creation of the world, in the things that have been made. So they are without excuse" (v. 20). So, even though the science will not bring someone to a saving knowledge of Christ, they are without excuse because it does reveal God's attributes. Maybe when someone sees the Signature in the Cell, they will ask, whose signature is it?

Notes

1. "After the early 1960s advances in the field of molecular biology made clear that the digital information in DNA was only part of a complex information-processing system, an advanced form of nanotechnology that mirrors and exceeds our own in its complexity, storage density, and logic of design." Stephen C. Meyer, *Signature in the Cell* (HarperOne, 2009), 14.

2. Bill Gates, *The Road Ahead* (Viking, 1995), 188; quoted in Meyer, *Signature*, 12.

3. Meyer, *Signature*, 29.

4. The only time the nucleotides in DNA interact with each other is when they are paired, A-T, C-G, and they do this through hydrogen bonding. However, this pairing is with nucleotides across from each other and serves to protect the DNA molecule. The coding has to do with the sequence of bases next to each other, and there is no chemical reason for one nucleotide to "prefer" being next to another.

5. "Apart from the molecules comprising the gene-expression

system and machinery of the cell, sequences of structures exhibiting such specified complexity or specified information are not found anywhere in the natural—that is, the nonhuman—world." Meyer, *Signature*, 110.

6. In the radio transcript, I included James Maxwell in this list. While he is among scientists whose belief in God did influence his work, he lived from 1831-1879 which was after the beginning of the Enlightenment. I chose to take his name out here for clarity, although he is a good example of someone who did not hold to the typical presuppositions of the Enlightenment.

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Creating Life in the Lab

Written by Heather Zeiger

The J. Craig Venter Institute recently announced their successful synthesis of a complete bacteria genome to an unsurpassed level of accuracy. Researchers were able to replace the genome of the host cell with the synthesized one. Several web sites and commentators have dispelled any aura of the miraculous by pointing out what exactly Venter's group did and what they did not do. For just a sampling (bolded emphasis is mine):

"What Venter and his team did was to determine the sequence of the DNA in one of the world's simplest bacteria, use the sequence information to synthesize a copy of that DNA from subunits sold by a biological supply company, then put the synthetic copy of DNA into a living bacterial cell from which the natural DNA had been removed."{1}

From the original research article on the Venter group's discovery: "We refer to such a cell controlled by a genome assembled from chemically synthesized pieces of DNA as a 'synthetic cell,' even though **the cytoplasm of the recipient cell is not synthetic**."{2}

"The idea that this is 'playing God' is just daft. What he has done in genetic terms would be analogous to taking an Apple Mac programme and making it work on a PC—and then saying you have created a computer. It's not trivial, but it is utterly absurd the claims that are being made about it."{3}

"To clarify the facts, 'the team put chemically synthesized pieces of the M. mycoides DNA into yeast which assembled the bacteria's genome. Then, the M. mycoides genome was transplanted into Mycoplasma capricolum and "booted up" to create a new synthetic version of M. mycoides'…For this 'proof of principle' instance, they tried to 'synthesize' a bacterium as close to the original genome as they could, with the major 'new' genetic material being watermark protein messages (e.g. spelling "CRAIGVENTER"). They didn't use the original DNA as a template, but just as a 'standard' for comparison. **Since this was a test of concept, the goal was to generate something that already exists**."{4}

Neat Trick or Cause for Concern?

I think one of the most laudable feats of this group that should please many biochemists is that they were able to perfect the DNA synthesizing technology to the point that they reconstructed an entire bacterial genome—a much longer sequence than what is typically done in the laboratory setting—and they were able to do it with such accuracy that the cell's translational machinery read it. Exciting for biochemists, but advancements in laboratory technique and technology are hardly the stuff of headlines. As a chemist, I think it's a neat trick; as a bioethicist, I am concerned. My concern is not about the technology itself, but about the

underlying presuppositions that seem to go unquestioned, even unnoticed.

The media response has been that of excitement and fear. At the heart of the fear surrounding genetic engineering is power. Why would anyone care about bacteria{5} unless he or she thought it implied something about human beings? Unless they are in the field, most people do not pay particular attention to the musing of a scientist about his research project on some esoteric species identifiable only by its Latin name. We do not care, that is, until that little bacterium has the potential to bring great harm or great good (or both) to human beings.

The fear or excitement (depending on your view of technology and scientists) is spread by two fundamental assumptions:

1) Since every organism, including human beings, is made up of genes, if scientists can manipulate one gene, then they can manipulate any gene, including human genes, and;

2) by manipulating genes scientists are manipulating life itself and the very essence of an organism's identity. This philosophical assumption, known as *reductionism*, is what we often assume without thinking about it.

These philosophical assumptions are grounded in a worldview of *materialism* (a.k.a. *naturalism*; I will use the term materialism throughout this article). The materialistic worldview says that matter and energy are all there is, there is no supernatural and there is nothing beyond what is in the natural world. If that is the case, then by definition, human beings are defined by their physical parts. There is nothing nonphysical which we can call our identity. That also means that the difference between something being alive versus not being alive must be defined by physical parameters. Since all organisms have a genome, scientists assume that there is some combination of nucleotides (the individual molecules of the

genome) or a certain minimal number of nucleotides that makes something alive.

The Venter Group's Reductionist Project

The Venter group, from the beginning of their project, was quite up front with the goals of their research. When asked about the implications of their project, Craig Venter responded in an interview posted in *SciWatch* in 1997:

> What is life? I don't think there are that many biologists trying to answer that one . . . . We're . . . working on a reductionist view of trying to take the smallest genome that we have…and see if we can't understand how those . . .[genes] work together to create life . . . .{6}

This is the same sentiment held by James Watson, Nobel Laureate and co–founder of the structure of DNA. In his book, *DNA*, he states:

> Our discovery had put an end to a debate as old as the human species: Does life have some magical, mystical essence, or is it, like any chemical reaction carried out in a science class, the product of normal physical and chemical processes? Is there something divine at the heart of a cell that brings it to life? The double helix answered that question with a definitive No.{7}

According to scientists who hold to materialistic presuppositions, life is chemistry. Who we are boils down to our chemistry, which puts those that can manipulate our chemistry in a position of power.

Given these beliefs, it is no wonder that people automatically jumped from the genome of a bacterium to the implications for people. But one thing science has shown us is that the leap from bacteria to man is not simple or straightforward. Man's genome is not much larger than many other, simpler organisms, yet scientists have found that human DNA is much more complex.

As it turns out, it is more than an issue of connecting nucleotides together like a chain of beads in the right order.

Reductionism and the Human Genome Today: What Is New

Dr. Richard Sternberg of the Biologic Institute conducts research based on several findings that seem to indicate that the blueprint for an organism's overall body plan is not found by reading the genome on a nucleotide-by-nucleotide basis. There seems to be a more complex interaction between the genome and other cellular functions and between different parts of the genome in different ways that was once thought. His research seeks to identify those interactions and how they translate into an organism's blueprint.{8}

What scientists are finding is that the genome is not read as a letter–by–letter array (one–dimensional), as was once thought, but that there are spatial and translational (three–dimensional) factors that help determine how our genome is interpreted. *No longer is it a simple issue of what letters code for what. Now it is what letters, located where, and interacting how, code for what. This flies in the face of reductionism because now we cannot assume that the chemistry codes for life. Apparently there is more to it than that.*

Reductionism and the Human Genome Yesterday: What Is Not New

Even before scientists discovered that there are layers of complexity to the genome, many researchers found that their experiments did not work as expected from a reductionist perspective because the step from bacteria to man is not a direct correlation. By looking back to the beginning of genetic engineering technology, we find that many people held reductionist presuppositions that fueled fear and concern. We also find that reductionism failed to account for the setbacks

in going from simple organisms to man. Many people reacted to the discovery of recombinant DNA (rDNA) in the 1970's and 1980's with fear, concern, and anticipation.

RDNA involves building DNA strands and inserting them into organisms using something called vectors. Today this technology is frequently used in the lab, and it was used by the Venter group for their procedure. In the 1970's and 80's much of the ethical debate centered on the implications of using rDNA in human beings, even though the procedure was only being used in bacteria. We call the use of rDNA technology in humans, human genetic engineering. Ironically, after all of the hype surrounding this new technology, 30 years of using rDNA has not resulted in success in human genetic engineering.

Reductionists would say that because every organism is composed of genes and life must be defined by its physical parts, if we can engineer and replace DNA in simple organisms, we can do the same in humans. However, in reality we still cannot replace portions of human DNA with synthesized DNA because there is a level of complexity in mammalian cells, and human cells in particular, that scientists still do not understand.

Conclusion: The Meaning of Life Is Not Found under a Microscope

The further down you go, even to the level of atoms, subatomic particles and quarks, you will never find the essence of life; at most you can understand structure. Those are two very different things that are confused when you have a commitment to a materialistic perspective. From a materialistic perspective, the essence is in the structure. Man is the sum of his parts. Contrast this to a theistic perspective. Man is made from similar elements as other organisms, connecting him with part of creation, but he is also beyond creation because of his relationship with or access to God. In a Christian

theistic view, in particular, the essence of man is not in his parts but in how those parts combined with his spiritual component make him more than a creature. He is something, someone, made in the image of God. Part of that image is our creativity and ability to communicate original ideas, as well as our self–awareness, including our place in time and our mortality. These are all attributes that describe God. Yet these traits don't seem to be shared by animals, even animals that are genetically similar to human beings.

In a *Science* article from 1999, several ethicists considered the implications of Venter's group's goal to create a minimal genome. Prophetically, the authors caution against reductionist implications: "…a reductionist understanding of life, especially human life, is not satisfying to those who believe that dimensions of the human experience cannot be explained by an exclusively physiological analysis… **There is a serious danger that the identification and synthesis of minimal genomes will be presented by scientists, depicted in the press [ref removed], or perceived by the public as proving that life is reducible to or nothing more than DNA…**"{9}

Now, eleven years later, one of the authors of that same article responded to the Venter group's recent announcement by saying:

> Venter and his colleagues have shown that the material world can be manipulated to produce what we recognize as life… Their achievement undermines a fundamental belief about the nature of life that is likely to prove as momentous to our view of ourselves and our place in the Universe as the discoveries of Galileo, Copernicus, Darwin, and Einstein.{10}

The author perpetuates the very assumption that the original ethics article cautions against! We should be careful to not assume so much. There is no reason to believe that the ultimate nature of life is locked away in our genes, and many

reasons to believe that it is not. The Venter group did not create life; they studied and mimicked the structure of Someone else's creation.

Notes

1. Jonathan Wells, "Has Craig Venter Produced Artificial Life?" posted on May 24, 2010 on Discover Institute blog, *Evolution News & Views*, www.evolutionnews.org/2010/05/has_craig_venter_produced_arti035081.html.
2. Original research article published in Science Express online: www.sciencemag.org/cgi/content/abstract/science.1190719
3. Steve Jones, geneticist, quoted by Jonathan Sarfati in "Was life really created in a test tube? And does it disprove biblical creation?" May 25, 2010, creation.com/synthetic-life-by-venter
4. Science Integrity, "Notes on 'Creation of a Bacterial Cell Controlled by a Chemically Synthesized Genome'," (link to cited article found here), scienceintegrity.net/SynthesizedGenome.aspx
5. The particular bacteria, M. mycoides, was selected because it has one of the simplest known genomes.
6. Quoted in Science vol 286, December 1999, p. 2087. Original quote from Anonymous, Sci Watch (September/October), 3 (1997).
7. Watson, James D., *DNA: The Secret of Life*, Random House, Inc. New York, 2003.
8. Richard Sternberg, "Current Research," www.richardsternberg.org/research.php. See also: www.biologicinstitute.org.
9. Science, vol. 286, December 1999, pg. 2087, emphasis added.
10. "Sizing up the 'synthetic cell'," online version of commentary in Nature, www.nature.com/news/2010/100520/full/news.2010.255.html.

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“Aren’t the Bonds in Peptides More Easily Formed?”

Dr. Bohlin: I have been in contact with a good friend and we have been having a wonderful discussion regarding a series of topics centering around intelligent design. As typical of our conversations we tend to head down tangential trails that avert our focus momentarily. This week’s parley has to do with chemical bonding as associated with protein synthesis. Specifically, your position that the probability of amino acids forming proteins on their own is astronomical. My friend sent you an email recently asking why covalence is not a possibility when considering formation of amino acids and eventually proteins. In your response you referred to two primary problems: chemical and informational. In regards to the chemical you briefly stated that using the early earth scenario (where earth scientists envision a watery world) the energy required to release the water molecule during the peptide bonding process is high especially in an aqueous solution. Further, you state that this barrier can be overcome by the cell through the use of ribosome in a protein fold devoid of water but that the early earth had no RNA to overcome this barrier. Here is my long drawn out question to you.

First, I contend that the weak hydrogen bond (not covalent) associated with the loss of the two hydrogen and one oxygen atom during the formation of an amino acid with the peptide bond is easily broken through a heat catalyst such that existed during the high radioactive decay of the early earth as it cooled from its molten stage (and still does today but to a much lesser degree). This loss of a water molecule would heighten the affinity of the amino acid to the peptide bond

thus strengthening their mutual attraction. The early earth model also indicates that pH (percent hydrogen) levels were probably very different which would also act as a catalyst to break the hydrogen bond as the hydrogen and oxygen atoms try to degas from solution and neutralize the solution. The earth's closed system perpetuated this process indefinitely by trapping the heated gases laden with other hydrous compounds such as sulfuric acid. The formation of the amount of water on earth certainly could not be accomplished by the release of water molecules through the formation of proteins alone. This begs the question of which came first the chicken or the egg? If it were the amino acids, then we would have a sea of amino acids greater than the volume of the oceans. If the amino acids were formed outside of an aqueous solution then where did the water molecules come from that were eventually released? Both hydrogen and oxygen had to be abundantly present and together they form many, many more molecules other than just amino acids and water. The information concern you were referring to suggests that 10 to 65th power is unobtainable. However, when there exists many times more that number of amino acids the odds quickly reduce and become more favorable. 10 to the 65th sounds astronomical but 10 to the 6500th is even more astronomical thus diminishing the former. Further, amino acids can be synthesized in the laboratory which suggests that the building blocks are present on earth. In time, with the correct agents in place (such as powerful radioactive isotopes {neutrinos perhaps?}) the left-handed stereoisotopes of amino acids may also be laboratorily synthesized.

Finally, I would like to know your thoughts on why you believe that proteins were designed. Is it purely philosophical or have you developed a hypothesis that has been tested by others that lends further credence to your postulation? Thank you for your time in advance.

Thank you for your consideration of my earlier response and I

am glad to answer your questions and objections.

First, the bonds that are broken to form a peptide bond formation with the subsequent release of water are not hydrogen bonds, they are covalent. That is why peptide bond formation is endothermic or uphill in relation to energy. Simply providing heat is not going to overcome this problem. Sydney Fox attempted thermal synthesis of proteins in early earth conditions, the results of which he termed proteinoids. Beginning with amino acids (in solution or dry) he heated the material at 200 degrees C for 6-7 hours. The water produced by bond formation (and any original water from the aqueous solution) is evaporated. The elimination of water makes a small yield of polypeptides possible. The increased temperature plus the elimination of water makes the reaction irreversible. However, this process has been rejected for four reasons. First, in living proteins only alpha peptide bonds are formed. In Fox's reactions, beta, gamma and epsilon peptide bonds are also found in abundance. Second, these thermal proteinoids are composed of both L and D amino acids. Only L amino acids are found in living proteins. Third, these are randomly sequenced proteins with no resemblance to proteins with catalytic activity. "Fourth, the geological conditions indicated are too unreasonable to be taken seriously. As Folsome has commented, 'The central question [concerning Fox's proteinoids] is where did all those pure, dry, concentrated, and optically active amino acids come from in the first place.'" (*Mystery of Life's Origin*, 1984, Thaxton, Bradley, and Olsen, p. 155-156)

I am sorry you got the impression that I believed that the formation of peptide bonds and the concomitant release of a water molecule produced the original water on the planet. That is not the nature of the chicken or egg dilemma. The chicken or egg dilemma refers to the fact that in living systems today, proteins are required for DNA and RNA to function with specificity. Histones are required to maintain DNA folding

structure and more importantly, proteins are required for DNA and RNA replication. However, it is the DNA which contains the code for the construction of proteins. DNA needs proteins, proteins need DNA. Which came first in the early earth? DNA or protein, chicken or egg? The proposed RNA world, RNA molecules which can perform some limited enzyme (protein) functions is negated by the fact that there is no mechanism for the production of RNA in an abiotic early earth. Even if this is accomplished, the enzyme-like functions of some small RNA molecules are not sufficient to support life in any shape or form.

Just because 1/10 to the 65th power is large compared to 1/10 to the 6,500 power does not minimize 1/10 to the 65th as a very small probability. It is estimated that there are 10 to the 80th power particles in the universe. The smallest amino acid, glycine is comprised on 13 atoms, each atom (either hydrogen, carbon, nitrogen or oxygen) is composed of multiple protons, electrons and neutrons and each of these is composed of multiple quarks. You can readily recognize that a sea of 10 to the 65th amino acids is a physical impossibility. Current estimates suggest that the concentration of amino acids in the early earth could never have exceeded, 10 to the -7 molar, which is the same as the present Atlantic Ocean (*Mystery of Life's Origin* cited earlier, p. 60). Sheer numbers are not going to help. Most researchers rely on some form of concentration mechanism to get enough amino acids together for protein formation. Even when this happens, many of the same problems that Fox's experiments run into are difficult to eliminate.

Finally, I believe that proteins are designed for both philosophical and scientific reasons. Proteins as stated earlier, contain information. The sequence of the 20 different amino acids in a protein consisting of 100 amino acids is crucial to its function. William Dembski (in the *Design Inference*, Cambridge University Press, 1999 and *Intelligent*

Design, Intervarsity Press, 2000) rigorously defines this information as complex specified information or CSI. It is complex because the sequence of a protein is not a simple repetition as in a nylon polymer. And it is specified because it can tolerate only a small range of substitution at any one of the 100 positions, indeed at some positions, no substitution can be tolerated. Summing these up is where the 10 to the 65th power came from.

Most biologists readily admit today that chance alone is incapable of overcoming these odds. Therefore, they hold out for some undiscovered natural law that will allow information to arise out of the chaos of a mixture of amino acids. But law is also an unlikely candidate. Some have suggested that perhaps certain amino acids have an affinity for certain other amino acids. This could give some level of sequence specificity. This fails on two counts. First no such pattern is observable when nearest neighbors are analyzed in modern proteins. Second, this would defeat the entire process since the sequence would no longer be complex but simple. Simple because the sequence could now be predicted once the first amino acid is put in place. This would lead to a very limited number of possible combinations and not the millions of possibilities currently residing in living cells.

The only known source for CSI today is intelligence. Even the fundamentalist Darwinian Richard Dawkins, said in his book *The Blind Watchmaker*, "Biology is the study of complicated things that give the appearance of having been designed for a purpose." Perhaps they appear to be designed because they were designed. There is certainly nothing unscientific about wanting to explore that possibility.

Respectfully,

Ray Bohlin
Probe Ministries

Tales From the Crypt: Do We Have the Bones of Jesus?

February 26, 2008

The last week in February started out with an incredible announcement. James Cameron (director of the film Titanic) and Simcha Jacobovici announced that they have found the bones of Jesus! At their news conference, they promoted their Discovery Channel special The "Lost Tomb of Jesus" that will air on March 4th and also promoted the book by Simcha Jacobovici and Charles Pellegrino entitled *The Jesus Family Tomb: The Discovery, the Investigation, and the Evidence That Could Change History* released by Harper-Collins.

If proved reliable, these findings would call into question the very cornerstone of Christianity: the resurrection of Jesus. But are they true?

The foundational claim is that they have discovered the family tomb of Jesus Christ. Is this really the tomb of Jesus or his family? There are many good reasons to believe this tomb has no relationship at all to Jesus and his family. Many are asking what to think about these claims. Therefore, I put together a quick two-page summary of some of the criticisms and concerns that surfaced in the first few hours after the announcement. Before we look at those criticisms, let's first review the history of this tomb.

We have known about this tomb since it was discovered in 1980. Back then, Israeli construction workers were digging the foundation for a new building in a Jerusalem suburb. Their digging revealed a cave with ten limestone ossuaries.

Archeologists removed the limestone caskets for examination.

When they were able to decipher the names on the ten ossuaries, they found: Jesua, son of Joseph, Mary, Mary, Mathew, Jofa and Judah, son of Jesua. At the time, one of Israel's most prominent archeologists (Professor Amos Kloner) didn't associate the crypt with Jesus. He rightly argued that the father of Jesus was a humble carpenter who couldn't afford a luxury crypt for his family. Moreover, the names on the crypt were common Jewish names.

None of this has stopped Cameron and Jacobovici from promoting the tomb as the family tomb of Jesus. They claim to have evidence (through DNA tests, archeological evidence, and Biblical studies) to prove that the ten ossuaries belong to Jesus and his family. They also argue that Jesus and Mary Magdalene might have produced a son named Judah. However, a number of biblical scholars say this is really just an old story now being recycled in an effort to create a media phenomenon that will sell books and guarantee a large audience for the television special.

First, does it really make sense that this would be the family tomb of Jesus? Remember that Jesus was in Jerusalem as a pilgrim and was not a resident of the city. How would his family be able to buy this tomb? As we already mentioned, Joseph (who had probably already died in Galilee) and his family did not have the funds to buy such an elaborate burial site. Moreover, they were from out of town and would need time to find this tomb location. To accept this theory, one has to believe they stole the body of Jesus and moved it to this tomb in a suburb of Jerusalem all within about a day's time.

Second, if this is the family tomb of Jesus and his family, why is Jesus referred to as the son of Joseph? As far as we can determine from history, the earliest followers of Jesus never called Jesus the son of Joseph. The record of history is that it was only outsiders who mistakenly called him that.

Third, if this is the family tomb of Jesus, why do we have the name of Matthew listed with the rest of the family? If this is the Matthew that traveled with Jesus, then he certainly was not a family member. And you would have to wonder why James (who remained in Jerusalem) would allow these inscriptions as well as allow the family to move the body from Jerusalem to this tomb and perpetrate a hoax that Jesus bodily rose from the grave. Also, the fourth-century church historian Eusebius writes that the body of James (the half-brother of Jesus) was buried alone near the temple mount and that his tomb was visited in the early centuries.

Fourth, there is the problem with the common names on the tombs. Researchers have cataloged the most common names at the time. The ten most common were: Simon/Simeon, Joseph, Eleazar, Judah, John/Yohanan, Jesus, Hananiah, Jonathan, Matthew, and Manaen/Menahem. These are some of the names found on the ossuaries and thus suggest that the tomb belonged to someone other than Jesus of Nazareth and his family. In fact, the name Jesus appears in 98 other tombs and on 21 other ossuaries.

Finally there is the question of the DNA testing. Apparently there is evidence that shows that the DNA from the woman (in what they say is the Mary Magdalene ossuary) and the DNA from the so-called Jesus ossuary does not match. So they argue that they were not relatives and thus must have been married.

But does the DNA evidence really prove that? It does not prove she is his wife. In fact, we really dont even know who in the ossuaries are related to the other. Moreover, we do not have an independent DNA control sample to compare these findings with. At best, the DNA evidence shows that some of these people are related and some are not.

All of this looks like sensationalism from Simcha Jacobovici (who has a reputation as an Indiana-Jones type) and James Cameron (the director of the highly fictionalized Titanic). The publicity s certain to sell books and draw a television

audience, but it is not good history or archaeology.

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Follow-up from Kerby 2/28/07

My commentary was a brief (two-page) summary of some of the criticisms and concerns that many people surfaced in the first few hours after the announcement. Now that we have a few days of reflection on the claims by James Cameron and Simcha Jacobovici, I think we can begin to provide an even more detailed perspective.

Here are some good commentaries and blogs posted by experts in the field as well some news articles that quote these people. Some of these experts have been able to see the Discovery Channel special "The Lost Tomb of Jesus" and thus can give even more detail than I was able to do when I first wrote my commentary on Monday, February 26. The first two links are for commentaries by Dr. Darrell Bock, Dallas Theological Seminary. He was on my radio program "Point of View" and provided some great insight. The next link is for a commentary by Ben Witherington, Asbury Theological Seminary. The following three are news articles quoting from experts:

Hollywood Hype: The Oscars and Jesus' Family Tomb, What do they share?
http://dev.bible.org/bock/node/106

No need to yell, only a challenge for some who need to step up and could:
http://dev.bible.org/bock/node/107

The Jesus Tomb? Titanic Talpiot tomb theory sunk from the start:
benwitherington.blogspot.com/2007/02/jesus-tomb-titanic-talpiot-tomb-theory.html

‘Jesus tomb’ documentary ignores biblical & scientific evidence, logic, experts say
http://www.bpnews.net/bpnews.asp?ID=25053

Ten reason why the Jesus tomb claim is bogus:
http://tinyurl.com/2rmj8a

Remains of the Day: Scholars dismiss filmmakers’ assertions that Jesus and his family were buried in Jerusalem:
http://www.christianitytoday.com/ct/2007/februaryweb-only/109-33.0.html

Kerby Anderson

The Case for a Creator

It has been the popular belief for decades that science and Christianity are light years apart. However, as our knowledge of cosmology, astronomy, physics, biochemistry, and DNA has continued to grow, this supposed gap has all but disappeared. Lee Strobel, award-winning journalist and former atheist, explores these and many other compelling evidences in his latest book, *The Case for a Creator*. In this article we will discuss just a handful of these evidences, as presented in his book, and find out how science itself is steadily nailing the lid on atheisms coffin.{1} Lets begin with the argument from cosmology.

Cosmology

Cosmology is the study of the origin of the universe. In investigating this field of study, Lee Strobel interviews philosopher and theologian, Dr. William Lane Craig. Craig describes in great detail what he calls “one of the most

plausible arguments for God's existence, the Kalam cosmological argument.{2} This argument has three simple steps: Whatever begins to exist has a cause. The universe began to exist. Therefore, the universe has a cause.

Craig then explains that when he first began to defend the Kalam argument he anticipated that the first step of the argument, whatever begins to exist has a cause, would be almost universally accepted. It was the second point, the universe began to exist, which he believed would be more controversial. However, so much evidence has accumulated, Craig explained, that atheists are finding it difficult to deny that the universe had a beginning. So theyve begun to attack the first premise instead.{3}

One such attack was presented in the April 2002 issue of *Discover* magazine. In an article entitled Guths Grand Guess, the author describes how quantum theory allows for thingsa dog, a house, a planetto be materialized out of a quantum vacuum. One professor is quoted as saying, Our universe is simply one of those things which happens from time to time.{4} Could such an audacious claim be valid?

Craig debunks this claim by making two very important points. First, These subatomic particles the article talks about are called virtual particles. They are theoretical entities and its not even clear that they actually exist as opposed to being merely theoretical constructs.{5} Secondly, however, these particles, if they are real, do not come out of nothing. The quantum vacuum is not what most people envision when they think of a vacuum that is, absolutely nothing. On the contrary, its a sea of fluctuating energy. This begs the question, So where does this energy come from? It must have a cause. So even quantum theory fails to explain the origin of the universe without a Creator. Rather, as Craig explains, the first cause of the universe is the transcendent personal Creator{6} of the Bible which states that In the beginning God created the heavens and the earth.

Anthropic Principle

What is called the *anthropic principle* essentially states that all seemingly arbitrary and unrelated constants in physics have one strange thing in common these are precisely the values you need if you want to have a universe capable of producing life.{7} To explore the particulars of this, Strobel interviews Robin Collins, who has doctorates in both physics and philosophy.

Collins, who has written several books on this subject, is asked to describe one of his favorite examples. He proceeds to illustrate the fine-tuned properties of gravity. He does so by comparing the range of possible gravitational force strengths with an old-fashioned linear radio dial that spans the entire width of the known universe. He says,

> *Imagine that you want to move the dial from where its currently set. Even if you were to move it by only one inch, the impact on life in the universe would be catastrophic. . . .*
>
> *That small adjustment of the dial would increase gravity by a billion-fold. . . .*
>
> *Animals anywhere near the size of human beings would be crushed. . . . As astrophysicist Martin Rees said, In an imaginary strong gravity world, even insects would need thick legs to support them, and no animals could get much larger. In fact, a planet with a gravitational pull of a thousand times that of the Earth would have a diameter of only forty feet, which wouldnt be enough to sustain an ecosystem. . . .*
>
> *As you can see, compared to the total range of force strengths in nature, gravity has an incomprehensibly narrow range of life to exist.{8}*

Collins goes on to discuss several other constants which show

a remarkable degree of fine-tuning such as the mass difference between neutrons and protons, electromagnetic forces, strong nuclear forces, and the cosmological constant. In fact, one expert has said that there are more than thirty separate physical or cosmological parameters that require precise calibration in order to produce a life-sustaining universe.{9}

It is this amazing degree of fine-tuning within physics which Collins believes is by far the most persuasive current argument of the existence of God.{10} The deeper we dig, Collins concludes, we see that God is more subtle and more ingenious and more creative than we ever thought possible. And I think that's the way God created the universe for usto be full of surprises."{11}

Astronomy

It had been said for years that there's nothing unusual about Earth. It's an average, unassuming rock that's spinning mindlessly around an unremarkable star in a run-of-the-mill galaxya lonely speck in the great enveloping cosmic dark, as the late Carl Sagan put it.{12} However, this is no longer thought to be the case. Even secular scientists are talking about the astounding convergence of numerous unexpected "coincidences" that make intelligent life possible on Earth, and in all likelihood, nowhere else in the universe.

In exploring these recent discoveries, Lee Strobel meets with Dr. Guillermo Gonzalez and Dr. Jay Wesley Richards, coauthors of the book *The Privileged Planet*. After hashing out a long list of unique characteristics of our own galaxy, our sun, and our planet, they then began to discuss another amazing coincidence: a whole new dimension of evidence that suggests this astounding world was created, in part, so we could have the adventure of exploring it.{13}

One of the more interesting examples given is that of a solar

eclipse. Perfect solar eclipses have allowed scientists to do things such as determine specific properties of stars and confirm predictions associated with Einsteins theory of relativity. Such things would be extremely difficult to explore if it werent for total eclipses. However, such eclipses are unique to Earth within our solar system. Of the nine planets and over sixty moons, only Earth provides the optimal scenario for viewing an eclipse. This is possible because our moon, which is 400 times smaller than our Sun, happens to also be exactly 400 times closer. This allows for just the right conditions for a perfect solar eclipse.

What intrigues Gonzalez is that the very time and place where perfect solar eclipses appear in our universe also corresponds to the one time and place where there are observers to see them.{14} Richards adds, What is mysterious is that the same conditions that give us a habitable planet also make our location so wonderful for scientific measurement and discovery. So we say there's a correlation between habitability and measurability.{15}

Indeed, this is exactly what we would expect if an all-loving, all-powerful God created the universe not only to sustain man but also, and most importantly, that man could find Him through it.

Information

In 1871, Darwin suggested in a personal letter that life may have originated spontaneously in some warm little pond, with all sorts [of chemicals] present.{16} However, in his day the immense complexity of living cells was virtually unknown. Today thats not the case. Modern science has revealed that cells are extremely complex and that this complexity is governed by the information packed structures of DNA. This raises the question, Where did this information come from?

To answer this question Strobel enlists the help of Dr. Stephen Meyer, who has degrees in physics, geology, history, and philosophy. During the course of their discussion, Meyer elaborates on various explanations as to the origin of information in the first living cell. After describing the virtual impossibility of simple random chance over time producing such information, and acknowledging the fact that virtually all origin-of-life experts have utterly rejected such an approach,{17} Strobel focuses Meyer in on a more recent attempt at an explanation, that which at times has been called *biochemical predestination*.

Meyer says the idea is that the development of life was inevitable because the amino acids in proteins and the bases, or letters, in the DNA alphabet had self-ordering capacities that accounted for the origin of the information in these molecules.{18} He then goes on to explain why this notion just isnt true.

First, he notes that the kind of self-ordering we see in nature, such as that in salt crystals, is repetitive; a particular sequence is simply repeated over and over again. It would be like handing a person an instruction book for how to build an automobile, Meyer explains, but all the book said was the-the-the-the-the. You couldnt hope to convey all the necessary information with that one-word vocabulary.{19}

Secondly, and more importantly, he points out that science has demonstrated the complete absence of any attraction between the four letters of the DNA code themselves. So theres nothing chemically that forces them into any particular sequence, Meyer states. The sequencing has to come from outside the system.{20}

For Strobel, as well as many scientists, the conclusion is compelling: An intelligent entity has quite literally spelled out evidence of His existence through the four chemical letters in the genetic code. Its almost as if the Creator

autographed every cell.{21}

Consciousness

Webster defines consciousness as the quality or state of being aware especially of something within oneself.{22} According to Darwinists, the physical world is all there is. Consciousness, therefore, is nothing more than a byproduct of the properties of chemicals. As far back as 1871, evolutionists believed that the mind is a function of matter, when that matter has attained a certain degree of organization.{23} Is this really true? Is the mind simply, as MITs Marvin Minsky put it, a computer made of meat?{24} Or is the Bible correct in its assertion that men and women are comprised of both material and immaterial components?

To address this question, Strobel interviews Dr. J. P. Moreland, who has degrees in chemistry and theology, and a Ph.D. in philosophy. One of the most compelling arguments presented by Moreland during this interview was the positive experimental evidence that consciousness and the self are more than simply a physical byproduct of the brain. For example, Moreland said, neurosurgeon Wilder Penfield electrically stimulated the brains of epilepsy patients and found he could cause them to move their arms or legs, turn their heads or eyes, talk, or swallow. Invariably the patient would respond by saying, I didn't do that. You did. According to Penfield, the patient thinks of himself as having an existence separate from his body. No matter how much Penfield probed the cerebral cortex, he said, There is no place . . . where electrical stimulation will cause a patient to [think]. Thats because [thought] originates in the conscious self, not the brain.{25}

As Strobel notes in agreement, it is evidence like this which has led one pair of scientists to conclude that physics, neuroscience, and humanistic psychology all converge on the same principle: mind is not reducible to matter. . . . The

vain expectation that matter might someday account for mind . . . is like the alchemist's dream of producing gold from lead.{26}

Conclusion

It is evidences like these, as well as the many others presented by Lee Strobel, which has continued to persuade scientists in every field of study that there must be a Designer. Naturalistic explanations are not sufficient to explain the beauty, complexity, and design that we observe both around us and within us. Strobel, indeed, presents an amazingly strong case for a Creator.

Notes

1. Lee Strobel, *The Case for a Creator* (Grand Rapids, Mich.: Zondervan, 2004) jacket.
2. Ibid., 97.
3. Ibid., 98.
4. Brad Lemley, "Guth's Grand Guess," *Discover* (April 2002) p. 35.
5. Strobel, 101.
6. Ibid., 110.
7. Ibid., 126.
8. Ibid., 132.
9. Ibid., 132.
10. Ibid., 130.
11. Ibid., 150.
12., Ibid., 153.
13. Ibid., 185.
14. Ibid., 186.
15. Ibid., 186.
16. Francis Darwin, *The Life and Letters of Charles Darwin* (New York: D. Appleton, 1887), 202.
17. Strobel, 229.
18. Ibid., 232.
19. Ibid., 234.

20. Ibid., 235.
21. Ibid., 244.
22. Merriam-Webster's Collegiate Dictionary, 10th ed., s.v., "Consciousness."
23. Thomas Huxley, "Mr. Darwin's Critics," *Contemporary Review* (November 1871)
24. Strobel, 250.
25. Ibid., 258.
26. Ibid., 272.

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Human Genome Project

Dr. Ray Bohlin takes a brief look at the accomplishment, purpose and consequence of the Human Genome Project.

 *This article is also available in Spanish.*

What's All the Fuss About the Human Genome Project?

In February of 2001, virtually every media outlet, whether TV news, newspapers, radio, Internet news services, or news magazines, was all worked up about the announcement of the completion of the Human Genome Project. In this article we will explore this monumental achievement and what it means for the future of medicine and our understanding of ourselves.

To appreciate this important accomplishment, we need to review a little basic genetics. It may actually astonish most adults just how much genetics the National Institutes of Health assumes we know about our genetic heritage. The educational video from the HGP includes a three-minute review of basic

genetic processes like DNA packaging, transcription of DNA into message RNA, and the translation of message RNA into protein. It’s no exaggeration to say that when I played this short piece during a lecture for high school students and their parents, mom and dad were left in the dust.

Honestly, I did that intentionally; because we are only in the beginning stages of a genetic revolution that will transform the way we diagnose and treat disease and how we may even alter our genetic structure. These new technologies bring with them numerous ethical and moral dilemmas we have only begun to address and for which there may not be simple answers. If we don’t take the time to familiarize ourselves with genetic research and its implications, we risk responding out of fear and ignorance and potentially throwing away crucial medical advances.

I have contended for a long time that we can no longer afford to remain ignorant of genetic technologies. They simply harbor far too great a power for both tremendous good and tremendous evil. We must work hard to take every thought captive to Christ and see what there is of benefit and what avenues of research and application we need to avoid to preserve human freedom and dignity.

Well let’s talk about our genome, the sum total of all our genes. In most of the 100 trillion cells of our body are 46 chromosomes. These chromosomes are tightly coiled and packed strings of a remarkable molecule called DNA (Deoxyribonucleic Acid). DNA is a polymer, a repetitive sequence of four molecules, which I will only refer to by their one-letter abbreviations, A, G, C, and T. The human genome sequence is simply the sequence of these four molecules in DNA from all our chromosomes. If you laid out the DNA from all our chromosomes in each of our cells end to end, it would stretch six feet long.

A gene is a segment of DNA that contains the precise coding

sequence for a protein. And proteins do all the real work in our cells. By looking at our completed sequence, it is predicted that our genome consists of 30,000 to 45,000 genes in each of our cells. So, now that we have the sequence, what does it mean? We'll begin answering that question in the next section.

What Does the Human Genome Project Hope to Accomplish?

The National Institutes of Health in cooperation with several international research organizations began the HGP in 1990 in the U.S. There were four primary objectives among the many goals of the HGP{1}.

The first and primary goal of the HGP was to map and sequence the entire human genome. There is a critical and significant difference between a map and the sequence. There are over three billion letters, or base pairs, in the human genome, spread out over 23 pairs of chromosomes. Trying to locate a sequence of say 1,000 letters, the code for a large protein, is a one in a million task. Therefore, researchers needed a refined roadmap to the genome. The map entails particular sequences that can be used like signs on a road map. If the trait a scientist is studying always seems to be present with this marker, the gene involved is probably nearby. In 1995, a detailed map was published with over 15,000 markers, one for every 200,000 base pairs. This will aid greatly in associating genes with particular diseases. And now with the sequence nearly complete, with over 99% accuracy, determining the precise effect of this gene on disease will be even easier.

A second critical goal was to map and sequence the genomes of several important model organisms: specifically, the bacterium E. coli, yeast, the roundworm, fruit fly, and mouse. This information is helpful, because each of these organisms have been used for laboratory studies for decades. Being able to

coordinate knowledge of their genomes with cellular and biological processes will certainly inform our study of the human genome and its various functions.

The third important objective of the HGP was to systemize and distribute the information it gathered. Any sequence over 2,000 base pairs is released within 24 hours. The sequence and map data is contained in publicly accessible databases on the Internet. The HGP has also been creating software and other tools for large-scale DNA analysis.

The fourth and final primary goal of the HGP was to study the ethical, legal, and social implications of genetic research. A full 5% of all funds appropriated for the HGP have been earmarked for these kinds of considerations. There are many concerns revolving around the use of genetic sequence data. Not the least of which are worries about ownership, patenting, access to personal sequence data by insurance companies, potential for job discrimination based on personal sequence data, and the prospects for genetic screening, therapy, and engineering. In the next section we'll begin investigating how the HGP thinks this information can be used.

What are the Long Term Hopes for the HGP?

The completion of the sequence was announced jointly in February 2001 in the journals *Nature*{2} and *Science*{3}. Both *Science* and *Nature* have made these landmark issues available, without subscription, on their websites.

The importance of recognizing the sequence of a particular gene has three important ramifications.{4} The first is diagnosis. Over the last few years, single genes have been found leading to deafness and epilepsy. Numerous genes, however, will influence most diseases in complex ways. Recently, genetic influences have been found in many forms of hypertension, diabetes, obesity, heart disease, and arteriosclerosis{5}. Genetic analysis of cancer tumors may

someday help determine the most effective drug therapy with the fewest side effects. Genetic diagnosis has the potential to more precisely prescribe treatments for many medical conditions.

Second, diagnosing ailments with more precision with genetics will also lead to more reliable predictions about the course of a disease. Genetic information about an individual's cholesterol chemistry will aid in predicting the course of potential heart disease. Obtaining a genetic fingerprint of a cancerous tumor will provide information concerning its degree of malignancy. Third, more precise genetic information will also lead to the development of better strategies for prevention of disease.

Many more ailments in newborns can eventually be screened more specifically to avoid disorders later in life. Currently, babies in the U.S. and other countries are routinely screened for PKU, a metabolic disorder that prevents the breakdown of a specific amino acid found in proteins. This condition becomes toxic to the nervous system, but can be prevented and managed with appropriate diet. Without dietary changes, affected babies face extreme mental retardation. Hopefully, the number of conditions this type of screening applies to can be expanded.

Screening can also be done for adults, to see if they may be carriers of potential genetic conditions. Certain Jewish and Canadian populations regularly obtain voluntary screening for Tay-Sachs disease, a known child-killer. This information has been used to help make decisions about future marriage partners.

Perhaps the greatest benefit will come from what is called gene-based therapy. Understanding the molecular workings of genes and the proteins they encode will lead to more precise drug treatments. The more precise the drug treatment, the fewer and milder will be the side effects.

Actual gene therapy, replacing a defective gene with its normal counterpart, is still very experimental. There are still many hurdles to overcome involving how to deliver the gene to the proper cells, controlling where that gene is inserted into a chromosome, and how it is activated.

Not surprisingly, some have seen the human genome sequence as a vindication of Darwin. We'll examine that contention next.

Did the Human Genome Sequence Vindicate Darwin?

Amid the controversy and exultation over the release of the near complete human genome sequence has been a not so quiet triumphal howling from evolutionary biologists. The similarity of many genes across boundaries of species, the seemingly messy patchwork nature of the genome, and the presence of numerous apparently useless repetitive and copied sequences all have been laid out for us as clear validations of evolution. Really!

If Darwin were alive today, he would be astounded and humbled by what we now understand about the human genome and the genomes of other organisms.

Let's take a closer look at the claims of one bioethicist, Arthur Caplan{6}, who thought the major news story was missed. So let's just pick a few of the more glaring statements to help us understand that little in his comments should be trusted.

First, Caplan says, "Eric Lander of the Whitehead Institute in Cambridge, Mass., said that if you look at our genome it is clear that evolution must make new genes from old parts."

While it may be true that we can see some examples of shared sequences between genes, it is by no means true that we see wholesale evidence of gene duplication throughout the genome.

According to one group of researchers,{7} less than 4,000 genes share even 30% of their sequences with other genes.

Over 25,000 genes, as much as 62% of the human genes mapped by the Human Genome Project, were unique, i.e., not likely the result of copying.

Second, Caplan says, "The core recipe of humanity carries clumps of genes that show we are descended from bacteria. There is no other way to explain the jerry-rigged nature of the genes that control key aspects of our development."

Not everyone agrees. The complexity of the genome does not mean, necessarily, that it has been jerry-rigged by evolution. There is still so much we do not know. Caplan is speaking more out of ignorance and assumption than data. Listen to this comment from Gene Meyers, one of the principal geneticists from Celera Genomics, from a story in the *San Francisco Chronicle*:

> *'What really astounds me is the architecture of life,' he said. 'The system is extremely complex. It's like it was designed.'*
>
> *My ears perked up. 'Designed? Doesn't that imply a designer, an intelligence, something more than the fortuitous bumping together of chemicals in the primordial slime?'*
>
> *Myers thought before he replied. 'There's a huge intelligence there. I don't see that as being unscientific. Others may, but not me.'{8}*

Jerry-rigged? Hardly! Confusing at the moment? Certainly! But more likely to reveal hidden levels of complexity, rather than messy jerry-rigging.

It will take more than bluster to convince me that our genome is solely the result of evolution. The earmarks of design are clear, that is, if you have eyes to see.

What are the Challenges of the Human Genome Project?

In closing, I would like to address what are many people's concerns about the potential for abuse of this information. While there is great potential for numerous positive uses of the human genome, many fear unintended consequences for human freedom and dignity.

Some are justifiably worried about the rush to patent human genes. The public consortium, through the National Institutes of Health, has made all its information freely available and intends to patent nothing. However, there are several patent requests pending on human genes from the time before the HGP was completed.

It is important to realize that these patents are not necessarily for the genes themselves. What the patent does protect is the holder's right to priority to any products derived from using the sequence in research. With the full sequence fully published, this difficult question becomes even more muddled. No one is anxious for the courts to try its hand at settling the issue. Somehow companies will need some level of protection to provide new therapies based on genetic information without hindering the public confidence and health.

Another concern is the availability of information about individual genetic conditions. There are legitimate worries about employers using genetic information to discriminate over whom they will hire or when current employees will be laid off or forced into retirement. Upwards of 80-90% of Americans believe their genetic information should be private and obtained or accessed only with their permission. The same fears arise as to the legality of insurance companies using private genetic information to assess coverage and rates. A recent bill (June 29,2000) before Congress to address these

very concerns was amended to the Health and Human Services appropriations bill, but was removed in committee. The bill will be reintroduced this session.{9} I would be very surprised if some level of privacy protection is not firmly in place by 2002.

Moreover, many are apprehensive about the general speed of discovery and the very real possibilities of genetic engineering creating a new class, the genetically enhanced. Certainly, there is cause for vigilance and a watchful eye. I have said many times that we can no longer afford to be ignorant of genetic technologies. And while I agree that the pace of progress could afford to slow down a little, let's be careful not to throw the baby out with the bathwater.

After a series of lectures on genetic engineering and human cloning at a Christian high school, one student wrote me to say:

> *I am a senior, in an AP Biology class, and I find genetics absolutely fascinating. It's both fascinating and scary at the same time. . . . [You have inspired me] to not be afraid of the world and science in particular, but to take on its challenge and trust God.*

Amen to that!

Notes

1. "Genetics: The Future of Medicine," *NIH*, Publication No. 00-4873, 2.
2. *Nature*, 409 (15 February, 2001), www.nature.com.
3. *Science*, 291 (16 February, 2001), www.sciencemag.org.
4. Genetics: The Future of Medicine, 9-11.
5. Kevin Davies, "After the genome: DNA and human disease," *Cell*, 104 (Feb. 23, 2001), 465-467.
6. www.probe.org/did-the-human-genome-project-prove-that-darwin-w

as-right/.
7. Wen-Siung Li, Zhenglong Gu, Haidong Waing, and Anton Nekrutenko, "Evolutionary analyses of the human genome," *Nature*, 409 (15 Feb 2001):847-849.
8. Tom Abate, "Human Genome Map Has Scientists Talking About the Divine – Surprisingly low number of genes raises big questions," Monday, February 19, 2001, *San Francisco Chronicle*.
9. James M. Jeffords and Tom Daschle, "Political issues in the genomic era," *Science*, 291 (16 February, 2001), 1249-1251.

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Human Genetic Engineering

Although much has occurred in this field since this article was written in 2000, the questions addressed by Dr. Bohlin are still timely and relevant. Is manipulating our genetic code simply a tool or does it deal with deeper issues? Dealing with genetic engineering must be done within the context of the broader ethical and theological issues involved. In the article, Dr. Bohlin provides an excellent summary driven from his biblical worldview perspective.

What forms of genetic engineering can be done in human beings?

Genetic technology harbors the potential to change the human species forever. The soon to be completed Human Genome Project will empower genetic scientists with a human biological instruction book. The genes in all our cells contain the code for proteins that provide the structure and function to all our tissues and organs. Knowing this complete code will open

new horizons for treating and perhaps curing diseases that have remained mysteries for millennia. But along with the commendable and compassionate use of genetic technology comes the specter of both shadowy purposes and malevolent aims.

For some, the potential for misuse is reason enough for closing the door completely—the benefits just aren't worth the risks. In this article, I'd like to explore the application of genetic technology to human beings and apply biblical wisdom to the eventual ethical quagmires that are not very far away. In this section we'll investigate the various ways humans can be engineered.

Since we have introduced foreign genes into the embryos of mice, cows, sheep, and pigs for years, there's no technological reason to suggest that it can't be done in humans too. Currently, there are two ways of pursuing gene transfer. One is simply to attempt to alleviate the symptoms of a genetic disease. This entails gene therapy, attempting to transfer the normal gene into only those tissues most affected by the disease. For instance, bronchial infections are the major cause of early death for patients with cystic fibrosis (CF). The lungs of CF patients produce thick mucus that provides a great growth medium for bacteria and viruses. If the normal gene can be inserted in to the cells of the lungs, perhaps both the quality and quantity of their life can be enhanced. But this is not a complete cure and they will still pass the CF gene on to their children.

In order to cure a genetic illness, the defective gene must be replaced throughout the body. If the genetic defect is detected in an early embryo, it's possible to add the gene at this stage, allowing the normal gene to be present in all tissues including reproductive tissues. This technique has been used to add foreign genes to mice, sheep, pigs, and cows.

However, at present, no laboratory is known to be attempting this well-developed technology in humans. Princeton molecular

biologist Lee Silver offers two reasons.{1} First, even in animals, it only works 50% of the time. Second, even when successful, about 5% of the time, the new gene gets placed in the middle of an existing gene, creating a new mutation. Currently these odds are not acceptable to scientists and especially potential clients hoping for genetic engineering of their offspring. But these are only problems of technique. It's reasonable to assume that these difficulties can be overcome with further research.

Should genetic engineering be used for curing genetic diseases?

The primary use for human genetic engineering concerns the curing of genetic disease. But even this should be approached cautiously. Certainly within a Christian worldview, relieving suffering wherever possible is to walk in Jesus' footsteps. But what diseases? How far should our ability to interfere in life be allowed to go? So far gene therapy is primarily tested for debilitating and ultimately fatal diseases such as cystic fibrosis.

The first gene therapy trial in humans corrected a life-threatening immune disorder in a two-year-old girl who, now ten years later, is doing well. The gene therapy required dozens of applications but has saved the family from a $60,000 per year bill for necessary drug treatment without the gene therapy.{2} Recently, sixteen heart disease patients, who were literally waiting for death, received a solution containing copies of a gene that triggers blood vessel growth by injection straight into the heart. By growing new blood vessels around clogged arteries, all sixteen showed improvement and six were completely relieved of pain.

In each of these cases, gene therapy was performed as a last resort for a fatal condition. This seems to easily fall within the medical boundaries of seeking to cure while at the same

time causing no harm. The problem will arise when gene therapy will be sought to alleviate a condition that is less than life-threatening and perhaps considered by some to simply be one of life's inconveniences, such as a gene that may offer resistance to AIDS or may enhance memory. Such genes are known now and many are suggesting that these goals will and should be available for gene therapy.

The most troublesome aspect of gene therapy has been determining the best method of delivering the gene to the right cells and enticing them to incorporate the gene into the cell's chromosomes. Most researchers have used crippled forms of viruses that naturally incorporate their genes into cells. The entire field of gene therapy was dealt a severe setback in September 1999 upon the death of Jesse Gelsinger who had undergone gene therapy for an inherited enzyme deficiency at the University of Pennsylvania.{3} Jesse apparently suffered a severe immune reaction and died four days after being injected with the engineered virus.

The same virus vector had been used safely in thousands of other trials, but in this case, after releasing stacks of clinical data and answering questions for two days, the researchers didn't fully understand what had gone wrong.{4} Other institutions were also found to have failed to file immediate reports as required of serious adverse events in their trials, prompting a congressional review.{5} All this should indicate that the answers to the technical problems of gene therapy have not been answered and progress will be slowed as guidelines and reporting procedures are studied and reevaluated.

Will correcting my genetic problem, prevent it in my descendants?

The simple answer is no, at least for the foreseeable future. Gene therapy currently targets existing tissue in a existing

child or adult. This may alleviate or eliminate symptoms in that individual, but will not affect future children. To accomplish a correction for future generations, gene therapy would need to target the germ cells, the sperm and egg. This poses numerous technical problems at the present time. There is also a very real concern about making genetic decisions for future generations without their consent.

Some would seek to get around these difficulties by performing gene therapy in early embryos before tissue differentiation has taken place. This would allow the new gene to be incorporated into all tissues, including reproductive organs. However, this process does nothing to alleviate the condition of those already suffering from genetic disease. Also, as mentioned earlier this week, this procedure would put embryos at unacceptable risk due to the inherent rate of failure and potential damage to the embryo.

Another way to affect germ line gene therapy would involve a combination of gene therapy and cloning.{6} An embryo, fertilized *in vitro*, from the sperm and egg of a couple at risk for sickle-cell anemia, for example, could be tested for the sickle-cell gene. If the embryo tests positive, cells could be removed from this early embryo and grown in culture. Then the normal hemoglobin gene would be added to these cultured cells.

If the technique for human cloning could be perfected, then one of these cells could be cloned to create a new individual. If the cloning were successful, the resulting baby would be an identical twin of the original embryo, only with the sickle-cell gene replaced with the normal hemoglobin gene. This would result in a normal healthy baby. Unfortunately, the initial embryo was sacrificed to allow the engineering of its identical twin, an ethically unacceptable trade-off.

So what we have seen, is that even human gene therapy is not a long-term solution, but a temporary and individual one. But

even in condoning the use of gene therapy for therapeutic ends, we need to be careful that those for whom gene therapy is unavailable either for ethical or monetary reasons, don't get pushed aside. It would be easy to shun those with uncorrected defects as less than desirable or even less than human. There is, indeed, much to think about.

Should genetic engineering be used to produce super-humans?

The possibility of someone or some government utilizing the new tools of genetic engineering to create a superior race of humans must at least be considered. We need to emphasize, however, that we simply do not know what genetic factors determine popularly desired traits such as athletic ability, intelligence, appearance and personality. For sure, each of these has a significant component that may be available for genetic manipulation, but it's safe to say that our knowledge of each of these traits is in its infancy.

Even as knowledge of these areas grows, other genetic qualities may prevent their engineering. So far, few genes have only a single application in the body. Most genes are found to have multiple effects, sometimes in different tissues. Therefore, to engineer a gene for enhancement of a particular trait—say memory—may inadvertently cause increased susceptibility to drug addiction.

But what if in the next 50 to 100 years, many of these unknowns can be anticipated and engineering for advantageous traits becomes possible. What can we expect? Our concern is that without a redirection of the worldview of the culture, there will be a growing propensity to want to take over the evolution of the human species. The many people see it, we are simply upright, large-brained apes. There is no such thing as an independent mind. Our mind becomes simply a physical construct of the brain. While the brain is certainly

complicated and our level of understanding of its intricate machinery grows daily, some hope that in the future we may comprehend enough to change who and what we are as a species in order to meet the future demands of survival.

Edward O. Wilson, a Harvard entomologist, believes that we will soon be faced with difficult genetic dilemmas. Because of expected advances in gene therapy, we will not only be able to eliminate or at least alleviate genetic disease, we may be able to enhance certain human abilities such as mathematics or verbal ability. He says, "Soon we must look deep within ourselves and decide what we wish to become."{7} As early as 1978, Wilson reflected on our eventual need to "decide how human we wish to remain."{8}

Surprisingly, Wilson predicts that future generations will opt only for repair of disabling disease and stop short of genetic enhancements. His only rationale however, is a question. "Why should a species give up the defining core of its existence, built by millions of years of biological trial and error?"{9} Wilson is naively optimistic. There are loud voices already claiming that man can intentionally engineer our "evolutionary" future better than chance mutations and natural selection. The time to change the course of this slow train to destruction is now, not later.

Should I be able to determine the sex of my child?

Many of the questions surrounding the ethical use of genetic engineering practices are difficult to answer with a simple yes or no. This is one of them. The answer revolves around the method used to determine the sex selection and the timing of the selection itself.

For instance, if the sex of a fetus is determined and deemed undesirable, it can only be rectified by termination of the embryo or fetus, either in the lab or in the womb by abortion.

There is every reason to prohibit this process. First, an innocent life has been sacrificed. The principle of the sanctity of human life demands that a new innocent life not be killed for any reason apart from saving the life of the mother. Second, even in this country where abortion is legal, one would hope that restrictions would be put in place to prevent the taking of a life simply because it's the wrong sex.

However, procedures do exist that can separate sperm that carry the Y chromosome from those that carry the X chromosome. Eggs fertilized by sperm carrying the Y will be male, and eggs fertilized by sperm carrying the X will be female. If the sperm sample used to fertilize an egg has been selected for the Y chromosome, you simply increase the odds of having a boy (~90%) over a girl. So long as the couple is willing to accept either a boy or girl and will not discard the embryo or abort the baby if it's the wrong sex, it's difficult to say that such a procedure should be prohibited.

One reason to utilize this procedure is to reduce the risk of a sex-linked genetic disease. Color-blindness, hemophilia, and fragile X syndrome can be due to mutations on the X chromosome. Therefore, males (with only one X chromosome) are much more likely to suffer from these traits when either the mother is a carrier or the father is affected. (In females, the second X chromosome will usually carry the normal gene, masking the mutated gene on the other X chromosome.) Selecting for a girl by sperm selection greatly reduces the possibility of having a child with either of these genetic diseases. Again, it's difficult to argue against the desire to reduce suffering when a life has not been forfeited.

But we must ask, is sex determination by sperm selection *wise?* A couple that already has a boy and simply wants a girl to balance their family, seems innocent enough. But why is this important? What fuels this desire? It's dangerous to take more and more control over our lives and leave the sovereignty of

God far behind. This isn't a situation of life and death or even reducing suffering.

But while it may be difficult to find anything seriously wrong with sex selection, it's also difficult to find anything good about it. Even when the purpose may be to avoid a sex-linked disease, we run the risk of communicating to others affected by these diseases that because they *could* have been avoided, their life is somehow less valuable. So while it may not be prudent to prohibit such practices, it certainly should not be approached casually either.

Notes

1. Lee Silver, *Remaking Eden: Cloning and Beyond in a Brave New World*, New York, NY: Avon Books, p. 230-231.
2. Leon Jaroff, Success stories, *Time*, 11 January 1999, p. 72-73.
3. Sally Lehrman, Virus treatment questioned after gene therapy death, *Nature* Vol. 401 (7 October 1999): 517-518.
4. Eliot Marshall, Gene therapy death prompts review of adenovirus vector, *Science* Vol. 286 (17 December 1999): 2244-2245.
5. Meredith Wadman, NIH under fire over gene-therapy trials, *Nature* Vol. 403 (20 January 1999): 237.
6. Steve Mirsky and John Rennie, What cloning means for gene therapy, *Scientific American*, June 1997, p. 122-123.
7. Ibid., p. 277.
8. Edward Wilson, O*n Human Nature*, Cambridge, Mass.: Harvard University Press, p. 6.
9. E. Wilson, *Consilience*, p. 277.

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Genetic Engineering – A Christian Scientist's Perspective

Dr. Ray Bohlin examines the rapidly moving world of genetic engineering from a Christian worldview perspective. He explains that most genetic engineering attempts to make more efficient changes similar to those previously done through selective breeding and other conventional techniques. However, those working in the field need to be aware of the ethical and religious issues that arise in this area of science.

What Is Genetic Engineering?

Our culture teeters on the edge of a steep and dangerous precipice. New technologies will soon allow us to change, radically and permanently, the world in which we live. Indeed, we will hold in our hands the capability of directly and purposefully changing who we are as human beings. The technology I am speaking of is genetic engineering.{1} Ethical and technical questions swirl around discussions of genetic engineering like the wall clouds of the eye of a hurricane. Many in society seem to be bracing themselves for the disappearance of the calm of the eye and the coming of the full force of a powerful and destructive combination of new plants and animals unleashed on an unsuspecting environment, with new and improved humans designed to succeed.

Before your alarm buttons go on overload, let me say that I hope to lend a reassuring voice with a dose of sober realism. Genetic technology will undoubtedly unleash great power to change our world forever, but should it, and will it? In this article I want to explore just a few of the technical and ethical questions we face as a society. The time to discuss

these issues is now, while we still have time to think without simply reacting.

The phrase *genetic engineering*, unfortunately, often conjures up images of macabre experiments resulting in Frankenstein-like monsters and the cold-hearted use of genetic information to create new social classes depending on our genes, as in the 1997 film *Gattaca*.{2} However, genetic engineering can simply be defined as the manipulation or alteration of the genetic structure of a single cell or organism.

Sometimes the manipulation of an organism's genome, the totality of all its genes, can simply refer to the project of identifying its complete DNA sequence in order to gain information for future study and potential alteration. The Human Genome Project is therefore, in a sense, a form of genetic engineering because the human genome must be broken up and manipulated in order to gain the desired information.

Ordinarily, genetic engineering refers to the direct addition, deletion, or intentional mutation of an organism's DNA sequence to produce a desired effect. Knockout experiments in mice seek to determine the effects of eliminating a particular gene from the mouse genome. Recombinant DNA experiments usually take a gene found in one organism and place the gene into another organism. These animals can be of the same or different species.

Sometimes researchers will simply change the DNA sequence in a gene to study what effect the specific change has on the gene or its protein product. All of these alterations fall under the umbrella of genetic engineering. In this broad definition, genetic engineering is neither good nor evil. The nature of the experiments themselves will determine if they are moral or immoral.

Why Are There Genetic Illnesses?

The initial thrust of genetic research is the treatment and potential cure of genetic illnesses. Therefore, we must explore why genetic illnesses occur at all. “Why questions” within science usually occur on two levels and are notoriously difficult. The first level and usually the easier of the two are the scientific. The “why” is best changed to “how.” For our purposes this means, How do genetic illnesses arise? The second, more difficult question asks on a moral basis, Why do genetic illnesses occur?

The answer to the first question, How do genetic illnesses arise?, is simply, mutations. Mutations are mistakes in the DNA sequence. Sometimes a mutation is simply the substitution of one nucleotide for another.

Mutations can also result from a piece of DNA being deleted. This may cause one or more codons to disappear. In cystic fibrosis (CF), codon 508 out of 1,480 is missing, causing one amino acid to be removed from the resulting protein. This causes the severe respiratory and digestive problems of CF patients that are usually lethal before their 30th birthday.

So far, genes for more than 1,200 human disorders have been identified, which are found over all twenty-three pairs of human chromosomes. Some estimate that there may be as many as 3,000 to 4,000 human genetic disorders that are due to defects in a single gene. Most disorders, however, will be due to mutations in a host of genes.

The moral question is perhaps not so difficult in its answer, but in our acceptance of the answer. Mutations exist as a result of the Fall. We know the serpent was cursed, Eve was cursed, and Adam was cursed (Gen. 3:14-19). But Romans 8:18-22 also tells us that all creation was subjected to futility, groans and suffers, and eagerly awaits the revealing of the sons of God so it may be set free from its slavery to

corruption. This world is not as God intended.

Asking why someone suffers from a genetic disease is no different than asking why someone was killed in a traffic accident when others walked away. We know our suffering is temporary. We know that God will somehow work it all out for good (Rom. 8:28). But in 2 Corinthians Paul tells us we suffer so we can comfort those who suffer after us (1:4), so other sufferers will know they are not alone (1:6), and, principally, we suffer so we will trust in God and not ourselves (1:9).

Part of the Christian mission has always been to alleviate suffering where possible. While Jesus' miracles clearly were part of fulfilled prophecy, they were also about relief from suffering. Genetic engineering, while possessing a power that can be used for evil, which we will discuss, also at least has the potential to relieve the suffering from, if not even cure, genetic disease.

Could Changing Genetic Material Produce a Dangerous Superbug?

One concern that many people have about genetic engineering is the possibility of unintentionally creating a superbug or a damaging plant or animal whose destructive nature is only discovered after the fact. After all, our knowledge of the workings of genes and proteins is still growing. We hear constantly how complex everything is. What makes us think we can tinker with this incredible biological reservoir of information without making some incredible blunder from which there is no turning back?

When genetic engineering in bacteria was first discovered and introduced (Recombinant DNA technology), many scientists had this very fear. This was partially the reason for the self-imposed moratorium and four levels of containment in the early 1970s. But geneticists and molecular biologists found that

dangerous, unintentional consequences were virtually nonexistent. Enforcement of the guidelines eventually relaxed and soon became outdated and ignored. What this means is that researchers were quite convinced that transferring DNA of known sequence and function into bacterial chromosomes and plasmids did not result in unforeseen consequences. The procedure became routine and straightforward.

This does not mean that someone, somewhere, won't use biotechnology to produce a superbug intentionally. Certainly this technology can be used to produce even more powerful and resistant agents of biological warfare. Some even speculated that HIV (human immunodeficiency virus), the virus that causes AIDS, was intentionally produced. Though this hypothesis has been successfully refuted, the prospect remains that DNA recombinant technology has opened up a new field that can be used for evil.

However, we must be clear that this is not the fault of the technology itself. It is entirely human to shrink with fear away from things that we don't understand. The first predictable reaction of tribal societies when faced with modern technology was to cower in fear. Something dreadful was about to descend upon them. Usually this didn't happen and, with some education and familiarity, fear dissipated. But only human agents alone can make evil choices. Fire will heat our homes and cook our food, but it can also kill indiscriminately in the hands of an arsonist. But fire itself is not evil.

What should concern us more than the advent of biotechnology is the growing popularity of a totally secular and naturalistic worldview. Naturalism contends that humans are just complicated animals. The end result of this assumption is that ethics becomes an exercise in simply determining what works, not what is right.

Biotechnology is powerful, indeed, but we cannot put the genie back in the bottle. Therefore we must engage the discussion as

to how this technology can be used to cure disease and not become another snare to degrade and dehumanize people's lives.

Are We Playing God by Creating Organisms That Never Existed Before?

Unfortunately, the concept of playing God means different things to different people.{3} For some it may have nothing to do with God at all. They are simply expressing awe and wonder at the power that humans can wield over nature.

For some Christians, however, the notion of playing God carries a pietistic view of God's realm of activity versus that of the human race. In this context, playing God means performing tasks that are reserved for God and God alone. If this is what genetic technology does, then the concerns about playing God are justified. But what is often being reflected in this perspective is that God acts where we are ignorant and it should stay that way.

What is really at stake is fear, fear of what we may learn, fear of what new responsibility this new knowledge will put on our shoulders, and fear that this new knowledge will be used to harm us and not for the common good. The point was made that technology itself is not evil. Any technology can be used to further God's purposes or hinder them. People make those decisions, not technology.

By the very fact that we are called to be stewards of God's creation (Gen. 1:26-28), we need to expand our knowledge of what God has made in order to better rule over His creation. Part of being made in God's image is our creativity. In this sense we "play God" by imitating Him. Our works of art, buildings, management of natural parks, and care for the poor, sick, and disadvantaged all imitate God for the good of His creation.

But we are still creating new creatures that did not exist

before. Isn’t God the only Creator in that sense? We seldom realize that we are hard-pressed to find in nature today the ancestors of nearly all the plants and animals we use for food or service. Our current varieties of corn, wheat, flowers, cattle, dogs, horses, etc., bear little resemblance to the original stock in nature. That is because we have selected and manipulated them over the millennia for our own purposes. We have already created animals and plants that never existed before. Genetic technology has greatly increased the specificity and power of our abilities, but the nature of what we can do is the same as before.

If we are to play God in the sense of imitating Him as we apply the truth of being created in His image and in exercising our appointment as stewards over all He has made, then we need to do so with humility and compassion. Our creative abilities should be used to enhance the condition of men and women as we struggle in a fallen world. Genetic technologies can and should be used to help alleviate or even cure the effects of genetic disease.

Is It Wrong to Combine Genes from Different Species?

Have you ever wondered if we should be transferring genes from one species to another at all? Does this in itself violate some ethical principle? One gene does not define a species. Bacteria are composed of thousands of genes and it is estimated that humans possess as many as 100,000 genes. Therefore, transferring one gene from one organism to another does not create a hybrid in the traditional sense. Genes, remember, are composed of DNA. DNA is a molecule; it is not living in and of itself.

If the idea of adding something foreign to an organism is troublesome, just realize that we do this all the time when we take antibiotics, over the counter pain medications, and other

synthetic medications. Our bodies would never come across most of these substances in nature.

What is different is that with genetic engineering, we have added something to a cell or organism that will change the composition of that cell or organism, possibly for as long as it lives, and is potentially passed on to future generations. It is reasonable to ask if we have the wisdom even to try to make these kinds of changes. No doubt, genetic technology provides a power never before possessed by human beings: to design intentionally or create a new variety of organism by altering its genetic structure.

Once again, the issues are, Which genes are actually being transferred? and, For what purpose? These questions, asked case by case, should rule our choices, not the inherent legitimacy of genetic engineering itself. Creating crops internally resistant to disease, particularly to help developing countries better feed their people, is a goal worthy of God's image-bearers.

However, intentionally manipulating the gene of a known pathogenic and deadly bacterium with the expressed intent of creating a biological weapon that is untreatable and incurable is a hideous evil. Kerby Anderson also warns that we need to consider the extent that genetic manipulation may cross over barriers God instituted in the created kinds.{4} If God felt it important to create boundaries of reproduction that his creatures were to stay within, we ought not cross over them ourselves (Gen. 1:11, 12, 21, 24, 25).

It is certainly possible for genetically modified organisms created for agricultural and medical purposes to develop in ways not planned or foreseen. Therefore, it is necessary that proper and extensive tests be performed to assure, as much as possible, that no unnecessary harm will come to the environment or to humans. As vague as this prescription is, it only serves to reinforce the necessity of further education on

the part of everyone to ensure that this powerful technology is used responsibly. We simply cannot afford to be ignorant of genetic issues and technologies and expect to contribute to the necessary discussion that lies ahead.

Notes

1. An excellent resource for Christians on this topic is *Genetic Engineering: A Christian Response*, Timothy J. Demy and Gary P. Stewart, eds. (Grand Rapids, MI: Kregel Publications, 1999)
2. *Gattaca*, a film by Andrew Niccol, A Jersey Films production, distributed by Columbia Pictures, 1997.
3. Allen D. Verhey, "Playing God," in *Genetic Ethics: Do the Ends Justify the Genes?* (Grand Rapids, MI: Eerdmans Publ. Co., 1997), 60-74.
4. J. Kerby Anderson, "The Ethics of Genetic Engineering and Artificial Reproduction," in *Genetic Engineering: A Christian Response*, Timothy J. Demy and Gary P. Stewart.

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A Darwinian View of Life

Probe's Dr. Ray Bohlin reviews Richard Dawkins' anti-theistic book, A River Out of Eden: A Darwinian View of Life*, showing the holes in Dawkins' arguments.*

A River of DNA

A River Out of Eden: A Darwinian View of Life by Richard Dawkins is the fourth in a series being published by Basic Books entitled "The Science Masters Series." This series is said to be "a global publishing venture consisting of original

science books written by leading scientists. “Purposing to “present cutting-edge ideas in a format that will enable a broad audience to attain scientific literacy,” this series is aimed at the non-specialist.

The first three releases were *The Last Three Minutes: Conjectures about the Ultimate End of the Universe* by Paul Davies, *The Origin of Humankind* by Richard Leakey, and *The Origin of the Universe* by John D. Barrow. These were followed by the contribution from Dawkins. A look at these books, and at future contributors like Daniel Dennett, Jared Diamond, Stephen Jay Gould, Murray Gell-Mann, Lynn Margulis, and George C. Williams, makes the endeavor look less like a scientific literacy series and more like an indoctrination in philosophical naturalism.

The exposition of a Darwinian view of life by Dawkins in *River Out of Eden* certainly fits into the overt anti-theism category. His “River Out of Eden” is a river of DNA that is the true source of life and the one molecule that must be understood if life is to be understood.

This river of DNA originally flowed as one river (one species) which eventually branched into two, three, four, and eventually millions of rivers. Each river is distinct from the others and no longer exchanges water with the others, just as species are isolated reproductively from other species. This metaphor allows Dawkins to explain both the common ancestry of all life along with the necessity of gradualism in the evolutionary process.

Dawkins refers to this river of DNA as a digital river. That is, the information contained in the DNA river is completely analogous to the digital information of languages and computers.

Surprisingly, Dawkins gives away the store in this first chapter. In pressing home the digital analogy, Dawkins first

uses probability to indicate that the code arose only once and that we are all, therefore, descended from a common ancestor:

> *The odds of arriving at the same 64:21 (64 codons: 21 amino acids) mapping twice by chance are less than one in a million million million million million. Yet the genetic code is in fact identical in all animals, plants and bacteria that have ever been looked at. All earthly living things are certainly descended from a single ancestor.(p. 12)*

So it is reasonable to use probability to indicate that the code could not have arisen twice, but there is no discussion of the probability of the code arising by chance even once. A curious omission! If one tried to counter with such a question, Dawkins would predictably fall back on the assumption of naturalism that since we know only natural processes are available for the origin of anything, the genetic code must have somehow beaten the odds.

African Eve

Chapter 2 attempts to tell the story of the now famous "African Eve." African Eve embodies the idea that we are all descended from a single female, probably from Africa, about 200,000 to 100,000 years ago. This conclusion originates from sequence data of the DNA contained in mitochondria.

Mitochondria are tiny little powerhouses that produce energy in each and every cell of your body. Just as your body contains many organs that perform different functions, the cell contains many organelles that also perform specific functions. The mitochondrion is an organelle whose task is to produce energy molecules the cell can use to accomplish its tasks.

However, mitochondria are also the only organelle to contain their own DNA. Certain proteins necessary to the function of mitochondria are coded for by the mitochondrial DNA and not by

the nuclear DNA like every other protein in the cell. One other unique aspect of mitochondria is their maternal inheritance. That is, all the mitochondria in your body are descended from the ones you initially inherited from your mother. The sperm injects only its DNA into the egg cell, not its mitochondria. Therefore, an analysis of mitochondrial DNA reveals maternal history only, uncluttered by the mixture of paternal DNA like nuclear DNA. That's why these studies only revealed an African Eve, though other recent studies claim to have followed DNA from the Y chromosome to indicate an ancient "Adam."

Now these scientists don't actually think they have uncovered proof of a real Adam and Eve. They only use the names as metaphors. But this action does reveal a shift in some evolutionists minds that there is a single universal ancestor rather than a population of ancestors. This at least is closer to a biblical view rather than farther away.

Finally, Dawkins makes his case for the reliability of these molecular phylogenies in general. Here he glosses over weaknesses in the theory and actually misrepresents the data. On page 43 he says, "On the whole, the number of cytochrome c letter changes separating pairs of creatures is pretty much what we'd expect from previous ideas of the branching pattern of the evolutionary tree." In other words, Dawkins thinks that the trees obtained from molecular sequences nearly matches the evolutionary trees we already had. Later on page 44, when speaking of all molecular phylogenies performed on various sequences, he says, "They all yield pretty much the same family tree which by the way, is rather good evidence, if evidence were needed, that the theory of evolution is true."

Well, besides implying that evidence is not really needed to prove evolution, Dawkins stumbles in trying to display confidence in the molecular data. What exactly does "pretty much" mean anyway? Inherent in that statement are the numerous contradictions that don't fit the predictions or the ambiguous

holes in the general theory. But then, evidence isn't really needed anyway is it?

While this chapter contained the usual degree of arrogance from Dawkins, particularly in his disdain for the original account of Adam and Eve, it was somewhat less compelling or persuasive than is his usual style. He hedged his bet frequently and simply waived his hand at controversy. Unfortunately, this may not be picked up by the unwary reader.

Scoffing at Design

In Chapter 3 Dawkins launches a full-scale assault on the argument from design. After presumably debunking arguments from the apparent design of mimicry (not perfect design, you know, just good enough), Dawkins states, "Never say, and never take seriously anybody who says, 'I cannot believe so-and-so could have evolved by gradual selection.' I have dubbed this fallacy 'the Argument from Personal Incredulity.'"

To some degree I'm afraid that many creationists have given Dawkins and others an easy target. Such a statement, "I cannot believe…," has been used many times by well-meaning creationists but is really not very defensible. It is not helpful to simply state that you can't believe something; we must elaborate the reasons why. First, Dawkins levels the charge that much of what exists in nature is far from perfectly designed and is only good enough. This he claims is to be expected of natural selection rather than a designer. This is because a designer would design it right while natural selection has to bumble and fumble its way to a solution. To begin with, the lack of perfection in no way argues for or against a designer.

I have always marveled at some evolutionists who imply that if it isn't perfect, then Nature did it. Just what is perfection? And how are we to be sure that our idea of a perfect design wasn't rejected by the Creator because of some flaw we cannot

perceive? It is a classic case of creating God in our own image.

The evolutionists are the ones guilty of erecting the straw man argument in this instance. In addition, Dawkins fully admits that these features work perfectly well for the task at hand. The Creator only commanded His creatures to be fruitful and multiply, not necessarily to be perfectly designed (humanly speaking) wonders. Romans 1:18-20 indicates that the evidence is sufficient if you investigate thoroughly.

Dawkins further closes off criticism by declaring that "there will be times when it is hard to think of what the gradual intermediates may have been. These will be challenges to our ingenuity, but if our ingenuity fails, so much the worse for our ingenuity." So if explanations fail us, the fault is not with the evolutionary process, just our limited thinking. How convenient that the evolutionary process is so unfalsifiable in this crucial area. But after all, he implies, this is science and intelligent design is not!

Dawkins concludes the chapter with a discussion on the evolution of the honeybee waggle dance. It is filled with probabilistic statements like "The suggestion is that…. Perhaps the dance is a kind of…. It is not difficult to imagine…. Nobody knows why this happens, but it does…. It probably provided the necessary…." Yet at the end, Dawkins proclaims,

> *We have found a plausible series of graded intermediates by which the modern bee dance could have been evolved from simpler beginnings. The story as I have told it…may not be the right one. But something a bit like it surely did happen.*

Again, "it happened" only because any other explanation has been disallowed by definition and not by the evidence.

God’s Utility Function

Dawkins concludes his attack on design in his book *River Out of Eden,* with a more philosophical discussion in Chapter 4, God’s Utility Function. He begins with a discussion of the ubiquitous presence of “cruelty” in nature, even mentioning Darwin’s loss of faith in the face of this reality. Of course, his answer is that nature is neither cruel nor kind, but indifferent. That’s just the way nature is.

But a curious admission ensues from his discussion. And that is, “We humans have purpose on the brain.” Dawkins just drops that in to help him put down his fellow man in his usual arrogant style. But I immediately asked myself, “Where does this ‘purpose on the brain’ stuff come from?”

The rest of nature certainly seems indifferent. Why is it that man, within an evolutionary worldview, has “purpose on the brain”? In his attempt to be cute, Dawkins has asked an important question: Why is man unique in this respect?

As Christians, we recognize God as a purposeful being; therefore if we are made in His image, we will also be purposeful beings. It is natural for us to ask “Why?” questions. No doubt if pressed, someone will dream up some selective or adaptive advantage for this trait. But this, as usual, would only be hindsight, based on the assumption of an evolutionary worldview. There would be no data to back it up.

At the chapter’s end Dawkins returns to his initial topic. “So long as DNA is passed on, it does not matter who or what gets hurt in the process…. But Nature is neither kind nor unkind…. Nature is not interested one way or another in suffering, unless it affects the survival of DNA.” Even Dawkins admits that this is not a recipe for happiness. The problem of evil returns. Dawkins’s simple answer is that there is no problem of evil. Nature just is.

He recounts a story from the British papers of a school bus crash with numerous fatalities and reports a Catholic priest's inadequate response to the inevitable "Why" question. The priest indicates that we really don't know why God would allow such things but that these events at least confirm that we live in a world of real values: real positive and negative. "If the universe were just electrons, there would be no problem of evil or suffering." Dawkins retorts that meaningless tragedies like this are just what we expect from a universe of just electrons and selfish genes.

However, it is also what we expect in a fallen world. Evolutionary writers never recognize this clear biblical theme. This is not the way God intended His world to be. What is unexpected in an evolutionary world are people shaped by uncaring natural selection who care about evil and suffering at all. Why are we not as indifferent as natural selection?

In making his point, Dawkins says that the amount of suffering in the natural world is beyond all "decent" contemplation. Where does decency come from? He calls the bus crash a "terrible" story. Why is this so terrible if it is truly meaningless? Clearly, Dawkins cannot live within the boundaries of his own worldview. We see purpose and we fret over suffering and evil because we are created in the image of a God who has the same characteristics. There are aspects of our humanity that are not explainable by mutation and natural selection. Dawkins must try to explain it, however, because his naturalistic worldview leaves him no choice.

Are We Alone?

Dawkins closes his book with a final chapter on the origin of life and a discussion on the possibilities of life elsewhere in the universe. This chapter is a bit of a disappointment because there is really very little to say. To be sure, it is filled with the usual Dawkins arrogance and leaps of naturalistic logic, but there is no real conclusion just the

possibility of contacting whatever other life may be out there.

Dawkins begins with a definition of life as a replication bomb. Just as some stars eventually explode in supernovas, so some stars explode with information in the form of life that may eventually send radio messages or actual life forms out into space. Dawkins admits that ours is the only example of a replication bomb we know, so it is difficult to generalize as to the overall sequence of events that must follow from when life first appears to the sending of information out into space, but he does it anyway.

While we can clearly distinguish between random and intelligent radio messages, Dawkins is unable to even ask the question about the origin of the information-rich DNA code. I suppose his answer is contained on page 138 when he says, “We do not know exactly what the original critical event, the initiation of self-replication, looked like, but we can infer what kind of an event it must have been. It began as a chemical event.”

This inference is drawn not from chemical, geological, or biological data, because the real data contradicts such a notion. Dawkins takes a few pages to evoke wonder from the reader by documenting the difficult barriers that had to be crossed. His conclusion that it was a chemical event is rather an implication that is derived from his naturalistic worldview. It is a chemical event because that is all that is allowed. Creation is excluded by definition, not by evidence. While chemical evolution may be difficult, we are assured that it happened!

The book closes with a discussion of the Ten Thresholds that must be crossed for a civilization of our type to exist. Along the way, Dawkins continues to overreach the evidence and make assumptions based on naturalism without the slightest thought that his scenario may be false or at least very wide of the

mark.

All along the way Dawkins tries to amaze us with both the necessity and complexity of each threshold but fails miserably to explain how each jump is to be accomplished. He depends totally on the explanatory power of natural selection to accomplish whatever transition is needed. It is just a matter of time.

But, of course, this begs the question. Dawkins perfects this art for 161 pages. Despite the smoke and mirrors, Richard Dawkins is still trying to sail upstream without a paddle. It just won't work. While many of his explanations and ruminations should make careful reading for creationists (he is not stupid and writes well), I have tried to point out a few of his inconsistencies, assumptions, and poor logic.

What bothers me most is that this is meant to be a popular book. His wit and dogmatism will convince and influence many. For these reasons I found it a frustrating and sometimes maddening book to read. Unfortunately, few will think their way through these pages and ask tough questions of the author along the way. This is where the real danger lies. We must not only show others where he is wrong but help them how to discover these errors on their own. We must help people to think, not just react.

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