Intelligent Design or Evolution?

Why the Origin of Life and the Evolution of Molecular Knowledge Imply Design

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This book will show that naturalistic laws do not explain the origin of life and then suggest that this failure implies that life was created. The logic behind this conclusion is known as intelligent design.

The Philosophy of Science

By definition, science must explain everything in terms of naturalistic laws. So before analyzing any data, science rules out the possibility that life was created. While this philosophy has served science well, it is somewhat problematic if a creator exists. Intelligent design differs from science because it does not use assumptions to eliminate possibilities. Instead intelligent design allows the evidence to lead where it may.

Scientific experiments test how evolution happens. Experiments designed to test if evolution is possible are not necessary because science assumes that chance and natural selection are responsible. This assumption has trapped science. To better understand the trap, suppose tomorrow that a thousand fossils are found that document how T. Rex evolved from another dinosaur. Science will assert that these fossils prove that T. Rex evolved from another ancient dinosaur. Further, it will assert that naturalistic laws fully explain the transition. Science does not have to justify the second assertion because it simply assumes that it is true. Furthermore, most scientists would consider any experiment designed to test the probabilities associated with this particular evolutionary transition as unnecessary. This philosophy does not allow science much freedom. No matter what the evidence shows, the assumptions on which science is based ensure that it will always support the theory of evolution. Thus, science is trapped.

The failure of science to ask is evolution possible has led to the premature acceptance of many ideas concerning evolution. For example, when Darwin proposed the theory of evolution in 1859, the chemistry of living organisms was a complete mystery, so the testing of Darwin's theory was limited. For nearly 100 years following Darwin's first publication, science only had three ways to test his theory: 1) search for the fossils that link existing animals and plants, 2) design experiments to observe how animals and plants change ever so slightly from one generation to the next and 3) accumulate evidence that the earth is very old. While such experiments were critical for evolution's acceptance, the chemical processes behind evolution remained a mystery. Science just assumed that naturalistic laws were responsible; thus, science was able to embrace the theory of evolution without understanding it.

The Molecular Theory of Evolution

In 1953, scientists began to unravel the chemistry of life when Watson and Crick proposed a model for DNA. Soon thereafter the genetic code was broken, and the chemical mechanism behind evolution became clear. The hypothesis put forth is outlined below:

Sections of DNA called genes store the information needed to make proteins, and this information is passed from one generation to the next when genes are replicated during reproduction. The replication process is not perfect, and as such it may by chance introduce errors. Errors during replication, mutations, have the potential to create new genes. Mutations may create new information, or they may simply alter existing information. In either case, nature preserves beneficial mutations through the process of natural selection and other mutations survive by chance. Over many millions of years, changes in existing genes yield new genes; therefore, animals continually evolve and adapt.

Soon after its proposal, this hypothesis became the framework for the theory of molecular evolution. While scientists have modified it over the years, the basic framework of the theory remains intact with one important exception.

If an existing gene evolves into a new gene with a new function, then the original function will be lost, and natural selection will not allow this to happen. So Ohno suggested that existing genes do not evolve into new genes unless they are first duplicated.[10] The duplicate copy is free to evolve a new function while the original maintains its current function. Others have refined the theory further by suggesting that pieces of existing genes may be duplicated and then rearranged to create new genes with new functions. With these modifications, the molecular theory certainly explains the origin of many genes.

But even with these improvements, the concern raised earlier remains the same - why not ask if evolution can happen? Science describes how it happens, but why not take the next step and investigate the probabilities associated with the required events. That is rather than assume that naturalistic laws are responsible, prove that these laws are responsible. This avoids the trap. Thus, experiments are needed to test whether or not evolution is possible.

A ten year experiment can hardly hope to model a billion years of evolution, but today there is a solution to this problem. Scientists around the world are actively sequencing the DNA of many animals, plants and bacteria, and after more than three decades of characterization, this information is freely available in online databases. These databases allow science to ask for the very first time two important questions. Can mutations operating over billions of years and guided by natural selection create new genes? And perhaps more importantly, are naturalistic laws responsible?

Is Evolution Possible?

To test if evolution is possible, consider a gene that is common to all living things. That is the gene is found in algae, bacteria, oak trees, carrots, mice, fish, people and all other living things. This gene will not be identical in all living things, but it will be similar. The form of the gene found in bacteria has had at least 2 and probably 3 billion years to change independently from the same gene found in animals and plants. The form of the gene in an oak tree has had at least 1 billion years to evolve independently from the gene in man. This gene and many others like it allow science to conduct experiments that look back in time - almost to the origin of life itself.

A comparison of this ancient gene in many different species will reveal how much information the gene contains, and from such an analysis, one can calculate the probability associated with the gene's evolution. If the probability so calculated is for all practical purposes zero, then design may be inferred. Unfortunately, this inference is not compelling because it fails to consider the effect of natural selection. In order to make the argument for design stronger, the concept of information must be replaced with another familiar concept, knowledge. The two definitions that follow are important.

Molecular information is the information found in a gene today. It is calculated by comparing the differences found in the same gene in many different animals, plants and bacteria. Information has a precise mathematical definition as defined by information theory.

Molecular Knowledge is the minimum amount of useful information required by a gene to have any function. Any region of DNA that does not contain molecular knowledge has no function at all. Thus, such a region cannot be preserved or optimized by natural selection, and it cannot be classified as a gene.

Molecular knowledge is always less than molecular information. Molecular knowledge is more difficult to calculate because it does not have a mathematical definition.

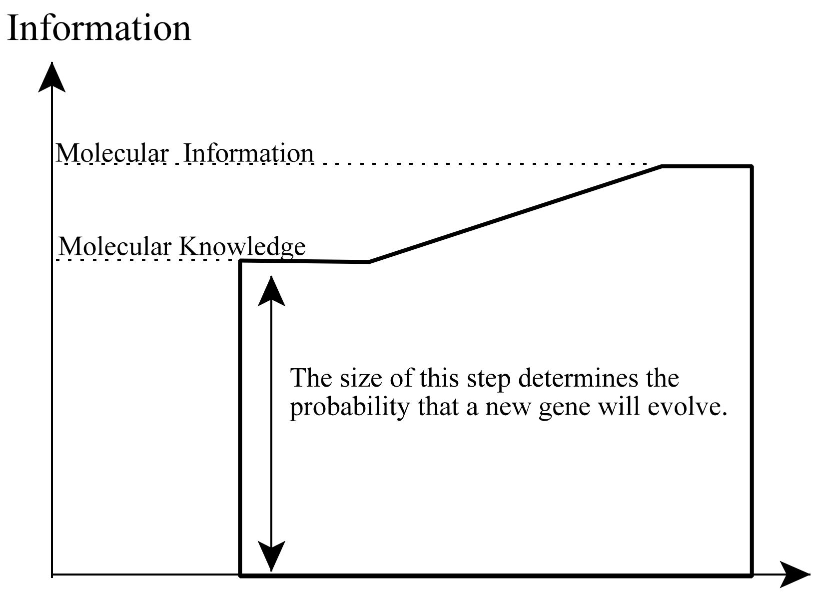
The Evolution of Molecular Knowledge

Because of natural selection, information cannot be used to calculate the probability that a gene will evolve. Information is useful because it has a precise mathematical definition not because it can answer questions concerning whether or not the evolution of a new gene is possible. Chance is not in control if natural selection is guiding which mutations survive. Therefore, relating the amount of information in a gene to a probability that it can evolve is not a valid mathematical analysis.

Molecular knowledge is the minimum amount of useful information required for a gene to have any function. If a gene does not contain molecular knowledge, then it has no function, it confers no selective advantage, and it is not a gene. Thus, before a region of DNA contains the requisite molecular knowledge, natural selection plays no role in guiding its evolution. Chance controls which mutations survive. Thus, molecular knowledge can be related to a probability of evolution. Figure 1 helps illustrate these important concepts.

Notice that the first step that creates the required molecular knowledge is vertical, and the subsequent step that creates molecular information is sloped. This difference is important in that it is meant to show that natural selection can help guide the last transition, but it plays no role in the first. Thus, it is the size of the first step that determines whether or not a gene can evolve.

Figure 1: Information in Life



A simple example will now be introduced to help clarify this concept. Consider the following sentences:

I have a 13 year old black lab who likes to fetch a tennis ball. His name is Bubba.

My 13 year old black lab, Bubba, likes to fetch a tennis ball.

mi 13 yr od blk lab, buba, like fetch tenis bal.

Each sentence represents a gene. The first sentence uses the most letters; therefore, by definition, it contains the most information. The second sentence uses fewer letters, communicates the same points and is still grammatically correct. The last sentence uses the fewest letters.

If these sentences are composed by randomly selecting letters from the alphabet, then the probability of spelling the last sentence is much better than the first. So only the last sentence and all sentences similar to it are useful for assigning a probability to the evolution of a gene. In this example, the first sentence represents molecular information and the last one represents molecular knowledge. If some concepts are not required, the last sentence may be simplified further. For example, the sentence fragment, mi black lab, still communicates some knowledge. Thus, finding the precise threshold of molecular knowledge can never be exact. It relies on both math and human insight.

At least one biologist, Richard Dawkins, has suggested that sentences like: "hh n swd dwqdoe ffnfnriiq jddk" still confer a selective advantage; therefore, given time these sentences will evolve into something useful under the guidance of natural selection.[1] Dawkins ran many computer simulations with sentences like the one above, and they all evolved into the desired result. But his programming and logic are both flawed because natural selection cannot preserve or optimize a gene that offers no selective advantage (the nonsense sentence above represents a gene that confers no selective advantage). A gene must contain some useful information before natural selection activates. Thus, chance and chance alone must create the initial knowledge. Because the probability that chance can accomplish this goal is proportional to the step height in figure 1, the size of this step completely determines whether or not a new gene will evolve. It is the goal of this book to characterize the size of this initial step. If it is small then naturalistic laws explain the evolution of knowledge. On the other hand, as the step size increases, the probability that chance will create the required molecular knowledge approaches zero, and at some critical threshold, the design inference becomes valid.

Large steps are associated with the evolution of genes that are completely different from all other existing genes. For these genes, the probability of chance finding an appropriate solution (even given 50,000 billion years) is very close to zero. The origin of these genes imply design.

Chemical Evolution

This book will also evaluate another hypothesis put forth in the 19th century. This hypothesis attempts to explain the origin of life and its basic premise is as follows:

The early earth's atmosphere was different from today in that no free oxygen was available. Under these circumstance, energy sources like sunlight and electrostatic discharges might create the chemicals necessary for life (chemical evolution). As these chemicals were concentrated in a small pond or puddle, the primordial soup, they organized themselves in such a way to form the first living organism. Because life is very complex, the first living thing is usually assumed to be a self replicating chemical rather than a living cell. Because the first living thing was able to replicate itself, it evolved into life as it exists today.

This hypothesis or some form of it is found in almost all biology books where it is put forth as the generally accepted theory. Yet in the scientific journals, scientists routinely dismiss many aspects of the hypothesis as highly improbable (Shapiro 1995 and 1999; Miller 1995 and 1998; Joyce 1984 and 1989; Nissenbaum 1975; Ferris 1987; Joyce and Orgel 1999; Thaxton:1984). When it comes to chemical evolution and the origin of life, science just does not have the answer.

One of the first experiments concerning the origin of life was conducted in 1953 by Stanley Miller. Miller created several amino acids (the building blocks that life uses to make proteins) in an electrostatic discharge chamber. The experiments conducted since Miller have demonstrated how difficult it is to create the biological precursors required for life. While several amino acids can be created under plausible conditions, proteins cannot be. Furthermore, DNA is much more problematic because its building blocks are difficult to create. Many of these building blocks are unstable and decay rapidly. Science has yet to offer a plausible explanation for how these hard to make and easy to destroy chemicals accumulated in the primordial soup (see references 3,4,5, 6, 7, 8 and 13 on page 15, and chapter 9).

The most prevalent myth concerning chemical evolution suggests that a continuous flow of energy through a complex system of nonliving chemicals will promote the formation of biologically relevant molecules. The researchers who hold to these views suggest that life arose spontaneously when these biological precursors combined in a small pond or puddle several billion years ago. While such energy flows are critical to the survival of life today, it is not clear how they solve the mystery of life's origin. Life knows how to use these energy flows to do work. Such knowledge is completely lacking from a system that only contains nonliving chemicals. Plentiful energy sources if anything do more harm than good. Sunlight bombarding a small pond on the earth 4 billions years ago is much more likely to destroy any useful biological molecules than create one (see for example Fox, Molecular Evolution and the Origin of Life, p37).

Surprisingly, such difficulties are often overlooked; as a result, many biologists mistakenly believe that it is quite easy to synthesize all of the required biological molecules. Nevertheless, a quick review of the relevant literature reveals that this is not true. For example, to synthesize adenine (one of the most important chemicals found in DNA and RNA), chemists start with a concentrated solution of hydrogen cyanide and ammonia. Concentrating ammonia is not an easy task since it is a gas that boils at sub-freezing temperatures, and it also decays rapidly in the presence of sunlight. Furthermore, concentrating hydrogen cyanide in the presence of water is impossible because it reacts with water quite readily yielding formic acid. Scientists tend to focus on the fact that adenine can be synthesized in a laboratory and ignore the fact that the conditions required for its synthesis did not exist on the primitive earth. [3,4,6]

After 50 years of investigation no plausible prebiotic path exists to synthesize cytosine, ribose or deoxyribose (three critical subunits of DNA and RNA). The problems with ribose and cytosine synthesis are so severe that Miller and several others have suggested that the first self replicating molecule probably contained neither.[7, 8]

Biological molecules may contain thousands of subunits all linked together by chemical bonds. Coercing the subunits to form a large biological molecule like DNA or RNA is not easy. These problems are often discussed in scientific journals like Nature, Science, PNAS, and the Journal of Molecular Evolution. For example, even today, investigators have yet to identify a plausible prebiotic method to link cytosine, thymine or uracil to ribose (a step necessary for DNA and RNA synthesis).[11] Nevertheless, not finding the answer is not news. So only the scientists who read these journals are aware of the difficulties involved.

Finally, the greatest challenge to the origin of life lies not with creating the chemical precursors, but instead with creating the required knowledge. The chemicals that make up life contain useful information, and it is this knowledge that allows life to propagate. The implication is that even if a few of the biological precursors required for life existed in the primordial soup, such precursors would not contain the knowledge necessary to live and evolve.

Joyce and Orgel sum up the situation best "After dreaming of self-replicating ribozymes emerging from pools of random polynucleotides, and having nightmares about the difficulties that must have been overcome for RNA replication to occur in a realistic prebiotic soup, we awaken to the cold light of day . . . It must be said that the details of this process remain obscure and are not likely to be known in the near future." - The RNA World, p72-73.

The Origin of Life

Before trying to understand the hurdles associated with the origin of life, it is useful to define life. In its simplest terms, life is a group of chemicals that possess molecular knowledge. The word *knowledge* implies that the information possessed by the chemicals is useful unlike information which may or may not be useful. The word *molecular* indicates that the knowledge resides in a chemical molecule instead of in a book or some other source.

It is this molecular knowledge that allows the chemicals in life to maintain a state that is very different from nonliving chemicals like vinegar, ammonia, and water. The molecular knowledge that life possesses is both procedural and conditional. Procedural knowledge is knowledge about how to do something. For example, how to extract energy from a sugar molecule and use it to build something else. Conditional knowledge is knowledge about why and when something needs to be done. For example, when there is no sugar present certain metabolic pathways should be turned off. Conditional knowledge in molecules is similar to that found in computer programs. A computer program may execute one command if a certain condition is true and another command if the condition is false. Computers do not think. The decisions are predetermined by the logic used in the computer's code.

It is now possible to develop a concise and accurate definition for life: *Life is a system of chemicals possessing molecular knowledge and a mechanism to implement this knowledge in such a way that the system can survive long enough to replicate itself.*

Today, life requires several chemicals to survive, grow, and reproduce. Two chemicals, DNA and RNA, store the required knowledge. Proteins and to lesser extent RNA implement this knowledge, and a third chemical, ATP, provides the energy to power the implementation. At a minimum, the simplest living system must be able to perform four critical functions:

- Store molecular knowledge.
- Implement this knowledge.
- Tap a plentiful energy source to power the implementation.
- Synthesize any biological molecules required for replication that are not plentiful in the primordial soup.

Herein, lies the mystery behind life's origin. The origin of life is a classic example of the chicken or the egg paradox because none of the critical functions listed above can exist without the others.

Many investigators have tried to overcome the paradox by suggesting that the first living thing was a single chemical that contained both the knowledge and the ability to implement the knowledge. RNA is a natural choice for the first living chemical because it can both store and implement knowledge. Nevertheless, after 25 years of experiments, the RNA hypothesis has yet to live up to its expectations. RNA has quite a bit of trouble with self replication (see Joyce:1989 and chapter 10).

Investigators have for the most part over looked the third critical function required for life, the need to tap an energy source to drive replication. Without this function, self replicating molecules become a special type of perpetual motion machine. A perpetual motion machine is a machine that runs forever with no energy input. Perpetual motion machines do not exist. They may run for a short time, but without a continuous input of energy, they eventually stop. Furthermore, all machines must know how to tap an energy source. A car with an empty gas tank cannot be driven to the gas station just because the sun is out. The sun provides an almost unlimited source of energy, but a gas engine does not know how to convert this energy into work. The same constraints apply to a self replicating RNA molecule. Unless such a molecule knows how to tap a plentiful energy source to drive its own replication, it can only exist in text books and in the imagination of researchers.

To summarize, life requires some minimal molecular knowledge to replicate. This knowledge can be possessed by a single chemical, or it can be spread out among many. In either case, the system must possess the knowledge to replicate, a way to implement this knowledge, and a way to power the implementation. A system that does not possess all three is not a living system. Furthermore, any system that is unable to synthesize the chemicals that are required for replication is not robust. These systems cannot evolve because they cannot self replicate.

Figure 2 depicts the focus of this book. The following chapters will concentrate on the genes and proteins that were required for the origin of life and on the chemicals that gave rise to these first genes and proteins. These are events that happened more than 2 billion years ago.

If a new gene evolves early in life's history, and it is completely different from any other existing gene, then the possibility that it arose by gene duplication can be eliminated. This makes the analysis much more manageable. Furthermore, the techniques used in the book simply will not work to prove that man did not evolve from apes. The DNA in a chimpanzee is almost identical to that of man's DNA. This similarity makes it difficult to infer design.

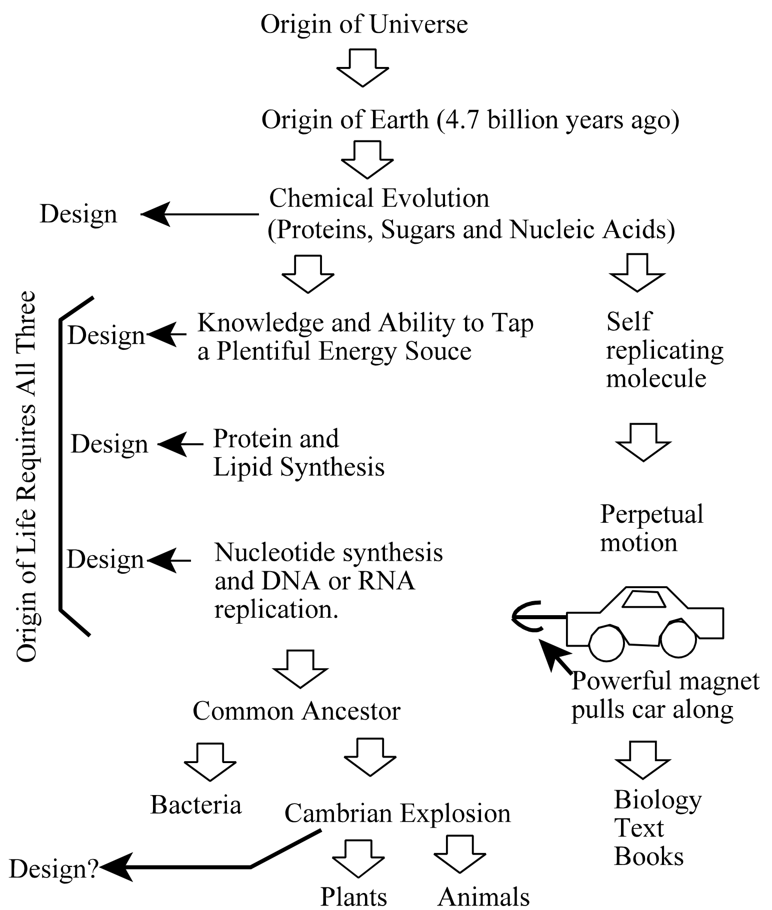
In figure 2, the self replicating molecule leads to a perpetual motion machine. The car in this figure that is pulled along by the powerful magnet is just one example of such a machine. Since perpetual motion machines do not exist, this pathway is not a very promising solution to the mystery of life's origin. It is far more likely that life arose all at once.

The difficulties associated with chemical evolution suggest that the biological precursors necessary for life would have been scarce if they existed at all, and this scarcity suggests that the first living thing was able to synthesize all of the chemicals that it needed for replication and drive this synthesis with a plentiful energy source. Today, life can only tap plentiful energy sources with the help of proteins and lipids, and this suggests that the first living thing was probably also able to synthesize proteins and lipids. Therefore, the first living thing was not a simple self replicating chemical, but rather a living cell very similar to life as it exists today.

While the idea that life arose all at once is not a popular one as it is contrary to Darwinian evolution, the evidence suggests that it did.

Notice in figure 2 that the Cambrian explosion may also imply design (Meyer: 2005). The fossil record indicates that almost every major biological classification (phylum) arose in a very short time span about 500 million years ago. The question mark is meant to show that any design inference based on the Cambrian explosion is subjective because no scientist has yet to accurately model the probabilities of such an event.

Figure 2: The History of Evolution



Before proceeding, one final clarification is in order. A few people have intentionally confused creation science with intelligent design. Creation scientists believe that the creation story in Genesis is scientifically accurate. Intelligent design differs from creation science in several important ways. First, intelligent design makes no assumptions as to what the scientific data should show. Intelligent design is just a methodology that uses indirect logic to interpret the scientific evidence. It does not depend on religion. Furthermore, the statistical techniques used by intelligent design require an old earth, common ancestry, and descent with modification.

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