Ex Nihilo Nihil Fit

(From Nothing, Nothing Comes)

Daniel J. Howard

To:
Renee, John, Heather, and Daniel
You Define My Universe

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Introduction

Many people have had the experience of gazing into a starry night sky, holding a newborn baby, or being poignantly self-aware, and then wondering about the ultimate origins of existence. These wonders are often addressed by citing God and various Holy Books. The Holy Book to which I was exposed as a child was the Bible.

I was raised in a Roman Catholic family and sent to Catholic schools; the Christian view of God was thoroughly impressed upon me. When I went to college and pursued what I thought was greater freedom of choice, I began to doubt. I first began to question Catholicism and later generalized those doubts to organized religion in general. Still later I questioned the concept of a God. With training in the scientific method, I became convinced that naturalistic explanations could account for all aspects of existence. But my early childhood rearing tugged at my heart too strongly to call my self an atheist, so I classified myself agnostic. I decided that I simply did not know whether there was a God.

When I turned forty I followed a childhood dream and adopted amateur astronomy as a hobby. I bought an eight-inch aperture Schmidt-Cassegrain telescope and began driving to southern Oklahoma to observe under skies not polluted by city lights. I traveled to this "dark site" usually in the middle of the week so I could be alone when observing. It was under the cloudy haze of the summer Milky Way six years ago that I again began to openly ask myself questions about the origin of the universe. As I explored the basis for my beliefs I became somewhat uncomfortable with my earlier

inclination to categorically account for existence through textbook explanations of the naturalist. On the other hand, I felt perhaps even more uncomfortable explaining reality through referencing Holy Books. So I began a personal journey to find for myself the answer to the most fundamental question any human being can ask: *Was the universe made on purpose or is everything (including us) ultimately an accident of nature?*

My journey led me to an examination of the scientific evidence relevant to this most basic of inquiries. The proposition that one can make inferences about design or purpose on the basis of natural evidence has, of course, been around for a long time. This area of study is called "teleology", although not everyone agrees that science can be used to make inferences about "God". George Coyne, Director of the Vatican Observatory, does not feel it is possible to make a God inference on the basis of scientific data. He considers it idolatry of science to attempt to infer God's existence through science. He believes in God because doing so enriches his life.[1]

For better or for worse, I am put together in such a way that God cannot enrich my life unless I find a rational basis for that belief. This does not mean I need to find any "absolute" proof of the existence of God. Given the inability to eliminate chance as an alternative explanation for *any* event, absolute proof will always remain elusive. An absence of certainty, however, does not suggest that the evidence is necessarily ambiguous. Throughout this manuscript I do not attempt to mask my belief that science strongly supports the inference that the universe is no accident of nature.

Einstein once said that, "the harmony of natural law…reveals an intelligence of such superiority that, compared with it, all the systematic thinking and acting of human

[1] "Science and Religion: Can We Talk", *Sky and Telescope*, October, 2003, p. 42.

beings is an utterly insignificant reflection".[2] This paper will review evidence on both a macro and micro level germane to the question of intelligent design (and therefore "choice") in nature. But the reader should not confuse that evidence with religion or religious mandates. Grounds to infer "design" or "purpose" provide no necessary information about who the designer or what the purpose is.

This work is the product of about five years of (intermittent) investigation stemming from my desire to weight what science has revealed about the chance versus design question. It is basically a compilation of information from different sources, primarily astrophysics, biology, chemistry, paleontology, and genetics.[3] The contribution of this paper, if there is one, is that it synthesizes a broad range of data in a short and hopefully readable manuscript. The writing style should be accessible to lay persons and assumes no technical expertise or training.[4] My purpose is to succinctly present the major arguments on the debate in a way that might prove interesting to those with even a moderate level of curiosity about larger questions in life. I hope you enjoy the journey as much as I did.

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[2] Albert Einstein (1974), *Ideas and Opinions: The World As I See It"*, New York: Bonanza Books, p. 40. [3] Although this paper is (and will remain) a personal document, reader comments are welcome. I will respond to all of them.

[4] The first chapter is likely to prove the most difficult because it requires some familiarity with concepts from astrophysics. Readers without such familiarity need not be overly concerned—keep reading. The manuscript gets easier as you continue.

Chapter 1: The Early Universe

Albert Einstein published his General Theory of Relativity in 1916, which is still the accepted physical model for understanding gravity. The solution to the general relativity field equations suggested something startling about the universe: It had to have a "beginning".[5] Today, that beginning is called the "big bang". The big bang refers to a cataclysmic explosion of mass-energy resulting in an expansion of the universe from compression in a dimensionless point to what is observed today.

In the Beginning[6]–

The story of the big bang is intimately associated with the debate on the design of nature. In the minds of many, the idea that the universe had a beginning suggests the need for someone who started it. That suggestion has bothered some because it mingles science and religion. As British physicist Arthur Eddington once stated, "Philosophically, the notion of a beginning of the present order of nature is repugnant to me. I should like to find a genuine loophole".[7] Others, however, believe that when science and religion address the same questions the implications of naturalistic knowledge for spiritual thought cannot be avoided. A review of the evidence supporting

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[5] The best demonstration of what a physical field looks like is to scatter iron filings near a bar magnet. Notice how they gather around the magnet in an orderly arc from the north to the south magnetic poles. The "invisible" something that is directing the iron filings is the "field" of the magnetic force (which, by the way, is the same thing that sets off the alarm when you try to walk through airport security with metal in your pockets). All physical forces have "fields" associated with them. The electric field bears responsibility for zapping you when you move across a carpet in your socks and then touch a metal doorknob. Consider next the gravitational field. History buffs might remember when the Apollo capsule heading for the Moon left the gravitational hold of the Earth and was captured by the gravitational force of the Moon. The point at which that occurred defined the boundary of the different gravitational fields of the Earth and Moon.

[6] See Eric Chaisson and Steve McMillan (1993), *Astronomy Today*, Englewood Cliffs, NJ: Prentice Hall, pp. 594-611 for an excellent discussion of the early universe and its development.

[7] Arthur S. Eddington (1931), "The End of the World: From the Standpoint of Mathematical Physics", *Nature,* Vol. 127, p. 450.

the big bang as a description of the early universe reveals why there is an inevitable overlap between the two.

In the 1920s Edwin Hubble discovered that galaxies were moving away from us at a speed proportionate to their distance; more distant galaxies were moving away at a faster speed.[8] This suggested that the universe was expanding, compatible with the notion of a primeval big bang. Further support was obtained in 1965 when two scientists from AT&T Bell Labs (Arno Penzias and Robert Wilson) were attempting to fine tune what was, at the time, the world's most sensitive radio receiver, but were unable to eliminate "noise" from an unknown source. The noise corresponded to a temperature of about 3 degrees Kelvin and was consistent across all parts of the sky.[9] Arno and Penzias were awarded the Nobel Prize in physics (in 1978) for their discovery of that "noise", later called the cosmic microwave background radiation, the echo of the big bang.[10]

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[8] Most readers probably have memories of a train quickly approaching and passing while blowing its whistle. Remember how the pitch of the whistle first increased as the train approached and then decreased as it passed and moved into the distance? This is called the "Doppler effect" and results from the contraction and stretching of sound waves as the train moved towards and then away from you. The same basic idea was used by Hubble in detecting the movement of galaxies relative to the Earth.
He reasoned that if the universe was expanding, electromagnetic waves would be stretched producing an increase in wavelength and a decrease in frequency. The end result would be spectral lines shifting towards the red end of the spectrum. This is called the "redshift" and is still used today to measure the speed at which objects are moving away from the Earth.

[9] This finding of thermal equilibrium (the temperature of the microwave radiation coming from any part of space is the same to within less than one one-thousandth of a degree) was a perplexing problem for scientists; how could such vastly different areas of space be so homogeneous? This point will be revisited later when discussing inflationary theory. Regarding temperature measurements, unlike the U.S., which uses the Fahrenheit (F) scale, most of the world uses the Celsius (C) scale in which water freezes at 0 and boils at 100 degrees Celsius. The Kelvin (K) scale was developed for convenience in which 0 degrees Kelvin is "absolute 0", i.e., the total absence of heat in which all atomic and molecular motion stops. Zero K= -273.15C..

[10] It is important not to get confused about the idea of radiation. The electromagnetic spectrum, which represents the full range of all radiation, includes, for example, radio and TV frequencies with long wavelengths. Shorter wavelengths include microwave, visible light, infrared, ultraviolet (responsible for suntans), X-ray (used in Doctor's offices to see your insides), and gamma ray portions of the spectrum. Visible light actually comprises a very small part of the electromagnetic spectrum. Keep in mind, however, that all of these different "types" of radiation are simply names given to different parts of the same phenomenon.

The discovery of Arno and Penzias fit the predictions for radiation that permeated space about 300,000 years (later refined to 380,000 years) following the big bang when temperatures had cooled to about 3,000K. This allowed photons (light) to break free from the cosmic soup. Physicists estimated that those photons, stretched via the Dopler shift to the microwave frequencies, should today (in modern times) be a few degrees above absolute zero and distributed throughout space with almost total homogeneity. That prediction was basically confirmed with the Arno and Penzias data.[11]

One problem with the hardware used by Arno and Penzias is that it was not sensitive enough to detect a very slight variation in the heat radiation (.001%) marking greater densities of matter. Confirmation of that variation was important because initial differences in the density of matter at the time of the big bang were necessary for the later evolution of galaxies and galactic clusters we see today. "Fingerprints" of those differences were first detected in 1992 by the Cosmic Background Explorer (COBE) satellite and re-confirmed and refined by the Wilkinson Microwave Anistropy Probe (WMAP), which was launched in July 2001.[12]

If the universe is currently expanding from a primeval explosion, then it obviously had to be smaller at some point in the past. But how small was it? Those opposed to appearances of a "creation event" were undoubtedly disturbed by the publication in 1992 of a series of theorems by Roger Penrose and Steven Hawking which proved, assuming general relativity held true and gravity remained an attractive force in

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[11] See Fred Heeren, *Show Me God*, Wheeling, IL: Day Star, p. 153.

[12] The WMAP project also estimated the present age of the universe to be 13.7 billion years with an uncertainty of +/-.2 billion years. The expansion rate of the universe was estimated to be about 72 kilometers per second per megaparsec (+/-10%) and accelerating. One parsec is 3.26 light years. Light travels 5.87 trillion miles a year. One megaparsec equals 1 million parsecs. For detailed WMAP results go to http://map.gsfcnasa.gov/m_mm.html

the conditions of the primeval universe, the universe began as a "singularity". A singularity is a mathematical point with no dimensions and infinite density, where spacetime is infinitely distorted, and where the known laws of physics break down.[13] With the physical universe crunched into a singularity, temperature would approach infinity and the four fundamental forces of nature (gravity, electromagnetism, and the strong and weak nuclear forces) would be unified.[14]

Let's now look at what is currently understood to have happened in the first moments after the Big Bang. At 10^{-43} seconds following the big bang, referred to as Planck time (named after Max Planck the founder of quantum theory), gravity began to decouple from the other forces of nature.[15] The size of the universe is estimated to have been 10^{-33}cm across with a mind boggling density of 10^{94} grams per 10^{-3}cm and a temperature of 10^{32}K. At 10^{-35} seconds and a temperature of 10^{27}K the strong nuclear force separated from the electroweak (unified electromagnetic and weak nuclear) force.[16] This breaking of the strong nuclear from the electroweak force is theorized by some to have resulted in a brief period of extraordinary (exponential) inflation in the size of the universe until 10^{-32} seconds following the big bang. The universe may have increased in size by a factor of 10^{30} (some say 10^{50} or even 10^{100}) within the inflationary period.

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[13] For a readable discussion see Steven Hawking, (2001), *The Universe in a Nutshell* ,New York: Bantam Books, p. 79; and Paul Davies, *The Mind of God*, New York: Simon and Schuster, p. 49.

[14] The strong nuclear force is responsible for binding the nuclei of atoms (protons and neutrons) together. It is this force that is harnessed for nuclear energy, or unleashed in an uncontrolled chain reaction with nuclear weapons. The weak nuclear force is responsible for a variety of nuclear processes, including radioactive decay of neutrons into protons. The electromagnetic force causes both electric and magnetic effects. The gravitational force is commonly understood and is why you are able to sit (rather than float) and read. The values of these forces of nature and their implications for design are later discussed.

[15] Scientists generally do not discuss what may have occurred prior to Planck time since all known laws of physics break down at that point.

[16] It is useful to try to conceptualize the size of the numbers cited in this paragraph. For example, 10^{-2} is scientific notation for 1 divided by 1 followed by 2 zeros, or 1/100; 10^{2} equals 1 followed by 2 zeros, or 100. Hence, it would clearly be an understatement, for example, to suggest that 10^{-43} is a very small number or that 10^{94} is a very large number. For big bang times and temperatures see, for example, http://csep10.phys.utk.edu/astr162/lect/cosmology/forces.html

At about 10^{-12} seconds electromagnetism decoupled from the weak nuclear force. All four of the fundamental forces of nature had now separated. At about 10^{-6} seconds, a period in which the primordial fireball had cooled to 10^{13}K, protons and neutrons formed from smaller subatomic particles. After about three minutes, protons and neutrons joined together to form atomic nuclei, although another 380,000 years would pass before protons captured electrons to form the first atoms. About 200 million years after the Big Bang the first stars appeared, followed by our sun about 9 billion years later.[17]

Big Bang Outcome Measures

Today, the big bang is accepted by most modern physicists as the preferred model for describing the early universe. Observations of the chemical elements of stars have revealed additional evidence supporting its occurrence. Theory predicts that hydrogen and helium should be the principal elements formed in the big bang because the searing heat was too great to allow heavier elements to form during the brief period in which fusion occurred. In fact, hydrogen and helium account for 99% of the observable material in the universe. Theory also predicts that the ratio of helium to hydrogen should be 25% in mass, which again corresponds closely to what has been found.

In a very real sense, we are "children of stardust". Nearly all of the naturally occurring periodic elements heavier than helium are literally "cooked" via fusion inside the nuclear furnaces of stars. Those elements are then either radiated into interstellar space by less massive stars or spewed into space via supernovas by more massive stars. In either case, that material may later be used to form new stars or planets. Given this

[17] WMAP found that the vast majority of the mass-energy "budget" (73%) of the big bang is a mysterious force called "dark energy" thought to be accelerating the expansion of the universe. About 23% is "dark matter" that cannot be seen. Only about 4% of the output of the big bang is actually ordinary matter (protons and neutrons).

process, one would expect earlier generations of stars that burned in the dawn of universal evolution would be relatively deprived of heavier elements when compared to stars formed more recently. This prediction can be tested by remembering that since the speed of light is finite, the further away a star is the further back in time one is observing. For example, M51, the Whirlpool Galaxy, is about 10 million light years from Earth. When you observe M51 (which can be accomplished with even a modest amateur telescope) you are looking into the past, i.e., you are looking at an image of the galaxy as it existed 10 million years ago. Using this reasoning, it has been confirmed that more primitive stars (stars that burned earlier in the history of universal evolution) contain fewer heavier elements than stars of more recent origin, consistent with the big bang theory. Given its overwhelming empirical support, it is a concern that surveys by the National Science Foundation have shown that only 33% of American adults believe that the big bang ever occurred.[18]

One of the most astonishing outcomes of the big bang has to do with the balancing of the repulsive force of universal expansion with the gravitational force of matter/energy that slows it down. The "critical density" of matter is when gravity precisely negates the outward force of expansion. The ratio of the actual to the critical density of matter/energy is called "omega" and is not only very close to 1, it *had* to be close to 1 for the universe as we know it to still exist. If within the first second of the big bang had omega exceeded 1 by more than 1 part in about 10^{17} the universe would have long ago re-collapsed on itself; an omega of less than 1 by the same amount would have

[18] More surprising, from an educational perspective, is that NSF surveys also reveal only 70% of American adults accept the basic premise of the Copernican universe, i.e., that the Earth revolves around the sun and not vice versa. See "Do You Believe in the Big Bang", *Astronomy*, December 2002, p. 13.

resulted in material dispersing so quickly that stars and galaxies would not have formed. If one goes back as far as Planck time (10^{-43} second after the big bang) omega had to have differed from 1 by less than 1 part in 10^{60} or we would not be here.[19] In a random or accidental universe, there is no obvious reason why omega should have a value so close to 1.

Another remarkable outcome of the big bang is that such a presumably chaotic event would result in the convenient formation of galaxies and galactic clusters. According to inflationary models of the universe, fluctuations in (quantum) subatomic particles produced distributional irregularities that were stretched to astronomical levels through inflation, which served as the foundation for the clustering of galaxies.[20] Again, these "fingerprints" were detected by both COBE and WMAP as irregularities in the temperature of the cosmic microwave background radiation, reflecting differences in the density, or distribution, of matter from the big bang. Without galaxies, the sharing of heavy elements between inter-stellar systems via supernovas would be far less likely, including the elements responsible for life.[21] The principal investigator of the COBE project was George Smoot, author of *Wrinkles in Time,* the story of finding irregularities in the distribution of matter from early years in universal evolution. Regarding his findings Smoot stated, "If you're religious, it's like looking at God".[22]

Still another provocative outcome associated with the big bang is why ordinary matter survived to occupy the expansion. During the inflationary period, mass-energy

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[19] Paul Davies (1982), *The Accidental Universe,* Cambridge: Cambridge University Press, p. 89.
[20] These distributional irregularities, assisted by gravity, are what help give the universe the appearance of being in defiance of the 2nd law of thermodynamics, which states that disorder (entropy) always increases in systems over time. Contrary to this expectation, the universe has evolved to a state of ordered complexity.
[21] The elements necessary for life are many and include, for example, hydrogen, nitrogen, oxygen, phosphorus, silicon, sulfur, and notably carbon. None of these elements (except hydrogen) were available in the first generation of stars.
[22] Milton Rothman, "What Went Before", *Free Inquiry,* Vol. 13, No. 1 (Winter 1992-1993), p .12.

was in the form of either photons (light particles) or quarks and anti-quarks. Quarks are subatomic particles. Both protons and neutrons are comprised of three quarks but during inflation it was simply too hot for quarks to "stick together" to form protons and neutrons.[23] An anti-quark is an example of anti-matter. When matter comes in contact with anti-matter, it causes instant annihilation, resulting in their transformation back to energy.

In the very early universe, when temperature cooled and energy was converted to mass, equal parts of matter and anti-matter were created. Modern theories of particle physics require that matter and anti-matter were equally common in the early universe. One mystery is that somehow an imbalance between quarks and anti-quarks occurred during this very early period and the imbalance favored quarks in an amount of about 1 part in 10^{10}.[24] It is only this excess matter that survived to form atomic nuclei. Although it doesn't sound like much, this imbalance is indeed fortunate for if quantities of matter and anti-matter had remained equal we would not be here. More specifically, "we" and everything we see is the result of this very slight initial imbalance between matter and anti-matter.

After considering the design implications of the big bang, astrophysicist Robert Jastrow said, "For the scientist who has lived by his faith in the power of reason, the story ends like a bad dream. He has scaled the mountain of ignorance; he is about to conquer the highest peak; as he pulls himself over the final rock, he is greeted by a band of

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[23] According to the standard model of particle physics, matter is comprised of 12 subatomic particles: six quarks (a name taken from a James Joyce novel) and six leptons (a name taken from the Greek *leptos* for tiny). The most widely known lepton is the electron. Another important lepton is the "neutrino", discussed again later in the paper.

[24] Steven Weinberg, "Life in the Universe", *Scientific American*, October, 1994, p. 45.

theologians who have been sitting there for centuries".[25] Although the big bang "smacks" of creation, however, it is important to look at current naturalistic ideas that attempt to account for the event. The view currently in favor is inflationary theory. The implications of this theory for design need to be considered in the context of quantum physics.

Quantum Reality

Quantum physics is the physics of the incredibly small. This field developed because common laws of physics deteriorate on small scales. For example, although Newtonian physics does well at describing planetary behavior, or energy transformations in the internal combustion engines of cars, it does not do well at describing the behavior of subatomic particles such as electrons, protons and neutrons, and even smaller particles that make up those particles.

Quantum mechanics has given the world the transistor, the superconductor, the electron microscope, and nuclear power. Despite these achievements, the quantum world is one where uncertainty and unpredictability reins. The best known example of this is the Heisenberg Uncertainty Principle, which states that one cannot know with certainty both the position and momentum of a subatomic particle; position and motion are incompatible quantum variables. Quantum uncertainty is so inherent at the subatomic level it is accepted that effects can occur without causes. So, given this background, what is a "quantum fluctuation"? When a physicist cites "quantum fluctuations" as the reason for any given event, it is essentially a citation of "chance" or "random" processes determining the nature of reality. No systematic or identifiable cause can be offered for a

[25] Robert Jastrow, *God and the Astronomers*, 2nd. Ed. , New York: Norton and Company, p. 107.

quantum fluctuation. They simply occur. This is important to keep in mind when considering the question of universal origin.

A true and measurable facet of quantum reality is that quantum particles sometimes just "pop into existence out of nowhere". Recalling Einstein's famous $E=MC^2$, one sees that a particle at rest mass M can be created if the energy MC^2 is provided.[26] This energy might be provided in a variety of ways, such as heat energy, kinetic energy, or even the rest energy of another particle. So, particles of matter always require energy from another source to make a permanent appearance. But are there cases where "virtual particles" can appear even without an energy supply? The answer is yes, at least temporarily. The reason again has to do with the Heisenberg Uncertainty Principle in which the law of conservation of matter and energy can be suspended for time T for a given amount E, where T = (H/E), and where H is Planck's constant, or $[6.63(10^{-34})]$.[27] Obviously, virtual particles are extremely fleeting and cannot travel far.[28]

Nevertheless, this idea of virtual particle creation is a widely used way of explaining existence, and can be called the "virtual universe" hypothesis. One idea is that since virtual particles can emerge from "nothing" then perhaps the entire universe did the same thing. Although such an event would not be "very likely", as explained by Carl Sagan in his award winning television series Cosmos, "it only had to happen once". A careful examination of this quantum generated genesis idea, however, reveals a

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[26] The symbol "C" represents the velocity of light (186,000 miles per second). According to Einstein's universe, nothing can exceed the speed of light. For example, let's say you lit a match in one-tenth of a second. In that amount of time its light would travel a distance about equal to once around the entire Earth.

[27] The first law of thermodynamics, called the principle of conservation of mass and energy, states that mass/energy can be neither created nor destroyed. This virtual particle discussion borrows from Davies, *The Accidental Universe,* pp. 17-19.

[28] Traveling at the speed of light the maximum travel distance of a proton is 1.32×10^{-15} m, called the proton Compton wavelength. For a detailed virtual particle discussion see Davies, *Accidental Universe,* pp. 13-19.

fundamental problem. Specifically, virtual particles *do not* actually materialize from "nothing". They require quantum fields to exist, which in turn require "space", and physicists are careful to distinguish fields and space from "nothing".[29] No physical theory can explain how something can come from nothing.

Inflation

When given a choice, physicists prefer theories that explain a greater rather than lesser number of natural phenomena. Accordingly, few ideas have generated as much excitement in recent years among cosmologists as inflationary theory. To understand why consider the following unexplained problems. The visible universe is estimated to contain about 10^{80} particles of matter—but where did that matter come from? We previously discussed the fact that the repulsive force of universal expansion matches the gravitational force of mass/energy to an incredulous degree. How could this be? Further, the microwave background radiation is homogeneous throughout space (reflecting thermal equilibrium), although galaxies formed through slight irregularities in the initial distribution of matter. What explains these (and other) phenomenon? It is accepted today that the greatest progress in explaining many puzzles left unanswered by standard big bang theory is "inflation". This idea postulates that the universe underwent a fantastic level of exponential inflation in its first microseconds of existence. So, how big was this inflation? Well, the minimal size inflation that occurred is thought to be 10^{30},

[29] This point is easy to miss. Even science writers who attempt to explain how the universe started from nothing often make the mistake of assuming that a universe starting with a small area of space qualifies as "nothing" (see, for example, Anthony Aguirre, "Where Did It All Come From", *Sky and Telescope*, December 2006, pp. 36-41.

which would result in something of molecular scale growing to the size of the Milky Way galaxy.[30]

In theory, inflation is the result of the peculiar characteristics of the "inflaton" field—and yes that is spelled correctly.[31] Basically, what is hypothesized is that a quantum fluctuation engaged the inflaton field which possessed both an energy level and a negative pressure. Negative pressure occurred because gravity is thought to have had an opposite effect during the inflationary period. This repulsive force fueled universal expansion. As the universe expanded increasing amounts of energy were generated and the inflationary process fed off this energy resulting in exponential growth. Once the inflationary process ended the inflaton field released its energy resulting in the formation of matter with cooling. In this way, according to inflation proponents, the universe ended end up with far more mass/energy than it started with.[32] Calculations show that if the universe inflated on the order of 10^{30} it could account for the origin of the 10^{80} particles of matter thought to exist within the observable universe. Importantly, inflation can also

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[30] Considering the size of this expansion one might wonder whether it "moved" the mass-energy of the universe faster than the speed of light. Actually, it did—many times faster. However, this can be explained as a loophole in Einstein's special theory of relativity which says that no physical object can exceed the speed of light. The loophole here is that physical space, not an object per se, was expanding faster than light. This point is important for understanding what occurred during the big bang. Mass-energy did not expand *into* space as a certain point in time. Space-time was the *result* of the expansion of mass-energy. Saint Augustine's centuries old view that the world was made "with" rather than "in" time corresponds precisely with modern physical theory. See Brian Greene (2005), *The Fabric of the Cosmos, New York,* Vintage Books, p. 284, for stats on the size of the universal expansion during inflation.

[31] The "inflaton" field is a variant of a Higgs field, associated with the Higgs Boson (particle). The Higgs boson is a theoretically expected but yet undiscovered particle in the standard model of physics.

[32] A fundamental law of physics is the principle of conservation of mass and energy, which states that matter/energy can neither be created nor destroyed. Although inflationary theory appears to violate this principle, physicists explain that since the energy associated with the gravitational field was negative during the inflationary period, it was perfectly offset by the energy in matter which was positive. In other words, $0 = (-1) + (+1)$. The problem is that since matter/energy conservation is still violated immediately after the inflationary period when the force of gravity became positive again and $(+1) + (+1) \neq 0$. Hence, it appears on the face of it that inflationary theory must either be considered a model of how "creation" was translated into physical reality and/or the principle of conservation of mass/energy has loopholes in it. According to some, there are, in fact, exceptions to the principle of mass/energy conservation (see Aguirre, p. 38).

account for the balancing of mass/energy and gravity: Inflation would result in a universe that appears geometrically flat to us in the same way an inflated balloon would appear flat to a microscopic bug. And a flat universe requires mass/energy to closely match gravitational attraction. Inflation explains the thermal equilibrium of space since energy could easily have achieved that equilibrium prior to the inflationary process. Finally, quantum fluctuations during the inflationary process might account for the distributional irregularities that resulted in the formation of stars and galaxies.

One important feature of inflation, however, often dismissed by those impressed with its explanatory power, is that it is a theory that requires a pre-existing universe. Some versions of inflationary theory require a universe that starts with about 20 pounds of pre-existing matter and others require only a speck of matter.[33]. Still, all versions require "something" to begin with. The response, "Well, then let's say that the universe emerged from 'almost nothing'" is not convincing since the question of creation being considered here doesn't seem compatible with a "horseshoe" scoring mentality. In terms of explaining universal origins, the position that a small amount of matter/energy always existed is no different than previous ideas that the material from which the universe developed pre-existed in a singularity. Again, no physical theory can explain how something comes from nothing. The possibility that the "something" from which our universe evolved came from another universe we cannot detect simply shifts the burden of responsibility elsewhere[34].

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[33] See Greene, p. 524.

[34] For more on this idea see Andrei Linde (1994), "The Self-Reproducing Inflationary Universe", *Scientific American*, November, pp. 48-55.

Suppose There Was No Beginning?

According to some models of the early universe, the mass/energy from which the universe evolved was pre-existent. In some of these models matter is crushed into a singularity. The notion of a singularity bothers many scientists for different reasons, including the fact that it is suggestive of a beginning, which in turn invites notions of "creation" and therefore God. A view of the early universe eliminating that singularity is the Hartle-Hawkins model. This model does so by converting the *point* from which space-time expanded into a *curved* hyperspace having no boundary. Time is still finite but has no distinct beginning. Hartle-Hawkins mathematically accomplish this through the use of "imaginary numbers" for the time variable in Einstein's field equations. An example of an imaginary number is the square root of -1.[35] One problem with the use of such numbers is that they have no correspondence with physical reality. Nevertheless, in the Hartle-Hawkins model "time" is converted to a spatial dimension at Planck time (10^{-43} seconds after the big bang) and gradually fades away as it approaches the base of the curved time-space cone, although it has no defined beginning.[36]

The importance of this model is not so much its theoretical strength but what the second author considers to be its implications.[37] In the words of Steven Hawkins, current holder of the same Chair held by Isaac Newton at Cambridge University, in his book *A Brief History of Time*, "So long as the universe had a beginning we could suppose it had a creator. But if the universe is completely self-contained having no boundary or edge, it

[35] For a readable description of this theory see Steven Hawking (2001), *The Universe in a Nutshell*, New York, Bantam Books, pp 80-85.; and Steven W. Hawking (2003), *The Illustrated Theory of Everything*, Beverly Hills, New Millennium Press, 78-87.

[36] See William Lane Craig (1998) "Design and the Cosmological Argument", in Dembski, pp. 346-354, for a critique of the Hartle-Hawkins model

[37] Some physicists are not impressed with the Hartle-Hawkins model since it makes assumptions about initial universal conditions that appear contrived (see Davies, *The Mind of God*, pp. 90-91).

would have neither a beginning nor an end: it would simply be. What place then for a creator?"[38] As Carl Sagan explained in the Introduction, the book was really about the "absence of God".[39] Hawkins later clarified that a universe with no beginning might be suggestive of the nature, rather than the existence, of God.[40]

Hawkins' clarification is important since some make the error of assuming that a self-existing universe negates the need for an intelligence underlying it. This is unfortunate since intelligence in universal design could just as likely be reflected by a self-existing universe as by one created ex niliho. A self-existing universe responsible for its own design and development would fit the definition of God for many people.
A universe that "is God" is not only compatible with certain spiritual belief systems but is also possible to conceive. Astrophysicist John Gribbin views the universe as (literally) a living and self-sustaining self-sufficient entity.[41] Some inflationary (and other) models look at the universe as a process of continuous re-creation.[42]

Regardless of one's view of universal origins, the question of why there is *something* rather than *nothing* must be addressed. As expressed by Leibniz, a contemporary of Newton, "There is a reason in nature why something should exist rather than not". Clues are found in a continued examination of the evidence.

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[38] Steven W. Hawking (1988), *A Brief History of Time,* New York: Bantam Books, p. 141.
[39] Ibid., p. x.
[40] Heeren, p. 109.
[41] See John Gribbin (1993), *In the Beginning,* Boston: Little, Brown. [42]
See, for example, Linde, pp. 48-55.

Chapter 2: Fine Tuning of Universal Constants

In the minds of many, the most persuasive argument for intelligent design of the universe comes from the fact that the values of critical physical constants each have to be almost exactly what they are in order for the universe to sustain life. Einstein once remarked that he was, "interested in whether God could have made the world in a different way; that is, whether the necessity of logical simplicity leaves any freedom at all".[43] The existing evidence seems to suggest that he may not have had much choice, at least in terms of creating a universe inhabited by people like ourselves.

The observation that disparate physical forces harmoniously interact in mutually supportive ways has baffled physicists for some time. As Princeton physicist Freeman Dyson once stated, "As we look out into the universe and identify the many accidents of physics and astronomy that have worked together for our benefit, it almost seems the universe must have known we were coming".[44] What is also puzzling is that an impersonal universe did not have to be this way. It could have been very different and yet it is not. The question of *why* various physical parameters are what they are lies at the heart of the design versus accident debate.

The Fundamental Forces of Nature[45]—

The strongest evidence for the "fine tuning" of physical constants is seen in the values of the four fundamental forces of nature. If any one of these forces varied by more than the slightest of amounts, the universe would be incapable of supporting life.

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[43] A.P. French (1979), *Einstein: A Centenary Volume,* Englewood Cliffs: Prentice Hall, p.128.
[44] Freeman Dyson (1979), *Disturbing the Universe*, New York: Harper and Row, p. 250.
[45] See Hugh Ross (1995), *The Creator and the Cosmos,* Colorado Springs, CO: NavPress, and J. Gribbins and Martin Rees (1989), *Cosmological Coincidences: Dark Matter, Mankind, and Anthropic Cosmology,* New York: Bantam, for excellent discussions of the fine tuning of physical parameters.

Consider first the strong nuclear force. The strong force binds together protons and neutrons within the nucleus of an atom against the enormous repulsive force of protons. The simplest nuclear compound is called deuterium, also known as heavy hydrogen, which is formed when a proton sticks to a neutron. The nuclear reactions within stars depend upon deuterium and if the strong nuclear force were about 5% weaker deuterium could not exist. Without deuterium either stars would not burn or they would have to come up with an alternative method doing so. If the strong nuclear force were about 2% stronger it would be enough to bind two single protons together (to form di-proton), which would result in hydrogen being volatile and explosive.[46] It is unlikely that hydrogen would have survived the early primeval universe, which would have evolved consisting almost entirely of helium. No hydrogen, no life.

The weak nuclear force is responsible for a variety of nuclear processes, including the transmutation of neutrons into protons, which is necessary for the formation of deuterium. Hence, without the weak force, the sun would not burn. The weak force is also responsible for interactions between neutrinos, another subatomic particle of great consequence for the universe in which we live, although they are so lacking in physical properties one could pass through light years of solid metal without obstruction. Yet, these particles play a critical role in the formation of life. When massive stars exhaust their nuclear fuel, gravitational contractions result in shrinkage and an implosion of the stellar core. The energy associated with the core collapse is carried outward by a flood of neutrinos which blasts away the outer envelope of the star.[47] The explosion of the outer layers of a star is known as a supernova. However, if the weak force were much stronger,

[46] Davies, *The Accidental Universe*, pp. 69-70.
[47] Davies, *The Mind of God*, pp. 196-197.

neutrinos would be caught inside the core of stars and rendered ineffective in executing a supernova. If the weak nuclear force were much weaker the neutrinos would not cause sufficient pressure to result in supernova explosions.[48] In both cases, stars would implode but never explode. Importantly, it is only through supernovas that elements such as carbon, oxygen and nitrogen, all necessary for life, are blasted into interstellar space and eventually incorporated into habitable planets such as Earth.

The electromagnetic force is responsible for a variety of important features of the universe. For one thing, it holds atoms (a nucleus surrounded by electrons) and molecules (two or more atoms linked together) together. If that force were any larger than it is, atoms would hold onto electrons so strongly that there would be no electron sharing with other atoms, and thus no molecules. No molecules, no life. If the force were any weaker atoms would not hold onto electrons at all and again there would be no molecules and no life.

On the macro scale, the electromagnetic force allows stars to radiate energy, which is obviously necessary for life. What is fascinating is how sensitive this critical electromagnetic process is to the strength of the gravitational force. The gravitational force, of course, is an attractive force between all masses in the universe. But stars are balancing acts: gravity works to compress a star and the electromagnetic force works to radiate energy outward. Incredibly, a change in the relative values of the gravitational and electromagnetic forces by only 1 part in 10^{40} and stars such as ours would not exist, nor would life as we know it.[49] If the gravitational constant were any stronger most stars would be blue giants; any smaller, and most stars would be red dwarfs. In either case,

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[48] Ibid., pp. 67-68.
[49] Paul Davies (1983), *God and the New Physics,* New York: Simon and Schuster, p. 188.

life as we know it would not be possible. For example, red dwarf stars are relatively cool stars, so cool in fact that they are unable to initiate helium fusion, and thus the fusion required for any of the heavier elements. No heavy elements in the universe, and no life. In order to have "main sequence" stars, i.e., stars like our sun, the value of the gravitational constant has to be precisely what it is. The value of the gravitational constant has to be exactly what it is for other reasons as well. For example, had it been 1% stronger the universe would have collapsed back in on itself within a few million years after the big bang; had it been 5% weaker stars would have been unable to coalesce leaving the cosmos an icy realm of dust clouds.

The relative weights of electrons and protons are also critical. A proton is 1836 times heavier than an electron. As things turn out, this ratio determines who and what we are. If it were any different molecules required for life would not be possible due to insufficient chemical bonding. Further, if electrons were even slightly less massive relative to protons, all stars would be red dwarfs.

Finally, consider the interaction between gravity, electromagnetism and the electron/proton mass ratio. In order for stars like ours to exist, the product of the electromagnetic fine structure constant and the electron/proton mass ratio must equal the strength of gravity and both must equal 10^{-39}. If this were not true there would be no main sequence stars (such as ours) and we would not be here.[50] A quick consideration of the enormity of this "coincidence" and its implications is stunning.

[50] Davies, *The Accidental Universe*, p. 73

The Necessity of Carbon

The fusion of elements inside stars is one of nature's most awesome mechanisms. In fusion, nuclei combine to make a different element. For example, four hydrogen nuclei fuse to make helium. However, the mass of the new nucleus is actually less than the sum of the masses of the nuclei that fused to make it up. This difference is what powers stars by an amount defined by $E=MC^2$. All of the chemicals that make life possible were born in the nuclear furnaces of stars and made available principally through the benefit of supernovas. Simply the thought that the chemicals of which we are made were born within nuclear furnaces and distributed through violent stellar deaths is both humbling and mind numbing.

An element of particular interest to Earth life is carbon. Carbon is the elemental foundation of all organic compounds. All proteins, along with DNA and RNA, are made of carbon. No carbon, and no life, at least life as we can currently conceive it. What is educational is to look at the improbability of carbon formation inside stellar furnaces.

Hydrogen is the principal fuel for most stars, which is generated by the liberation of energy when hydrogen is fused into helium. Helium, in turn, can be fused into both carbon and oxygen. The production of carbon, however, appears to be a fluke of nature. Carbon is produced by the almost simultaneous encounter of three helium nuclei in what is called a "triple alpha" stellar reaction. What happens is that two helium atoms fuse to produce a very short lived element called beryllium. How short? Beryllium decays in 10^{-12} seconds. That is the time in which a third helium atom has to fuse with beryllium before the chance to form carbon is gone. The problem is that one trillionth of a second is not long enough to allow stable carbon formation from helium's interaction with

beryllium. In order for carbon production to occur in any significant amount a high density stellar environment is required with very specific "resonances". A resonance is an energy level at which physical interactions are facilitated (and therefore accelerated). For example, think of the precise acoustic note that is required in order to shatter glass. That specific note is a resonance. The same specificity with respect to resonance levels is needed to produce carbon. British astrophysicist Fred Hoyle calculated that at a "resonance" of 7.82 million electron volts the helium and beryllium interaction would be accelerated just enough to allow the formation of a stable carbon 12 compound before beryllium decays. The further production of oxygen from carbon occurs when carbon fuses with helium. Very specific resonances are again required to make this happen in a way in which carbon will be preserved but oxygen produced, especially in significant amounts.

Happily, both of these resonance levels are found to exist within massive stars. When Hoyle calculated the odds against such events occurring by chance he was so incredulous that he called the formation of carbon and oxygen a "put-up job". He stated that, "If you wanted to produce carbon and oxygen in roughly equal quantities by stellar nucleosynthesis these are the two levels [resonances] you would have to fix and your fixing would have to be just about where these levels are actually found to be [within stars]. A common sense interpretation of the facts suggests that a super intellect has monkeyed with physics, as well as chemistry and biology, and that there are no blind forces worth speaking about in nature."[51] A confirmed atheist, Hoyle admitted that his discovery greatly challenged his belief system. Importantly, the types of stars in which the necessary resonances exist are also the types of stars that obligingly explode in

[51] Fred Hoyle (1983), *The Intelligent Universe*, London: Michael Joseph, p. 218.

supernovas and thus make carbon and oxygen and other elements necessary for life available to places like the planet Earth. Hoyle opined that it appears, "the laws of physics have been deliberately designed with regard to the consequences they produce within stars".[52]

It should be intuitively clear that there is an infinite range of values the physical constants could have assumed. There is no intrinsic reason why the values of the forces of nature had to be what they are and there certainly is no reason why everything had to work together in such a suitable way. Astrophysicist Paul Davies once stated that the numerical coincidences in the universe, "offer compelling evidence that something is going on".[53] So, what exactly *is* going on? The probability of the universal constants appearing with just the right values needed to support life on the basis of chance is infinitesimally small. So, is there a naturalistic explanation? It depends on how one interprets "naturalism". The existence of an infinite number of alternative universes is the explanation currently favored by most scientists who prefer not to involve notions of a God in accounting for the fine tuning of the physical forces.

Infinite Universes

Although the notion of multiple universes is consistent with aspects of inflationary theory, the idea has its roots in quantum theory. As first proposed by Hugh Everett, each time an event occurs, the universe splits in two. This is theoretically possible using quantum reasoning since on the quantum level an event can be measured as either a wave or a particle. So, which is true? According to the strange world of quantum physics both are true. Using this reasoning, whenever a choice occurs the

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[52] Mervyn Stockwood (1959), *Religion and the Scientists,* London: SCM, p. 82. [53] Davies, *The Accidental Universe*, p. 110.

universe splits in two and both realities exist. Thus, everything that could happen has happened. Hence, we are here observing this universe because it is the one out of an infinite number in which everything happened to work out right.[54] As summarized by Steve Hawkins, "The universe must have every possible history each with its own probability. There must be a history of the universe in which Belize won every gold medal at the Olympic Games though maybe the probability is low. This idea that the universe has multiple histories may sound like science fiction but it is now accepted as science fact".[55] In fact, the existence of alternate universes is not accepted as scientific fact, although it is a way of explaining existence without citing God.[56] It is also a weakly disguised way of saying that chance accounts for reality, i.e., there is no identifiable "cause" that needs to be cited when everything that can happen does happen.

In any case, the multiple universes idea meshes well with what is known as the (weak) anthropic principle.[57] According to this idea we should not be surprised at realizing we are here observing the universe since unless it was suitable for life we could obviously not be here observing it.[58] The universe has to be ordered as it is or we would not be here to reflect on that fact. Thus, the universe we see has, in a sense, been selected by us.

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[54] Davies, *God and the New Physics,* pp. 116-117, 172-173. [55]
Hawking, *Universe in a Nutshell,* p. 80.

[56] This surprising statement was likely due to Hawkins' attempt to reach a broader audience by generalizing and simplifying issues with his *Universe in a Nutshell* book.

[57] For a discussion of anthropic principles see John Barrow and Frank Tippler (1986), *The Anthropic Cosmological Principle*, Oxford: Oxford University Press.

[58] The "strong" anthropic principle argues that carbon life forms, e.g., people, explain many features of the observable universe and thus the universe *must* have the properties which allow for the development of life at some point in its history. Clearly, this principle reverses the logic typically used in scientific endeavors. See Brandon Carter (1974), "Large Number Coincidences and the Anthropic Principle", in M.S. Longair, ed., *Confrontation of Cosmological Theories with Observation*, Dordrecht: Reidel, pp. 112-134 for an interesting discussion of the strong principle.

The multiple universes hypothesis has also been given publicity by inflationary theory since versions of that theory are compatible with the idea that at a high enough energy level a singularity exists at the core of a back hole. A black hole is an area of space of such intense gravitation that even light cannot escape. Gravity overwhelms all other forces and the end result is a point of infinite density and no dimensions, i.e., a singularity. Through that black hole a universe might open up in another dimension. Such a process could explain where the mass-energy of our universe came from. One universe would connect with another through what is called a "wormhole" which would give birth to a "daughter" universe and then snap closed after its emergence, setting the daughter universe free to expand in a big bang. In this way, an endless number of alternative universes are born. Unfortunately, this idea can never be confirmed or refuted. Once a new universe appears the wormhole through which it came forever closes.[59]

In my view, if science is to shed light on the question of God it should do so using testable theories. Attempting to explain the one universe we live in by arguing for an infinity of other universes we can never observe runs directly contrary to accepted notions of science. Further, it violates Oscam's razor (in the extreme) which says that given two plausible explanations, the simpler one is to be preferred. The God hypothesis is certainly a more parsimonious explanation for this one universe than an infinity of alternate realities. Another problem is that the infinite universes idea unloads the explanation for the mass-energy of our universe onto some other dimension from which

[59] Another idea, proposed by superstring theory, is that a proton width collision between our universe and another parallel but invisible universe provided the mass-energy currently identified as the big bang. Future collisions provide a source of matter-energy in an eternal process of re-creation. Although this theory has potential mathematical appeal (in unifying general relativity and quantum mechanics), the ideas underlying the theory are considered untestable.

we appeared. It still does not address the question of where the mass-energy came from in the first place.

Unusual Events and First Causes

One line of reasoning offered to support the "we are just the results of a cosmic freak accident" hypothesis is that extremely unusual events happen all the time. That is certainly true. While visiting my mother once, I walked down a beach on the Florida coast and looked out over the Gulf of Mexico. A sparkle caught my eye and I bent down to pick up a handful of sand. I let the sand fall between my fingers and found myself staring at a single shiny grain. I wondered how likely it was that I, that very second, would be staring at that one particular grain of sand. I decided I was witnessing a highly unusual event. The probability that I would ever look upon that one grain of sand had to be very, very small. So, if small probability events happen all the time, why is it so hard to believe that such an event might explain the origin of the universe in a way that is amenable to life? The answer is that the emergence of the universe was not just "any" unusual event. It was an event imbued with meaning and significance.[60] True, if the universe were born with any other set of physical values, those numbers would be equally unlikely as the ones it has. However, the fact that the ones it turned out to have not only allowed the emergence of life but life could not exist without them being exactly what they are is what makes that particular unusual event different.

The idea that every effect has a cause is deeply embedded in Western and scientific thought. The cosmological argument in favor of a God is that since there cannot be an infinite series of causes there must have been a first cause and that first cause is labeled God. Philosophers have long had a problem with this reasoning because

[60] Davies, *God and the New Physics,* p.170.

one could then ask, "What causes God". This objection has been answered by saying that God by definition needs no cause. The reply is, "Then why cannot we just say the universe needs no cause?"[61] The problem with this reasoning is that the evidence is consistent with the proposition that the universe did in fact have a beginning. This has caused distress to many scientists resulting in ideas such as infinite numbers of alternate universes and the Hartle-Hawkins imaginary numbers model.

Given the current evidence that suggests all physical entities have an origin, why should the universe be exempt from this rule? One of the favorite ways to counter this particular "first cause" argument is that quantum events are laced with uncertainty. Since a quantum effect, such as the emergence of virtual particles, can occur without a direct cause, nature demonstrates that not all effects necessarily have predetermined causes. Whether the implications of such a quantum event can be generalized to the emergence of the physical universe, particularly one that gave birth to intelligent life, is a matter of judgment. At the least, it is debatable whether one can conclude that since the fleeting microsecond appearance of a virtual particle can be uncaused, the 13.7 billion year universe might also be uncaused.

The Design of Nature?

The fact that the universe appears to be carefully thought out is what propels the intelligent design movement. Design is defined as the purposeful arrangement of parts.[62] This movement is comprised of scientists, philosophers and others who argue that a careful examination of the available scientific evidence leads to the rejection of the

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[61] See Michael A. Corey (2001), *The God Hypothesis*, Lanham, NJ: Rowman and Littlefield, pp. 16-17 for an historical discussion of the cosmological argument. Also see Craig, pp. 332-359, for a more detailed analysis.

[62] *Cosmic Pursuit*, Vol. 2, No. 1., p. 34.

hypothesis that the universe was an accident, i.e., the product of random or chance forces. They argue that one can detect design not only by looking for highly unusual events but by seeing whether they are "specified", i.e., follow a pattern towards a particular end. For example, in one famous legal battle a man responsible for setting the ordering of candidates on ballots was accused of bias since democrats tended to be listed in the first ordered position, which given voter behavior is preferred. In court, he defended himself by arguing it was just chance that resulted in the ordering. The judge ruled against him given evidence that the probability of democrats always (except once) being listed in the top order on the ballots on the basis of chance alone was 50 billion to one. The judge stated, "Confronted with these odds, few persons of reason will accept the explanation of blind chance". So, if it was not chance, what explained his presumed bias? Well, he was a democrat.[63] This is what is meant by "specified" unusual events. They are not only low in probability but they follow a recognizable pattern. Design theorists say that an interpretation of events in nature in this way can lead to reasonable inferences regarding the universe being designed. For example, the odds against the universe possessing the characteristics it does on the basis of chance are infinitesimally smaller than 50 billion to one. Further, the characteristics that it does have are "specified" by being essential for the emergence of life.

Nevertheless, the press and some courts have not been kind to the intelligent design movement. The movement has been labeled as a way in which fundamentalist Christians are attempting to insert religion into science and science curriculums. Although these criticisms sometimes seem on the mark, in writing this paper I found that

[63] From William A. Demski (1998), "Redesigning Science", in William A. Dembski, ed., *Mere Creation,* Downers Grove Ill: Intervarsity Press, pp. 92-112.

many who most vigorously oppose the idea of intelligent design often understand it the least.[64] For example, science writer Corey Powell recently stated that, "intelligent design…is based on a lack of evidence (anything we don't understand just gets attributed to an unknown designer").[65] That statement is not true. Intelligent design attempts to make inferences about probable causes based on how the universe is put together, including how disconnected areas of natural science cooperate in producing a universe in which life exists. Overall, the design movement bases its arguments more on what is *known* and less on what is *unknown* about the universe in which we live.

Observations of "specified" events that are highly improbable go beyond the structure of the universe and its constants. The story becomes more baffling and the debate more heated once a critical eye is turned to Earth. For example, consider the fact that unless the orbit of the Earth was anything other than what it is the planet would not be habitable. If the Earth's orbit were 5% smaller an extreme greenhouse effect would have resulted and the oceans would have evaporated long ago. If the orbit were 1% larger the oceans would have frozen about 2 billion years ago and remained that way. T he mean temperature of the planet would be about -50F.[66] Again, did we just get lucky?

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[64] For the record, I do not believe intelligent design theory should be offered as an alternative explanation for the physical universe, including the development of life, in science textbooks or classrooms. On the other hand, texts should state up front that as naturalistic endeavors, *only* naturalistic explanations are considered acceptable in the sciences. Resisting the temptation to imply that naturalistic theories explain more than they actually do is also needed. For an interesting court case ruling against teaching intelligent design in public schools see, "Intelligent Design is Religious Judge Says", *USA Today*, December 21, 2005, p.1.

[65] Letters: "Making Sense of Science", response to Corey Powell, *Discover*, February, 2006, p. 6.

[66]Michael Hart (1995), "Atmospheric Evolution, the Drake Equation and DNA: Sparse Life in an Infinite Universe", in *Extraterrestrials—Where are They?"* Ben Zuckerman and Michael Hart ,eds., Cambridge: Cambridge University Press, p. 217.

What about biochemical coincidences? Without carbon, life would probably not be possible. All of the vital structures of a cell are constructed from carbon compounds. Scientists know of no other chemical that can compete with carbon for the suitability of life. Curiously, the chemical reactivity of carbon is maximized in the same temperature range in which water happens to exist as a liquid.[67] This turns out to be fortunate since the chemical and physical properties of water appear fit for the development of life. Scientists know of no other candidate that can compete with water as suitable for nurturing living organisms. One reason for this has to do with the unique thermal properties of water.[68]

And what about the electromagnetic radiation that reaches the surface of the Earth? Most of the radiation in the electromagnetic spectrum is harmful to life, although the small part within the visible range (1 part in 10^{25}) is ideally fit for photosynthesis. Atmospheric gases absorb practically all of the harmful radiation reaching Earth from space but allows in the small band useful for biological development.[69]

These biochemical coincidences are only a few of the many that have been noticed by scientists over the years.[70] All of them share the common theme of leading

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[67] Michael Denton (1998), *Nature's* Destiny, New York: Free Press, p. 112.

[68] Water expands and contracts with heat and cold. Yet, if this process was followed consistently then the bottom of lakes and seas would be frozen first because they are colder. Once frozen, they would remain so since surface heat would have a difficult time melting them. Fortunately, the properties of water are such that it contracts with increased coldness until it comes close to freezing (4C) and then it expands due to hydrogen bonds pushing water molecules apart. The less dense cooler water rises up. The result of this is that warmer water lies under cooler water in our oceans and lakes. When water becomes ice it experiences an even more significant expansion. Hence, the density of ice is less than water, i.e., a given volume of ice weighs less than the same volume of water, and ice floats! Water also has a number of other fortunate properties. It has a high heat capacity, which means that it provides stability by its ability to absorb heat without becoming much hotter itself. Water further has an extremely high surface tension: It sticks to everything and therefore makes everything "wet". Finally, water dissolves practically anything. Together these properties make water ideal for the development of early life on Earth. See Denton, pp. 23-37.

[69] Denton, pp. 47, 50-51, 60.

[70] See, for example, Peter Ward and Donald Brownlee (2000), *Rare Earth: Why Complex Life is Uncommon in the Universe*, New York: Copernicus.

inexorably to life on Earth. Again, one could "explain" these coincidences by suggesting that had they not occurred we would not be here to wonder about them. On the other hand, such an "anthropic" philosophy merely suggests that life is the way it is because of the way it is without addressing the deeper question of "why" it happens to be so. The following chapter examines life on Earth and then evaluates whether chance, assisted by selection processes, can account for who we are.

Chapter 3: Biological Evidence

Sir Isaac Newton once asked, "Whence arises all that order and beauty we see in the world". Newton's question is a good one if you assume that in the beginning there was chaos which somehow evolved into order. Order within nature is a reason often given by people when asked why they believe in a God. Most scientists, however, are convinced that biological order on Earth can be explained via naturalistic mechanisms. Their arguments are persuasive. The evidence is overwhelming that all life shares a common origin. For example, the existence and metabolism of cells is common to all living organisms and genetic instructions are conveyed using a universal code.[71] Given a common origin, chance genetic mutations accompanied by selection pressures that favor survival might account for much of the diversity that we see on the planet today. This was Darwin's original thesis. But can this account for *all* aspects of life? Darwinian theory is today called by some "a theory in crisis". Despite its explanatory strength it has difficulty accounting for fundamental aspects of life as we know it.

The Origin of Life

The solar system, including Earth, was formed about 4.6 billion years ago. For the next half billion years Earth was a very unfriendly place. The surface was quite hot, active volcanoes were prevalent, and the planet was constantly and fiercely bombarded by asteroids and comets from space. Material continued to accumulate in the formation of Earth until it reached its present size about 4.2 billion years ago. What is remarkable about this scenario is that reliable evidence of life, discovered on Akilia Island near Isua

[71] Paul Davies (1999), *The 5th Miracle,* New York: Simon and Schuster, p. 71.

Greenland, has been dated at 3.85 billion years.[72] Apparently, life has not only existed on Earth for the vast majority of its history but formed soon after conditions allowed. The first life likely existed within 150-200 million years after the Earth cooled.

Given the 3.85 billion years it took to evolve from microbes to humans, some argue it should have taken at least that long to go from pond scum to the initial forms of life. There is general agreement that the transition from non-living to living matter had to be long and complicated. The development of the genetic code and the first cell arguably should have been the most time consuming process in the evolution of life.[73]

The fact that there does not seem to be enough time between the formation of a hospitable planet and the emergence of life has been a source of scientific bafflement. This problem has led some to conclude that life on Earth must have alien origins. Although this idea, called the "panspermia" hypothesis, may sound outrageous it has been advocated by prominent researchers, including Sir Francis Crick, who received the Nobel prize (along with James Watson) for breaking the genetic code, and Fred Hoyle.[74] As summarized by NASA scientist David McKay, "Either life on Earth began whole, like the goddess Athena springing from the head of Zeus, or it began somewhere else".[75] Although the possibility of Earth life having extraterrestrial origins cannot be refuted, that suggestion still does not address the fundamental question: How could life (regardless of where it started) emerge from non-living matter?

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[72] S.J. Mojzsls (1996), "Evidence for Life on Earth Before 3,800 Million Years Ago", *Nature,* .
[73] See, for example, Davies, *The 5th Miracle,* p. 30.
[74] See, for example, Fred Hoyle and Chandra Wickramasinghe (1981), *Evolution from Space*, London: J.M. Dent. For Crick's involvement, see Davies, *The 5th Miracle,* p. 249.
[75] Heeren, p. 1.

The Miller-Urey Experiment[76]

It comes as a surprise to many to learn that the origin of life on Earth presents great difficulty for scientists. The reason for this surprise is likely because high school and college biology texts so often explain the development of life by discussing the results of a 1952 experiment conducted by graduate student Stanley Miller, who was working under Harold Urey at the University of Chicago. In that experiment, Miller wanted to simulate the atmosphere of the prebiotic Earth and observe the types of chemicals produced. He circulated a mixture of methane, hydrogen, and ammonia along with water vapor in a sealed glass flask and used electrical sparks to simulate the effects of sunlight. After about a week Miller found that the chemical mixtures in the water contained a small amount of amino acids, which are used to build proteins common to all life.

This study elicited great excitement and is still routinely cited in textbooks despite the fact that scientists today recognize the assumptions underlying the Miller-Urey experiment were wrong. Today, the early Earth atmosphere is believed to have predominantly contained carbon dioxide, nitrogen and water vapor, a mixture of which does not readily yield amino acids. Nevertheless, this study did stimulate additional research and most amino acids have been experimentally produced. Apparently, amino acids are not especially difficult to make.

The most problematic inference from the Miller-Urey study has been the implication (by some) that if the building blocks of proteins can be experimentally produced with relative ease then proteins themselves are simply matters of extension. There is a very large difference, however, between the production of amino acids and

[76] See Davies, *The 5th Miracle,* pp. 86-94 for an excellent summary of this experiment.

their assembly into functional proteins. The production of amino acids (which have been found on meteorites) is a step in the development of proteins in the same way that the generation of musical notes is a step in the development of a symphony. Without proper sequencing, nothing meaningful is obtained.

For proteins to exist, amino acids must link together to form molecules called peptides. Proteins consist of one or more peptide chains (or polypeptides). The probability of producing even a small polypeptide on the basis of chance molecular shuffling is effectively zero.[77] Even more importantly, proteins entail specified amino acid sequences that define chemical properties required for particular functions of life. Another analogy useful for understanding the importance of sequencing is to think about the difference between random collections of letters and meaningful sentences used within the context of a story. Functional amino acid sequencing arrangements producing proteins are akin to context specific meaningful sentences.

The probability of producing even a small protein with 100 correct sequencing arrangements of the 20 amino acids on the basis of chance is 1 part in 10^{130}.[78] These odds are so preposterously small they defy imagination. To put these odds in perspective it again helps to recognize there are only 10^{80} subatomic particles (measured as a multiple of the mass of the hydrogen atom) in the visible universe.[79] Further, many such proteins are needed to create even the simplest of cellular organisms. The complexity of life as presently known involves hundreds of thousands of different proteins. The likelihood of proteins, as a class, forming on the basis of chance has been estimated to be

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[77] See, for example, I.G. Prigogine, G. Nicolis and A. Babloyantz (1972), "Thermodynamics of Evolution", *Physics Today*, Vol. 25, pp 23-31.
[78] See, for example, Steven C. Meyer (1998), "The Explanatory Power of Design", in Dembski, p. 125. [79] See Nadis, p. 37.

approximately 10^{40000}.[80] To paraphrase Fred Hoyle, the likelihood of life assembling by chance is similar to the odds of a whirlwind hitting a junkyard and producing a Boeing 747 capable of flying.[81] To argue that the odds against the development of a self-replicating system are far smaller would be a grand understatement. Chance doesn't seem any more capable of explaining the origins of life than it does the fine tuning of universal physical constants.

Genetic Foundations of Life

Michael Denton defines life as a, "complex chemical system capable of assembling and replicating itself, of manipulating its components and drawing its vital nutrients and constituents from its environment."[82] Implicit within this definition is the trait of autonomy. Living things, especially higher organisms are able, within limits, to choose or select. This self-determinism is a puzzling aspect of living systems and its origins remain mysterious.[83]

The properties of life are so extraordinary some have argued that it qualifies as an alternate state of matter. Darwin never answered the question of how life initially came to exist. How did the first microbe form? What process was entailed in transforming non-living to living matter? Once a living organism existed, Darwinian forces could take over and account for much of life as we know it. The problem is in explaining how the first self-replicating life form came to be.

The proteins from which a cell is made cannot direct their own construction. Although DNA stores and transmits information (instructions on how to build an

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[80]Hoyle and Wickramasinghe, p. 24.
[81] Hoyle, *The Intelligent Universe,* p. 19.
[82] Denton, p. 3.
[83] Davies, *The 5th Miracle*, p. 33.

organism), it cannot manufacture proteins (or anything else). So, on the one hand, you have materials, such as proteins, used in cell formation and on the other hand you have DNA blueprints that provide specific directions on what is to be done with those materials. Since proteins cannot form without DNA, and DNA cannot be translated without proteins to begin with, how did the first cell form?[84] A popular analogy is to consider proteins the "hardware" of the cell and DNA the "software", i.e., the directions on what is to be done. Hardware is useless without software and software cannot be translated without hardware.[85] Yet, somehow, both the hardware and software necessary for life cooperatively exist.

After Watson and Crick discovered the structure of DNA, researchers learned how DNA directs the synthesis of proteins within a cell. It soon became clear that the specificity of amino acids within proteins is causally linked to a similar specificity within the DNA molecule.[86] DNA contains a list of all of the proteins a certain organism needs to live. The information needed to convert amino acids into proteins is contained in the four DNA and RNA nucleotide bases. The sequencing of the nucleotide bases defines the genetic code.[87]

To understand the magnitude of the problem to be explained it is instructive to look at the complexity of what happens within cells. A cell is common to all life, including bacteria. Cells are alive. They breathe, take in food, grow, reproduce and eliminate waste. A cell can be viewed as a factory of intricate proportions in which

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[84] Denton, p. 293.
[85] See Davies, *The 5th Miracle,* see pp. 35-36, 113-115. [86]
Meyers, p. 121.
[87] A DNA molecule in a human being, stretched out, would make a string about 2 meters long. The peculiar arrangement of the nucleotide bases along that string (or spine of the DNA helix) is what makes each of us human but at the same time somewhat different.

workers all have certain duties and depend on one another to do their jobs effectively. All living things also contain proteins and the structures of a cell are mostly made of proteins. Again, proteins are made of polypeptide chains, which are formed by different arrangements of twenty amino acids. The sequencing instructions on how to produce the proteins in a cell are furnished by DNA. In providing these instructions, DNA, which resides in and does not leave the nucleus of a cell, uses RNA. DNA provides a copy of the genetic blueprint to messenger RNA (mRNA) which then moves to the cytoplasm, the liquid substance inside of the cell but outside of the nucleus. The mRNA attaches to ribosomes, workshops of protein production, which reads the instructions specifying the correct amino acid sequence for protein production. Transfer RNA (tRNA) collects those amino acids in the cytoplasm and brings them over to the ribosomes attached to the mRNA. The mRNA then executes the instructions provided by DNA, which entails adding one amino acid after another in a particular sequence to a polypeptide chain.[88] Hence, the term "biologically relevant information" refers to the storage and transmission of highly specific directions for the development of proteins designed for equally specific biological tasks.

The origin of life problem requires understanding how proteins could initially get made without DNA to code for them. If proteins did not exist first, one could not have DNA, which is partially comprised of proteins (as is also true of mRNA, tRNA and ribosomes). It is a classic enigma: You cannot have proteins without DNA and you cannot have DNA without proteins.[89]

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[88] See Davies, *The 5th Miracle, pp 105-112.*

[89] A recent discussion of the creation of life in a lab ("What Came Before DNA?", *Discover [cover story]*, June 2004) both sensationalizes and glosses over the fundamental difficulties faced in explaining life's origin. This article discusses the work of scientists "creating life" through tinkering with RNA. RNA has

How DNA sequences came to be is a question that no scientist has been able to answer. How could the proper amino acid coding assignments develop in the first place? How could biologically relevant information carried by RNA come to be *understood* by amino acids? The answer to this question is particularly difficult since the number of biologically functional DNA sequences is very small. Minute changes in either how DNA information is translated or in the coding assignments for even a single amino acid would likely prove lethal.[90] Given these restrictions, the process of Darwinian evolution does not appear to be a viable option. Human experience with codes and language indicates that only intelligent sources can produce such information rich systems, such as those represented by DNA sequences.[91]

In any case, it is clear that for life to develop what was necessary was the creation of cellular hardware that resulted in the creation of software containing specific

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the ability not only to store information but to act as a weak catalyst as well, raising the possibility that life began with RNA, since both the hardware and software might be present in the same molecule. If RNA can act as a catalyze for its own replication then with Darwinian evolution RNA based life forms could have evolved over time eventually developing the capability to assemble proteins and build DNA. Unfortunately, the work of present day scientists interviewed in this article does not resolve the difficulties with the original findings of Tom Cech, who won the 1983 Nobel Prize for his research in this area, particularly his discovery of RNA molecules that act like simple enzymes (today called *ribosomes).* In terms of explaining the origin of life, the problem is that scientists *start with* carefully designed procedures and catalysts under highly artificial lab conditions. The argument that life evolved from RNA based organisms requires an explanation of how RNA itself first developed from a random chemical mix in the prebiotic Earth. The *Discover* article shows how easy this critical matter is to miss. It states, "The best proof that life got its start as an RNA based organism would be to create one…A handful of ribosomes in a beaker…simply doesn't make the cut. It's as if Szostak [the scientist interviewed] wanted to prove that a car can exist; at this point he's got brake pads, a steering wheel, and a lot of other parts strewn across a yard. Now he's got to get the pieces to work together". That is NOT the issue. In reality, he would *first* have to show how a set of brake pads and a steering wheel and all other parts of the car could be engineered randomly given the conditions and constraints of the early Earth. Only then would he be faced with explaining how all those different parts just happened to assemble in the right order to provide a functioning automobile. But perhaps most importantly, if life started with RNA replication then evidence supporting that fact should still exist. It does not. Genes coding for RNA replication differ quite significantly among the three domains of life, indicating that RNA came *after* the existence of a common ancestor (for more on this point see Davies, *The Fifth Miracle* pp. 131-132). Thus, the argument that life started with RNA does not appear to be a compelling one.

[90] Davies, *The 5th Miracle, p. 112.*

[91] Meyers, p. 136.

instructions for the development of the hardware.[92] No scientist can provide a mechanistic process to account for the transition between protein hardware and the development of software for constructing living cells. Current laws of nature simply cannot explain what happened. This is painfully true given the general scientific assumption that the pre-biotic environment was a random mix of molecular building blocks.

Irreducible Complexity

When asked to explain where human beings came from, most scientists answer "evolution". When asked to explain how the first cell emerged most cite "chance". However, as outlined in the previous section, a simple citation of chance in explaining the origin of life is difficult to support. But for the sake of argument, let us assume that the first self-replicating cell somehow emerged on the basis of chance or mechanistic laws. Given such an initial condition, could Darwinian theory then explain the development of life as we see it today? Some have argued that the answer is still "no". Biologist Michael Behe takes this position in a provocative book titled *Darwin's Black Box*.[93] Behe's thesis is that although Darwinism has value in explaining many aspects of evolution, it cannot account for the development of life on the micro biological level. Since all living systems are highly integrated, any non-trivial change in a given sub-system would necessitate simultaneous and functional changes in many, if not all, of the sub-systems with which it interacts. Thus, it is hard to imagine how undirected evolution, through a succession of small independent self-selected changes, as envisioned

[92] Davies, *The 5th Miracle*, p.113.
[93] Michael J. Behe (1996), *Darwin's Black Box*, New York: Free Press.

by Darwin, could ever produce systems as complex as many of those observed on the micro-biological level.[94]

Behe points to a number of cellular tasks performed by "molecular machines" that are "irreducibly complex". An irreducibly complex system is a single system comprised of separate "closely matched" components that interact in such a way to produce a function beyond what is provided by the individual parts and where the exclusion of any single component would result in the system ceasing to provide its function.[95] Behe's favorite analogy is the mousetrap.[96] A mousetrap is comprised of five critical components: the platform (flat bottom portion of mousetrap), spring, hammer (the U-shaped piece that whacks the mouse), a holding bar to keep the hammer back, and a catch (the trigger the holds the bait and releases the holding bar). All five parts are necessary for the mousetrap to function. For example, without the platform, the remaining pieces would fall apart. Without a spring, the mouse would not be captured by the hammer. Thus, if a system is irreducibly complex, Darwinian mechanisms could not account for its development since a series of small, separate changes could not produce a living system in which all of its parts critically depend upon one another for the system to function. As Darwin stated in the *Origin of Species* (1882), "If it could be demonstrated that any complex organ existed which could not possibly have been formed by numerous successive, slight modifications, my theory would absolutely break down".[97] Irreducible complexity appears to fit Darwin's criteria for refutation of his theory.

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[94] Denton,, p. 321.
[95] Bebe, p. 39.
[96] Ibid, pp. 42-43.
[97] Charles Darwin (1872), *Origin of Species*, 6th ed. (1988), New York: New York University Press, p. 154.

The fundamental contention is that there is no gradual route to the development of irreducibly complex systems and many cellular mechanisms are comprised of such systems. Irreducibly complex systems appear to have been produced *all-at-once* as integrated units. Behe offers a variety of examples, including bacterial flagellum, the eukarotic cilium, coagulation, clonal selection, and the intracellular transport system.[98] Each of these involve multiple interacting parts, all of which need to be in place before the system works. None can be produced through small incremental modifications of an earlier system because any such system lacking one of its components would be non-functional. Although some have speculated that perhaps the parts of these systems had different roles which changed over time, there is no evidence to support that suggestion.

The conclusions of Behe are not significantly different from those of William Paley, who wrote *Natural Theology* in 1809. Paley argued that if he stumbled upon a rock on the ground and was asked "how" it came to exist, he would not be able to answer how the rock came to be. The stone could have been there forever. However, if he found

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[98] A shortened version of Behe's explanation of the irreducible complexity of intracellular transport is as follows: "…an irreducibly complex biochemical system is the one that targets proteins for delivery to subcellular compartments. The eukarotic cell contains a number of membrane enclosed areas that perform specialized tasks. These include lysosomes for digestion, Golgi vesicles for export, and others. Unfortunately, the machinery for making proteins is outside these compartments, so how do the proteins that perform tasks in subcelular compartments find their way to their destination? It turns out that proteins that will wind up in subcellular compartments contain a special amino acid sequence…called a signal sequence. As the proteins are being synthesized, a complex molecular assemblage called the signal recognition particle, or SRP, binds to the signal sequence. This causes synthesis of the protein to halt temporarily. During the pause in protein synthesis the SRP binds…the SRP receptor, which …allows the passage of the protein into the interior of the endoplasmic reticulum (ER). As the protein passes into the ER the signal sequence is cut off. For many proteins the ER is just a waystation on their travels to their final destination. Proteins that will end up in the lysosome are enzmatically tagged…while still in the ER….One protein, clathrin, forms a…dome called a coated vesicle, which buds off from the ER. In the dome there is also a receptor protein that binds to both the clathrin and to the…protein that is being transported. The coated vesicle then leaves the ER, travels through the cytoplasm and binds to the lysosome through another specific receptor protein. Finally, in a maneuver involving several more proteins, the vesicle fuses with the lysosome, and the protein is at its destination…Virtually all components of the transport system are necessary for the system to operate…The consequences of even a single gap in the transport chain can be seen in the hereditary defect known as I-cell disease…[which is]…characterized by progressive retardation, skeletal deformities and early death." (Michael Behe (1998), "Intelligent Design Theory as a Tool for Analyzing Biochemical Systems", in Dembski, p. 181-182.).

a watch, and was asked the same question, he would be able to provide a different answer. Given the machinery of the watch, i.e., the ordering of individual components to achieve a function beyond each of those components, Paley suggested he would have clear grounds to reply that the watch had not been there forever but rather had been purposefully designed.[99] In the same way, Behe argues that the integrated workings of the cell appear to be designed and not the product of mindless evolutionary forces. Although some have argued they have refuted Paley's original position (see, for example, Richard Dawkins, *The Blind Watchmaker*) in my view none have.[100] It is also interesting to go online and see the way Behe's book is panned by critics. There are numerous exchanges between Behe and eminent scholars across fields who feel offended by the suggestion that aspects of life might involve something other than Darwinian forces. To this date I have not seen any scholar explain how an irreducibly complex system could have evolved under the dictates of Darwinian evolution. Few educated people today, including Behe and the Pope, deny the reality of Darwinian forces. Yet, some apparently feel threatened by the prospect that Darwin's theory might not be a complete explanation.

Challenging Darwinism

Much of the present discontent with Darwin is the belief that undirected evolution must account for all forms of life observed today. As an academic, I am well aware of the tendency of scholars to assume that theory is more encompassing than it really is. The explanatory power of Darwinian theory is clear but the claim that it accounts for the totality of the diversity of life is quite another matter. In a 2001 Gallop poll 45% of American adults agreed that, "God created human beings pretty much in their present

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[99] See William Paley (1809), *Natural Theology*, London: Faulder and Son, pp.9-10. [100] Richard Dawkins (1985), *The Blind Watchmaker*, London: W.W. Norton.

form at one time within the last 10,000 years".[101] Although this figure is obviously disturbing, science should still insist that Darwinists respond to legitimate challenges regardless of whether another naturalistic account is available to fill the void.

There appear to be a variety of examples in life that defy Darwinian mechanisms. The existence of irreducibly complex systems is one such example. Others include the origin of the genetic code, the origin of sexuality, the flight feather of the bird, the eye of the lobster, and self-replication. The problem is that an iterative approach to evolutionary development makes no sense for these (and other) observations in life.

For example, although natural selection may account for differential survival rates among self-replicating organisms, Darwin's theory cannot explain where the phenomenon of self-replication came from in the first place. In other words, since Darwinian "survival of the fittest" *requires* replicating organisms to already exist, it cannot explain how replication originated. Since natural selection does not address the development of self-replicating organism, what can? Again, non-theistic writers seem to argue with a shrug that it must be chance. But the belief that chance molecular arrangements accounted for the development of self-replicating organisms is little more than an act of faith using the name of "chance" in place of "God". This is particularly true given the fact that life emerged so quickly after the early Earth cooled sufficiently.

Consider next the eye of the lobster.[102] Over the course of its development the eye of the lobster changes from a refracting system (as a larva) to a reflecting system (as an adult) in which the eye contains a perfectly square set of mirrors to perform the seeing function. This is puzzling since a refracting eyesight system is far simpler than a

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[101] David Quammen, "Was Darwin Wrong?", *National Geographic*, November 2004, p. 6. [102] See Denton, pp. 351-365.

reflecting system. Further, the mystery in terms of Darwinian evolution is explaining how some intermediate eye form between a refracting and reflecting system would have survival value. As an amateur astronomer I have to agree that this argument is strong. To have any value, to be able to achieve focus, a reflecting system must be perfectly formatted. The mirrors must be almost perfect squares and the mirror surfaces must be flat. How an intermediate system between as refracting and a reflecting system could evolve by virtue of a large number of small successive iterations strains credibility. One might suggest that perhaps the change occurred all at once, and some do. But to argue that a reflecting system of eyesight emerged all at once is just as fantastic as trying to imagine that it evolved slowly over time.

The problem for Darwinism is that a continuous path through intermediate life forms with survival value is not believable for many observations in life. Further, there is an absence of fossil records to fully support Darwinian theory. To appreciate this point it is important to clarify the difference between microevolution and macroevolution.

Microevolution refers to the generation of species with very slight differences due to genetic mutations. Macroevolution refers to the transition of one living thing into another. An example of this would be the evolution of reptiles into birds. Darwinian processes clearly do well at explaining microevolution. However, there is a lack of transitional fossils to support the premise that macroevolution occurred *via Darwinian mechanisms*, i.e., via a succession of small mutations each profitable to survival. Note that this challenge does not question the premise that all life emerged from a common source. An examination of the clustering of similar species in neighboring habitats, similar clustering patterns in geologic strata, findings in embryology showing that

mammals pass through stages resembling reptiles, as well as morphology findings in which all living creatures can be sorted into categories based on shared physical characteristics, provides consistent evidence that we stem from a common ancestor.[103] The question is how did the transition occur from one phylum or class to another? If Darwin's natural selection process is correct then the fossil record should support it. That record is not there, which makes many people question the degree to which small iterative mutational processes account for physical reality.

The absence of transitional fossil forms and the "biological big bang" in the Cambrian era are inconsistent with Darwinian theory. An examination of the fossil record shows a very small number of multicellular organisms in rocks older than about 600 million years. However, in rocks just slightly younger an explosion of fossilized multicellular creatures is observed. The time period in which the Cambrian period lasted has most recently been revised to 30 million years but the vast majority of evolutionary change emerged within the first 10 million years of that period. Virtually all phyla came into existence during this short time period and none appeared afterwards.[104] No intermediate fossil records support the theory of evolutionary change proposed by Darwin. These findings motivated Steven Gould to propose what is now known as "punctuated equilibrium". In the words of Gould, the problem was as follows:

> 1. Stasis. Most species exhibit no directional change during their tenure on earth. They appear in the fossil record looking pretty much the same as when they disappear; morphological change is usually limited and directionless. 2. Sudden appearance. In any local area, a species does not arise gradually by the steady transformation of its ancestors; it appears all at once and "fully formed".[105]

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[103] Quammen, pp.12-13.
[104] See, for example, Denton, p. 268.
[105] Steven Jay Gould (1985), "The Episodic Nature of Evolutionary Change", in *The Pandas Thumb,* New York: Norton, p. 182.

This idea suggests that species undergo little evolutionary change for long periods of time and then undergo rapid change (over a period of perhaps just a few thousand years) in small isolated populations. After evolutionary change is finished, they spread out and multiply in great numbers, which increases the chances of fossilization. This explains the existing fossil record by suggesting that the transitional forms were too fast and few to survive the fossil record. Punctuated equilibrium is today generally accepted as "the way" to account for the lack of transitional evidence of macro evolutionary change.

Another way to explain the existing fossil record, however, would be to theorize that evolution is "directed" (directed mutational processes). This idea is not popular with atheists because it smacks of "purpose". Nevertheless, directed evolution is not difficult to conceive. Since genes are able to direct developmental changes, why cannot they also direct evolutionary changes? Genes re-arrange themselves during developmental changes and the same process could reasonably occur during evolutionary changes. Keep in mind that the majority of genetic change in higher organisms does not involve the development of new genes but rather re-arranging existing genes.[106] Indeed, research at the University of New Mexico makes the idea of directed evolution appear not so far fetched. This research proposes the existence of an unseen clock operating in all forms of life that dictate the rate of evolutionary change. Evidence consistent with this suggestion includes findings that demonstrate evolutionary rates are proportional to size and body temperature.[107]

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[106] See Denton, pp. 279-286.
[107] "A Question of Timing", *Dallas Morning News*, June 21, 2004, Section E, p 1.

Self-Organization

Complexity theory argues that many aspects of life are the result of the tendency of complex systems to self-organize, rather than natural selection. A leading scholar and author in this area is Stuart Kauffman, who believes that Darwinian theory only explains part of the truth.[108] This idea has been popular among some scientists because of its sweeping theoretical appeal in accounting for unexplained phenomenon.

According to the self-organization view, life is built into the fabric of the universe. Large and complex systems have a natural affinity to spontaneously arrange themselves into ordered patterns. In non-living systems, objects such as spiral galaxies, snowflakes and rainbows display organized complexity of a wondrous sort. Given these examples, some contend that non-living matter may have self-organized to greater levels of complexity until life occurred. If this is true, it suggests life might be a "necessity" built into the logic of existence. Life might be the result of determinism built into physics and chemistry. For example, Fox and Dose believe that chemistry itself favors peptide chains that are biologically relevant and this tendency explains how life initially formed.[109] One reason for the popularity of the self-organization view is that some believe it removes God from the picture. If order and life are deterministic properties of existence there is no need to invoke God.

Many others (myself included) consider the suggestion that life is built into the logic of existence to directly contradict the meaninglessness of existence presumed by atheists. If life is a natural consequence of physical reality it can only mean, in the words

[108] See Stuart Kauffman (1995), *At Home in the Universe*, Oxford: Oxford University Press.
[109] See S. Fox and K. Dose (1977), *Molecular Evolution and the Origin of Life,* New York: Marcel Dekker.

of Paul Davies, that "the laws of nature have engineered their own comprehension".[110] It would seem to me only a matter of choice or taste whether one wishes to label the engineering force that underlies this process "God" or "nature". Indeed, hypothesizing an inherent bias of nature towards life appears to blur the very distinction between the concepts of God and nature.

Regardless, scientists now believe in a bio-friendly universe in which life is expected.[111] This view is strongly embedded within NASA in its search for extraterrestrial life forms. However, if life is the result of simple random molecular combinations the odds against it occurring by chance are so remote that it cannot reasonably be expected to occur more than once in a universe of our size or age.[112] Thus, if life is found on other planets, the implications will be very profound. It would imply that life did not occur by simple random events, regardless of whether one wishes to accept the concept of a God who creates life or the idea of a self-organizing force in nature that is biased towards life. In either case, it would indicate that purpose or intent is inherent within our existence. It would indicate that we were meant to be here.

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[110] Davies, *The 5th Miracle,* p. 246.
[111] Ibid.
[112] Ibid., p. 251.

Chapter 4: Ultimate Issues

One fundamental truth is still reflected by the Latin axiom, "Ex nihilo nihil fit", from nothing, nothing comes. The best of all logical efforts have failed to find a way around this basic fact. The proposition that the energy of which the universe is comprised suddenly appeared without input from another source is fundamentally untenable. But given that the universe is obviously "here", where did it come from? What options are there? There seems to be two alternatives: Either it was always here or someone put it here. Although the first possibility runs contrary to existing scientific evidence, it is preferred by those who do not believe our existence has meaning.

Purpose Versus Meaninglessness

The philosophy of "meaninglessness" appears to be popular today, especially among scholars. Richard Dawkins, of Oxford, stated, "The universe has precisely the properties we should expect if there is, at bottom, no design, no purpose…nothing but pointless indifference".[113] Nobel prize winning physicist Steve Weinberg, in his book *The First Three Minutes*, stated, "The more the universe seems comprehensible the more it seems pointless".[114] Nobel biologist Monod of France, in his book *Chance and Necessity,* concluded that man finally, "knows that he is alone in the universe's unfeeling immensity out of which he emerged".[115]

The purposelessness agenda appears especially prevalent among intellectuals who believe it is their duty to inform the ignorant masses that their spiritual belief systems have no foundation in reality. They suggest that spiritual belief is actually a failure of

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[113] Dawkins, p. 123.
[114] Steven Weinberg (1977), *The First Three Minutes*, New York: Basic Books, p. 149.
[115] Jacques Monod (1972) (trans. A Wainhouse), *Chance and Necessity*, London: Collins, p. 167.

intellect. They imply that you can either believe in God or be rational but not both. Many seem to regard it as a mark of modern wisdom to not believe in "God".[116] After all, science has removed the need for a God. In my view, people who make claims that science has removed the need for a God have either not sufficiently thought through the issues involved, or have personal (including socio-political) agendas in mind when offering their remarks. Although science has done well at accounting for much of what we see, to provide an explanation is not the same as explaining away a phenomenon.

Regardless of whether one believes that the universe *was* designed, it most certainly gives the *appearance* of being designed.[117] Those who, for whatever reason, do not want there to be anything outside of naturalistic explanations for the universe are justifiably concerned. A close examination of the scientific evidence has increasingly made "chance" explanations for the universe appear naive. It is true that just because some aspect of existence is too complex to be explained by existing natural theory does not mean one should necessarily invoke the notion of God. This "God of the Gaps" response, which is the tendency to explain gaps in knowledge by referencing God and selective divine intervention, has been and deserves to be criticized. On the other hand, the citation of "chance" is the God of the Gaps of atheists. Atheists appear to offer "chance" as a way of explaining their gaps in knowledge about the origin of the universe and life as least as frequently as many religious people offer the concept of a "God". However, when chance is repeatedly cited as the basis for a broad series of highly improbable and disconnected events all of which are necessary for life, a reasonable

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[116] See Gregg Easterbrook (1998), *Beside Still Waters,* New York: William Morrow.

[117] The "appearance" of design is a common theme in the writings of Davies, e.g., *The Accidental Universe, The Mind of God, God and the New Physics, The 5th Miracle.*

person might wonder whether some guiding force might be behind those ostensibly chance events.

Evidential Arguments

So what are the major categories of evidence that purpose is inherent within the universe? The very existence of the universe itself appears to be a pretty good starting point. Although current evidence *does not* support the view that the universe has always existed, if it *has* then it engineered its own development, organization, and comprehension. Current evidence *does* support the view that the universe came into existence at a distinct moment and in a controlled fashion. Either view is far more consistent with a philosophy of purpose than of meaninglessness.

Some of the strongest evidence for purpose is seen in how the universe is constructed. The universe is an interdependent system of forces all of which had to be configured exactly the way they are in order to support life. The fact that the fundamental constants of nature "appeared" perfectly fine tuned for life has been a particularly difficult issue for those who prefer meaninglessness. As Steve Hawkins once remarked, "It would be very difficult to explain why the universe should have begun in just this way, except as an act of God who intended to create beings like us."[118] The compelling nature of the fine tuning of physical parameters is revealed by the fact that the "infinite number of alternative universes" hypothesis is the major naturalistic alternative.

Another candidate for indicating purpose would be the appearance of life. In his book *Life Itself* Francis Crick states, "An honest man, armed with all the knowledge available to use now, could only state that in some sense, the origin of life appears at the moment to be almost a miracle, so many are the conditions that would have to be

[118] Hawkins, *A Brief History of Time,* p. 65.

satisfied to get it going".[119] Scientists still puzzle over how the first cell might develop through a mix of random events, and in particular how genetic material might arise on the basis of naturalistic mechanisms. Similar to the values of, and relationships between, the fundamental forces of nature, life appears to have been preset. The possibility that life might be programmed into the fabric of existence is also much more consistent with purpose than with meaninglessness.

A final candidate for indicating purpose, and one not yet discussed, is "mind", or human consciousness. According to physicist Steve Weinberg, consciousness does not seem to be derivable from any known physical law.[120] But what is there about human consciousness that points to purpose in life? Nothing at all, according to some people: Everything that you are, including your awareness and consciousness, is nothing *more* than the outcomes of nerve cell firings and their associated molecules. Many who find comfort in meaninglessness take this position in various forms. Many others, myself included, view the argument that "since our brains and bodies are nothing but impersonal nerve firings, we are therefore nothing more than that" to be an absurdity and a classic case of missing the forest for the trees.

There are many phenomena called "emergent phenomena" that can only be interpreted and understood at the holistic level but are devoid of meaning at the component or micro level. For example, although it is true that a novel is but a collection of letters, it is also much more than that. Although it is true that a symphony is but a

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[119] Francis Crick (1981), *Life Itself,* New York: Simon Schuster, p. 88.
[120] See David J. Chalmers, "The Puzzle of Conscious Experience", *Scientific* American, December, 1995, p. 83.

collection of musical notes, it is also much more than that. The same idea holds for the phenomenon of life, including human consciousness.[121]

In the end, a "mind" that can give direction to matter in the environment, and then reflect on that reality, is not likely to be a function of random chemical mixes that "got lucky". The fact that we can sit here and ask ourselves how and why the universe came to be is not a trivial event. In the words of Allan Dressler, it means that, "The universe has invented a way to know itself".[122] This can be no accident of nature.

Final Thoughts

I believe that God is to be found in what we discover and learn about the world, rather than as an explanation offered for what we do not know. Accordingly, it is the sum total of the different lines of evidence, the ingenuity with which nature is constructed, that lends strength to the position that an intelligence underlies existence. As Bacon once said, "A little science takes you away from God; a lot of science moves you towards his face".

Since many consider it too incredulous to contend that existence is all an accident, one of the debates that rages is between a "personal versus impersonal" God. A personal God is one that can come to our aid whereas an impersonal God cannot. An impersonal God is best exemplified by the writings of Spinozo, who identified God with characteristics of nature, which gave rise to pantheism. A God without relevance to people or events is popular among those knowledgeable enough to be embarrassed about offering "chance" as an explanation for existence but who still prefer a philosophy of meaninglessness.

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[121] See Davies, *God and the New Physics,* pp 63-64, 82-86.
[122] Allan Dressler (1994), *Voyage to the Great Attractor,* New York: Knopf, p.335.

Perhaps the strongest objections to the existence of a personal God are found in the nature of the human condition. The argument that God cannot be omnipotent (infinitely powerful) and benevolent (infinitely good) at the same time is a compelling one. If one assumes God is benevolent, it is difficult to justify the existence of evil in a world in which He is likewise assumed to be omnipotent. However, many people make the mistake of inferring that if God is not omnipotent then God must not exist. But why consider God omnipotent? Some human beings, and Holy Books written by human beings, make that claim but there seems to be little else to support the idea. So, what would a non-omnipotent God be like? I must assume that within the physical universe God abides by the rules of physical law just as we do.[123]

I have come to view atheism as a belief system, a faith, as strong as that of any religious fundamentalist. In the process of writing this paper, I had private debates with persons who are confirmed atheists. What struck me over time was the fervent passion with which they professed their atheism. Some grew angry when challenged and would froth and spray me with saliva and food particles as they verbally vented their emotions. I have had similar experiences with fundamentalists from organized religious denominations as well. Some Christian fundamentalists believe the Earth is 10,000 years old despite scientific evidence making that position untenable. Atheists, on the other hand, hold to the view that the universe, including life, is a lucky accident, despite

[123] This may be less of a limitation than it appears. As earlier discussed, physicists are in agreement that cause-effect relationships break down at the quantum level. Hence, "miracles", i.e., physical effects without physical causes, appear compatible with quantum theory.

accumulated evidence making that position untenable as well.[124] Both of these views require enormous faith that runs contrary to what is currently known through science.

Personally, I am not one who has much need for faith, outside of human relationships. I am convinced that a rational inference about the existence (although not the character) of God can be made on the basis of what is known about physical reality. But can "absolute proof" in the existence of God ever be found? I believe the answer is no. All possible explanations other than God will never be eliminated, including chance. Another problem is that living inside of our universe, our cosmic egg, our ideas are necessarily restricted. Being a part of the whole, we cannot see outside of it. We can never know the full truth via logic, which is restricted to understanding aspects of the larger whole. However, just because absolute proof is not obtained does not mean that a conclusion is inherently ambiguous. If you had to make a choice, purpose versus accident, what would it be? Well, relative proof is found when the probability of one answer being true is higher than the other.

The view I currently hold is that the universe was made on purpose. God embodies all of the forces of nature and is responsible for the orderly development of the universe, including the evolution of life on Earth. God is a universal mind and force, a unifying consciousness, and we are each points of consciousness within the larger whole. This is neither a personal God that "comes to us" nor an impersonal God that cannot. Rather, visualizing God as a universal mind and force allows *us to come to Him*.

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[124] Many atheists trained in the sciences object to the criticism that their views are overly grounded in "chance" as an explanatory device. They note that history is replete with examples demonstrating how new discoveries and theoretical advances resolved existing gaps in knowledge. The point is well taken. The prospect of *future* knowledge providing ultimate answers to our existence can never be eliminated as a possibility. Nevertheless, the criticism still stands: Given the state of *current* knowledge, atheists place inordinate amount of faith in "chance" as a way of accounting for reality.

Adjusting human awareness and perception to tap into the totality of existence is an experience quite congruent with numerous belief systems. As an alternative, atheism perceives randomness to lie at the core of our existence.

In the end, everyone will have to make a choice. So, take your pick. You may pay your respects to a giant slot machine in the sky or to an intelligence greater than yourself.