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TASC

TASC's mission is to rebuild and strengthen the foundation of the Christian faith by increasing awareness of the scientific evidence supporting the literal biblical account of creation and refuting evolution.

October 2021

Review of *Return of the God Hypothesis* by Stephen C. Meyer: Part 2

By Dan Reynolds, PhD

This month we continue the review[1] of Stephen Meyer's new book *Return of the God Hypothesis: Three Scientific Discoveries That Reveal the Mind Behind the Universe*.

Chapter 6: The Curvature of Space and the Beginning of the Universe

Stephen Hawking was the first physicist to demonstrate mathematically that the universe may have started out as a *singularity*. As the expansion of the universe is run in reverse, space-time curves until all the mass of the universe coalesces into a point with no volume, infinite curvature, infinite temperature, and infinite density. This point is a *singularity*. The known laws of physics break down at the singularity. Time stops at the singularity. The singularity marks the beginning of the universe: the beginning of space-time, matter, and energy. Hawking in collaboration with others demonstrated that, based on relativity, a singularity was the result even if one assumed the universe was *not* perfectly homogeneous. On the significance of the singularity, Meyer comments:

> Indeed, neither matter nor energy can exist in the absence of space and time. Thus Hawking, Ellis, and Penrose's singularity proofs (interpreted as a realistic depiction of the history and spatial geometry of the universe) implied that a material universe of infinite density began to exist some finite time ago starting from nothing—or at least from nothing spatial, temporal, material, or physical. (p.116)

Hence matter and energy would only be able to emerge after there was a space-time in which to exist.

However, some have questioned the applicability of relativity to the early stages of the universe when, due to the microscopic scale, quantum mechanical effects should be taken into account. Hence, physicists have worked for decades to develop a *quantum theory of gravity* albeit so far without complete success. Hawking and his collaborators acknowledged that relativity could only accurately describe the universe when its curvature was down to 10^{-33} cm, but no smaller. This limitation did not mean that the universe did not start as a singularity, only that relativity could not quite get entirely to the singularity although it pointed to it. Nevertheless, most cosmologists considered Hawking's results as demonstrating that the universe did have a beginning.

The Big Bang model has several difficulties, among which are the horizon (homogeneity) and flatness problems. The horizon problem seeks an explanation for how the universe could be so uniform in temperature (according to the cosmic microwave background [CMB] radiation) when the universe's size and age coupled with the speed of light preclude thermal equilibrium. In other words, the alleged age of the universe (13.8 billion years) does not provide enough time for the light energy from the various parts of the universe (the diameter of the universe is 5.468×10^{23} miles or 9.3×10^{10} light years) to have reached all the other parts (required for thermal equilibrium) given the speed of light (186,282 miles/s in a vacuum). The flatness problem refers to the balance between the rate of expansion of the universe and the force of gravity (due to mass) working to halt or even reverse the expansion. The geometry of our universe is flat, that is, the rate of expansion of the universe and the gravitational forces due to its mass are balanced. Thus, the universe expanded fast enough to prevent an expansion reversal but slowly enough for gravity to pull matter together to form stars and galaxies. Alan Guth advanced a theory to explain these problems called *inflation*. Inflation theory says that a brief period of very rapid expansion of space-time took place very early in the universe's history. The rate of expansion quickly slowed to a rate similar to what is observed now. So, as soon as space-time existed and matter-energy appeared within it, the hot plasma rapidly came to thermal equilibrium. Then inflation resulted in the universe increasing in size several orders of magnitude in a fraction of a second. This explains the

[1] For Part 1 see: <https://tasc-creationscience.org/sites/default/files/2021-09/sept2021_0.pdf>

horizon problem. Inflation also resulted in a rate of expansion that just counter-balanced gravity due to the universe's mass resulting in a flat space-time.[2] Guth's inflation model assumed the universe had a beginning.

Soon other scientists proposed alternative inflationary theories. One class of inflationary models was called *eternal chaotic inflation*. As the name implies, these models said there had eternally been an infinite number of "beginnings" to an infinite number of universes. These inflation models do incorporate quantum mechanics. Indeed, it is thought that quantum fluctuations are what get a new universe started. So, the eternal inflation theories have been seen by some as undermining the view that all of existence had a beginning.

But then other scientists, notably Borde and Vilekin, began to investigate whether eternal chaotic inflation indeed said there was no beginning. They concluded that the universe must have had a beginning, *even if* inflationary *cosmology is correct*. The Borde-Guth-Vilekin (BGV) theorem holds that any universe that has expanded through most of its history must have had a beginning.[3] The BGV theorem is based on geometric arguments and Einstein's *special theory of relativity*.[4] The BGV theorem applies so long as the universe has a non-zero expansion rate. It applies to inflationary cosmologies, multiverses, and cosmic egg models.

Chapter 7: The Goldilocks Universe

In chapter 7, Meyer discusses the fine tuning of physics for life.[5] Fine tuning refers to the fact that the laws and constants of physics, as well as the properties of elementary particles, are precisely what they must be for human beings to exist. What makes these "coincidences" so amazing is that, as far as we know, there are no physical or logical reasons why the universe should be this way. Meyer touches on the fine tuning of the four fundamental forces: the strong force, weak force, electromagnetism, and gravity. For example, consider the ratio of the strong force to the electromagnetic force. The strong nuclear force is the force that holds quarks together in protons and neutrons and holds protons and neutrons together in atoms. The electromagnetic force causes liked-charged particles to repel one another and oppositely charged particles to attract. In the nucleus of an atom, the strong force overcomes the repulsive electromagnetic force between positively charged protons so that the nucleus holds together. If the strong force were a little stronger, stars would burn brighter, hotter, and faster due to accelerated nuclear fusion reactions. On the other hand, if the nuclear force were weaker, some elements could become unstable, and stars would not burn as brightly.

Meyer discusses one example of fine tuning in detail. Recall that Meyer is an old-earth creationist and believes God used nuclear fusion in stars and supernovae to generate the elements in the periodic table. One problem in this regard that scientists struggled with in the middle of the twentieth century was the formation of carbon. Carbon is central to biochemistry and without it there would be no life. Several possible ways for carbon to form via stellar nucleosynthesis turned out to be implausible. A step-by-step process where lighter elements might add one proton or neutron at a time until the carbon nucleus was built ran into theoretical problems when elements containing five nucleons (neutrons plus protons) were made. These five-nucleon elements were extremely unstable and short-lived, making it very unlikely they would persist long enough to react with other species to generate heavier elements. Fred Hoyle, pioneer of stellar nucleosynthesis, then conceived the possibility that beryllium (^{8}Be) and helium (^{4}He) might be able to react to form carbon (^{12}C). The beryllium could be made from two helium atoms colliding; hence the overall process came to be known as the triple alpha[6] process. But Hoyle's calculations suggested that the collision of beryllium and helium to make carbon would be feasible only if carbon had a very specific high energy state, otherwise the collisions would be fruitless. His calculations had shown that the sum of the energies of He and beryllium was greater than the energy of carbon, so carbon would have to have a way to accommodate the extra energy without falling apart. Hoyle calculated the required specific high energy state of carbon. Experiments would later confirm that carbon did indeed possess an energy state with the exact energy required to make the nucleosynthesis of carbon possible. From Hoyle's then atheistic perspective, the only way carbon could have come into the universe was through nucleosynthesis. Hoyle soon realized that for

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[2] However, the reason that the universe ended up with exactly the right mass and expansion rate to result in a flat space-time is not quantitatively explained by inflation and suggests fine tuning and design.

[3] Borde A, Guth AH, Vilenkin A (2003) Inflationary spacetimes are not past-complete. *Phys. Rev. Lett.* 90:151301 <https://arxiv.org/pdf/gr-qc/0110012.pdf> Accessed 2021 Sep 13

[4] Special relativity addresses the relationship between the speed of light and time. General relativity deals with gravity.

[5] For a good discussion of fine tuning, see <https://www.tasc-creationscience.org/sites/default/files/2021-03/oct2019.pdf> and <https://www.tasc-creationscience.org/sites/default/files/2021-03/nov2019.pdf>.

[6] Alpha particles are helium nuclei consisting of two protons and two neutrons.

carbon to form from the collision of beryllium and helium, several other parameters also had to be "just right" such as the magnitudes of the strong and electromagnetic forces, the magnitude of the force of gravity, and the masses of quarks. That physics was so fine-tuned to allow the production of carbon in stars convinced Hoyle that there was a "super-intellect" behind the universe.

Meyer says that the strong and electromagnetic forces must be within 0.5 to 4% of their current values to make the formation of carbon in stars possible. The masses of the up and down quarks must be fine-tuned to within 1 part in 10^{21}. If gravity were weaker, the temperature within stars would not get high enough to form carbon, and if it were stronger, elements heavier that carbon would predominate. Also, if gravity were weaker, there would be no supernovae and no release of the elements needed for life back into space. A stronger gravitational force would lead to faster burning, shorter-lived stars. The gravitational constant G is fine-tuned to within 1 part in 10^{35}. The electromagnetic force constant is fine-tuned to 1 part in 25. The strong nuclear force constant is fine-tuned to 1 part in 200. The ratio of the weak force constant to the strong force constant is fine-tuned to 1 part in 10,000. The ratio of the electromagnetic force to the gravitational force is fine-tuned to 1 part in 10^{40}. Could all this fine tuning be an accidental coincidence?

Meyer finishes the chapter by quoting several scientists, some Nobel laureates, that all agree that fine tuning points to an intelligent designer.

Chapter 8: Extreme Fine Tuning – by Design?

In chapter 8, Meyer discusses the fine tuning found in the initial conditions of the universe and the universe's expansion rate. He also discusses the anthropic principle (weak and strong versions) and William Dembski's *complex specified information* (CSI).

Assuming a Big Bang scenario for the unfolding of the universe, extreme fine tuning of the distribution of matter and the universe's expansion rate would be required to arrive at the cosmos we observe now. Consider the distribution of matter. If the distribution of matter in the early universe had been more uniform than what is indicated by the CMB, the giant gas clouds would never have formed stars. That is because slight inhomogeneities in the distribution of matter are required to allow gravity to begin clumping matter into stars. On the other hand, if the distribution of matter had been much less uniform than that indicated by the CMB, most matter would have collected into black holes, resulting in a universe very different than ours. So, the distribution of matter had to be "just right" to generate the stars and galaxies we see today. The expansion rate had to be fine-tuned as well. If it had expanded slightly more rapidly, gravity could not have brought matter together into stars, and the resulting universe would have been a featureless giant gas cloud. On the other hand, if the expansion rate had been slightly slower, gravity would have eventually caused the expansion to cease and then reverse, ultimately resulting in a "big crunch."

Another fine-tuned property of the universe is its entropy. Entropy is a measure of disorder. Natural processes typically move systems towards greater disorder. The less entropy a system has, the more useful work it can potentially do; the more entropy a system has, the less useful work it can do. The entropy of the early universe had to be extremely low. This touches upon the even distribution of matter and energy early on. This even distribution with slight inhomogeneities had great potential to do the work required to form stars, galaxies, galaxy clusters, and even larger structures. The universe has low entropy now (it is ordered by gravity), so it had to have even lower entropy in the early universe. The mystery is why the universe started with such low entropy when all known physical processes move systems towards greater disorder over time. The law of entropy, that natural systems tend towards greater disorder and lose the potential for useful work over time, is also known as the Second Law of Thermodynamics. Low entropy systems are less probable than high entropy systems. Hence natural processes cause systems to move from less probable states to more probable states. The mystery concerning entropy and the universe is: How is it possible that the universe was able to start from a very improbable, low entropy state? Penrose calculated that the probability of the early universe having the required low entropy to result in the universe we see today is 1 in $10^{10^{123}}$. When one considers there are only 10^{80} particles in the universe, the degree of fine tuning of the entropy of the early universe would have been unimaginably large, certainly too large to have resulted by chance.

The early universe also had to have had an extremely fine-tuned matter density. Assuming a Big Bang scenario, the matter density of the universe at one billionth of a second after the beginning would have to have been 10^{24} kg/m^3. If the initial density had varied by a mere 1 kg/m^3, our universe would not have formed. Hence the matter density of the early universe was finely tuned to 1 part in 10^{24}.

Meyer briefly mentions the fine tuning of the masses of the up quark (1 part in 10^{21}), the down quark (1 part in 10^{21}), the electron (1 part in 1000), and the neutrino.

Next, Meyer introduces the weak and strong anthropic principles. These principles were introduced by scientists to address the appearance of design implicated by the fine tuning of physics. The weak anthropic principle (WAP) says that human observers should not be surprised by the fine tuning of the universe since if it were otherwise, we would not be here to make observations. But the WAP does not explain *why* the universe is fine-tuned in the first place, which is the question. The strong anthropic principle (SAP) states "the Universe must have those properties which allow life to develop within it at some stage in its history" (p.155). Again, this version of the SAP does not explain why the universe must be fine-tuned. Another version of the SAP holds that observers are required in order to confer reality upon the universe. The circular reasoning in this version of the SAP is readily apparent. Yes, the universe must be the way it is in order for us to exist, but that is beside the point: why is the universe the way it is? What caused it to be this way? In other words, what explains fine tuning? Nothing in nature provides an explanation as far as we know, and the anthropic principles do not shed light on the cause of fine tuning.

At this point, Meyer asks if nature can't explain fine tuning, what can? He suggests intelligent design. He discusses William Dembski's *complex specified information* (CSI) criteria for the detection of design.[7] Dembski showed that anything that is complex (improbable) and corresponds to an independent pattern invariably traces back to an intelligent cause and not random natural processes.[8] For example, the carvings at Mt. Rushmore are highly complex and correspond to the images of past presidents. The face of a cliff is also highly complex but does not correspond to an independent pattern. We have no problem recognizing that intelligent agents created the shapes on Mt. Rushmore and that natural processes created the shape of the side of a cliff. Applying Dembski's reasoning to the universe, we see that the universe is very fine-tuned (very complex and highly improbable) and that it has just those properties required for our existence (independent pattern). Hence the universe was designed by an intelligence. Later in the book, Meyer deals with attempts to expand the universe's probabilistic resources by invoking a multiverse.

Meyer ends the chapter by observing, based on the comments of many scientists in recent years, that we are seeing the beginnings of a revival of natural theology.

In chapters 9 to 15, Meyer discusses the information in biology. He returns to cosmology and fine tuning of physics in chapter 16.

Chapter 9: The Origin of Life and the DNA Enigma

Darwin had no understanding of the workings of a cell. He believed that cells consisted of *protoplasm*, a simple substance that made life possible. Today we understand that even the simplest cell is far more complex than any human invention. Cells consist of many large molecules (macromolecules) including DNA, RNA, proteins, carbohydrates, lipids, and others. There are myriad molecular machines that perform numerous functions. All these molecules and machines are configured and integrated into a functional, self-replicating whole. We now understand that the sequences of bases[9] along the DNA helix specify the amino acid sequences[10] of proteins. We understand the genetic code and how the sequence of bases in DNA is chemically transcribed into RNA and ultimately translated into the amino acid sequence of a specific protein. The amino acid sequence of a protein determines its three-dimensional structure which in turn determines its function. Multiple proteins assemble into complex molecular machines that perform various necessary functions. What is now apparent is that the cell is a molecular information processing entity. The question is where did this information originate: blind chemistry or an intelligence?

Scientists have assumed *abiogenesis* for decades. Abiogenesis, or chemical evolution, is the theory that life began as a result of unguided chemistry on the early earth. Abiogenesis as a theory faces many insurmountable problems.[11] There is the problem of generating the correct building blocks for DNA and proteins (nucleotides and amino acids, respectively) under realistic geochemical conditions and the problem of correctly combining/polymerizing the building blocks into functional, biochemically relevant macromolecules with functional sequences. Specifically, how does one explain by unguided chemistry the formation of DNA and

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7 For a good discussion of the concepts of intelligent design including complex specified information, see Reynolds D (2006) Intelligent design. <https://tasc-creationscience.org/article/intelligent-design> Accessed 2021 Sep 13

8 Dembski's ideas have a quantitative aspect in that the information in some things can be quantified in bits. The information content of an object can then be compared with the "probabilistic resources" of the universe to determine if random natural processes could reasonably account for the information. If the universe's probabilistic resources are inadequate to account for the measured information, intelligent design is indicated. See the previous footnote for more details.

9 There are four different nucleotides that make up the DNA alphabet: A, C, G, and T.

10 There are 20 amino acids found in the proteins of living things.

11 See Thaxton CB, Bradley WL, Olsen, RL, Tour J, Meyer S, Wells J, Gonzalez G, Miller B, et al. (2020) *The Mystery of Life's Origin*, Discovery Institute Press, Seattle

proteins with the sequences of nucleic acids and amino acids that are required for life? Only proteins with very specific and rare amino acid sequences are functional and hence useful to a cell. How did these sequences originate? The vast majority of sequences of nucleic acids or amino acids are nonfunctional, much in the same way as most strings of letters of the alphabet do not form meaningful sentences.

Experiments where conditions were setup to mimic the presumed conditions of the early earth have had limited success in generating the required building blocks for macromolecules. The yields of the desired compounds were extremely poor, not all of the required building blocks were formed, and some of the desired building blocks that did form had the wrong three-dimensional structure. By what natural process could the desired building blocks have been isolated so they would react exclusively with each other and not with the other (majority) products? Even starting with pure building blocks, reactions that link amino acids together do not spontaneously form amino acid sequences that are biochemically relevant. Nucleotides do not spontaneously polymerize into functional DNA and RNA sequences. Calculations show that allowing unguided reactions billions of years does not help. Chemistry alone cannot account for the sequences of the amino acids in proteins and nucleotides in DNA/RNA found in living cells.

Meyer points out that the pattern of the base sequences in DNA is *aperiodic*, that is, it is nonrepetitive. This is significant because some scientists have claimed that there are natural forces at work which determine the base sequences in DNA. But if there were chemical laws that determined how one nucleotide could react with another, then the number of possible sequences would be greatly reduced, and the information capacity of DNA would likewise be diminished. We would expect to find predictable and repetitive sequences. So, the information coded into the aperiodic nucleotide sequences of DNA cannot be explained by chemical laws. Indeed, chemical and physical laws can explain *order*, but not *information*.

Extant life is so complex that some have suggested that the first "life" may have been a self-replicating molecule such as RNA. Unlike DNA, there are RNA molecules that can carry information *and* perform catalytic functions like protein enzymes. These enzymatic RNA molecules are called *ribozymes*. According to the "RNA World" hypothesis, the first self-replicating molecule was RNA. Somehow, so the theory goes, the RNA World eventually evolved into our DNA/RNA/protein world over billions of years. There are many problems with the RNA World hypothesis. Here are some of the known problems: (1) unstable RNA, (2) building block problem, (3) sequence/information problem, (4) the error catastrophe problem, (5) homochirality problem, and many others.[12] Even in the extremely unlikely event that a self-replicating RNA molecule ever did appear on the earth, it would only be able to replicate a few times before the mistakes made during the replication process would erase the information required for replication. Extant cells have molecular machines that proofread replicated genetic text and make corrections as needed. A lone self-replicating RNA molecule would have no proofreading mechanism. Moreover, no one has ever observed or synthesized a self-replicating RNA molecule.[13] Some scientists have even suggested that life on earth was seeded by aliens, but that still does not explain where the aliens came from.

Meyer explains that in our consistent experience as human beings, the only known adequate cause of the complex specified information seen in DNA and proteins is intelligence.

Part 3 will be published in the November newsletter. ☙

COMING EVENTS

TASC Zoom Meeting, October 14, 7:00 pm EDT

Dan Reynolds, PhD will present a review of Stephen Meyer's new book *Return of the God Hypothesis*. In *Return*, Meyer discusses how the origin of the universe, the origin of life, and the Cambrian Explosion point to God as Creator.

Join Zoom Meeting
https://us02web.zoom.us/j/4430308956

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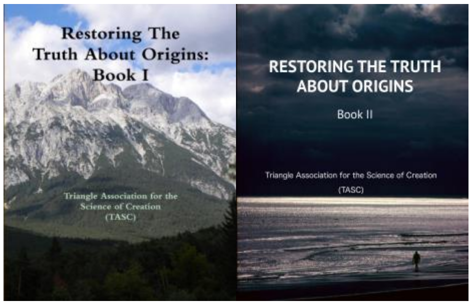
[12] The book *Stairway to Life* details many of the difficulties. See <https://tasc-creationscience.org/article/review-stairway-life-origin-life-reality-check> for a review.

[13] To be sure, scientists have been able to make molecular systems consisting of several RNA based molecules that can replicate (see <https://tasc-creationscience.org/article/has-science-found-how-life-began-and-species-evolved-examination-rna-world-hypothesis-and>), but note these systems were *designed* and therefore do not support abiogenesis.



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