From Fish to Fishers of Men: Does Evolution Invalidate Biblical Creation?

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Contents

Introduction

"In the beginning, God created the heavens and the earth" (Gen. 1:1).[1] From the very first sentence of the Bible, Christians and atheists would disagree. Is there a god? Is there a heaven? Is the universe the product of intentional creation? Disagreement is not uncommon between believers and nonbelievers and is to be expected when discussing the metaphysical, but the subject of creation and evolution moves this argument into the realm of science. If Christians are to consider every story in the Old Testament as literally true through a modern, scientific lens, then they will find themselves at odds with mainstream science.

The Bible is the inerrant Word of God. However, the accepted theory of evolution spanning billions of years and a scientific interpretation of Genesis cannot both be true.[2] Therefore, either mainstream science has erred, or human interpretation of Genesis is inaccurate. This thesis will examine the evidence for evolution and the contextual meaning of Genesis to determine where the human fault has occurred. In no way has God made an error. The questions this thesis sets out to answer are as follows: does modern scientific evidence point to a process of evolution spanning billions of years? If so, is this compatible with the narrative of creation put forth in Genesis and the salvation of mankind?

First, this thesis will provide an overview of the current, accepted model of human evolution. To support this model, evidence will be drawn from the fossil record, the structure of the human body, and genetic experimentation. The origins of humanity can be traced back

[1] Unless otherwise noted, all biblical references will be from the ESV.

[2] There are varying degrees to which Christians affirm the validity of the science presented in Genesis. These views will be expounded upon later in this thesis.

through the history of the entire universe, including, but not limited to the Big Bang theory, chemical evolution, abiogenesis, the endosymbiotic theory, microevolution, and macroevolution.[3] This thesis will focus on microevolution—the change in gene frequency within a population that gives rise to variations—and macroevolution—long-term changes within a population that give rise to new species—essentially microevolution over an extended period of time. Specifically, this thesis will follow the development of humankind from ancestral hominids, who share more features with other great apes, to the modern form *Homo sapiens*.

This thesis will then examine the context in which the creation narrative was written. Forcing Genesis into a modern, Western worldview does not do the text justice nor does it enable readers to fully understand what God was communicating to the ancient Israelites. By analyzing Ancient Near Eastern (ANE) mythology and ontology, this thesis will reconstruct the setting in which God's character and creation were originally comprehended.

Then, the different syntheses of the creation narrative and the theory of evolution affirmed by Christians today will be examined. There is a spectrum of the degrees to which a Christian accepts evolution, ranging between the extremes of Theistic Evolution and Young Earth Creationism. Each viewpoint differs on both their interpretation of Genesis and their coherence to mainstream evolutionary thought. This thesis will not address every single viewpoint individually, but it will address the most prominent shared beliefs and ultimately,

[3] The Big Bang theory explains the rapid expansion of the universe from an infinitesimal volume to its present, ever-increasing vastness. Chemical evolution is the diversification of elements after the Big Bang, beginning with hydrogen and helium and resulting in the wide range that make up the naturally occurring elements of the periodic table. Abiogenesis is the theory that proposes how the first living organisms emerged from inorganic material. The endosymbiotic theory proposes how eukaryotic cells became prokaryotic cells which contain more diverse organelles.

conclude which is the most viable.

There is substantive evidence for the theory of evolution which does not contradict the truths presented by the Genesis creation narrative when placed into its background of the ANE. Therefore, the human error has occurred not within science, but within interpreting the Bible to mandate a literal, six-day creation.

Before beginning this thesis, it is important to define and distinguish certain ideas surrounding the theory of evolution. One must note that the word theory, such as used in "the theory of evolution" has a different meaning in the scientific realm than in everyday language. Colloquially, one can say that they have a theory with no evidence. Any explanation or guess for why something has happened can be deemed a theory. Whereas in science, a theory is a group of well-substantiated related models that explains an aspect of the natural world.[4] Theories are refined as new evidence is presented and enable scientists to make predictions based on their model.[5] There is no tier level above "theory" that would indicate evolution has more credibility. Some examples of other theories are the germ theory, the idea that a specific germ causes a specific disease;[6] the kinetic molecular theory, the relationships of gas properties; and the general theory of relativity, Einstein's theory of how gravity affects space-time. Evolution cannot be disregarded as "just a theory."

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[4] National Research Council; Committee on Defining and Advancing the Conceptual Basis of Biological Sciences in the 21st Century; Board on Life Sciences; Division on Earth and Life Studies, *The Role of Theory in Advancing 21st-Century Biology* (District of Columbia: National Academies Press, 2008), 32-33, https://nap.nationalacademies.org/read/12026/chapter/4#32.

[5] Ibid.

[6] National Research Council (US) Committee to Update Science, Medicine, and Animals. "A Theory of Germs." In *Science, Medicine, and Animals.* Washington: National Academies Press (US), 2004. https://www.ncbi.nlm.nih.gov/books/NBK24649/?report=reader.

Additionally, the theory of evolution does not propound a singular, immutable explanation for how all life on earth came to be. As new evidence is discovered, scientists' understanding of life's past changes, and the theory of evolution is updated to reflect the newest breakthroughs. For example, in 2013, fossilized remains of a previously unknown hominin, dubbed *Homo naledi*, were discovered in South Africa. They have been dated to the middle of the Pleistocene epoch, which surprised scientists because *H. naledi* exhibits primitive features which were thought to have not persisted length of time. Its cranial vault, dentition, shoulder, manual phalanges, pelvis, and proximal femur are similar to those of the more ancient *Australopithecus*, while its wrist and hand structure are more similar to that of modern humans.[7] Scientists are unsure how *H. naledi* fits into the hominin phylogenic tree; it could be an ancestor to modern humans or simply another branch. However, one thing is certain: the recent discovery of *H. naledi* has changed scientists' understanding about persisting hominin diversity and prompted them to examine the topic further. There is not one, single evolution narrative nor are scientists claiming to have all the answers. Much of humanity's past remains unknown, and researchers today are trying to piece together ancient evidence, a process which entails adapting as new discoveries are made.

For the purpose of this thesis, the distinction between hominins and hominids will follow the currently accepted phylogenic grouping. The term hominid is a broader term including all members of the family Hominidae (orangutans, chimpanzees, bonobos, gorillas, humans, and their extinct close relatives). The term hominin refers to members of the tribe

[7] Lee R. Berger, John Hawks, Paul H.G.M. Dirks, Marina Elliott, and Eric M. Roberts. "*Homo naledi* and Pleistocene Hominin Evolution in Subequatorial Africa." *eLife,* (May 2017), accessed January 9, 2023, https://doi.org/10.7554/eLife.24234.

Hominini (only humans and their extinct close relatives).[8] Due to the distinction between *Homo sapiens* and other hominins, which will be explored later in this thesis, all uses of "human," "humanity," "humankind," and "mankind" will refer to members of *Homo sapiens*.

Compared to the extensive quantity of research around evolution and the substantial amount of defense of creationism, the synthesis of these two ideas has pitifully little public attention, despite the significant number of Christians who have accepted evolution. In the 2014 U.S. Religious Landscape study conducted by Pew Research, 53% of Christians affirmed that they believed humans had evolved over time, and the majority of these evolution-accepting Christians attributed evolution to a "supreme being," as phrased in the poll question.[9] While these numbers do vary among denominations, it is clear that a large portion of believers no longer adhere to a rigid interpretation of Genesis. In the past century, archaeology has advanced drastically, and mainstream science has accepted the theory of evolution by natural selection, which will be expounded upon in greater depth later in this thesis. High school curriculum has reflected this change, and every year, more students are being taught evolution as undisputed fact within their biology courses. Since 2009, more class time has been dedicated to evolution and the topic has been increasingly emphasized as settled science, shutting out the possibility of creationism.[10] Undoubtedly, this leaves

[8] A tribe is a classification rank between a subfamily and a genus.

[9] Pew Research Center, "The Evolution of Pew Research Center's Survey Questions About the Origins and Development of Life on Earth," Pew Research Center, February 6, 2019, accessed January 9, 2023, https://www.pewresearch.org/religion/2019/02/06/the-evolution-of-pew-research-centers-survey-questions-about-the-origins-and-development-of-life-on-earth/.

[10] Eric Plutzer, Glenn Branch, and Ann Reid, "Teaching Evolution in U.S. Public Schools: A Continuing Challenge," *Evolution: Education and Outreach* 13, no. 14 (June 2020), accessed January 9, 2023, https://doi.org/10.1186/s12052-020-00126-8.

numerous Christian students a bit confused. Many Christian denominations assert the inerrancy of the Bible, but the education system seems to directly contradict chapter one of this holy book. This is why understanding evolution and Genesis is critical for a Christian. No believer should begin doubting God because science seems to indicate his Word is flawed. Likewise, no unbeliever should be disinclined to seek God because of a preconceived notion that Christians reject science. Additionally, it is noteworthy to mention that whether one accepts evolution has no bearing on their personal salvation. Salvation is found through faith in God, not contingent on one's interpretation of a singular book of the Bible. Many people are able to never even ponder the question of origins and still accept Jesus Christ as Lord of their life. However, even if the issue of evolution might not affect one personally, it does affect the people one is surrounded by and their perceptions of Christians, God, and the inerrancy of the Bible.

History of Evolution

Date	Event
ca. 4th C. BC	Aristotle and the *scala naturae*
ca. 1st C. BC	Titus Lucretius Carus
1735	Linnaeus's hierarchal taxonomy
1749	Buffon's *Histoire Naturelle* supports descent from a common ancestor
1809	Lamarck's theory of use and disuse
1825	Cuvier proposes mass extinctions
1830	Lyell advances uniformitarianism
1844	*Vestiges* is anonymously published and ridiculed
1859	Darwin publishes *On the Origin of Species*

1871	Darwin publishes *The Descent of Man*
1900	Mendel's work on genetics is rediscovered
1942	Mayr presents the biological species concept
1968	Kimura proposes the neutral theory of evolution
1975	Humans and chimps are found to be 99% genetically similar

Figure 1. History of evolutionary thought.
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Ancient Concepts of Life

Aristotle

The earliest secular thought on animal and human evolution came from Ancient Greece. Aristotle (4th century BC) had very complex views regarding the ontology of organisms and their relationship between physical form and soul. Simply put, he believed that species were immutable.[11] However, he also suggested a grouping of animals from lesser to higher beings, called the *scala naturae*, or ladder of being, in which humankind was adjacent to angels.[12] If Aristotle would have imposed a timescale to his *scala naturae*, he would have gotten much closer to the modern theory of evolution.

Titus Lucretius Carus

Another philosopher would get closer to Darwin's idea. In his 1st century BC work on epicureanism called *De Rerum Natura,* or *On the Nature of Things*, Titus Lucretius Carus proposed that the earth randomly generated living beings, most of which died.[13] Only the

[11] Fran O'Rourke, "Aristotle and the Metaphysics of Evolution," *The Review of Metaphysics* 58, no. 1 (September 2004), accessed February 14, 2023, https://link.gale.com/apps/doc/A122990764/AONE?u=txshrpub100321&sid=googleScholar&xid=4c9166dd.

[12] Ibid.

[13] David Sedley, "Lucretius," *The Stanford Encyclopedia of Philosophy,* ed. Edward N. Zalta (Winter 2018), accessed February 14, 2023, https://plato.stanford.edu/entries/lucretius/.

strongest and craftiest were able to survive and give birth to subsequent generations of their kind.[14] This sounds eerily similar to the concept of survival of the fittest, only written 1900 years prior.

Pre-Darwinian Evolutionary Thought

Georges-Louis Leclerc, Comte de Buffon

The Scientific Revolution and the Enlightenment brought renewed interest in the origin and classification of life to Europe. In the 18th century, Georges-Louis Leclerc, Comte de Buffon, set out to publish an encyclopedia of all that was currently known about natural history and biology in a set of volumes entitled *Histoire Naturelle, Generale et Particular*. Buffon did not rely on the Bible for an explanation of Earth's history, nor did he support any intersection of science with the metaphysical.[15] Buffon asserted that the earth was much older than the biblical 6000 years and that life could arise spontaneously.[16] In *Histoire Naturelle,* he affirmed that all animals are descended from a single ancestor, and their shared heredity has caused similar morphology between species.[17] His work came under sharp criticism from the Christian community, and he was forced by the theological committee at the University of Paris to recant some of his findings and state that he abandoned that which was contrary to the Bible so that he

[14] Ibid.

[15] "Buffon, Georges-Louis Leclerc, Comte De," in *Complete Dictionary of Scientific Biography,* vol. 2, (Charles Scribner's Sons, 2008), 577, accessed February 18, 2023, link.gale.com/apps/doc/CX2830900701/GPS?u=txshrpub100321&sid=bookmark-GPS&xid=3da79d74.

[16] Ibid., 580.

[17] Ibid.

would not be censured.[18] Later in his life, Buffon would support the works of the rising French biologist Jean Baptiste Lamarck.

Jean Baptiste Lamarck

Lamarck proposed the first comprehensive theory of evolution in his 1809 book *Philosophie Zoologique.* His proposed mechanism for evolution was through use and disuse of traits.[19] A giraffe who needed to reach for higher leaves would gain a slightly longer neck, an acquired characteristic to be passed to its offspring, which in turn, would also lengthen their necks.[20] Lamarck's ideas were not received positively from either the scientific or religious communities, and although he erred greatly in his conjectures, he did correctly identify some key elements to the process of evolution, including the change of species and the imperceptible changes that would eventually result in new species.[21]

Georges Cuvier

Georges Cuvier, a Frenchman, was a leading expert in zoology and natural history in the early 19th century. A common misconception at the time was that all fossils found belonged to a species that was still currently alive but currently living at a different place on earth. Cuvier studied the bones of mammoths and concluded that they were very different from living

[18] Ernst Mayr, *The Growth of Biological Thought* (Cambridge: Harvard University Press, 1982), 1407, accessed February 18, 2023, Google Books.

[19] "Lamarck, Jean Baptiste Pierre Antoine De Monet De," in *Complete Dictionary of Scientific Biography,* vol. 7, (Charles Scribner's Sons, 2008), 591, accessed February 18, 2023, link.gale.com/apps/doc/CX2830902433/GPS?u=txshrpub100321&sid=bookmark-GPS&xid=94419423.

[20] Ibid.

[21] D. Graur, M. Gouy, and D. Wool, "In Retrospect: Lamarck's Treatise at 200," *Nature* 460 (August 2009): 688–689, accessed February15, 2023, https://doi.org/10.1038/460688a.

elephants and must have belonged to a different species.[22] Cuvier attributed their extinction to "revolutions," or previous large-scale changes on Earth that resulted in the extinctions of many organisms.[23] In the wake of these revolutions, which brought on changing environments, new kinds of organisms appeared.[24] However, as Cuvier believed species were immutable, he was unable to provide a comprehensive mechanism for the advent of new species. Rather, he left this up to "wonders."[25] There was definite resistance to Cuvier's theory of catastrophism, as how could God allow an entire species to be wiped out? Cuvier, a Christian himself, believed that extinctions could be compatible with the Bible.[26] Cuvier's opposition to the transmutation of species would make the French scientific realm hesitant to accept Darwin's theory of evolution by natural selection.

Charles Lyell

In contrast to Cuvier, English geologist Charles Lyell proposed a theory of the earth's history that did not rely on catastrophic disruptions. Instead, Lyell avidly supported and advanced the theory of uniformitarianism. Uniformitarianism asserts that the geological processes and physical laws of the past are the same as those of the present.[27] Erosion, sediment deposition, and regular volcanic eruptions combined with an immeasurably vast history could

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[22] Yu. Ya. Soloviev, "240th Anniversary of the Birth of Georges Cuvier (1769–1832)," *Paleontological Journal* 44, no. 6 (2010), accessed February 18, 2023, https://link.gale.com/apps/doc/A362853912/GPS?u=txshrpub100321&sid=bookmark-GPS&xid=86c9078f.

[23] Ibid.

[24] Ibid.

[25] Ibid.

[26] Ibid.

[27] "Lyell, Charles," in *Complete Dictionary of Scientific Biography*, vol. 8, (Charles Scribner's Sons, 2008), 569, accessed February 18, 2023, link.gale.com/apps/doc/CX2830902713/GPS?u=txshrpub100321&sid=bookmark-GPS&xid=37ac1734.

explain the variety of stratigraphic data collected.[28] Lyell published his theory in *Principles of Geology* in 1830, a book that would accompany Darwin on his five-year journey across the world aboard the *HMS Beagle*.[29] Not only was Darwin convinced of Lyell's uniformitarianism, but he applied and expanded upon Lyell's theory while travelling.[30] In addition to his geological theories, Lyell also promoted an approach to science that disregarded miracles as a mechanism for natural processes, another view that would be adopted by Darwin and many other 19th century naturalists, beginning the dismissal of God in science.[31]

Vestiges of the Natural History of Creation

In 1844, *Vestiges of the Natural History of Creation* was published anonymously by the Scottish Robert Chambers.[32] This book proposed an evolutionary model that began with the origin of the universe and moved through to the development of mankind, and while it was widely popular with the general public, no scientist seriously considered it as an explanation for an evolutionary mechanism. Instead of proposing a testable, empirical method for development, *Vestiges* left the process up to a mysterious "law" that would fulfill the Creator's preordained plan.[33] While scientists at the time did not agree with *Vestiges*, many were willing to consider explanations that relied on both science and the divine; as for the public, the divine definitely had

[28] Ibid., 568.

[29] Michael Ruse, *The Evolution-Creation Struggle* (USA: Harvard University Press, 2006), 67.

[30] Ibid., 68.

[31] Ibid.

[32] Alvar Ellegård, *Darwin and the General Reader: The Reception of Darwin's Theory of Evolution in the British Periodical Press* (Chicago: The University of Chicago Press, 1990), 11, accessed January 31, 2023, Google Books.

[33] Ibid.

some role in bringing about mankind and the abundance of life on earth.[34] In composing his own theory of evolution, Darwin set out to exhaustively prove his theory because if it were lacking in any way, then others would demand divine intervention in what he wanted to be a solely scientific work.[35]

Charles Darwin

Darwin published *On the Origin of Species* in 1859, and the initial 1250 copies immediately sold out, prompting more editions to be published. His book, a culmination of over twenty years of study, proposed two main arguments: the variety of living species alive today have all descended with modification from their ancestors, and the mechanism for this process is natural selection. Due to scarcity in resources and slight variation between organisms, over time, the fitter organisms will survive to pass on their genes, producing notable change in a species over time as desirable traits are propagated.[36] Many of Darwin's contemporaries believed that each species had been independently created and were immutable, meaning that they did not change.[37] Darwin's ideas received a very mixed response from both the scientific and religious communities. Many scientists were convinced of evolution but doubted the capability of natural selection.[38] Additionally, many people were willing to accept the evolution of the lower organic

[34] Ibid., 12.

[35] Ibid., 17.

[36] Gordon Chancellor and John van Wyhe, "Darwin's Origin of Species, First Edition (1859): An Introduction by Gordon Chancellor and John van Wyhe," Darwin Online, 2002, accessed February 16, 2023, http://darwin-online.org.uk/EditorialIntroductions/Chancellor_vanWyhe_Origin1st.html.

[37] Ellegård, 13.

[38] Ruse, 85.

world but felt reluctant to apply it to humankind due to religious beliefs. It was not until 1871 when Darwin would do exactly that with his publication of *The Descent of Man.*

After Darwin

Darwin knew nothing of genetics, as this field did not take off until the beginning of the twentieth century. Understanding genetics has enabled researchers to understand the method by which traits are inherited, a key component to natural selection. The sequencing of the human genome, genetic compatibility experiments, and mutation studies have provided powerful evidence for evolution over the course of the last century. The support of Darwin's ideas with genetics is called Neo-Darwinism.

The Theory of Evolution

Classification Systems

Along with the theory of evolution, the concept of species underwent substantial development over the last three centuries. In 1735, Carl Linnaeus developed a rigid system for naming and classifying organisms which he published in *Systema Naturae.*[39] The Linnaean hierarchy groups organisms by their observed similarities in the following descending order: kingdom, phylum, class, order, family, genus, species.[40] Referring to an organism could be done succinctly and clearly with a two-part scientific name, or binomial. This name would be written in the format *Genus species*.

[39] Carol Kaesuk Yoon, *Naming Nature: The Clash Between Instinct and Science* (New York: W.W. Norton & Company Inc., 2009), 47.

[40] Ibid., 45.

In the 19th century, the traditional taxonomic system received a blow. The widespread idea of species variability led naturalists to wonder where the line between two species could be drawn. This problem had stumped Darwin for years until he realized that the hierarchical classification of nature is reflective of divergent evolution, subsects of a population of organisms growing more disparate.[41] This revelation completely upheaved the established taxonomic guidelines put in place by Linnaeus which were based on human intuition to place organisms into strict categories. If an evolutionary tree of life was the hidden backbone of Linnaeus's hierarchy, then there was now a correct classification of organisms, one following their divergence from a common ancestor.[42] The field of taxonomy was extremely haphazard for decades following this shift from observational to evolutionary evidence.

Defining a species was one of many challenges brought about by this shift. In 1942, Ernst Mayr, an ornithologist and curator of birds at the American Museum of Natural History, created the biological species concept by defining species as "groups of actually or potentially interbreeding natural populations, which are reproductively isolated from other such groups."[43] Other definitions, such as the one put forth by Mayr's colleague George Gaylord Simpson said that a species was a "series of populations seen through time that was evolving separately from others and had its own evolutionary roles and tendencies."[44] Both definitions are problematic. Some organisms reproduce asexually. To test if two organisms are the same species, one might

[41] Ibid., 75.

[42] Ibid.

[43] Ibid., 106.

[44] Ibid., 108.

not have the time or resources to force them to interbreed. What determines if a species has a distinct evolutionary lineage?

Despite the fact that a perceived species is constantly changing and the forms of organisms which humans see today is just a snapshot of a much, much longer evolutionary journey, humans are still trying to find ways to delineate them. One of the most revolutionary methods of this is through cladistics, which was popularized in the 1960s. This system classified organisms based on shared, novel characteristics in a particular lineage.[45] Taxonomy shifted from human observation and intuition to trying to understand the evolutionary relationships between organisms. Cladistics can sometimes be alarming, as many perceived groups, such as the overarching term "fish" does not actually exist as its own clade without including cows, humans, and all land-dwelling creatures.[46] This is because a singular clade includes all descendants from a given common ancestor, and there is not a single common ancestor of all fish but of fish alone.

The Latin binomial nomenclature is still commonly used by scientists for its simple, instinctive approach to classification. For this thesis, binomials will be used, but these are not indicative of evolutionary relationships. Additionally, the idea of a species is a human construct, and there is no definitive line when one population in a species becomes distinct. Cladograms show that there is no point at which an ape "becomes" a human and stops being an ape. Descendants of an organism will forever belong to their ancestral clades, but as they are ever-changing, new clades will arise and be nested within established ones.

[45] Ibid., 242.

[46] Ibid., 257.

Timeline of the Earth

While cladistics provides valuable insight into the evolutionary relationships among species, they are just one way of tracing the vast history of life on earth, which spans billions of years, as represented in Figure 2.

Years Before Present	Event
13.5 billion	Beginning of the universe
4.5 billion	Formation of the earth
3.8 billion	First living organism
535 million	Cambrian explosion
375 million	Animal life exits the oceans
6.5 million	Last common ancestor of humans and chimpanzees
300,000	*Homo sapiens*

Figure 2. Timeline of the earth.
Created by author.

Evidence for Evolution

There has been ample time for evolution to occur, and this process has left evidence throughout numerous fields including biology, genetics, biogeography, paleontology, and paleoanthropology. Only a few examples will be explained in this thesis.

Intermediate Forms

An intermediate, or transitional, form is an organism that demonstrates the progression of one ancestral trait into a common trait among descendants. All organisms are technically transitional forms, as evolution is on-going. However, from a human perspective, fossil evidence is observed as recording an organism's approach to its present-day form. Additionally, the fossil

record does not show present-day organisms evolving into other present-day organisms. Monkeys do not evolve into humans. Rather, monkeys and humans evolved from a common ancestor, and this is what the fossil record shows. Transitional forms of hominids will be discussed later in this thesis.

One of the longest-lasting arguments against evolution is that there is a lack of intermediate forms both within the fossil record and among currently living organisms.[47] Neither of these claims are true, and transitional forms are actually strong evidence *for* evolution.

In 2004, Neil Shubin, a paleontologist and professor of anatomy, discovered a groundbreaking transitional form: an organism demonstrating the shift from aquatic creatures to land dwellers. Leaving the ocean would have been a missive evolutionary hurdle, as such a drastically different lifestyle would require new methods of, and organs for, breathing, excretion, feeding, and moving.[48] Structurally, fish and early land dwellers are very different as well. Fish have conical heads, no necks, scales, and fins whereas early land dwellers had flat heads, necks, no scales, and limbs.[49] Before setting on his expedition, Shubin hypothesized that an organism demonstrating this water-to-land transition would have been a live 365–385 MYA.[50] This is because at the time, the earliest evidence for amphibians dated to 365 MYA, but at 385 MYA,

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[47] Ian Hesketh, *Of Apes and Ancestors: Evolution, Christianity, and the Oxford Debate* (Toronto: University of Toronto Press, 2009), 81, accessed February 16, 2023, Google Books.

[48] Neil Shubin, *Your Inner Fish: A Journey into the 3.5-Billion-Year History of the Human Body* (New York: Pantheon Books, 2008), 6.

[49] Ibid., 22.

[50] Ibid., 10.
MYA stands for million years ago.

there were only fish.[51] Shubin's new fossil, called *Tiktaalik*, had a mix of fish and tetrapod features and was dated to 375 MYA, fitting perfectly within the expected range.[52] *Tiktaalik* had scales and webbed fins like a fish but also a flat head, a neck, and joints, similar to early tetrapods, and its role as an intermediary is shown in Shubin's diagram below.[53]

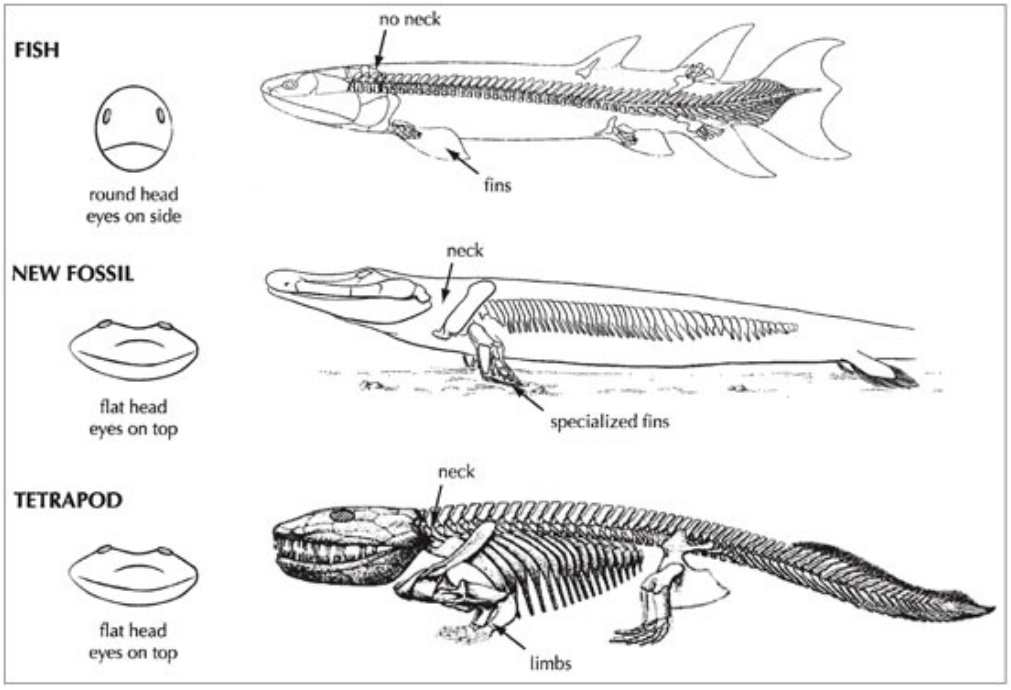

Figure 3. Tiktaalik as a transitional form.[54]

Tiktaalik's large pectoral muscles and appendage joints would have enabled it essentially to do push-ups.[55] *Tiktaalik* likely lived and fed in shallow aquatic environments. However, these environments were shared with massive predators. The joint structure of *Tiktaalik* would have

[51] Ibid.

[52] Ibid., 23–24.

[53] Ibid.

[54] Ibid., 24.

[55] Ibid., 40.

enabled it to traverse the muddy banks more efficiently and get away from predators.[56] While *Tiktaalik* is not the ancestor of all land tetrapods, it represents a snapshot of the species that was, a fact well-accepted by evolutionary biologists.

The fossil record is quite comprehensive, and as more archaeological work is done, supposed missing links will continue to be found, as every year there are more and more evolutionary "gaps" being filled in such as tetrapod to snake, invertebrate to vertebrate, dinosaur to bird, and many more.

Non-coding DNA

Just as the earth is littered with preserved fossils, remnants of creatures that once walked the earth, the genomes of living species contain preserved nonfunctional genes that are often indicative of past expressed genes. There are countless examples of these. In fact, the majority of the human genome does not code for functional proteins; instead, it is comprised of regulatory regions and areas with no present known function.

In the human genome, the *GLO* gene is one such nonfunctional gene. Most vertebrates are able to naturally synthesize vitamin C, while the great apes (including humans), some bats and birds, teleost fish, and guinea pigs do not have this ability. They do, however, have a mutated L-gulono- γ-lactone oxidase (*GLO*) gene, which codes for the enzyme needed for the final step of vitamin C biosynthesis. This gene is more easily lost and regained than others because it only makes a single compound and does not affect other metabolic pathways. Losing the ability to synthesize vitamin C was effectively a neutral mutation, as the hominin diet included fruit, an external source. All species lacking a functional *GLO* gene have diets that

[56] Ibid., 41.

could provide vitamin C for them. On the other hand, no species that is lacking this ability has a diet deficient in vitamin C.[57] The loss of the *GLO* gene was possible because it was not selected against. Organisms that were able to survive by obtaining vitamin C from their diets experienced no selective pressure to maintain a function *GLO* gene. On the other hand, in humans, *GLO* is a pseudogene; it has no current purpose, but it was once used by ancestors.

Genetics

The advent of genetics has provided a powerful tool for unraveling evolutionary history. Similarities in the genomes of different species enable researchers to understand what mutations and changes have occurred to result in the present diversity of life. Phenotypic differences, which are observable on a surface level, are not always indicative of the level of genotypic similarity. For example, just as a paternity test relies on genetic similarity to determine how closely related two people are, comparing genomes is a method of discerning how long ago species diverged from a common ancestor. The protein-coding sections of human and chimpanzee DNA are 99% similar when accounting for single nucleotide alterations.[58] Accounting for duplication, deletion, inversion, and translocation events can make comparing the entire genome more difficult, as the differences in the regulatory genes cause the major phenotypic differences between chimpanzees and humans. The overwhelming similarity of human and chimpanzee genomes supports a recent common ancestor.

[57] Guy Drouin, Jean-Rémi Godin, Benoît Pagé, "The Genetics of Vitamin C Loss in Vertebrates," *Curr Genomics* 12, no. 5 (August 2011), accessed March 26, 2023, https://doi.org/10.2174/138920211796429736.

[58] Maria V. Suntsova and Anton A. Buzdin, "Differences Between Human and Chimpanzee Genomes and Their Implications in Gene Expression, Protein Functions and Biochemical Properties of the Two Species." *BMC Genomics* 21, no. 7 (September 2020), accessed March 27, 2023, https://doi.org/10.1186/s12864-020-06962-8.

Evidence for evolution can be found in the comparing the chromosomes of human and other hominids. Humans have 46 chromosomes (23 pairs) while all other great apes have 48 (22 pairs). This suggests that the common ancestor of these species had 48 chromosomes and a fusion event led to the reduced number in humans.[59] Evolutionary theory predicts this, but what does scientific evidence show? If the human chromosome number exhibits a recent fusion (in terms of the timeline of evolutionary history), then there should be traces of such an event.

This is exactly what is found in human chromosome 2. A typical chromosome has a centromere at its center and telomeres at each end. These can be distinguished from the rest of the genome by particular sequences of base pairs. Human chromosome 2 exhibits degenerate telomere sequences near its middle and one additional centrosome area, as if the two chromosomes were connected at their ends.[60] The genes found on these chromosomes line up as well. This is exactly what evolutionary theory predicts.

Vestigial Structures

Organisms retain remnants of their evolutionary history in their genome and on their bodies. Over the course of evolution, some structures no longer retain the same function in one species that they had in their ancestors and may be physically reduced. These are called vestigial structures. Some vestigial structures have no use, and some have undergone exaptation, repurposing for a function other than that for which it was selected. There is an abundance of vestigial structures in nature, and a few will be discussed here.

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[59] Yuxin Fan, Elena Linardopoulou, Cynthia Friedman, Eleanor Williams, and Barbara J. Trask, "Genomic Structure and Evolution of the Ancestral Chromosome Fusion Site in 2q13–2q14.1 and Paralogous Regions on Other Human Chromosomes," *Genome Research* 12 (2002), accessed March 22, 2023, https://doi.org/10.1101/gr.337602.

[60] Ibid.

The fossil record shows that snake ancestors had four legs, each with a forelimb and a hindlimb. Their forelimbs were reduced and lost followed by the hindlimbs. Today, snakes have remnants of legs left over from their evolutionary journey. Some snakes such as pythons and boas diverged from snake ancestors before the leg had been completely reduced. For this reason, these snakes still have a vestigial pelvic girdle, femur, and claw.[61]

Evidence of human's evolutionary past can be found on one's own body. The palmaris longus is a muscle originating at the medial epicondyle of the humerus and inserting to the palmar aponeurosis, essentially running from elbow to wrist along the anterior forearm.[62] The palmaris longus can be seen on one's body by moving one's thumb to connect with the pinkie finger, as demonstrated in Figure 4. The presence of this muscle varies greatly among ethnic groups, with its absence ranging from 3% to 63.9%.[63] There is no impact on wrist flexion in people lacking this muscle, making it a common choice for reconstructive tendon grafts.

Orangutans, the only completely arboreal ape, always have a palmaris longus, while more terrestrial apes are less likely to have them.[64] The higher frequency of this muscle in arboreally-inclined apes indicates that its function could assist in daily tree activities. This reduction of size and complete disappearance of the palmaris longus is due to the tendency of evolution to

[61] Francisca Leal and Martin J. Cohn, "Loss and Re-Emergence of Legs in Snakes by Modular Evolution of *Sonic hedgehog* and *HOXD* Enhancers," *Current Biology* 26, no. 21 (November 2016), accessed March 15, 2023, https://doi.org/10.1016/j.cub.2016.09.020.

[62] Nicole Capdarest-Arest, Jorge P. Gonzales, and Tolga Türker, "Hypothesis for the Ongoing Evolution of Muscles of the Upper Extremity," *Medical Hypotheses* 82, no. 4 (January 2014), accessed March 15, 2023, https://doi.org/10.1016/j.mehy.2014.01.021.

[63] Ibid.

[64] Ibid.

prioritize energy output, as there is no reason to waste energy building and sustaining a structure that provides no evolutionary advantage.[65]

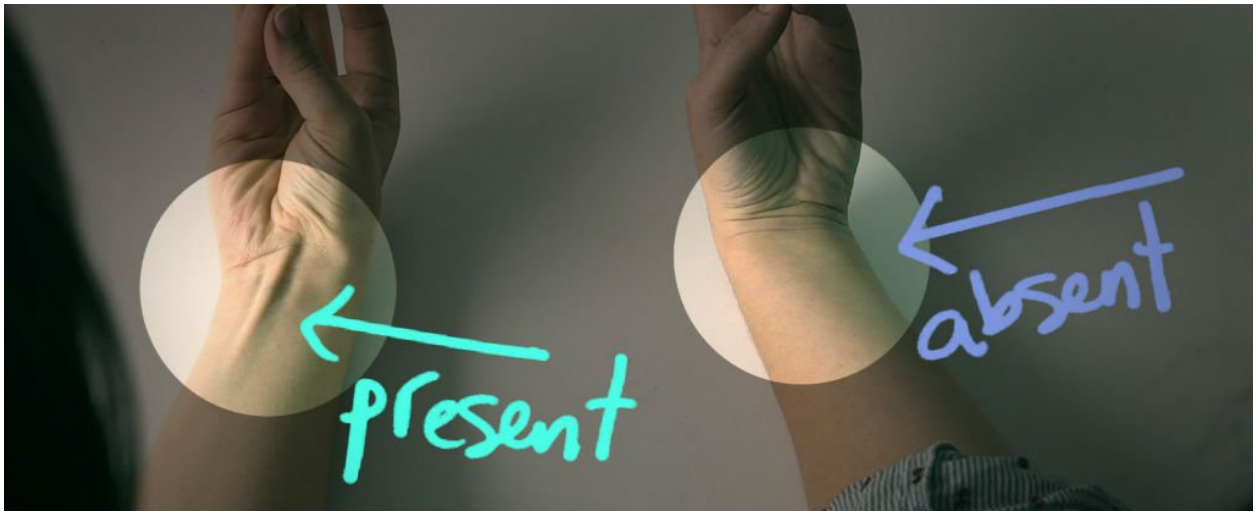

Figure 4. Palmaris longus.[66]

Ancestral Hominins

Looking at common and absent features can allow scientists to conclude how long ago two species diverged relative to another species. This can be done on a genetic level as well, using known mutation rates and shared mutations between species. These molecular clocks have enabled scientists to conclude that the last common ancestor of humans and chimpanzees lived between 10 and 7 MYA.[67] Since this divergence, there have been many different species of hominins, some of which are ancestors to *H. sapiens* and others which could be deemed cousins, although this evolutionary distinction can be hard to determine. *H. sapiens* is the only species of

[65] Ibid.

[66] Vox, "Proof of Evolution that You Can Find on Your Body," (video), March 17, 2016, accessed March 17, 2023, https://www.youtube.com/watch?v=rFxu7NEoKC8.

[67] Alice Roberts, *Evolution: The Human Story,* 2nd ed. (New York: DK Publishing, 2018), 58.

hominin still alive today. There are many more species of extinct hominids, so only a select group of transitory species will be analyzed here.

In the specialization of the hominin clade from the great apes as a whole, a few key changes occurred. The hominids shifted from quadrupedal to bipedal, the cranial volume increased, and the use of tools became more widespread. Bipedalism brought about many advantages. It enabled hominins to travel long distances more efficiently, minimized sun exposure, increased visual range, and freed up the hands for tool usage. Bipedalism also brought about other structural changes which can be found in fossils such as a barrel-shaped rib cage, arches in the feet, a shorter and wider pelvis, a curved spine, a larger, more elliptical femoral head, and an increase in the ratio of the size of the lower limbs to the upper limbs.[68] Some remains can be identified as bipedal even without a complete skeleton because bipedalism mandates changes in other traits, such as the shift of the foramen magnum (from which the vertebral column extends out of) from the rear of the skull's base to the center.

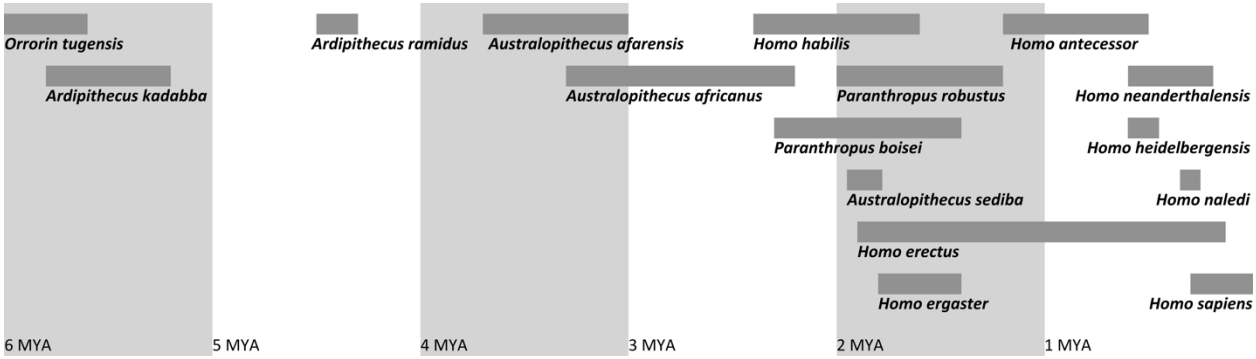

Figure 5. Timeline of hominin fossils.
Created by author, based on data from Roberts.

[68] Ibid., 69.

Ardipithecus ramidus

While there is evidence that earlier hominids such as *Sahelanthropus tchadensis* (7–6 MYA) and *Orrorin tugenesis* (6.2–5.6 MYA) were bipeds, significantly more remains of *A. ramidus* (4.5–4.3 MYA) have been found. This ancient hominid exhibited a blend of modern human and ancestral Miocene ape characteristics. The great toe of *A. ramidus* was significantly more divergent than that of *H. sapiens*. However, it lacked the grasping ability of chimpanzees, and its lateral rays were used in pushing itself forward for terrestrial movement.[69] The structures of the pelvis, the spine, and the sacrum indicated bipedal movement, but *A. ramidus* likely still had an affinity for the trees.[70] This is supported by the fact that their arms and legs were of similar length, suggesting that *A. ramidus* was able to efficiently clamber arboreally.[71] This equal ratio of leg size to arm size was similar to other Miocene apes.[72]

Australopithecus afarensis

Lucy is quite possibly the most famous hominin discovery, as she was the most complete skeleton found as of 1973. *A. afarensis* lived 3.7–3 MYA and like *A. ramidus,* exhibited a blend of traits from shared with humans and Miocene apes. *A. afarensis* had long, orangutan-like fingers but a more barrel-shaped chest than extant apes.[73] The limb joint proportions of this

[69] Tim D. White, C. Owen Lovejoy, Berhane Asfaw, Joshua P. Carlson, and Gen Suwa, "Neither Chimpanzee nor Human, *Ardipithecus* reveals the Surprising Ancestry of Both," *Proceedings of the National Academy of Sciences* (April 2015), accessed March 18, 2023, https://doi.org/ 10.1073/pnas.1403659111.

[70] White, et al.

[71] Roberts, 71.

[72] White, et al.

[73] Ibid., 79.

species was close to that of modern humans.[74] This fact, along with the foot, ankle, and pelvic structures, has led scientists to hold firmly to the fact that *A. afarensis* was a biped.[75]

Homo habilis

H. habilis is one of the more widely debated taxa of human relatives. While there have been many skulls found from the Olduvai Gorge, little else has been recovered. One pristinely preserved foot exhibited many human qualities such as shorter toes and limited joint mobility.[76] The skulls provide valuable insight to the facial structure of this ancient species. The lower face projected forward significantly less than in earlier hominins and compared to the australopithecines, the face was smaller.[77] This species was given its name "handy man" because they were discovered with tools in the Olduvai Gorge.[78] Compared to the australopithecines, *H. habilis* had a larger brain, smaller molars, and more humanoid feet.[79]

Homo erectus

H. erectus spanned almost two million years on the earth and are largely accepted to be the first hominids to exhibit control over fire. Additionally, the species has been found widely

[74] Anjali M. Prabhat, Catherine K. Miller, Thomas Cody Preng, Jeffrey Spear, Scott A. Williams, Jeremy M. DeSilva, "Homoplasy in the Evolution of Modern Human-Like Joint Proportions in *Australopithecus afarensis*," *eLife* (May 2021), accessed March 18, 2023, https://doi.org/10.7554/eLife.65897.

[75] Ibid.

[76] Roberts, 100.

[77] Ibid., 101.

[78] Ibid., 102.

[79] Ibid. 100.

dispersed throughout Africa, Europe, and Asia.[80] They are characterized by an increased body size, a wide face, smaller teeth, and a massive brow ridge.[81] *H. erectus* were efficient hunters and scavengers, supplying the increased energy demand brought on by larger bodies and brains. The dental structure is indicative of less need for mastication, the chewing of substances to stimulate salivation.[82]

Homo neanderthalensis

H. neanderthalensis has recently enjoyed its time in the spotlight, as Svante Pääbo won the 2022 Nobel Prize in Physiology or Medicine for sequencing the genome of the Neanderthal. Neanderthals first showed up in the fossil record 430,000 years ago and died out around 40,000 years ago. *H. neanderthalensis* made art, understood death and symbolism, had rituals, and created body ornaments. While there are many habitual similarities between the two species, their physical characteristics and genomes distinguish them. Compared to *H. sapiens,* Neanderthals were, on average, shorter and more robust, with larger chests and flared ribcages; the ratio of their forearm to upper arm as well as the ratio of shin bone to thigh bone were lower.[83] However, based on the Linnean concept of species, they could be grouped together, as they were able to reproduce, and many people today have some Neanderthal DNA in them, which a simple heredity test can show.

[80] Adam P. Van Arsdale, "*Homo erectus* – A Bigger, Smarter, Faster Hominin Lineage," *Nature Education Knowledge* 4, no. 1 (2013), accessed March 27, 2023, https://www.nature.com/scitable/knowledge/library/homo-erectus-a-bigger-smarter-97879043/.

[81] Roberts, 125.

[82] Van Arsdale.

[83] Roberts, 151.

There is not a current consensus for what caused Neanderthals to go extinct, and it was likely a combination of many factors. One such factor is differences in immunities. Due to population barriers, *H. sapiens* ancestors and *H. neanderthalensis* had different immunities to different diseases. *H. sapiens* had deadlier and more numerous diseases than the Neanderthals, resulting in the latter's survival.[84] Another proposed mechanism for Neanderthal extinction is competition with *H. sapiens* for resources.[85] Despite the fact that Neanderthals had, on average, larger braincases than modern humans, their genome has revealed that they were not as intellectually advanced, a potential source for their defeat at the hands of *H. sapiens.* A single base pair substitution resulted in a single amino acid being translated differently, thus allowing the human brain to produce more neurons and engage in more complex thought than the Neanderthal.[86]

Homo sapiens

The earliest fossil of *H. sapiens* dates to about 300,000 years ago, found in the cave site Jebel Irhoud in Morocco.[87] Humans today share many morphological characteristics: a large, rounded brain case, a small face underneath the frontal bone, a chin (even in infants), a

[84] Gili Greenbaum et al., "Disease Transmission and Introgression Can Explain the Long-Lasting Contact Zone of Modern Humans and Neanderthals," *Nature Communications* 10, no. 5003 (2019), accessed March 30, 2023, https://doi.org/10.1038/s41467-019-12862-7.

[85] William Gilpin, Marcus Feldman, and Kenichi Aoki, "An Ecocultural Model Predicts Neanderthal Extinction Through Competition with Modern Humans," *Proceedings of the National Academy of Sciences of the United States of America* 113, no. 8 (2016), accessed March 30, 2023, https://doi.org/10.1073/pnas.1524861113.

[86] Anneline Pinson et al., "Human TKTL1 implies greater neurogenesis in frontal neocortex of modern humans than Neanderthals," *Science* 377, no. 6611 (September 2022), accessed March 30, 2023, https://doi.org/10.1126/science.abl6422.

[87] Roberts, 164.

slight, discontinuous brow ridge, a slim trunk and pelvis, and distinct dental microstructure.[88]

Overview of Biblical Creation

Now that evolution has been understood, a Christian must explore what the Bible teaches about creation to investigate if the two are compatible. While many Young Earth Creationists (YECs) claim that their view has been held for millennia and the non-literal interpretations of Genesis represent the growing capitulation of traditional Christian doctrine to modern standards, this is not the case.[89] Since the beginning of Christianity, a six-day creation has not been the only exegesis of Scripture.

Early Interpretations of Genesis

Justin Martyr

One of the earliest divergences from a literal interpretation regarded the length of the days of creation. In his *Dialogue with Trypho*, written between 155 CE and 160 CE, church father Justin Martyr references the saying, "The day of the Lord is as a thousand years."[90] This is drawn from 2 Peter 3:8, "With the Lord one day is as a thousand years, and a thousand years as one day," and Psalm 90:4, "For a thousand years in your sight are but as yesterday when it is past, or as a watch in the night," both of which indicate that God experiences time in a different manner than that of humans. Justin Martyr corroborates his assertion with the fact that Adam lived to be 930 years

[88] Christ Stringer, "The Origin and Evolution of *Homo sapiens*," *Philosophical Transactions of the Royal Society of London. Series B, Biological sciences* 371, no. 1698 (2016), accessed March 29, 2023, https://doi.org/10.1098/rstb.2015.0237.

[89] Within this thesis, each viewpoint will frequently be referred to in its abbreviated form, and proponents of that view may be referred to using the singular or plural form. For example, YEC can refer to Young Earth Creationism or a Young Earth Creationist, while YECs refers to Young Earth Creationists.

[90] Justin Martyr, *Dialogue with Trypho*, chapter 22, ed. Alexander Roberts, James Donaldson, A. Cleveland Coxe, trans. Marcus Dodds and George Reith (Buffalo: Christian Literature Publishing Co., 1885), accessed February 8, 2023, https://www.newadvent.org/fathers/01282.htm.

old even though he had been told, "You may surely eat of every tree of the garden, but of the tree of the knowledge of good and evil you shall not eat, for in the day that you eat of it you shall surely die" (Gen. 5:5; Gen. 2:16-17). Because Adam lived to be 930 years old, he died within a thousand-year period. If one day indicates 1000 years, then his old age would technically be within the same "day" of his sin. Justin Martyr personally does not further apply this logic to the six days of creation. However, his assessment shows that since the origin of Christianity, not all the temporal information in Genesis has been read literally.

Hippolytus of Rome

Many early church fathers shared a similar view as Justin Martyr. Some believed that the earth was created in six 24-hour days, but that the universe would end after 6000 years; others believed that the six days of creation contained 1000 years each. Hippolytus of Rome, writing between the 2nd and 3rd centuries, exemplified the former of these views. He was analyzing the end of the world and believed that each of the literal six days of creation corresponded to 1000 years of existence, also relying on 2 Peter 3:8.[91] Additionally, he argued that Jesus came during the analogous sixth day, and Hippolytus himself was writing during this time period, which would have been between 5000 and 6000 years since the beginning of creation. The end of days would come at the end of this 1000-year sixth day, and God would finally rest.

Lactantius

Lactantius, a 4th century teacher of Christianity in Rome, adopted a very similar view to that of Hippolytus. In his *Divine Institutes,* he argued the following:

[91] Hippolytus, "Second Fragment (Of the Visions)," chapter 4, in *Exegetical Fragments*, ed. Alexander Roberts, James Donaldson, and A. Cleveland Coxe, trans. S.D.F. Salmond, https://www.newadvent.org/fathers/0502.htm.

> Therefore let the philosophers, who enumerate thousands of ages from the beginning of the world, know that the six thousandth year is not yet completed, and that when this number is completed the consummation must take place…God completed the world and this admirable work of nature in the space of six days, as is contained in the secrets of Holy Scripture, and consecrated the seventh day, on which He had rested from His works.[92]

This excerpt concisely summarizes a prominent view of creation in the early church: the world was created in six days but would last for 6000 years.

Cyprian

The latter of the two 1000-year views is exemplified by Cyprian, a 3rd century bishop and recognized saint in both Western and Eastern Christian sects. He believed that the days of creation were not 24-hour days. When discussing the importance of the number seven, he explicitly stated that the seven days of Genesis contain seven thousand years.[93] However, not all theologians relied on the idea of 1000 years to depart from the literal interpretation of Genesis.

Origen

One of these theologians was Origen, a prolific 3rd century Christian writer. He argued for many allegorical interpretations of Scripture, including the creation story. In one of his homilies, he broke down the days of creation and explained how they were reflective of a person living for God.[94] He did not discuss how long the first chapters of Genesis might have taken in historical time because they were simply instructions for becoming a holy, God-centered person. For

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[92] Lactantius, *The Divine Institutes,* book VII, chapter 14, ed. Alexander Roberts, James Donaldson, and A. Cleveland Coxe, trans. William Fletcher (Buffalo: Christian Literature Publishing Co., 1886), accessed February 10, 2023, https://www.newadvent.org/fathers/07017.htm.

[93] Cyprian of Carthage, "Treatise 11," chapter 11, ed. Alexander Roberts, James Donaldson, and A. Cleveland Coxe, trans. Robert Ernest Wallis (Buffalo: Christian Literature Publishing Co., 1886), accessed February 10, 2023, https://www.newadvent.org/fathers/050711.htm.

[94] Origen, *Origen: Homilies on Genesis and Exodus,* ed. Ronald E. Heine, (Washington: The Catholic University of America Press, 1981), 49, accessed February 10, 2023, Google Books.

example, Origen stated that the separation of the waters above and the waters below (an event done on the fourth day of creation) is something in which each Christian must metaphorically take part. This is through discerning what waters are spiritually "higher" and "lower." By separating oneself from the lower, spiritually evil waters, the "dry land" can appear, which would take the form of good deeds.[95] Origen applied this outlook to the sun, the moon, seeds, and all the other products of creation. He also presented the idea that "it is our inner man, invisible, incorporeal, incorruptible, and immortal which is made 'according to the image of God'"[96] and would be impious to assume that fleshly bodies represent God.

Theophilus of Antioch

Some church fathers, such as Theophilus of Antioch, did however, express a strictly literal interpretation. In his letters to Autolycus, dated to about 180 CE, Theophilus of Antioch addressed the suggested inconsistency that plants, which were created before the sun, could not have grown without the sun. Instead of this being an impossibility which reflects God is not real, Theophilus of Antioch asserted that this miracle indicated the limitless power of God.[97] He stated that God "knew the follies of the vain philosophers, that they were going to say, that the things which grow on the earth are produced from the heavenly bodies, so as to exclude God."[98] The creation order was intended to spurn the philosophers who imagined a world without God. Theophilus of Antioch took a similar approach to addressing the age of the earth, which he

[95] Ibid.

[96] Ibid., 63.

[97] Theophilus of Antioch. *To Autolycus,* book II, chapter 15, ed. Alexander Roberts, James Donaldson, and A. Cleveland Coxe, trans. Marcus Dods (Buffalo: Christian Literature Publishing Co., 1885), accessed February 10, 2023, https://www.newadvent.org/fathers/02042.htm.

[98] Ibid.

calculated, based on genealogies, to be 5698 years.[99] He did acknowledge that while there was room for potential error in these calculations, there would not be substantial enough error to indicate that the earth was tens of thousands of years old, a view subscribed to by Greek philosophers such as Plato and Apollonius.[100] Theophilus of Antioch's approach to the age of the earth would align with that of Young Earth Creationists today. He used the Bible as a source for the literal history of the origin of the universe.

Basil the Great

Basil the Great, a bishop of Caesarea in the 4th century would have strongly concurred with Theophilus of Antioch. Basil the Great gave many homilies on Genesis, and in these, he argued for the authority of Scripture's teachings on the matter of creation. He stated that a day is twenty-four hours and is marked by the revolution of the sun.[101] Note that Basil of Caesarea mentioned the revolution of the sun, not the revolution of the earth around the sun, reflecting his geocentric worldview. In arguing for a literal interpretation of Genesis, he made many other blatant scientific errors, such as expressing that on some occasions the earth literally brings forth living creatures, as Genesis 1:24 would insinuate. Basil of Caesarea pointed out that while some creatures are produced according to their kind (which a modern person would understand as sexual and asexual reproduction), others, such as grasshoppers, mice, frogs, and eels, were

[99] Ibid., book III, chapter 28.
Given that this text was written in 181 CE, this would indicate that the earth is 7540 years old in 2023 CE, the time of writing this thesis.

[100] Ibid., chapter 29.

[101] Basil of Caesarea, *Hexaemeron,* Homily 2, chapter 8, ed. Philip Schaff and Henry Wace, trans. Blomfield Jackson, (Buffalo: Christian Literature Publishing Co., 1895), accessed February 10, 2023, https://www.newadvent.org/fathers/3201.htm.

produced directly from the earth after rain.[102] Forcing a scientific explication onto Genesis has resulted in scientific inaccuracies for centuries, which will be explained in depth later in this thesis.

Augustine of Hippo

Augustine of Hippo was one of the few church fathers who acknowledged this division of the Bible and science. He initially promoted a very allegorical view of Genesis, in which the days of Genesis 1 were "epochs of redemptive-historical history" or "7 stages of the Christian life."[103] However, with the writing of *The Literal Commentary on Genesis* in the early 5th century, Augustine argued for a non-allegorical interpretation. This did not mean he promoted a strictly literal interpretation either. Rather, in this work, he accepted Genesis as containing historical truth, even if there might be figurative language employed.[104] Augustine wrote an abundance of texts surrounding creation, and his key beliefs will be summarized here.

In his commentary on Genesis, Augustine argued for instantaneous creation with the potential to develop further under the guidance of the Creator. He used the image of a seed to convey the idea that God imbued the world with exactly the powers it would need to bring about life and eventually humans.[105] However, this process would not be possible without God to nurture it. Given that he took a position of instantaneous creation, Augustine believed that the days of creation were not twenty-four-hour days, and in his *City of God*, he wrote "What kind of

[102] Ibid., Homily 9, chapter 2.

[103] Gavin Ortlund, "Did Augustine Read Genesis 1 Literally?" Henry Center, September 4, 2017, accessed February 10, 2023, https://henrycenter.tiu.edu/2017/09/did-augustine-read-genesis-1-literally/.

[104] Ibid.

[105] Alister McGrath, "Augustine's Origin of Species," Christianity Today, May 8, 2009, accessed February 13, 2023, https://www.christianitytoday.com/ct/2009/may/22.39.html.

days these were it is extremely difficult, or perhaps impossible for us to conceive, and how much more to say!"[106] Although Augustine asserted that God created time, he also acknowledged the futility of a human attempting to grasp God's relationship with time, and instead, simply trusted God and accepted his Word as truth.

Interestingly, Augustine did adhere to the biblical genealogies as establishing an age for the earth. He rebuked the chronologies of other civilizations, such as the Greeks and Egyptians, saying, "They are deceived, too, by those highly mendacious documents which profess to give the history of many thousand years, though, reckoning by the sacred writings, we find that not 6000 years have yet passed."[107] Augustine did, however, recognize that Christians are not to outright reject science in favor of biblical beliefs, warning that this would result in ridicule of believers.[108] Rather, he advocated digging deeper into Scripture to understand the theological truths. This was because "it was not the intention of the Spirit of God, who spoke through them [the inspired authors], to teach men anything that would not be of use to them for their salvation."[109] Augustine knew that the Bible was true, but he was willing to probe deeper into what kind of truths it held. The reason he affirmed the biblical chronology over those of pagans is because he trusted God over human record keepers. It was a matter of conflicting cultures, not religion and science. If it were religion and science, Augustine would likely have taken a different approach, as he did not want Christians to misinterpret Scripture to support a false

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[106] Augustine of Hippo, *The City of God,* book XI, chapter 6, ed. Philip Schaff, trans. Marcus Dodds (Buffalo: Christian Literature Publishing Co., 1887), accessed February 12, 2023, https://www.newadvent.org/fathers/120111.htm.

[107] Ibid., book XII, chapter 10.

[108] Augustine of Hippo. *The Literal Interpretation of Genesis,* 1:20 (408), accessed February 12, 2023, https://www.catholic.com/tract/creation-and-genesis.

[109] Ibid., 2:9.

secular history. His views do not align neatly with any prominent ones of today. Given his vast influence on the church, Augustine's hesitancy to treat Genesis strictly literally augmented the conflict between theologians over the matter.

Protestant Reformation

Martin Luther

Writing over a millennium later, Martin Luther cited Augustine as the cause for continuing disputes about creation.[110] Luther took an opposing position to Augustine. As a primary tenet of his reform efforts was the authority of Scripture alone, *sola scriptura*, a literal interpretation of Genesis reasonably accompanied it. Luther took a firm stance on the creation narrative and what he believed to be the errors of Augustine, writing, "With respect, therefore, to this opinion of Augustine, we conclude, that Moses spoke properly and plainly, and neither allegorically nor figuratively: that is, he means, that the world, with all creatures, was created in *six days*, as he himself expresses it."[111] Luther draws attention to the fact that even though God could have created the world in one instant does not mean that he did. Rather, he chose to create in a certain way and then revealed this way to Moses. As a recipient of divine inspiration, Moses is a better teacher on the matters of creation than any philosopher lacking supernatural aid.[112]

John Calvin

Notable Protestant reformer and Luther's contemporary John Calvin also adhered to a literal exegesis. In his 16th-century *Commentary on Genesis*, Calvin took a Christ-centered

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[110] Martin Luther, *Commentary on Genesis,* chapter I, trans. John Nicholas Lenker (Minneapolis: Lutherans in All Lands Co., 1904), accessed January 29, 2023, https://www.gutenberg.org/cache/epub/48193/pg48193-images.html#sect9.

[111] Ibid.

[112] Ibid.

approach to the creation narrative, explaining how the beginning of the Bible is not isolated to the subject of creation. Rather, it is the beginning of a chronicle which would find its fulfillment in Christ's coming in the gospels. Calvin condemned those who misconstrued Scripture to support a creation model that was not within six days.[113] His adversaries were those supporting views in line with Augustine's instantaneous creation or Origen's allegories, which he goes so far as to attribute to Satan's infiltration of the Church.[114] The Protestant Reformation, which emphasized the importance of Scripture also emphasized a corresponding literal creation story, as demonstrated by Luther and Calvin.

James Ussher

Moving into the 17th century, Anglican archbishop James Ussher is an important figure to note for his writings on creation. He is remembered, not for his interpretation of Genesis, but for his chronology calculations. Using biblical genealogies as well as corresponding historical events, he determined that the world was created 4004 years before the birth of Christ, and each day of the creation week was a literal, 24-hour day.[115] Ussher used the date of Nebuchadnezzar's death to anchor his timeline and even included the exact date and time.[116] This date became extremely widespread and was even published in many Bibles, including the official Bible of

[113] John Calvin, *Commentaries on the First Book of Moses Called Genesis,* vol. 1, trans. John King (London: Ionh Harifon and George Bifhop, 1578), accessed February 12, 2023, https://ccel.org/ccel/calvin/calcom01/calcom01.iii.html.

[114] Ibid.

[115] James Ussher, *Annals of the World* (London: E. Tyler, 1658), 12, accessed February 12, 2023, https://archive.org/details/AnnalsOfTheWorld/page/n10/mode/1up.

[116] Doug Linder, "Bishop James Ussher Sets the Date for Creation," Famous Trials, 2004, accessed April 11, 2023, http://law2.umkc.edu/faculty/projects/FTrials/scopes/ussher.html.

Church of England. Although more calculations have been done, the Young Earth Creationist stance still puts forth a date very close to this one for the beginning of the world.

Christian Responses to Evolution

Early Christian Supporters

Notably, there was early Christian support for evolution from men such as James McCosh, the Presbyterian president of Princeton; James Iverach, a New Testament theologian; Aubrey Lackington Moore, an Anglo-Catholic priest; and more Christians of renown.[117] McCosh was the first religious leader to publicly endorse evolution, and although he did not believe that mankind was created through natural selection, he applied Darwin's ideas to the rest of the organic world.[118] In his 1894 book *Christianity and Evolution*, Iverach wrote in defense of evolution, stating, "Why should supernatural design be regarded as possible only if it works suddenly and with a stroke? or why should supernatural design be limited only to special creations? Supposing natural selection true, what is it but another way of indicating design?"[119] Moore sought to dissolve the animosity between evolution and Darwinism and argued that understanding humanity's origins enables God's method of creation to be revealed.[120] Asa Gray, a Christian botanist, was one of the biggest supporters of evolution in the United States but believed in the addition of a guiding deity.[121] Many Christians wanted to agree with scientists

[117] Ruse, 135.

[118] Paul F. Stuehrenberg, "Christian Responses to Charles Darwin, 1870–1890: An Exhibit at the Yale Divinity School Library," Yale University Library, April 6, 2009, accessed February 16, 2023, https://divinity-adhoc.library.yale.edu/Exhibits/Darwin.htm.

[119] James Iverach, *Christianity and Evolution* (London: Hodder and Stoughton, 1894), 79, accessed February 16, 2023, Google Books.

[120] Stuehrenberg.

[121] Ibid., 132.

because they believed that science was the process through which mankind could better understand God's creation.[122] As a Deist himself, Darwin did not set out to clash with religion. Thomas Huxley, nicknamed "Darwin's bulldog," was the one to continually pit evolution against religion due to his personal beliefs.[123]

Oxford Debate

Despite some support, there was undeniable Christian resistance to evolution as well. This is best demonstrated in the 1860 debate at Oxford which set Samuel Wilberforce, the bishop of Oxford, against Joseph Hooker and Huxley. Wilberforce had two main objections: he asserted that if artificial selection through breeding could not produce new species, then neither could natural selection; and that the fossil record lacks intermediary forms indicative of evolution.[124] Ultimately, however, his deficiency in technical expertise showed, as Hooker presented scientific evidence that left Wilberforce defenseless. For the rest of the world, who won the Oxford debate was not as important as the concept and publicized hostility of the debate.[125] It was time to pick a side: God or Darwin.

The State of Tennessee v. John Thomas Scopes

In 1925, the Butler Act was passed in Tennessee which prohibited all state schools from teaching "any theory that denies the story of Divine Creation of man as taught in the Bible, and

[122] Ibid., 136.

[123] Ibid., 94.

[124] Hesketh, 81.

[125] Ibid., 87.

to teach instead that man has descended from a lower order of animals."[126] This was a culmination of a recent wave of evolution backlash after World War I.[127] Led by William Jennings Bryan, a former Secretary of State, this movement maintained that Germany's militaristic actions were fueled by Darwin's concept of a "struggle for existence" and that evolution deflected focus from the spiritual to the material.[128] The American Civil Liberties Union (ACLU) saw the Butler Act as a violation of the First Amendment and volunteered to defend in court any teacher who faced charges under it. John Scopes was one such teacher, and he accepted the ACLU's offer. The trial proceeded with Bryan prosecuting, Clarence Darrow defending and Judge John T. Raulston presiding over the case. Judge Raulston did not allow for any scientific experts to testify, hurting the defense's case because they sought to reconcile evolution with religion. Scopes was therefore found guilty, and the ACLU appealed the case.

The Tennessee Supreme Court upheld the constitutionality of the Butler Act, stating that teachers at state institutions had to comply with state laws and that the Butler Act did not force teachers to endorse a religion but rather, prohibited them from perpetuating the evils of evolution.[129] Scopes's conviction was ultimately reversed on a technicality, but the law stayed in effect until a similar law in Arkansas reached the Supreme Court in 1968 in the case *Epperson v. Arkansas.* The Supreme Court found the Arkansas statute contradictory to the First and Fourteenth Amendments.

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[126] Jonathan K. Van Patten, "The Trial of John Scopes," *South Dakota Law Review* 66, no. 2 (Summer 2021), accessed February 26, 2023, link.gale.com/apps/doc/A686656600/GPS?u=txshrpub100321&sid=bookmark-GPS&xid=e52ab5ba.

[127] Ibid.

[128] Ibid.

[129] Ibid.

Although Scopes did technically violate the law and was found guilty, the biggest impact of the Scopes Trial was that its high publicity—it was the first trial broadcasted over the radio and had attracted large crowds—highlighted the holes in religious fundamentalism. Darrow thoroughly defeated Bryan's biblical arguments when he examined him on the stand, getting Bryan to contradict himself and look out of his depth.

Growth of the Young Earth Creationist Movement

After the Scopes Trial, creationism was losing traction among the public but still remained prevalent in the classrooms. Once the Soviets surpassed the United States in aerospace engineering, demonstrated by the successful launch of Sputnik in 1957, the US's science curriculum was revamped, and new textbooks, including biology textbooks which endorsed Darwinian evolution, were printed.[130] This caused the creation-evolution debate to intensify.

In 1961, the creationist movement tried to bring science to their side, led by the publication of *Genesis Flood: The Biblical Record and its Scientific Implications*, by theologian John C. Whitcomb and hydraulic engineer Henry M. Morris. Their work supports creation occurring in six twenty-four-hour days and a 6000-year-old earth.[131] The seemingly ancient geology of the world is the result of a catastrophic global flood 4000 years ago and all "kinds" of animals, as described in Genesis, are the result of individual creation events. With science on their side, creationists challenged evolutionists to debate and pushed for creation to be taught in schools.

[130] Michael Ruse, "Creationism," *The Stanford Encyclopedia of Philosophy* (Winter 2022), ed. Edward N. Zalta and Uri Nodelman, accessed February 26, 2023, https://plato.stanford.edu/entries/creationism/.

[131] Ibid.

Kitzmiller v. Dover Area School District

In 2004, the Dover Area School District voted to implement Intelligent Design into their biology curriculum and to utilize copies of the Intelligent Design-promoting textbook *Of Pandas and People* which had been donated to the school.[132] Parents sued the school district on the basis that this violated the First Amendment. After a bench trial, Judge John E. Jones found that intelligent design represented a religious belief, as many parts of the textbook were simply copied from a creationist textbook. Additionally, the "wedge document," an outline of the goals of creationists, was discovered and provided an explicit declaration that they wanted materialistic science replaced with theistic ideas such as Intelligent Design.[133] The clearly religious motivations behind Intelligent Design resulted in it being deemed unconstitutional to teach in school, just like creationism.

Modern Interpretations of Genesis

There are many different interpretations of Genesis prevalent today; some try to be compatible with modern science and others try to get as close as possible to the text's intended meaning. The most prominent will be summarized in the following pages.

Day-Age Interpretation

The day-age theory states that each singular day of Genesis 1 symbolizes a vast period of time, upwards of one million years.[134] The biblical evidence for this view comes from the fact that the Hebrew word for day, *yom,* can be used to indicate indefinite periods of time or the

[132] "Kitzmiller v. Dover: Intelligent Design on Trial," National Center for Science Education, December 15, 2015, accessed March 13, 2023, https://ncse.ngo/kitzmiller-v-dover-intelligent-design-trial.

[133] Ibid.

[134] Vern S. Poythress, *Redeeming Science: A God-Centered Approach* (Wheaton: Crossway Books, 2006), 111.

period of daylight and not just twenty-four-hour days (Gen. 1:5; Gen 2:4; Zeph. 1:14–16). Biblically, the day-age theory does not hold up, as the addition of a number with the word *yom,* as in "the first day" combined with the mention of morning and evening indicates that these are ordinary days.[135]

As an attempt at reconciliation with science, the day-age theory is weak. Proponents of this view still assert that creation still occurred in the sequential order put forth in Genesis, so there are still scientific problems raised. For example, in the Bible, God creates vegetation on the third day but does not create the sun until the fourth day (Gen. 1:11; Gen. 1:14). The astronomical history of the universe would place the sun forming almost one billion years before the first plants. Another scientific inaccuracy is that God creates flying creatures before land animals whereas the evolutionary timeline can trace the development of flight beginning with land animals that manage to take to the skies (Gen. 1:20–21; Gen. 1:24). The day-age interpretation fails both biblically and scientifically.

Gap Interpretation

The gap interpretation holds that Genesis 1:1 was God's initial creation, which was perfect and sinless.[136] A large time span, potentially millions of years, could have passed between Genesis 1:1 and Genesis 1:2, allowing for the geologic ages seen in rock layers. The six days in the subsequent chapters are then considered literal, twenty-four-hour days in which God recreated the world that was ruined by sin.[137] The basis for this comes from an alternative

[135] Poythress, 111.

[136] Poythress, 108.

[137] Ibid., 109.

translation of Genesis 1:2. Two translations of the verb *hayah* mean that this verse can be read "The earth was without form…" or "The earth became without form…"[138]

However, this interpretation is not without its shortcomings. The Bible never references this process of initial or secondary creation. In fact, Genesis 2:3–4 summarizes God's creation work and only references the days.[139] The gap interpretation is contrary to Scripture, so it is not a valid option for those seeking to adhere as strictly as possible to the literal text.

Framework Hypothesis

This interpretation draws parallels between the first three days of creation and the second three days of creation. The former days are used for setting up habitats and the latter are used for filling those habitats.[140] For example, on day one, God created the light and the darkness while day four, He created the sun and the moon. This ordered process is used to highlight the artistic care God took with creating the universe. While there is nothing inherently incorrect with this interpretation, it is superficial at best, as it provides insight to neither the individualized function of aspects of creation nor any explanation of physical creation. This contextual approach and original understanding of the creation narrative will be explained later and is a useful addition for adherents of the framework hypothesis in deepening their understanding of the text.

[138] Don Stewart, "What is the Gap Theory? (The Ruin and Reconstruction Theory?)" Blue Letter Bible, April 24, 2007, accessed March 17, 2023, https://www.blueletterbible.org/faq/don_stewart/don_stewart_654.cfm.

[139] Ibid.

[140] John H. Walton, *The Lost World of Genesis One: Ancient Cosmology and the Origins Debate* (Downers Grove: InterVarsity Press, 2009), 110.

Mature Creation Interpretation

The mature creation interpretation is extremely attractive to those looking to accept modern science as well as a literal interpretation of the Bible. This view holds that God created the world in six days, as described in the Genesis account. However, just as he created Adam as a mature adult, the rest of creation would also bear evidence of age.[141] With this interpretation, all of science can be accurate and reliable but it is studying a history that never actually occurred. The universe only appears to be billions of years old. Past climactic events only appear to have happened. The fossil record exists, but those past organisms were never alive.

Arguably, many of the miracles Jesus performed relied on this notion of mature creation. One such example is the transformation of water into wine at the wedding at Cana.[142] Wine takes months to years to make and age properly so that it tastes good. The wine Jesus created was enjoyed by the guests who would have assumed it went through the typical winemaking process. Here God created wine with the appearance of age and past events.

While the wine at Cana, Adam, and the plants in the garden of Eden may have been created mature, the universe is different. In the case of the wine, there is precedent for how wine is supposed to be made. In the case of Adam and the plants in Eden, there is a repeatable method by which all future humans and plants will be made. There is a set path of maturing and expected history. The universe was created once. There is no expected history of it other than the one time it actually occurred. By creating the universe with the appearance of age, God would not have been fulfilling any set path of maturing. He would be leaving clues to a history that never

[141] Poythress, 116.

[142] John 2:7–11.

happened and that is never supposed to happen. In creating Adam, the plants, and the wine with the appearance of age, God is not being deceitful, as he is creating things as they should naturally occur. There is no set way the universe is supposed to naturally occur other than the way that it did. By indicating the earth is older than it is, by providing remains of animals that were never alive, and by pointing the astrophysicists to a date billions of years off, God would be leading humans to discern a story that contradicts his Word.

A Creationist's Biblical Arguments Addressed

Past Biblical Misinterpretations

Flat Earth

At the time of writing the oral tradition of Hebrew cosmography and the writing of the books of the Bible, most cultures in the ANE believed that the earth was flat. The Hebrews were no exception. To them, the plane of the earth resided below the dome of the firmament and above Sheol. This worldview is reflected frequently in the Old Testament such as in Job 28:24, Job 38:14, Isaiah 40:22, and Proverbs 8:27. Many of these verses simply allude to a flat earth or would make sense if the earth were flat. In the early Church, many writers advocated for a flat earth while many accepted scientific findings and labelled biblical references to a flat earth as merely figurative. Scientists have believed the world is round for thousands of years and today, it is hardly a controversy, although some fundamentalist Christians may use the Bible to defend this belief.

Geocentrism

Geocentrism had a much stronger foothold in Christianity and was immortalized in the trial of Galileo Galilei in the 17th century. Nicolaus Copernicus propounded his theory of heliocentrism, but it was not until the empirical work of Galileo that it gained strong support.

Like other scientists at the time, Galileo worked within church institutions. While he initially worked with the Pope's blessing, their relationship turned hostile after Galileo ridiculed geocentrism in one of his publications when he had been asked to simply explain it alongside his own theory.[143] Galileo was found guilty of heresy and insubordination and was sentenced to house arrest. Notable geocentrists were among the early church, the medieval Catholic Church, and the Protestant Reformation. References to geocentrism are more abundant than those to a flat earth, and some can be found in Psalm 93:1, Psalm 96:10, Psalm 104:5, and 1 Chronicles 16:30. Geocentrism was the prevailing belief among the early church although many YECs believe in neither flat earth nor geocentrism.[144] Nonetheless, these misinterpretations are mentioned because they highlight the fallacy of using the Bible as a source of literal, scientific information.

Failure of Literal Interpretations

Within the creation narrative, there are some statements that are clearly figurative, and no creationists today try to claim are true. Genesis 2:24 describes the union of husband and wife as becoming "one flesh." There is no misinterpretation here. Ancient and modern audiences have understood this to mean they are bound together to function as one unit in a proper marriage. As previously mentioned, Genesis 1:24 was once interpreted to literally mean that the earth could create organisms from nothing, a view completely disregarded today for being an unfaithful representation of the text and science. The metaphorical joining of flesh and bringing forth of creatures from the earth are not topics of contention today because they are easy to understand in

[143] Danny R. Faulkner, "Geocentrism: History and Background," Answers in Genesis, August 29, 2020, accessed March 13, 2023, https://answersingenesis.org/astronomy/geocentrism-history-background/.

[144] William Lane Craig, *In Quest of the Historical Adam: A Biblical and Scientific Exploration* (Grand Rapids: Wm. B. Eerdmans Publishing Co., 2021), 17.

their context. YECs are choosing when to take the creation narrative literally when, in reality, they should be examining the entire text for its intended meaning.

Original Interpretation of Genesis

Only by examining the world of the Hebrew Bible can the message which God was trying to communicate with the recipients of divine revelation be understood. In the ANE, the Hebrew people were influenced by their surrounding cultures, evidenced by their similar creation stories and their shared cognitive environment. Other cultures in this area included Egyptians, Canaanites, Hittites, Sumerians, and Akkadians.

John H. Walton, leading theologian in Old Testament interpretation, repeatedly stresses that the Bible was written for twenty-first-century humans, as it was written for everyone, but it was not written *to* twenty-first-century humans. It was written to an ancient audience with a very different worldview.[145] God could have explained modern physics and biology to these people, but they would not have been in the position to understand it or effectively communicate it. Instead, God fit the truths that he wanted to convey to his people about creation in a narrative they could readily understand. God teaches in this way, as seen in the parables of Jesus Christ. He told stories that relied on elements his audience was familiar with to convey truths about the Kingdom of God. His parables included subject such as shepherds, vineyards, farming, and servitude and were full of figurative language. No one is trying to prove that there really was a prodigal son who squandered his father's fortune in the exact way described in Luke 15:11–32. This same approach should be taken to understanding Genesis 1–11, identifying the elements that were used to help the ANE people comprehend God's message.

[145] Walton, *The Lost World of Genesis One,* 7

Ancient Near Eastern Cosmography

Humans today and humans in the ANE have very different concepts of cosmic geography, or ways in which they picture the world. Today, (most) humans know that they are on a globe revolving around the sun in an infinitely vast universe. Currently, there is discussion about whether the modern interpretation of ANE cosmography has been misconstrued. Figure 6 reflects what has typically been thought to represent ANE cosmography. Many scholars, such as William Lane Craig and Vern Poythress argue that this is not a true depiction of what ANE people believed the world to literally be. For example, both the Bible and other ANE texts reflect an ancient understanding of rain and its association with clouds, not aligning with the idea that it falls through the windows of the heavens.[146] Walton argues that ANE people truly believed that their world was structured like Figure 6 while dissenters claim that their references to such forms are poetic in nature. Regardless, neither necessitates a literal application of this worldview to modern science.[147]

[146] Craig, 190.

[147] Ibid., 191.

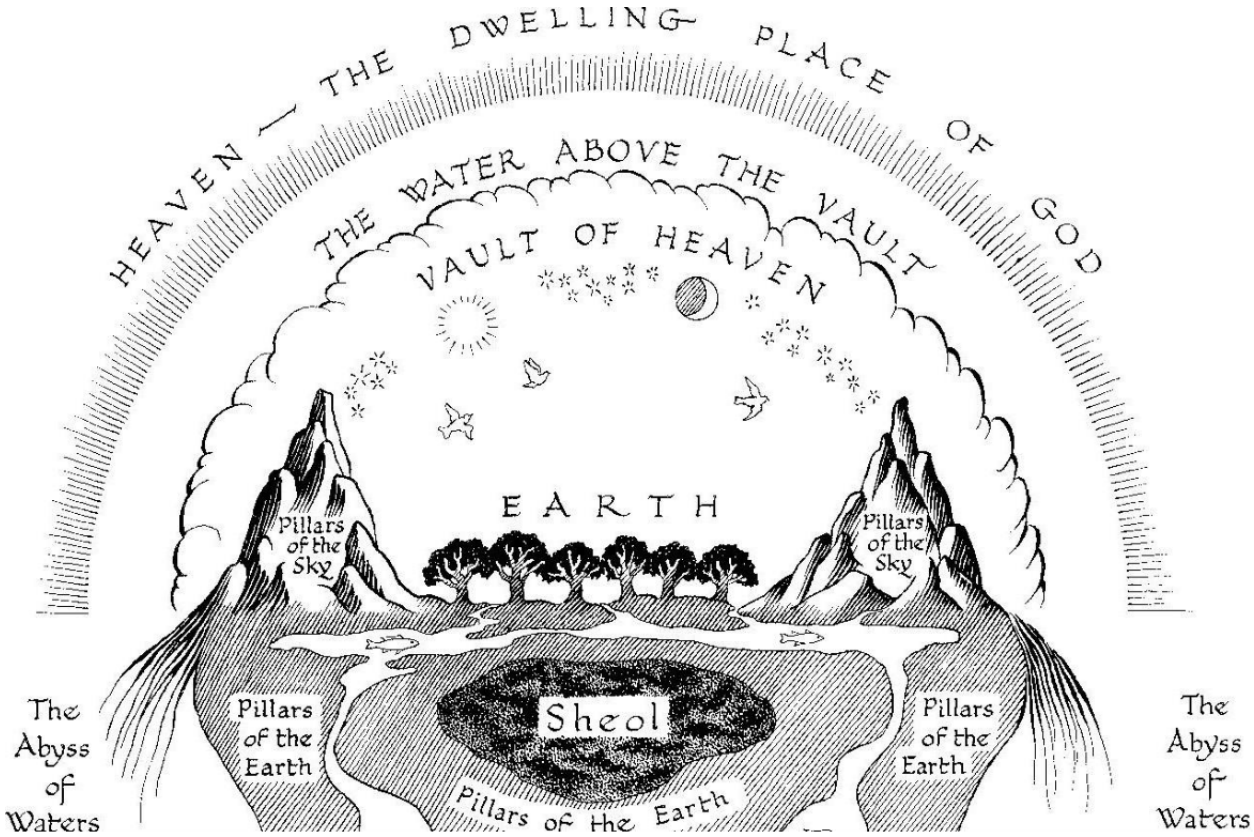

Figure 6. Traditional depiction of Ancient Hebrew cosmography.[148]
The earth was seen as a flat, disk-shaped plate with mountains at its edges and a dome-like sky above it. The sun, moon, stars, and planets occupied the air and were below the sky. The Hebrew word *raqi'a* better translates as firmament and was believed to be solid. The waters above were held back by the firmament but could fall through as rain. Beneath the continent lied the netherworld, or Sheol.

Ancient Near Eastern Ontology

As with their cosmic geography, the people of the ANE had a very different concept of ontology than that of modern day. In modern thought, the world exists based on its physical presence, but this was not the case in the ANE. Walton succinctly phrases their definition of ontology: "In the ancient world something came into existence when it was separated out as a distinct entity, given a function, and given a name."[149] An example of this is seen in Egyptian

[148] Reyburn and Fry, "A Biblical Picture of Cosmology," 1998. Accessed March 20, 2023, https://www.semanticscholar.org/paper/Biblical-Cosmology%3A-The-Implications-for-Bible-Roberts/63e1b44d3474477155cf534b3ee4c4f331f3e5f6/figure/0.

[149] Ibid., 180.

cosmology. The sky goddess Nut arches herself over the earth while the earth god Get lies beneath her. The people did not believe that they could literally touch the body of Get by touching their earth. Rather, this truth represented the function of the gods, not their substance.[150]

To establish being, a creation account must establish function, which is exactly what the Genesis account does; elements of the cosmos are separated, given a function, and named. When God creates, the word *bārā'* is used. When meaning "to create" in the Bible, *bārā'* always takes God as its subject and rarely refers to physical construction. Instead, *bārā'* can be used to indicate the assigning of a new function.[151] "Create" is not often used this way in modern English, but a close example is seen in the phrase "Monica creates a welcoming environment." She does not literally build a home or reception area that is welcoming; rather, she gives a new quality to an existing location. This is akin to how the ancient Hebrew people understood the creation of the world. In Psalm 51:10, *bārā'* is used in this sense as well. When the psalmist beseeches God to "create a clean heart," he does not ask for a new literal, clean heart. He asks for a reorienting and change to his existing heart.[152] This reflects the ANE understanding of the definition of creation.

Genesis 1–11 as Mytho-History

While Walton advocates for a strictly functional view of creation, many scholars do not align with him. Assigning function and creating physically do not have to be mutually exclusive. Instead of reading Genesis as purely functional and searching for the meaning this way, Craig

[150] Ibid., 181.

[151] Ibid., 183.

[152] InspiringPhilosophy [Michael Jones], "Genesis 1a: And God Said!" (video), June 7, 2019, accessed March 15, 2023, https://www.youtube.com/watch?v=R24WZ4Hvytc.

assesses the intended genre of Genesis, analyzing its source content and themes across the cultural environment. First, he assesses if Genesis can be deemed a myth, and while the definition of a myth is not universally agreed upon, Craig identifies the key characteristics of myths and tests them against Genesis 1–11, as summarized in Figure 7.

Criteria	Fulfilled by Genesis 1–11?
Myths are narratives, whether oral or literary.	Yes
Myths are traditional stories handed down from generation to generation.	Yes
Myths are sacred for the society that embraces them.	Yes
Myths are objects of belief for members of the society that embraces them.	Yes
Myths are set in a primaeval age or another realm.	Yes
Myths are stories in which deities are important characters.	Yes
Myths seek to anchor present realities such as the world, mankind, natural phenomena, cultural practices, and the prevailing cult in a primordial time.	Yes
Myths are associated with rituals.	No[153]
Myths express correspondences between the deities and nature.	No[154]
Myths exhibit fantastical elements and are not troubled by logical contradiction or incoherence.	Yes

Figure 7. Criteria for myths.
Created by author. Based on Craig, 45–131.

Any fictitious story cannot be deemed a myth, and myths are distinct from folktales and legends. While describing Genesis as "mythical" may sound alarming to some, it is not using the word "myth" in a colloquial way; myth simply means fulfilling the criteria of Figure 7 Reading the Bible according to genre is not cherry-picking or diminishing the power of God. Instead, it provides a more accurate way to understand a text that was written well over a millennium ago. Craig also argues that Genesis 1–11 has a unique historical interest. The events take place in a

[153] Craig argues that this requirement is not applicable to all myths, and therefore, should not be a basis for disregarding Genesis 1–11 as myth. Regardless, there is an argument to be made that Genesis 1 sets up the practice of observing the Sabbath.

[154] Genesis fails this test because it is monotheistic and lacks naturalistic deities.

chronological order, and the presence of genealogies indicate historical interest. While the years may be exaggerated, as was common in ANE genealogies, the people were real.[155] While Craig's application of the genre of mytho-history to Genesis enables him to extract the following truths expressed by the primaeval history:

1. God is one, a personal, transcendent Creator of all physical reality, perfectly good and worthy of worship.
2. God has designed the physical world and is the ultimate source of its structure and life-forms.
3. Man is the pinnacle of the physical creation, a personal, if finite, agent like God, and therefore uniquely capable of all Earth's creature of knowing God.
4. Mankind is gendered, man and woman being of equal value, with marriage given to mankind for procreation and mutuality, the wife being a helper to her husband.
5. Work is good, a sacred assignment by God to mankind to steward the earth and its creatures.
6. Human exploration and discovery of the workings of nature are a natural outgrowth of mans' capacities, rather than divine bestowals without human initiative and effort.
7. Mankind is to set apart one day per week as sacred and for refreshment from work.
8. Man and woman alike have freely chosen to disobey God, suffering alienation from God and spiritual death as their just desert, condemned to a life of hardship and suffering during this mortal existence.
9. Human sin is agglomerative and self-destructive, resulting in God's just judgement.
10. Despite human rebellion against God, God's original purpose to bless all mankind remains intact, as he graciously finds a way to work his will despite human defiance.[156]

Anyone who has read the creation story critically likely has come to similar conclusions, regardless of if they have regarded Genesis as literal history. The theological truths of Genesis are not contingent on a literal interpretation.

[155] Craig, 142.

[156] Craig, 202.

Unique Components of Genesis

While Genesis was clearly a product of its cognitive environment, it is still incredibly valuable to modern humans by understanding what it meant to ancient humans. In Genesis, no aspects of creation are personified as a deity; there is only one God, setting up the monotheistic basis of the Hebrew faith.[157] Other ANE texts had many gods and there was often a time during which the cosmos was in turmoil due to theomachy, conflict between gods or deities.[158] God, on the other hand, had no worthy adversary, and creation is the product of his unopposed divine will. Additionally, the Hebrew creation story had no account of theogony, the origin of a deity, as there is no time before God.[159]

The creation of people in Genesis imbues them with a level of worth that is not present in other ANE texts. Being made in the image of God is a blessing to rule creation, not to provide for God's needs.[160] Instead of being required to provide shelter, clothing, and food for the gods in exchange for protection, the Hebrew people only needed to be faithful to God in obeying their covenants.[161] Some other cultures had a similar yet distorted idea, applying this status to only some people (such as in Mesopotamia) or using it as the basis for political power (such as in Egypt).[162] Genesis also expresses monogenesis, the idea that humans were created from a single

[157] John H. Walton, *Genesis 1 as Ancient Cosmology* (Winona Lake: Eisenbrauns Inc., 2011), 194.

[158] John H. Walton, *Ancient Near Eastern Thought and the Old Testament: Introducing the Conceptual World of the Hebrew Bible* (Grand Rapids: Baker Academic, 2006), 199.

[159] Ibid.

[160] Walton, *Genesis 1 as Ancient Cosmology,* 195.

[161] Ibid., 197.

[162] Ibid., 196.

pair, while many other ANE texts believed that many humans were created at once (polygenesis) to be used as slave labor.[163]

Adam and Eve

The Making of Man

Mankind is different from the rest of creation. Not only are they made in the image of God, but their creation receives additional, in-depth attention in Genesis 2. Some scholars assert that Genesis 2 occurs after the cosmogonic account in Genesis 1, allowing for the growth of the human population before Adam. However, there is little in-text evidence to support that the creation of man in the image of God and the creation of Adam are separated by eons of time, allowing for growth of a population.[164]

In chapter two, the physical composition of Adam is described. Sumerian, Akkadian, and Egyptian texts all provide comparative stories for human origins. The material used varies among these cultures and among different myths within the same culture. Building materials can be divine, natural, or a combination. The most common natural ingredient is clay while divine ingredients can include tears, blood, or flesh.[165] Egyptian texts also include divine breath in the animation of humans, which indicates the deity as the source of life but not a part of physical composition.[166] The physical component used in Genesis for the construction of Adam is dust, or *ʿāpār.* While clay, as in other creation stories, provided structure and indicated the artistic

[163] Ibid., 195.

[164] Craig, 89.

[165] Walton, *Ancient Near Eastern Thought and the Old Testament,* 206.

[166] Ibid.

process, dust was only connected with death.[167] As in other ANE texts, in Genesis, the ingredients used to construct humans are reflective of the archetypal role for humanity. All humans are made of dust and will return to dust because they are mortal (Gen. 18:27, Psalm 103:14, Eccles. 3:20).

The Making of Woman

In the creation story, God created Eve from the rib of Adam (Gen. 2:22). At least, this is what the traditional English version would have modern readers believe, but what does a closer examination reveal? Before supposedly removing Adam's rib, God put Adam into a deep sleep (Gen 2:21). The Hebrew word for this is *tardēmâ*. In the Old Testament, this noun is used six other times in the Bible, and five of these instances are related to a trance-like or prophetic state (Gen. 15:12; 1 Sam. 26:12; Job 4:13; Job 33:15; Pro. 19:15; Isa. 29:10). The creation of woman from man is something Adam witnesses in a dream, the communication from God about the framework of their relationship.

Another word misunderstood is rib, or *ṣēlāʿ*. Nowhere else in the Bible does this word mean human rib. Rather, it normally is translated as "side," such as a direction or a side chamber. This translation is more logical with the set-up of Adam's dream. God showed him the creation of woman from his side. She is to function as his other half, something not found among the animals.[168] If Eve were created from one of Adam's literal ribs, there would be an immediate contradiction in this passage, as upon seeing Eve, Adam states "This at last is bone of my bones

[167] Ibid.

[168] InspiringPhilosophy [Michael Jones], "Genesis 2: The Dust and The Rib" (video), August 16, 2019, accessed March 23, 2023, https://www.youtube.com/watch?v=mw2LCTQHMUI&t=573s.

and flesh of my flesh" (Gen. 2:23). However, the preceding verses stated that Eve was constructed from Adam's rib (bone), not flesh.

The creation of mankind found in the Bible answers the questions that other creation mythologies posed, which mainly focused on the relationships of humans. From Genesis 1–2, the ANE Hebrews could understand that mankind is connected to the earth in their mortality, and that man and woman are connected to each other as a pair.[169]

In the Image of God

Bearing the image of God is a key characteristic that sets mankind apart from the rest of creation. In the ANE, being made in the image of a deity was not a novel idea. In Mesopotamian literature, kings are often described as bearing the image of a deity when they exhibit a trait or function of that deity; for example, a benevolent king was described as being the image of Bel.[170] In Egypt, the function of a god was carried out through a king, who was considered to bear his image.[171] Whereas in the ANE, typically only a king would bear the image of a deity, all humans in Genesis are created in the image of God.

Additionally, images of gods could be made manifest in inanimate objects, such as idols. A graven image would be brought into a temple after it was completed. In Genesis 1, God structures a temple out of the cosmos, installs his images, and then takes residence in this cosmic

[169] Walton, *Ancient Near Eastern Thought and the Old Testament,* 208.

[170] Walton, *Genesis 1 as Ancient Cosmology,* 79.

[171] Ibid., 83.

temple.[172] Accordingly, as false gods had lifeless images in their temples, the living God has breathing, real images in his.

Humans do not physically resemble God, as God is beyond this three-dimensional world, although God can take on flesh to directly interact with this world. Some people claim that the image of God means that humans spiritually or mentally resemble God, but this claim fails as humans are not the only beings to possess such qualities. For example, the serpent in the garden possessed intelligence, rationality, and moral discernment. These qualities could also be attributed to angels, including Lucifer, but these beings are not made in the image of God.[173] In Scripture, the only component that differentiates humans from animals is that they are given the image of God. Both humans and animals are created (*bārā'*) and have a soul (*nepeš*), but only humans are bestowed with the designation "image and likeness of God" (Gen. 1:20–21, 1:24, 1:27, 1:30, 2:7, 2:19). Humans are called into a relationship with God, and being an image bearer is not a biological or ontological similarity but is based on roles. As image bearers, Adam and Eve serve as the first priest and priestess with the task of being the representatives of God to the rest of Creation.

This is an example of God's free election. Just as he would later choose Israel to be the nation through which he would bless all others and as he chose David to be king, God chose human beings to fulfill a purpose within His divine plan.[174]

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[172] InspiringPhilosophy [Michael Jones], "Genesis 1b: And It was Good" (video), July 5, 2019, accessed March 27, 2023, https://www.youtube.com/watch?v=7t-7exqSLpw&t=629s.

[173] Voice of Light Productions [Joshua Moritz], "Lecture 11: 'Let Us Make Man in Our Own Image' : What does it mean to be human?" (video lecture), 2012, accessed March 27, 2023, https://vimeo.com/41244016.

[174] Voice of Light Productions [Joshua Moritz].

Scientific Validity of Adam and Eve

Now the question arises of whether all of humanity descended from this original pair of progenitors who had been bestowed with the image of God. Scripture does not necessitate this, but neither does science preclude it. Two strong supporters of this idea are Craig and Joshua Swamidass, a Christian professor of Laboratory and Genomic Medicine at Washington University in St. Louis. If Adam and Eve lived long enough ago and there were other hominids outside the garden, this could be possible. This historical Adam and Eve could have been *de novo* creations or simply called into the image of God and elected to a special role in His plan. However, as humans, these beings would have chosen to jeopardize their intimate relationships with God, thus allowing sin to enter the world through their free will and temptation.

There is scientific support for the concept of mitochondrial Eve and Y-chromosomal Adam, terms used to describe the one woman who all present-day women are related to and vice versa.[175] Although initial estimates had placed mitochondrial Eve much further back in time than Y-chromosomal Adam, recent studies have allowed for significant overlap between the two.[176] If all humans were descended from two humans, allowing for interbreeding, then it would take significant time for the entire population to share these two ancestors. If the image of God is a trait to be passed on heritably, then there would have been thousands of years during which image bearing humans coexisted with other hominids. There are many arguments for the creation

[175] All women receive their mitochondrial DNA from their mother, and all men inherit their Y-chromosome from their father. Far enough back in time, there would have been a woman who is an ancestor to all women alive today, and the same applies for the men. However, this does not mean that humans are descended *only* from mitochondrial Eve and Y-chromosomal Adam.

[176] G. David Poznik et al. "Sequencing Y Chromosomes Resolves Discrepancy in Time to Common Ancestor of Males Versus Females," *Science* 341, no. 6145 (August 2013), accessed March 29, 2023, https://doi.org/10.1126/science.1237619.

of humans in addition to Adam and Eve, asserting that, historically, others could have been called into the image of God as well. The others outside of the garden may or may not have been image-bearers, but their presence could provide insight to the age-old question of Cain's wife, the outsiders he feared, and the Nephilim (Gen. 4:14, 4:17, 6:1–4).

Death Before Sin

Another biblical issue brought up by evolution is that it contradicts the YEC belief that there was no death (neither animal or human) before the Fall, based on Romans 5:12 and the fact that God described his creation as very good, leaving no room for death.[177] The case for no animal death comes from the belief that God intended his original creation to be entirely vegetarian, as Genesis 1:29–30 provides plants as a food source for both humans and animals. This does not change until after the flood when God gives Noah "every moving thing" as food, thus expanding his diet to include animals.[178]

The Genesis account lends no proof to the immortal state of man, and the presence of a tree of life indicates the exact opposite. God casts Adam and Eve out of the garden as a precaution so that they do not eat from the tree of life and live forever (Gen. 3:22). If the original humans were created immortal, there would be no reason for the tree of life to exist or for God to prevent humans from eating of it.[179] If there is a physical death connected to the Fall, Adam and

[177] Ken Ham, "Was There Death Before Adam Sinned?" in *The New Answers Book 3,* (Answers in Genesis, 2014), accessed March 15, 2023, https://answersingenesis.org/death-before-sin/was-there-death-before-adam-sinned/.

[178] Ibid.

[179] Craig, 236.

Eve became ineligible for immortality, as they had lost access to the garden.[180] The couple may have been created mortal, but they had an opportunity to live forever.

Another objection to death before the Fall comes from the fact that God deemed his creation "very good" (Gen. 1:31). How is there room for death in this world? The answer can be found in how mankind is instructed to interact with this world. In Genesis 1:28, God told them to "subdue" the earth and to "have dominion." These words are easily glossed over, but their Hebrew counterparts are not. Subdue, or *kāḇaš*, is used in twelve other verses in the Old Testament. The majority of these are related to war, while some instances are associated with enslavement or sexual assault.[181] When *kāḇaš* is used, there is always an opposition to the subduer.

In Genesis, this word is placed in conjunction with having dominion, *rāḏâ*. This verb is not used to simply indicate a hierarchy, such as within a bureaucratic system. Rather, it is used in the context of gaining power over foreign nations through warfare.[182] Such harsh language is used in a world deemed "very good." Dr. Joshua John Van Ee, a professor of Hebrew and the Old Testament, challenges the presumed state of peace in God's original creation:

> Subduing comes before ruling, making it possible. Humans had to overcome the resistance of the animals before they could rule them. This conclusion has profound implications for the primeval period. If the command to subdue implies conflict and the animals are the source of that conflict, then the initial state was not characterized by animal peace.[183]

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[180] Ibid., 237.

[181] Joshua J. Van Ee, "Death and the Garden: An Examination of Original Immortality, Vegetarianism, and Animal Peace in the Hebrew Bible and Mesopotamia," UC San Diego Electronic Theses and Dissertations, 201, accessed March 21, 2023, https://escholarship.org/uc/item/0qm3n0mt.

[182] Ibid, 208.

[183] Ibid., 207.

A cursory reading of God's creation might seem to set up a peaceful world devoid of animal death, but the actual Hebrew does not. Just as God brought order to the cosmos, humans are called to join him in fulfilling that role. However, this is not implying that humans were given freedom to abuse Creation.

In the Old Testament, God advocates for treating animals humanely (Prov. 12:10; Deut. 25:4; Exod. 23:12). This opposition to animal cruelty must be reconciled with humanity's permission to subdue the earth. One way of doing this is placing mankind as a hunter in creation. He still subdues the earth but does so in alignment with God's attitude toward animals. Animal death is a healthy part of ecosystems and is necessitated by the survival of other organisms such as decomposers, scavengers, and predators. Additionally, animals are not eligible for salvation, so their deaths would not be equal to that of a human's.

However, the instructions given to Noah in Genesis 9:3, allowing humans to eat animals, are strong evidence that mankind was vegetarian previously. Craig classifies this original vegetarianism of all organisms to be a fantastical element of Genesis.[184] It is a state that existed in the deep, primeval past, not subject to current conditions, as even the ancient Hebrew people knew it was not possible for all animals to be vegetarian. Additionally, if the genre of myth is accepted for Genesis 1–11, this potential contradiction is a non-issue, as myths permit contradiction between stories. Both the command to subdue the earth in Genesis 2 and the permission to eat animals in Genesis 9 hold significance for their sub-story and can both be accepted as true in myth.

[184] Craig, 111.

Jesus

One person to look to for clarification of the meaning of Genesis is the Son of God himself. However, the only reference Jesus made to the events of creation is found in Matthew 19:4–6, in which he quoted Genesis 2:24 when discussing marriage. Jesus' words do not, in any way, necessitate a literal reading of Genesis. He supports the theological meaning behind the story: male and female were created and are to join together in holy union. Jesus even references the figurative language present in the creation narrative by stating that "they are no longer two but one flesh" (Matt. 19:6). Jesus, like the author of Genesis, is not advocating for couples to be surgically connected but that they should function as one and should be closer to one another than to their earthly parents.

Paul

One of the bigger ramifications for viewing the creation narrative as myth is how it impacts original sin. Surprising to many, Adam and the concept of original sin are not mentioned at all in the rest of the Old Testament, save a genealogy in 1 Chronicles and cursory reference in Hosea 6:7. In fact, ideas of original sin are oddly absent from the aftermath of the Fall. Adam and Eve are cursed after their disobedience; Eve will experience pain in childbearing and must submit to her husband while Adam must harvest the land (Gen. 3:16–19). There is no mention that all future humans will bear the sins of ancestors. In fact, as Peter Enns points out, the following narrative of Cain and Abel emphasizes Cain's free will to choose to sin or not.[185] He is not portrayed as dramatically predisposed to sin, which would imply the conference of original

[185] Peter Enns, *The Evolution of Adam* (Grand Rapids: Brazos Press, 2021), 86, accessed March 28, 2023, Google Books.

sin. Rather, Cain has the ability to "rule over it" (Gen. 4:7). Paul seems to be adding an interpretation of Genesis that was not previously there, but as a recipient of divine inspiration, he has the authority to do so. Like with all inspired authors, however, there is a question of to what degree his own worldview influenced the text.

In his epistles, Paul discusses Adam and Genesis significantly more than Jesus does, and some argue his references to the first man provide credence to the belief in a historical Adam (Rom. 5:12–21; 1 Cor. 15:22, 45–49; 1 Tim. 2:13–14). A frequent theme in Paul's writing is providing new interpretations to the texts of the Old Testament, interpretations that would never have been drawn by the original audience.[186] Enns provides an easily digestible exploration of five such examples in which Paul recasts an Old Testament passage in the light of Jesus Christ and the gospel.[187] This is exactly what he does in his teachings about Adam. Paul uses the creation narrative, a story many would be familiar with, and uses it to explain the truth of the gospel: through his death and resurrection, Jesus has made eternal life possible. Paul provides a novel interpretation of Genesis, which does not invalidate the original but serves as a vessel to convey the most pressing theological matters. As Enns puts it, "Paul's understanding of Adam is shaped by Jesus, not the other way around."[188]

In the chapters leading up to Paul's examination of Adam, he focuses on Jews and Gentiles. Both have sinned, but there is salvation available to all through Jesus Christ (Rom.

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[186] Enns, 100.

[187] Ibid., 100–107.

The following passages from Scripture are explored: 2 Cor. 6:2 and Isa. 49:8; Gal. 3:16, 29; Gal. 3:11 and Hab. 2:4; and Rom. 11:26–27 and Isa. 59:20.

[188] Enns, 115.

3:27–30). Paul recasts Abraham as the father of all the faithful, not just Israel, and it would not be logical to argue that all believers are literally descended from Abraham (Rom. 4:13–18).[189] Just as Jews and Gentiles can be united in faith, they are united in their sin, a connection Paul draws back to Adam. Adam's sin is the cause of the death of all humans, therefore the cause of his death, sin, has been passed on as well.[190] As Enns explains, this is not necessitating a literal Adam to be the father of all, but it is using a familiar narrative to convey a modern message.

> Paul's Adam as first human, who introduced universal sin and death, is not derived from Genesis. It is a creative interpretation of the story of Adam to support the implication that Jesus's resurrection demands: Jew and gentile are on the same footing, are in need of the same Savior, and therefore are one people of God and should be free of hostility.[191]

Paul seems to be adding an interpretation of Genesis that was not previously there, but as a recipient of divine inspiration, he has the authority to do so. Like with all inspired authors, however, there is a question as to what degree his own worldview influenced the text. If Adam was not a historical human being, this does not change the historicity of Jesus, and claiming that it does draws a false dichotomy unsupported by Scripture. Drawing a parallel between Adam and Jesus does not mean they both have to be of the same historical validity. Paul's statements about Adam are a cultural assumption whereas his assertations about Jesus are based on present, historical events.[192]

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[189] Enns, 122.

[190] As expressed earlier, the creation narrative does not set up humans as immortal. Sin caused death in that it removed access to the tree of life.

[191] Ibid., 123–124.

[192] Ibid., 117.

Evolution Acceptance Spectrum

Christianity does not preclude evolution, although many refuse to reconcile them. There are two components to a Christian's beliefs about creation and evolution. The first is how they interpret the Bible, and these views have been explained in the prior section. The second component is to what degree they accept evolution. The previously explained interpretations of Genesis are held by people across the evolution acceptance spectrum; proponents of Intelligent Design (ID) and Old Earth Creationism (OEC) have the most varying interpretations of Genesis.

	Atheistic Evolution	**Theistic Evolution**	**Intelligent Design**	**Old Earth Creationism**	**Young Earth Creationism**
Earth's Age	Billions	Billions	Billions	Billions	<10,000
Evolution	Evolution	Evolution	Evolution	Immutable	Immutable
Mutations	Random	Random	Intentional	N/A	N/A
God	No Creator	Creator	Creator	Creator	Creator

Figure 8. Evolution acceptance spectrum.
Created by author. Note that the ID position presented here is the most progressive form of the idea and that OECs and YECs often rely on principles of ID as well.

Theistic Evolution

Theistic evolution (TE) is largely synonymous with evolutionary creation, but the latter is technically a subset of TE which emphasizes the role of God as creator. This paper will refer to the following viewpoint as TE. Deborah B. Haarsma, an astronomer and president of BioLogos provides the following definition: "Evolutionary creation is the view that God created the universe, earth, and life over billions of years, and that the gradual process of evolution was crafted and governed by God to create the diversity of all life on earth."[193] Haarsma recognizes

[193] Deborah B. Haarsma, *Four Views on Creation, Evolution, and Intelligent Design,* 125.

that there are two ways through which God reveals Himself, nature and Scripture, and these two revelations will not conflict.[194] They only would conflict if human interpretation of one or both of these sources of revelation is incorrect. Science for TE does not conflict with atheistic science because they are studying the same world with the same minds.[195] TE focuses on two components of science—discovering the natural mechanisms in the physical world and celebrating God who designed them—while atheistic sciences ignore the latter. The scientific position on evolution held by TE aligns with the evidence presented earlier in this thesis. Many Christian scientists are TEs, the most well-known being Francis Collins, who is the founder of BioLogos and the leader of the Human Genome Project.

Intelligent Design

Beginning with TE, which aligns fully with mainstream science, ID, OEC, and YEC all depart from mainstream science in progressively greater amounts. As previously mentioned, those who adhere to ID can have a very wide range of biblical interpretations but also scientific stances. YECs and OECs often support ID, believing that the probability of mutations producing new, advantageous information is so astronomically low that evolution is impossible. The most progressive form of ID would agree that random mutation statistically is not enough to account for the new mutations that cause speciation; therefore, for common ancestry and descent with modification to hold true, mutations are the result of divine intelligence acting on a system. This progressive ID is what is show in Figure 8. At its core, ID stresses that information must come from an intelligent source. Code is written by programmers, books are written by authors, and likewise, the genome requires an intelligent designer, God. ID was popularized through

[194] Ibid., 127.

[195] Ibid., 134.

Kitzmiller v. Dover as simply "creationism rebranded," and while many YECs and OECs draw on ID for why evolution cannot be feasible, others use it as a divine explanation for evolution.

Old Earth Creationism

Like with ID, OECs have varying biblical interpretations. This view holds that the earth was created in the order set by the Bible, which is at odds with mainstream science. Regarding evolution, OECs reject a universal common ancestor and descent with modification, essentially, macroevolution. Instead, they posit that each "kind" (likely equivalent to a taxonomic family) was created directly by God before the time of man. After the creation of man, God's direct creative work ended, and only the process of microevolution proceeds.[196] Adam and Eve, the first humans, were the result of special creation by God; however, there is not an agreed-upon date for their origin, as both the Bible and genetic clocks produce a wide range of potential dates. Hugh Ross, the president of Reasons to Believe, places this date between 45,000 and 200,000 years ago.[197] Currently, mainstream science does not affirm a single couple as the ancestors to all of humankind.[198] OECs support that Noah's flood was local and affected the entire world's population, but not the entire globe.[199] Some OECs argue that other hominids existed but were

[196] Hugh Ross, *Four Views on Creation, Evolution, and Intelligent Design,* 84.

[197] Hugh Ross, "When Did God Create Adam and Eve?" *Reasons to Believe,* October 19, 2016, accessed March 15, 2023, https://reasons.org/explore/blogs/todays-new-reason-to-believe/when-did-god-create-adam-and-eve.

[198] Stephen Schaffner, "What Genetics Says About Adam and Eve," *BioLogos*, July 11, 2021, accessed March 15, 2023, https://biologos.org/articles/what-genetics-say-about-adam-and-eve.

[199] Ross, *Four Views on Creation, Evolution, and Intelligent Design,* 85.

not descendants of Adam and therefore were not killed during the flood.[200] Likely, this deluge occurred during the last ice age.

Young Earth Creationism

As YEC is the most extreme position on the evolution acceptance spectrum, a significant portion of this thesis will be dedicated to explaining their beliefs and evaluating if they are viable. Unsurprisingly, Young Earth Creationism adheres to a strictly literal interpretation of the Bible. As such, their biblical doctrine and natural history are intrinsically interwoven. While many Christians believe that the first eleven chapters of Genesis do not correspond to literal, historical events, YECs accept this beginning as completely literal, even within a modern worldview. Their prominent beliefs will be quickly summarized here.[201]

- Approximately 6000 years ago, God created the world in six twenty-four-hour days in the order set forth in Genesis 1.
- Adam and Eve were the first two historical humans. Adam was created from dust, and Eve was created from the rib of Adam. They lived in the Garden of Eden but were tempted to sin by the serpent in an event known as the Fall.
- There was no animal or human death before the Fall.
- In 2348 BC, a catastrophic, year-long, global flood destroyed the world. Noah, his family, and the animals he brought aboard his ark were the only survivors.

[200] Casey Luskin, "Review of William Lane Craig's *In Quest of the Historical Adam,*" *Discovery Institute,* November 30, 2021, accessed March 15, 2023, https://www.discovery.org/a/review-of-william-lane-craigs-in-quest-of-the-historical-adam/.

[201] The following beliefs described are taken from *Answers in Genesis*, the largest and arguably most influential YEC organization.

- God created a literal water canopy around the earth on the second day. This canopy remained intact until the flood, during which the waters above contributed to the heavy rains.[202]
- The diversity of language and dispersion of ethnic groups is the result of the scattering of people after the events at the tower of Babel.

These views raise a variety of biblical and scientific problems, the latter which will be explained in the following section.

A Creationist's Scientific Arguments Addressed

Flood Geology

Rapid Speciation

Answers in Genesis (AiG), the organization behind the Ark Encounter, produced a to-scale recreation of Noah's ark that opened in 2016. In the construction of this ark, Ark Encounter researchers had to determine the size of the boat and if this could accommodate the number of necessary kinds to produce the diversity of life seen today.

Based on the biblical measurements of 300 cubits long by 50 cubits wide by 30 cubits high, they calculated the vessel to be 510 feet by 85 feet by 51 feet. Accounting for the curvature of the hull, this results in a volume of 1.88 million cubic feet.[203] AiG claims that a misconception about the ark is that two of every single species would have been brought onboard. Rather,

[202] Many YECs disagree on the state of matter of the water in this canopy. It created a high pressure environment that resulted in tropical climates and increased longevity for early inhabitants.

[203] Michael Belknap and Tim Chaffey, "How Could All the Animals Fit on the Ark?" Answers in Genesis, April 2, 2019, accessed March 18, 2023, https://answersingenesis.org/noahs-ark/how-could-all-animals-fit-ark/.

The length of a cubit is not entirely precise, and other calculations have placed the dimensions at 450' x 75' x 45'.

representatives from each "kind" would have been rescued to be able to diversify after the flood.[204] For example, instead of bringing thirty seven different pairs of big cats (Felidae),[205] one set of ancestors to all future members would have been saved.[206] Noah also did not need to bring insects onto the ark, as the Bible only specifies that creatures "in which there was the breath of life" were taken aboard, and insects respirate through the surface of their bodies, not relying on lungs to breathe (Gen. 7:15). Additionally, marine creatures were not rescued; while many of them died during this event, the Bible does not necessitate that all of them died, only that all breathing, terrestrial creatures outside the ark died (Gen. 7:22). The Ark Encounter estimates that there were approximately 1400 distinct animal kinds on the ark and 7000 animals on the ark. Noah did not just bring two of each kind; he brought fourteen (seven pairs) of each clean kind and flying kind (Gen. 7:2).[207]

While there are many objections to the possibility of Noah's ark, this thesis will largely focus on the evolutionary consequences of such an extreme bottleneck.[208] As YECs accept microevolution, they posit that the complete variety of life is descended from the kinds preserved after the flood. Both genetics and archaeology contradict this. For example, two members of the family Felidae were supposedly taken on the ark to give rise to all domestic cats, leopards, tigers,

[204] A YEC field of science known as baraminology has been developed to study what "kinds" would have been necessary on the ark to produce the current variety of life.

[205] Note that domestic cats are of a single species, so this number is referring to cheetahs, pumas, etc.

[206] Belknap and Chaffey.

[207] Ibid.

[208] Some of these objections include the following: How did eight people manage to care for thousands of animals and maintain the boat? How did Noah provide the correct feed for all of the animals? How did the ark meet the habitat needs of every animal (such as temperature and humidity)? How did Noah build the ark? After building such a feat of naval construction, why was this knowledge not passed on?

lions, cougars, ocelots, pumas, wild cats, and all the various species of these groups all within the last 4000 years.

Archaeology has shown evidence of anatomically modern species living around the time of Noah's flood. According to the flood model, only the preserved "kind" and its recent descendants should be alive at this time. However, Egyptian art from near this time shows cats looking quite similar to their modern domesticated selves, as exemplified in a three-dimensional cat-shaped jar from the Middle Kingdom.[209] Within the Bible itself, certain species are mentioned, such as leopards and lions, indicating that they were already distinct.[210] Both archaeology and the Bible prove that there were individual members of the family Felidae alive thousands of years ago which is not possible under the recent global flood model.

If rapid speciation occurred after disembarking from Noah's flood, why is there no evidence of this reflected by naturalists? As explained previously, early ideas on the concept of species presented them as immutable, not indicating that people were witnessing the rapid creation of new species. In reality, it seems YECs deny macroevolution but support an unfeasibly rapid process of microevolution.

[209] *Cosmetic Vessel in the Shape of a Cat,* ca. 1990–1900 B.C., The Met, accessed March 22, 2023, https://www.metmuseum.org/art/collection/search/544039?searchField=All&sortBy=Relevance&where=Egypt&ft=cat&offset=0&rpp=20&pos=15.

[210] Isa. 11:6.

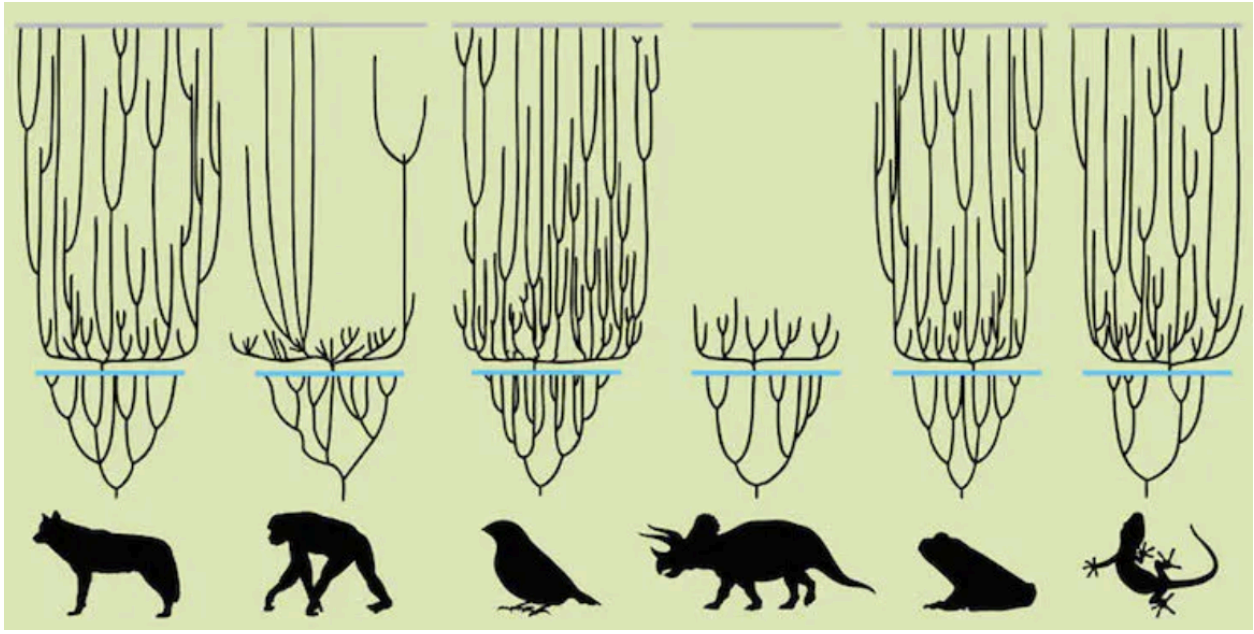

Figure 9. Flood model of speciation.
Answers in Genesis, "Bill Nye Debates Ken Ham - HD (Official)" (video), February 4, 2014, accessed March 22, 2023, https://www.youtube.com/watch?v=z6kgvhG3AkI&t=211s.

The Heat Problem

The biggest problem created by a literal interpretation of the Noah's flood is not the mechanism of the boat or repopulation of the earth. The biggest problem is that if the flood were responsible for the increased rates of nuclear decay, every meteorological impact event, volcanic eruptions, and the shifting of the continents from the supercontinent of Rodinia to that of present day, then the world would have endured unprecedented levels of heat. Many YECs claim that the rate of nuclear decay was not constant in the past, resulting in radiometric methods producing ancient dates. To reconcile this, the rate of decay was increased during the flood. This is untenable, as radioactive decay releases heat. Releasing billions of years' worth of heat over the span of one year would have utterly decimated the earth.[211] Many radioactive elements are found

[211] Some YECs fit 4.5 billion years of decay into the flood year, and others place the majority of decay into the creation week with 500 million years of decay occurring during the flood.

in types of granite—one of the main components of the earth's crust—and the amount of accelerated nuclear decay would have been enough to melt, if not vaporize the rock, a fact acknowledged by creationists.[212] Adding to this problem is the heat produced by the rapid movement of tectonic plates, which creationists have agreed would melt 12 km of the crust and boil 25 km of the earth's oceans.[213] The animals left out of the ark and the ark itself would have been completely destroyed. After decades of trying to find a workaround for the heat problem, YECs currently rely on miraculous intervention to explain the feasibility of accelerated nuclear decay and catastrophic plate tectonics.[214] This completely undermines the scientific methodology of YEC and exhibits that they hold firmly to the God of the gaps fallacy.

Dinosaurs

To a non-creationist, the YEC position of dinosaurs is likely one of the most surprising tenets of their view, and it deserves special attention. According to AiG*,* dinosaurs, like other land animals, were created on the sixth day along with the other land animals, Adam, and Eve.[215] Dinosaurs and people coexisted. They could not have died on millions of years before the advent of humankind, as no death (neither of people nor of animals) occurred until after the Fall.

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[212] William Worraker, "Heat Problems Associated with Genesis Flood Models—Part 1: Introduction and Thermal Boundary Conditions," *Answers Research Journal* 11 (July 2018), accessed March 19, 2023, https://answersresearchjournal.org/heat-problems-flood-models-1/.

[213] "Flaws in a Young-Earth Cooling Mechanism," *Reports of the National Center for Science Education* 24, no. 1 (Winter 2004), accessed March 19, 2023, https://ncse.ngo/flaws-young-earth-cooling-mechanism.

[214] Shaun Doyle, "Too Much Heat in Noah's Flood?" Creation Ministries International, 2020, accessed March 19, 2023, https://creation.com/flood-heat-problem.

[215] Ken Ham, "What Really Happened to the Dinosaurs?" in *The New Answers Book 1,* Answers in Genesis, August 11, 2021, accessed March 16, 2023, https://answersingenesis.org/dinosaurs/when-did-dinosaurs-live/what-really-happened-to-the-dinosaurs/.

Dinosaurs were brought onto the ark to survive the flood. The plethora of dinosaurs that did not survive the flood contributed to the amount of dinosaur fossils recovered today.

YECs draw on biblical, historical, and scientific evidence for the coexistence of humans and dinosaurs. Genesis 1:21 describes the creation of "sea monsters" which could refer to aquatic beasts such as *Mosasaurus, Sarcosuchus imperator,* or *Liopleurodon;* other similar references are found in Psalm 74:13, Isaiah 27:1, and Job 41.[216] Just as many cultures have a flood narrative, many also have tales of monstrous creatures, which YECs use to support the fact that humans and dinosaurs coexisted. Examples of these include the prominent role of dragons in Chinese culture, *The Epic of Gilgamesh* records a hero who encountered a dragon, and St. George was renowned for having slain a dragon.[217] There has also been cave art allegedly depicting dinosaurs. However, this art has been thoroughly debunked through X-ray fluorescence which revealed the initial image underneath.[218] Over time, a drawing of two humans, a serpent, and some sheep faded, and its paint ran, producing a pterodactyl-like picture. There were no human/dinosaur interactions.

In 2005, Mary Schweitzer identified apparent red blood cells and other soft tissue structures from a *Tyrannosaurus rex* which had lived 67 MYA, according to modern dating techniques.[219] YECs jumped on this finding, asserting that organic substances cannot persist that long, and if the dinosaur fossil is incorrectly dated, then the absolute dating methods used on it

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[216] Ibid.

[217] Ibid.

[218] Jean-Loïc Le Quellec, Paul Bahn, and Marvin Rowe, "The Death of a Pterodactyl," *Cambridge University Press* 89, no. 346 (August 2015), accessed March 16, 2023, https://doi.org/10.15184/aqy.2015.54.

[219] Mary Schweitzer, "Blood from Stone: How Fossils Can Preserve Soft Tissue," *Scientific American*, December 1, 2010, accessed February 16, 2023, https://www.scientificamerican.com/article/blood-from-stone/.

must be flawed too; all of this points to a young earth. However, this does not follow. Although initially controversial within mainstream science, Schweitzer's discovery and the many similar ones since 2005 indicate that there is a method of preservation that allows soft tissue to last for millions of years. While there is not a definitive answer yet, scientists have postulated many likely models for the presence of organic materials in dinosaur remains. One such model is the stabilization brought on by contact with iron molecules which can facilitate the increase in resistance of biomolecules to biological degradation. Iron can bind oxygen molecules, preventing the oxidation of organic materials.[220] Schweitzer showed the drastic impacts of preserving proteins in the presence and absence of hemoglobin. Additionally, despite YEC claims, Schweitzer did not find actual red blood cells, only small chunks of a rust-colored structure that resembled red blood cells. The preserved organic material were proteins that had well-established, stable structures.[221]

Schweitzer is openly Christian and has been very frustrated by the slew of YECs misconstruing her work to falsely support their conclusions. Although she is an evolutionist and respected scientist, Schweitzer believes science enriches her faith. She shared, "I don't feel that I'm discrediting God with the work I'm doing, I think I am honoring him with the abilities he's given me."[222] Schweitzer has nailed what it means to be a Christian scientist and is using her talents to conduct good, reliable science, unlike YECs who refuse to accept the creative methods of God.

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[220] Scott Buchanan, "Dinosaur Soft Tissue," *Letters to Creationists,* June 2019, accessed March 16, 2023, https://letterstocreationists.wordpress.com/dinosaur-soft-tissue/.

[221] Ibid.

[222] Mary Schweitzer, interview by Emily Ruppel, July 21, 2014, BioLogos, accessed March 16, 2023, https://biologos.org/articles/not-so-dry-bones-an-interview-with-mary-schweitzer.

Creationist Explanation of Hominids

Evolutionists adhere to a fluid model of human evolution. Technically, every fossil found is a transitional form and there is no one point at which one species becomes another. As previously explained, there have been an abundance of hominin fossils found of mankind's extinct relatives. YECs, OECs, and some proponents of ID deny that these fossils represent intermediaries between ape and man.[223] Instead, they believe that all fossils can be classified as either *H. sapiens* or the family Pongidae.[224] This rigid classification creates quite a few problems, as nature has not drawn a sharp line between taxa but rather produces a smooth gradient of evolutionary history.

Deciding whether an extinct human relative is human or ape remains a subject of contention among creationists, as not everyone agrees what qualifies a fossil as human and more information is constantly being discovered. The divide seems to lie with *H. habilis*. Species more ape-like than *H. habilis* are apes, and species more man-like are humans. *H. habilis* itself is not regarded as a distinct species by creationists.[225] While among the evolutionary community, there is some debate to the correct classification of *H. habilis*, the classification system does not have any impact on the validity of the fossil record. These fossils still existed and represent organisms that are a part of human's evolutionary lineage. What they are called does not change that. The

[223] While *H. sapiens* are a member of the great apes (Hominidae), "ape" is being used more colloquially to describe the more "ape-like" common ancestor of humans and chimpanzees.

[224] Pongidae is no longer recognized as an official taxonomic grouping as it excludes humans as a member of the great apes. Hominidae is the correct family level, which includes humans.

[225] Peter Line, "The Myth of Ape-To-Human Evolution," *Creation* 41, no. 1 (January 2019), accessed March 19, 2023, https://creation.com/ape-to-human-evolution.

creationist approach to sorting hominids would place the ape/human divide between skulls F and G in Figure 10, despite their remarkable similarity that even a layperson can see.

Figure 11 demonstrates the smooth growth of cranial volume (and accordingly, brain size) throughout time in extinct hominins. This concisely shows the gradual growth in a selected trait over time, just as evolutionary theory would predict. Even if human classification of the hominids associated with these skulls has erred, that does not change the fact that there is a gradual curve of cranial growth leading up to *H. sapiens* and *H. neanderthalensis*, which is extremely strong support for evolution.

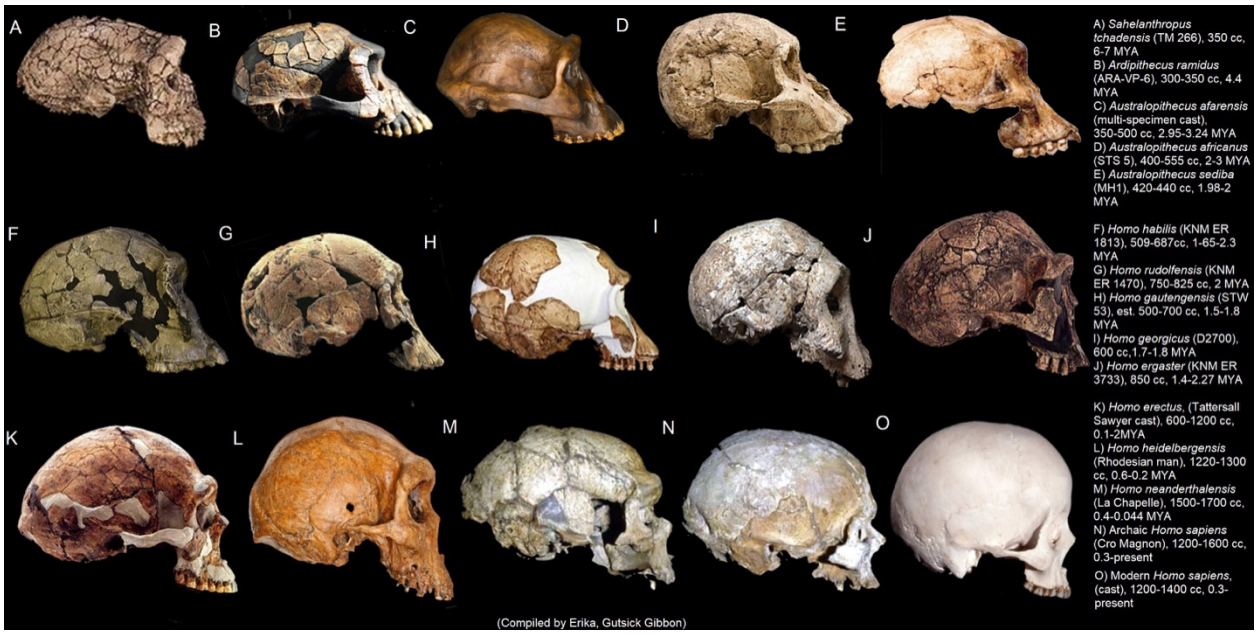

Figure 10. Progressive change in hominin skulls.
Gutsick_Gibbon [Erika], Twitter post, July 5, 2021 (12:37 p.m.), accessed March 17, 2023, https://twitter.com/Gutsick_Gibbon/status/1412103425295327232?s=20.

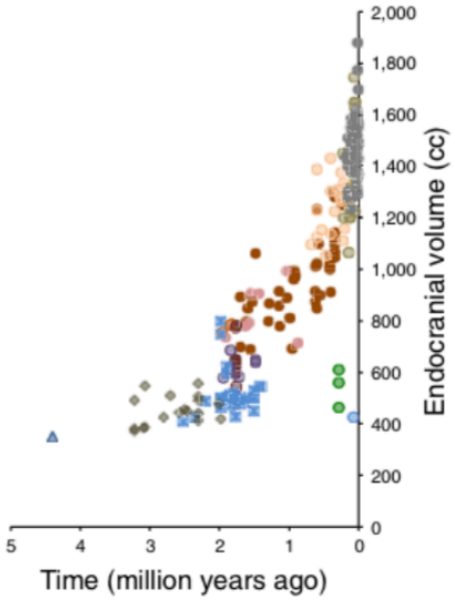

Figure 11. Variation in hominin brain size through time.[226]
Ardipithecus ramidus (blue triangle), *Australopithecus* (diamond), *Paranthropus* (blue square), *Homo habilis* and *Homo georgicus/Dmanisi* hominins (purple circle), *Homo rudolfensis* (orange square), *Homo ergaster* (pink square), *Homo erectus* (brown square), *Homo heidelbergensis* (pale orange square), *Homo neanderthalensis* (pale brown square), *Homo sapiens* (grey square). *Homo naledi* (green square), *Homo floresiensis* (pale blue square)

Another issue raised by the sharp division between ape and man is the recent evidence that bipedalism evolved in two separate lines. The human-like mode of locomotion was seen in *A. afarensis, H. erectus,* and *H. naledi,* while *A. Africanus, A. sediba, Paranthopus robustus, P. boisei, H. habilis,* and *H. floresiensis* exhibited ape-like limb proportions and likely incorporated more elements of arboreality into their movement.[227]

Absolute Dating

Radiocarbon Dating

Another branch of science which YEC rejects is absolute dating. Traditionally, absolute dating relies on the decay rates of subatomic particles in unstable elements. Over time, the

[226] Stephen Montgomery, "Hominin Brain Evolution: The Only Way Is Up?" Current Biology 28, no. 14 (July 2018), accessed March 18, 2023, https://doi.org/10.1016/j.cub.2018.06.021.

[227] Prabhat, et al.

unstable parent isotope decays into a stable daughter isotope. A half-life is the amount of time for half of the parent isotope to decay into daughter isotope. Half-lives of radioactive isotopes have been found to be constant, even under variable conditions. To measure the age of an organic material, carbon dating can be used. Cosmic radiation causes a nitrogen atom to eject a proton, creating a carbon-14 atom. This unstable isotope is incorporated into CO_2, which is taken in by plants, which are consumed by animals, allowing carbon-14 to be found in bones, shells, wood, organic cloths, and other materials. Over time, carbon-14 decays back into stable nitrogen. However, carbon levels in the atmosphere have not remained constant. For this reason, the carbon levels must be calibrated using other methods such as dendrochronology and varves.[228]

Dendrochronology is the study of tree ring growth and what they indicate about the age of a tree and the climate in which it grew. Trees grow annual, concentric rings, and the width of these rings and consecutive ring trends are indicative of what the conditions to which a tree was exposed. One tree ring consists of a thicker, light layer which forms during spring and summer and a thinner, dark layer which forms in fall. A wider tree ring indicates a healthy year for the tree. This tree ring cycle only occurs outside of the tropics because when it is wet all year, tropical trees produce many small, thin layers. By working backwards using living trees, petrified wood, and wooden structures, a database of climatic history can be constructed for a geographical region. Overlapping tree rings extend over 13,000 years into the past, well beyond

[228] Kim Foecke, "Dating," *Smithsonian National Museum of Natural History,* accessed March 16, 2023, https://humanorigins.si.edu/evidence/dating.

a 6000-year-old earth.[229] By measuring the carbon levels in a tree ring of a known date, the calibration curve for radiocarbon dating can be updated.

Varves, thin sediment layers deposited annually in lakes, can push the calibration curve further back in time. Based on seasonal blooming of flora and grain size of silt, researchers can distinguish between summer and winter, much like with tree rings. Flora and fauna trapped in these layers can be dated using carbon. Lake Suigetsu in Tokyo provides a vastly deep record of consistent varves, and from a 70-meter core from the lake, the carbon record can be stretched back 52,000 years.[230]

Varves, tree rings, and carbon-14 dating confirm one another quite rigorously. The black lines in Figure 12 show the window of ages for the tree ring or varve, as predicted by uncalibrated radiocarbon dating. This is based on the assumption of constant decay, meaning these dates do not exhibit circular reasoning. The red and green lines show the ages of the tree rings and varves through counting backward. Three independent methods beautifully line up, proving that all three are accurate and that varves and dendrochronology make effective tools in fine-tuning carbon-14 dates.

[229] Johannes van der Plicht, Christopher Bronk Ramsey, TJ Heaton, Marian Scott, and Sahra Talamo, "Recent Developments in Calibration for Archaeological and Environmental Samples," *Cambridge University Press* 62, no. 4 (April 2020), accessed March 14, 2023, https://doi.org/10.1017/RDC.2020.22.

[230] Ewen Callaway, "Carbon Dating Gets a Reset," *Scientific American*, October 18, 2012, accessed March 16, 2023, https://www.scientificamerican.com/article/carbon-dating-gets-reset/#.

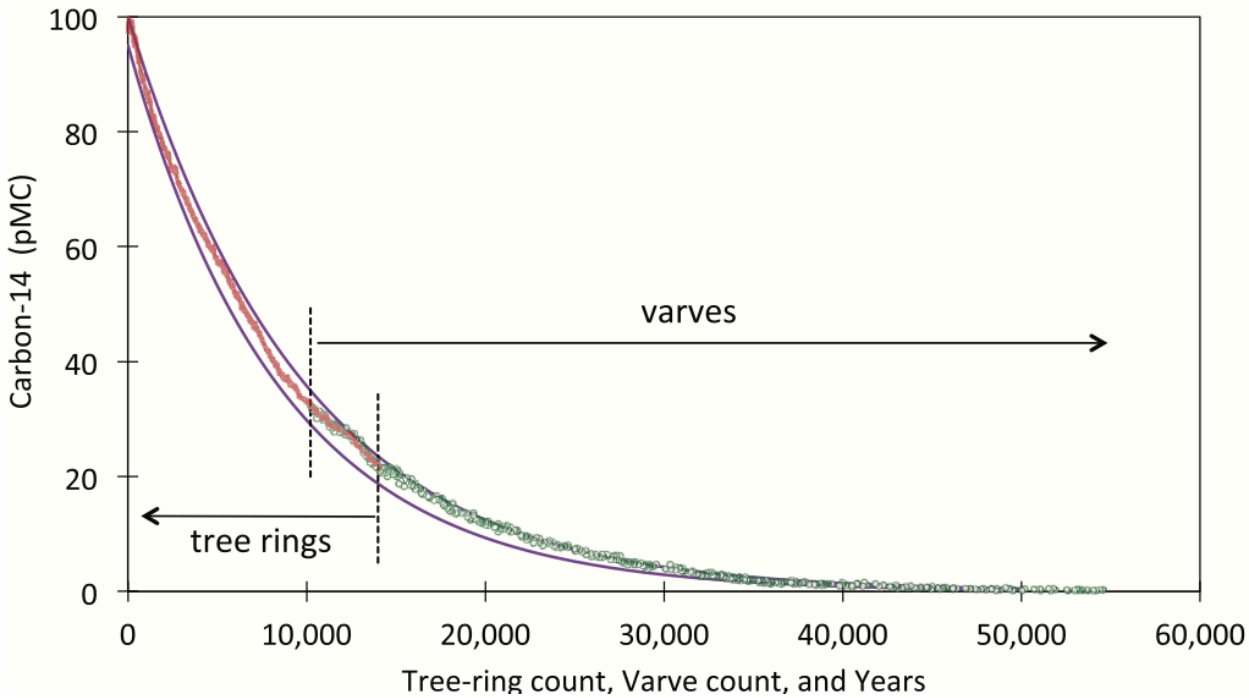

Figure 12. Carbon-14 dating independently confirmed.
Gregg Davidson and Ken Wolgemuth, "Testing and Verifying Old Age Evidence: Lake Suigetsu Varves, Tree Rings, and Carbon-14," *American Scientific Association* 70, no. 2 (June 2018), accessed March 20, 2023, https://www.asa3.org/ASA/PSCF/2018/PSCF6-18Davidson.pdf.

Other Radiometric Methods

Radiocarbon dating is constrained not only by the calibration curves but by the short half-life of carbon-14, only 5730 years. Samples over 50,000 years old do not contain enough carbon to produce accurate measurements.[231] Luckily, there are other radioactive isotopes that have much longer half-lives. Potassium, a common component in volcanoes, decays into argon, a gas which is then trapped in the mineral's crystals. As potassium-40 has a half-life of 1.251 billion years, this method can be applied on samples older than 100,000 years old.[232]

[231] Foecke.

[232] Ibid.

Another isotope used is uranium-238. Due to its massive weight, a multi-step pathway of decay is required until a stable isotope, lead-206, is reached. Individual steps along the pathway can also be dated. The most useful of these is thorium-230, as it is insoluble in water, unlike uranium. Geologic material formed from water is likely to have uranium in it but not thorium, indicating that all thorium-230 present is the result of decay. However, thorium-238 is not stored indefinitely, as it is not stable. The relationship between still-decaying thorium-238 and the final lead-206 enables researchers to date a sample more accurately.[233] The half-life of uranium-238 is 4.468 billion years, the half-life for the decay from uranium-238 to thorium-230 is 245,000 years, and the half-life for thorium-230 is 75,000 years.

Electron-Based Methods

Electron paramagnetic resonance (EPR) dates substances that have unpaired electrons. In crystalline structures, there are imperfections which act as electron traps. When a substance is exposed to radiation, the electrons detach and get caught in the traps. Sunlight or high heat release these trapped electrons, but after being buried, electrons accumulate. The effect of radiation may also cause a substance to become paramagnetic, and their signal can be measured in a lab. This data is used to calculate how long ago something was buried. Tooth enamel is made of hydroxyapatite which is extremely sensitive to ionizing radiation and thus, a prime candidate for EPR.[234]

[233] Ibid.

[234] Mathieu Duval, "Dating Fossil Teeth by Electron Paramagnetic Resonance: How Is That Possible?" *Spectroscopy Europe/World* 26, no. 1 (2014), accessed March 16, 2023, https://www.spectroscopyeurope.com/article/dating-fossil-teeth-electron-paramagnetic-resonance-how-possible.

Optically stimulated luminescence (OSL) applies a similar concept to other materials. Minerals, such as quartz, have structures that easily trap electrons. While in the sun, the radiation causes the crystalline lattice to vibrate and free the traps. This does not occur when buried, so electrons build up. Scientists expose these materials to light in a lab and measure the luminescence emitted, which is proportional to the time buried. Both EPR and OSL are accurate for vast ranges of time, between tens of thousands of years and millions of years.[235]

Objections to Absolute Dating

If a YEC cannot move past the well-funded assumptions behind the dating methods already presented, then there is one, final dating method that indicates definitively that there is an old earth. Isochron dating does not make any assumptions about initial conditions. Instead, the ratio of the decaying isotope to a stable isotope is measured along with the ratio of the daughter isotope to the stable isotope. Rubidium-87 decays into strontium-87 while strontium-86 does not decay. This can be modeled by the equation,

$$\left(\frac{^{87}\mathrm{Sr}}{^{86}\mathrm{Sr}}\right)_t = \left(\frac{^{87}\mathrm{Sr}}{^{86}\mathrm{Sr}}\right)_0 + \left(\frac{^{87}\mathrm{Rb}}{^{86}\mathrm{Sr}}\right)_t \left(e^{\lambda t} - 1\right)$$

in which t is the time that has passed and λ is the decay constant. $(^{87}Sr/^{86}Sr)_t$ and $(^{87}Rb/^{86}Sr)_t$ can be measured in a lab with mass spectrometry. This equation takes the form of $y = b + mx$ which can easily be graphed. The y-intercept of the line $(^{87}Sr/^{86}Sr)_0$ indicates the initial ratio, and the slope $(e^{\lambda t}-1)$ can be used to find how much time has passed.[236] Due to the presence of a constant isotope, no assumptions about initial conditions are needed in isochron dating.

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[235] Foecke.

[236] Stephen A. Nelson, "Radiometric Dating," Tulane University, April 18, 2012, accessed March 20, 2023, https://www2.tulane.edu/~sanelson/eens212/radiometric_dating.htm.

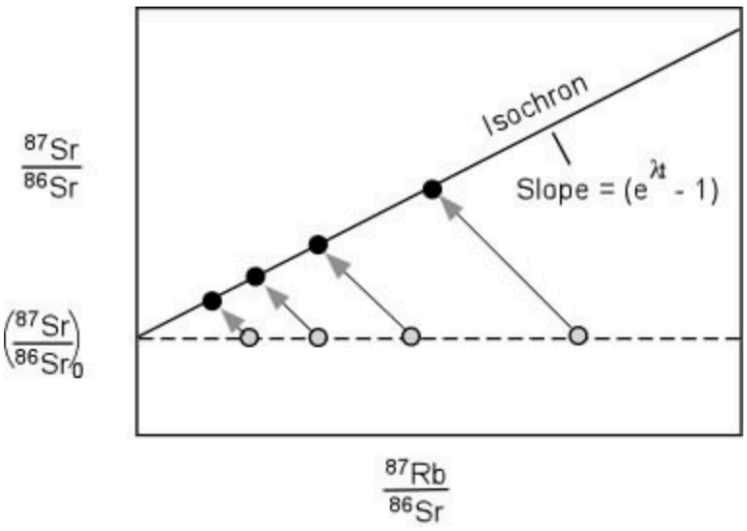

Figure 13. Isochron dating.
Stephen A. Nelson, "Radiometric Dating," Tulane University, April 18, 2012, accessed March 20, 2023, https://www2.tulane.edu/~sanelson/eens212/radiometric_dating.htm.

To invalidate radiometric methods of dating, YECs cite research that has used these methods yet has produced undeniably erroneous dates After the eruption of Mount St. Helens in 1980, a dacite dome formed from rapid magma solidification and layering over a six-year period. In 1996, Dr. Steven A. Austin, a professor of geology at the Institute for Creation Research (ICR), relied on potassium-argon dating for samples from this site and obtained ages between 0.05 and 2.8 MY.[237] Given that the known date for this sample was ten years old, YECs boasted these results as disproof for radiometric dating.

However, there has been comprehensive refutation to this study from many established scientists regarding the methods used by Austin and the research process within organizations such as the ICR. The swiftest response to Austin's results is that he knowingly used an inaccurate method. Radioactive isotopes are only reliable within a certain window based on their

[237] Steven A. Austin, "Excess Argon within Mineral Concentrates from the New Dacite Lava Dome at Mount St. Helens Volcano," *Creation Ex Nihilo,* no. 10 (1996), accessed January 14, 2023, https://www.icr.org/research/index/researchp_sa_r01/.

half-lives and the precision of the technology used in measuring. The samples used from Mount St. Helens were sent to Geochron Laboratories with the statement that they should expect "low argon" but no details about the origin of the rock or its already known age. Had Austin revealed this, Geochron Labs likely would have told him what was already posted clearly on their website: they cannot analyze samples expected to be younger than two million years old.[238]

A YEC would respond to this by stating that this proves all radiometric dating to be unreliable, but this comes from a misunderstanding of the process. Erroneous dates are expected from using K-Ar dating on a ten-year-old sample because it is akin to using a meterstick to measure a strand of hair and being distressed that it is about 1/16". The appropriate dating method needs to be discerned from where a rock sample is in the geologic column. When done correctly, these dates are consistent in their progression backward in time, which would not be true if measuring systems were flawed. Radiometric dating has been exhaustively proven and all discrepancies that YECs point to are the results of science being conducted poorly.

Irreducible Complexity

To deny evolution, YECs not only attempt to invalidate the age of the earth but also the molecular possibility of evolution, replacing it with design instead. The argument for design has been around since long before Darwin and was initially used as an argument for the existence of God, not a counterargument to evolution. William Paley, an Anglican clergyman, published a treatise in 1802 which advocated for the now-famous watchmaker analogy. If one were to find a watch sitting out in nature, they would logically conclude that someone made the watch with

[238] "K-Ar," Geochron Labs, [http://www.geochronlabs.com/kar.html], December 6, 1998, accessed March 17, 2023, https://web.archive.org/web/19981206195129/http://www.geochronlabs.com/kar.html.

intention and knowledge.[239] The same logic can be applied to irreducibly complex biological systems, systems that require all components to be present in order to function. There is no selective advantage to a useless mutation even though many seemingly useless mutations might produce something new and useful. Irreducible complexity, first proposed by Michael J. Behe in *Darwin's Black Box* (1996), challenges the gradual, step-by-step process of natural selection, and is championed by creationists and proponents of ID because there must be direct divine intervention to create the complex biological organisms present today.

There are many processes and structures that have frequently been pointed to as examples of irreducible complexity, but as science advances, past conundrums are becoming explainable through evolution. Paley cited the eye as a complex system akin to a watch, in that it demands a designer. Behe supports this claim with the intricate biochemical makeup of ocular systems. However, his claims about the eye are tainted by the same thing that taints the entirety of his book: Behe notoriously ignores existing research that contradicts his arguments. For this reason, his work is extremely compelling to a general audience of laypeople but is not taken seriously within the scientific community.[240] The very elements that Behe claims are impossible and have never properly been looked into have had heaps of research done surrounding them. In his tenth anniversary edition, Behe acknowledges that other research exists but claims none adequately explain the biochemical system. This still is not true, and since then, even more research has been done, confirming the evolutionary pathways of supposed irreducibly complex systems.

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[239] Michael J. Behe, *Darwin's Black Box: The Biochemical Challenge to Evolution,* 2nd ed. (New York: Free Press, 2006), 212.

[240] Karen Bartelt, "A Scientist Responds to Behe's 'Black Box,'" *Reports for the National Center for Science Education* 19, no. 5 (Fall 1999), accessed March 16, 2023, https://ncse.ngo/scientist-responds-behes-black-box.

Both Paley and Behe rely on the eye as an example of irreducible complexity. After a brief technical explanation of the biochemical steps that occur in the process of seeing, Behe concludes that they are simply too complicated to be explained by evolution, and therefore, all other evidence for evolution is also irrelevant.[241] Behe does not attempt to offer an explanation for the evolution of such a process, even though comprehensively dismantling them would prove to be strong support in his favor, and he perpetuates an all or nothing mindset. If there truly were insurmountable biochemical hurdles to evolution, then the other evidence for evolution would have to be seriously reexamined, and the theory would have to be modified, not immediately thrown away, as Behe suggests. Disproving evolution does not prove individual creation. The issue of the origin of vision has been comprehensively studied, and while not everything is understood completely, it is not the gaping hole Behe would have one believe.

Opsins, G-protein-coupled-receptors that are sensitive to light, are part of the rods and cones in light-receptive organisms, humans included. Instead of a mutation giving rise to a brand-new light sensitive receptor (an impossible leap), an existing signaling pathway was modified, a process known as co-option.[242] Scientists have even identified the key mutation needed to produce opsin: the substitution of amino acids to result in lysine in the seventh transmembrane region of a G-protein-coupled-receptor.[243]

Many of the evolutionary hurdles deemed insurmountable by creationists are not easily solved by the creation model either. For example, in his novel *The Evolution of a Creationist*,

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[241] Behe, 22.

[242] Todd H. Oakley and M. Sabrina Pankey, "Opening the 'Black Box': The Genetic and Biochemical Basis of Eye Evolution," *Evolution: Education and Outreach* 1, no.4 (2008), accessed March 26, 2023, https://doi.org/10.1007/s12052-008-0090-3.

[243] Ibid.

famous defender of YEC, Jobe Martin describes many remarkable aspects of God's creation which he claims could not have arisen through evolution by natural selection. One such example is the golden plover, a small bird that navigates from Alaska to Hawaii, a nonstop 88-hour flight. This bird cannot swim, and there is no land for it to rest. Martin concludes that this bird must have been specially designed for such a flight.[244] However, this still poses a problem for YECs, as they believe all species are descended from distinct general species saved during the flood. This level of minute speciation, which Martin claims is impossible, is required by their flood model. In both an evolutionary and creationist point of view, the golden plover is descended from ancestors who lacked this migratory ability. This means that both evolutionists and creationists accept that it is possible for extremely complex biological systems to arise from more basic ones, undermining a key tenet of the argument for design.

Neutral Theory of Evolution

Creationists object to the power of mutations in driving evolution based on their assertions that mutations do not produce significant, new information required for evolution and that mutations are overwhelmingly detrimental. Both claims do not hold up, as demonstrated in Richard Lenski's *E. coli* experiments comprehensively explained by Richard Dawkins in *The Greatest Show on Earth.*[245]

In 1988, Lenski began his experiment which would last for over three decades and produce over 75,000 generations of bacteria as of 2023. Lenski began with twelve populations of bacteria, isolated in different flasks. The bacteria were given a glucose-rich broth which served

[244] Jobe Martin, *The Evolution of a Creationist* (Rockwall: Biblical Discipleship Publishers, 2004), 204.

[245] Richard Dawkins, *The Greatest Show on Earth: The Evidence for Evolution* (New York: Free Press, 2009), 116–130.

as the limiting nutrient. The population would grow as the bacteria consumed glucose but soon starve as they ran out. From these dying *E. coli*, Lenski rescued a small sample to repopulate a new flask with a new food source. The researchers also periodically froze a sample from each flask as a benchmark in evolutionary history.

Following the theory of natural selection, the bacteria better equipped to use glucose more efficiently or compete better for the resource would reproduce more. After thousands of generations, the *E. coli* should be superior to the initial batch. This is exactly what Lenski observed. By allowing a new generation of bacteria to compete with an unfrozen sample of the original, the researchers saw that the more evolved *E. coli* was better at using its resources to survive and pass on its genes. This evidence is not alarming to a creationist, as they accept microevolution demonstrated here.

An anomaly in population Ara–3 is what dismantles their arguments against mutations. After generation 33,100, the optical density, which is used as a reference for population size, skyrocketed from 0.04 (similar to that of the other populations) to 0.25. The researchers discovered that the *E. coli* had acquired the ability to consume citrate, a compound in the broth that the bacteria were originally unable to eat under the experiment's conditions. Based on genetic mutation rates, it would be unlikely for this newfound ability to be the result of a single gene mutation or else it would have arisen in other populations, in addition to Ara–3. Instead, the ability to consume citrate must have been brought on by mutations in multiple genes, which likely occurred at different times. By dethawing the frozen samples of Ara–3, Zachary Blount found that around generation 20,000, a neutral mutation arose and propagated through subsequent generations of the population. As it provided no evolutionary advantage, this was not the work of natural selection, merely chance. This first mutation primed the population so that

when a second mutation arose, the *E. coli* were then able to consume citrate. The second mutation likely arose in other populations of bacteria but without the first mutation to prime the bacteria, it was useless.

Lenski's long-running experiment shows new information arising in the genome, information that is beneficial to the survival of an organism. It also demonstrates that multi-step, constructive evolution is possible through genetic drift spreading a seemingly pointless mutation.[246] This first step is an example of the neutral theory of evolution, which was proposed by Motoo Kimura and postulates that a mutated form of a gene might not have any impact on the survival of an organism. By chance, it happens to be spread throughout a population.[247] This is extraordinarily problematic for creationists because they cannot claim that mutations do not produce new information.

God of the Gaps

Despite the constant new support being added to the theory of evolution, such as Kimura's proposal, creationists still like to fill any supposed "holes" with miracles. At the beginning of humankind, the divine was used to explain everything. Over millennia, the metaphysical has lost ground to science. While ancient cultures invoked deities to explain celestial bodies and natural phenomena, today, science is able to fill the role religion once had. When something could not be explained, the supernatural, in this case, God, was used to fill in the gaps. These gaps have been shrinking as modern science expands. The earth revolves around

[246] Ibid.

[247] Ibid., 334–335.

the sun due to gravity. Storms are caused by climatic interactions involving water vapor, temperature, and winds. Illness comes from bacteria or viruses, not divine wrath.

This is not to say that God is absent from these phenomena. He is the primary cause and has put laws into nature that govern its processes. A natural event has a natural cause, but God is the cause for the very existence and properties of nature. By assigning God to "the gaps" of human understanding, he seems to be losing power through the years as science claims his territory, but the truth is that God's power has in no way diminished. Examples that were once presented as irreducibly complex and used to indicate God have been disproven with the advancement of science. Any current gaps in human understanding will likely follow the same path and be filled in with time. For this reason, seemingly unexplained hurdles in evolution do not need to be attributed to direct divine intervention.

Academic Dishonesty

The evidence for evolution is overwhelming. It does not just explain the past, but it makes accurate predictions about what should be found through archaeology and genetics.[248] Creationism can accommodate some science, cherry pick from existing research, and conduct their own, often deeply flawed, experiments. Dr. Nathaniel Jeanson, the most revered scientist in the YEC community, as he has a Ph.D. in cell and developmental biology from Harvard University, is well-known for his work locating the genealogical Adam and Eve at approximately 6000 years ago. His method used has been widely discredited by all mainstream scientists, as he

[248] Such as the discovery of *Tiktaalik* dating to the exact time frame

inaccurately uses the mutation rate (the rate at which mutations occur per generation) as the substitution rate (the rate at which mutations accumulate).[249]

Jeffrey Tomkins, the scientists who has attempted to exacerbate the differences between human and chimp genomes, has published and retracted numerous different similarity percentages, each time using different, erroneous methods. When comparing genomes, he weights each section equally. To illustrate his incorrect methods, if a 4000-base pair segment is 100% similar and a 20-base pair segment is 50% similar, Tomkins would have concluded that the genome was 75% similar, instead of weighting the similarity percentages based on the length of the base pair sequence.

After thoroughly investigating the YEC community's literature, blog posts, YouTube debates, and documentaries, a resounding lack of academic integrity is revealed. Frequently, when YEC channels post their debates, they cut out their opponents' (scientifically sound) rebuttals. In YEC movies and documentaries, they misrepresent mainstream research by quote-mining abstracts. In many instances, the research abstract is briefly presented with one sentence highlighted, a sentence that usually discusses the existence of some scientific problem within fields related to evolution. They then conclude by stating that mainstream scientists agree evolution is flawed. If a viewer were to pause the video and read the rest of the abstract, they would find that this paper is presenting the solution to the aforementioned problem. It is hard to defend the academic integrity of YECs, as they are clearly misrepresenting science to their layperson audience.

[249] Creation Myths [Daniel Stern Cardinale], "Creation Myth: Mitochondrial Eve 6000 Years Ago" (video), June 23, 2020, accessed March 29, 2023, https://www.youtube.com/watch?v=cy7e-H_qjwc&t=0s.

Conclusion

Despite differences among believers about evolution, this topic is ultimately not a matter of dogma, nor does it have any effect on the salvation of the believer. This is not to say that the issue is not important. Many Christians have grown up in YEC households and upon learning about evolution, turned away from their faith either because they do not know how the two can be compatible or because they have felt betrayed by their Christian community. Science should not drive Christians away from God, and it should not deter nonbelievers from finding faith. Falsely presenting Christianity as incompatible with evolution does both.

Reading the Bible as a 21st century Christian leaves out thousands of years of context that simply cannot be translated verbatim. Hebrew and Greek can be translated to English, but the audience and surrounding culture of a text greatly influences how it is written and requires much more analysis that the act of translation alone. The creation/evolution controversy has prompted in-depth scrutiny of biblical passages and ancient documents that can provide insight to this doctrine. This level of examination should be afforded to the entire Bible, and hopefully the additional enrichment gained from the investigation of creation-related passages will inspire readers to do exactly that.

The creation narrative of Genesis is beautiful. Forcing its artistry into a modern, empirical reading does not value the creativity of God, who crafted such a story to communicate with an ancient audience. Then, over 2000 years later, Paul was able to provide new meaning to the text, reorienting the entire Old Testament in light of the resurrection of Christ.

The majority of YECs are well-intentioned, and their rejection of evolution comes from an admirable position of faith. However, the arguments for YEC from a scientific standpoint are largely regurgitations of deeply flawed creation research. This is why they have gained a bad

reputation in the scientific community, not because they are Christians but because they are not honest scientists. Evolution begins with zero presuppositions and uses the evidence to draw a conclusion. YEC begins with a conclusion and manipulates the scientific data to support it. If a scientist could disprove conventional evolution and propound an updated or novel model of how life on earth came to exist that stood up to rigorous testing, that scientist would be making history, earning countless awards, and being invited to speak all around the globe.

As YEC is often a deeply ingrained belief, it is unlikely that this thesis completely changed anyone's mind on evolution. However, hopefully it has *opened* people's minds to the fact that there is room for both evolution and Christianity in the world. Evolution is often deemed "the path to atheism," but it does not need to hold this power over believers. Instead, evolution for a Christian should be a path to critical thinking, scientific queries, and scriptural analysis. Evolution will only remain a path to atheism if people are told that the only way to accept God is to accept the pseudoscience of creationism.

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For the Lord gives wisdom; from his mouth come knowledge and understanding.
Proverbs 2:6

Lynley Pace