

# On Fossils and Faith

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I am a geologist, paleontologist, veterinary anatomist, evolutionary biologist, and a lifelong Christian. I am extraordinarily privileged to teach in a superb research university, and I have been blessed with a succession of excellent students with whom I have traveled the world. I have been even more greatly blessed with the companionship of my wife of 48 years, Dawn, with whom I have two children and three grandchildren. These are the three great priorities of my life: family, faith and fossils.

As a child, dinosaurs fascinated me. While most children grow out of this fascination, I simply never did. I lived in northern Indiana until I was 11. My older brother, Steve, was an amateur naturalist and astronomer. He taught me to love collecting fossils. My father, Edward O. Dodson, was an evolutionary biologist who taught at Notre Dame. When I was 11 he moved our family to Canada, where he taught at the University of Ottawa for the rest of his career. He encouraged my scientific interest in dinosaurs and in natural history. He raised me in the Christian faith, and he also taught me to appreciate evolution as a natural biological process that played out in the immensity of geological time. There was no conflict between Christianity and evolution in his mind, nor is there in mine.

I completed my Ph.D. in geology and geophysics (actually paleontology) at Yale in 1974. Since

that time I have spent my entire professional career teaching gross anatomy to veterinary students at the University of Pennsylvania in Philadelphia, while also supervising undergraduate and graduate students in the Department of Earth and Environmental Sciences.

In the first two decades of my scientific career, I confined my research to Canada and the United States. My first new discovery was a small horned dinosaur from south central Montana, which in 1986 I named *Avaceratops lammersi*. A skeleton of the dinosaur is on display at the Academy of Natural Sciences of Philadelphia (now the Academy of Natural Sciences of Drexel University). This animal is named not after my wife, but after Ava Cole, the wife of the man who first found its fossils on the Careless Creek Ranch owned by the Lammers Family (hence the species name). It took me another 19 years to repair this serious marital *faux pas*.

All of my subsequent discoveries have been made and published with my students. In 1999 and 2000, we collected a long-necked (i.e., sauropod) dinosaur from southern Montana. Six months later we were in Egypt, where we collected remains of a very large sauropod. The humerus (upper arm bone) measured 5 feet 7 inches in length. At the time of this discovery at Bahariya Oasis in the Western Desert, it was the second largest humerus ever recorded in the

fossil record. In 2001, we named the dinosaur *Paralititan stromeri*, meaning "Stromer's giant from the swamp," honoring the German paleontologist Ernst von Stromer who collected legendary dinosaurs from Bahariya Oasis before the First World War. In 2004, graduate student Jerry Harris and I wrote about the Montana sauropod, which we called *Suwassea emiliae*. This was an ingenious name devised by Jerry, derived from the Crow Indian language. It means "Emilie's ancient thunder," a tip of the hat to the famous but discredited name of "*Brontosaurus*," the thunder lizard.

A new chapter in my research life began when I attended a scientific meeting in Beijing in 1995. There I met an impressive young Chinese man who had just completed his master's degree and was looking to continue his studies. I invited You Hailu to come to Philadelphia and study with me. He followed me to Penn, where he completed his Ph.D. in 2002. He then returned to China and named *Magnirostris dodsoni* ("Dodson's big nose!") in my honor. More importantly, he invited me to come to China and work with him and his collaborator, Li Daqing, in Gansu Province in northwest China. This has been a very fertile collaboration and has resulted in three more University of Pennsylvania Ph.Ds. In 2005, we at last honored my wife Dawn with a small horned dinosaur from Gansu, which we named *Auroraceratops rugosus* ("Dawn's bumpy horned face"), which was the subject of Eric Morschhauser's Ph.D. dissertation. My current Chinese student, Ligu Li, worked with me to name another sauropod from Gansu, *Yongjinglong datangi* ("Mr. Tang's dragon from Yongjing County"). We also named a two-legged plant-eater *Gongpoquansaurus mazongshanensis* ("Gongpoquan reptile from the Horse Mane Mountains").

This is a brief summary of some of my activities around the world as a dinosaur paleontologist aided by grants from the National Science Foundation, the National Geographic Society, and other agencies. Projects presently on my desk include working on a new horned dinosaur

from northern Mexico and an interesting specimen from the Hell Creek Formation of Montana. I have spent much of my career studying horned dinosaurs, not because of careful planning but rather by virtue of serendipitous discovery. I have called myself a paleontologist for nearly 50 years, but I have yet to call paleontology a career. I take my science and my role as teacher and mentor very seriously.

I also take my Christian faith very seriously. I had never attempted to integrate my Christianity with my life as a scientist until I was explicitly challenged to do so. The challenge came in the form of a seminar that I attended in December 1988, given by Cornell University biologist and historian of science Will Provine. This seminar, entitled "The Evolution of Human Morality," literally changed my life. Citing the authority of modern evolutionary biology, Provine invited his audience, scientists at the Academy of Natural Sciences of Philadelphia, to face what he claimed were the consequences of evolution: there is no God; there is no soul; there is no life after death; there is no such thing as free will.<sup>1</sup> We make hundreds of choices every day, Provine explained, but these are all the result of either our genes or our environment. Scientists who claim to believe in God are hypocrites who must check their brains at the back of the church.

Moreover, Provine claimed that most evolutionary biologists do not believe in God. In fact, he opined, those that do could probably be counted on the fingers of one hand. Wow! What a stunning expression of scientific naturalism. I admit that I have led a somewhat sheltered life, primarily in the company of fellow Christians. I was not so unaware that I failed to know that some scientists were atheists, but none had espoused to me the view that a scientist cannot believe in God. I was rocked to my core by Provine's compelling presentation. The seeming approval of Provine's sentiments by my colleagues caused me to slump in my seat. I was left literally speechless. Although I disagreed with every word he uttered, I could summon

neither the words nor the courage to respond.

As this event occurred only ten days before the celebration of the birth of Our Lord, I left Provine's seminar feeling rather depressed and lonely. Part of his message was the implicit taunt that anyone in the audience who did not share his views belonged in the closet. In a few days my depression changed to anger and resolve. I sat down and composed a four-page letter to Will Provine registering my various complaints and disagreements with his presentation, and maladroitly expressed my views on the history of science and the significance of religion. He generously replied in five pages. Although he did not suffer fools gladly (and indeed I was foolish in my ignorance of history), Provine concluded his letter with an invitation for me to come to Cornell and to debate him on his stage. I am not a debater by inclination, least of all when I lack confidence in my base of knowledge on the topic. I replied to him in six pages, politely declining his invitation to come to Cornell, where I was certain I would have been slain in the lion's den. There our correspondence ceased.<sup>2</sup>

For many years thereafter, I devoured as much literature on the topic of science and faith as I could. I soon discovered the writings of John Polkinghorne, FRS. This distinguished British mathematical physicist left the physics laboratory at Cambridge University in 1979 at age 49 and studied for Anglican holy orders.<sup>3</sup> He was ordained in 1982, and co-founded the Society of Ordained Scientists, along with Arthur Peacock of Oxford University. Polkinghorne was elected Fellow of the Royal Society in 1974 for his contributions to physics. Later he served as president of Queens College, Cambridge University. Although his scientific contributions are substantial, he has been a most prolific and accessible writer on the topic of religion and science. He delivered the Gifford Lectures at the University of Edinburgh in 1993 – 1994, and published these as *Science and Christian Belief* (in the United States as *Faith of a Physicist – Confessions of a Bottom Up Thinker*, Polkinghorne, 1994). In this book and many others, he es-

poused a very orthodox Christianity. A second author I encountered was astronomer and historian of science Owen Gingerich, of Harvard University and the Harvard-Smithsonian Astrophysical Observatory. Gingerich, an expert on Copernicus and Galileo, is a devout Christian and author of several books, notably *God's Universe* (2006) and *God's Planet* (2014), and many essays and articles on science and religion.

A third early influence on me was Ian Barbour (1923 – 2013). A Christian with a Ph.D. in physics from the University of Chicago (1950), Barbour later earned a divinity degree from Yale Divinity School. He enjoyed a lengthy teaching career at Carleton College in Northfield, MN, where he taught both science and religion and wrote a number of books on the harmony of the two. His 1966 book, *Issues in Science and Religion*, has been credited with founding the modern field of religion and science. Barbour presented the Gifford Lectures at the University of Aberdeen (1989 – 1991), which formed the basis for his book, *Religion in an Age of Science* (1990). In this book he developed a useful fourfold taxonomy of the relationship between religion and science. His four categories were: Conflict, Independence, Dialogue, and Integration.

The fourth influence on me during this critical time in my life was John Haught, a theologian at Georgetown University. Beginning in 1970, Haught taught a course in religion and science at Georgetown, and his lectures coalesced in 1995 into the splendid book *Science and Religion: from Conflict to Conversation*. I cannot imagine a better text to introduce the topic than this book. Like Barbour, Haught described the relationship between the two fields by employing a fourfold classification, which he alliteratively labeled Conflict, Contrast, Contact and Confirmation. In 1998 Haught coined the provocative idea that evolution was Darwin's gift to theology, inferring an evolutionary dynamism in an unfinished Creation. Haught has written prolifically and creatively, including such titles as *God After Darwin: A Theology of Evolution*

(2000, 2008); *Deeper Than Darwin: The Prospect for Religion in the Age of Evolution*, (2003); and *Making Sense of Evolution: Darwin, God and the Drama of Life* (2010). There is evidently a large and growing body of literature by scientifically and philosophically-astute theologians and theologically-knowledgeable scientists; I hope I may count among the latter.

Tutored by such powerful Christian intellects that were knowledgeable about science as well as philosophy and theology, I finally constructed the long-overdue foundation I needed to evaluate the atheist attacks on religious belief by some members of the Academy. It was clear that Provine was only the current articulator of an old view. The disappearance of religion in western society has been predicted since the time of the Enlightenment, a prediction that has repeatedly failed to be borne out by fact; theologian Langdon Gilkey labeled this prediction the “Walt Disney theory of cultural evolution.” One of the most lucid and succinct statements of scientific naturalism or scientism came from Bertrand Russell (1872 – 1970), the distinguished British mathematician, logician and philosopher. His dictum was: “Whatever knowledge is attainable must be obtained by scientific methods; what science cannot discover mankind cannot know.”<sup>74</sup> Is that not an impoverished view of reality? A contrary view was expressed by John Polkinghorne: “Science purchases its great success by the modesty of its ambitions.”<sup>75</sup> Not all of reality is accessible to science, whose proper domain is physical reality, that subset of reality that can be measured, weighed or timed. Wisdom, beauty, truth, goodness, faithfulness – in short, all of the things that make life worth living – are inaccessible to science. Nobelist Richard Feynman was even more emphatic about the limits of science: “Scientific knowledge is a body of statements of varying degrees of certainty, some of them most unsure, some nearly sure, but none absolutely certain.”<sup>76</sup> Where then does the overweening confidence of atheism come from?

Richard Dawkins, the reigning *bête noir* of evolutionary biology and scientific naturalism,

has claimed that Darwin made it possible to be an intellectually satisfied atheist. That may be true, but it is also true that Darwin himself was never an atheist. Entering medical school in Edinburgh, Darwin failed to follow in his father’s footsteps and enter the profession of medicine, finding surgery in those days before anesthesia to be barbaric and repulsive. Instead he matriculated as a divinity student at Cambridge University in order to prepare for a life in the Anglican ministry, his tepid religious convictions to the contrary notwithstanding. Initially Darwin was a great admirer of William Paley’s 1802 Bridgewater Treatise, *Natural Theology, or Evidences of the Existence and Attributes of the Deity*, published in 1802. In this important book, Paley drew on the complexities of the biological and astronomical systems as “proof” of the existence of God, arguing that such complex systems could not possibly have been achieved without Divine Intelligence. When Darwin discovered the mechanism by which the complex contrivances in the natural world could have arisen by natural means, his tepid Christian faith was undermined. He eventually lost his faith, not because of his studies of evolution but because of the death of his beloved daughter, ten-year-old Annie, in 1851. Nonetheless, Darwin was a warden of the village church in Down that his devout wife Emma attended with their children. He participated actively in the charitable works of the church, and was a close friend of the vicar, Rev. John Brodie Innes, with whom he maintained a lifelong correspondence after Innes left Down and returned to Scotland. Brodie wrote of Darwin, “He is a man of the most perfect moral character, and his scrupulous regard for the strictest truth is above that of almost all men I know....I never saw a word in his writings which was an attack on Religion. He follows his own course as a Naturalist and leaves Moses to take care of himself.”<sup>77</sup> Darwin himself wrote, “I have never been an atheist in the sense of denying the existence of a God. – I think that generally... an agnostic would be the most correct description of my state of mind.”<sup>78</sup>

Although Darwin effectively scuttled Paley’s

“proof” of the existence of God, it is fallacious to argue that Darwin’s achievements constitute proof of the non-existence of God. Indeed, John Henry Newman in 1852 discredited Paley’s argument, arguing cogently that Paley’s argument did not lead to the God of Christianity and the Bible. It was certainly not the case that religious thinkers uniformly rejected Darwin’s views. Rev. Charles Kingsley, for example, wrote to Darwin that in his view “it is just as noble a conception of Deity, to believe that he created primal forms capable of self development into all forms needful pro tempore and pro loco, as to believe that He required a fresh act of intervention to supply the lacunas which He Himself had made. I question whether the former be not the loftier thought.”<sup>9</sup> Although at Harvard University geologist Louis Agassiz, the founder of the Museum of Comparative Zoology, rejected the idea of evolution altogether, his colleague, botanist Asa Gray, was an ardent Darwinian, but also an ardent Christian, subscribing to theistic evolution. He argued that it was God who was the source of evolutionary change. A grateful Darwin wrote, “It seems to me absurd to doubt that a man may be an ardent theist & an evolutionist.”<sup>10</sup> This view is strongly endorsed by historian of science Michael Ruse (2000) in his book, *Can a Darwinian Be a Christian?*

The idea that there is an intrinsic enmity between science and religion is quite absurd, a post-Enlightenment conceit fanned by flames of intolerance in the late 19<sup>th</sup> century. Science developed because of, not in spite of, Judeo-Christian beliefs, especially the understanding that Creation is separate from the Creator, that Nature is orderly, and that the order reflects the Mind of the Creator. Thus, investigating Nature is an act of worship. Any history of science traces the roots of modern science to churchmen of the 13<sup>th</sup> century such as Albertus Magnus and Roger Bacon. Thomas Aquinas (1225 – 1274) was one of the most rational men who ever lived. He saw God acting through “Secondary Causes”, or what we understand to be the laws of nature. Until the middle of the 19<sup>th</sup> century almost all scientists, or “natural philosophers” as they were

called, were persons of faith. If one were to accept Dawkins’ diatribes at face value, it is a wonder that any religiously oriented scientist preoccupied with “a pokey little medieval universe” would produce any contribution of intellectual value.

As counterexamples, I offer three exemplars. Gregor Mendel (1822 – 1884), the Augustinian monk and abbot, performed his famous experiments on peas in the monastery garden and discovered the gene, the mechanism for hereditary transmission that Darwin lacked. Georges Lemaître (1894 – 1966) was a Belgian priest, physicist and astronomer who is described as the Father of the Big Bang, having been the first to propose the expansion of the primordial universe and the first to derive Hubble’s law and Hubble’s constant. Pierre Teilhard de Chardin (1881 – 1955) was a French Jesuit and a distinguished geologist, mammalian paleontologist and evolutionary thinker, who was also the excavator of ‘Peking Man’ at Zhoukoudien near Beijing. He was a great Christian mystic.

Many scientists today continue to believe in God. Among the contemporary scientists who have written of their religious faith in relation to their academic professions are University of Delaware physicist Stephen Barr (*Modern Physics and Ancient Faith*); Harvard astronomer Owen Gingerich (*God’s Universe*); Brown University evolutionary cell and molecular biologist Kenneth Miller (*Finding Darwin’s God: A Scientist’s Search for Common Ground Between God and Evolution*); Stanford University ecologist Joan Roughgarden (*Evolution and Christian Faith*); University of California at Irvine evolutionary biologist Francisco Ayala (*Darwin’s Gift to Science and Religion*); Cambridge University paleontologist Robert J. Asher (*Evolution and Belief – Confessions of a Religious Paleontologist*); Oxford University mathematician John C. Lennox (*God’s Undertaker – Has Science Buried God?*); and paleontologist Stephen Godfrey (*Paradigms on Pilgrimage – Creationism, Paleontology and Biblical Interpretation*). Perhaps the most prominent of all

such offerings (or the most infamous if you are of another persuasion) is Francis S. Collins' book, *The Language of God – A Scientist Presents Evidence for Belief*. Francis Collins is one of the most respected biomedical scientists in the world, and the former director of the human genome project. He currently directs the National Institutes of Health, with its annual budget of more than \$30 billion. Essentially, Christians are everywhere in academia, but most do not make a lot of noise about it.

How is it that religious faith can persist in the Age of Science? A survey published in 1997 suggested that roughly 40% of scientists believe in a personal God, a number that was unchanged throughout the 20<sup>th</sup> century.<sup>11</sup> In fact, according to Harvard University evolutionary biologist E.O. Wilson, "The predisposition to religious belief is the most complex and powerful force in the human mind and in all probability an ineradicable part of human nature."<sup>12</sup> For most of human history, most human beings have believed in the existence of God (or gods). In fact, one might hazard the possibly unpopular view that there is something wrong with a person who does not hold such a belief. Like color blindness, tone deafness or autism, it is not a fatal defect, but a defect nonetheless that may detract from the fullness of human life. In an evolutionary sense atheism decreases fitness, by which I mean that atheists on average have fewer children than do religious persons, and thus, their genes contribute less to future generations, a view confirmed by the Pew Research Center.<sup>13</sup> Evolutionists and evolutionary psychologists love to "explain" religion, as if to explain something means to deprive it of its legitimacy. Science can explain the trajectory of a speeding bullet or an onrushing train, but that does not make these lethal hazards go away. Science may explain why my mother loved me, but that does not mean she did not love me. Evolutionary biology may "explain" religion as an adaptation that promotes group cohesiveness, or it may assert that the predisposition to believe in things that aren't there protected our ancestors from unseen predators. Isn't it nice to

know that true religious belief is not maladaptive? But the religious believer is not so obtuse as to conclude that this is all there is to religious belief. As Polkinghorne put it so elegantly, "One can accept the insights of natural selection and still feel that one has not heard the whole story."<sup>14</sup> Since we are speaking of beliefs, scientific naturalism is based on the unprovable belief that all legitimate human knowledge is scientific knowledge. This belief is neither scientific, nor is it falsifiable.

What is it that Religion can provide that Science cannot? Science cannot accommodate human experience. As Polkinghorne put it, "Humanity does not live in the lunar landscape of reductionism described by science." Science banishes the very experiences that make us what we are. Science treats people as objects rather than as subjects. Meaning and purpose have no place in science. Science can describe how thermally-excited molecules of dihydrogen monoxide undergo a phase transition from liquid to vapor, but science cannot detect that water is boiling because I want a cup of tea. Rabbi Jonathan Sacks expressed the view that the purpose of science is to take things apart and figure out how they work, while the purpose of religion is to put things back together and figure out what they mean. Science and Religion are both essential perspectives that keep us both human and humane. Said Sacks: "There is absolutely nothing in science – not in cosmology or evolutionary biology or neuroscience – to suggest that the universe is bereft of meaning, nor could there be, since the search for meaning has nothing to do with science and everything to do with religion."<sup>15</sup> We humans cannot live without meaning in our lives. As Rev. Kenneth Olson pointed out, all scientists are part-time scientists, but full-time human beings.<sup>16</sup>

As a Christian and a scientist, I regard the Bible with the utmost seriousness. I do not look to the Bible as a scientific authority. Who uses the Bible as a basis for meteorology or for tomorrow's weather report? To do so would be to trivialize Scripture. As a scientific source the

Bible is incomplete. As Galileo pointed out to Grand Duchess Christina of Tuscany<sup>17</sup>, only a single planet is mentioned in the Bible, the Morning Star (Venus).<sup>18</sup> “The Bible contains such things as are necessary for our salvation,” explained Galileo. “The rest God leaves for us to discover.” Augustine of Hippo taught that the purpose of the Bible was to show us how to go to Heaven, not how the heavens go. Augustine also taught that we do not praise God with our ignorance. God gave us intelligence and expects us to use it. Two verses strike me as giving a mandate to scientists to pursue our quest for understanding God’s Creation. Psalm 33, verse 4 tells us that “the works of the Lord are trustworthy.” The second is Romans 1: 20, “We shall know the Creator through the works of Creation.” What does a scientist do but study the works of Creation, the natural world? If I pursue my science with reverence and humility, I will not be deceived. As a paleontologist, I take special interest in several other verses such as Psalm 90, verse 4: “For a thousand years in your sight are like yesterday when it is past, or like a watch in the night.” Its more recent counterpart is 2 Peter 3: 8, “But do not ignore this one fact, beloved, that with the Lord one day is like a thousand years, and a thousand years are like one day.” This tells me that God, who exists outside of time, is not too concerned with time as measured by humans – a year, a thousand years, a million years, a billion years – these periods are vastly different to us, but are they to God? 1 Corinthians 15: 47 says, “The first man was from the Earth, Earthly.” This speaks to me of the fossil record that has yielded up its treasure of fossils: *Homo habilis*, *Homo erectus*, *Homo neanderthalensis*, *Homo sapiens*. Were these all not part of God’s plan?

Looking more specifically at evolution, which some Christians regard as problematic, if we do not look to Genesis 1 as a scientific account of Creation, can we find theological reasons to support the concept of evolution? Evolution, the record of change over time, imbues Creation with dynamism. Haught has referred to evolution as *Darwin’s Gift to Theology*.<sup>19</sup> In what

sense can this be so? One key insight comes from God’s own assessment of the work of Creation on the Sixth Day: “God saw everything that He had made, and indeed, it was very good” (Genesis 1: 31). The affirmation of the goodness of Creation is an extremely fundamental Judaeo-Christian understanding. But note also the imperfection of Creation – in a word, *very good* means there is still room for improvement. How do you improve on perfection? You cannot. Perfection is a static state that is not consistent with the dynamism seen in the natural world or in human affairs. Creation is not finished – it is ongoing. Since the Fall of Adam, the imperfection of humankind has been all too evident. Only with the grace of God may we dare to hope that the future will be better than the past, as we struggle to overcome the burden of both personal and corporate sin.

Observation of the cosmos shows that the heavens also are by no means static. The orbiting Hubble Space Telescope has produced gorgeous images of so-called stellar nurseries, in which new stars are being formed as we watch. One of the most exquisite images from the Hubble is the nursery named the Pillars of Creation, located in the Eagle Nebula.<sup>20</sup> At the opposite end of the finite lifecycle of stars, supernovae record their cataclysmic deaths. A supernova is a possible astronomical explanation for the Star of Bethlehem in Matthew’s gospel, although numerous other phenomena have been advanced as well (a comet, a planetary conjunction, etc.). A widely reported astronomical event occurred in July 1994 when the comet Shoemaker-Levy 9, having been fragmented into many pieces by the intense gravitation field of the giant planet Jupiter, collided with the surface of that planet over a period of six days with the impact force exceeding by a factor of hundreds the entire nuclear arsenal of the Earth. Unimaginably intense fireballs elevated the atmospheric temperatures around the impact sites by thousands of degrees Centigrade, and scars on the surface of Jupiter could be observed for months. Thus the work of Creation was not finished on the Sixth Day. Again, we may ask how this can

be? The answer is that God's love for Creation, all of Creation, is infinite. The infinite, by definition, cannot be poured out in an instant. God's love is ongoing, and God's love lifts all of Creation. This lifting we may call Evolution.

For my part, I accept that God created through the process of evolution. I accept that God created through the laws of Nature, the Secondary Causes of Aquinas. The Cosmos assembled itself according to God's laws. What kind of a clockmaker would God be if he had to advance the hands of his clock minute-by-minute? Did God really have to create each and every species by a special act? If we attend carefully to the words of Genesis, it does not say that God fashioned living creatures directly. Instead "God said, 'Let the earth bring forth living creatures according to their kinds—livestock and creeping things and beasts of the earth according to their kinds.' And it was so." (Genesis 1: 24) *Let the earth bring forth* – a natural process!

I reject the notion of a young Earth. The Earth gives the impression of great age, 4.6 billion years to be precise. To hold that apparent age is an illusion is to imply that God is deceitful, flying in the face of Psalm 33, verse 4, which reminds us that the works of the Lord are trustworthy. Amen! Accounts of Creation are numerous throughout the Bible (e.g., Isaiah 40; Job 38 – 41; Proverbs 8; Psalm 104; Psalm 148; John 1; Colossians 1:16, etc.), and most lack the apparent specificity of Genesis 1 and 2. Let us put to rest the myth that the Bible speaks univocally on the duration and mode of Creation. Let us not put limits on what God could and could not do!

I accept that life has a deep history. Life appeared on Earth by 3.8 billion years ago and possibly as long ago as 4.1 billion years. By 3.5 billion years, dome-like structures called stromatolites, which are formed by mats of sediment-trapping blue-green bacteria, become evident in the fossil record, for instance at Glacier National Park in Montana. Did the Spirit of God move

across the face of the waters as in Genesis 1: 1, or did a bolt of lightning discharge into a primeval soup of chemicals? As a paleontologist, I surely cannot distinguish one from the other. As a theistic evolutionist, I believe the answer is not necessarily either/or; it could be both. It is an act of faith to believe either the Biblical account of Creation or the scientific one – nobody witnessed the event that has been lost so deeply in the mists of time.

Even if scientists succeed in creating life in the laboratory, my faith will not be challenged – Jesus did not come to save blue-green bacteria, for they are blameless. Jesus came to save sinners, meaning all humans. Harvard paleontologist Andy Knoll calls blue-green bacteria the working class heroes of the Precambrian because they were responsible for building up the oxygen content of the atmosphere, which allowed more complex life to flourish.<sup>21</sup> Around 2 billion years ago eukaryotes appeared, organisms with a nucleus, a cell wall, and organelles such as mitochondria and the Golgi apparatus. These differentiated into plants, animals, fungi and protists, and the potential for sexual reproduction quickly followed, speeding up the pace of evolution. Around 600 million years ago soft-bodied sea creatures became large enough and complex enough to be visible to the naked eye – measured in inches rather than microns. Around 540 million years ago animals with hard parts developed: snails, clams, corals, sponges, arthropods (trilobites), relatives of the octopus that lived in beautiful shells. The seas teemed with life. Fishes were part of these fertile ecosystems. Around 425 million years ago the Earth began greening; plants began to colonize the land, followed by insects that grazed upon them. By 360 million years AC, vertebrates appeared on land to consume insects and breathe the sweet air.

Three hundred million years ago, great scale trees reached 100 feet in height, cockroaches were 18 inches long and dragonflies had 36-inch wingspans. By 230 million years AC, the first dinosaurs and mammals populated the Earth.



Dinosaurs reigned for the next 160 million years, after which the meek (in the form of small mammals) inherited the Earth. Mammals held unchallenged sway over the Earth for 65 million years and left a rich record in the rocks. We can, for example, trace the history of horses back 55 million years. At first appearance they had four toes on their front legs and three on their hind legs; had short faces and low teeth; and were the size of medium-sized terriers. We can trace them by stages and document their increase in size, the progressive reduction in their toes, the lengthening of their faces, and the development of high tooth crowns for chewing abrasive prairie grasses. The fossil record of horses is documented in Wyoming, Nebraska, Oregon, and Texas, among other places, although no one location preserved all their stages of development.

Many other ancient animals left behind a rich fossil record. The evolution of the rhinoceros has also been demonstrated on the Western Plains. Rodents have one of the most important, extensively sampled and exquisitely studied fossil records; these mostly small animals constitute about 40% of all living species of mammals today.

Human ancestors appeared in the African record about 7 million years ago, the first members of our own group, the hominins. Small-brained *Homo habilis* is the oldest member of our own genus, *Homo*, and lived in East Africa between 2.8 and 1.5 million years ago. Our near relative, the large-brained Neanderthal (*Homo neanderthalensis*) dwelled in Ice Age Europe and Asia from 250,000 to about 40,000 years ago. They fashioned stone tools, and recently it has been thought that they may have buried their dead. Our own species, *Homo sapiens*, may have originated in Africa between 200,000 and 100,000 years ago. When modern humans migrated out of Africa somewhat less than 100,000 years ago, they encountered their near relatives, the Neanderthals. We can only speculate about what social interactions were like between Neanderthals and modern humans.<sup>22</sup> What we do know is that by 30,000 years ago there was only a single

species of human, our own species. We do share some genes with Neanderthals, suggesting limited interbreeding (although these genes could have been the result of a common ancestor).

The history of life on Earth is deep beyond our comprehension. When a visitor to the Grand Canyon gazes into that vast and colorful chasm, the brain fails to process the magnitude of what it sees. This also happens when we contemplate time and space. What does a million years mean? What does a billion years mean? What does a light year mean? There are many ways of representing the immensity of geological time. As a child I was deeply impressed by a figure in my favorite dinosaur book, a vertical helical spring with one end at the beginning of time and the other lodged in recorded human history; the relevant positions of significant events in the history of life clustered remarkably near the upper end. John Haught likes to represent the history of life in the 13.7 billion year old *Cosmos* as a 30 volume set of books of 450 pages each, in which each page represents one million years.<sup>23</sup> The first 22 volumes are blank and lifeless. The Earth appears in volume 21, but life on earth waits until late in volume 22. The explosion of complex life at the beginning of the Cambrian Period begins late in volume 29. Dinosaurs appear on page 220 of volume 30 and disappear on page 385. Hominids appear on page 440 of the last volume, and modern humans only make an appearance in the last paragraph at the bottom of page 450.

My own preference is to represent the age of the Earth as a 365-day calendar. The Earth began on January 1, 4.6 billion years ago. Bacteria appeared during the month of February, perhaps as early as February 10. Eukaryotic cells with a nucleus and mitochondria appeared by July 13. Fossils became abundant in the Cambrian explosive diversification event on November 17. Dinosaurs and mammals appeared on December 13. With the exception of birds, dinosaurs became extinct on December 26. *Homo habilis*, the earliest members of the genus *Homo*, appeared at 5 p.m. on December

31, New Year's Eve. *Homo sapiens* appeared by 11:15 p.m., and all of human history is confined to the final minute before midnight, 11:59 p.m. on New Year's Eve.

When the British biologist J.B.S. Haldane was asked what his studies of biology told him about the Mind of the Creator, he is said to have responded: "An inordinate fondness for beetles." This is because there are 400,000 species of beetles, making them the most abundant group of animals on Earth. To this I would add a love for dinosaurs – they lived on Earth for more than 160 million years, and like all of Creation they gave praise to their Creator. By studying the history of life, we learn many things. One of the conclusions we may reach is that God loves all of life, and that the extinct plants and animals had significance and beauty in their own right. God shows immense patience. Many will ask, if the account I have offered is true, why did it take so long for Humankind to appear? Creationist Duane Gish said, "Evolution is so inefficient. God could not possibly have worked that way."<sup>24</sup> Really? Who is Duane Gish (or Peter Dodson) to tell God what God can or cannot do? Let us avoid blasphemy if we can! Studies of the fossil record show us that 99.9% of all creatures that have ever lived are extinct. Otherwise the Earth would be crowded indeed. And consider this – we could not thrive in a world that was terrorized by *Tyrannosaurus rex*! It is not hard to believe that it was Divine Wisdom that sent an asteroid hurtling towards Earth 65 million years ago to wipe out the dinosaurs and cleared the way for mammals and humans to inherit the Earth. With the Psalmist we may share the wonder: "What is man that you are mindful of him, and the son of man that you care for him?" (Psalm 8: 4). Humans are a very special species "crowned with glory and honor" – for all of our faults, we are beloved of our Creator, "little lower than heavenly beings" (Psalm 8: 5). The standard accounts of evolution suggest no basis for inferring that humans are anything other than an accident of the uncaring Cosmos. But as believers we are not compelled to accept this metaphysical position. Our profound intui-

tion is that we are here because God wants us to be here, a view that contradicts no scientific finding. Humankind is no accident. God was not surprised by our appearance.

A strictly scientific account of human affairs is "hopelessly incomplete," according to evolutionary biologist Francisco Ayala.<sup>25</sup> Science does not tell me the purpose of life; how to live my life; and why I should love my neighbor. What room is there for wisdom, beauty, and goodness in a strictly naturalistic system? We may grant that atheist scientists, from Bertrand Russell to Dawkins, share an uncompromising passion for honesty and pursuing the truth. How is this ethical behavior consistent with the idea that our moral imperatives are only adaptations, "tricks played on us by our genes"<sup>26</sup> to ensure their propagation into the next generation? If human discourse in the absence of free will is merely the result of our genes or our environment (for in this view there is nothing else), then why should the words of Dawkins or Dennett be trusted; are they anything more than clever automata? As G.K. Chesterton said, "Mr. Darwin can explain everything but Mr. Darwin explaining everything." Darwin himself was aware of the contradiction. "The horrid doubt always arises whether the convictions of man's mind, which has been developed from the mind of the lower animals, are of any value or are at all trustworthy. Would anybody trust the convictions of a monkey's mind, if there are any convictions in such a mind?"<sup>27</sup>

Atheism is a powerful explanatory belief system, but so is religious belief. Religious belief can fully accept a scientific account of the world, but it can also incorporate a human perspective. Science does not require atheism. Modern western science grew out of Judaeo-Christian beliefs about the relationship between God and Creation, the material world. Science cannot accommodate all of human experience, and therefore it fails to describe the world that we actually inhabit. Science enriches us materially, but absent, extra-scientific foundations can leave us spiritually impoverished. Religious faith

enriches us spiritually and brings meaning and purpose to life. I accept the death, resurrection and ascension of Jesus Christ. I accept with gratitude the gift of salvation that He has won for me. Everything in my life follows from these facts. Because of my beliefs, I see reality more clearly and in more depth than my atheist colleagues do. And this I also know – God LOVES dinosaurs. Like all creation they gave Him praise.<sup>28</sup> The works of the Lord are trustworthy.<sup>29</sup> Amen!

## REFERENCES

- [1] The Scientist, September 1988. <http://www.the-scientist.com/?articles.view/articleNo/9707/title/Scientists--Face-It--Science-And-Religion-Are-Incompatible/>
- [2] There is a postscript to this story. Fifteen years later I delivered a paleontology lecture at Cornell. Unbeknownst to me, Will Provine was in the audience. He greeted me with great warmth afterward and invited me to lecture to his evolution class because he wanted his class to hear from a theistic evolutionist. I accepted with pleasure. I spoke about my fossil research for 40 minutes but reserved the final 10 minutes for thoughts on science and faith. In Q and A afterwards a student asked me if I saw any evidence for God acting in my life on a daily basis. “Oh, heavens yes!” I replied. “One of the most exciting things about being a Christian is that sometimes God uses me to touch other people and sometimes God uses other people to touch me. For example, fifteen years ago God used Professor Provine to touch me!” Provine beamed with pleasure at this thought and we embraced on stage to the amusement of all present.
- [3] John Polkinghorne. 2007. *From Physicist to Priest. An Autobiography.* Society for Promoting Christian Knowledge, London.
- [4] Bertrand Russell. 1961. *Science and Ethics,* Oxford University Press.
- [5] John Polkinghorne. 1994. *Faith of a Physicist.* Princeton University Press.
- [6] Richard Feynman. 1988. *What Do You Care What Other People Think? Further Adventures of a Curious Character.* W.W. Norton.
- [7] John Brodie Innes, letter to Charles Darwin, Dec. 1, 1878 <https://www.darwinproject.ac.uk/letter/DCP-LETT-11768.xml>

- [8] Charles Darwin, letter to John Fordyce, May 7, 1879. <https://www.darwinproject.ac.uk/letter/DCP-LETT-12041.xml>
- [9] Charles Kingsley, letter to Charles Darwin, Nov. 18, 1859. <https://www.darwinproject.ac.uk/letter/DCP-LETT-2534.xml>
- [10] Charles Darwin, letter to John Fordyce, May 7, 1879. <https://www.darwinproject.ac.uk/letter/DCP-LETT-12041.xml>
- [11] Larson, EJ & L. Witham. 1997. Scientists are still keeping the faith. *Nature* 386: 435 – 436.
- [12] E.O. Wilson. 1978. *On Human Nature*. Harvard University Press. p. 169.
- [13] Michael Lipka. 2015. Why people with no religion are projected to decline as a share of the world’s population. Pew Research Center Fact Tank. [www.pewresearch.org/fact-tank/2015/04/03/why-people-with-no-religion-are-projected-to-decline-as-a-share-of-the-worlds-population/](http://www.pewresearch.org/fact-tank/2015/04/03/why-people-with-no-religion-are-projected-to-decline-as-a-share-of-the-worlds-population/)
- [14] Polkinghorne, op. cit. p. 16
- [15] Jonathan Sacks. 2011. *The Great Partnership – Science, Religion and the Search for Meaning*. Random House, New York.
- [16] Kenneth H. Olson. 2011. *Lens to the Natural World – Reflections on Dinosaurs, Galaxies and God*. Wipf and Stock, Eugene, OR.
- [17] Galileo Galilei. 1615. Letter to Grand Duchess Christina of Tuscany. [ttp://www4.ncsu.edu/~kimler/hi322/Galileo-Letter.pdf](http://www4.ncsu.edu/~kimler/hi322/Galileo-Letter.pdf)
- [18] E.g., Revelation 22: 16. “I [Jesus] am the root and the descendant of David, the bright morning star.”
- [19] John F. Haught. 2000. *God After Darwin – a Theology of Evolution*. Boulder, CO. p. 221.
- [20] <http://hubblesite.org/newscenter/archive/releases/2003/34/image/a/format/web/>
- [21] Andrew H. Knoll. 2003. *Life on a Young Planet – the First Three Billion Years of Evolution on Earth*. Princeton University Press.
- [22] Jean M. Auel has written a series of fascinating paleontologically-informed novels, beginning with *The Clan of the Cave Bear* (1980) exploring this very topic.
- [23] <http://static1.1.sqspcdn.com/static/f/558814/12052477/1304486287727/Haught.pdf?token=uqfeQ8w5oHYOHQj5OUwWgHpJoyA%3D>
- [24] Duane T. Gish. 1973. *Evolution: the Fossils Say No!* Creation-Life Publishers.
- [25] Francisco J. Ayala. 2007. *Darwin’s Gift to Science and Religion*.
- [26] John Haught. 2010. *Making Sense of Evolution – Darwin, God and the Drama of Life*. Westminster John Knox Press.
- [27] Charles Darwin, letter to William Graham, July 3, 1881. <https://www.darwinproject.ac.uk/letter/DCP-LETT-13230.xml>
- [28] Psalm 148.
- [29] Psalm 33, v. 4.