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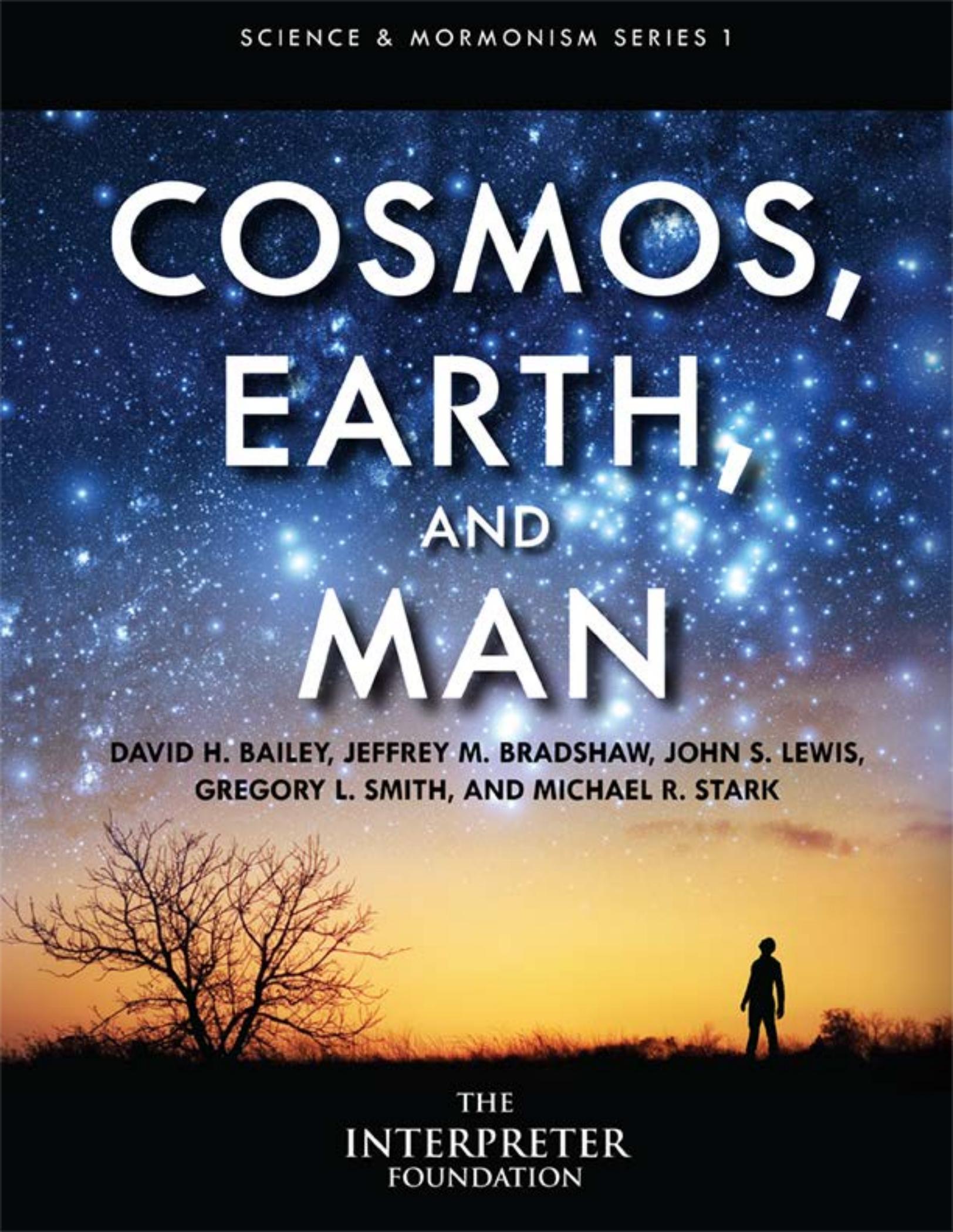
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SCIENCE & MORMONISM SERIES 1

COSMOS, EARTH, AND MAN

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GREGORY L. SMITH, AND MICHAEL R. STARK



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SCIENCE VS. RELIGION: CAN THIS MARRIAGE BE SAVED?

David H. Bailey

The methodology of modern science has been remarkably successful in uncovering the workings of the Earth and universe about us. Just in the past half-century, science has unlocked the code of life and read the DNA of many organisms, traced the history of the known universe, discovered a set of mathematical laws that explain virtually all physical phenomena with remarkable precision, and laid the foundation for astounding advances in technology.

One look at a modern smartphone, which packs computer power and memory exceeding that of the world's most powerful supercomputer just twenty years ago together with a dazzling facility for gathering data and communicating around the world, and one begins to appreciate the progress that has been achieved. Even greater advances are in store for the future: a manned mission to Mars is likely within the next decade or two as is the advent of personalized, DNA-based medicine and countless other advances that haven't yet been conceived.

Thus it is increasingly clear that any movement that opposes the progress of modern science will be soundly rejected by much of modern society.

On the other hand, religion plays a similarly important foundation in the lives of the vast majority of people worldwide. According to a recent study, over 92% of Americans (including, amusingly enough, 21% of self-described atheists and 55% of self-described agnostics) affirm some belief in God. What's more, 39% of Americans (including 37% of atheists and 48% of agnostics – more than the population at large) say that they experience a “deep sense of wonder about the universe” on at least a weekly basis (Pew, 2008). One of my scientific colleagues — who has not practiced conventional religion for many years — nonetheless acknowledged that with regard to the magnificence of the universe and the elegance of natural laws that govern it, he is a “devoted worshipper.”

Religion has indisputably inspired some of the world's greatest art and literature, as is evident from even a casual stroll through any of Europe's great art museums. The Book of Job's remarkable search for meaning in suffering has few peers in world literature (Norwegian, 2011). Religious motifs pervade the works of Shakespeare, especially marquee plays such as *Macbeth*, *Hamlet* and *Othello*. Johann Sebastian Bach, who composed over a thousand pieces of sacred music, is today widely regarded as the greatest composer in history, and his Mass in B-Minor is thought by many to be one of the greatest single works of music in the classical repertoire (Tommasini, 2011). Similarly, Victor Hugo's intensely religious *Les Misérables* is widely regarded as one of the greatest novels of all time and in our own day spawned both London's longest-running musical theater production and an enormously popular full-length film.

Even more important, religion has played an enormous role worldwide as a governor of moral conduct through the ages. In their 1968 book *Lessons of History*, Will and Ariel Durant wrote, "Even the skeptical historian develops a humble respect for religion, since he sees it functioning, and seemingly indispensable, in every land and age. ... There is no significant example in history, before our time, of a society successfully maintaining moral life without the aid of religion" (Durant, 1968, pp. 43, 51). In our own time, well-known skeptic Michael Shermer, after reviewing tragedies in the name of religion, nonetheless acknowledged, "However, for every one of these grand tragedies there are ten thousand acts of personal kindness and social good that go largely unreported in the history books or on the evening news. Religion, like all social institutions of such historical depth and cultural impact, cannot be reduced to an unambiguous good or evil" (Shermer, 2000, p. 71).

Thus it is clear that any movement that opposes modern enlightened religion will be soundly rejected by much of modern society.

In this light, it is clear that science and religion must work together. As Hugh B. Brown of the LDS First Presidency in the 1960s and 1970s once explained, "Peace and brotherhood can be achieved when the two most potent forces in civilization — religion and science — join to create one world in its truest and greatest sense" (Brown, 1999, p. 139).

The "War" Between Science and Religion

Unfortunately, beginning in the early twentieth century but with greater intensity in the past decade or two, a battle is being waged between two camps loosely representing "science" (actually, certain atheistic scholars and scientists) and "religion" (actually, certain creationists and religious fundamentalists — mostly not of the LDS faith).

There are some misconceptions about the historical roots of this battle. Many presume that the conflict had its roots in the dispute between Galileo and the Catholic Church in the 1600s, blossoming into full-scale war in the 1800s, and has



Galileo Before the Holy Office of the Vatican in 1633, 1847. Joseph Nicolas Robert-Fleury, 1797-1890

continued unabated since. Whereas there is some truth to this, in reality the history is not so simple.

To begin with, Galileo himself was not without fault in his dispute with the Catholic Church. His opus *Dialogue on Two World Systems* placed the traditional cosmology in the mouth of Simplicio (“simpleton”), which was hardly a diplomatic way to present his views to papal authorities. Even so, his punishment (house arrest in Florence) at the hand of Church authorities was very mild for the times. In any event, in 1757 Pope Benedict XIV formally ended the ban on heliocentric cosmology, so it was thereafter not an issue. Similarly, in the nineteenth century, although there was significant discomfort with old-earth geology and Darwin’s theory of evolution as these theories unfolded, by the end of the century theologians of major denominations had largely made their peace with modern science, at least in a general sense. Even William Jennings Bryan, who argued the case against Scopes in the Scopes trial of 1925, agreed that the days of creation might well be millions of years in duration (Numbers, 2009, p 183).

It is also important to note that modern science arguably had its roots in Judeo-Christian monotheism. Some present-day scholars wonder aloud whether modern science would ever have developed in the absence of Judeo-Christian monotheism (see below). Further, many leading scientists throughout history were persons of religious faith, often connected closely to mainline Christian churches. Gregor Mendel, who discovered the genetic basis for biology, was an Augustinian friar. Georges Lemaitre, who was the first to promulgate the expanding universe and big bang cosmology, was a Jesuit priest. And even those scientists who rejected some aspect of Judeo-Christian theology often retained a fundamental faith. Isaac

Newton wrote more on theology and the Bible than he did on mathematics and physics, although he became convinced that modern Christianity had deviated from original Christian theology. Charles Darwin rejected organized religion but concluded his *On the Origin of Species* by exulting: “There is grandeur in this view of life, with its several powers, having been originally breathed into a few forms or into one; and that, whilst this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been, and are being, evolved” (Darwin, 1859, p. 490). And Albert Einstein, who rejected conventional Judeo-Christian monotheism, nonetheless declared that the “cosmic religious feeling” was the “strongest and noblest motive for scientific research” (Einstein, 1930, p. 39).

Thus while the overall tension between science and religion may extend back for centuries, the consensus of historians is that the present conflict dates back to roughly the 1920s, partly in reaction to the Scopes trial and the publicity that ensued (Numbers, 2009). The writings of Seventh-day Adventist George McCready Price are often mentioned here. In 1902 he argued that much of modern science is “in the highest degree improbable and absurd” (Price, 1902, p. 69) and in the process laid the foundations for what is now known as “creationism” or “creation science” (Price, 1923). Whitcomb and Morris’ 1961 influential work *The Genesis Flood* gave additional impetus to the movement. These authors argued, as did Price, that since the scriptures clearly describe a creation over six literal days and a universal flood, Christians have only two choices: reject God’s inspired Word or reject modern science. So they offered instead an alternative view that rejected much of modern science (Whitcomb, 1961).

In subsequent decades of the twentieth century, many in the Protestant world in particular were drawn to this worldview, in part to counteract the increasing dominance of modern science, which was underscored by the advent of nuclear energy, color television, DNA, big bang cosmology, and the Apollo moon landing. Then, beginning in roughly 1970, numerous religious organizations began to promote material based on the works mentioned above for public school curricula. Most of these attempts were subsequently blocked by court rulings, but battles continue to the present day, leaving a legacy of tension and distrust (Rich, 2013).

In the wake of the battles over school curricula and the like, not to mention tragedies such as the 9/11 attacks, numerous scientists and secular scholars became similarly polarized in their views and more vocal in the public arena. Best known among these writers are the “New Atheists,” namely Richard Dawkins, Daniel Dennett, Samuel Harris, and Christopher Hitchens. Not content merely to promote science education and defend science against pseudoscience, they have attacked religion as both irrational and harmful. Their books and articles have been widely read and are considered by many to be the canonical view of religion by modern science.

Not surprisingly, all of this has led to widespread perception of all-out war between science and religion, requiring one to choose a certain side and reject the other. Many scientists with religious faith live double lives, not mentioning their religious beliefs to their colleagues. Many college students and adults experience crises of religious faith because they have heard only this all-or-nothing rhetoric from the two warring parties. Moderate voices are seldom heard.

So is it true that the choice is between one extreme or the other? Can this marriage be saved?

The War Between Science and Religion: Camp A

Personally, I do not like the labels “science” and “religion” here, since many prominent scientists reject the rhetoric of the first group, and many prominent religious leaders, including some LDS leaders, reject the rhetoric of the second group. So for the purposes of this discussion, hereafter they will be denoted “Camp A” and “Camp B,” respectively. We will examine each camp in turn.

As mentioned above, the best known Camp A writers are four authors known loosely as the “New Atheists,” namely Dawkins, Dennett, Harris, and Hitchens (Dawkins, 2006; Dennett, 2006; Harris, 2006; Hitchens, 2007), although several other writers could be listed as well. Camp A writers typically hold that religion is fundamentally irreconcilable with modern science and reject essentially all modern religions as irrational. They also insist that science is the only route to truth and that all religious precepts, including the existence of God, must be tested scientifically and rejected if found wanting. Some of these writers highlight the history of religious wars through the ages as evidence that religion is fundamentally harmful. They also blame religion for many of society’s ills.

One of these writers, in a single breathtaking sentence, decried religion as “violent, irrational, intolerant, allied to racism, tribalism, and bigotry, invested in ignorance and hostile to free inquiry, contemptuous of women and coercive toward children” (Did he leave anything out?) (Hitchens, 2007, p. 56). In a similar vein, a prominent biologist asked us to imagine “a world with no religion, ... no suicide bombers, no 9/11, ... no persecution of Jews as ‘Christ killers,’ ... no shiny-suited, bouffant-haired televangelists fleecing gullible people of their money” (Dawkins, 2006, pp. 23-24). Several of these writers emphasize that this conflict is an all-or-nothing matter: “Science could not be more different (than religion)” (Gee, 2013); “Indeed you must check your brains at the (church-house door)” (Provine, 1988).

Religious scholars who have analyzed the writings of the Camp A writers have identified significant flaws in this literature (Haught, 2008; Ward, 2008; see also Bailey, 2013a). To begin with, Camp A writers are often blustery in tone, as can be seen from above, as if the victory of the war between science and religion would go to the side that shouts the loudest. Such rhetoric is unbecoming of serious scholarship, and if included in a manuscript submitted to a research journal would be cause



Taking of Jerusalem by the Crusaders, 15 July 1099, 1847, Emile Signol, 1804-1892

for quick rejection. Also, Camp A writers typically highlight statements made by a few rather dogmatic religious figures (the straw man approach), then presume all who are partial to religion are of the same mindset. Finally, they ignore or dismiss the many positive social values of religion as have been highlighted in numerous historical and social studies.

Some of the Camp A criticisms must be granted. For example, their assertions that religion has often led to armed warfare are, of course, quite correct. Hundreds of thousands died in the crusades of 1095-1291. Between two and four million died during the French religious wars of 1562-1598. Between three and twelve million died in the Thirty Years' War (1618-1648), which was fought between Protestants and Catholics in what is now Germany. Hundreds of thousands were tortured or killed by the Inquisition and in similar persecutions by Protestants. Millions of Jews died in the Holocaust of the 1940s. Historians Will and Ariel Durant, after reviewing this history, solemnly declared, "(W)e must rank the Inquisition, along with the wars and persecutions of our time, as among the darkest blots on the record of mankind" (Durant, 1975, vol. 4, p. 784).

Horrible as these conflicts were, however, the consensus of present-day historians is that the wars of the Reformation, for example, were only partially due to religious differences. Just as important was the desire of northern nation-states to assert independence from Rome's centuries-long hegemony over Europe (Durant, 1975, vol. 6, pp. 935-940). These conflicts also must be weighed in context with secular conflicts of the same general time period, many of which were even worse. Thirty-six million, roughly one-sixth of the world population at the time, died in the An Lushan Rebellion of China during the eighth century (Pinker, 2011, pp. 194-195). Between 30 and 60 million died in the Mongol conquests of central

and eastern Asia during roughly 1200 to 1500. Between 3.5 and 6.5 million died in the Napoleonic Wars. Between twenty-three and sixty-five million died in World War I, and between forty and seventy-two million died in World War II. Finally, between twenty and thirty million perished in the Chinese Cultural Revolution from 1966 to 1976. Religion was not a significant factor in any of these conflicts.

It is worth pointing out, contrary to the claims of some of the Camp A writers, that secular and atheistic movements have also wreaked considerable havoc throughout history. In the 1790s, leaders of the French Revolution systematically repressed religion in an attempt to replace God, the Son, and the Holy Ghost with a new trinity of Liberty, Equality, and Fraternity (Durant, 1975, vol. 11, p. 43). Approximately 25,000 priests, who refused to swear allegiance to the new regime after it confiscated the church's property, fled to other lands. In the ensuing Reign of Terror, priests were among the many thousands of Frenchmen who were guillotined. Six carriage-loads of priests were executed on a single day in 1792 (Durant, 1975, vol. 11, p. 44). Anti-religious violence, conducted specifically in an attempt to eradicate religion, continued even into the twentieth century. For example, Stalin's regime, in addition to directly or indirectly killing millions of Russian citizens, also methodically closed or destroyed thousands of Greek Orthodox churches and killed hundreds of priests. Fifty-five priests were executed on a single day in 1938 (Brown, 2006). In short, while Camp A writers are correct in noting religious wars in history, when placed in a larger historical context, clearly these claims are significantly inflated to help make the Camp A authors' points.

Scholars analyzing the Camp A literature are also concerned at the attempts by these writers to "prove" that God cannot exist by means of scientific or philosophical arguments (Haught, 2008; Ward, 2008). Camp A criticisms of the



The Albert Einstein Memorial, 1979. Robert Berks, 1922-2011.
Bronze statue located on the grounds of the National Academy of Sciences in Washington, DC.

traditional philosophical arguments for God, such as those of the medieval scholar Thomas Aquinas, are hardly new. Difficulties with these arguments have been known for decades, if not centuries. Camp A "scientific" arguments against God are fundamentally flawed, since science, properly defined, cannot say anything one way or the other about the existence or nature of a supreme being.

Along this line, perhaps the most succinct definition of science is given by the

National Academy of Science (NAS), the premier scientific society in the U.S.A. (NAS, 2008, p. 10): “The use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process.” The statement elaborates, “If explanations are based on purported forces that are outside of nature, scientists have no way of either confirming or disproving those explanations.” Many other writers have expressed similar views (Pennock, 1999, p. 5). Thus, the “scientific” arguments against religion raised by Camp A writers do not have much credibility.

A similar assessment applies to the assumption, which very frequently appears in Camp A literature, that the empirical world studied by modern science comprises all of truth and reality. This view is known variously as scientific materialism, or scientism. It may be easy to dismiss religion from this worldview, but it is just as easy to dismiss art, literature, music, philosophy, ethics, and many other disciplines widely considered to be essential to understanding the human condition. What’s more, the scientific materialist worldview itself would itself have to be questioned, since it cannot be derived from experimental science or mathematical reasoning and thus must be accepted on faith (Haught, 2008, p. 45).

One important point is that the writings of the Camp A authors on the topic of religion are not often published in respected, peer-reviewed journals. This material may be typical of polemical literature targeted directly to the public, but it is not solid, peer-reviewed scholarship, nor is it based on solid, peer-reviewed scholarship. This fact may be taken for granted in the academic community, but it



Richard Dawkins, 2013. Albert H. Teich, 1942-

is not well known among lay members of the public, many of whom mistakenly believe that Camp A writings represent authoritative statements of leading scholars in the field, based on solid research. If any of the Camp A writers believe they have arguments or insights worthy of peer-reviewed publication, they are invited to submit them to a journal in the field of theology, philosophy, religious studies, or history, as appropriate. Until they do so, it is hard for professional scholars to take this material very seriously.

Published reviews of the Camp A works are generally rather negative. Here are a few excerpts from reviews by some prominent scientists and secular scholars:

Despite my admiration for much of Dawkins’s work, I’m afraid that I’m among those scientists who must part company with him here. Indeed, *The*

God Delusion seems to me badly flawed. ... (H)is book makes a far from convincing case. (Orr, 2007)

(T)he new atheists believe that they alone are in possession of truth; like Christian fundamentalists, they read scripture in an entirely literal manner and seem never to have heard of the long tradition of allegoric or Talmudic interpretation. (Armstrong, 2009, pp. 303-305)

The new atheists are saying in effect that if God exists at all, we should allow this God's identity to be determined once and for all by the fundamentalists of the Abrahamic religious traditions. (Haight, 2008, pp. xv-xvi)

I am afraid that *The God Delusion* is a deeply flawed book that does not approach Dawkins' usual standards, and suspect that he got carried away by the sheer enjoyment of writing it. (E. B. Davies, 2010)

The War Between Science and Religion: Camp B

Camp B is led by certain religious fundamentalists, mostly, although not exclusively, of the conservative Protestant tradition. Their criticisms of science are, in most cases, deeply rooted in biblical inerrancy, which is the view that the Bible is an *infallible* and *complete* repository of God's word and that it must be read as a scientific and historical treatise as well as a religious text. In this regard, they insist that Genesis should be read very literally as the creation of the Earth (or the entire universe), *in toto* and *ex nihilo*, over a six-day period six thousand years ago.

Before continuing, it is important to note that this view of Bible inerrancy and completeness goes well beyond the LDS view of the Bible. The central lesson that Joseph Smith learned as a young man, after hearing numerous contending preachers, was that many of the issues he was concerned about could not be resolved solely by literal readings of biblical scripture—additional revelation was needed. In a similar vein, the Book of Mormon, which was published a few years after his first vision, noted that many “plain and precious things” had been deleted through the years from the biblical text (1 Nephi 13:28-40). He also rejected *ex nihilo* creation, at least in the sectarian sense.

Similarly, Brigham Young declared,

As for the Bible account of the creation we may say that the Lord gave it to Moses, or rather Moses obtained the history and traditions of the fathers, and from these picked out what he considered necessary, and that account has been handed down from age to age, and we have got it, no matter whether it is correct or not, and whether the Lord found the earth empty and void, whether he made it out of nothing or out of the rude elements; or whether he made it in six days or in as many millions of years, is and will remain a matter of speculation in the minds of men unless he give revelation on the subject (JD, vol. 14, p. 116 [14 May 1871]).

Certainly there are some LDS leaders who have expressed a preference for relatively literal interpretations of scripture. For example, Elder Bruce R. McConkie

taught at one time that the six days of creation were six days according to Kolob, or in other words, six thousand years (McConkie, 1966, pp. 130, 184), though he later accepted the view of a very old earth (see Lewis, this volume). President Joseph Fielding Smith rejected evolution and in general argued for a relatively strict interpretation of biblical scripture. Yet even he nonetheless acknowledged that limits must be placed on highly literal readings of biblical scripture:

Even the most devout and sincere believers in the Bible realize that it is, like most any other book, filled with metaphor, simile, allegory, and parable, which no intelligent person could be compelled to accept in a literal sense. ... The Lord has not taken from those who believe in his word the power of reason. He expects every man who takes his “yoke” upon him to have common sense enough to accept a figure of speech in its proper setting, and to understand that the holy scriptures are replete with allegorical stories, faith-building parables, and artistic speech. ... Where is there a writing intended to be taken in all its parts literally? Such a writing would be insipid and hence lack natural appeal. To expect a believer in the Bible to strike an attitude of this kind and believe all that is written to be a literal rendition is a stupid thought. No person with the natural use of his faculties looks upon the Bible in such a light (Smith, 1956, vol. 3, p. 188).



Returning to the analysis of Camp B literature, many of these writers are not content to simply criticize Camp A writers for their lack of religious faith, to argue for a strict compliance with biblical scripture, or even to express general unease with the increasing dominance of science in modern society. Instead, they argue that major portions of modern science are *technically* in error (Foster, 1991; Morris, 1985; Whitcomb, 1961). Some say that they have evidence that the Earth really is a mere six thousand years old, that evolution never really happened, or that big bang cosmology is wrong. Others acknowledge the general fact that the Earth and universe appear very old but suggest that God created the world to appear that way, perhaps as a test of faith. In a larger sense, these writers devote considerable efforts to identifying phenomena that cannot be explained by science, thinking that such instances prove the hand of God.

Finally, just like Camp A writers, Camp B writers are firmly convinced that their opponents (science in general, and evolution in particular) are responsible for many of the ills of modern society. Morris (1997), in a single breathtaking sentence, blamed science for “racism, fascism, Marxism, imperialism, ... Freudianism, promiscuity, abortion, homosexuality (and) drug use.” (Did he leave anything out?)

And Camp B writers, also like their Camp A counterparts, often insist that this is an all-or-nothing matter, criticizing those writers who attempt to find a moderate middle ground. As one writer emphasized, “This is an all or nothing proposition — there is no middle ground to stand on” (Truck, 2010).

Needless to say, Camp B literature has its critics. From a scholarly point of view, Camp B literature, like Camp A literature, it is often blustery in tone. Like Camp A writers, these writers typically do not present any new data or scholarship, but mostly pick faults in their opponents. Like Camp A writers, Camp B writers often quote a handful of outspoken writers from the opposing camp, then assume that all think that same way. And like Camp A writers, Camp B writers typically do not publish their work in respected, peer-reviewed journals. Instead their books and articles are, for the most part, targeted directly to the lay public.

With regard to technical arguments raised by Camp B writers, the consensus of scientists, even among scientists who are religious believers (and even among LDS scientists), is that these arguments are deeply flawed and do not pose a significant technical challenge to existing scientific theories (Collins, 2006; Fairbanks, 2007; Miller, 1999; Miller, 2008; Stephens, 2001; see also Bailey, 2013c).

To begin with, Camp B claims that the Earth and the universe are only six thousand years old fly in the face of modern radiometric dating, which has been refined and improved over several decades and which produces very consistent and reliable dates (typically many millions of years) for the various epochs of the Earth’s development (Dalrymple, 2004). There is no possibility that each and every one of many thousands of careful measurements is off by factors of millions. A few decades ago one might have been able to claim “reasonable doubt” with regard to radiometric dating measurements, but not today.

Camp B claims that “scientists can’t explain” this or that phenomenon are often out of date. For example, Camp B writers have asserted that scientists have not found any transitional fossils documenting the hypothesized transition between modern land-based mammals and sea-based mammals such as orcas and dolphins (Gish, 1985, pp. 78-79). Yet at least thirty distinct intermediate species are now known (Thewissen, 2002; Zimmer, 2001, p. 138; see also Bailey, 2013b). Similarly, Camp B writers are fond of arguments based on probability and information theory (Dembski, 1998; Foster, 1991, pp. 79-83). But mathematicians who have examined these arguments find them deeply flawed (Elsberry, 2011; see also Bailey, 2000).

It should be emphasized that there may be inaccuracies in the existing theories of geology, biology, and cosmology. Every year, tens of thousands of peer-reviewed studies are published in these fields, as scientists re-examine and refine these theories. But the overall picture of biological organisms descending from common ancestors over many millions of years is, according to the vast majority of scientists, hardly in doubt. Indeed, it is hard to interpret recent DNA data in any other reasonable way. As a single example, humans, gorillas, bonobos, and a handful of other primate species

share a common genetic defect: unlike almost all other animals, we cannot produce our own vitamin C, due to a mutated gene. A detailed analysis of mutations within this gene provides a virtual blow-by-blow story of how these species diverged from common biological ancestors (Fairbanks, 2007, pp. 53-55; see also Bailey, 2013e).

Just as importantly, there are significant philosophical and theological difficulties with Camp B literature. To begin with, the Camp B search for phenomena that cannot be explained by natural laws, in an attempt to “prove” the hand of God, is almost a contradiction in terms, since science, as explained above, cannot comment one way or the other on the existence or nature of a supreme being. Also, attempting to “prove” the hand of God using scientific analysis indirectly implies that faith is not an essential feature of religion and ironically affirms the scientific materialist worldview of Camp A writers. Finally, defining religion in terms of what is currently unexplained in science is tantamount to “God of the gaps” theology, which has left a legacy of disappointment as science continues to advance.

The last straw for many observers is the notion, which has been seriously advanced by some Camp B writers, that the world may appear to be very old, governed by natural laws and the product of an evolutionary development, but this is only because God created the world with an “appearance of age,” perhaps as a test of faith (Whitcomb, 1961, pp. 233-238; Morris, 1985, p. 203). While this notion may give comfort to some, most others find it highly problematic, tantamount to “God the Great Deceiver” theology.

Consider, for example, some implications of this “appearance of age” theory: (a) each of the roughly 10^{30} specks of rock 0.1 mm in size within two miles of the Earth’s surface must have had its isotopic profile deliberately altered, so that when twenty-first century scientists analyze it, it would appear millions of years old, when in reality it is only a few thousand years old; (b) fossils must not be from real ancient creatures millions of years ago but were planted in rock layers to appear very old; (c) each of the 10^{23} photons of light from galaxies millions of light-years away (which photons were thus emitted millions of years ago) reaching the Earth *every second* must have been individually constructed, in transit to the Earth a few thousand years ago, with spectral characteristics of light emitted from distant galaxies; (d) supernova explosions in distant galaxies must not have really occurred – instead, a few thousand years ago, God created a stream of incoming photons so that when twenty-first century astronomers would view them, it would look like a supernova exploded. Surely there is a better approach to reconciling religion with modern science! (Bailey, 2013d).

In general, the same challenge could be offered to Camp B writers as to Camp A writers: If any of these writers believe they have sound arguments drawing some prevailing scientific theory into question, which arguments they believe are truly worthy of serious consideration, they are invited to submit this material to a leading journal in the field. Until these writers do this, it is hard for professional research scientists to take them very seriously.

Although scientists have long rejected Camp B literature, it is also important to note that many prominent religious writers also question these writings. Here are just a handful of excerpts that could be cited, including two from LDS authorities (Brigham H. Roberts and James E. Talmage), one from Pope John Paul II, and one from Francis Collins, the Director of the National Institutes of Health and an evangelical Christian:

On the other hand, to limit and insist upon the whole of life and death to this side of Adam's advent to the earth, some six or eight thousand years ago, as proposed by some, is to fly in the face of the facts so indisputably brought to light by the researcher of science in modern times (Roberts, 1931, pp. 363-364).

The opening chapters of Genesis, and scriptures related thereto, were never intended as a textbook of geology, archaeology, earth-science or man-science. ... We do not show reverence for the scriptures when we misapply them through faulty interpretation (Talmage, 1931, p. 244).

The Bible itself speaks to us of the origin of the universe and its make-up, not in order to provide us with a scientific treatise, but in order to state the correct relationships of man with God and with the universe (Pope, 1986).

The image of God as a cosmic trickster seems to be the ultimate admission of defeat for the (Camp B) perspective. Would God as the great deceiver be an entity one would want to worship? Is this consistent with everything else we know about God from the Bible, ... namely, that he is loving, logical and consistent? (Collins, 2006, p. 177).

Other LDS commentaries on science will be presented below.

Would Camp A or Camp B Literature Pass Peer Review Standards?

As mentioned above, neither Camp A nor Camp B writers typically publish their works in respected, peer-reviewed journals in the respective fields (theology, philosophy, or religious studies on one hand, or geology, biology, and physics on the other). But it is worth asking whether these writings, if submitted, would have much chance at being accepted.

While peer-review standards vary from journal to journal and field to field, some commonly accepted criteria include the following:

1. Relevance to the journal's charter.
2. Clarity of exposition.
3. Objectivity.
4. Acknowledgment of prior work: authors must demonstrate familiarity with existing literature in the field; sweeping dismissals of other works are not acceptable.
5. Freedom from plagiarism: this is invariably considered a serious breach of ethics.
6. Theoretical background: what exactly is the hypothesis being analyzed?
7. Experimental procedures and statistical methods.

8. Sound conclusions: have the authors adequately justified their claimed results?
9. Originality: even if all the above are satisfactory, is it worth publication?

It is clear, from our discussion above, that neither Camp A nor Camp B literature would pass peer review. The bluster and polemic language that is often seen in both camps would be grounds for immediate rejection. Not acknowledging prior scholarship in the field, which unfortunately is typical of both Camp A writers (e.g., ignoring a large body of literature in theology and the history of religion) and Camp B writers (e.g., ignoring a large body of published scientific results), would again be fatal. The requirement for sound, carefully reasoned arguments, verified by well-qualified reviewers, would doom writings from both camps, as we have seen above. And originality is also an issue, as writers from both camps seldom present fundamentally new insights or results.

In general, we have to ask whether Camp A or Camp B writers are truly qualified to present the sweeping critiques of the opposing camp that they present to the public. According to an ancient account, when Pharaoh Ptolemy I of Egypt grew frustrated at the degree of effort required to master geometry, he asked Euclid if there were some easier path. Euclid is said to have replied: “There is no royal road to geometry” (Durant, 1975, vol. 2, p. 501). Indeed, and there is no “royal road” to science or religion, either. Flawed, polemic arguments do not advance a cause no matter how strongly its adherents believe in it. As the Apostle Paul wrote, “For if the trumpet give an uncertain sound, who shall prepare himself to the battle?” (1 Corinthians 14:8).

Can This Marriage Be Saved?

We have explained why neither Camp A nor Camp B literature offers much help to those seeking a reasonable, intellectually honest harmony between science and religion. So what can be said in a positive light?

First of all, it is essential to acknowledge that while Latter-day Saints, along with many other seekers of truth, believe that all truth ultimately may be attained, in the meantime both scientists and religious believers need to recognize the limitations of their own domain and respect the other domain. As we noted above, there may be inaccuracies in the existing theories of geology, biology, and cosmology. Every year, tens of thousands of peer-reviewed studies are published in these fields, as scientists re-examine and refine these theories. But the overall picture of biological organisms descending from common ancestors over many millions of years is, according to the vast majority of scientists, hardly in doubt.

Along this line, it is instructive to make an inventory of biblical passages that have some relevance to modern science. There are a few references to astronomy, including, interestingly enough, some mentions of specific stars and constellations. For example, Job 38:31-33 declares, “Canst thou bind the sweet influences of Pleiades, or loose the bands of Orion? Canst thou bring forth Mazzaroth [meaning unknown]



in his season? Or canst thou guide Arcturus [*Ursa major*] with his son's [cubs]? Knowest thou the ordinances of heaven? Canst thou set the dominion thereof in the earth?"

There are, as one might expect, a few references to the ancient cosmology. 1 Samuel 2:8 declares, "for the pillars of the earth (are) the LORD's, and he hath set the world upon them." In 1 Chronicles 16:30, we read, "the world also shall be stable, that it be not moved," and similarly Psalm 93:1 states, "the world also is stablished, that it cannot be moved." Psalm 104:5 describes God as the being "(Who) laid the foundations of the earth, (that) it should not be removed for ever." Ecclesiastes 1:5 states, "The sun also ariseth, and the sun goeth down, and hasteth to his place where he arose." Many have ridiculed the Bible for such passages, but a more honest reading of these passages in context makes clear that in every case they were in a poetic context, praising God for the wonders of creation, and were not intended to be read as technically precise declarations in the modern scientific sense.

There are only a handful of biblical passages that present quantitative data at all. Among them are the passages in the Old Testament giving dimensions of various structures in Solomon's temple. But again, it is clear from context that these figures were intended only to give the reader a notion of the scale of the structure, not as highly precise scientific measurements in our modern sense. For example, 1 Kings 7:23 and 2 Chronicles 4:2 both say that the circular baptismal font on the temple grounds was 10 cubits in diameter and 30 cubits in circumference. Obviously this cannot be precisely correct, because the ratio of the circumference of a circle to its diameter is $\pi = 3.14159$ But surely these measurements were given as

approximations, to enable one to judge the scope of the temple features and were not intended as precise mathematical fact.

In short, one can search in vain for a single passage of biblical scripture written in the precise, quantitative, testable style of a modern scientific research work. So those who read the Bible as a scientific textbook are surely mistaken, as LDS Apostle James E. Talmage has noted above (Talmage, 1931, p. 244).

According to the Gospel of Matthew, when Jesus was asked if Jews should pay taxes to Rome, he replied: “Render therefore unto Caesar the things which are Caesar’s; and unto God the things that are God’s” (Matthew 22:21). Similar advice could be offered here: “Render unto science the things which are scientific and unto religion the things that are religious.”

What Do Science and Religion Have in Common?

Many a marriage counselor, when meeting with a couple having difficulty, has advised them to make a list of what they have in common – experiences, interests, aspirations, and life goals. Often after examining these lists, the couple recognizes they really do have a lot in common, and their commonalities exceed whatever differences they may perceive. Similarly, it is useful to note that science and religion (the LDS religion in particular) actually have much in common.

To begin with, the Judeo-Christian religion since the beginning has included as a fundamental tenet a quest for truth and enlightenment. Just a few of the biblical verses with this philosophy include, “[Y]e shall seek me, and find *me*, when ye shall search for me with all your heart.” (Jeremiah 29:13); “Seek and ye shall find (Matthew 7:7) and “(Y)e shall know the truth, and the truth shall make you free.” (John 8:32). Even more pointed admonitions are included in LDS scriptures. In the Book of Mormon we read scathing criticisms of those who say, “We have received, and we need no more!” (2 Nephi 28:27). The Doctrine and Covenants includes the memorable passage, “The glory of God is intelligence, or, in other words, light and truth” (D&C 93:36). So the quest for truth is certainly one arena where scientists and religious believers are on common ground.

Along this line, it is often said that religion teaches unquestioning faith. But this is not what is taught in scriptures. For example, the Apostle Paul admonished, “Prove all things; hold fast that which is good.” (1 Thessalonians 5:21).

Another area of commonality, particularly strong in the context of LDS theology, is the “idea of progress.” Conservative scholar Robert Nisbet defined the “idea of progress” as the notion that “mankind has advanced in the past, is now advancing, and may be expected to continue advancing in the future” (Nisbet, 1980, pp. 4-5). Note that this is almost a word-for-word restatement of the LDS Ninth Article of Faith, encapsulating the LDS doctrine of eternal progression.



Vision of St. Thomas Aquinas, ca. 1720s
Martino Altomonte, 1657-1745

Most other ancient religions believed in an endless course of recurrent cycles, similar to the day, month, and year of the calendar and the birth-youth-maturation-die cycle of ordinary life. In Babylonian cosmology, a Great Year was thought to be 424,000 years, after which the universe repeats (Eliade, 1971, p. 115). Even Plato's cosmology was cyclic, with a periodic destruction and recreation of the world (Plato, 1952, p. 451).

The Hebrew religion, in contrast, taught what is now termed "linear," or "progressive" history: the world had a starting point in the past, and we can look forward to a future epoch when the misfortunes, injustices, and evil of this world will be set right. This can be seen in the Genesis account of the creation of the earth; in the

promise to Abraham that his seed would prosper; in the account of Moses and the children of Israel migrating from Egypt to the promised land; and finally, in their anticipation of the Messiah who would reign in glory. Christianity further developed this tradition of progressive history by identifying Christ as the Messiah, by naming his advent as the "meridian of time," by teaching a higher law that superseded the Law of Moses, by predicting a future second coming of Christ, and by describing a heaven where the righteous dead will be resurrected (Eliade, 1971, pp. 102-130, 141-147). Later Christian theologians such as St. Augustine correctly observed that this philosophy rules out the notion of eternal recurrence (Augustine, 1952, p. 350).

Closely connected with this concept of linear, progressive history is the Judeo-Christian belief that God governs the world based on a system of rational laws. The biblical account of the creation, for example, can be read as the creation of order out of chaos. Faith in the rationality of God is also emphasized in books such as Job, which eloquently teaches that ultimately everything will be righted in spite of the many tragedies and hardships in life (Haught, 1995, pp. 22-25).

British philosopher Alfred North Whitehead noted that modern science, as it developed in the West, was based on this faith in rationality:

Faith in reason is the trust that the ultimate natures of things lie together in a harmony which excludes mere arbitrariness. It is the faith that at the base of things we shall not find mere arbitrary mystery. The faith in the order of nature which made possible the growth of science is a particular example of a deeper faith (Whitehead, 1967, pp. 17-19, 27).

British-American physicist Paul Davies wonders whether modern science would ever have evolved in the absence of Judeo-Christian monotheism:

Without belief in a single omnipotent rational lawgiver, it is unlikely that anyone would have assumed that nature is intelligible in a systematic quantitative way, mirrored by eternal mathematical forms. ... Without minds prepared by the cultural antecedents of Greek philosophy and monotheism (or something similar) — and in particular the abstract notion of a system of hidden mathematical laws — science as we know it may never have emerged (P. Davies, 2010, pp. 74-75).

In the early twentieth century, French theologian Pierre Teilhard de Chardin argued that human progress was inexorable, virtually mandated by the natural laws of the universe. He further saw the idea of progress as the one theme that could re-unify science and religion: “To incorporate the progress of the world in our picture of the kingdom of God ... would immediately and radically put an end to the internal conflict from which we are suffering” (Teilhard, 1975, p. 96).

Similarly, scholar Robert Wright describes a vector of progress, consisting of ever-widening extensions of human cooperation, extending over several millennia:

(I)f ... we talk about the objectively observable features of social reality, the direction of history is unmistakable. When you look beneath the roiled surface of human events, beyond the comings and goings of particular regimes, beyond the lives and deaths of the “great men” who have strutted on the stage of history, you see an arrow beginning tens of thousands of years ago and continuing to the present. And, looking ahead, you see where it is pointing. ... Maybe history is ... not so much the product of divinity as the realization of divinity (Wright, 2001, pp. 17, 332).

One other very important area of commonality is reverence for the magnificence of the universe and the elegant laws that govern it, laws that grateful humans have been privileged to comprehend. As mentioned in the introduction, a surprisingly high percentage of the public (even more so among agnostics), acknowledge a deep reverence for the universe on at least a weekly basis. Albert Einstein understood this principle well, even though he personally had difficulties with traditional notions of God. He once wrote:

On the other hand, I maintain that the cosmic religious feeling is the strongest and noblest motive for scientific research. ... Those whose acquaintance with scientific research is derived chiefly from its practical results easily develop a completely false notion of the mentality of the men who, surrounded by a skeptical world, have shown the way to kindred spirits scattered wide through the world and through the centuries. Only one who has devoted his life to

similar ends can have a vivid realization of what has inspired these men and given them the strength to remain true to their purpose in spite of countless failures. It is cosmic religious feeling that gives a man such strength (Einstein, 1930, p. 39).

The astronomer Carl Sagan expressed this same idea in the following terms:

How is it that hardly any major religion has looked at science and concluded, “This is better than we thought! The Universe is much bigger than our prophets said, grander, more subtle, more elegant?” Instead they say, “No, no, no! My god is a little god, and I want him to stay that way.” A religion old or new that stressed the magnificence of the universe as revealed by modern science might be able to draw forth reserves of reverence and awe hardly tapped by the conventional faiths. Sooner or later, such a religion will emerge (Sagan, 1994, p. 52).

The LDS Perspective on Modern Science

While many of these issues are common to a broad range of Judeo-Christian thought, there are some interesting perspectives specifically from an LDS point of view. Arguably the most important of these is the traditional LDS notion that God operates in accord with, not in violation of, natural law (although we might not fully understand all of these laws at the present time). Sadly, this tenet is not widely appreciated in the LDS community. Here are a few excerpts from the discourses of LDS leaders where this view is clearly expressed:

Yet I will say with regard to miracles, there is no such thing save to the ignorant — that is, there never was a result wrought out by God or by any of His creatures without there being a cause for it. There may be results, the causes of which we do not see or understand, and what we call miracles are no more than this — they are the results or effects of causes hidden from our understandings (Brigham Young, JD, vol. 13, pp. 140-141 [11 Jul 1869]).

Among the popular errors of modern times, an opinion prevails that miracles are events which transpire contrary to the laws of nature, that they are effects without a cause. If such is the fact, then, there never has been a miracle, and there never will be one. The laws of nature are the laws of truth. Truth is unchangeable, and independent in its own sphere. A law of nature never has been broken. And it is an absolute impossibility that such law ever should be broken (Parley P. Pratt, 1855, p. 100).

Miracles are commonly regarded as occurrences in opposition to the laws of nature. Such a conception is plainly erroneous, for the laws of nature are inviolable. However, as human understanding of these laws is at best but imperfect, events strictly in accordance with natural law may appear contrary thereto. The entire constitution of nature is founded on system and order (James E. Talmage, 1899, p. 20).

Miracles cannot be in contravention of natural law, but are wrought through the operation of laws not universally or commonly recognized (James E. Talmage, 1915, p. 139).



Christus Consolator, 1838. Albert Bertel Thorvaldsen, 1770-1844
 Replica located in the North Visitors Center of Temple Square, Salt Lake City, Utah

Latter-day Saints are inclined to hold that forces about us, known in part through common human experience, especially in the field of physical science, were employed in the formation of the earth (John A. Widtsoe, 1960, p. 150)

Given that we should view God as working within the realm of natural law, and there are no “miracles” that fundamentally contravene natural law, then why does there need to be a “war” between science and religion? Indeed, the LDS notion of natural law completely removes any need for conflict between the two disciplines.

Even beyond the LDS teachings on the topic of natural law, a survey of LDS discourse on modern science yields numerous very positive assessments, such as the following:

True science is a discovery of the secret, immutable and eternal laws, by which the universe is governed (H. Tate to J. Taylor, *Times and Seasons*, vol. 4, p. 46 [15 Dec 1842]).

Every discovery in science and art, that is really true and useful to mankind, has been given by direct revelation from God, though but few acknowledge it (Brigham Young, JD, vol. 9, p. 369 [31 Aug 1862]).

[O]ur religion will not clash with or contradict the facts of science in any particular. ... If we understood the process of creation there would be no mystery about it, it would be all reasonable and plain, for there is no mystery except to the ignorant (Brigham Young, JD, vol. 14, p. 116 [14 May 1871]).

Truth is truth forever. Scientific truth cannot be theological lie. To the sane mind, theology and philosophy must harmonize. They have the common ground of truth on which to meet (John A. Widtsoe, 1908, p. 156).

Religion and science have sometimes been in apparent conflict. Yet the conflict should only be apparent, not real for science should seek truth, and true religion is truth. ... The gospel accepts and embraces all truth; science is slowly expanding her arms and reaching into the invisible domain in search of truth. The two are meeting. ... Time is on the side of truth — for truth is eternal (Ezra Taft Benson, 1966, p. 546).

But in a larger sense [the 20th century] has been the best of all centuries. ... The life expectancy of man has been extended by more than twenty-five years. Think of it. It is a miracle. The fruits of science have been manifest everywhere. ... This has been an age of enlightenment. The miracles of modern medicine, of travel, of communication are almost beyond belief (Gordon B. Hinckley, 1999).

President Hinckley's comments are particularly interesting in light of the pervasive talk that is often heard of the inexorable decline of society. He acknowledges that such talk can be self-defeating; to the contrary, there is much to celebrate, and the progress due to science and technology is certainly among the proudest achievements of our society.

The above comments are certainly not exhaustive, and there are certainly instances of LDS leaders voicing critical comments towards certain aspects of modern science (e.g., evolution). Such comments are often highlighted by critics of the LDS movement who attempt to portray the LDS movement as anti-scientific. But a larger study of LDS discourse reveals such comments to be in the minority, easily outnumbered by much more positive commentary.

It is worth pointing out that Brigham Young University has strong departments in numerous arenas of modern science, certainly including astronomy, botany, zoology, geology, physics, chemistry, computer science, and mathematics. Evolution in particular has been taught at the university for decades with full approval from the LDS leadership, and several of the BYU faculty have made notable contributions to this field.

With regard to the Church's "official" position on the age of the Earth, a good source is the *Encyclopedia of Mormonism's* article "Age of the Earth," which starts with the noncommittal statement, "The scriptures do not say how old the earth is, and the Church has taken no official stand on this question. ... Nor does the Church consider it to be a central issue for salvation" (Petersen, 1992).

The Church's view on evolution has "evolved" somewhat over time. In 1909, the First Presidency released a statement entitled "The Origin of Man," which included a comment skeptical of the notion that "the original human being was a development from lower orders of the animal creation." However, in 1925 the First Presidency

released another statement, largely a condensation of the 1909 statement, which omitted this language.

In 1930, Elders Joseph Fielding Smith, Brigham H. Roberts, and James E. Talmage became engaged in a discussion over whether there were “pre-Adamites” or other living organisms before Adam. After several manuscripts were circulated, the First Presidency concluded that additional discussion would be fruitless and released a letter to all general authorities. It noted that the statement that pre-Adamites existed was “not a doctrine of the Church” and similarly for the opposite assertion. It concluded with the instruction:

Upon the fundamental doctrines of the Church we are all agreed. Our mission is to bear the message of the restored gospel to the world. Leave geology, biology, archaeology, and anthropology, no one of which has to do with the salvation of the souls of mankind, to scientific research, while we magnify our calling in the realm of the Church (Evenson, 1992).

In 1992, this passage was included as part of a brief article on “Evolution” in the *Encyclopedia of Mormonism*, which article was prepared with direct input from President Gordon B. Hinckley. Subsequently this article, together with the 1909 and 1925 statements and one other document were assembled to form what is now known as the BYU Packet on “Evolution and the Origin of Man,” approved by BYU Board of Trustees and LDS First Presidency (BYU, 1992). As far as the present author is aware, this packet, including the *Encyclopedia* article, is the latest word.

We should add that this noncommittal approach is a wise one because just as it is important for science to stay scientific, focused on studying natural laws, processes, and empirical data, so it is important for religious movements to stay focused on religion and not embrace in their central belief systems some particular scientific theory or worldview. As Holmes Rolston observed, “The religion that is married to science today will be a widow tomorrow. ... Religion that has too thoroughly accommodated to any science will soon be obsolete” (Rolston, 2006, p. ix).

Conclusion

We have presented here a high-level survey of issues relevant to the perceived conflict between modern science and religion. Certainly there are numerous specific questions and issues that have not been treated. What’s more, this study only briefly discusses how these specific issues connect to LDS scriptures and discourse. But it is hoped that it presents at least a framework within which such a dialogue can begin.

The overall consensus of respected writers from both the science and religious worlds, including several LDS writers, is that it is not only futile for religion and science to battle each other; it is also unnecessary. Most major religious denominations, including the LDS Church, have either made peace with the scientific world or at least have recognized that it is pointless to attack the world of science. Most leading

scientists either affirm a religious faith in some general sense or at least recognize that it is pointless to attack the world of religion.

And both scientists and religious believers can stand in awe at the majesty of the universe, which is now known to be much vaster, more intricate and more magnificent than ever before realized in human history. So why all the fighting?

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Endnotes

1. Beginning in the second edition, Darwin modified the wording of his conclusion to read as follows (emphasis added):

There is grandeur in this view of life, with its several powers, having been originally breathed *by the Creator* into a few forms or into one; and that, whilst this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been, and are being, evolved.

DAVID H. BAILEY



David H. Bailey is a mathematician and computer scientist. He recently retired from the Lawrence Berkeley National Laboratory, but is still a very active research scientist. He has published six books and over two hundred technical papers on topics such as high-performance scientific computing, computational mathematics, financial mathematics, and computational biology. He has received the Sidney Fernbach Award from the IEEE Computer Society, the Gordon Bell Prize from the Association for Computing Machinery, and the Chauvenet and Merten Hesse Prizes from the Mathematical Association of America — the only person to have received major awards from each of these three professional societies.

Bailey is a strong believer in rigorous standards of ethics and reproducibility in scientific research. In 1991, concerned about lax standards in the field of high-performance computing at the time, Bailey wrote papers highlighting questionable practices and proposing more rigorous standards to analyze performance. In November 2015, one of these papers was recognized with the Test of Time Award from the ACM/IEEE Supercomputing Conference for its enduring impact on the field. More recently, he has also written about the lack of rigorous standards in the financial mathematics field, and has proposed new techniques and methodologies to ensure responsible research in the field.

Bailey has also written extensively on topics of science and religion in general, and on science and Mormonism in particular. He is the editor of the website ScienceMeetsReligion.org, which includes articles on topics such as evolution, geology, physics, cosmology, and how the awe-inspiring developments in these fields can be seen to be in harmony with modern, enlightened religion.

Bailey and his wife, Linda, live in Alamo, California. He served as a full-time missionary in the Hong Kong-Taiwan Mission, and currently teaches the High Priests Quorum. Linda volunteers at the Oakland Family History Center. They have four married daughters and seven grandchildren.