CREATIONISM AT THE GRASS ROOTS:
A STUDY OF A LOCAL CREATIONIST INSTITUTION

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by

Paul J. Wendel

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A dissertation written by

Paul J. Wendel

B. S., Kent State University, 1988
M. S., University of Akron, 1998
M. A., Kent State University, 2003
Ph. D., Kent State University, 2008

Approved by

________________________________, Director, Doctoral Dissertation Committee
Wendy Sherman Heckler

________________________________, Member, Doctoral Dissertation Committee
Andrew Gilbert

________________________________, Member, Doctoral Dissertation Committee
Nathan Myers

Accepted by

________________________________, Interim Chair, Department of Teaching, Leadership, and Curriculum Studies
J. David Keller

________________________________, Interim Dean, College and Graduate School of Education, Health, and Human Services
Donald L. Bubenzer

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Relying on the book of Genesis as a source text, young-earth creationists or “creation scientists” claim to find physical evidence that the earth was created in six 24-hour periods less than ten thousand years ago and that most of the geologic column was laid down in a year-long worldwide flood. Unsurprisingly, these claims lead to a boundary dispute over the definition of science, in which mainstream scientists impugn the validity of creation science and creation scientists respond in kind. Although young-earth creationism is a growing movement, little is known about it. In particular, little is known about how creationists view the relationship between creationism and science or how the rhetoric of moral, cultural, environmental, and/or biological decline informs creationist practice. In order to investigate these issues, I studied the Fossil Museum (pseudonym), a local young-earth creationist institution, through a combination of naturalistic inquiry and visitor interviews.

With respect to the rhetoric of decline, I found that cultural, environmental, and biological decline appear to function independently of one another in Fossil Museum rhetoric. With respect to views of the relationship between creationism and science, I found that despite having limited training or experience in science and despite
committing numerous scientific errors, Fossil Museum associates respect and emulate science. Believing that physical evidence mediated by honest science will vindicate young-earth creationism, Fossil Museum associates speak of science in highly Baconian terms, invoking the ideal of assumption-free data and privileging observation over inference. They also accept the notion that science should be falsifiable and they suggest that on this criterion, mainstream science is not scientific. Yet because of their belief that physical evidence can vindicate their position, they openly discuss counterevidence to young-earth creationism, regarding such counterevidence as anomalies for future resolution rather than occasions for crisis. I conclude that because of Fossil Museum associates' honest approach to physical data and their belief that science can resolve disputes, productive dialogue is possible and desirable between mainstream scientists and some young-earth creationists, but such dialogue will be useful only if it is aimed at mutual understanding rather than mutual conversion.
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CHAPTER I
INTRODUCTION

Opposition to Evolution in the Public Schools

Along with sex education and school-sanctioned prayer, evolution is one of the most contested curricular issues facing educators in the United States. Following Oklahoma’s passage of the first anti-evolutionary law in 1923, the 20th century witnessed a steady stream of statewide and local initiatives intended to prohibit, restrict, or offer alternatives to the teaching of evolution in public schools, together with numerous successful law suits challenging these laws and policies (Alters & Alters, 2001, pp. 203-206; Larson, 1985). Yet opposition to evolution in U. S. schools extends beyond the legal system. For example, creationist seminars encourage students to interrupt evolutionary instruction by raising their hands and asking, “Were you there” (Ham & Davis, 2004)? Expression of opposition to evolution in public schools is encouraged by a student anti-evolutionary essay contest ("Research paper challenge,” 2006) whose top prize now includes a $50,000 scholarship to Liberty University. The effectiveness of these and other forms of opposition to evolutionary education is indicated by numerous studies, each demonstrating that in response to public pressure, personal conviction, or both, at least 20% of U. S. biology teachers avoid or actively oppose teaching evolution in the public schools (Aguillard, 1999; Ellis, 1983, 1986; Moore & Kraemer, 2005;
Rutledge & Mitchell, 2002; Shankar & Skoog, 1993; Tatina, 1989; Trani, 2004; Weld & McNew, 1999; Zimmerman, 1987). Because of the variety, intensity, and success of these challenges to evolutionary education, science educators have been forced to respond. At least 25 major scientific organizations have issued statements supporting evolutionary education (Alters & Alters, 2001, pp. 201-202), including extensive statements by the National Science Teachers Association and the National Association of Biology Teachers (Alters & Alters, 2001, pp. 213-224). Creationism has also come to occupy a significant part of the professional discourse among biology educators. A search of the 2,478 articles published in The American Biology Teacher between 1971 and 2006 reveals that 209 (8.4%) of the articles concern teaching evolution and 55 (2.2%) specifically deal with creationism. Given the strength of anti-evolutionary sentiment in the U. S., the need for such responses will likely continue.

The Strength of Creationism in the United States

Religiously based opposition to evolution is generally known as creationism. In the broadest sense, a creationist is anyone who endorses the theistic creation of the universe and/or life within the universe. Under this definition, even theistic evolutionists could be classified as creationists, despite their acceptance of the antiquity of the earth (approximately 4.5 billion years) and their acceptance of the evolution of life on earth. However, during the twentieth century the use of the word “creationism” has gradually narrowed to exclude theistic evolutionists (Numbers, 1992). Today a typical “creationist” adheres to the Judeo-Christian tradition and relies on biblical accounts,
especially the book of Genesis, to inform belief about the origin and history of the natural world, and rejects Darwinian evolution. While “old earth” creationists reconcile geologic time scales with a literal view of the bible, “young-earth” creationists believe that the universe was created in six twenty-four-hour days less than 10,000 years ago. The present study focuses on young-earth creationists.

Residents of the United States tend to be receptive to creationist views. For example, 42% of Americans agree with the statement, “Life on Earth has existed in its present form since the beginning of time” (The Pew Forum on Religion & Public Life, 2005). Slightly more than half of Americans reject human evolution (CBS News, 2005; The Pew Forum on Religion & Public Life, 2005). Religious affiliation is closely correlated with anti-evolutionary sentiment. For example, whereas 42% of Americans agree that life has always existed in its present form, this percentage rises to 70% among white evangelicals and drops to 15% among secular Americans (The Pew Forum on Religion & Public Life, 2005). In recent decades, several major creationist organizations have emerged to support and exploit these antievolutionary sentiments, including Answers in Genesis (2007a), the Creation Research Society (2007), the Institute for Creation Research (2007), and the Discovery Institute’s Center for Science & Culture (2007). These are powerful, well-funded organizations, as evidenced by Answers in Genesis’ $28 million, 50,000 square foot creationism museum which opened in northern Kentucky in May, 2007. In addition to the major organizations, the Creation Research Society lists over 130 local creationist organizations scattered among 41 states (Creation Research Society, 2006). This creationist infrastructure is likely to maintain
the popularity of creationism among conservative Christians and it may increase the acceptance of creationism among the general public. As described above, such creationist organizational power and popularity has forced scientists and science educators to confront creationism, and it motivates some scientists to call for even greater involvement with the issue (Attie et al., 2006; National Center for Science Education, 2006).

The Dearth of Knowledge About Creationists

The scientific, historical, and philosophical literature regarding creationism is extensive and in the social sciences there are many quantitative studies involving creationism. However, the record of close qualitative study of creationists is thin, with the notable exception of Christopher Toumey’s work with creationists in North Carolina (Toumey, 1987, 1990, 1994). As a result of this lack of data, scientists and science educators who respond to creationist claims occasionally resort to broad assumptions about creationist motives and methods. Consider zoologist Richard Dawkins (1989), who writes: “It is absolutely safe to say that if you meet somebody who claims not to believe in evolution, that person is ignorant, stupid or insane (or wicked, but I’d rather not consider that)” (Dawkins, 1989, p. 35). Science educator Ron Good (2005) furnishes a less dramatic example when he writes that scientists and creationists maintain entirely different habits of mind, and that these habits of mind are incompatible with each other. Such statements appear to be widely believed by scientists and science educators, e. g. when I told one well-known science education scholar of my intention to study creationists, he replied, “why
would you want to study a bunch of mental defectives?” In the absence of disconfirming
evidence, scientists, science educators, and other anti-creationists tend to assume that
creationism is an extra-rational position and therefore its adherents must be non-rational in
some way.

To the extent that creationism is associated with Christian fundamentalism, Nancy
Ammerman’s (1987) study of Christian fundamentalists supports the assumption that
creationists are irrational. For example, Ammerman describes a Christian fundamentalist
who is conflicted over whether he should buy a new tent from the Sears Roebuck company
until he discovers that the roebuck is listed as a “clean” animal (acceptable for
consumption) in Deuteronomy 14, thereby validating his decision to buy a tent at Sears
(Ammerman, 1987, pp. 53-54). We can find this sort of irrationality in a specifically
creationist context as well. Consider the example of Johan Huibers, a Dutch businessman
who is building a 70 m “scale” model of Noah’s Ark. Huibers cuts the timbers using a
large old power saw which had been abandoned in an open field. Despite having been
neglected for a long time, the saw worked as soon as Hubers plugged it in, leading him to
remark, “That is no coincidence, but a sign from God. He knows how to run his business”
("Pious Dutch businessman builds Noah's Ark," 2005). This habit of attributing minor
coincidences to God tends to confirm Dawkins’ and Good’s biases toward the extra-
rationality of creationists.

On the other hand, Toumey’s (1987; 1990; 1994) studies of the creationists of
North Carolina reveal a sophisticated group of people, many of them professional scientists
or engineers, who are rational, careful thinkers. Where creationism appears to entail a
straightforward subjugation of scientific accounts of the world to a literal reading of the bible, Toumey reveals that in part, creationism is a reasoned response to unease with secular culture. Specifically, creationists partly blame the perceived moral failings of modern American life on the wide acceptance of the theory of evolution and/or the belief in the antiquity of the earth (see Toumey, 1994, pp. 143-144). A review of *Answers*, a quarterly magazine devoted to creationism published by Answers in Genesis, confirms Toumey’s finding. For example, the January-March, 2007 issue of *Answers* connects belief in the theories of evolution and earth antiquity to the growth of Planned Parenthood (Wright, 2007), belief in the inferiority of women (Bergman, 2007), the retrospective justification of slavery (P. Taylor, 2007), the increased acceptance of homosexuality (Ware, 2007), the decline of the church and family ("Behind the scenes: A closer look at the Creation Museum," 2007), and the disillusionment of youth with the church (Ham, 2007). The contributors to *Answers* may be taking a rhetorical position in these articles, discouraging acceptance of evolution and earth antiquity by strategically associating them with perceived social ills, or they may genuinely believe that acceptance of modern scientific theories is partly responsible for these cultural anxieties. Toumey’s studies indicate that the only way to answer such questions is to actually study creationists. Relying on creationists’ public statements is not enough—it is necessary to observe closely, to listen, to ask.
The Need for Information About Creationists

Because of the general popularity of creationist views and creationists’ aggressive efforts to introduce anti-evolutionary and/or pro-creationist views into the public schools, the need to respond to creationists is growing (Attie et al., 2006). However, the relative lack of knowledge regarding creationists hampers this response to creationism. For example, in Chapter 2 I will show that some scientists and science educators claim that creationists do not empirically test or modify their theories, but in fact creationists regularly modify or abandon theories in the light of fresh evidence or further study. Accurate knowledge of one’s opponents is useful in public discourse. This is true of science educators responding to creationists in the classroom or scientists who find themselves defending evolution or deep time before the general public—all can mount more persuasive arguments if they better understand their creationist opponents. Studies of the public rhetoric employed by well-known creationists are useful, but close studies of ordinary creationists can better reveal whether they are “ignorant, stupid, or insane,” maintain characteristic habits of mind, or are likely to be won over by various arguments. Without such data, those who respond to the creationist challenge must resort to assumptions based solely on leading creationists’ public statements.

In order to reach an understanding of creationists, they must be studied respectfully and on their own terms. For this reason, I completed a case study (Flyvbjerg, 2001; Stake, 2003) of the Fossil Museum and Fossil Park, a small creationist facility in the industrialized Mid-West. In order to learn how the staff, patrons, and trustees of this institution make sense of the world, I conducted a naturalistic inquiry of this facility. As
an outsider, i.e. an old-earth evolutionist who does not share the religious commitments of Fossil Museum associates, I studied Fossil Museum staff and patrons’ level of respect for science, the extent to which the staff describe their own practice as science, and how staff and patrons distinguish science from non-science. I also investigated how the themes of progress and decline (see Chapter 2) are manifested in the Fossil Museum. I did all of this in the hope that as scientists and science educators gain a greater understanding of these issues and others, they will be better equipped to respond effectively to creationists. Furthermore, one hopes that greater mutual understanding between scientists and creationists can contribute to a more productive dialogue between them, ultimately leading to a reduction in the rancor and legal battles that have so far characterized encounters between scientists and creationists.

In Chapter 2 I review the history of creationism—its roots in Christian fundamentalism, its progress through the early 20th century, and the ascendancy of young-earth creationism initiated with the publication of *The Genesis Flood* (Whitcomb & Morris, 1961). As young-earth creationism grew in popularity and claimed the title of “creation science,” the scientific community was obliged to respond to its claims. However, the scientific response to creationism relied on dubious criteria in an attempt to disqualify creationism as science. This strategy has proven to be successful in the courtroom and the classroom, but the result has been an internally inconsistent, self-contradictory answer to creationism. I offer a more self-consistent alternative, although it is not clear that this alternative would succeed in the courtroom.
In Chapter 3 I describe a methodology for studying the Fossil Museum, but this methodology is derived from an unusual epistemological stance. Most researchers, including constructivists, assume that people maintain stable, structure-like, context-independent belief systems or worldviews. Under this assumption, a person experiences cognitive dissonance when these belief structures are internally inconsistent, so each person attempts to maintain a consistent worldview from situation to situation. Therefore viewed in the conventional “worldview” manner, at any given moment a person’s individual actions are a response to or manifestation of an underlying belief system. By contrast, I assume that each action is a performance, created at that particular time and place. One can identify performance tendencies, i.e. the habits or characteristic behaviors that make up a personality, but I assume that no “belief structure” lies behind human action. Therefore methodologically it makes no sense to rummage through creationist brains in an attempt to reconstruct their belief systems. One may look for sense-making habits or performance tendencies, but one must recognize that these depend critically on context. Furthermore, if actions are on-the-spot performances, then the researcher is a co-creator of the interaction. Therefore research results cannot be “objective” in the sense that one could know what would have happened if the researcher were not present. In the same way, the results will not be “replicable” because no on-the-spot performance is replicable, although performance tendencies can be identified.

In Chapter 4 I describe the Fossil Museum and its daily routines. Fossil Museum staff, speakers, and visitors all describe Fossil Museum activities as scientific, and all express considerable esteem for science. Despite this esteem for science, however, many
of the Fossil Museum’s exhibits and arguments are founded upon untrustworthy evidence or scientific errors. Both staff and visitors distinguish between science and non-science in a highly Baconian way, particularly emphasizing the ideal of examining empirical data without preconceptions. Fossil Museum staff and speakers distinguish reproducible/observable “operational” sciences from non-reproducible/non-observable “historical” sciences such as geology and cosmology. Closely related to this distinction, Fossil Museum speakers demarcate science from non-science on the criterion that science must be testable and/or falsifiable, and they rule out historical science on this criterion. Yet Fossil Museum staff and exhibits present numerous arguments purportedly falsifying theories in mainstream historical science. Fossil Museum staff, speakers, and visitors also discover and discuss counter-instances to young-earth creationist theories. However, they do not regard them as falsifications, but rather as anomalies to be resolved in the future. Finally, I find that the theme of decline plays an important role as an explanatory and rhetorical tool at the Fossil Museum, but the themes of cultural decline and biological decline appear to be independent of one another.

In Chapter 5 I discuss the results of Chapter 4 and their implications. I discuss the paradox that Fossil Museum associates respect and emulate science, but Fossil Museum exhibits include numerous scientific errors. I scrutinize the notion of assumption-free data, the distinction between historical and observational science, and the tentative nature of science, and I discuss how these notions serve the Fossil Museum rhetorically and strategically. I consider the implications of the Fossil Museum’s approach to falsifications and anomalies, and I situate the Fossil Museum approach to cultural and genomic
devolution within the approach to devolution taken by the larger young-earth creationist community. Finally, I suggest that the Fossil Museum’s esteem for science and commitment to empirical evidence indicate the possibility of productive dialogue between mainstream scientists and creationists, and I suggest ways in which science educators can contribute to such a dialogue.
CHAPTER II
LITERATURE REVIEW

Why Evolution?

There is abundant evidence for biological evolution. In the decades before Charles Darwin published *The Origin of Species* in 1859, geologists recognized that where layers of sedimentary rock have not been disturbed by geological processes, fossils of relatively modern-looking organisms are found in the higher/younger strata, while fossils of more primitive organisms are found in the lower/older strata (National Academy of Sciences, 1999, pp. 12-13). This lead a number of thinkers to propose that more recent organisms evolved from earlier organisms. In Darwin’s time paleontology was in its infancy and intermediate forms had not yet been discovered in the fossil record. This is no longer the case today. For example, Philip Gingerich found hundreds of specimens of an early Eocene primate ranging from 53.5 to 51 million years ago, exhibiting little change from one sample to the next but tracing a gradual development through successive strata from one species to a second species and then to a third (Gingerich, 1983, pp. 134-137). In this case the theory of evolution demonstrates explanatory power. More recently, paleontologists reasoned that a transitional form between limbed vertebrates and lobe-finned fish would likely be found in a particular geological formation in northern Canada. Guided by this hypothesis, paleontologists searched this formation and discovered several
specimens of such a transitional form (Daeschler, Shubin, & Jenkins, 2006, pp. 1-3; National Academy of Sciences & Institute of Medicine, 2008; Shubin, Daeschler, & Jenkins, 2006). Here the theory of evolution demonstrates predictive as well as explanatory power.

Beyond the fossil record, living organisms also display considerable evidence of evolution. For example, the forelimbs of bats, mice, and humans all exhibit the same basic form although they are used in very different ways. Another example is that a reptile’s jaw has several bones, and a mammal’s jaw has only one bone, but the additional bones of the reptile jaw resemble and correspond to the bones in the mammalian ear (National Academy of Sciences, 1999, pp. 14-15). When such structures have similar form but different functions, a logical explanation is that these organisms share common ancestors and that different functions evolved from an earlier structure. On the other hand, religiously motivated critics of evolution typically respond that since certain physical structures are best suited to the requirements of life, one would expect to find these structures throughout the higher animals (e.g. Bergman, 2001). Yet this explanation wears thin in the face of such completely different functions as jaw movement and hearing. Only evolution suits the evidence.

Another important line of evidence is in the geographic distribution of species. Plants and animals live in geographically isolated but similar environments throughout the world, such as deserts. However, plants and animals living in a particular desert are typically more closely related to plants and animals living in nearby non-desert environments than to plants and animals living in similar but geographically isolated desert
environments. One can make sense of this by assuming that in these geographically isolated regions, species independently evolved between respective desert and non-desert environments. Hawaii is similar to many tropical locations throughout the world, yet many Hawaiian species are found nowhere else, and many species common to tropical environments are absent from Hawaii. This is easily explained by a long period of evolution on the geographically isolated Hawaiian islands (National Academy of Sciences, 1999; D. R. Olson, 2004).

Most recently, genome sequences of various organisms have provided striking confirmation of evolutionary relationships deduced from comparative anatomy. The human genome is found to be the most similar to the chimpanzee genome and then successively less similar to the genome of the lemur, the rabbit, etc. (F. S. Collins, 2006, pp. 127-129). Religiously motivated evolutionary critics may argue that since similar function requires similar form, it is no surprise that similar protein-coding genes are found among similar species. Yet in many cases the order in which these protein-coding genes are found plays no role in their function, but these genes are found in the same order among related species. Why would a creator put them in the same order when order plays no role? More importantly, between these coding genes one finds non-protein-coding sequences. Comparing the mouse genome to the human genome, geneticists find numerous examples in which protein-coding genes appear in the same order in both species, and the same non-protein-coding genes are found between them (F. S. Collins, 2006, pp. 134-137). Without evolutionary theory, it is very difficult to explain why non-coding sequences would be found in corresponding locations of the human and mouse genomes. Since non-coding
sequences do not affect the organism in any way, there is no reason that non-coding sequences should be similar in mice and humans. Yet with evolutionary theory, it becomes clear that both humans and mice inherited these non-coding sequences from a common ancestor.

Putting all of this together, it is clear that the paleontological, morphological, and genomic evidence for evolution is enormous and growing. Yet as we saw in Chapter 1, such strong evidence for evolution has not resulted in wholesale acceptance of the theory of evolution among Americans. Many Americans actively oppose the theory of evolution for religious reasons, an opposition that has become the creationist movement.

The Historical Context of Modern Creationism

In order to understand present-day American creationists, it is necessary to explore their history. Creationism can be interpreted as a sub-movement of Christian fundamentalism, which in turn is closely related to but distinct from Christian evangelicalism. Early 20th-century anti-evolutionists were disorganized and characterized by a variety of views regarding the age and history of the earth. However, the minority views of young-earth creationism, i.e. the belief that the earth was created in six 24-hour days a few thousand years ago, together with flood geology, which attributes large-scale geological features to a world-wide Noachian flood, eventually came to dominate creationism and ultimately claim the title of “creation science.” This view is the focus of the present study. Some of the features of young-earth creationism/flood geology are associated with broader cultural themes of progress and decline and the
premillenial/postmillenial dispute within Protestant Christianity. Most recently, present-day creation science borrows from the closely related but more recent development of Intelligent Design. Overall, young-earth creationism has become a well-funded and politically active movement which aims to transform science education.

**Evangelicals and Fundamentalists**

In the First Great Awakening of the 1730s and 1740s, Christians in the American colonies were encouraged to develop an emotional relationship to God through public acknowledgement of guilt and redemption. This impulse to personal religious renewal returned in the Second Great Awakening of the early 1800s with an intensified emphasis on converting non-Christians. As a result, by the late 1800s much of American Protestantism had become preoccupied with personal responsibility for sin, redemption, the pursuit of an intimate relationship to Jesus, and Christian evangelism. In this atmosphere, Christian evangelicalism and fundamentalism developed as two distinct but overlapping cross-denominational movements in the latter 19th century and the early 20th century (Marsden, 1991). Evangelicalism recalled the spirit of the Second Great Awakening in emphasizing the spread of the Gospel. Evangelicals were often willing to defer doctrinal differences in order to win converts, and participants in the evangelical movement were drawn from a variety of Protestant denominations. Where evangelicalism was directed outward toward the spread of Christianity, Christian fundamentalism was directed inward as an effort to protect the church from influences judged to be dangerous. The defining event of fundamentalism was the publication of *The
Fundamentals, a series of 12 tracts published between 1910 and 1915. In these tracts and elsewhere, fundamentalists reacted against such developments as German higher biblical criticism, which used textual techniques to investigate the authorship and history of Christian scripture and ultimately challenged traditional Protestant interpretations. In the same way The Fundamentals reacted to the theory of evolution, which challenged traditional views of the development of life. In this respect American fundamentalism was an anti-modernist movement, parallels of which can be found among Roman Catholics, Jews, and Muslims (Armstrong, 2000). But as bible scholar John Dominic Crossan explains, fundamentalists adopted modernist tools in order to combat modernism:

It was inevitable and understandable that against secular rationalism would arise counterstrains of religious rationalism. If science and reason claimed a monopoly on truth, Christianity trumped them with biblical inerrancy, traditional conformity, and papal infallibility. These were, of course, the supreme victories of rationalism, the ultimate submission of sanctity to certitude (Crossan, 2000, p. 198).

Fundamentalists responded to modernist rationalism with a rationalism of their own, searching the scriptures for universal and inviolable laws and principles in the same way that natural philosophers had discovered laws and principles governing the natural world. Since many fundamentalists were concerned with the spread of the Gospel, many fundamentalists were also evangelicals, but the two movements are not identical. Moreover, since fundamentalism and evangelicalism were initially cross-denominational movements, fundamentalist or evangelical churches were not easily identified in the early 20th century. By the later 20th century, such identifications became possible.
Fundamentalists were more likely than evangelicals to be biblical literalists, but biblical literalism was strictly necessary to neither.

*Christian/Fundamentalist Responses to the Theory of Evolution before 1960*

**Early Anti-Evolutionism**

Following the 1859 publication of Charles Darwin’s *The Origin of Species*, natural scientists rapidly accepted evolutionary theory, and within two decades scientific opposition was very thin. Historian Ronald Numbers reports that a few prominent scientists opposed evolution early on, including Louis Agassiz, John William Dawson, and Arnold Guyot, but scientific opposition didn’t last: “Beyond Dawson and to a lesser extent Guyot, one searches in vain for a prominent late nineteenth-century North American scientist who actively opposed organic evolution” (Numbers, 1992, p. 11). In the absence of opposition to evolution among scientists, conservative and often fundamentalist Christian pastors and preachers began to oppose the theory of evolution, but in doing so they focused on its social and religious implications rather than its scientific merit. By the end of the First World War, conservatives such as William Jennings Bryan held the growing acceptance of the theory of evolution to be responsible for German aggression, the growth of “godlessness” in colleges and universities, and numerous social ills (Numbers, 1992, pp. 41-44). Few addressed the scientific issues of evolution, and those who did generally lacked scientific credentials or training. For example, Presbyterian minister Harry Rimmer began the now-familiar ritual of staging debates with evolutionary biologists and winning over the audience with humor and
oratorical skill rather than evidence. Rimmer’s son is said to have observed, “Dad never won the argument; he always won the audience” (cited in Numbers, 1992, p. 66).

Another early anti-evolutionist was Seventh-Day-Adventist George McCready Price, an amateur geologist who claimed that a world-wide Noachian flood had so scrambled the geologic record that earth history could not be inferred from geologic strata (Price, 1926; Toumey, 1994, pp. 133-134). Thus the very few anti-evolutionists who took on scientific issues did so without expertise, and by far most of the early post-World-War-I evolution deniers focused on its religious and social implications rather than its scientific merit.

Early Organizations

In time, however, people like Rimmer and Price inspired young biblical literalists to study science at the college level, and a movement began to grow. The Religion and Science Association (RSA) was organized in 1935 to unite the scattered attempts to employ scientific arguments against evolution, but doctrinal and scientific disagreements brought about its collapse by 1938 (Numbers, 1992, pp. 102-117). One problem was that some of the early RSA members were Seventh-Day Adventists, many of whose beliefs were held (as they are held today) to be heretical by non-Adventist Protestants. Intertwined with these denominational differences, interpretation of the first lines of Genesis created problems. In the 17th century, Archbishop James Ussher aligned Old Testament genealogies with secular sources to calculate that the earth had been created in 4004 BC. Some RSA members followed Ussher’s lead, insisting that the universe had been created ex nihilo 6,000 years ago in six literal days. Henceforth I will refer to these as “young-earth” creationists. Flood geologists are typically a variety of young-earth
creationist. Whereas standard geology attributes many present-day geologic formations to gradual processes of uplift, erosion, and sedimentation over 4.5 billion years, flood geologists attribute nearly all geologic features to the world-wide deluge described in Genesis chapters 6-8. In addition to the flood geologists, other RSA members advocated “day-age theory,” by which each of the six “days” in Genesis I represents a geologic era. By interpreting “day” in this way, day-age theorists are able to accommodate the six-day creation in Genesis to the billions of years required in standard geologic theory, thereby reconciling the two. Still other RSA members championed “gap theory,” which allows for a long period of time between the opening line of Genesis, “In the beginning God created the heavens and the earth,” and the six days of creation. Some gap theorists allow for geologic activity and the existence of life during this period of earth history, while others allow only geologic activity. In either case, gap theory, like day-age theory, is able to partly accommodate the six-day creation narrative of Genesis to modern geological theories involving gradual geologic processes over long periods of time.

Within the RSA, the doctrinal and scientific disagreements between the young-earth flood geologists, the gap theorists, and the day-age theorists were not easily ignored. Ultimately these doctrinal/scientific differences proved to be intolerable, producing the break-up of the RSA after just three years. A second effort in 1938 led by Seventh-Day Adventists, the Deluge Geology Society, attempted to circumvent these problems by

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1 Although Price was a flood geologist and generally followed Ussher’s chronology, he also followed the Adventist doctrine that the universe may have existed long before the six-day creation of the earth (Numbers, 1992, p. 203).
excluding day-agers and gap theorists. But again, bitter doctrinal (and to some extent scientific) squabbling dissolved the organization by 1945 (Numbers, 1992, pp. 118-139).

The American Scientific Affiliation

In 1941, a group of scientists who were also evangelical Christians founded the American Scientific Affiliation (ASA), committed to the reconciliation of faith with science (Numbers, 1992, pp. 158-183). The ASA has grown to become a large and strong organization, including 2,100 members (R. Isaac, personal communication, February 9, 2007), hosting a four-day annual meeting, and sponsoring a peer-reviewed quarterly journal, presently entitled *Perspectives on Science and Christian Faith*, which is nearing its 60th year of publication (American Scientific Affiliation, 2007). As the ASA grew, it attracted several members with strong scientific credentials who in turn exerted considerable influence on the ASA. Within a few years, most ASA members accepted the antiquity of the earth affirmed by standard geological theories and dismissed the ability of flood geology to explain the geologic features of the earth. By 1960 most accepted the theory of evolution as well (Numbers, 1992, pp. 171-181). Flood geology, which had always been a minority view among creationists (Numbers, 1992, p. xi), was pushed to the fringes within the ASA, yet it was flood geology, rather than day-age or gap theory, which eventually claimed the title of “creation science.”
The Birth of Creation Science

The Genesis Flood

Although George McCready Price and others advanced and developed flood geology in the first half of the 20th century, the watershed moment in flood geology arrived with the 1961 publication of John Clement Whitcomb and Henry M. Morris’s *The Genesis Flood* (Whitcomb & Morris, 1961). This text has been very popular—to date, about 220,000 copies of *The Genesis Flood* have been published (B. H. Craig, personal communication, February 20, 2007), and it remains in print today. Whitcomb was a theologian, but Morris held a PhD in civil engineering (specializing in hydraulics) and chaired the department of civil engineering at Virginia Polytechnic Institute. As flood geologists, both felt marginalized within the ASA (Numbers, 1992, p. 188). In *The Genesis Flood*, Whitcomb and Morris used the bible as a source text, together with many references to scientific literature, to argue that the earth was created *ex nihilo* relatively recently in six 24-hour days and that most of the geological features observable today can be attributed to a Noachian flood. Although they did not tie themselves to the Ussher chronology, conceding that “scriptural evidence” does not require an age of just 6,000 years, they explicitly argued that scripture disallows the Flood occurring more than a few thousand years earlier than 4,000 BC (Whitcomb & Morris, 1961, pp. 474-489) or creation occurring more than a few thousand years before the Flood (p. 34). Therefore *The Genesis Flood* is the first widely publicized young-earth flood geology text.

Some of Whitcomb and Morris’s arguments were remarkably far from the scientific mainstream. For example, they claimed that in the Paluxy Riverbed near Glen
Rose, Texas, dinosaur and human tracks were found in the same stratum (p. 167, pp. 172-176). Therefore dinosaurs did not become extinct some 65 million years before modern humans developed, as the standard scientific account has it, but dinosaurs and humans lived simultaneously. Based on scripture, they argued that before Adam’s fall, all creatures (including dinosaurs) were herbivores (p. 461), so they were not dangerous. Since there was no death before Adam’s fall, Whitcomb and Morris expect to find no fossilized remains of herbivorous precursors to carnivores (pp. 461-464). But just as post-Fall curses resulted in structural changes to the serpent, which lost its limbs, and women, who began to experience pain in childbirth, some animals experienced the structural changes necessary to become carnivorous. Since only the carnivorous (post-Fall) versions of these creatures died, only the carnivorous versions were fossilized (pp. 464-466).

If Whitcomb and Morris’s postulate of human and dinosaur cohabitation deviated markedly from scientific accounts, their antediluvian cosmology went even further. Recognizing that there is not enough moisture in the present atmosphere to flood the earth to an appreciable depth (p. 121), they built on the work of a few obscure predecessors (Numbers, 1992, p. 401, note 47) to argue that before the flood, a very thick “vapor blanket” surrounded the earth (Whitcomb & Morris, 1961, pp. 239-257). Whitcomb and Morris claimed that God created this thick layer of water vapor in the upper atmosphere on the second day of creation: “God made the firmament, and divided the waters which were under the firmament from the waters which were above the firmament” (KJV, Genesis 1:7). Enormous amounts of water vapor were suspended in
this layer, supported by the drier (and therefore denser) layer of air near the earth’s surface. Acting like a greenhouse, this vapor canopy maintained a uniform near-tropical temperature over the entire earth’s surface, which in turn prevented atmospheric turbulence. Without atmospheric turbulence, nucleating particles such as dust or sea salt could not be carried into the air. Therefore rainfall was unknown before the Flood and the water canopy remained aloft. The vapor canopy shielded the earth from cosmic and solar radiation, greatly reducing the formation of carbon-14 in the atmosphere (pp. 374-378) and affecting decay rates of radioactive minerals in the earth’s crust (p. 350), which explains the failure of radiometric methods to confirm the earth’s youth.\footnote{Here Whitcomb and Morris attempted to explain why carbon-14 dates sometimes exceed 10,000 years. A steady stream of cosmic radiation bombards the atmosphere, causing the radioisotope carbon-14 to form in the atmosphere at a predictable rate. This constant rate of cosmic radiation results in a nearly constant atmospheric ratio of carbon-14 to carbon-12. When plants absorb carbon dioxide from the atmosphere, they absorb carbon-14 and carbon-12 in the same ratio found in the atmosphere. Since animals, in turn, derive their food from plants, all living plants and animals exhibit the atmospheric ratio of carbon-14 to carbon-12. However, after a plant or animal dies, it no longer consumes carbon-14, so radioactive decay gradually diminishes the amount of carbon-14 in its remains. Therefore the ratio of carbon-14 to carbon-12 decreases at a known rate, enabling estimation of the year of the plant or animal’s death based on the ratio of carbon-14 to carbon-12. Whitcomb and Morris argued that a vapor canopy would have shielded the atmosphere from most cosmic rays, causing the ratio of carbon-14 to carbon-12 to be markedly lower in the past. Consequently, creatures which died while the vapor canopy was aloft would exhibit very low carbon-14 to carbon-12 ratios, thereby appearing to be much older than they really are. However, a vapor canopy would not affect the decay rates of minerals in the earth’s surface as Whitcomb and Morris claimed.} Under these ideal conditions, humanity flourished. Whitcomb and Morris estimated that in the 1,656 years between the creation and the Flood, the earth’s human population swelled from two (Adam and Eve) to approximately one billion people (p. 26).
In the generations following Adam’s fall, however, this perfect world was gradually ruined. The vapor canopy precipitated during the Flood, providing a large portion of the flood waters. Like the flood geologists before them, Whitcomb and Morris claimed that most of the geologic column, sometimes amounting to thousands of feet of sedimentary strata, was laid down during the year-long worldwide deluge and its immediate aftermath. Unlike Price, they acknowledge the fact that simple aquatic creatures tend to be found low in the geologic column and complex terrestrial creatures tend to be found high in the geologic column, but they explain the order in terms of the dynamics of worldwide inundation rather than in terms of geo/biological eras:

[O]n top of the beds of marine vertebrates would be found amphibians, then reptiles and finally birds and mammals. This is in the order: (1) of increasing mobility and therefore increasing ability to postpone inundation; (2) of decreasing density and other hydrodynamic factors tending to promote earlier and deeper sedimentation, and (3) of increasing elevation of habitat and therefore time required for the Flood to attain stages sufficient to overtake them (p. 276).

Following the Flood, a geographically altered world without a protective vapor canopy began to experience the weather, the seasons, climatic zones, and even an ice age. Without the protective vapor canopy, increased exposure to solar and cosmic radiation shortened the human life span from hundreds of years to a few decades. In answer to the obvious question of how waters sufficient to cover the globe were able to recede afterward, they propose that the antediluvian ratio of land to sea on the earth’s surface was greater than it is now and that the antediluvian continents were lower in elevation, and the seas were shallower. Following the Deluge, “tectonic movements” elevated the
continents and deepened the sea beds. Therefore the flood waters are still present on the earth’s surface, stored in the deepened oceans (pp. 121-122).

In addition to scripture-based arguments, Whitcomb and Morris repeated numerous physical arguments that the earth is young. For example, they argued that over billions of years, the earth would have accumulated much higher levels of sea salt, atmospheric helium, and meteoric dust than is presently observed. They also attempted to find flaws in numerous geological, radiological, and astronomical arguments for the earth’s antiquity. One of the most vexing questions they faced involves radioactive decay series. If the earth is only a few thousand years old but some nuclear half-lives are of the order of millions or billions of years, one would expect to find a preponderance of parent nuclei and very few daughter nuclei in the earth’s crust. Instead, entire decay series are found in approximate proportion to their half-lives. In answer to this problem, Whitcomb and Morris resorted to an argument for “appearance of age”:

It is perhaps possible that only the parent elements of the radioactive decay chain were originally created, but it is eminently more harmonious with the whole concept of a complete Creation to say that all the elements of the chain were also created simultaneously, most likely in a state of radioactive equilibrium.

This means that, with each mineral containing a radioactive element, there were also at the original Creation all of the daughter elements in the decay series, including some of the final stable end-product. Such a concept is undoubtedly shocking to the mind of a consistent uniformitarian, but there is nothing impossible or unreasonable about it. In fact, short of denying the existence of any Creator or original Creation at all, one must logically come to some place in the long chain of secondary causes where something was created. If so, that something, at the instant of creation, must have an “appearance of age.” And the only way we could then determine its “true age” would be through divine revelation (p. 345, emphasis original).
A similar problem is that some astronomical objects appear to be billions of light-years away, but according to Whitcomb and Morris’s time scale, light from these objects would have had only a few thousand years of travel time. Therefore these objects should be invisible. Again, Whitcomb and Morris invoked “appearance of age” to solve this problem:

If creation has occurred at all . . . then it is reasonable that it would have been a complete creation. It must have had an “appearance of age” at the moment of creation. The photons of light energy were created at the same instant as the stars from which they were apparently derived, so that an observer on earth would have been able to see the most distant stars within his vision at that instant of creation (p. 369, emphasis original).

Thus the Creator simultaneously made these astronomical objects and the light appearing to emanate from them billions of light years away. Only a true believer could be satisfied with such reasoning. Whitcomb and Morris employed similar ad hoc arguments in answer to the problem of fitting two of every kind of air-breathing animal onto the arc. First, they argued that only two “representatives from the doglike variety” need to have survived on the arc because modern wolves, dogs, coyotes, and jackals have arisen from these two just as “over 500 varieties of the sweet pea have developed from a single type since the year 1700” (p. 66). Whitcomb and Morris described these as varieties within existing “kinds” rather than new species. Therefore only two of every “kind” (roughly equivalent to the family in the Linnaean taxonomic system) need to have been preserved on the ark. Regarding the immense logistical problems of feeding, watering, and waste removal on the arc over the course of a year, Whitcomb and Morris resorted to hibernation (pp. 70-75).
Whitcomb and Morris’s *Rhetoric of Decline*

Like their anti-evolutionary predecessors, Whitcomb and Morris echoed fundamentalist concerns in linking widespread acceptance of the theory of evolution to perceived social ills including communism, humanism, and the rise of the United Nations (pp. 443-445). Remarkably, they also linked the moral decline of humanity, initiated by Adam’s sin in the Garden of Eden, to the physical decline of the universe. Specifically, they suggest that the Second Law of Thermodynamics\(^3\) entered the world with the Fall:

Creation . . . actually has been accomplished by means of creative processes, which are now replaced by the deteriorative processes implicit in the second law. The latter are probably a part of the “curse” placed upon the earth as a result of the entrance of sin (Genesis 3:17), the “bondage to decay” to which it has been “subjected” by God for the present age (Romans 8:20-22) (pp. 224-225).

It was at the time of the Edenic curse of Gen. 3:17-19 that “the creation was

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3 The Second Law of Thermodynamics is a statement of probability. If a hot object and a cold object are in thermal contact it is very likely that the hot object will elevate the temperature of the cold object, but it is very unlikely (although statistically possible) that the cold object will elevate the temperature of the hot object. This is attributed to the Second Law. One expression of the Second Law is that an isolated system will tend to experience an increase in entropy over time. If entropy is described as the “unavailability” of energy, then if we isolate our hot and cold object from the rest of the universe, the hot/cold system’s energy is initially available, e. g. we could power a machine through the transfer of energy from the hot object to the cold object, so the initial entropy is low. However, after the two objects have reached an intermediate temperature (I will refer to it as a warm/warm system), the total energy of the system has not changed, but the energy has become much less available (we could no longer power a machine because the energy flow between the two warm objects is equal in both directions). Therefore while the hot object was elevating the temperature of the cold object, the system energy remained constant but the system entropy increased. Finally, if entropy is described as “disorder,” we could say that the hot/cold system is highly ordered (most of the more energetic particles are in the hot object and most of the less energetic particles are in the cold object), but after they reach an intermediate temperature the warm/warm system is disordered (there is no longer a spatial separation between high- and low-energy particles, so we can think of them as all mixed together.) Hence the entropy of this isolated system has increased because it has become more disordered.
subjected to vanity” by God. This “vanity” . . . is further described as “the bondage of corruption,” which is the explanation for the fact that “the whole creation groaneth and travaileth in pain together until now.” [Romans 8:19-22] teaches very clearly that some tremendous transformations took place in the realm of nature at the time of the Edenic curse . . . (p. 459).

Thus for Whitcomb and Morris, decline was caused by human sinfulness and then built into the very structure of the universe as part of God’s curse. The Second Law of Thermodynamics became a moral principle as much as a physical principle, and to deny the Second Law would be tantamount to contravening God’s judgment over human sinfulness. Specifically, Whitcomb and Morris argued that progressive evolution represents an increase in complexity and therefore a decrease in entropy over time. Consequently, evolutionary progress violates the Second Law of Thermodynamics (pp. 224-228).

Whitcomb and Morris’s suggestion that there was no Second Law before the Fall raises scientific questions. For example, since many biochemical processes depend on the Second Law, how could life have existed before the Fall? Perhaps more fatal to their argument is the fact that the Second Law applies only to closed systems. Since the earth’s surface receives a constant influx of energy from the sun, the earth’s surface is not a closed system. When Whitcomb and Morris argue that evolution violates the Second Law of Thermodynamics, they acknowledge but then subsequently ignore this problem (Whitcomb & Morris, 1961, p. 226). When Robert E. D. Clark advanced a similar argument in the 1930s, he was aware of and tried to answer this difficulty (Numbers, 1992, pp. 153-157). In contrast, Whitcomb and Morris simply discount the significance of the influx of energy onto the earth’s surface. The result is wholly unconvincing to
scientific ears (see, e.g. Pigliucci, 2002, pp. 190-201), yet ever since Whitcomb and
Morris raised the argument in *The Genesis Flood*, evolution’s alleged Second-Law
violation has been a staple of creationist argument, at least partly out of a sense that the
entire culture is sinful and degenerating.

*Evolution and the Rhetoric of Progress and Decline*

Creationists and evolutionary biologists alike tend to situate the origin of the
creation/evolution debate in either the 1858 announcement of Alfred R. Wallace and
Charles Darwin’s theory of evolution by natural selection or more commonly in the 1859
publication of Darwin’s *Origin of Species* (1872/1936). Yet the theory of evolution
predates Darwin by at least one hundred years. In his introduction to the sixth edition of
*The Origin of Species*, Darwin acknowledges numerous predecessors beginning with
Jean-Baptiste Lamarck’s publications in the early 1800s (Darwin, 1872/1936, pp. 3-10).
Yet the idea of a progression of species can be traced at least as far back as Denis Diderot
(1713-1784) (Ruse, 2005b, pp. 28-30). Starting with Diderot, we can identify at least two
varieties of thought questioning the fixity of species. Progressivists such as Diderot,
Lamarck (1744-1829), Erasmus Darwin (Charles Darwin’s grandfather, 1731-1802), and
Darwin’s contemporaries Herbert Spencer (1820-1903) and Thomas Henry Huxley
(1825-1895) supported a progressive evolution from lower species to higher species (J. C.
Greene, 1959). As Michael Ruse notes, their belief in biological progress closely
paralleled their belief in human progress: “Early evolutionism was truly an
epiphenomenon of culture—a construction built on the back of the ideology of social and
other kinds of progress” (Ruse, 2005a, p. 12). With respect to humans, these beliefs
supported the dominant Western racial beliefs of the time, placing various human races in different positions along a progressive evolutionary scale (J. C. Greene, 1959; Haller, 1971; Ruse, 2005a).

Yet the ideology of progress was not universally shared in the West in the 18th and 19th centuries. A far older tradition assumed that both humans and non-humans tend to decline rather than progress. This may take the form of belief in a lost Golden Age, as can be seen as far back as Hesiod among the Greeks, Ovid among the Romans, and of course Genesis among the Hebrews (Geoghegan, 1991). This ideology of decline was particularly strong during the period in which the theory of evolution arose. According to Peter Burke (1976), Europeans generally equated change with degeneration between the early 15th century and late 18th century:

The very word “new” seems often (though not always) to have carried pejorative overtones . . . On the other hand, terms meaning “old” often carried favorable overtones . . . That pessimism came more naturally in this period than optimism is also suggested by the rich variety of words, images, and formulae then current to describe change for the worse (Burke, 1976, pp. 137-138).

Thus as the theory of evolution developed, its rhetoric of progress had to compete with the entrenched cultural assumption that the present represents a decline from past glory. Such assumptions are still familiar in the Western world. Modern Westerners will recognize a similar rhetoric of decline with respect to the environment (Murphy, 2003), religion, politics, and morality (Bork, 2003; Murphy, 2001), and of course the public schools (see, e. g. Bestor, 1953; McEwan, 1998; Rickover, 1963; Smith, 1954).

Given the long-established ideology of decline, it is not surprising that natural philosophers such as Thomas Burnet (1635?-1715), Comte de Buffon (1707-1788), and
Johann Friedrich Blumenbach (1752-1840) recognized change in the fossil record, but interpreted these changes as degeneration from an earlier state of vitality rather than advancement of species (J. C. Greene, 1959). Buffon and Blumenbach assumed that like plants and animals, humans had declined from an earlier state of perfection as well. Like the progressive evolutionists before them, these “declinists” adopted the Western racial assumptions of the time, assuming that Europeans had degenerated, but that non-Europeans had degenerated further (J. C. Greene, 1959, pp. 221-230). Therefore despite recent attempts to blame Western racism on either evolution or creationism, racist beliefs have always been flexible enough to accommodate both (see, e. g. Good, 2003; Moore, 2001; Moore, 2002; Shipman, 1994; Walker, 2002). In popular culture, evolutionary declinism reached the point of despair in H. G. Wells’ *The Time Machine* (1895/1966), in which humanity evolves into two species, one of which feeds on the other (see Ruse, 2005b, pp. 118-120).

Still other natural philosophers, such as Carolus Linnaeus (1707-1778) and Georges Cuvier (1769-1832) rejected progress as well as decline. Linnaeus rejected the concept of evolution altogether, believing in an essentially steady-state natural world

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4 For example, creationist Paul Taylor writes, “slavery has been retrospectively justified on the basis of the supposed lower order in the evolutionary process of certain ‘races’” (P. Taylor, 2007), and in 2001 the Louisiana House Education Committee passed a Resolution on Teaching Evolution which “reject[s] the core concepts of Darwinist ideology that certain races and classes of humans are inherently superior to others” (Good, 2003). Creationists such as Humber (1987; 2006) and Ham & Ware (2007) similarly implicate the theory evolution in racist ideologies. On the other side, evolutionist Randy Moore documents the extensive cross-membership and alliances among fundamentalist preachers, anti-evolutionists, and the Ku Klux Klan (Moore, 2001, 2002).
characterized by neither progress nor decline (J. C. Greene, 1959). Based on the geologic record, Cuvier believed that catastrophes periodically wiped out most of the life in a given area on the earth, followed by repopulation by species from other parts of the earth. Instead of a process by which new species arise from old, there was a periodic redistribution of existing species (J. C. Greene, 1959; Ruse, 2005b). Even Wallace and Darwin’s theory of evolution by natural selection represented, at least formally, a rejection of the language of progress and decline. Darwin objected to Lamarck’s assumption that progress is inevitable (J. C. Greene, 1959, p. 285), and he recognized that progress and survivability are distinct concepts (J. C. Greene, 1959, pp. 299-301). Darwin acknowledged the appearance of progress in the fossil record, but he also knew that an entirely mechanical process of natural selection leads to neither progress nor decline, but rather survival or non-survival.

When Whitcomb and Morris wrote of social & moral decline together with physical decline typified in the Second Law of Thermodynamics, they took the “decline” side in this broad cultural struggle between ideologies of progress and decline, a struggle which has informed the question of evolution from the beginning. Yet a struggle between ideologies of progress and decline has also played out within Christianity in the form of a struggle between postmillennialism and premillennialism (Ruse, 2005b). In the bible, Revelation 20:1-6 describes a 1,000-year reign of Jesus and the Church over the earth. “Postmillenialists” assume that this reign has already begun and that the world is progressing under Jesus’ guidance, ultimately leading to his return at the end of the millenium. Postmillenial views tend to be associated with liberal Christianity.
“Premillenialists,” by contrast, believe that the reign of Jesus and the Church has not yet begun, and they expect a period of decline and then a period of “tribulation” (worldwide suffering) to precede the 1,000-year reign. Premillennial views tend to be associated with fundamentalism and, to a lesser extent, with evangelicalism. Whitcomb and Morris took the premillenial side of this dispute. The Second Law of Thermodynamics, which Whitcomb and Morris saw as a law of decline and degradation, was theologically important as an argument against postmillennialism as well as scientifically important as an argument against evolution. If the Second Law does not apply on the earth’s surface, both arguments are weakened. Therefore despite the fact that the earth is an open system, constantly receiving energy from the sun, Whitcomb, Morris, and their followers cling to the Second Law argument because so much is at stake.

*Creation Science Today*

Henry Morris went on to co-found the Creation Research Society in 1963, a coalition of creationists with scientific credentials who publish the *Creation Research Society Quarterly*, and he also co-founded the Institute for Creation Research in 1972. The puzzle is that by 1980, Whitcomb and Morris’s extreme version of creationism with its unequivocal denial of evolution, its insistence that the earth is on the order of ten thousand years old, and its attribution of most geological features to a worldwide flood, had claimed the titles of “creation science” and “scientific creationism.” After all, Christians of many denominations, including many biblical literalists, had developed interpretations of Genesis which accommodated astronomical and geological time scales. Yet over the two decades following the publication of *The Genesis Flood*, such “gap” and
“day-age” theories became the minority creationist view. This is partly attributable to the efforts of the Creation Research Society and the Institute for Creation Research, but Ronald Numbers offers an additional explanation:

By starting with the text of Genesis and then fitting the scientific data into that framework, they appealed to Christians “fed up with articles and books which tried to make scripture conform to the latest theory” . . . (Carson, 1980, p. 10). For believers in the verbal inerrancy of the Bible, flood geology required no assumptions of days that really meant ages or of temporal gaps that went unmentioned. By showing how the deluge of Noah compressed earth history into no more than ten thousand years, Whitcomb and Morris at one stroke eliminated the need for such “biblical gymnastics” and deprived evolutionists of the time required for the natural origin of species (Numbers, 1992, p. 338).

Conducting science based on Genesis involves difficult choices and a constant strain against the contemporary intellectual currents of astronomy, geology, and biology. On the other hand, interpreting Genesis in the light of science requires a re-thinking of the nature of scripture. Both choices are difficult for the biblical literalist, but the latter offers certainty about neither science nor scripture, while the former offers a sense of permanence and certainty with respect to scripture while awaiting resolution of the uncertainties of science.

Today the Creation Research Society boasts about 1700 members, of which 700 are voting members, i. e. they hold graduate degrees in scientific fields (Creation Research Society, 2007). The Institute for Creation Research (2007) maintains a museum, a research facility, and a graduate program offering masters degrees in biology, geology, astrophysics/geophysics, and science education. In 1994, three members of the Institute for Creation Research founded Answers in Genesis, a young-earth creationist organization whose slogan is “upholding the authority of the Bible from the very first
verse” (Answers in Genesis, 2007a). Its president and co-founder, Kenneth A. Ham, is a popular and effective speaker. Answers in Genesis is sited in northern Kentucky explicitly because it is within 650 miles of 2/3 of the U. S. population. It employs over 250 staff, a substantial proportion of which is devoted to activities connected to its $28 million, 50,000 square foot Creation Museum which opened in May 2007, designed as a counterbalance to secular museums of natural history throughout the United States. The Answers in Genesis speakers’ bureau offered over 400 seminars in 2006, and its daily 90-second radio program, Answers with Ken Ham, is carried on about 800 U. S. stations and 200 stations outside the U. S. Answers in Genesis produces numerous books and dvds and in 2006 it launched Answers, a popular-level quarterly magazine which offers both bible- and science-oriented articles and whose distribution is nearly 50,000. Historically, Answers in Genesis was affiliated with Answers in Genesis-UK in the United Kingdom and Creation Ministries International in Australia (which publishes Creation Ex Nihilo magazine), although all three organizations are entirely independent at present.

In addition to the Creation Research Society, the Institute for Creation Research, and Answers in Genesis, the Creation Research Society web site lists over 130 local young-earth creationist organizations in the U. S., scattered among 41 states (Creation Research Society, 2006). These local organizations range from interest groups/speaker bureaus, some bearing colorful names such as Maryland’s “Evolution is Dead Ministries” or Michigan’s “Revolution Against Evolution,” to modest local museums. Outside the U. S., the Creation Research Society lists over 60 local creationist organizations in 28 countries.
Intelligent Design

The American Scientific Affiliation (ASA) continues to represent the mainstream scientific (old-earth evolutionary) viewpoint among evangelical Christians. Its membership increased from about 220 in 1951 (Everest, 1951) to nearly 3,500 in 1978 (American Scientific Affiliation, 1978) but is now down to about 2100 (R. Isaac, personal communication, February 9, 2007). The ASA has now been joined, or perhaps counterbalanced, by the Intelligent Design movement, whose adherents generally accept the antiquity of the earth and uniformitarian geological theories, but reject the theory of evolution by natural selection. The beginning of the modern Intelligent Design (ID) movement is generally attributed to the 1994 publication of Michael Behe’s *Darwin’s Black Box* (Behe, 1996). Behe argues that some biological structures are “irreducibly complex,” i.e. that since the removal of any one part of the biological structure would render it inoperative, it could not have evolved but must have been created as a whole.

Neither Behe nor his Intelligent Design successors (e.g. see Dembski, 2006; Dembski & Ruse, 2004; Pennock, 2001; J. Wells, 2000) explicitly rely on the bible as a source text, and the Designer/Creator is not identified as God, an extraterrestrial life form, or anything else. The Discovery Institute’s Center for Science and Culture has grown to support the ID Movement via 40 academic fellowships and support for high-quality video production. The Discovery Institute claims to be a secular organization:

Discovery Institute is a secular think tank, and its Board members and Fellows represent a variety of religious traditions, including mainline Protestant, Roman Catholic, Eastern Orthodox, Jewish, and agnostic. Until recently the Chairman of Discovery’s Board of Directors was former Congressman John Miller, who is Jewish (Discovery Institute Center for Science & Culture, 2007).
However, the vast majority of the Discovery Institute Fellows are conservative Christians and most of its financial supporters are religiously motivated (Wilgoren, 2005). A notable exception is the Gates foundation, which in 2003 pledged $9.35 million to the Discovery Institute over ten years. However, all of the Gates funding is earmarked for the Cascadia project, a study of regional transportation, rather than the study and promotion of Intelligent Design conducted by the Center for Science and Culture (Wilgoren, 2005). Therefore the Discovery Institute’s claims to secularity should not be taken at face value.

Creationism and the Struggle to Define Science

In order to defeat the theory of evolution, creationists need intellectual validity, and the best validation of all would be recognition as science. According to Christopher Toumey, respect for science has grown to the point that it is granted “plenary authority” among the nonscientific public, even when the science is not understood. Toumey refers to such “respect without comprehension” as “science in an old testament style” (Toumey, 1996). Creationists claim this plenary authority when they use the term “creation science” and when they attempt to obtain legal recognition of creationism as a scientific pursuit. Scientists, science educators, and others respond by attempting to deny creationism the status of science and the authority that comes with that status. The result has been an extensive boundary dispute enacted in the courts and in creationist and anti-creationist literature. A comprehensive apprehension of this boundary dispute is prerequisite to understanding creationism.
The Legal Landscape

Early Cases: Creationism and the Establishment Clause

Court cases involving creationism and the public schools have centered on the Establishment Clause of the First Amendment to the U. S. Constitution: “Congress shall make no law respecting an establishment of religion, or prohibiting the free exercise thereof.” If it could be shown that creationism and/or anti-evolutionism rests in specific religious doctrines, then its introduction into public schools (a government institution) would violate the Establishment Clause. Tennessee’s Butler Act of 1925 is a fairly clear example of such an Establishment Clause violation:

[I]t shall be unlawful for any teacher in any of the Universities, Normals and all other public schools of the State which are supported in whole or in part by the public school funds of the State, to teach any theory that denies the story of the Divine Creation of man as taught in the Bible, and to teach instead that man has descended from a lower order of animals (Butler Act, 1925).

Soon after the Butler Act became law, the American Civil Liberties Union advertised for a test case. Prompted by local businessmen in Dayton, Tennessee, substitute teacher John Thomas Scopes intentionally violated the law in a science class and was convicted of having violated the Butler Act. However, the Tennessee Supreme Court reversed the ruling because of a procedural error on the part of the judge in the Scopes trial. When the attorney general refused to retry Scopes, the American Civil Liberties Union was left without a defendant or a route to federal court. As a result, the Butler Act remained unchallenged and in force until the Tennessee Legislature repealed it in 1967 (Moore, 1998a, 1998b).
The first Establishment Clause challenge to anti-evolutionary legislation would wait until *Epperson v. Arkansas* in 1968. In 1928, the citizens of Arkansas had passed the Rotenberry Act (Initiated Act No. 1 of 1928) by a statewide ballot initiative. The act reads in part:

> It shall be unlawful for any teacher or other instructor in any University, College, Normal, Public School, or other institution of the State, which is supported in whole or part from public funds derived by State and local taxation to teach the theory or doctrine that mankind ascended or descended from a lower order of animals . . . (Moore, 1998c)

Just as the American Civil Liberties Union had done in 1925, the Arkansas Education Association recruited a volunteer to challenge the Rotenberry Act. Arkansas biology teacher Susan Epperson volunteered and petitioned the courts to invalidate the Rotenberry Act. After hearing arguments on April 1, 1966, a lower court ruled in Epperson’s favor, stating that since the Rotenberry Act was arbitrary and vague, it violated the Fourteenth Amendment to the U. S. Constitution (requiring due process). The Arkansas Supreme Court reversed the decision, clearing the way for a challenge in the U. S. Supreme Court. The U. S. Supreme Court, in turn, reversed the Arkansas Supreme Court decision. The Court concurred with the lower court that the Rotenberry Act violated the Fourteenth Amendment, but the Supreme Court focused on the Establishment Clause:

> Arkansas has sought to prevent its teachers from discussing the theory of evolution because it is contrary to the belief of some that the Book of Genesis must be the exclusive source of doctrine as to the origin of man. No suggestion has been made that Arkansas' law may be justified by considerations of state policy other than the religious views of some of its citizens. It is clear . . . that fundamentalist sectarian conviction was and is the law's reason for existence . . . The law's effort was confined to an attempt to blot out a particular theory because
of its supposed conflict with the Biblical account, literally read. Plainly, the law is contrary to the mandate of the First, and in violation of the Fourteenth, Amendments to the Constitution (Epperson v. Arkansas, 1968).

Here the Supreme Court ruled that even a comparatively modest anti-evolutionary law (the Rotenberry Act prohibited the teaching of human evolution from other animals, but not evolution in general) violated the Establishment Clause because it was motivated by and favored a particular sectarian religious view.

Following Epperson, numerous anti-evolutionary laws were abandoned or struck down on Establishment Clause grounds (Moore, 1999a). Also, creationists mounted legal challenges to the teaching of evolution in public schools, claiming that since the theory of evolution advances a “religion of secular humanism,” presenting it in public schools violates the Establishment Clause. These efforts also failed. Consequently, in legislative and legal efforts, creationists increasingly expressed creationism in the language of science rather than religion.

Recent Cases: Anti-Evolution Becomes Creation Science

In 1981, the state of Arkansas enacted Act 590: The Balanced Treatment for Creation-Science and Evolution-Science Act. As its title implies, Act 590 mandated that all instruction in evolutionary theory in the Arkansas public schools be counterbalanced by equivalent instruction in “creation-science.” In Epperson, the court had ruled that outlawing the teaching of evolution amounted to governmental establishment of a religious viewpoint. But in Act 590, the State of Arkansas did not forbid evolutionary instruction, but rather mandated an additional “scientific” point of view, “creation-
science.” Yet the religious content of Act 590’s “scientific” point of view was fairly transparent. Consider the definition of creation science in Section 4, part (a) of Act 590:

“Creation-science” means the scientific evidences for creation and inferences from those scientific evidences. Creation-science includes the scientific evidences and related inferences that indicate: (1) Sudden creation of the universe, energy, and life from nothing; (2) The insufficiency of mutation and natural selection in bringing about development of all living kinds from a single organism; (3) Changes only within fixed limits of originally created kinds of plants and animals; (4) Separate ancestry for man and apes; (5) Explanation of the earth’s geology by catastrophism, including the occurrence of a worldwide flood; and (6) A relatively recent inception of the earth and living kinds (*McLean v. Arkansas Board of Education*, 1982, p. 1264).

Although the parallels between this definition and the first 11 chapters of Genesis are obvious, the Arkansas legislature hoped that by explicitly couching creationism in scientific rather than religious terms, Act 590 would survive an Establishment Clause challenge. This did not prove to be true. Less than three months after the passage of Act 590, a coalition of 23 Arkansas citizens and organizations challenged the law on First Amendment (Establishment Clause) grounds as well as Fourteenth Amendment grounds, arguing that Act 590 was unconstitutionally vague and thereby denied citizens due process (Moore, 1999b). In the resulting case, *McLean v. Arkansas Board of Education* (1982), Judge William Overton ruled that Act 590 failed the Lemon Test (*Lemon v. Kurtzman*, 1971) for Establishment Clause compliance: The statute must have a secular legislative purpose, the statute’s principal effect must be neither advancement nor inhibition of religion, and the statute must not foster “an excessive government entanglement with religion.” Although failure of any one of these indicates an Establishment Clause violation, Judge Overton ruled that Act 590 failed all three parts of
the Lemon test. Act 590’s failure of the second part of the Lemon Test, that the statute’s principal effect must be neither advancement nor inhibition of religion, hinged on Overton’s conclusion that “creation science” is not science at all.\(^5\) Overton initially invoked a very general definition of science: “science is what is ‘accepted by the scientific community’ and is ‘what scientists do’” (\textit{McLean v. Arkansas}, 1982, p. 1267). Noting that “there is not one recognized scientific journal which has published an article espousing the creation science theory described in section 4(a)” (\textit{McLean v. Arkansas}, 1982, p. 1268), Overton ruled that creation science is neither accepted by the scientific community nor what scientists do. Yet Overton also relied on a more precise definition of science offered in the testimony of philosopher Michael Ruse:

\begin{quote}
The essential characteristics of science are:
(1) It is guided by natural law;
(2) It has to be explanatory by reference to natural law;
(3) It is testable against the empirical world;
(4) Its conclusions are tentative, i.e., are not necessarily the final word; and
\end{quote}

Overton ruled that creation science fails to adhere to the first and second of these characteristics of science when, for example, creationists rely on supernatural

\footnote{\(^5\) In his decision, Overton wrote:}

\begin{quote}
The conclusion that creation science has no scientific merit or educational value as science has legal significance in light of the Court’s previous conclusion that creation science has, as one major effect, the advancement of religion. The second part of the three-pronged test for establishment reaches only those statutes having as their \textit{primary} effect the advancement of religion. Secondary effects which advance religion are not constitutionally fatal. Since creation science is not science, the conclusion is inescapable that the \textit{only} real effect of Act 590 is the advancement of religion. The Act therefore fails both the first and second portions of the test in \textit{Lemon v. Kurtzman} (\textit{McLean v. Arkansas}, 1982, p. 1272).\end{quote}
intervention to produce a worldwide flood. He also ruled that creation science fails to adhere to characteristics 3-5, noting, for example, that the definitions of creation science in section 4(a) are not subject to revision:

A scientific theory must be tentative and always subject to revision or abandonment in light of facts that are inconsistent with, or falsify, the theory. A theory that is by its own terms dogmatic, absolutist and never subject to revision is not a scientific theory. The creationists’ methods do not take data, weigh it against the opposing scientific data, and thereafter reach the conclusions stated in Section 4(a). Instead, they take the literal wording of the Book of Genesis and attempt to find scientific support for it . . . While anybody is free to approach a scientific inquiry in any fashion they choose, they cannot properly describe the methodology used as scientific, if they start with a conclusion and refuse to change it regardless of the evidence developed during the course of the investigation (McLean v. Arkansas, 1982, pp. 1268-1269).

Since creation science rests on an unalterable foundation (the book of Genesis), it is not testable, falsifiable, or tentative. Therefore, the court concluded, “creation science” does not meet the criteria of science.

Shortly after the Arkansas legislature passed Act 590, Louisiana considered a nearly identical Balanced Treatment for Evolution-Science and Creation-Science bill (Balanced Treatment Act, 1981; Moore, 1999c). However, the day after McLean et. al. filed suit against the Arkansas Board of Education, the sponsors of the Louisiana bill deleted the definition of creation science which proved to be constitutionally fatal to Act 590. This modified version of the Balanced Treatment Act became Louisiana law in 1981. Following a lower-court decision and an appeal, the Balanced Treatment Act reached the U. S. Supreme Court in 1986 as Edwards v. Aguillard, where the Court held that despite the law’s careful deletion of religious references and its very general definition of creation science as "the scientific evidences for creation and inferences from
those scientific evidences,” it failed the first part of the Lemon Test (the Act does not have a clear secular purpose), and therefore it violated the Establishment Clause (Edwards v. Aguillard, 1987). Like McLean, the Court ruled in Edwards v. Aguillard that creation science is religiously motivated, yet unlike McLean, the Court did not explicitly rule on the question of whether creation science is science.6

Finally, in Kitzmiller et. al. v. Dover Area School District (Kitzmiller v. Dover, 2005), Judge John E. Jones III presided over a case involving Intelligent Design (ID), a form of creationism which avoids religious references. Jones ruled that the Dover, PA Board of Education violated the Establishment Clause when it required that a disclaimer be read in high school biology classes which referenced alleged flaws in evolutionary theory and offered Intelligent Design as an alternative.7 Jones ruled that this disclaimer

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6 However, a coalition of 72 Nobel Laureates, 17 State Academies of Science, and 7 other scientific organizations filed an Amicus Curiae Brief for Edwards v. Aguillard (1986) which declared that creation science is not science because: (a) science is restricted to natural explanations for phenomena, while creation science invokes supernatural explanations; and (b) a scientific explanatory principle “must be consistent with prior and present observations and must remain subject to continued testing against future observations,” while creation science invokes non-testable explanatory principles.

7 The full text of the disclaimer is:

The Pennsylvania Academic Standards require students to learn about Darwin's Theory of Evolution and eventually to take a standardized test of which evolution is a part.

Because Darwin's Theory is a theory, it continues to be tested as new evidence is discovered. The Theory is not a fact. Gaps in the Theory exist for which there is no evidence. A theory is defined as a well-tested explanation that unifies a broad range of observations.

Intelligent Design is an explanation of the origin of life that differs from Darwin's view. The reference book, Of Pandas and People, is available for students who
failed the *Lemon* test for permissibility under the Establishment Clause as well as an “endorsement test” for the Establishment Clause (that a knowledgeable, objective observer would not perceive a statute as a state endorsement of religion). Specifically, Jones found that the Dover School District failed the endorsement test because:

1. “An objective observer would know that ID and teaching about ‘gaps’ and ‘problems’ in evolutionary theory are creationist, religious strategies that evolved from earlier forms of creationism” (pp. 716-723);

2. Both an objective student and an objective Dover citizen would view the disclaimer as an official endorsement of religion (pp. 723-735); and

3. Intelligent Design is not science (pp. 735-746).

Jones listed at least three reasons that ID is not science. First, Jones noted that the invocation of supernatural causes “violates the centuries-old ground-rules of science” (p. 735), thereby rendering many of its assertions untestable and causing ID to be rejected by every major scientific organization. Second, Jones noted that in 1981, Judge Overton criticized creationism in *McLean* for employing an illogical “contrived dualism,” whereby every argument *against* evolution is taken as an argument *in favor of* creationism. Jones noted that ID employs the same logical fallacy when it mounts arguments against evolution. Yet unlike the arguments for the existence of a designer, the arguments against evolution are testable and have accordingly been refuted by the
scientific community. Jones emphasized that these are tests of evolutionary theory rather than tests of the existence of a Designer, and thus there is no logical contradiction between the untestability of ID and the failure of its anti-evolutionary arguments: “[E]ven if irreducible complexity had not been rejected, it still does not support ID as it is merely a test for evolution, not design” (p. 741). Third, Jones noted that since ID has no peer-reviewed publications in the scientific literature and does not research or test its theories, it is not science.

Testability/Falsifiability

Testability/Falsifiability as a Unitary Demarcation Criterion

We have seen that creationist’s efforts to remove evolution from and/or introduce creationism into the public school curriculum have been defeated in numerous court cases. (For other examples, see Alters & Alters, 2001, pp. 203-206.) We have also seen that an important component to many of these defeats has been the failure of creation science (including intelligent design) to find acceptance as science in court. Consequently, it is not surprising that pro-evolutionary scientists and science educators emphasize a distinction between science and creationism/intelligent design theory. The National Academy of Science (NAS) is the pre-eminent scientific organization in the United States, members of which are elected “in recognition of their distinguished and continued achievements in original research” (National Academy of Sciences, 2006), and over 200 of whose nearly 2500 members and associates are Nobel Laureates. In Science, Evolution, and Creationism (National Academy of Sciences & Institute of Medicine,
2008), the National Academy emphasizes a distinction between science and creationism, relying on testability as one of its demarcation criteria:

The arguments of creationists reverse the scientific process. They begin with an explanation that they are unwilling to alter—that supernatural forces have shaped biological or Earth systems—rejecting the basic requirements of science that hypothesis must be restricted to testable natural explanations. Their beliefs cannot be tested, modified, or rejected by scientific means and thus cannot be a part of the process of science (p. 43).

Creationist claims are not subject to empirical tests, so they cannot be modified in response to empirical observation. Since they are neither testable nor tentative, data-driven modification and improvement of creationist theories are out of the question. Thus along with a stricture against invoking supernatural causes to explain natural phenomena, the NAS uses the non-testability of creationist claims as an important disqualifier to the designation of “science.” By contrast, the authors emphasize the testability of scientific theories:

In science, explanations must be based on naturally occurring phenomena. Natural causes are, in principle, reproducible and therefore can be checked independently by others. If explanations are based on purported forces that are outside of nature, scientists have no way of either confirming or disproving those explanations. Any scientific explanation has to be testable—there must be possible observational consequences that could support the idea but also ones that could refute it. Unless a proposed explanation is framed in a way that some observational evidence could potentially count against it, that explanation cannot be subjected to scientific testing.

Definition of Science: The use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process (p. 10, emphasis original).

In short, science is empirically testable/falsifiable, and since creationism relies on supernatural explanation, it is not empirically testable and is therefore not science.
The Failure of Testability/Falsifiability as a Unitary Demarcation Criterion

The first serious problem with relying on testability, falsifiability, or tentativeness to disqualify creationism as science is that creationists test, falsify, and correct themselves. For example, as mentioned above Whitcomb and Morris reported that overlapping human and dinosaur footprints had been found in the Paluxy River bed near Glen Rose, Texas (Whitcomb & Morris, 1961, pp. 167, 172-176). Later John Morris, Henry Morris’s son, studied and enthusiastically promoted these findings (J. D. Morris, 1976, 1980). However, when contrary evidence surfaced Morris reversed his position (Holroyd, 1987; Jones, 1986; J. D. Morris, 1986a, 1986b; Thulborn, 1986) and the Institute for Creation Research Museum removed a display promoting this evidence (Jukes, 1986; Rosnau, Auldaney, Howe, & Waisgerber, 1989a). Or consider creationist Robert Gentry’s careful studies of radiohalos in granite (scars in the granite attributed to emission of alpha particles by radioactive particles). Gentry argues that some of these radiohalos indicate that granite is a “Genesis rock,” i.e. that granite could not have gradually cooled from a molten state as standard geologic theory holds, but must have been created suddenly in a solid state, thereby supporting the six-day creation story (Gentry, 2003). Although Gentry was a rising star among creationists in the 1960s and 1970s, conducting research at the Oak Ridge National Laboratory and publishing radiohalo studies in *Science* (Gentry, 1968, 1970, 1974a, 1976) and *Nature* (Gentry, 1973, 1974b), the *Creation Research Society Quarterly* published a detailed criticism of Gentry’s work and conclusions by young-earth creationist Kurt Wise (1989) together with Gentry’s response (Gentry, 1989). Since then, the Institute for Creation Research
has rejected Gentry’s conclusions (see, e.g. Snelling, 2005). Other proposals are subject to vigorous debate among young-earth creationists. For example, D. Russel Humphreys (1994; 1997) has proposed a relativistic solution to the problem of astronomical appearance of age (the detection of light from astronomical objects 15 billion light-years away in a 6,000-year-old universe) which has been vigorously debated among young-earth creationists (e.g. Byl, 1997; Humphreys, 1997), and the young-earth publication *Creation Ex Nihio Technical Journal* has published extensive criticism of Humphreys’ views from outsiders, along with Humphrey’s responses (Conner & Page, 1998; Fackerell & McIntosh, 2000; Humphreys, 1998, 2000). The young-earth International Conference on Creationism has rejected Humphreys’ proposal, while Answers in Genesis, the Institute for Creation Research, and the Creation Research Society promote his work (Conner & Ross, 1999). Creationists debate where geologic evidence indicates that the Flood occurred in the geologic column—above the Pleistocene layers, the Cretaceous layers, or the Carboniferous layers (Tyler, 1997), or whether the geologic column is even a valid concept in flood geology (Reed & Froede, 2003). All of this points to an internal process by which creationists debate, test, and modify their conclusions based on physical evidence as well as theoretical considerations. Therefore neither the courts nor the NAS can accurately disqualify creationism as science based on a testability/falsifiability criterion.

A strategic error and a logical contradiction present further weaknesses in using testability or falsifiability as a science/non-science demarcation tool. Writing about the *McLean* decision, philosophers Larry Laudan (Laudan, 1982/1996) and Philip Quinn
Quinn, 1984/1996) point out that if creationist claims are not falsifiable by the methods of science, then science can say nothing about whether or not creationism is true. As Laudan aptly puts it:

In brief, [creationist] claims are testable, they have been tested, and they have failed those tests. Unfortunately, the logic of the [McLean] Opinion’s analysis precludes saying any of the above . . . Asserting that Creationism makes no empirical claims plays directly, if inadvertently, into the hands of the creationists by immunizing their ideology from empirical confrontation. The correct way to combat Creationism is to confute the empirical claims it does make, not to pretend that it makes no such claims at all (Laudan, 1982/1996, p. 352).

Laudan’s point is that claiming the untestability of creationism is poor strategy on the part of scientists and their allies because it disables one of science’s most effective tools, namely the ability to devise experiments and make empirical observations. Quinn echoes Laudan when he argues that scientists commit a logical as well as a strategic error when they claim that creationism is not testable. Quinn points out that biologist Stephen Jay Gould (1983) asserts that creationist claims are not falsifiable but also asserts that they are easily refuted (Quinn, 1984/1996, p. 377). Logically, creationist claims can be irrefutable or refuted, but not both. Unfortunately the National Academy of Sciences commits the same logical error in Science, Evolution, and Creationism. Within the same document, the NAS claims that creationism is untestable (see above) and identifies instances in which creationism fails empirical tests. For example, the NAS describes observational evidence falsifying a worldwide deluge and argues that even if the Flood occurred, the geological record would be inconsistent with a Flood (National Academy of Sciences & Institute of Medicine, 2008, p. 38). The National Academy writes

“Intelligent design is not a scientific concept because it cannot be empirically tested”
two pages after “[T]he claims of intelligent design creationists are disproven by
the findings of modern biology” (p. 40). The National Academy argues, correctly in my
view, that creationist claims are inconsistent with the physical evidence. Since creationist
claims have been tested and found wanting, the NAS falls into a logical error when it
simultaneously asserts that creationist claims cannot be tested.

The Failure of An Improved Testability/Falsifiability Boundary Criterion

Occasionally a more sophisticated version of “testability” appears which avoids
the problems noted above. For example, Stephen Jay Gould, whom Quinn takes to task
for simultaneously claiming that creationism fails tests and yet is untestable, eventually
distinguished untestable central tenets from testable peripheral claims:

The flood story is central to all creationist systems. It also has elicited the only
specific and testable theory the creationists have offered . . . Creationism reveals
its nonscientific character in two ways: its central tenets cannot be tested and its
peripheral claims, which can be tested, have been proven false. At its core, the
creationist account rests on “singularities”—that is to say, on miracles
(Gould, 1984, p. 129).

If we grant Gould the dubious premise that the Noachian flood could be “central to all
creationist systems” and yet a “peripheral claim,” he appears to have escaped the logical
inconsistency shown above by dividing essential/untestable from inessential/testable
facets of creationism. Judge Jones employed similar reasoning in Kitzmiller when he
found fault with “irreducible complexity,” the ID argument that structures and processes
such as the bacterial flagellum, the human immune system, or blood clotting could not
have evolved because the removal of any part disables them. Jones argued that
“irreducible complexity” is testable and that it has failed its tests. However, Jones argued
that tests of “irreducible complexity” are really tests of the falsehood of evolution rather than tests of the ID hypothesis:

We therefore find that Professor Behe’s claim for irreducible complexity has been refuted in peer-reviewed research papers and has been rejected by the scientific community at large . . . Additionally, even if irreducible complexity had not been rejected, it still does not support ID as it is merely a test for evolution, not design (Kitzmiller v. Dover, 2005, p. 741).

Intelligent Design, by contrast, argues that biological systems were designed and created by a “tactically unnamed designer” (p. 718). Jones concluded that since Intelligent Design requires a suspension of natural law, ID is untestable:

[T]he purported positive argument for ID does not satisfy the ground rules of science which require testable hypotheses based upon natural explanations. ID is reliant upon forces acting outside of the natural world, forces that we cannot see, replicate, control or test, which have produced changes in this world. While we take no position on whether such forces exist, they are simply not testable by scientific means and therefore cannot qualify as part of the scientific process or as a scientific theory (pp. 742-743).

Therefore the “irreducible complexity” claims of ID are testable, albeit as tests of evolution, but the core claim of ID, that the world was designed, remains untestable.

Thus both Gould and Jones offer a nuanced version of the testability criterion, acknowledging that some aspects of creationism are testable while others are not.

Although science is testable in general, at any given time scientific theories may exist for which tests have not yet been invented. Scientists may temporarily tolerate untestable but promising theories with the proviso that empirically testable predictions must eventually emerge. The best contemporary example may be string theory, which is particularly well known for over twenty years of active research in the absence of empirical tests that could distinguish it from competing theories (Ehrlich, 2006; B.
Greene, 1999, 2004; Smolin, 2006; Woit, 2006). Although apparently feasible tests of unique string theory predictions have emerged recently (e.g. Hewett, Lillie, & Rizzo, 2005; J. Jiang, Li, & Nanopoulos, 2007), two decades without proposed empirical tests had prompted Nobel Laureate Steven Weinberg to wonder aloud whether or not string theory’s untestability disqualified it as science (Cort & McMaster, 2003). A great many others expressed similar concern (Cartwright & Frigg, 2007; Ehrlich, 2006; Smolin, 2006; Woit, 2006). Nonetheless, during this period most physicists agreed that string theory was science, albeit in a highly speculative form and with the expectation that empirical tests would eventually emerge.

Yet even less speculative forms of science include the untestable assumption that the principles and laws of the universe are comprehensible (see, e.g. Rutherford & Ahlgren, 1990, p. 2). This assumption drives all of scientific inquiry, yet how could one test it? Furthermore, numerous non-scientific theories, such as astrology and literary theory, are testable (Laudan, 1983/1996; R. Morris, 1991). Therefore lack of testability does not always disqualify scientific theories, nor does the presence of testability always validate a theory as being scientific. Therefore even in this sophisticated form, testability fails as a singular demarcation criterion.

When Gould and Jones refer to the “testable” aspects of creationist theories, they do not stop at the simple question of whether or not empirical tests can be devised. Gould writes that tests of the Noachian flood have lead to its refutation, and Jones notes that tests have lead to the refutation of irreducible complexity. For both Gould and Jones, empirical tests imply the possibility that theories can be falsified, i.e. that empirical tests
are conducted precisely to determine whether or not a theory is true. Although testability and falsifiability are not identical (e.g., testability is a necessary but not a sufficient condition for falsifiability), Gould and Jones use them to mean essentially the same thing. This leads to an additional problem with Gould and Jones’ assertion that creationism is non-scientific because some of its tenets are untestable. Thomas Kuhn famously argued that scientists operate under “paradigms,” exemplars of practice which guide their scientific work, and that these paradigms are irrefutable by empirical tests:

It has often been observed, for example, that Newton’s second law of motion, though it took centuries of difficult factual and theoretical research to achieve, behaves for those committed to Newton’s theory very much like a purely logical statement that no amount of observation could refute . . . [S]cientists fail to reject paradigms when faced with anomalies or counterinstances. They could not do so and still remain scientists (Kuhn, 1970b, p. 78).

Thus scientists routinely invoke infallible assumptions. Arguing in a similar vein, Imre Lakatos parses scientific theory into a “hard core” of central tenets surrounded by a methodological “protective belt.” Like Kuhn, Lakatos uses historical case studies to show that the protective belt effectively shields the hard core from falsification based on empirical tests (Lakatos, 1972). Since philosopher/historians such as Kuhn and Lakatos demonstrate that numerous aspects of science are non-falsifiable, Gould and Jones’ argument, namely that the presence of irrefutable elements in creationist claims disqualifies them as science, is undermined.  

Falsifiability as a science/nonscience

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8 One might argue that foundational assumptions in science, such as the simplicity and universality of physical laws, are falsifiable in principle, whereas foundational assumptions in creationism, such as the creation of the universe by Divine action, are not. However, we can infer from Kuhn and Lakatos that neither would be falsifiable in practice.
demarcation criterion has notable supporters such as Karl Popper (Popper, 1961, 1968),
but its numerous weaknesses (see, e. g., Chalmers, 1999, pp. 87-103) warrant its
abandonment as a demarcation criterion (Laudan, 1983/1996). Therefore declarations
that creation science is not science on testability/falsifiability grounds, such as those
found in Judge Overton’s McLean decision, Judge Jones’s Kitzmiller decision, and the
National Academy of Science in Science, Evolution, and Creationism, do not withstand
scrutiny.

Additional Demarcation Criteria

Tentativeness

Other science/non-science criteria used in McClean and Kitzmiller fare no better.
For example, the fourth of Judge Overton’s criteria for science is that “Its conclusions are
tentative, i. e., are not necessarily the final word” (McLean v. Arkansas, 1982, p. 1267).
That is, the claims of science are held tentatively and are revised as new evidence is
produced. Yet some features of science fail to exhibit tentativeness. As argued above,
numerous scientific claims are not falsifiable by empirical evidence, so they are anything
but tentative. On the other side, creationists have revised their claims and arguments over
time, often in response to new data (Laudan, 1982/1996). The gradual rejection of the
Paluxy River footprints and the reinterpretation of granitic radiohalos (see above) serve
as examples. Therefore “tentativeness” fails to characterize all science, and
“tentativeness” fails to rule creationism out. Therefore tentativeness cannot stand alone
as a boundary criterion.
Methodological Naturalism

Overton wrote that “science is guided by natural law” and must be “explanatory by reference to natural law” (*McLean v. Arkansas*, 1982, p. 1267). As Laudan (1982/1996) points out and Quinn (1984/1996) echoes, a great deal of scientific work is done before an explanatory framework has been developed:

Galileo and Newton took themselves to have established the existence of gravitational phenomena, long before anyone was able to give a causal or explanatory account of gravitation. Darwin took himself to have established the existence of natural selection almost a half-century before geneticists were able to lay out the laws of heredity on which natural selection depended. If we took the *McLean* Opinion criterion seriously, we should have to say that Newton and Darwin were unscientific; and, to take an example from our own time, it would follow that plate tectonics is unscientific because we have not yet identified the laws of physics and chemistry which account for the dynamics of crustal motion (Laudan, 1982/1996, p. 354).

Clearly Galileo, Newton, and Darwin were doing science, but their guidance by or reference to natural law was unclear. Since geologists have yet to settle on an explanatory model for plate tectonics (see, e.g. Monroe & Wicander, 2005, pp. 356-357), the connection between plate tectonics and natural law remains tenuous and yet there is no question that plate tectonics is science. Yet in referring to natural law, Judge Overton likely meant that scientists do not invoke supernatural causes for natural events, i.e. they practice methodological naturalism. This can be seen in Overton’s only direct reference to natural law in *McLean*. Section 4(a), of Arkansas Act 590 reads in part:

Creation-science includes the scientific evidences and related inferences that indicate: (1) Sudden creation of the universe, energy, and life from nothing.

Commenting on this section of Act 590, Overton writes:
First, the section revolves around 4(a)(1) which asserts a sudden creation "from nothing." Such a concept is not science because it depends upon a supernatural intervention which is not guided by natural law. It is not explanatory by reference to natural law, is not testable and is not falsifiable (McLean v. Arkansas, 1982, p. 1267).

Thus Overton’s assertion that scientific statements rely on natural law amounts to a prohibition of supernatural intervention as an explanatory principle.

In Kitzmiller, Judge Jones did not refer to natural law, but specifically invoked a prohibition against supernatural intervention in scientific explanation:

Expert testimony reveals that since the scientific revolution of the 16th and 17th centuries, science has been limited to the search for natural causes to explain natural phenomena . . . This revolution entailed the rejection of the appeal to authority, and by extension, revelation, in favor of empirical evidence . . . While supernatural explanations may be important and have merit, they are not part of science . . . This self-imposed convention of science, which limits inquiry to testable, natural explanations about the natural world, is referred to by philosophers as "methodological naturalism" and is sometimes known as the scientific method . . . Methodological naturalism is a "ground rule" of science today which requires scientists to seek explanations in the world around us based upon what we can observe, test, replicate, and verify (Kitzmiller v. Dover, 2005, p. 735).

Although early scientists such as Boyle and Newton regularly invoked divine intervention as an explanatory principle (Burtt, 1932, pp. 191-195), Jones correctly observes that in the intervening centuries, scientists have come to eschew divine intervention as an explanatory device for natural phenomena. Yet as Jones also notes, creationists would like to “change the ground rules of science to allow supernatural causation of the natural world” (Kitzmiller v. Dover, 2005, p. 736). In other words, creationists believe that such a prohibition is unwarranted. Although this prohibition against supernatural intervention does not encounter the sorts of objections that bedevil
falsification or tentativeness, it only applies to explicitly religious practices such as creationism. It is ineffective against practices such as astrology, homeopathy, or extra-sensory perception because these do not invoke supernatural causes. Therefore methodological naturalism is a necessary but not a sufficient condition to define science. Furthermore, the methodological naturalism criterion is a true and helpful criterion with respect to creationism, but it does little philosophical work because it is tautological: scientists study the natural world while theologians (or other religious people) study the divine. This point is taken up further in the discussion of Non-overlapping Magisteria (below).

*Mertonian Norms*

Robert Merton (1973/1938a; 1973/1942) attempted to describe science by its norms and values, but these fail to provide workable demarcation criteria as well (Evans, 2005). Merton lists norms such as universalism (scientific work is accepted on its merits, regardless of the nationality, ethnicity, or social status of those doing the work), communism (scientific knowledge is common property), disinterestedness, and organized skepticism (Merton, 1973/1942). Yet for each of these and other norms which have been proposed in science, counter-norms have been identified which are equally important to scientific practice. For example, universalism is balanced by preference for the work of specific scientists, communism is balanced by secrecy, and disinterestedness is countered by the norm of emotional commitment (Mulkay, 1976, 1980). Depending on context, scientists use norm or counter-norm to justify their actions and both are considered to be

**Alternative Approaches to Science/Non-Science Demarcation**

With the possible exception of methodological naturalism, no unitary epistemic, logical, or methodological demarcation criterion of science has withstood scrutiny (Evans, 2005; Gauld, 1982; Hipkins, 2005, p. 244; Laudan, 1983/1996; Lederman, 1992; Lucas, 1975; McComas, Clough, & Almazroa, 1998, pp. 5-6; Nott & Wellington, 1998, p. 580). Three approaches to the science/non-science relationship are examined below, each of which avoids context-independent demarcation. Two of these approaches concentrate specifically on the relationship between science and religion. First, Ron Good (2005) suggests that science and religion are not separated by epistemic criteria so much as by their attitude toward authority. Second, Stephen Jay Gould suggests that science and religion can be separated by area of inquiry: where science investigates the natural world, religion investigates the spiritual & moral realms, and the two need not intersect. The third alternative approach to the science/non-science relationship, built on the work of Ludwig Wittgenstein, suggests that the distinction between science and non-science is a practical judgment for which demarcation criteria are not necessary.

**Habits of Mind**

For Ron Good (2003; 2005), science and religion represent incompatible habits of mind characterized by divergent attitudes toward authority:
The habits of mind associated with science are not only different than those associated with religion (and especially fundamentalist religion), they are basically incompatible. Most religions encourage believers to accept without evidence the authority of holy books and leaders while science encourages a respect for real evidence and a questioning attitude toward authority. Nature is the final authority in science. When young children are indoctrinated into believing that for which there is no evidence (God, Heaven, Hell, etc.) a habit of mind is being developed that is inconsistent with the open, inquiring mind needed for scientific study. The habits of mind are not merely different, they are incompatible between science and religion, especially where an unseen God, or angels, or other agents are said to intervene into people’s lives. The fact that some scientists believe in a God that intervenes into our world, causing things to happen that otherwise would not, in no way “proves” that science and religion are compatible. It simply shows that some people are able to separate their lives as scientists from their religious lives (Good, 2003, p. 515).

Where the scientific habit of mind is characterized by open inquiry and doubt, the religious habit of mind is characterized by indoctrination and submission to authority. Yet there are reasons to doubt Good’s neat division between scientific and religious mental habits. For example, Thomas Kuhn argues that “normal science” owes its productivity to allegiance to particular paradigms (Kuhn, 1970a, 1970b, 1977), a form of intellectual authoritarianism which enables scientists to proceed with minimal doubt. Along similar lines, Imre Lakatos argues that research programs maintain a “hard core” of principles which are protected from evidentiary threats (Lakatos, 1972). If Kuhn and Lakatos are correct, then open inquiry and doubt are not defining characteristics of professional scientists. Among sympathetic nonprofessionals, attitudes toward science are characterized by trust in authority comparable to religious faith (Midgley, 1985, 1992; Toumey, 1996). For example, a study of American adults indicated a tendency to trust either science & nature or religion & state with essentially equal admixtures of personal faith & doubt (Proctor, 2006). Authoritarianism may also play a role in the rejection of
religion. For example, studies of students in the United Kingdom correlated an authoritarian acceptance of science to a negative view of Christianity (Francis, Fulljames, & Gibson, 1990; Francis & Greer, 2001).

On the other hand, there are indications that creationists are more authority-driven than non-creationists. For example, in an intensive study of four high school biology students, the most creationist of the four was also the most likely to seek an authority figure in order to resolve conflicts between epistemological positions (Demastes, Good, & Peebles, 1995). In a study of Texas undergraduates, Eve & Harrold (1986) constructed a “dogmatism” scale based on questionnaire items such as “A group which tolerates too much difference of opinion among its members cannot exist for long.” They found a strong correlation ($r = 0.31$) between creationism and dogmatism (p. 414). In a survey of Midwestern undergraduates, Sinatra et. al. found a correlation ($r = 0.23$) between epistemological sophistication (which includes willingness to criticize authority and independence from authority) and acceptance of human evolution (Sinatra, Southerland, McConaughy, & Demastes, 2003). In a survey of Texas high school biology teachers, Shankar and Skoog found that 31% of the creationist teachers agreed that in case of conflict between a scientific finding and a biblical passage, the scientific finding must be wrong (Shankar & Skoog, 1993, p. 230). Therefore although authoritarianism does not seem to distinguish science from religion, authoritarianism may characterize anti-evolutionists.
**Non-Overlapping Magisteria (NOMA)**

We saw above that since scientists do not invoke supernatural causes to explain natural phenomena, methodological naturalism is a limited but useful science/non-science demarcation criterion. Biologist Stephen Jay Gould extends this idea into an informal peace treaty between science and religion, suggesting that they occupy “non-overlapping magisteria” (NOMA), i.e. their areas of inquiry, expertise, and teaching authority are entirely independent of each other:

> The net of science covers the empirical universe: what is it made of (fact) and why does it work this way (theory). The net of religion extends over questions of moral meaning and value. These two magisteria do not overlap . . . Many of our deepest questions call upon aspects of both for different parts of a full answer (Gould, 2001, pp. 741-742).

Since science and religion represent different areas of inquiry, there is no reason for conflict:

> If religion can no longer dictate the nature of factual conclusions properly under the magisterium of science, then scientists cannot claim higher insight into moral truth from any superior knowledge of the world’s empirical constitution (Gould, 2001, p. 747).

In proposing NOMA, Gould is reviving an old idea, proposed by Siger deBrabant in the 13th century (Caiazza, 2005), Soren Kirekegaard in the 19th century, and Karl Barth in the 20th century (Meyer, 2000). Yet Gould’s reintroduction of the idea has caught on among scientists and science educators:

> Knowing that science cannot and should not address all questions is vital if we are to avoid the common but false premise that science and religion are at war. To the contrary, science and religion play vital, but distinct, roles in human affairs (McComas, 2004, p. 27).
Science is only one way of knowing about the world in which we live. Art, religion, and history are other important sources of knowledge, but science has a different goal than these enterprises, which is to understand natural phenomena (Chiappetta & Koballa, 2006, p. 195).

Religions and science answer different questions about the world. Whether there is a purpose to the universe or a purpose for human existence are not questions for science . . . No one way of knowing can provide all of the answers to the questions that humans ask (National Academy of Sciences, 1998, p. 58).

By separating religious knowledge from scientific knowledge, it is hoped that religious students, including creationists, can be put at ease when their beliefs appear to conflict with science. Experience suggests that this compartmentalization of knowledge is a practical and effective way of dealing with creationism in the classroom.

Although NOMA may be appealing and practical, science and faith appear to overlap a great deal. First, scholars have noted that the Protestant Reformation (e. g. Harrison, 2006; Trigg, 2003) and Puritanism (e. g. Merton, 1973/1938b) were important spurs to the rise of modern science. Second, scientific theories such as the theory of evolution have influenced religious thinking a great deal (Polkinghorne, 2005). Even Christian fundamentalism is a thoroughly modern movement that has been profoundly influenced by science (Marsden, 1995). Furthermore, Gould’s version of religion is limited to ethical or moral issues, excluding even a belief in God (Carey, 2001). Consequently as Roger Trigg explains, the NOMA “compromise” grants science a much higher epistemic status than religion:

The trouble with this stance is that it either becomes relativist (and even subjectivist), or it gives pride of place to science. “Real” explanations are then to be regarded as scientific, and religion is left with people’s attitudes. Science is about truth, and religion can be left with issues about “meaning.” The latter may seem important, but all too often what is being claimed is that science has a
monopoly of insights into the nature of reality, leaving religion with individual decisions about how to view life. Science then has no need to imagine any conflict with religion, since it has by definition claimed the high ground, and is able to have the last word on the nature of the world. Religion has to be content with whatever is left (and that is not in fact very much) (Trigg, 2003, p. 14).

Since scientists already practice methodological naturalism, they give up little in the NOMA compromise. Where religious belief encompasses only the spiritual realm, as is true for some Christians, people of faith also give up little. However, in the NOMA compromise religious people give up any claims which impinge on the natural world. For example, many Christian traditions encompass such beliefs as the eternal resurrection of the body, the second coming of Christ, and the ultimate destruction and rebuilding of the earth. Acceptance of NOMA would require the surrender of these beliefs together with belief in everyday miracles (such as miraculous healing) which characterizes many Christian traditions. The result is growth of scientific authority and diminishment of religious authority. For this reason, NOMA is likely to be rejected by many religious people.

A Wittgensteinian Approach to Science/Non-Science Demarcation

criteria, any competent participant in the language can use and communicate these concepts without confusion. No single meaning runs through all examples of a concept, yet the many overlapping uses of a concept bear a “family resemblance” to one another. Consider the case of the word “game”:

For how is the concept of a game bounded? What still counts as a game and what no longer does? Can you give the boundary? No. . . . (But that never troubled you before when you used the word “game”) . . . We do not know the boundaries because none have been drawn. To repeat, we can draw a boundary—for a special purpose. Does it take that to make the concept usable? Not at all! (Wittgenstein, 1958, §68-69).

The concept of “game” is indistinct, yet this fact does not diminish its utility for thinking and speaking. In fact, as Masterman (1970) claims with respect to the “paradigm” concept and Wittgenstein (§71) claims generally, the indistinctness or crudeness of a concept can increase its usefulness for thinking and discourse. Therefore philosophy is severely limited in what it can say about a concept. It cannot establish the foundation of a concept and it cannot control its use; in the end, philosophy can only describe language (§124). Therefore it is not surprising that when one tries to squeeze a definition out of the idea of “science,” it slips through the fingers.

However, this is not to say that various indicators are not useful. Falsifiability fails as an either/or demarcation criterion, but we saw that string theory caused misgivings among scientists because it was untestable for so long. Here testability does not serve as a definitive science/non-science boundary marker, but an untestable theory raises concern. In Wittgenstein’s terms, testability is a typical characteristic of the science family, but like any family trait, at any given time some members of the family
may not share that characteristic. The same is true of tentativeness, methodological naturalism, or Merton’s norms—each is useful as indicators of family resemblance, but none of them is sufficient to rule a practice in or out as science. This is particularly visible in McComas, Almazroa, and Clough’s list of consensus views of the nature of science compiled from eight international science standards documents:

- Scientific knowledge while durable, has a tentative character.
- Scientific knowledge relies heavily, but not entirely, on observation, experimental evidence, rational arguments, and skepticism.
- There is no one way to do science (therefore, there is no universal step-by-step scientific method)
- Science is an attempt to explain natural phenomena
- Laws and theories serve different roles in science, therefore students should note that theories do not become laws even with additional evidence
- People from all cultures contribute to science
- New knowledge must be reported clearly and openly
- Scientists require accurate record keeping, peer review and replicability
- Observations are theory-laden
- Scientists are creative
- The history of science reveals both an evolutionary and revolutionary character
- Science is part of social and cultural traditions
- Science and technology impact each other
- Scientific ideas are affected by their social and historical milieu

(McComas, Almazroa, & Clough, 1998, pp. 6-7; McComas, Clough et al., 1998, p. 513)

Many of these areas of consensus are notably imprecise. Scientific knowledge tends to be both durable and tentative, to rely heavily on observation and other practices, but not entirely, to be methodical but to include many methods, to be evolutionary as well as revolutionary, etc. None of them could define science, but to borrow Wittgenstein’s metaphor, each attribute of science is a fiber in a thread, “[a]nd the strength of the thread does not reside in the fact that some one fibre runs through its whole length, but in the overlapping of many fibres” (Wittgenstein, 1958, §67). We don’t expect to find a single
unitary definition of science which applies to all contexts; instead, many overlapping indicators assist in reaching a judgment regarding whether or not any particular practice should be classified as “science.”

Having given up on identifying a context-independent science/non-science demarcation criterion, Larry Laudan concludes that

[i]f we would stand up and be counted on the side of reason, we ought to drop terms like “pseudo-science” and “unscientific” from our vocabulary; they are just hollow phrases which do only emotive work for us (Laudan, 1983/1996).

I agree with Laudan that “scientific” is unworkable as a context-free epistemic category, but I do not agree that the distinction between science and non-science is useless. Science is a practice whose existence precedes and presupposes efforts to define it. Consequently, no formulaic definition can separate science from non-science, but judgments can be and are made about whether or not a practice is “science.” In making boundary judgments, special attention must be paid to the opinions of scientists themselves. As Judge Overton initially defined science in McLean: “science is what is ‘accepted by the scientific community’ and is ‘what scientists do’” (McLean v. Arkansas, 1982, p. 1267). Occasionally the work of scientific outsiders comes to be accepted by the scientific community years later, so there is no warrant for elevating “acceptance by the scientific community” to the status of a single, unitary, and sufficient boundary criterion. However, as Phillip Quinn (1984/1996, p. 368) observes, non-scientists generally defer to the judgment of scientists in the case of boundary disputes. When scientists disagree about the scientific status of a practice, such as epidemiology (Amsterdamska, 2005) or clinical recovery of suppressed memory (Ashmore, Brown, & MacMillan, 2005), non-
scientists generally wait for scientists to reach a consensus and then accept that judgment. Thus when Judge Jones observed in *Kitzmiller* that creationism/ID is uniformly rejected by every major scientific organization and has essentially no publication record in peer-reviewed scientific journals, this near-consensus is a strong indication, although not a proof, that creationism/ID is not science. Arguments from tentativeness, falsifiability, etc. are useful, but they are generally made posterior to the judgment among scientists that creationism is not science.

*Teaching the Nature of Science*

Closely related to efforts to demarcate science from non-science is the drive to teach the nature of science, which now occupies a prominent part of the American science education landscape. Scientific organizations such as the American Association for the Advancement of Science (1993; Rutherford & Ahlgren, 1990) and the National Research Council (1996) emphasize “nature of science” education in their model curricula. Therefore it is unsurprising that the nature of science is prominent in science educators’ responses to creationism. Organizations such as the National Academy of Sciences (1998; S. Olson, 2004), the National Science Teachers Association (2003), and the National Association of Biology Teachers (2001) recommend that teachers present the nature of science as a counterweight to religiously motivated resistance to evolution. For these organizations, education is a solution because the problem is ignorance: “Opposition to teaching evolution reflects confusion about the nature and processes of science” (National Association of Biology Teachers, 2001, p. 216). Since creationism is
religion rather than science, creationist opposition to science should have no part in the classroom. Numerous biology educators support this strategy (Attie et al., 2006; Barclay, 2006; Clough, 1994; Farber, 2003; Flammer, 2006; Narguizian, 2004; Nickels, Nelson, & Beard, 1996; Scharmann & Harris, 1992) of preempting creationist resistance through “nature of science” education:

If you’ve done a thorough job of presenting the nature of science as described here, you will be much less likely to be challenged when you teach the science of geological age-dating, the evolution of stars, life’s origins, the evolution of life, and other issues that might seem to conflict with some traditional views. If you are challenged, you can simply refer back to earlier class experiences and discussions on the nature of science (Flammer, 2006, p. 197).

By this strategy, teaching the nature of science, including the fact that creationism isn’t part of science, eliminates the need to address creationist views in the science classroom. Nature-of-science education effectively ends the argument before it starts.

Although the nature of science is an open question (Gauld, 1982; Hipkins, 2005, p. 244; Lederman, 1992; Lucas, 1975; McComas, Clough et al., 1998, pp. 5-6; Nott & Wellington, 1998, p. 580), scholars agree that science does not proceed according to anything like the naïve inductivism promoted by Francis Bacon in *Novum Organum* (1620/1952). In Bacon’s approach to science, one suspends all preconceived notions, seeks out and organizes the facts of nature through observation and experiment, and then gathers these facts together into laws. Although the Baconian vision for science is widely discredited (Gauld, 1982; McComas, 1998, pp. 58-59; Rudolph & Stewart, 1998), it is found in many science textbooks (Clough & Olson, 2004; Jacoby & Spargo, 1989; Matthews, 1994, pp. 110-111) and believed by most science teachers (Hipkins, 2005, pp.
246-247; McComas, Clough et al., 1998, p. 10; Rudolph & Stewart, 1998). In subtle but persistent ways, this naïve inductivism can find its way into the nature-of-science response to creationism. For example, in the National Academy of Sciences’ suggested framework for evolutionary instruction includes this statement: “As scientists started to notice patterns in nature, they began to speculate about some explanations for those patterns” (National Academy of Sciences, 1998, p. 24). This is a Baconian description of science, in which observation precedes and induces theory. Subtle forms of inductivism can also be found in case studies, as when the National Academy describes scientific discoveries in a language of inevitability:

If Copernicus had kept his ideas to himself, the discovery of heliocentrism would have been postponed, but it would not have been blocked, since other astronomers eventually would have come to the same conclusion. Similarly, had Darwin and Wallace not published their hypotheses, the concept of biological evolution would nevertheless have emerged as the accepted explanation for the history of life on earth. The same cannot be said in other areas of human endeavor; for example, had Shakespeare never published, we would most assuredly never have had his plays. The publications of scientists, unlike those of playwrights, are a means to an end—they are not the end itself (National Academy of Sciences, 1998, p. 30).

Here the NAS does not weave a story of building provisional models and theories and then testing them against data, nor a story of accounting for data which could be validly interpreted in multiple ways (Clough & Olson, 2004). Instead, the NAS describes a rather straightforward process by which data leads to conclusions. Despite the rhetoric of tentativeness, scientific knowledge becomes independent of the people who produce it. Like assembling a jigsaw puzzle, there is only one solution because this is where the “facts” will lead.
In addition to being historically inaccurate, the Baconian story of science is unlikely to persuade creationists that creationism is not science. A cornerstone of the Protestant reformation was the abandonment of allegorical readings of scripture in favor of its literal, common-sense interpretation (Harrison, 2006). In American fundamentalism, this style of biblical interpretation became highly inductive: without preconceived ideas, one reads the “facts” of scripture and collects them into principles and conclusions. Under the influence of Scottish Common Sense philosopher Thomas Reid, this Baconian approach to scriptural interpretation found its parallel in a Baconian approach to science among American fundamentalists (Bozeman, 1977; Marsden, 1980, 1984, 1991; C. A. Taylor, 1996). Informed by this heritage, American creationists approach knowledge in a strikingly Baconian way (C. A. Taylor, 1992, 1996). For example, from 1996-2001, an anti-evolutionary warning label was pasted into all secondary biology text books used in Alabama public schools. It included the statement:

No one was present when life first appeared on earth. Therefore, any theory about life’s origins should be considered as theory, not fact (Alabama Citizens for Science Education, 2004).

A revised label, in use in Alabama from 2001-2005, read in part:

Since natural selection has been observed to play a role in influencing small changes in a population, it is assumed that it produces large changes, even though this has not been directly observed . . . [Students] should learn . . . to distinguish between observations and assumptions used to draw conclusions . . . (Alabama Citizens for Science Education, 2004).

In these warning labels, the Alabama legislature argued that since the large-scale evolution of species is unobservable, the theory of evolution is highly speculative, leaving the facts (that which can be directly observed) far behind. By contrast,
creationists portray themselves as being grounded in fact. For example, Phillip Johnson, a leading figure in the Intelligent Design movement, says: “The argument for intelligent design is based upon observation of the facts. Now that’s my definition of good science. It’s observation of the facts” (Phillip Johnson in Meyer & Allen, 2005, p. 45). Therefore when science educators in general and the National Academy of Sciences in particular disseminate an inductivist-empiricist philosophy of science in order to dissuade creationism, they inadvertently reinforce the creationist point of view.

Research Questions

In this project, the central question is how creationists view the relationship between creationism and science. What status and how much respect do they ascribe to “science” and scientists? Do they regard their own practice to be science? Do creationists separate science from non-science? If they do separate them, then how does this happen? Do they rely on such criteria as falsifiability, tentativeness, or a form of inductivism to demarcate science from non-science? Is a science/non-science boundary contested among creationists, or is there a general consensus about how to separate them?

A second major question in this project is whether narratives of progress and/or decline play out within creationism. Do creationists subscribe to a kind of “declinism,” and if so, what does this look like? Are cultural and biological decline joined among creationists in the way that Whitcomb and Morris joined them, or do they function independently of one another?
A Philosophy of Social Science Research

According to Kuhn (1970b), the natural sciences are guided by paradigms, i.e. exemplars of practice which unify communities of practice. Operating under a paradigm, “normal science” can proceed without disputes over the foundational concepts of the discipline. By contrast, the social sciences could be described as either non-paradigmatic, i.e. they are not guided by paradigms, or multi-paradigmatic, i.e. small groups of social scientists work under a variety of paradigms which may change in a relatively short time. As Miles & Huberman write, “The paradigms for conducting social research seem to be shifting beneath our feet . . .” (Miles & Huberman, 1994, p. 5).

Because of the non- or multi-paradigmatic nature of the social sciences, it is necessary to philosophically position the present study in greater detail than would be necessary in the natural sciences.

In the following, I describe my philosophical commitments and how these lead to a methodology. Specifically, a worldview is assumed to be a stable, internally consistent, and context-independent way of seeing the world which is maintained by each person. The existence of worldviews is taken for granted in the English language and worldviews serve as important explanatory tools in social research, but the worldview metaphor
carries serious weaknesses as well. The “performance tendency” serves as an alternative to the worldview metaphor. However, the performance tendency carries methodological consequences. Whereas worldview research attempts to reveal the stable, structure-like belief system assumed to underlie human behavior, performance-tendency research studies how people interact with and make sense of the world at particular moments in time. Whereas worldview research attempts to reach generalizations regarding context-independent mental structures, generalization in performance-tendency research involves the identification of patterns in how people interact with the world.

The Explanatory Power of Worldviews

The concept of worldview is a powerful analytic and explanatory tool. For example, Nancy Allen and Frank Crawley (1998) studied the traditional band of the Kickapoo, a group of Native Americans which has resisted westernization until recently. In their study of the first generation of traditional Kickapoo to attend a U. S. school, Allen and Crawley observed:

The preference for cooperative methodology was pronounced among the Kickapoo students (100% of data) and sharply contrasted with the competitive scenario in the classroom (90% of data). Teachers were constantly baffled and frustrated by the refusal of the Indian students to compete in the classroom. Cooperation, rather than competition, is highly regarded among Kickapoo people. Most Kickapoo, for example, will not attend competitive sports games (Allen & Crawley, 1998, p. 122).

This conflict in values was most apparent in situations in which teachers or administrators tried to motivate Kickapoo students. The rewards used as motivators often conflicted with traditional Kickapoo values: for example, free admission to competitive sports events, high grades, promises of material gain, and the chance to leave the area and see the world. Kickapoo culture disdains
competition—in sports or grades—and values spiritualism over materialism (p. 128).

Clearly there is a divide between the Kickapoo students and their American teachers and classmates, and a clash of worldviews—the Euro-American value of competitiveness vs. the Kickapoo value of cooperation and Euro-American materialism vs. Kickapoo spiritualism—offers a compelling explanation for this divide. Powerful though the contrasting-worldview approach may be, it often involves the assumption that worldviews are like mathematical systems or structures. In this case Allen and Crawley assume “first, that worldviews ‘strive’ toward maximum logical and structural consistency; and second, that worldviews are given coherence and shape by the necessity of having to relate to an external environment” (Allen & Crawley, 1998, p. 113). Similar to Piaget’s suggestion that “cognitive disequilibrium” motivates conceptual change (Piaget, 1977/1955, 1977/1958, 1977/1975), Allen & Crawley and other worldview theorists (e.g. Aikenhead, 1997; Kawagley, Norris-Tull, & Norris-Tull, 1998) assume that the human mind searches for philosophical consistency.

Worldview theorists generally adopt a constructivist metaphor for human thought. As Marcia Linn (Linn, 1987) expresses it:

There is widespread agreement that learners actively construct an individual worldview based upon personal observation and experience and that they respond to formal instruction in terms of this preexisting intuitive perspective. Research has also revealed that learners construct a sense of themselves which guides their learning behavior (Linn, p. 195).

The underlying metaphor here is that the human mind is a building which is always under construction. Learning is the process of adding new material (information) to the
building, like adding a new brick on a Lego™ set. However, sometimes we have trouble fitting a new brick onto our building, indicating that we have made a mistake in the process of constructing our building. In science instruction, this is the typical explanation for post-instructional misconceptions—the new, correct information does not fit onto our existing Lego building: “misconceptions . . . do not arise merely from failure to absorb information but rather from erroneous interpretation based on intuitive perceptions that must be overcome” (Linn, p. 197). In order to incorporate the new information into the human mind, our Lego building must be partially dismantled and rearranged (Posner, Strike, Hewson, & Gertzog, 1982; von Glasersfeld, 1992). This is why physics students experience such difficulty in learning Newton’s Laws, and this is why the Kickapoo experience such difficulty in American schools.

If worldviews “strive” toward maximum logical consistency, then the underlying worldview-constructivist metaphor may also be influenced by Euclidean geometry, in which five foundational postulates support a complex system of theorems, each of which stands in a strictly logical relationship to every other theorem. When a mathematician recognizes that a new piece of information (e.g., a theorem) is in logical conflict with the existing logical structure, then the new theorem will be rejected or the logical system will be modified to accommodate it, possibly at the foundational (postulate) level. This is the underlying image when Piaget describes a state of “cognitive disequilibrium,” leading to the process of “accommodation” (Piaget, 1977/1958). Worldview theorists assume that the human mind regulates itself, attempting to maintain logically compatible relationships between various pieces of information.
The Weakness of Worldviews

The metaphor of a worldview as a stable, structure-like or theory-like model of human thought has its shortcomings. First of all, whether consciously or unconsciously, worldviews must rely on memory, and human memory, in turn, does not seem to be particularly stable. As Elizabeth Loftus and many others have shown (Brainerd & Reyna, 1998; Hagen, 1997; Loftus, 1979; Neiser & Harsch, 1992; Payne, Elie, Blackwell, & Neuschatz, 1996; Reyna, Holliday, & Marche, 2002), memory is highly malleable and subject to change. Inaccurate memory appears to be a normal part of being human. If memory itself is so malleable, then the consistent recall of a complex, structure-like, logically consistent worldview seems highly unlikely. This is a burden that real human memory simply cannot bear. As bible scholar John Crossan (1998) observes,

Memory is as much or more creative reconstruction as accurate recollection, and unfortunately, it is often impossible to tell where one ends and the other begins. We usually work from either or both with the same serene and implacable confidence (p. 59).

We see that memory is more of a performance than a structure. Just as no two performances are alike, so no two instances of recall are alike.

Our understanding of the verb “to remember” is subject to the metaphors of our time. Crossan argues that with the advent of widespread literacy in the industrialized world, we have come to understand memory to be stable in the way that a text is stable. Yet this stable, text-like understanding of memory is not shared in oral cultures. Crossan cites the work of Milman Parry among Serbo-Croatian singers in the 1930’s. Parry recorded these illiterate singers as they performed long, epic tales. From a single artist,
Parry transcribed four different versions of the same song: 154 lines, 234 lines, 279 lines, and 344 lines. Clearly these four performances are not identical, yet the singers regard them to be the same song. In an interview with a literate researcher (N), an illiterate singer (D) compares his performance of a song to another artist’s performance:

N: Was it the same song, word for word and line for line?
D: The same song, word for word and line for line. I didn’t add a single line, and I didn’t make a single mistake . . . .
N: Tell me this: If two good singers listen to a third singer who is even better, and they both boast that they can learn a song if they hear it only once, do you think that there would be any difference between the two versions? . . .
D: There would . . . It couldn’t be otherwise. I told you before that two singers won’t sing the same song alike (Milman Parry, cited in Crossan, p. 75).

Here we see a conflict between two different metaphors for memory. In the oral tradition, singing the song “the same way” means that the performance has the same quality. It is equally beautiful, moving, or satisfying. In the literate tradition, singing the song “the same way” means repeating the same words, like repeated readings of the same text. It is accurate. Although the memory-as-text metaphor may be more familiar to the literate society, the memory-as-performance metaphor may be closer to the everyday experience of memory.

Given the problems encountered in comparing the mind to a logico-structural Lego set, we need a new metaphor for human thought. I believe that the Serbo-Croatian singers have it right. It’s not a structure; it’s a performance. We don’t have thoughts so much as we think. Perhaps human thought is like swinging a golf club. Although we can identify tendencies among individual golfers (such as slicing), each performance is unique. I might have a tendency to overshoot the green, but on any given approach, I am
quite capable of undershooting the green. In the same way the proclivities of the
Kickapoo are not necessarily structure- or theory-like worldviews, but performance
tendencies. Crawley & Allen have clearly documented these performance tendencies, but
we should not be surprised if these tendencies turn out to be contextually bound.

Study of Performance Tendencies

The assumption of a “performance tendency” rather than a “mental structure”
view of human interaction carries important implications for the study of the social
world. First, if there is no context-independent logico-structural worldview within a
person, then no attempt will be made to isolate such a worldview for analysis. For
example, in an interview we should be aware of contextual factors which may influence
the interaction between interviewer and interviewee, but there is no context-independent
“right” answer which would be revealed if only we could remove the contextual factors
from the interview. However, as Charles Briggs explains, a great deal of interview
researchers proceed under the assumption that such context-independent beliefs and
attitudes exist:

[T]his approach leads most practitioners to believe that if no particular source of
“bias” is present or if . . . overt “distortions” have been accounted for, the
researcher can treat these data as if they were a direct reflection of the
interviewee’s thoughts. In other words, once the problem of “bias” has been
treated in this way, one can forget that the statements were made in the course of
a particular interview . . . A response lies within the interviewee, and the problem
simply consists of extracting it from her or him as directly as possible (Briggs,
1986, pp. 21-22, emphasis added).
Operating out of a worldview assumption, the researcher is tasked with accurately exposing the inner belief structure of the research participant. Operating out of a performance-tendency orientation, the researcher studies the participant’s interactions in order to understand how this person makes sense of the world. A research participant may respond differently in an interview compared to some other social situation, or respond differently in one interview compared to another. In worldview research this is a problem to be solved in an effort to describe a person’s essential, logically consistent beliefs. In performance-tendency research, such inconsistencies are a reality to be embraced. If someone expresses themselves differently in different contexts, this is important information in developing a holistic understanding of the person.

People can, in fact, behave very differently from context to context. Building on the work of Hubert and Stuart Dreyfus (1988), Bent Flyvbjerg argues that while novices in a particular situation tend to rely on rules, experts tend to rely on intuition and experience. Therefore soccer fans are not surprised that expert soccer players, for example, will ignore or contradict the principles of sound passing or shooting as often as they follow them (Flyvbjerg, 2001). In the same way we should not be surprised when Judge Overton declares creation science to be false and yet non-falsifiable (see Chapter 2), or when we learn that creation scientists appeal to the stability of natural law in some contexts but rely on the suspension of natural law in other contexts. We should expect no one, even mathematicians or philosophers, to behave (or even to try to behave) in a unitary, logically consistent manner in all contexts. However, we can expect a person to exhibit cross-contextual performance tendencies, i.e. noticeably similar ways of
interacting in the world. Since social partners or members of a group or community can be expected to influence one another, performance tendencies should also be identifiable among groups, even at the scale of groups who share a common language (Wittgenstein, 1958). In this sense, “generalizability” is meaningful, not as information about what is inside people or what people are, but rather as what people tend to do, i.e. how they tend to interact with or make sense of the world.

If social behavior is closely tied to context, then the social practice known as social science must also be tied to context. In quantum physics, an electron will behave in a wave-like manner in some experiments but in a particle-like manner in other experiments. Neither set of experiments reveals the essence of the electron and both sets of experiments are necessary for understanding the electron. In the same way, in social science no investigational method or methods can be expected to reveal the essence of a person, but rather various methods can increase our understanding of how a person typically interacts with the world (Eisenhart, 2005; Maxwell, 2004; Salomon, 1991). Like quantum physics, social science methods and results interact with each other. Surveys or other quantitative methods, for example, yield statistically manipulable data which enable the establishment of correlations between variables. Such correlations can enormously increase our understanding of social situations, but the researcher should remember that the act of filling in a survey is a particular social context which may or may not match other social contexts. Therefore the survey is not a method of extracting the persons’ pre-existing thoughts, but a complex performance involving interaction between the person, the survey, and the rest of the context, enacted in a particular place
and time. The same is true of an interview, in which we cannot accept “the naïve concept of the interviewer as the medium through which the respondent’s attitudes and beliefs are conveyed to the reader. The interviewer rather stands as a co-participant in the construction of a discourse” (Briggs, 1986, p. 25; see also Fontana & Frey, 2003, pp. 90-93). Whether in a survey, an interview, or any other form of social investigation, the researcher contributes to the interactions under investigation. One cannot study social interaction in the absence of social interaction, so there is no “fly-on-the-wall” perspective, and none will be pretended in the present study.

The Case Study

As described in Chapter 2, the research questions in this study include how creationists talk about science, how they distinguish science from non-science, and the role of the themes of progress and decline among creationists. The development, validation, and execution of a survey would shed light on creationist practices, as would interviews with a large number of creationists or the use of a hybrid such as Q-methodology (McKeown & Thomas, 1988). In various degrees, these methods have the potential to increase understanding of creationist practice, but they are disadvantaged by a loss in interactional and contextual detail. Therefore rather than observe from a distance, I prefer to study these themes from close up, i.e. to conduct a “naturalistic inquiry,” attending to rather than bypassing contextual detail (Haraway, 1999), and to produce a “thick description” (Geertz, 1973; Ryle, 1971a, 1971b) of creationist practices.
The first step is to choose a group of people to work with. In a case study, the researcher establishes a geographic, temporal, and/or practice-oriented boundary around a group of interest. According to Robert Stake (2003), this group may be chosen for instrumental or intrinsic reasons. In an instrumental case study, a particular case is examined mainly to provide insight into an issue or to redraw a generalization. The case is of secondary interest, it plays a supportive role, and it facilitates our understanding of something else. The case is still looked at in depth, its contexts scrutinized, its ordinary activities detailed, but all because this helps the researcher to pursue an external interest (Stake, 2003, p. 137).

The instrumental case study is initiated as part of a larger effort to answer existing questions or to build theories. In an intrinsic case study, by contrast, the case is chosen for its own sake, because it is interesting. Rather than serving theoretical interests, practical issues and/or intuition drive the choice to investigate the case. Many case studies, including the present study, are both instrumental and intrinsic to varying degrees.

Since instrumental case studies concern theoretical or practical questions of broader significance, one must face the question of typicality. As Stake points out, some researchers suggest that generalizability can be maximized when a case is representative of a larger population of interest. However, Stake argues that on balance, the “opportunity to learn” is a superior criterion to typicality in case selection:

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9 Whether or not that boundary exists independently of the researcher may be unknowable, as the researcher’s choice of a boundary may actually create the community of interest (Angrosino & Mays de Pérez, 2003, p. 121).
The researcher examines various interests in the phenomenon, selecting a case of some typicality, but leaning toward those cases that seem to offer the opportunity to learn. My choice would be to examine that case from which we feel we can learn the most. That may mean taking the one most accessible, the one we can spend the most time with. Potential for learning is a different and sometimes superior criterion to representativeness. Isn’t it better to learn a lot from an atypical case than a little from a seemingly typical case (Stake, 2003, p. 152, emphasis original)?

Here Stake suggests that a typical case is generally ideal, but other considerations (accessibility, etc.) may counterbalance the advantages of typicality. By contrast, Bent Flyvbjerg (2001) argues that the most instructive case studies are often the extremes rather than the typical. For example, Galileo claimed that in the absence of air friction, the acceleration due to gravity of all objects would be the same. Galileo’s successors removed all lingering doubts by demonstrating that a feather and a piece of lead fall at the same rate through an evacuated chamber. Flyvbjerg points out that the issue was not settled by dropping a “typical” object or by dropping large numbers of objects, but by the extreme case of a feather and a piece of metal (Flyvbjerg, 2001, pp. 74-75). The extreme case can be more instructive in the social sciences as well. Flyvbjerg cites Robert Michels’s (1962) search for oligarchy where none would be expected, namely in a highly democratic grass-roots organization, reasoning that “if this organization is oligarchic, so are most others” (Flyvbjerg, 2001, p. 79). In the same passage Flyvbjerg cites W. F. Whyte’s (1943) finding that a Boston slum neighborhood was highly socially organized, contravening prevailing social theory. Again, if the apparent chaos of a slum neighborhood turns out to be socially organized, then social organization may be universal in human experience. To draw an example from creationism, Toumey (1990;
1994; 1996) found that creationists are motivated by a faith in “the plenary authority of science” as much as by religious faith. Since such scientism is exhibited by people whose primary commitment lies far outside of science (faith in the infallibility and authority of scripture), Toumey was able to argue that scientism is a virtually ubiquitous habit among Americans. The extremes (creationists) illuminate the mainstream (Americans generally). Thus for Flyvbjerg the atypical or extreme case may reveal the most information and, paradoxically, be the most revealing about the general population. Where Stake would include typicality as one criterion among many, Flyvbjerg advocates atypicality as a positive criterion for case selection. In Flyvbjerg’s terminology, one searches for critical cases rather than typical cases. Of course identifying a critical case is risky, as the researcher assumes that he or she knows enough about the case and its relationship to its larger social context to be able to identify it as a critical case prior to the study. Flyvbjerg describes an example in which he was several months into a study before he realized that a case was not critical, at least not for the reasons that he had assumed beforehand (Flyvbjerg, 2004, pp. 426-427). Therefore researchers like Flyvbjerg risk misidentifying a case as critical, but perhaps learning that it is not a critical case is valuable in its own right.

Validity, Objectivity, and Researcher Influence

In naturalistic inquiry, the researcher is the primary instrument of research, which raises questions of validity. As Matthew Miles has written,
The most serious and central difficulty in the use of qualitative data is that methods of analysis are not well formulated. For quantitative data, there are clear conventions the researcher can use. But the analyst faced with a bank of qualitative data has very few guidelines for protection against self-delusion, let alone the presentation of unreliable or invalid conclusions to scientific or policy-making audiences. How can we be sure that an “earthy,” “undeniable,” “serendipitous” finding is not, in fact, wrong (in Miles & Huberman, 1994, p. 2)?

Although Miles & Huberman (1994) attempt to address and improve the non- or multi-paradigmatic state of qualitative research, they admit that such problems persist. Struggles over validity and reliability arise in the natural sciences (see, e.g. H. M. Collins & Pinch, 1998) and in quantitative social research (see below), but questions of validity in other areas do not insulate naturalistic inquirers from issues of validity. Under a performance-tendency orientation, “did the researcher get it right?” remains an important question. In the passage quoted above, Miles and Huberman imply that standardization of qualitative inquiry would assist the reader in making validity judgements. First, it is not obvious that this is the case. For example, quantitative social science is highly standardized, yet development, validation, and implementation of an instrument still depend on the judgment of the researcher (Fraenkel & Wallen, 2003, pp. 158-165). Second, the very nature of qualitative research renders methodological standardization doubtful. Harold Garfinkel writes that the researcher who wishes to understand a social setting as its participants understand it must avoid the use of professional social categories that come from outside the setting (Garfinkel, 1967, p. 33). If this is true, then standardization of investigational methods is prohibited (see Flyvbjerg, 2001, p. 33). Therefore each reader must decide whether to accept the qualitative researcher’s
methodology, accounts, and judgment, largely based on the reader’s experiences, e. g. “does this account ring true,” and the reader’s level of trust in the researcher.

Related to validity are questions of researcher “objectivity” and the researcher’s influence on the social situation. With regard to the former, the worry is that the naturalistic inquirer is particularly vulnerable to finding what he or she is looking for, simply confirming preconceived ideas of how the participants make sense of the world and interact with each other. Flyvbjerg offers two useful answers to the question of researcher bias. First, the close familiarity of the naturalistic inquirer with research participants, combined with the inherent flexibility of naturalistic inquiry, enables the researcher to recognize and adapt to changing conditions. By contrast, since a large-scale written survey or a highly structured interview protocol cannot be readily adapted to new realizations or changing conditions, these methods are more likely to confirm the researcher’s preconceived ideas (Flyvbjerg, 2001, p. 83). Therefore the observant qualitative inquirer is arguably less vulnerable to bias than the quantitative researcher. Second, the confirmation of preconceived ideas rarely matches the reported experiences of researchers:

According to [Donald] Campbell, Charles Ragin, Clifford Geertz, Michel Wieviorka, and others, researchers who have conducted intensive, in-depth case studies typically report that their preconceived views, assumptions, concepts and hypotheses were wrong and that the case material has forced them to revise their hypotheses on essential points. This is my own experience as well (Flyvbjerg, 2001, p. 82).

If qualitative researchers routinely report such changes of mind, then it is clear that researcher bias is not as great a problem as we might imagine it to be. Furthermore,
underlying the question of “objectivity” and the question of researcher influence on the social situation is the assumption that a “fly-on-the-wall” perspective exists, i.e. that it is possible to report events as they would have occurred in the researcher’s absence. But as mentioned above, social research is a social interaction, co-created by the researcher and the participants. It is not an approximation to some ideal interaction which would take place without the researcher. The interaction among the researcher and participants is created on the spot, and it is the only reality to be reported. Therefore the “problems” of objectivity and researcher influence are created by the researcher’s assumption that a more authentic reality underlies the reality in which he or she participates.

The Study

The Fossil Museum (pseudonym) is a young-earth creationist facility which opened near a Mid-Western city in 2005. Its founder, pseudonym Art, is a businessman in his mid-fifties. For about twenty years before opening the museum, Art had been collecting fossils and creationist artifacts and conducting creationism seminars in local churches. Eventually he gathered a board of trustees and together they formed a non-profit corporation to open and operate the Fossil Museum. They acquired a 5,000-square-foot building on several acres of land in a semi-rural area. Within the Fossil Museum, staff and exhibits present astrophysical, geological, historical, and biological arguments that the universe is less than 10,000 years old and that complex organisms could not have evolved from simpler forms. Outdoors is Fossil Park, a multi-acre playground equipped with standard playground equipment plus spectacular extras such as
an eight-foot-tall Sauropod, a 200-ft. zip-line ride, and a dinosaur-themed water-balloon launching game. Art oversees the Fossil Museum and Park, but he is not a paid employee. The paid staff includes full-time director Ben (pseudonym) and about ten seasonal/part-time employees. The staff conducts hourly museum tours, hosts birthday parties, runs the gift shop, operates the zip-line ride, offers games in Fossil Park, and maintains a web site. The paid staff also hosts monthly science classes for elementary and middle-school students and several week-long summer day camps. For adults, the museum hosts a monthly lecture series presented by museum staff, local speakers, or creationists from other states.

I conducted a case study of the Fossil Museum and Park. To borrow Stake’s terminology, this is an intrinsic case study in the sense that the Fossil Museum is a rich site whose exhibits, activities, staff, and visitors are interesting in their own right. However, it is also an instrumental case study investigating how creationists distinguish science from non-science and how narratives of progress and decline are enacted among creationists. In Flyvbjerg’s terminology, the Fossil Museum and Park is a critical case. Creationists are outsiders to mainstream science, e. g. they are unpublished in peer-reviewed scientific literature (Gilchrist, 1997; Scott & Cole, 1985). Yet we shall see

10 Although Robert Gentry’s radiohalo studies were published extensively in peer-reviewed scientific literature (Gentry, 1968, 1970, 1973, 1974a, 1974b, 1976), his creationist views/conclusions were not (Gentry, 2003; Scott & Cole, 1985). In the Intelligent Design arena, the Discovery Institute lists nine pro-ID articles in peer-reviewed scientific journals (Discovery Institute Center for Science and Culture, 2007), but by contacting the authors of a similar list produced by the Discovery Institute in 2002, the National Center for Science Education was able to show that the Discovery Institute
that like mainstream scientists, the scientific outsiders at the Fossil Museum rely on testability/falsifiability, tentativeness, and a form of inductivism to distinguish science from non-science, suggesting that this demarcation practice is probably widespread in American culture. We shall also see that Fossil Museum staff and speakers discover and sort out anomalies in a way that closely parallels the way scientists discover and respond to anomalies. If both scientists and creationists, their ostracized “others,” respond to anomalies in the same way, these practices are likely paralleled throughout the wider culture. Typical of a critical case study, the extremes (creationists) illuminate the mainstream (non-creationist Americans).

In an effort to pursue the themes of science/non-science demarcation and progress vs. decline, this case study consisted of a naturalistic inquiry into the Fossil Museum, including regular observations of and participation in the normal activities of the museum, study of the physical displays in the museum, and unstructured interviews, i.e. informal, unscripted questions on an ad-hoc basis (Fontana & Frey, 2003). In order to elicit reactions from Fossil Museum patrons, I also conducted guided interviews with 35 Fossil Museum visitors (see the interview guide in Appendix A). Since none of these interactions with Fossil Museum associates represented an attempt to excavate pre-existing world views, I did not hide my status as an outsider and I honestly answered questions about my religious and scientific opinions despite the fact that most of these opinions ran counter to Fossil Museum arguments. During the first few weeks of the

had misrepresented the listed authors and articles (National Center for Science Education, 2007a).
study I noticed that some patrons assumed that I was on staff with the Fossil Museum, so
during the rest of my time at the Museum I wore a name badge bearing the Kent State
University logo. Yet as a matter of courtesy I attempted to stay out of the way and to be
helpful wherever possible.

I conducted this inquiry under the oversight of Kent State University’s
Institutional Review Board and with the permission of the Fossil Museum’s Board of
Trustees, Founder, and the Director. All of the Museum staff signed written consent
forms, as did all interviewed patrons. I obtained written consent forms from the
parents/guardians of minors prior to observing them in such activities as science classes
or summer day camps.
CHAPTER IV
DATA

Physical Facilities

The Fossil Museum

The Fossil Museum is located in a suburban area of the Midwest, occupying the first floor of a two-story business building. Upon entering the parking lot, the nature of the Fossil Museum is made clear to the visitor. A wooden fence runs the length of the parking lot, and along this fence a trail of green three-toed “dinosaur tracks” interweaves a set of black human footprints, emphasizing the young-earth creationist belief that dinosaurs and humans lived at the same time. A ten foot long, seven foot tall model of a Stegosaurus rests beside the fence. The head of the model has been missing since 2006, exploded by vandals using fireworks. A piece of burlap covers the damaged area and the Stegosaurus wears a sign reading “Ouch!”

Each black and white sign identifying the museum is adorned with a green image of a Tyrannosaurus Rex. The wall beside the entrance is painted in a blue and white background over which is painted a tree and several dinosaur silhouettes in orange, yellow, and green paint. A solid green entrance door leads to the gift shop. Upon entering, the front desk is to the immediate left of the entrance, consisting of an L-shaped countertop. A large computer monitor rests at the corner of the front desk, serving as a
cash register, a register for employees to clock in and out, and a work station for word processing. The rest of the front desk is covered with fliers announcing various activities, a sign-in sheet for the Museum mailing list, a display of Fossil Museum gift cards in the amounts of $10, $20, and $25, a “lava lamp,” a telephone, an adding machine, several plastic dinosaurs, and a variety of inexpensive dinosaur items for sale such as Fossil Museum wrist bands.

Fossil Museum/Fossil Park admission prices are displayed on the wall behind the counter. Without a museum tour, visitors can use Fossil Park for $3 each. Admission to the Fossil Museum (which includes use of Fossil Park) is $7 for adults, $5 for children under 13 years of age, and free for children under 2 years of age. The maximum charge for a family is $25, and a one-year unlimited family pass is $75. During the summer the Fossil Museum is open five days per week, but during the school year it is open only two days per week.

Although the front desk forms the visual focus of the gift shop, it is only part of a colorful and active room. Like the entire Fossil Museum, the concrete floors of the gift shop are painted green. Across the room from the front desk, the wall is painted with a brightly-colored mural depicting cartoon-like dinosaurs in pink, orange, green, blue, and purple against a blue and green pastoral scene. Three circular tables of about three feet in diameter rest in front of the wall, each surrounded by a set of three wooden chairs. Each table carries at least one stuffed dinosaur toy about a foot in height, and two of the tables also carry cartoonish wooden models of mammals. The seat of each chair is covered in bright orange vinyl, embossed with the image of a dinosaur. Between two of the tables
rests a 3-foot by 3-foot plastic model of a “baby” Ceratopsian dinosaur (similar to Triceratops, but having only one horn). The entrance to the main exhibit hall is at the right side of this wall.

The gift shop merchandise is arranged on bookshelves and display racks. Books for adults include titles from Henry Morris such as *What is Creation Science?* (H. M. Morris & Parker, 1982), *The Long War Against God* (H. M. Morris, 1989), and *Science, Scripture, and the Young Earth* (H. M. Morris, 1983). Other titles include *Reason in the Balance: The Case Against Naturalism in Science, Law, and Education* (Johnson, 1995), *Darwin’s Black Box* (Behe, 1996), and *Bones of Contention: A Creationist Assessment of Human Fossils* (Lubenow, 2004). For children, there are books about Noah’s ark (e.g. Clanin & Hight, 1996) and numerous creationist books about dinosaurs, including *What Really Happened to the Dinosaurs?* (J. D. Morris, Ham, & Chang, 1990), *God’s Dinosaurs Fun Book* (Snellenberger & Snellenberger, 1993), *Dinosaurs by Design* (Gish, 1992), and *The Amazing Story of Creation: From Science and the Bible* (Gish, Dish, Snellenberger, & Snellenberger, 1996). There are also creationist materials for children about animals other than dinosaurs, such as *Bomby the Bombardier Beetle* (Rue, 1984), *A Trip to the Ocean* (J. D. Morris, 2000), and *The Life and Adventures of Monica Monarch* (Poirier, 1998).

The dinosaur theme is echoed in merchandise such as plastic dinosaur toys, puzzles, and games, Fossil Museum T-shirts bearing the Fossil Museum’s green Tyrannosaurus Rex logo, and a casting of a Tyrannosaurus Rex tooth. Samples of some of these materials hang from the ceiling. Customers can also buy a replica of a cup
embedded in coal, castings of shark’s teeth and shark’s jaws, and numerous toys such as plastic rockets, novelty glasses, and various bracelets and necklaces. A large glass-doored cooler carries canned soda, bottled sports drinks, candy bars, and bottled water labeled with the Fossil Museum’s Tyrannosaurus Rex logo.

A large open doorway leads from the gift shop to the lecture room. Lecture room seating consists of about twenty chairs, mostly green plastic lawn-type chairs, arranged in three arc-shaped rows. At the front of the lecture room is a DVD player and shelves holding various fossils, fossil castings, and other materials used in the introductory lecture to the museum tour. Mounted onto a side wall is a partial casting of a Tyrannosaurus Rex skull, a casting of a Hadrosaurus (duck-bill dinosaur) skull, and a model of a Triceratops head. A banner above the entrance reads “Truth Begs for Scrutiny and Heresy Begs for Tolerance!” Another sign reads “Design is the purposeful arrangement of parts. As the number and quality of the components that fit together to form the system increases, we can be more and more confident of the conclusion of design.” A series of signs lists “4 Questions of Life”: “Who am I,” “Where Did I Come From,” “Where Will I go When I Die,” and “What is my Purpose Here?” A small sign reads “Sci-ence n. [<scire, to know] Systematized knowledge derived from observation, study, etc.” A large poster reads:
<table>
<thead>
<tr>
<th>CREATION MODEL</th>
<th>EVOLUTION MODEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>The creation model includes the scientific evidence and the related inferences suggesting that:</td>
<td>The evolution model includes the scientific evidence and the related inferences suggesting that:</td>
</tr>
<tr>
<td>I. The universe and the solar system were suddenly created</td>
<td>I. The universe and the solar system emerged by natural processes.</td>
</tr>
<tr>
<td>II. Life was suddenly created.</td>
<td>II. Life emerged from nonlife by naturalistic processes.</td>
</tr>
<tr>
<td>III. All present living kinds of animals and plants have remained fixed since creation, other than extinctions, and genetic variation in originally created kinds has only occurred within narrow limits.</td>
<td>III. All present kinds emerged from simpler earlier kinds, so that single-celled organisms evolved into invertebrates, then vertebrates, then amphibians, then reptiles, then mammals, then primates, including man.</td>
</tr>
<tr>
<td>IV. Mutation and natural selection are insufficient to have brought about any emergence of present living kinds from a simple primordial organism.</td>
<td>IV. Mutation and natural selection have brought about the emergence of present complex kinds from a simple primordial organism.</td>
</tr>
<tr>
<td>V. Man and apes have a separate ancestry.</td>
<td>V. Man and apes emerged from a common ancestor.</td>
</tr>
<tr>
<td>VI. The earth’s geologic features appear to have been fashioned largely by rapid, catastrophic processes that affection the earth on a global and regional zscale [sic] (catastrophism).</td>
<td>VI. The earth’s geologic features were fashioned largely by slow, gradual processes, with infrequent catastrophic events restricted to a scale (uniformitarianism).</td>
</tr>
<tr>
<td>VII. The inception of the earth and living kinds may have been relatively recent.</td>
<td>VII. The inception of the earth and then of life must have occurred several billion years ago.¹¹</td>
</tr>
</tbody>
</table>

¹¹ This list appears in an Institute for Creation Research publication (Gish, Bliss, & Bird, 1981).
In one corner of the back wall rests a display resembling a painted wooden craps table, the top surface of which is covered in black fabric and surrounded on all four sides by six-inch walls. Two plastic boxes each hold about 20 “dice,” i.e. wooden toy letter blocks. During the lecture portion of the tour (see below), a patron is invited to roll these dice onto the table to try to produce a particular pattern. The table’s walls are decorated with multi-colored holiday-style lights. An orange rope light leads from the table, up the back wall, and surrounds a black-and-white sign reading “Probability and Complexity.” Still higher on the wall, a larger sign spells “Chance” in red rope lighting. Two pairs of large toy dice hang just above the “Chance” sign.

To the immediate left of the “Chance” game along the back wall is a plastic storage bin labeled “Primordial Soup,” a computer with its side panels removed, and an 18-inch-tall plastic model of the human skeleton. Further to the left of the “Chance” display behind the rows of chairs, a brightly colored motorized model of a bacterial flagellum is mounted in a display case. On the left side of the back wall, a hallway leads to men’s and women’s rooms, an entryway to storage and private office space, and “the party room,” a brightly painted room containing folding tables and chairs, used mostly for birthday parties and science classes. Against one wall of the party room is a 12-foot by 6-foot sandbox. Embedded along the length of the sand box is a model of a dinosaur spine which children can “excavate” during parties.
Fossil Park

From the gift shop, one can enter either of the exhibit hall rooms (described below) or exit the building to the multi-acre Fossil Park. Just outside the exit door to Fossil Park is an eight-foot-tall green-and-brown model of a Sauropod. Beside a “Dinosaur Hunting” sign, wooden posts support bungee-cord water balloon launchers. From the accompanying deck, patrons can launch water balloons toward dinosaur-shaped targets on the lawn at distances of 50, 75, and 100 feet. Beside a sign reading “Measure Your Dino Power,” children use a pulley system to elevate weights to a height of fifteen feet. For preschool children there is a rectangular concrete track with several riding toys, a sand box, a play house labeled “USS Noah,” a swing set, and a slide. Beyond the preschool area, two foot bridges (a flexible suspension bridge and a rigid conventional bridge) cross a creek to an area including a wood and bungee maze. Beside the suspension bridge, a “Swamp Swing” consists of nine six-inch hexagonal blocks suspended from thick ropes. Children can swing from them (standing or sitting) or try to swing from one rope to another.

For older children there is an area labeled “Spinasaurus [sic] Territory” with a cartoon of a dizzy Sauropod dinosaur. Part of this area is on a grassy hillside and part is in a wooded lot. It includes a homemade amusement-park-sized “sky slide,” a full-sized playground swing set and slide, two merry-go-rounds, and a “helicopter swing.” The helicopter swing supports four children at a time on sling seats suspended by chains from a six-foot horizontal steel disk. The disk is mounted to an axle about twelve feet above the ground. A staff member pulls one of the swings (with a child in it) in a circle until
the other three have swung out from the center and revolve about the center post. When the fourth child is released, an effect similar to a coupled pendulum causes the fourth child to swing first higher than the others and then lower than the others. Sometimes one child after another will swing higher than the others.

A “giant swing” is an especially long swing with a launching deck about four feet from the ground. The “Nerve Wracking Ball” is a bowling ball suspended from a rope. Children are instructed to sit perfectly still while a staff member releases the ball near their chin. It swings out and back, and because of friction it stops a few inches short of the child’s chin. A five-foot model of a Triceratops head peeks out from the bushes, and three picnic tables rest in the shadiest part of the wooded lot. Plans are underway to add a putt-putt golf course.

The centerpiece of Fossil Park is the “zip line.” Starting from a deck about thirty feet above the ground, each rider is outfitted with a helmet and a rock-climbing harness. From the harness, a rope connects the rider to a pulley which rides on a steel cable about ten feet above the deck. One park employee stands on the deck, while the other waits with a step ladder near the lower end of the cable. For each rider, the staff runs through a list of safety checks in which the upper staff member calls out “line clear,” “runway clear,” “rider harnessed,” “rider ready,” “gate open,” etc., each echoed by the lower staff member in confirmation. Following the safety checks, the upper staff member instructs the rider to hold onto the rope and step off when ready. Upon stepping from the deck, the pulley sounds like a loud zipper as the patron glides 200 feet along the cable to nearly the far end, then glides about 1/4 of the way back. The lower staff member uses a step ladder
to support the rider while unhooking the rope from the harness, then the rider climbs down the ladder and pulls the rope/pulley back to the deck for the next rider.

The Museum Tour

Classroom Presentation

Except for those who pay the $3 fee to use Fossil Park only, all museum visits (whether for individuals, families, or large groups) begin with a classroom presentation and a guided tour totaling about 45 minutes, after which patrons are typically escorted to Fossil Park but encouraged to re-visit the exhibits at their leisure. Before the tour, museum visitors are seated in the lecture room. The tour begins when a tour guide stands at the front of the lecture room for a twenty-minute presentation. If children are part of the tour, as is usually the case, the tour guide will instruct them to touch only items that have been handed to them.

The guide may begin by explaining that creationists and evolutionists study the same data (fossil evidence) but reach different conclusions because of differing initial assumptions. The guide explains the difference between a fossil and a casting and explains that visitors will see some of each in the course of the tour. The guide typically begins by highlighting the full-scale castings of the Tyrannosaurus and Hadrosaurus skulls and the Triceratops model. Holding a casting of a Tyrannosaurus tooth, the guide notes that the tooth’s root makes up most of the tooth’s bulk, and notes marks in the Hadrosaurus skull which may correspond to carnivore bite marks.
The guide describes and then passes around several fossils and castings, including a 12” cast of a claw from a Megaraptor (a 25-foot-long carnivorous dinosaur), a somewhat smaller cast of a claw from an Allosaurus (a 30-foot-long carnivorous dinosaur), a fossil tooth row from an Edmontosaurus (a duck-billed herbivorous dinosaur formerly known as an Anatotarsasaurus), an approximately 6-inch by 2-inch casting of a Tyrannosaurus brain (cast from the brain case), a fossil Triceratops vertebra, a six-inch-long fossil Trilobite (a marine animal resembling a modern pill bug), an un-fossilized piece of wooly mammoth leg bone, a casting of a dinosaur egg, and a six-inch by three-inch fossil egg from an Oviraptor (a six- to eight-foot-long dinosaur resembling a modern bird). The guide also displays an x-ray image of the egg, taken in search of an embryo. The guide states that the evidence for an embryo is inconclusive. The guide passes around a casting of coprolite (fossilized animal dung), asking people to guess its identity. After it has been passed around the room, the guide will disclose its identity as dinosaur dung and will often tease the children, saying “you touched it!”

The guide explains that because dead things decay quickly or are eaten by scavengers, rapid burial is required for fossilization. However, the guide also explains that contrary to the standard scientific account by which fossilization requires “millions of years,” fossils can form very quickly. The guide passes around a “fossilized teddy bear” as evidence, explaining that it had been “fossilized” in (unspecified) laboratory

\[1\]

Often tour guides will add the humorous but apocryphal tale that two scientists discovered coprolite together and that one named it for the other as a joke. However, coprolite is not named for a person, but its name was derived in the early 1800s from the Greek words for “dung” and “stone” (Simpson & Weiner, 1989).
conditions in only two weeks. The teddy bear is fairly light weight, indicating that it has been coated with a mineral solution that has subsequently hardened rather than permeated with minerals. Sometimes the guide will reinforce the “rapid fossilization” point by displaying a small poster of a “fossilized” human leg encased in a boot that was manufactured in the 20th century (Hovind, 2005b, seminar 1, slide 524). The guide explains that most of the fossil record probably formed during Noah’s Flood. Guides often explain that whereas clams typically open when they die, most fossilized clams are closed, indicating rapid burial and providing additional evidence for Noah’s Flood.

Next, the guide holds up an arrowhead and a triangular rock, asking which appears to be designed. The guide asks how one recognizes design (the arrowhead) vs. chance (the triangular rock), then explains that design is recognized by its improbability of occurring naturally and its use for a particular purpose, suggesting that by these criteria the room and the chairs were obviously designed. The guide holds up a string of beads, explaining that it represents an amino acid chain, and rhetorically asks for the likelihood that the beads on the chain could assemble in this order by chance. In order to answer the question, the guide selects a volunteer from the audience to play the “Chance” game. The guide hands the volunteer a small plastic pail holding 17 toy blocks with letters on

13 Occasionally a guide will state that this teddy bear was mineralized at a waterfall in the Czech Republic. An article in *Creation Ex Nihilo* describes a waterfall near York, England under which small teddy bears and other objects are hung (White, 2002). Because of the water’s high mineral content, they become encased in stone in as little as three months. Although these objects are merely coated with minerals, the author describes them as “petrified.”
14 The original human leg/boot combination, known as the “Limestone Cowboy,” is housed at Baugh’s Creation Evidences Museum in Glen Rose, Texas.
the sides. The guide also holds up a paper strip depicting the 17 letters on the blocks and asks whether the volunteer can roll the blocks to produce the letters in this order. The volunteer tries and fails. The guide may offer another roll, and then rhetorically asks how many rolls would be required. The guide answers that the probability is only one in 355 trillion that chance alone could produce the 17 letters in this order,\(^\text{15}\) but the chance becomes very good if an intelligent person places them in the required order. Returning to the string of beads, the guide points out that the chance of an amino acid forming by chance is even slimmer, so intelligence, i. e. God, must have been involved. The guide steps to a large motorized model of a bacterial flagellum, suggesting that in the same way, such a complex organelle could not have come about by chance, i. e. it must have been designed rather than evolved. The guide plays a 3-minute portion of the *Unlocking the Mystery of Life* DVD (Meyer & Allen, 2002) illustrating the process of protein synthesis within a living cell. The guide reinforces the point that such a process could not have developed by chance, but must have been designed.

If there are children in the audience (and there nearly always are) and the weather is warm and dry, the guide distributes paper airplane templates on 5.5” by 8.5” pieces of paper and asks whether paper can fly. The guide asks a few volunteers to try to make their pieces of paper fly, and their papers flutter to the floor. The guide explains that intelligent design is needed to make paper fly. The guide leads the audience through the steps of folding the paper airplane, then adds a “stabilization device” (a staple), a “launching hook” (a paper clip), and a “bonding strip” (plastic tape). The guide

\(^{15}\)The number of possible permutations of 17 unique blocks is \(17! = 3.56 \times 10^{14}\).
admonishes the audience not to use the plane indoors but to save the paper airplane for outdoor use after the tour.

*The Exhibit Hall*

At this point the classroom presentation ends and the exhibit tour begins. The exhibit hall consists of white book cases arranged as display cases, illuminated with overhead track lighting and resting on the green concrete floor. The display cases mostly hold fossils, castings, or 8.5-inch by 11-inch posters glued to stiff foam-board backing. Most of the posters are either resting loosely on the shelves or connected to the display with Velcro strips so that tour guides and visitors can pick them up. Most of the display cases are open so the tour guides and/or visitors can handle the exhibited objects, but clear acrylic sheets restrict access to about one fourth of the display cases.

Upon entering the exhibit hall, the guide stops at a display labeled “Young Earth Evidence from Archaeology.” The guide passes around several casts of “Ica burial stones,” smooth 6-inch carved river stones said to be retrieved from South American grave sites.\(^{16}\) The casts depict dinosaurs and/or humans, indicating that humans and dinosaurs lived simultaneously. The guide notes the rosette patterns on some of the dinosaur images, then produces a casting of “fossilized dinosaur skin.” The guide points out that the rosette patterns on the dinosaur images match the scaly pattern of the fossilized dinosaur skin, indicating that the stone carvers must have actually seen the dinosaurs.

\(^{16}\) See Appendix B for an analysis of this and many other Fossil Museum exhibits.
The guide reinforces the idea of human/dinosaur cohabitation with photographs of clay figurines said to be retrieved from grave sites near Acambaro, Mexico. The guide explains that the lizard-like Acambaro figurines depict dinosaurs, including “dermal spikes” (skin surface features) which were unknown to science until recently. The guide concludes that the artists must have actually seen the dinosaurs, reasoning that they couldn’t be modern fakes because they were produced before the discovery that dinosaurs had dermal spikes. The guide also calls the patrons’ attention to photographs of several Native American petroglyphs depicting creatures which resemble dinosaurs. The guide cites these as evidence that the artists experienced first-hand encounters with dinosaurs.

Next, the guide refers the visitors to a casting of a flat skull approximately 20 inches long and 12 inches across. The skull is mounted to the wall at the front of a six-foot-long drawing of an alligator-like skeleton. After asking for guesses about what this animal might have been, the guide explains that it is the skull of a giant salamander. The guide explains that because of different atmospheric conditions in the past, animals like salamanders were able to grow much larger.17

The tour guide stops briefly at a display of crystalline mineral formations and highlights the display’s caption: “non-living chemicals make beautiful things, not living things.” The tour guide picks up the theme of past gigantism at a display reading “The fossil record shows things were bigger and have remained the same or become extinct.

No intermediaries.” The guide shows physical evidence of gigantic creatures from the past, including a jaw bone and teeth from a wooly mammoth and a casting of a mammoth tusk. The guide refers to a variety of posters in the display describing evidence from the fossil record of giant clams, a beaver eight feet tall, a dragonfly having a 50-inch wingspan, 60-foot-tall cattails, 18-inch cockroaches, and an Elk whose antlers spanned 12 feet (these are reproductions of Hovind, 2005b, seminar 2b, slides 121, 125, 126, 131, 135, 142, 156, 157). The guide notes again that this gigantism was caused by the different atmospheric conditions of the past.

At this point the guide often highlights a single casting of three fossilized trilobites. Two of the trilobites are entirely on the surface of the substrate, while only about half of the anterior of a third is showing. The guide explains that they were likely buried in Noah’s Flood, but that only one of the trilobites saw the coming flood and tried to hide in the mud.

Next, the guide highlights several arguments that the earth is young. The guide explains that judging from the present rate at which the earth’s rotation is slowing, tens of thousands of years ago the earth would have been spinning too fast for life to have existed on its surface. The guide explains that the earth’s magnetic field is getting weaker at such rate that the earth could not be more than 25,000 years old. The guide explains that since helium enters the atmosphere at a known rate and leaves the atmosphere at a smaller rate, atmospheric helium would reach its present levels in only 2 million years. The guide explains that if the earth were billions of years old, there would be much more helium in the atmosphere.
The guide notes that since some planets rotate in the opposite direction to the others, the nebular hypothesis (of solar system formation) violates the principle of conservation of angular momentum. The guide explains that Jupiter is cooling too fast to be billions of years old. The guide notes that Sirius was observed to be red thousands of years ago, but now it is white. Therefore scientists are wrong about the astronomical time scale, by which it would take “billions of years” for a red giant to become a white dwarf. The guide explains that the moon recedes from the earth at such a rate that the moon would have been touching the earth’s surface less than 4 1/2 billion years ago. The guide explains that after 4 1/2 billion years, a layer of dust should have developed on the moon which would be several miles deep. The guide explains that the Apollo program’s lunar landers were built to accommodate this dust, but NASA was surprised to discover only a thin layer of moon dust.

The guide moves on to a display arguing that dinosaurs were alive until recently (and/or are still alive) and that humans have seen them. The guide describes reported sightings of Sauropod dinosaurs in African jungles, the carcass of a Plesiosaur (a sea-dwelling dinosaur) which was raised by a Japanese fishing boat, and several sightings of the Loch Ness Monster and similar creatures around the world (represented as likely Plesiosaurs). The guide explains that since “dinosaur” is the modern word for “dragon,” the dragon legends are probably based on actual sightings. Therefore the legends of St.

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18 According to the nebular hypothesis, a large rotating cloud of gas and dust condensed to form the solar system. The guides incorrectly claim (see Appendix B) that conservation of angular momentum requires that all of the planets must spin in the same direction.
George slaying a dragon, Beowulf battling a dragon, and Marco Polo’s reports of
domesticated dragons in China are all evidence that humans saw dinosaurs. If dinosaurs
were alive until recently, then the geological time scale is called into question but it
confirms the creationist belief that dinosaurs were passengers on Noah’s ark.

After discussing a display about the local fossils of the area, the guide moves on
to a dramatic display about human traces left in Cretaceous limestone from the Paluxy
River near Glen Rose, Texas. These include castings of two huge footprints, each about
16 inches in length, a human handprint, and a fossilized human finger. Patrons are
encouraged to touch these castings, and the tour guide emphasizes that not only animals,
but people also grew larger and lived longer under the different atmospheric conditions
preceding the Flood. Sometimes the guide will mention biblical references to giants
(Genesis 6:4 and Numbers 13:31-33), and sometimes the guide will mention that
professional basketball player Shaquille O’Neal’s foot is about the same size as these
giant footprints. The guide explains that since the middle finger of the hand print curls
slightly toward the palm, the hand print could not have been carved. The guide identifies
the finger as being female. All of this reinforces the idea that dinosaurs and humans lived
at the same time.

Next the tour guide may discuss “out-of-place artifacts” such as a gold necklace
which was found embedded in coal or display a casting of an iron cup which was found
embedded in coal. (I am pleased to report that I never heard a tour guide mention that
castings of the iron cup in coal are available for sale in the gift shop.) The guide asks
rhetorically how such objects could be found in coal if the coal were millions of years
old. Even more dramatically, the guide discusses the Fossil Museum’s casting of the “London Hammer,” a hammer partly embedded in supposedly multi-million-year-old stone. Like the artifacts embedded in coal, the guide explains that a human artifact embedded in stone disproves the geological time scale. The guide also explains that the hammer’s metallurgy is such that it could not have been forged under present-day atmospheric conditions, but it could have been forged under the atmospheric conditions that prevailed before the Flood. Furthermore, the guide explains that the hammer is coated with an unusual layer of iron oxide, and a file mark made in the hammer decades ago has not rusted at all. Therefore in addition to disproving the standard geological time scale, the London Hammer’s chemical content serves as evidence for the different atmospheric conditions before the Flood and the superior metallurgical knowledge of antediluvian cultures.

**Opening the Doors of Truth**

The second room of exhibits, entitled “Opening the Doors of Truth,” primarily covers the first eleven chapters of Genesis (creation, fall, and Noah’s flood). Here most of the displays consist of three-foot by four-foot posters/panels mounted onto doors. Hinges connect the doors to one another in groups of two or three. Hardware fastens the doors to the floor and stabilizing chains connect them to the ceiling. A trail of giant human footprints is painted onto the green floor in yellow and pale green. The footprint trail guides the visitors through the maze of doors.
Whereas the classroom presentation lasts about 20 minutes and the exhibit tour lasts about 15 minutes, the tour of Opening the Doors of Truth is only about seven minutes long. At the first set of panels, entitled “Is the Bible Reliable,” the tour guide mentions that thousands of biblical manuscripts are known to exist and that historical evidence confirms the bible’s accuracy. At a set of three panels/doors entitled “Day 1,” the guide mentions that God created the heavens and the earth on Day 1. At the “Day 2” exhibit, the guide describes the theory that a “vapor canopy” surrounded the earth before the Flood. The guide explains that like a fiber optic network, the canopy would have transmitted light around the world so that even at night the sky would have had a pinkish glow. The guide explains that the vapor canopy would have filtered out harmful ultraviolet light, caused atmospheric pressure to be higher, and elevated the proportions of oxygen and carbon dioxide in the air. Moving to a door labeled “The atmosphere was different before the flood,” the guide displays a piece of amber and explains that bubbles in the amber trap ancient air. The guide explains that analysis of this air reveals the ancient atmosphere to have been about 35% oxygen.

The guide explains that under the canopy, the filtration of ultraviolet light, the elevated atmospheric pressure, and the elevated oxygen and carbon dioxide levels enabled plants, animals, and humans to live longer and grow larger. Referring to the exhibit, the guide describes a Japanese scientist who filtered ultraviolet light and elevated carbon dioxide and oxygen levels while growing a tomato plant. The guide explains that

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19 On many tours, the guides imply that the elevated atmospheric pressure caused the elevated oxygen content. For example, one guide stated: “It [the vapor canopy] also pressured in a lot more oxygen . . . Back then it was 35%” (tour A188).
the plant reached a height of 16 feet and produced ten thousand tomatoes. The guide also explains that under these special atmospheric conditions a person could run 200 miles without getting tired and that this explains why some large dinosaurs could survive despite having small (horse-sized) nostrils or lungs. The guide explains that under these conditions a cut would heal over night, which is why some hospitals use hyperbaric chambers to speed healing.

The guide moves very quickly from this point forward, voicing just one sentence at many exhibits. While walking past the exhibits, the guide mentions that God created the dry land and the plants on Day 3, the sun, moon, and stars on Day 4, the birds and fishes on Day 5, and the land animals and Adam and Eve on Day 6. At the Day 7 exhibit, the guide pauses to explain that on Day 7 God rested and that this is the origin of the 7-day week. The guide reports that all nations throughout the world have always used the 7-day week. The guide adds that when a ten-day week was attempted in the French Revolution and the Russian Revolution, it failed in both cases and the 7-day week was re-instituted, indicating that the 7-day week is “ideal” or “natural” for humanity.

At an exhibit entitled “The Fall of Man,” the guide explains that Adam’s sin caused death to enter the world and that this lead to Noah’s Flood and the collapse of the water canopy. The Noah’s Flood exhibit includes a six-foot-long model of Noah’s Ark with plastic animals (including dinosaurs) on the decks. To lend a sense of scale, a model of a railroad stock car rests on top of the Ark. The guide explains that since Noah’s Ark was 1 1/2 football field lengths long and its volume was equivalent to hundreds of railroad stock cars, it could easily accommodate all of the animals, feed, and supplies
needed to last for a year. The guide also notes that over 200 traditional flood stories confirm Noah’s Flood.

After a brief mention of the restoration of the water canopy after the Second Coming of Christ, the tour ends. The guide escorts the visitors into Fossil Park to fly the airplanes. Using the paper clips attached to the planes, they are launched from rubber bands stretched between vertical posts. With practice patrons can fly them to distances of up to 200 feet. Afterward the guide reminds visitors that they are free to tour the exhibits on their own, but visitors typically enjoy Fossil Park first. Few visitors return to the exhibits afterward.

Fossil Museum Staff

The Fossil Museum founder, pseudonym Art, is a middle-aged businessman who taught middle-school science for a short time. For several years before founding the Fossil Museum, Art collected specimens and delivered young-earth creationist speeches at local churches and community groups. Art is an extraordinarily friendly man with an easy smile and a ready laugh.

The Fossil Museum director and only full-time employee, pseudonym Ben, is in his early twenties. Ben is from a large family and was home schooled through grade 12. He plans to attend college and major in either geology or business while working full time at the Fossil Museum. His duties include managing day-to-day Museum operations, conducting tours, operating Fossil Park, and presenting creationism seminars at local
churches and community groups. Ben is formally responsible for design and revision of exhibits, but he defers to Art in this regard.

Claire is the Fossil Museum’s education director. She is in her early twenties and a full-time student earning a degree in education. Claire works full time during the summer, organizing and conducting day camps, conducting tours, operating Fossil Park, and operating the gift shop. During the school year she works on weekends conducting tours and teaching monthly Saturday science classes for children of ages 5-10.

Diana is the Fossil Museum’s education specialist. She is in her mid-forties, holds a bachelor’s degree in biology, and has extensive experience with home-school education. She teaches high school science courses for home school students which meet weekly at the Fossil Museum and at a local church. She also conducts monthly Friday science classes for children in grades 5-8, guides tours, and assists with the summer camps.

Besides Ellen, a woman in her early twenties who does administrative work for the Museum, the rest of the Museum staff are in their late teens and conduct tours, operate Fossil Park, operate the gift shop, assist with summer camps, and clean the museum. These include Francis, Graham, Hazel, Jay, and about five others who are not named in this study.
Science at the Fossil Museum

*Respect for Science*

The Fossil Museum staff may disagree with mainstream science, but they maintain considerable respect and esteem for science. As mentioned above, Art was once a middle-school science teacher and Diana holds a bachelors’ degree in biology. Hazel, an eighteen-year-old summer staffer whose entire education was through home schooling, has begun study at an accredited Christian college where she plans to study archaeology and then pursue graduate studies in archaeology. Ben talks of earning a geology degree at a public university and then studying paleontology on the graduate level. All of this indicates respect for science, albeit with an eye toward its correction and reformation.

*The Creek Study*

The Fossil Museum’s respect for science is clearly seen in the Creek Study, an effort to monitor the creek which traverses Fossil Park for pH, dissolved oxygen, temperature, and flora and fauna. In a preface to a Saturday lecture a few months after the Fossil Museum opened, Art announced that the Fossil Park would apply for a grant to provide some of the necessary equipment. Art explained:

“We are doing science. And one of the things, I had the opportunity to listen to [a scientist] this past week, who is absolutely against the Intelligent Design movement. Considers it to be illegitimate . . . . The point that he was making is that his concern is: where’s the science? OK, and I think it’s a valid concern. And I made the comment to Ben. I said I do [a non-science business] for a living, and I’m a professional. And the nature of whether or not I know what I’m doing is to some extent measured by the loyalty of clients that I maintain. OK? However, if someone who’s not in the . . . business comes to me and challenges me and says, ‘You know, you don’t know anything about what you’re doing,’ you
Art recognized the concern of the local scientist, and he indicated that in order to legitimate its commitment to science, the Fossil Museum must collect data and do science, however modest the effort may be. The following spring Fossil Museum staff began taking and recording measurements every week, inviting local students to participate. Eventually they incorporated this activity into their monthly science classes for children in grades 5-8 (see below). Working under the guidance of three board members with biological training, they began to record air and water temperatures. In order to gauge the amount of dissolved oxygen in the creek, they began to collect plant and invertebrate samples from the creek, noting that some species can survive only in an oxygen-rich environment, while others can survive in oxygen-poor environments. However, these collections became irregular through the busy summer months at the Fossil Center.

The following fall, the Fossil Museum hired Diana to expand the Fossil Museum’s educational program. Since Diana holds a bachelor’s degree in biology and is an experienced educator, she assumed the Creek Study as part of her duties and has been running it since then. She expanded the weekly Friday survey to include measurements of pH and turbidity\textsuperscript{20} in addition to temperature measurements and surveys of flora and fauna. Diana explained to me that in Art and Ben’s unsubmitted grant application for

\textsuperscript{20} Turbidity is a measurement of suspended solids in water.
electronic monitoring equipment, they planned to conduct the study “according to Environmental Protection Agency (EPA) regulations.” However, Diana explained that EPA water quality monitoring standards are purpose-specific and that amateurs are not qualified to conduct the most rigorous, legally defensible studies. Consequently Diana conducts the Creek Study mostly for its educational rather than scientific value. At present, the collected data remains in a notebook in “raw” form as field notes, but Diana hopes that eventually a student will take an interest in tabulating and graphing the data.

Monthly Science Classes

Diana conducts the museum’s on-site and off-site biology courses for home-schooled students. These courses run the entire school year and meet weekly in two-hour sessions. In addition, Diana and Claire run an informal monthly science class, advertised as a club, for children of grades 5-8. Unlike the formal biology course, the monthly classes are available on a walk-in basis. About a dozen students, mostly home-schooled, attend these two-hour sessions. The creationist themes of a young earth and anti-evolution are assumed, but rarely surface in these thoroughly planned, content-rich classes. For example, a class about thunderstorms and tornados included information on how to recognize the cloud formations characteristic of the most dangerous storms. Diana encourages each student to keep a science notebook, and she distributed photos printed from the internet for each student to tape into his or her notebook. As a trained “sky-warn” spotter for the National Oceanic and Atmospheric Organization, Diana described techniques for estimating wind speeds, passed along information about self-protection from dangerous storms, and played video excerpts from documentaries about
dangerous thunderstorms. Claire typically organizes a craft for each class. In this instance, Claire helped the students to construct “tornado tubes” out of used water bottles.

Other “club” sessions are equally rich in content and experience. In a class about birds, students examined a dissected pigeon and various eggshells including an Ostrich shell. Afterward they listened to recorded bird calls and then spent time identifying the birds in Fossil Park by their calls. In a session devoted to invertebrates, students observed and gathered samples from all over Fossil Park and the creek, making drawings, taking measurements, studying specimens under a microscope, and attempting to identify them from Diana’s ever-present field guides. A student captured a female preying mantis which, we later learned, mated with and consumed a male preying mantis in Diana’s terrarium. In an engaging class on insect collecting, one of Diana’s former home-school students (now in the 12th grade) brought in a magnificent collection of mounted moths and butterflies, and together the class practiced proper mounting and display techniques, starting with Japanese beetles and then advancing to large beetles and a cicada.

Throughout this class, Diana emphasized that the difference between “collectors” and “scientists” is that the latter maintain thorough records and carefully classify specimens for further study. On the Saturday following each of the monthly science classes, Claire offers a shorter (one-hour) version for students aged 5-10, adjusting the content and activities to accommodate the younger students.

Summer Camp

The museum’s respect for and interest in science was also visible in the summer camp program. The Fossil Museum offered five week-long day camps consisting of four
half-days for younger students (ages 5-12) and one week-long camp for students over 13 years of age. The camps were dinosaur themed. One of the highlights was a one-hour presentation by a local reptile enthusiast who displayed and described several live specimens for the children to see and touch. Another highlight was a “fossil dig,” in which the children “mapped” and “excavated” a site in Fossil Park which had been seeded with fossils, castings, and other items for the students to discover. The site was staked and strung to simulate standard paleontological practice, and tripods supported two screens for sifting the soil. Diana asked students to map the area first, which they did, and asked them to record the locations and positions of their finds, which they did not. She encouraged them with scientist-honoring comments such as “It’s a dirty job being a scientist. But the nice thing about summer camp is you can try things to decide whether you want to be a scientist when you grow up” and “If you were a scientist, you might dig all day. And you have to stop and measure and then dig some more.” As the students left for the day, students were allowed to choose a marine fossil to take home.

With its “dinosaur” focus, creationist themes were more prominent in the summer camp than in the monthly science classes. The staff attributed the fossil record to the Genesis Flood. Based on Biblical references to fire-breathing creatures (e.g. Job 41:18-21), Ben suggested that one or more species of dinosaur may have been able to breathe fire. In one of the camps, Ben attributed the early misidentification of a dinosaur to mistaken “evolutionary assumptions.” Nonetheless, some entire camp days pass without the mention of any creationist theme or even of God. In fact contrary to what would be
expected in a Vacation Bible School, neither the summer camps nor the monthly science classes open with prayer.

Monthly Lectures

Each month the Museum hosts a one-hour lecture for adults, generally on a creationist theme. Topics include flood geology, radioisotope dating, arguments that humans and dinosaurs lived at the same time, the nature of biological “kinds,” the concept of race, etc. Art or Ben present about half of the lectures. Visiting speakers, sometimes from other states, present the rest. So far two of the speakers have not been creationists. Both spoke on environmental issues, and one even presented a brief defense of the standard geological timeline. Although Ben and Art are well aware that I am not a creationist, they invited me to speak about my analysis of the Fossil Museum exhibits (Appendix B) even though they knew that my analysis would not be flattering. I declined in order to preserve the Fossil Museum’s anonymity.

I attended 17 lectures, in which audience attendance ranged from 4 to 41 with a median of 8. In one case I was the only audience member until the speaker’s family arrived about 10 minutes into the talk. No minors attended 6 of the lectures, and in the largest audience, 11 of the 41 audience members were minors. In most lectures, the audience included at least one Fossil Museum staff member.

Daily Routine

The Fossil Museum’s enthusiasm and respect for science are also apparent in the daily life of the Museum. On several occasions, Diana excitedly sought me or the museum staff to share an interesting find. On one occasion she showed me a water
boatman (an aquatic insect) because she knew I had never seen one. On another occasion she found a hydra as part of the Creek Study and encouraged me and Fossil Museum staff to view it through the microscope. In both cases her enthusiasm for discovery were obvious and infectious.

Some members of the general public also demonstrate an enthusiasm for science. One day a family of five (including a mother, a father, and three children between the approximate ages of eight and twelve) brought in a collection of fossils to donate to the museum. The man explained that he took the family to three different sites specifically to collect them. They included several large slabs of rock impressed with what appeared to be fossil matrices of tree branches. However, the man expressed the opinion that they were bones, and Ben and the man examined and discussed them for about a half hour. Ben said that they could be bones, but that they were more likely branches. Ben used a rock-hammer and a chisel to separate layers on two of the slabs to expose more fossils. After the family left, Ben explained that donors occasionally arrive with boxes of fossils. He said that since the collection sites are unknown and the species are common, the fossils have little scientific value and Fossil Museum staff generally distribute them to summer campers.

Exhibits

Yet for all of their interest in science and their desire to spread this interest to the general public, several of the Fossil Museum’s exhibits/arguments are founded upon specious evidence or elementary scientific errors. (See Appendix B for examples.) The
worst of these erroneous exhibits/arguments trace to a few particularly unreliable creationists. Many of these errors are obvious to a scientifically trained observer or revealed by a modest amount of research, and leading young-earth creationists have explicitly rejected at least twelve of the Fossil Museum’s exhibits/arguments (see Table 2 in Appendix B).

Occasionally Fossil Museum staff members express misgivings about the exhibits. During a tour Hazel pointed to the “Living Dinosaurs” display and said “Now most of these pictures are hoaxes.” On another occasion I asked Claire why a photograph in the “Living dinosaurs” exhibit had been covered with paper. Claire replied: “It’s been pretty much shown to be a hoax.” Ben expresses broader misgivings. For example, on one occasion Ben told me that the Fossil Museum exhibits are not on an adult level: “This [the Fossil Museum] is for eighth grade and below. I stand behind it all, but it’s not real science. The real science is at events like [creationism conferences].”

Yet in addition to expressing misgivings about the level of the Museum’s arguments, at various times Ben also expressed worry over their accuracy. For example, Ben has spent time with Carl Baugh, a key source for Fossil Museum material, and he is reluctant to criticize him. Nonetheless, Ben described some of Baugh’s ideas as “out there,” and lamented the fact that since Baugh does not publish many of his claims, there is no way to check them for accuracy. Ben recounted reading a publication in which Baugh listed several “facts,” many of which Ben believes to be untrue. Ben said that he believes that Answers in Genesis distrusts Baugh to such a degree that they will not publicize any of his claims unless they have checked them out first-hand. On one
occasion, Ben raised Baugh’s claim that when poisonous snakes are raised in hyperbaric conditions, the venom becomes non-poisonous. Although Museum tour guides occasionally repeat this claim, Ben expressed skepticism, noting that a scientifically trained person told him that snake venom is a protein whose synthesis should be independent of atmospheric pressure.

In the broadest criticism of the Museum that I witnessed on the part of a staff member, Ben told me on another occasion that had he designed the Museum, he would have excluded some of its arguments. Without naming specific exhibits, Ben said that the Museum’s weakest exhibits are also the easiest to understand, and he expressed doubt about whether more sophisticated and complicated young-earth arguments could be presented understandably. Yet Ben also noted with some anger that he had visited a mainstream museum of natural history which displayed a misleading description of horse evolution, despite the fact that mainstream scientists had discredited this description long ago. But Ben also noted that sloppiness in a mainstream museum is no excuse for Fossil Museum sloppiness, and he said that Christians should “hold to a higher standard.” On other occasions Ben and I discussed my progress in analyzing the exhibits. On two of these occasions, Ben said that he wished he had the time to perform such an analysis himself and that he was anxious to read my conclusions (Appendix B). Although Ben did not single out examples, it is clear that Ben is uneasy about some of the exhibits. Ben

\[21\] For example, see Baugh (1996), vol. 2, 1:08:50 – 1:13:30.

\[22\] For a history of misleading accounts of horse evolution, see Gould (1987). See below for Ben’s comments in the Fossil Museum newsletter.
may “stand behind it all,” but apparently he stands behind some of the exhibits more out of loyalty than conviction.

_Scientists_

Occasionally a guest lecturer at the Fossil Museum accuses mainstream scientists of foolishness or even deception. For example, a guest lecturer who holds an advanced degree in science, pseudonym Dr. Smith, asserted that in public debate evolutionists tend to obfuscate material rather than clarify the issues:

“We have a great advantage in audiences, we can just say it. And, if you’re defending a lie, you usually do cloud it up with big-sounding words that make you sound smart, and only give the illusion that you’re smart. Maybe you’re foolin’ yourself, maybe it’s an instinct, maybe you’re not even doin’ it on purpose.” (L13)

Here Dr. Smith stated that scientists use technical jargon in order to make a “lie” more credible. Yet Smith did not accuse the scientists of consciously lying. Earlier in the lecture, Dr. Smith ascribed the lie to the supernatural:

“And actually, I believe personally that one reason why every, a lot of people believe in evolution is that there is a dark spiritual force that is perpetuating this, this belief in people who are otherwise intelligent. OK, that’s, and I think you need to pray against that when you are trying to talk to someone about evolution. This is a spiritual thing. This is my personal theory on it. This is my theory. I’m now telling you my theory. That there’s a spiritual thing that takes a miracle to get unplugged from the evo-matrix, OK? Facts don’t matter. Data doesn’t matter. Evidence doesn’t matter. Fossils don’t matter. Neither data nor logic can change it or our value. Only faith in evolution seems to matter. Over and over and over again we see it. So are Darwinists playing a game? Are they mean liars? Nope. Game is playing them. A game is playing them. Big thing to realize when you are talking to someone. When you are debating with someone, they don’t see it. They’re not mean, they’re not stupid. But they don’t see it.” (L13)
Dr. Smith suggested that mainstream scientists perpetuate a lie, but the liar is not the scientist, but rather the liar is a “dark spiritual force.” Therefore the scientists are victims as well as perpetrators of this “lie.” Even so, Dr. Smith held the scientists responsible:

“Again, this is not wanting to know. This is not a case of not being capable of understanding. It’s a case of not wanting to know. If you want a Biblical reference, ‘they are willingly ignorant,’ says Second Peter.23 Willingly ignorant. Another epistle, I forget, I think it’s Titus says, ‘Ever learning and never able to come to the knowledge of the truth.’24 They are, in Romans one it says, without excuse because the visible things testify of the invisible creator.25 So this is a mental block. Hey, if someone’s wrong, and they’re so sure they’re right, there is a mental block.” (L13)

Dr. Smith described mainstream scientists as being hampered by a mental block, but it is a mental block that they have chosen. Therefore under Dr. Smiths’ description, evolutionary scientists are both deceived and deceivers.

By contrast, Art and the Fossil Museum staff are nearly always respectful of mainstream scientists. Far from repeating Dr. Smith’s rhetoric of deception, they attribute their disagreements with mainstream scientists to differing worldviews and assumptions, questioning the conclusions of mainstream scientists rather than their motives. In my presence, only Ben expressed a stridency toward mainstream scientists that approached Dr. Smith’s, and only occasionally. In an issue of the Fossil Museum newsletter, Ben described his discovery of an inaccurate horse evolution exhibit at a mainstream museum. (See Gould (1987) for a description of common misrepresentations

23 “For this they are willingly ignorant of, that by the word of God the heavens were of old, and the earth standing out of the water and in the water” II Peter 3:5 (KJV).
24 II Timothy 3:7 (KJV)
25 “For the invisible things of him from the creation of the world are clearly seen, being understood by the things that are made, even his eternal power and Godhead; so that they are without excuse” Romans 1:20 (KJV).
of horse evolution.) Ben described the exhibit as “fallacious,” a “hoax,” and a “lie.” In another instance, during part of a public lecture on flood geology, Ben briefly criticized radiocarbon dating. While doing so, he read a quote taken from scientific literature: “‘If a C 14 date supports our theories, we put it in the main text. If it does not entirely contradict them, we put it in the foot-note, and if it is completely “out of date,” we just drop it.’”26 That’s kind of the, how these carb, these dates are derived.” (L6) Here Ben implied that by their own admission, mainstream scientists are dishonest with respect to radiocarbon dating. These criticisms are sharp, but they are also rare at the Fossil Museum. These are the only instances I encountered in which Fossil Museum staff publicly impugned the integrity of scientists.

In one instance Ben privately accused scientists of dishonesty. Zebediah (pseudonym) is a local creationist who is not affiliated with the museum but who has spoken in the monthly lecture series. Unlike Fossil Museum staff, Zebediah regularly accuses mainstream scientists of foolishness and/or dishonesty. One day Zebediah stopped by the Fossil Museum and struck up a conversation with me. He recommended a book in the Museum gift shop for its allegations of mainstream scientists’ obfuscations and lies in defense of evolution and earth antiquity. As I answered that such accusations tend to diminish rather than enhance the author’s credibility, Ben joined the conversation.

26 Säve-Söderbergh and Olsson reported American archaeologist J. O. Brew’s tongue-in-cheek statement in order to illustrate the doubt with which archaeologists regarded the nascent techniques of radiocarbon dating in the 1960s (Säve-Söderbergh & Olsson, 1970, p. 35). Although Säve-Söderbergh and Olsson were criticizing archaeologists’ mistrust of radiocarbon dating rather than radiocarbon dating per se, the quote is widely used in creationist circles to cast doubt on radiocarbon dating or the integrity of scientists (e.g. "How long have Aborigines lived in Australia?" 1993).
Ben described an allegation that a famous scientist intentionally misrepresented orangutan remains as if they were hominid remains in order to retain his research grant. In response to my skeptical reaction, Ben said, “So you’re saying that anyone who accuses someone of being a liar is a liar?” I replied that this is not true, but I suggested that a deceitful person is more likely to suspect others of deception. I suggested that the Fossil Museum staff trusts me to fairly represent the Museum because they are fair people. At this point Diana joined the conversation, asking “Who is saying that we trust you,” to which we all laughed. Zebediah replied that it is not a matter of trust, but that the Museum is “under God’s protection.” Therefore for Ben, Zebediah, and Diana, neither mainstream scientists nor my integrity as a researcher were above question.

With these exceptions, the Fossil Museum staff did not question the integrity of mainstream scientists in the day-to-day operations of the facility, adopting an attitude of respectful disagreement rather than antagonism. Ben’s comments were notable but unusual counterexamples. Of course the Fossil Museum staff may have avoided making such comments in my presence because I was open about my acceptance of biological evolution and the standard geological time scale, but certainly in my presence, such statements were very rare.

27 A week later I reminded Diana of her question. She said that although she was kidding, there was some truth to her question. Diana said that she hates it when evolutionists misleadingly and unfairly quote creationists, and I agreed that I abhor misleading quotations on the part of evolutionists as well as creationists.
Declinism

Decline and Death

A declinist ethos is observable throughout the Fossil Museum. This ethos results in part from the Fossil Museum’s association of evolution with progress, but it also results from the belief that Adam’s sin introduced death and degradation into the world, and that this process of degradation will continue until the Second Coming. An “Opening the Doors of Truth” display entitled “The Fall of Man” reads in part:

Adam’s disobedience to God’s Word broke his fellowship with God, resulting in the divine “Curse” of decay and death on all his dominion, including even the “ground,” the elements out of which all things were made. There was no death in the world before Adam’s sin brought it into the world.

Therefore since the day of Adam’s sin, life on earth has been characterized by death and degradation. Furthermore, following creationists such as Whitcomb and Morris (see Chapter 2), the same display attributes the Second Law of Thermodynamics to Adam’s sin: “The universal Second Laws [sic] is the scientific reflection of God’s curse on His created world because of sin . . . This tendency directly precludes any natural evolution toward higher order.”

Therefore Adam’s sin affected both the living and non-living worlds, subjecting both to death and degradation. In such a world, progressive evolution is out of the question.

On one hand, Fossil Museum staff and speakers credit God for the beauty, order, and complexity of the natural world. On the other hand, Fossil Museum staff and speakers attribute instances of suffering or disorder in the natural world to this ongoing

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28 See Appendix B for a discussion and critique of the attribution of the Second Law to the Fall.
process of degradation. This tension can be seen in Ben’s lecture on the Fibonacci sequence, which only I and four members of Ben’s family attended. Ben argued that the Fibonacci sequence appears in nature in a variety of phenomena, including flower pedals, leaf growth patterns, ram horns, and pine cone growth, and he argued that this is evidence for harmony and balance in the created order. He also argued that the height and width of Noah’s Ark was a ratio of two Fibonacci numbers. Ben presented all of this as evidence for a wise and benevolent creator. However, Ben attributed significant deviations from Fibonacci numbers to death and decay resulting from the Fall. For example, Ben suggested that the proportions of an attractive human nose might be Fibonaccian. This prompted Ben’s mother to ask:

Ben’s Mom: “How do you explain the aberrations from that way. You know the things that don’t, that might be what might be considered a deformity or”

Ben: “How do you explain that then?

Ben’s Mom: “Mm hm. Is that because of the Fall, because with all this Fall . . . (?) . . .

Ben: “Well, I would, well, yea, I would say it’s not the, it’s not the normal.

Ben’s Mom: “Right.”

Ben: “It goes against the norm. It’s a loss of information or of genetics, basically. It’s degradation from the original state. Just like different birth defects or something like that.”

Ben’s Mom: “Right. Because that’s what the Fall’s about.” (L12 43:00-44:00).

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29 In the Fibonacci sequence, each number is the sum of the previous two. Starting the sequence with 0 and 1, the sequence becomes 0, 1, 1, 2, 3, 5, 8, 13, 21, . . .
We see that Ben and his mother attribute deviations from the norm, particularly in the extreme case of human deformity, to the Fall. Echoing the language of the Intelligent Design movement (see below), Ben argues that it results from “a loss of information or of genetics” and that it is a “degradation from [the] original state.” By implication, early post-Adamic people were less likely to suffer deformity and were more likely to have noses in Fibonaccian proportions. Therefore a benevolent Creator is responsible for all that is balanced and beautiful in the natural world, while Adam’s sin is responsible for anything that is not.

Ancient Superiority

As a corollary to universal decline and degradation, the Fossil Museum suggests that antediluvian humans were larger, stronger, and intellectually superior to present-day humans. For example, Fossil Museum guides attribute the gigantic size of its human footprint castings to the genetic superiority of antediluvian humanity and to superior environmental conditions before the Flood. Numerous “out-of-place” artifacts are offered first as proof that the geologic column is inaccurate, but second as evidence of ancient people’s exceptional technical knowledge. For example, the “London Hammer” display reads in part: “Tests performed at Battelle Laboratory document the hammer’s unusual metallurgy: 96.6% iron, 2.6% chlorine; and 0.74% sulfur (no carbon). Density tests indicate forging of exceptional quality” (from Baugh, 1999, p. 93). Similarly the “Baghdad Battery” display (see Appendix B) suggests the use of electrical technologies at least 2,000 years ago. Guides explain that Ica burial stones depict skilled surgeries and the use of telescopes in ancient times. All of this is presented as evidence that humans
were as intelligent or more intelligent in the past than they are today. Despite obvious improvements in technology in recent times, humanity has declined to our present state rather than advanced to our present state.

However, Fossil Museum patrons recognize that there is little evidence of advanced technology in ancient times. During a guest lecture on Noah’s Ark, a member of the audience questioned typical assumptions about the technology that would have been available to Noah:

**Audience 1:** “But bein’ as, if you follow Carl Baugh’s teaching that they would have had a greater intelligence back then than we do even today, or more use of what they had, that the possibility that they could have had technology equivalent to today’s with them on that Ark. For instance, electricity or lights, they didn’t need to use primitive things like we, yea, the evolutionists say that man was dumber back then, and so maybe we’ve carried that over to Noah, thinking that he was more cave-like . . .” (L14)

In saying that “evolutionists say that . . . man was dumber back then,” this person appears to have conflated biological evolution with cultural evolution. However, if evidence of progress is evidence of evolution, then it is not surprising that he emphasized the superiority of ancient humans and that he expects that advanced technology would have been available to Noah and his family. The speaker replied that since antediluvian people lived for hundreds of years, time-saving technologies were possible but not desired:

**Speaker:** “When you equate intelligence and technology, they do not equate. When you equate a person who’s gonna live for in excess of 500 years to a person who will live something in excess of 50 years, it doesn’t equate. In other words, if you were gonna live for 960 years, 900 plus years, do you care if it took 5 minutes or 20 minutes? You probably enjoyed your work. If you enjoy wood working, you just get absorbed with the work. With your hands. It
is not a bad thing to be absorbed in your work. It is a bad thing when you put your work first. So from a technology point of view, it was not desired, it wasn’t needed, certain parts of it . . .” (L14)

Here the speaker provided a solution to the scant evidence of advanced technology in ancient times: it simply wasn’t needed. However, later in the conversation Art suggested advanced technical knowledge must have accompanied the Ark because advanced civilizations developed immediately after the Flood:

Art: “Well, it’s interesting because I mean the advance of the civilizations follow, right following the Flood. And the Egyptians and so forth and so on, . . . (?) . . . and all that kind of stuff, is evidence that there was an enormous amount of knowledge that came from the eight survivors of the Flood.” (L14)

After the speaker replied in agreement with Art’s comment, a member of the audience suggested that given the superior intelligence and long lives of ancient people, advanced technology would be inevitable:

Audience 2: “Let’s say, our whole society has invented science as we know it in 400 years, really, give or take, since Newton. And imagine if Newton could have lived 900 years. What could he have done (one audience member laughs)? Or Einstein or Faraday or Maxwell or any of a long list of people? The, we, they accomplished what they did and made amazing strides in a very short period of time. From creation to the Flood was 1600 years. If there were any men with the . . . (?) . . . like then, which I assume to be more then than there are today because our genome is decaying, and they didn’t have that problem, they could have made tremendous advances. The only real advantage we have over them is petroleum, which made the industrial revolution possible. Other than that we wouldn’t have invented steam. But who knows what they had? I mean, the early Miconeans had hot and cold running water. That’s, you know, that’s the time of ancient Egypt.” (L14)

Given their superiority in both time and ability, why shouldn’t antediluvian societies have developed advanced technology? Without disputing the premise that antediluvian
humans were superior and lived longer, the speaker offered two other reasons that such technological advances might not have occurred. First, the speaker suggested that under the idyllic environmental conditions preceding the Flood, such technological advances would have been unnecessary, and second, the speaker suggested that the absence of warfare would have slowed technological advancement:

Speaker: “If you have a perfect environment, where you don’t need heating and air conditioning, your food grows right outside your door,”

Audience 2: “Oh, that’s true too, then your, then your”

Speaker: “you know, why do you need tractors for, to raise things, when you just go outside? And you got to weed it and hoe it so to speak, but it’s, it was an easier environment to do things.”

Audience 2: “Right. But in terms of what they were capable of, they could have done quite a bit more than what we . . . (?) . . .”

Speaker: “If you look at our world today, in weaponry. I’ve worked and been associated with the military . . . And I assure you that most of the development of the history is based on violence . . .” (L14)

In response, Audience 2 conceded that under these idyllic conditions, intellectual superiority could have been manifested in fine craftsmanship rather than technological advance:

Audience 2: “If you look at the bible, it says, was it Zeno was a worker with brass and iron? You don’t just pound iron. You’ve got to burn it into harps and flutes. That doesn’t just grow on trees. So, again, if you’re a harp maker for a hundred or so years, you’re gonna make a great harp.”

Speaker: “Mm hm.”

Audience 2: “And then if your brother’s doin’ iron or your son, just, it’s amazing what we could do in that much time. Lord helpin’ us.”
And again, like you said, if you’re not wastin’ our time on air conditioning and making weapons (audience laughs).”
(L14 )

All of the participants in this conversation agreed that humans were more intelligent in the past, but they responded to the relatively weak archaeological evidence for this superiority in a variety of ways. Art explained that such intelligence can be inferred from the rise of advanced civilizations immediately after the Flood. The speaker suggested that advanced technology was unnecessary because of the long lives, superior environmental conditions, and absence of warfare. Audience 2 eventually conceded that antediluvian intelligence could be exhibited in fine craftsmanship rather than advanced technology. The relative dearth of physical evidence supporting the superiority of ancient humanity was a potential threat to their declinist beliefs. It was a creationist anomaly. Yet through practical reasoning they resolved or deferred this anomaly. As we shall see, this sort of practical resolution of anomalies is a normal part of Fossil Museum practice.

\textit{Devolution}

In the previous section, an audience member mentioned that “our genome is decaying.” During one of the monthly lectures, Zebediah also expressed the idea of human biological devolution, but in far more alarmist terms:

“It’s a shame what’s happening. It’s almost criminal what is happening. Because evolutionary theory is sidetracking scientific research in a big way. I mean they are ignoring the fact that we are genetically devolving. Rapidly, rapidly genetically devolving. Matter of fact some scientists put the human race at being unable to reproduce within a hundred years. Because we are reaching genetic catastrophe. The genetic load is gettin’ so high that the mutation rate per generation is compounding and it’s getting to a rate where our, where the DNA
self-checking mechanism is going to be flawed to the point where it’s just going to ignore too many mutations and that’s gonna compound it more quickly. So, and the fact that they don’t admit this is happening? They’re ignoring, they’re ignoring a major problem that we are facing as a species. But the problem is the evidence, you know, if you look at multiplying population, population’s exploding, how can we be devolving and all this stuff? Say (laughs) well, you know, that has nothing to do with it.” (L16)

Here Zebediah takes the notion of genomic decline to the apocalyptic extreme. This statement is atypical of the Fossil Museum in at least two ways. First, as noted above Zebediah regularly impugns the motives and integrity of scientists, but museum staff and speakers rarely engage in such “scientist bashing.” An expression like “almost criminal” is beyond anything Ben said even in his angriest moments. Second, expressions of human decline are commonplace in the museum, but decline is generally regarded as a sad fact of life rather than an impending catastrophe. Also note that Zebediah recognized a potential objection to the devolution theory, namely that human populations continue to grow. He does not answer the objection, but rather reassures his listeners by dismissing it. Here a potential anomaly was deferred for future discussion, although Zebediah did not address this question in his next lecture despite the fact that the lecture was devoted entirely to human devolution.

Such alarmism appears to be rare at the Fossil Museum. More commonly, declinism is expressed as part of an Intelligent Design argument that natural selection

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Zebediah’s comments likely trace to Joseph Mastropaolo’s (2001; 2002; 2003) theories. Based on the rising number of known genetic disorders and infant mortality statistics, Mastropaolo concludes that humanity will become extinct within a century. Yet Eric Blievernicht, who accepts Mastropaolo’s premise of genetic devolution, criticizes Mastropaolo for several obvious blunders (Blievernicht, 2002, 2003), and few creationists appear to accept Mastropaolo’s apocalyptic version of genetic decline.
cannot add information to the genome (see, e.g., Dawkins, 2001; Dembski, 2001). As Art expressed it in a monthly lecture:

“[T]here’s no natural law through which matter can give rise to information, nor is any physical process or material phenomenon known that can do this. Natural selection and mutation are losses of information, not additions to information. So this whole business of, this whole business of information is now a part of the whole scientific study because DNA is the code of information which causes the organism to then become what it’s supposed to, supposed to be. So if indeed a single-cell animal became a human being . . . the information would have had to have been in the original DNA or where did it come from?” (L2, emphasis original)

Art argued that information cannot be added to any genome by natural means, so biological evolution cannot occur and natural selection can only result in devolution. To make this case, a scientifically trained local guest speaker described a published experiment in which native rain-forest fruit flies were subjected to a dry environment until 85% of the population had died and then the remaining fruit flies were allowed to reproduce (A. A. Hoffman, Hallas, Dean, & Schiffer, 2003). After repeating the process through over 30 generations, the researchers found no increased resistance to dry conditions. The speaker concluded that “they had adapted to the wet environment and lost the genetic information for a dry environment” (L7). In other words, Noah’s fruit flies were highly adaptable, but the process of specialization via natural selection requires a sacrifice of genetic information. The result is a highly specialized, non-adaptable variety of fruit fly. The speaker argued that the rain-forest fly had adapted by a process of devolution rather than evolution.

The development of antibiotic-resistant bacteria presents a particular challenge to creationists, as the phenomenon demonstrates evolution within a human time scale. Yet
when the loss of an enzyme by genetic mutation leads to antibiotic resistance by natural
selection, Dr. Smith described this process in declinist terms:

“He might be a sickly little bacteria, but if he can survive without that enzyme, the antibiotic can’t kill him. That’s the third way of becoming immune. And it is truly by a mutation. But was it new information? Was it a new feature? Was it new DNA? Was it new gene? No! It was devolution. It was the loss of information . . . You know, this, it’s not evolving, but they’ll tell you it is. It’s a lie. And it’s taught in schools, and it’s seen as the greatest proof of evolution by National Geographic. I tell you this to show you that the research in fighting diseases that’s being driven by evolution is going totally on the assumption that these germs can always evolve. If you’re a creationist, you know there are limits to this. We can eventually do stuff they can’t evolve to be immune to. This means there is an error in the thinking. It will cripple research, just like not bein’ willing to look for Carbon 14 in dinosaur bones or diamonds. They won’t see it because they’re married to a misconception.” (L13)

Here genomic devolution is a corollary to the Intelligent Design assertion that natural selection cannot add information to the genome (see, e. g., Dawkins, 2001; Dembski, 2001). The result is genetic limitation. Just as natural selection can exhaust the original genetic endowment of fruit flies, so natural selection can eventually exhaust the antibiotic resistance of microbes. Therefore drug-resistant bacteria are not more virulent than their non-drug-resistant cousins, but weaker, less able to compete, less adaptable, and therefore less dangerous. From the creationist/declinist perspective, drug resistance should reach definite limits, whereas evolutionists assume that drug resistance is unlimited, at least in principle. By implication, the question could be settled experimentally, although as we saw in Chapter 2, experimental results would more likely displace the argument to questions of experimental validity.

31 Some creationists claim that significant amounts of Carbon 14 have been detected in coal and diamonds (DeYoung, 2005, pp. 51-57).
Corollary to the ideas of devolution and genomic limitation is the notion of “kinds,” in which God created all of the types of plants and animals observable today during the original six-day creation. Varieties can develop within these “kinds,” but as Art explained in a lecture, these varieties develop only within specific genetic limits:

“There’s no evidence at any time in the past, nor any place in the present, where changing species has ever happened. One type never changes into another one, and without the type change, we can’t have evolution. It’s the complicated DNA code within each plant and animal that erects the barrier wall which cannot be passed. There is another wall beyond which a species cannot go and that’s the DNA code. Its internal genetic code forbids it to change, because what happens is, it will show up as a problem to be solved. (laughs)” (L2, emphasis original)

Any anti-evolutionary position, in which varieties develop only within specific limits, implies some sort of genetic conservatism. Here Art expressed this genetic conservatism explicitly. When a species, such as the tropical fruit fly discussed above, reaches the outer edge of genetic capacity, it can change no further because the boundary-like nature of the genetic code “forbids” further change. In an exchange with Ben, Art explained that infertility enforces the genetic boundary:

Ben: “So when corn, say we push it to a point where they are infertile”

Art: “Yea, can, you can plant that seed and it won’t grow.”

Ben: “It’s still not a different plant.”

Art: “It’s still corn.”

Ben: “Still corn.”

Art: “And it could be a hybrid, but it’s still, it still is going to be in the gene confines or abilities of DNA that makes corn. That’s as far as the limits can go but then you really begin to moving into this kind of corn over here
would be naturally selected out, cause it couldn’t reproduce itself . . . All of those outer fringe, they won’t exist in the natural world. They’ll be selected out—can’t reproduce.” (L2)

Ben wondered whether an infertile hybrid might be a different kind or a new species, but Art explained that infertility is a means by which the genome prevents new species from developing. Hybrid infertility makes evolution impossible and reveals genomic decline.

Ways of Speaking of Science

Assumption-free Data

In the classroom, a poster entitled “Assumption Junction” presents two flow-charts. One flow-chart reads:

Assumptions A $\rightarrow$ Assumption of evolution and the old earth $\rightarrow$ Data (drawings of geologic strata and a clam) $\rightarrow$ Interpretation A: This clam evolved over long periods of time $\rightarrow$ Interpretations consistent with evolution and the old earth. All contrary evidence explained away.

The second flow-chart reads:

Assumption B $\rightarrow$ Assumption of young earth $\rightarrow$ Data (same drawings of geologic strata and a clam) $\rightarrow$ Interpretation B: This clam died in a major catastrophe, having descended from originally created clams $\rightarrow$ Interpretations consistent with the young earth.

Both flow charts share the same “data,” i.e. the same drawings of geologic strata and a clam. By implication, people start with differing assumptions but then observe the same data. Both the data and the initial assumptions influence the interpretation. Here both assumptions and interpretations are human enterprises and are therefore unstable, whereas the “data” is stable.

In a lecture about the geologic column, Art expressed this view as follows:
“Now, when we get to the geologic column and keeping in mind the evidence doesn’t change. We’ve oftentimes said the evidence doesn’t change. It is always our assumptions about the evidence that are in question. This is a shell, OK? Is it old or is it young? That’s always the interpretation. The evidence doesn’t change. As we’ve oftentimes said in the museum, the facts are cast in stone. What’s not cast in stone is our interpretation of the evidence.” (L3)

For Art, evidence is “cast in stone,” i.e. it is stable and therefore not subject to human whim or fashion. By contrast, human assumptions and interpretations change over time. Later in the lecture, a member of the audience expressed the danger of assumptions and the preference for data:

Audience 2:  “There’s even speculation now that oil may be a byproduct of a bacterial thing. They’re, scientists are starting to look into because they’re starting to question that maybe oil wasn’t formed the way

Art:   “Exactly”

Audience 2:  “they thought it was.”

Art:   “Yea.”

Audience 2:  “See all of this stuff is all based on assumptions, What we thought it was.”

Art:   “Right.” (L3)

Here Audience 2 used the word “assumptions” to mean something closer to “presumptions.” For Audience 2, assumptions are dangerous in science because they can mislead. Later in the discussion, Audience 2 discussed some puzzling features that creationists are struggling to explain in the aftermath of the Mt. St. Helens eruption, concluding that “Maybe some of that is from features that we can’t explain at this point in time because all we’ve looked at is from the uniformitarian or gradualism perspective.” (L3) Here Audience 2 indicated that mainstream scientific assumptions can contaminate
even creation science. By implication, creationists must recognize and discard such assumptions in order to evaluate the evidence properly.

At the Fossil Museum, the history of the geologic column is of particular importance as an example of data having been contaminated by evolutionary assumptions and interpretations. Ben and Art described this process in separate lectures, and on a third occasion Art interrupted one of Ben’s lectures to recount the story. In this case, Art said:

Art: “Well the other thing too, Ben, that, and we talked about this, in the geologic time scale. It was actually invented originally by two creation scientists, and their names escape me, although I do have the information. With the whole idea of trying to organize identifying layers of rock. It was only later that the geological time scale

Ben: “Right.”

Art: “was added to the geologic column

Ben: “Right.”

Art: “by the evolutionary thinking process. So, you know, when you look at those kinds of things, the assumption of evolution and things changing over time was imposed upon the original thought of a geologic column defining rock layers.”

Ben: “Right.” (L15)

In this description, creationists invented the geologic column in order to “organize identifying layers of rock.” But later, evolutionists co-opted and distorted this originally assumption-free organization of data, turning it into the instrument of mainstream geology that we know today. The original evidence (the geologic column) was fine, but an erroneous interpretation was “imposed upon the original thought.”
In a one-on-one conversation, Diana also expressed this idea of stable data accompanied by unstable assumptions and interpretations. Diana told me that biological taxonomy has changed a great deal over recent decades, considerably expanding the number of biological families. She concluded that “The world hasn’t changed, but the way we divide it up has changed.” To the extent that “the world” can be viewed as “data,” Diana appears to have expressed the same idea as Art. Data is permanent, but human interpretation is not. Therefore data is trustworthy, but human interpretation is likely to change and is therefore less trustworthy.

Ben exhibited a preference for assumption-free data throughout his talk on the Fibonacci sequence. But in this case Ben took an explicitly inductive approach to the data: not only should data be observed without inappropriate or contaminating assumptions, but the data should induce theoretical conclusions. Although he acknowledged that the Fibonacci sequence was discovered before it was observed in nature, Ben argued that it could have happened the other way around:

“I was doing this last night, and that’s when I really began considering quite deeply that it’s not really the sequence that we’re trying to fit everything into, it’s everything’s fitting into the sequence.” (L12)

Rather than imposing a theory onto nature, Ben preferred that nature reveal a pattern. Yet his attempts to induce the Fibonacci sequence from natural observation repeatedly ran into trouble. For example, his first example involved the reproduction of rabbits. He introduced the example as follows:

“We see this pattern all throughout nature . . . And really, you almost have to come to the point as, of almost not thinking about the numbers for what I’m showing you, and just think, objectively: Do we find the numbers whether we’re
looking for them or not? We try to make sense of a pattern throughout nature. And so, one of those would be, for instance, in the generations of rabbits. If you take two rabbits, starting with an initial pair, and again we’re not looking for the numbers, the numbers work out by themselves. We start with the initial two rabbits, I think it’s assuming in this illustration, the first pair have a new pair of rabbits every month . . .” (L12)

Clearly Ben was concerned that the Fibonacci sequence could be induced from assumption-free natural observation. Yet after describing the example, he revealed that it was a far more theoretical example than he would have preferred:

“Does that make sense? In this hypothetical illustration, assuming it’s a constant one per month or once per year, however the illustration was. They assumed in that illustration, that the rabbits never die, producing one male and one female every month. So somewhat hypothetical. It may not be seen in nature in that way but it helps us understand what we’re getting at here.” (L12 6:45 – 7:11)

In order to produce a “natural” Fibonacci sequence, Ben had to assume that each generation reproduced at the same rate and that none of the rabbits died. The “facts” from which he wanted to induce the Fibonacci sequence turned out to be an idealized version of nature, no more observable than the friction-free environments familiar to physics students.

Like the example of rabbit reproduction, Ben’s second example, involving bee reproduction, also relied on simplifying assumptions rather than direct observation of nature. When he used examples that relied on photographs, such as the number of flower petals, leaf growth patterns, and pine cone spirals, the Fibonacci numbers were difficult to find. In the end, it seemed to be highly unlikely that one could induce the Fibonacci sequence from them. Yet Ben maintained that the Fibonacci sequence could be induced
in the natural world. Just as the natural world induced the Fibonacci sequence, so the Fibonacci sequence induced a Creator:

“I would say this would point back to my original foundation for all my thought would be back to, well this would point to a Creator. That we see this because God would create a system of design, and he, we would see that then, it would, like your finger, fing, fingerprint. You would see that throughout nature then.” (L12)

Since the lecture concluded with an inductive design argument for the existence of God, the Fibonacci sequence must be induced as well.

Finally, the assumption of theory-free data extends to scriptural interpretation. As a visiting speaker expressed this view:

Speaker: “I only have one basic passion of my life. If it hadn’t shown through yet, I believe that the bible is true from the first verse to the last, and it’s interpreted by itself in context.

Audience 1: “Amen.”

Audience 2: “Yea.”

Audience 1: “Amen.”

Speaker: “And that God created everything that was created, nothing was created except that He created it.” (L14)

Scripture, like physical evidence, is stable and true “from the first verse to the last.” Moreover, it is self-interpreting: “it’s interpreted by itself in context.” Therefore for this speaker, scriptural belief is reliable in a way that science can never be reliable. As Ben and Francis each told me in independent conversations, scientific ideas change over time, but the bible does not, and therefore the bible is more reliable than science.
Worldviews

In addition to assumption-free data, Fossil Museum speakers and staff also speak of “worldviews.” For example, in a dramatic opening to his guest lecture, Ward gestured for Ben to come to the front of the room, and then indicated by gesture that Ben was to spin in a circle and clap his hands, and then he gestured for the audience to clap along.

After several seconds, he ended the demonstration and said:

“You’re probably wondering, what in the world is he doing? (audience laughs lightly) The first thing I want to start out and talk to you about today is influence. And influence, much of the influence we experience comes from the front of a classroom . . . So you have an authority figure that stands at the front of the classroom. So anything that this authority is telling you is influencing the way you think, because you’ve been introduced to him as an authority on whatever he’s doing.” (L4)

Ward went on to list “five basic influences” “on the way you think,” including family, friends & peers, education, religion and the media. Finally he asked Ben to return to the front of the room and placed a cardboard box over his head. Ward said:

“Those things that I just talked about, those influences, can actually be representative of the sides of this box. OK? And this box can represent what I’d like to call my worldview. Those influences are what build or define your worldview. And your worldview being the way you think—it’s the overarching, thing that ties everything together in the way that you live, the things you believe, and the way you think. Now I like to think of the box here as a filter. This is what I call most of my worldview filter. And we all have this filter that we wear in our head all the time. Whether we want to or not, you have a worldview and you filter everything through the worldview. Everything that comes through your eyes and your ears is filtered through this worldview so that you can evaluate the world around you through this thing called worldview . . . I want to show you how your worldview affects the way you think in our science environment here today.” (L4)

Ward presented worldview as a composition of the major influences of life. He indicated that everyone has a worldview “whether we want to or not” and that it filters everything
that we see and hear. Therefore worldview is profoundly influential in life in general as well as science in particular:

“What we do, then, is we take the evidence and we filter it through our worldview—the way we think, what we believe. And then we come out with a conclusion. I can take two different scientists here, and I can give them one piece of evidence, and I can have them evaluate it through their worldviews. And if they have differing worldviews, they can come up with two completely different conclusions about exactly the same piece of evidence. And I’m going to prove that to you here this morning.” (L4).

Next, Ward divided the classroom into two groups. He showed one group a drawing of a rabbit. He showed the second group the same picture, but he rotated it 90° so that the “rabbit” drawing appeared to be a “duck.” He concluded:

“Now if this evidence was able to speak in and of itself, when I asked you what you saw, you should all be able to tell me exactly the same thing . . . What I did was I showed you the same piece of evidence and looked at it from two different perspectives. One way you look at it, it’s a rabbit, and the other way you look at it, it’s a duck. And what I have done, is that I set each of you up. I showed you the evidence from a certain perspective. And typically when we’re being educated, the things that we are shown first is what we tend to believe. You have to undo those things to be able to come to, I mean you have to undo all of that thinking to be able to think in a different, in a different way, OK? That make sense? So in the science endeavor, I think what we have to understand is the evidence is the same for everybody. It’s how we evaluate this evidence through our worldviews that we make sense of the world.” (L4)

Therefore for Ward, a scientific controversy, such as the evolution/creation debate, may not be based in evidence so much as in the worldviews through which people view the evidence. If theory-free data exists, worldviews render it inaccessible. More importantly, it takes effort to shed a uniformitarian worldview in favor of a creationist worldview:
“I was taught in freshman geology that everything happens on the surface of the earth at the same rate that it’s been happening for the last 4.5 billion years . . . But the, to go back to the original point about the rabbit and the duck, we can see that right here. In that if you have what they call a uniformitarian world view, is that the present is the key to the past, that everything we see happening on the earth today has happened since it began, and is happening at the same rate, therefore everything takes millions of years to accomplish anything. We take that kind of thinking, if that’s the kind of thinking we have then that’s the only thing we can apply to what we’re looking at . . . Well, if you go in there with that kind of a mind set, that’s exactly what you’re gonna come out with is those kind of conclusions. So one has to be very careful about what they read as scientific conclusions because you don’t always know what the worldview is of the observer.” (L4)

Since worldview determines conclusions, the creationist is justified in distrusting or discounting mainstream science. For the scientifically trained creationist, contaminating assumptions must be discarded in order to “see clearly.”

Following Ward’s talk, the Fossil museum incorporated Ward’s rabbit/duck drawing into the Museum tours. Museum staff position the drawing in different orientations for different parts of the audience and then reveal that the rabbit and the duck were the same drawing. After doing so in a tour, Jay concluded: “Same picture, two different ways of looking at it. Same fossil, two different dates.” In another tour, Francis was more explicit: “This is to show that evolutionists and creationists look at the same fossils but see different things.” In this way both tour guides attributed the creation/evolution dispute to worldview, although neither used the word.

**Operational Science vs. Historical Science**

The worldview concept enables explanation of the creation/evolution dispute as a clash of worldviews, but the distinction between operational and historical science enables another explanation. A visiting university professor in the natural sciences,
pseudonym Dr. Nichols, introduced his lecture with a description of “operational science”:

“Say well, how come there’s such different views of how we got here? Did God really create us, or did we just evolve from the monkeys? Well I think some of it has to do with how we view science. And there’s a distinction between what I’d like to call operational science and historical science. Course operational science. We look at the world around us, we make observations. We do things in a controlled environment by experiments. Say, well if I increase the temperature what is going to happen to the system? Does a reaction go faster? Does the color change quicker? Those types of things. We look for order in our experiments and out of that we discover laws, like laws of gravity, laws of thermodynamics, kinetic energy. Then we try to understand those laws by generating theories, and theories are really models . . . Well, this leads then to new questions . . . You can have a hypothesis. And then you can go and test that hypothesis based upon your model and theory, how you understand how the world works. So it’s, it forms a complete loop and you bring new questions that lead to more experiments and then you go through this whole scientific process. (L7)

Here Dr. Nichols described a highly inductive view of science. Operational science begins with observations and experiments, from which one finds patterns (“order”), laws, and finally theories or models. He also described a process of model testing, but it “forms a complete loop” so that such testing leads one back to repeat the process of induction. Dr. Nichols continued:

“So a couple of terms that just popped out: reproducible and predictive. You can go and synthesize aspirin based upon the laws of chemistry. I can do it here, I can go to Beijing, China and do it. It’s reproducible. I can drop a bowling ball off the roof and measure its velocity. Get kinetic energy, potential energy, those types of things. I can look at plants and how they breathe, how characteristics are passed on, Mendel’s classic experiments with peas and pea pods. They’re really, operational science is descriptive. If you summarize it, it tells how things work.” (L7)
Here the key feature of operational science is that it is reproducible and therefore it can be used to make predictions. It will always happen the same way. By contrast, historical science is non-reproducible and therefore retrodictive:

“Now to contrast that, if we’re going to deal with issues, things like origins, where did we come from. Now we’re getting into the realm of historical science. There’s a parallel to making observations. Now we’re not really finding laws, but we’re applying laws that are found in the natural sciences. We propose explanations, so we still have models there. Like at a crime scene. A crime scene, we don’t reproduce the crime scene. In the sense that we’re not going to kill somebody to figure out who did the murder. But where you use the evidence and we try to put together a story to reconstruct what happened at the crime scene, so it’s non-reproducible in that sense. And we generate hypotheses and questions, and we can test those things out. So there is the ability to propose testable hypotheses even with historical events, like finding ancient archaeological artifacts. But it’s non-reproducible. So it’s a different kind of way of looking at things. It’s also, you might say, retrodictive. That is, you’ve gotta look back and try to predict what you thought would have happened based upon the evidence you have gathered. And again, you can’t go back and reproduce it.” (L7)

For Dr. Nichols, the non-reproducibility of past events is the major difference between the operational and historical sciences. Like the operational scientist, the historical scientist makes observations, proposes hypotheses and models, makes predictions, and tests those predictions. Yet the historical scientist uses existing natural laws but does not find laws. Therefore historical science is somewhat less inductive than operational science. Nonetheless, Dr. Nichols clearly regards it as science.

Apparenty Dr. Nichols’ point was that since a historical science such as geology, archaeology, or paleontology is non-replicable, its results should not be regarded with the same level of confidence that operational science receives, nor can disagreements be resolved with the same assurance. But it is still science. Yet as Dr. Nichols brought his
discussion of observational and historical science to a close, Art suggested that historical science is closer to judicial practice than science:

Dr. Nichols: “But it [historical science], so instead of describing the process of how things work, they try and say what happened. So we’ve got this difference here.”

Art: “Now one of the things that we use as an example too in that is proving that you were in class on Monday. Well, you can’t prove that scientifically. You have to use historical, legal evidence—I have eyewitnesses, the teacher said I was here. Oh, I had a paper that was due and it’s in the stack, it was turned in with the other people. So you can develop enough evidence to support the fact that you were there, but it’s not really science. It’s a historical, legal standard without question.”

Dr. Nichols: “Right.”

Art: “Beyond a shadow of a doubt.”

Dr. Nichols: “Right. (L7)

Here Art suggested that since historical science cannot be “scientifically proven” in the same way that operational science can be scientifically proven, it is less reliable. Moreover, to the extent that “proving that you were in class on Monday” is analogous to a historical theory such as evolution, Art suggested that “it’s not really science.” Thus evolution, the primary historical science of concern to Art and Dr. Nichols, may be outside the realm of science altogether.

Later in his talk, Dr. Nichols appeared to support Art’s position that historical science may not be science at all. In the course of a discussion of the history of dogs, Dr. Nichols recounted evidence that dogs all appear to have a common ancestor but discounted the idea that dogs and cats share a common ancestor:
“And then the DNA evidence would support wolves as being the common ancestor. So it’s a descent with modification but within limits is what I would say about that. So that’s what we observe experimentally. We observe dogs making dogs, wolves radiating out to other types of similar kinds of animals. But we don’t see the, a common ancestor in the sense of millions of years of evolution turning into a dog or turning into a cat. There’s the rapcid which is like the common ancestor between dogs and cats. They both came from the same thing according to the macroevolutionary view. We don’t see that. We see dogs making dogs and cats making cats. And say, well it takes too long. Well then, that’s not experimentally observable, so then it’s presumption or inference. So you’re dealing with interpretation of the data. It’s a historical, nonreproducible vs. reproducible.”

Here Dr. Nichols expressed the Fossil Museum view that natural selection can produce varieties of a particular “kind” of creature, but that one “kind” can never evolve into a different “kind.” In creationist terms “microevolution” can take place, which involves a specialization and degeneration of the genome, while “macroevolution,” which would involve an addition of genetic information, cannot take place. He reasoned that since the development of new dog varieties can be directly observed, it is defensible. However, since the evolution of one “kind” into another is “not experimentally observable,” it is “presumption or inference.” “Presumption” seems to be outside the realm of science. Also his statement that “you’re dealing with interpretation of the data” assumes the existence of assumption- and interpretation-free data as documented above. Since historical science involves interpretation of data, it is less reliable for Dr. Nichols.

Caution regarding the unreliability of historical science can also be observed in Fossil Museum tours and science classes. For example, Ben remarked in a tour: “We

32 Dr. Nichols probably meant the miacids, thought to be ancestors to all carnivorous mammals.
have to keep in mind that this is the past we’re talking about. Nobody was there. At least
we weren’t there” (TA248). Here Ben subtly reminded Fossil Museum visitors that
historical science is intrinsically unreliable because the past cannot be directly observed.
In one of the Saturday classes for 5- to 10-year-old children, Claire read aloud an excerpt
from a creationist children’s book entitled The Great Dinosaur Mystery (P. S. Taylor &
Films For Christ Association, 1989), including:

Unfortunately, some scientists have not been careful enough in their
descriptions of dinosaurs. They have told grand stories of how dinosaurs looked
and behaved. All of these descriptions are based on guesswork—the imaginations
of people who have never seen a living dinosaur.

Some scientists have made complete pictures of dinosaurs based on just a
single bone or tooth or leg. Such pictures are based on many guesses and very
little facts. The scientists’ ideas often turn out to be wrong when more facts are
discovered.

Dinosaur fossils are not found with labels or photographs attached
showing what the animals looked like. This is why no pictures of dinosaurs in
this book or any other are exactly right . . .

If scientists could climb into a time machine and travel to the past, they
could get much better information. Only then would they know the true
appearance of dinosaurs or what they ate and how they really behaved. Scientists
might be very surprised at what they would learn (P. S. Taylor &

Dr. Nichols expressed an awareness that historical scientists construct evidence-based
hypotheses. In the summer-camp’s simulated fossil dig, Diana laid out a stake-and-string
grid and emphasized paleontologists’ careful measurements and meticulous record-
keeping. By contrast, Taylor dismissively describes paleontologists as reckless dreamers
making unwarranted and extravagant guesses. Furthermore, Taylor casts doubt on the
possibility of historical science, indicating that only a time machine could reveal reliable
information about dinosaurs. After the children listened to this buffoonish description of
paleontology, the children used multicolored sheets of craft foam to make and decorate
dinosaur face masks. In introducing the activity, Claire explained that since nobody
really knows what the dinosaurs looked like, it is OK for children to use their
imaginations to decorate the dinosaur faces, i.e. there is no need to attempt to re-create
drawings that they might have seen. By implication, if historical sciences amount to
guesswork, then one guess is as good as another.

Testability/Falsifiability

Art, Dr. Nichols, and Fossil Museum staff expressed caution about historical
science. With characteristic humor and exaggeration, Dr. Smith elevated caution to
ridicule:

“But this is something Dr. Dawkins said in an interview, on PBS, just, what two
years ago just about. ‘Evolution has been observed. It’s just that it hasn’t been
observed while it’s happening.’ (audience laughs) Now, you might laugh, but
I’m convinced Dr. Dawkins believes it’s completely justified to say that. He’s
probably meaning that evolution happened so slowly that that you just cannot see
it. This is like saying the Easter Bunny runs too fast for you to see him. You
know, that kind of thing. It’s making up an excuse. OK, well if you just keep on
saying that it’s there, you just can’t tell. There’s no way to detect it. That is,
that’s a fairy tale. That is an urban myth. And you can call it a theory but you
can’t say ‘we know.’ ” (L13)

Without making too much of Dr. Smith’s rhetorical exaggerations, his essential argument
was that if evolution cannot be observed while it is happening, then it should not be taken
seriously. By implication, non-observable theories are comparable to fairy tales and
urban myths. Earlier in his lecture, Dr. Smith expressed the same idea in terms of
testability:

33 Smith extracted this comment from Dawkins’ interview with Bill Moyers on the Public
Broadcasting System program NOW (Moyers, 2004).
“Darwin said, ‘I’m quite conscious that my speculations run quite beyond the bounds of true science.’ In a letter he wrote to a friend. Birch and Ehrlich, this is a famous quote creationists use all the time, but I think it’s an admission that needs to be shown. In Nature magazine, 1987 [sic], ‘Our theory of evolution has become one which cannot be refuted by any possible evidence. It is thus outside of empirical science.’ Isn’t there any test case that can be done? I’ll show you a few tonight. Evolution, therefore, is not science.”

(L13)

34 This is excerpted from Charles Darwin’s June 18, 1857 letter to Asa Gray. The full quote is “It is extremely kind of you to say that my letters have not bored you very much, & it is almost incredible to me, for I am quite conscious that my speculations run quite beyond the bounds of true science” (Darwin, 1857a). Darwin was responding to Gray’s June 1, 1857 letter (Gray, 1857). Darwin and Gray were not corresponding about the theory of evolution by natural selection per se, which Darwin would not disclose to Gray until July 20, 1857 and more fully on September 5, 1857 (Darwin, 1857b, 1857c). Instead, Darwin and Gray were corresponding about Darwin’s hypothesis that “disjoined species” are more likely to occur in small genera or orders, i.e. that when populations of the same species are found in geographic isolation from one another, they are likely to have few sister species. Darwin was searching for evidence that species spread across the globe from single, rather than multiple, sources, and the “disjoined species” hypothesis played a part in this inquiry (Hermann, 1999). Gray wrote that he could not provide data to support Darwin’s hypothesis. Dr. Smith may not have realized that Darwin’s “speculations” might have supported Smith’s belief in a global distribution of species from the Ark.

35 This is taken from the concluding paragraph of Birch and Ehrlich’s (1967) argument that evolutionary history can sometimes be inferred from present relationships between species, but that not all present relationships should be attributed to evolution. The expanded quote is

Our theory of evolution has become, as Popper described, one which cannot be refuted by any possible observations. Every conceivable observation can be fitted into it. It is thus “outside of empirical science” but not necessarily false. No one can think of ways in which to test it. Ideas, either without basis or based on a few laboratory experiments carried out in extremely simplified systems, have attained currency far beyond their validity. They have become part of an evolutionary dogma accepted by most of us as part of our training. The cure seems to us not to be a discarding of the modern synthesis of evolutionary theory, but more skepticism about many of its tenets (Birch & Ehrlich, 1967, p. 352).

Birch and Ehrlich were not arguing against the theory of evolution, but against its inappropriate application.
Smith used the Darwin quote to set up the idea that evolution is not science, and he used the Birch and Ehrlich quote to demonstrate that evolution is non-testable, concluding that “Evolution, therefore, is not science.” However, having claimed that the theory of evolution is not testable, Smith asked: “Isn’t there any test case that can be done? I’ll show you a few tonight.” Smith proceeded to describe tests which the theory of evolution allegedly fails. Therefore like the examples described in Chapter 2, Smith committed the logical error of asserting that the theory of evolution is untestable while simultaneously claiming that it fails its tests.

During Ben’s lecture on the Fibonacci sequence, he mentioned that design is not the only possible reason that Fibonacci numbers might be found in nature. He speculated that from an evolutionary standpoint, Fibonacci numbers might confer a survival advantage. His mother asked him how a random process could lead to a “perfect” (Fibonacci) design, and Ben attempted to explain it from an evolutionary point of view. The final part of this exchange was:

Ben: “Basically, I don’t know if I was clear. Basically the thought is nothing else works with that design.”

Ben’s Mom: “So all the others died out.”

Ben: “So whatever creature, whichever creature evolves that specific area of design first is the one that survives, cause it’s the only survivable trait.

Ben’s Mom: (laughs) “I see.”

Ben: “And it’s, a, it’s almost a nonargument, though, because there’s no way to disprove that then.”

Ben’s Mom: “Right, you can’t go back to see the ones that
Ben: “Right”

Ben’s Mom: “didn’t,”

Ben: “Right.”

Ben’s Mom: “didn’t make it.”

Ben: “Right.” (L12)

Ben explained that from an evolutionary point of view, various creatures would independently develop Fibonaccian proportions because “it’s the only survivable trait.”

Yet Ben asserted that this explanation can be discounted as “almost a nonargument,” because it cannot be falsified. Ben and his mom concluded by agreeing that past events are unobservable and by implication, highly speculative.

Anomalies

Evolutionary Anomalies

Despite the occasional claim that historical science in general or evolution in particular is not science because it is not testable, Fossil Museum exhibits describe a variety of tests for the theory of evolution and standard geochronology. Unsurprisingly, evolution and standard geochronology fail all of these tests in the Fossil Museum view. Consulting Table 1 in Appendix B, a few of these tests are based on recognized scientific anomalies. The Lunar Recession argument, for example, is based on the calculation that given the present rate at which the moon recedes from the earth, the moon would have

36 Ben’s explanation is doubtful from an evolutionary point of view, as creatures in similar habitats often exhibit widely varying characteristics.
been catastrophically close to the earth considerably less than 4.5 billion years ago. (See Appendix B for a more detailed discussion.) The Fossil Museum staff concludes that this fact falsifies standard geochronology. Most of the arguments, however, are rooted in misunderstandings of science or erroneous claims. For example, an exhibit misinterprets the leap second to grossly exaggerate the frictional deceleration of the earth’s spin, concluding that by standard geochronology, the earth would have spun impossibly fast at the time of the dinosaurs. (See Appendix B.) Here a mistake leads to a pseudo-anomaly.

Whether the anomalies are genuine or not, each is aimed at falsifying mainstream theories. For example, Dr. Smith quoted Max Planck:

“Max Planck of the Planck constant said, ‘Whenever an experimental finding contradicts the accepted theory, another step on the ladder of progress is thereby announced, for the contradiction signifies that the accepted theory must be overhauled and improved.’ And indeed, if data gets in the way of your theory, it should be dropped.” (L13, emphasis original)

Using Planck’s words, Dr. Smith argued that when faced with an anomaly, the sensible scientist revises or rejects the theory in question.

Earlier in the same lecture, Smith supplied an example of an anomaly to which scientists did not respond with theory revision or rejection. As described in Chapter 1, distantly related species exhibit marked similarities in non-coding regions of their DNA, providing strong evidence for a shared ancestry (see, e. g., F. S. Collins, 2006, pp. 133-141). Yet Dr. Smith argued that some of this so-called “junk DNA” has been found to

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37 This is taken from a 1941 lecture. Planck continues: “But the question as to just where and how to change it, entails serious difficulties. For the more tried an existing theory is, the more sensitive it is, and the stronger resistance it puts up to every attempt to alter it” (Planck, 1949, p. 111).
serve a purpose in the organism, thereby resolving the creationist conundrum that a
designer would have no reason to place the same non-coding DNA in unrelated
organisms. Smith concluded:

“I predict we’ll find that there’s very, very little of the DNA that isn’t doing
something. Points to a creator, not to redundant, leftover DNA from our past
evolutionary stages. Well, they’re starting to come to dawn on this. Isn’t this,
you know, this great proof that evolution was true, junk DNA, isn’t this shakin’
anybody’s tree? Isn’t this rattlin’ anybody’s cage? No. No. Hope springs
eternal in the rest of the faithful.” (L13)

By implication, when scientists encounter disconfirming evidence they should change
their minds. If they do not, they must be intellectually blind or inappropriately hopeful.

Yet Kuhn (1970b) argued that anomalies are a normal part of science and that
they are usually insufficient to falsify a theory. Scientists may discover and recognize
anomalies, but they assume that they will be resolved eventually. Anomalies are
something to think about and work on but not something to worry over. While
sometimes agreeing with the naïve falsificationism expressed by Dr. Smith, Fossil
Museum staff dealt with anomalies in a complex manner, and at times they took a
practical approach analogous to that of scientists.

For example, while describing his experiences on a week-long fossil excavation
trip, Ben took a falsificationist approach to an observed anomaly. Ben noted that since
the geologic column is a theoretical construct, it cannot be directly observed:

“You never find this exact order anywhere in the world. You’ll find bits and
pieces everywhere. It’s pieced together from the broader global context. So
that’s why we find a lot of ana-anomalies [sic]. For instance, I said earlier where
we were digging was in one rock layer. Down the road, the rock layer supposed
to be below it—and our chart here says it’s below it—was actually on top of it.
So we have all these, called anomalies or things that don’t match up to the
grid. And that’s because I would say according to my interpretation that this wasn’t a uniform process where everything was being laid down slowly where it would actually tend to be consistent. We had a global upheaval.” (L10)

For Ben, an incidence of rock layers which “don’t match up to the grid,” i.e. rock layers which are out of order according to the standard geologic column, is an anomaly to standard geology. It tends to falsify the geologic column and to confirm flood geology.

In the same talk, Ben described ripple marks between rock layers as another anomaly to standard geology:

“But you can actually see the ripple marks. And that’s actually pretty consistent. They find ripple marks a lot of times in between rock layers. Now the evolutionary explanation for this was it was laid down by water as well. So I don’t know if you’d have a difference, but it did say it takes millions of years to make a fossil. Those ripple marks would not remain intact if these took millions of years to form.” (L10)

Ben argued that if lithification requires millions of years, then ripple marks in hydraulically deposited sediments should erode away before they can be preserved.

Therefore the existence of these ripple marks represent an anomaly falsifying the notion of gradual lithification.

Creationist Anomalies

We have already seen several anomalies to the creationist point of view. We saw that Fossil Museum associates struggled to reconcile the scant archaeological evidence for ancient advanced technology with their expectation that antediluvian people were

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38 Beginning in the early 1900s, flood geologists began to point to such out-of-order strata as discrepancies to uniformitarian geology (Numbers, 1992, pp. 79-81). The Lewis overthrust of Montana is a particularly dramatic example (see, e.g., Monroe & Wicander, 2005, p. 380). Mainstream geologists attribute these to geologic activities which push older strata onto younger strata in some cases or invert strata in other cases.
genetically, culturally, and technologically superior. They dealt with this problem in a variety of practical ways, including suggestions that superior environmental conditions, enhanced longevity, and absence of warfare rendered advanced technology unnecessary. We saw that Fossil Museum speakers and staff described the development of antibiotic-resistant bacteria as instances of devolution rather than evolution. In each case Fossil Museum associates appeared to have answered possible threats to creationism to their own satisfaction. Yet we also saw that Zebediah did not answer the question of how humans could be so successful from a reproductive point of view and yet experience catastrophic genomic decline and immanent sterility. Zebediah acknowledged and then deferred the question. In each case the theories (antediluvian human superiority, anti-evolution, and catastrophic genomic decline) were never in question. Instead, Fossil Museum associates dealt with the anomalies as evidence that could be incorporated into the theories, albeit with difficulty. In the following, we see that this response is typical. In each case, Fossil Museum associates took theory-threatening evidence seriously, suggesting answers where they could and deferring anomalies for future explanation where necessary.

*Gastroliths*

In the 1800s, paleontologists occasionally discovered worn stones in close proximity to dinosaur remains, and by 1904 they established that at least some of these were gastroliths, i.e. stones which the dinosaurs had swallowed (B. Brown, 1904; G. R. Wieland, 1906). These gastroliths were composed of a variety of types of rock, including at least one specimen in which marine fossils were visible on the rock surface (G. R.
Over a dozen suggestions have been made for the possible utility of these stomach stones, ranging from digestive functions such as food grinding to parasite destruction to buoyancy regulation in aquatic species (Wings, 2007).

During his lecture about his fossil excavation trip, Ben noted that he and some of his fellow excavators discovered apparent gastroliths. Since Ben and his compatriots attribute most of the fossil record, including their excavation site, to the Noachian deluge, they expect to find no pre-Flood fossils. Therefore a gastrolith from an animal killed in the Flood should include no fossils. However, marine fossils were visible in one of the gastroliths. Ben described the discovery and a subsequent discussion about the find:

“We’ve found what have been called gastroliths or stomach stones. I found one on the site. You guys can pass that around, what looks to be one. That’s a broken one that I found. But this is one that Scott found. And you’ll notice there’s actually some fossils in this. Which is very interesting. Go to the next slide. It looks very clearly to be fossils of some sea-shell type creatures. Now Virgil just e-mailed me the other day. We had been talking about this. And, fossils in a gizzard stone. And this is what his comments on this: ‘If the one Scott found was indeed a gizzard stone, the question arises, why does it have a fossil in it? We should have seen essentially no fossils before the Flood and those dinosaur remains at the . . . site were definitely a Flood deposit.’ In her, his interpretation that these bones were definitely a Flood deposit. ‘I can envision some fossils before the Flood, but they would be very, very few and far between. Much like today I would expect. So the odds of a fossil forming, getting eroded out of its host rock, and then eaten by a dinosaur are extremely remote. Unless they had the same quantity of fossils we have today.’ This is talking about before the Flood. Historical context would be Noah’s Flood. ‘Unless they had the same quantity of fossils we have today. Something which they should not have had. We would believe the fossil record was made during Noah’s Flood.’” (L10)

In reporting his exchange with Virgil, Ben acknowledged that fossil-bearing gastroliths are contrary to flood geology. Yet rather than falsifying flood geology, Ben and Virgil explored an alternative interpretation of the evidence:
“He [Virgil] was recently meeting with a number of geologists and such, and they were talking about how a lot of the previously-thought gizzard stones don’t look like they’re actually gizzard stones. Which makes a dif—big difference if this is a gizzard stone or not. It loo, it seems to prose [sic] a problem for the creationists. What does this evidence show? Were there fossils before the flood, because we’re saying all these fossils are a product of Noah’s Flood. So, what we would call a living fossil to the evolutionists, coelacanth for instance, was thought to be dead for millions of years, found one in the early 1930s. Eighteen whatever. Li--they call it a fossili—a living fossil. An ana, analomy [sic], something that wasn’t expected, doesn’t fit into the theory. This may be one of those. For the creationists. And just like that original quote before, we can’t scientifically know everything from the past because it’s from the past. We’re not there looking at it happening.”  (L10)

Here Ben acknowledged the significance of the problem and compared it to the discovery of the coelacanth, which creationists regard as an evolutionary anomaly because the coelacanth’s apparent morphology has remained unchanged over millions of years (Helder, 1998). Yet in Kuhn’s (1970b) terms, Ben does not take the inclusion of fossils in gizzard stones as a crisis for flood geology, but rather as a puzzle to be solved or a discrepancy to be resolved in the future. He and Virgil briefly considered and discarded the possibility that fossil-included rocks could have formed, eroded out, and been swallowed by a dinosaur in the short period of time between the Creation and the Flood. Next, they considered the more promising possibility that these stones are not true gizzard stones. Finally, Ben invoked the inherent uncertainty in historical science to indefinitely defer the question. Therefore the interpretation of the evidence was in question, but flood geology was never in question. In short, Ben and Virgil demonstrated

39 “Gizzard stone” and “gastrolith” are sometimes regarded as synonyms, although the former assumes that gastroliths were used to grind food, which is one of several plausibe theories (Wings, 2007).
practical reasoning and judgment analogous to that employed by mainstream scientists upon encountering an anomaly.

During the questions and answers following Ben’s talk, Art suggested another solution. Perhaps the fossils became embedded in the gastrolith after the dinosaur has died and decomposed:

Art: “Another explanation that I have read on that is that the gizzard stones themselves actually become softened to some extent being in the stomach with the acids and so forth. And at the disintegration those can absorb, you know, the carcass goes first, can actually absorb a shell that might be lying on the bottom as well, and that whole process could occur that way.”

Ben: “And then it becomes part of the

Art: “The whole thing”

Ben: “rock.”

Art: “is fossilized. So I’ve heard that explanation, but I agree that it’s still subject to question.”

Ben: “Right.” (L10)

Implausible though this explanation may be, it demonstrates Art’s search for an explanation consistent with flood geology. Like Ben’s suggestion that the root of the problem may be in misidentification of gastroliths, Art presented his suggestion tentatively rather than definitively. Both agreed that the problem is “still subject to question,” i.e. the question remained unresolved, but neither reconsidered their commitment to flood geology. Both regarded this anomaly as a puzzle rather than a crisis.
**Audience-Identified Anomalies**

Speakers/presenters raised the anomalies in all but one of the discussions described so far. However, in several instances audience members pointed out potential anomalies or threats to Fossil Museum explanations. For example, a speaker argued that crushed specimens in the fossil record indicate rapid burial during a Flood:

Speaker: “[W]hen you find even entire dinosaurs they are often flattened *incredibly* thin. Tremendous overburden was piled on top of them. Most fossil trees, petrified trees, are often crushed one way. You know how much pressure it takes to flatten a solid tree? Think about that! Even if it’s water logged, it still takes an *enormous* amount of pressure, especially when it’s buried. *Enormous* amount of pressure. I believe all this indicates rapid burial.”

(L1, emphasis original.)

Later, the speaker described fossils of giant hollow reeds in Joggins, Nova Scotia. Since the giant reeds cut across multiple layers of sedimentary rock, the speaker concluded that they were buried suddenly during the Noachian Deluge. Yet Ben recognized that sudden burial would likely crush the reeds:

Ben: “How come the reeds weren’t crushed flat? They are flat?”

Speaker: “They’re not crushed flat—they’re actually—they are slightly flattened, but then they fractured and in-filled with mud.”

Ben: “Then that’s how they support the inside.”

Speaker: “Yea, and—But not always, too. And you got to remember, it appears the mud went above rapidly and filled it in before it had a chance to crush if they were short enough. An excellent question.”

(L1)

The speaker had emphasized that the Flood had crushed dinosaurs and solid trees, indicating rapid burial. Since the speaker had also claimed that the reeds at Joggins were
buried rapidly, the fact that they were not crushed represented a potential anomaly. When Ben pointed it out, the speaker was ready with an explanation, namely that mud filled the reeds and prevented their collapse. We have seen that Ben is not hostile to the idea of a world-wide Flood, but rather he recognized a discrepancy and he sought a solution.

Another potential anomaly arose after Dr. Smith explained that bacteria exchange bits of extra-chromosomal DNA known as plasmids. In the audience, Dr. Nichols recognized that if such exchange occurs between bacterial “kinds,” then this would represent an anomaly to the creationist theory that “genetic barriers” separate “kinds.” He raised the issue with Dr. Smith:

Dr. Nichols: “Well back to the plasmid transfer of genes, are you aware of, I guess limitations to the process? Can any information be transferred anywhere?

Dr. Smith: “By plasmids?”

Dr. Nichols: “By plasmids. I mean, is there some limits with it. Because it seems to me the plasmid gene transfer is really, can really be viewed in terms of a variability of species. An adaptation to the environment. Responding to environmental pressure. And we know that ge, the observational evidence is that there is genetic adaption, mutation occurs, but it occurs within limits.”

Dr. Smith: “Mm hm.”

Dr. Nichols: “It’s, I, so I guess that the question I’m asking is, are you aware of some of maybe the more fundamental scientific research along the lines of the plasma, and the plasmid transfer and limits.”

Dr. Smith: “Just the limits of plasmid transfer?”

Dr. Nichols: “Yea.”
Dr. Smith: “I know that it can be interspecific, or between species.

Dr. Nichols: “Right.”

Dr. Smith: “And any information”

Dr. Nichols: “But not any two species.”

Dr. Smith: “M, no, no maybe not any two.”

Dr. Nichols: “I don’t know.

Dr. Smith: “Yea”

Dr. Nichols: “That’s, I’m asking . . . (?) . . . “

Dr. Smith: “OK. Well, as far, I mean just a cursory comment on the ‘any’: There may be exceptions that, there are maybe some bacteria that can’t transfer plasmids, but I don’t know of any. You’re going to the outer envelope of my actual knowledge on that . . .” (L13)

Dr. Nichols was clearly concerned about the extent to which interspecific plasmid transfer can occur, and he implicitly raised this potential counterexample to the assumed “genetic barriers.” Dr. Smith was able to confirm interspecific plasmid transfer, but he didn’t know what its limits might be. After this exchange, Dr. Smith reminded the audience that plasmid reception constitutes the acquisition of existing information rather than the development of new information. This prompted an audience member to address the potential anomaly more explicitly:

Audience 1: “Wouldn’t that be just like when a donkey mates with a zebra?

Dr. Smith: “Yea.”

Audience 1: “So when stripes go into that between the two or when it’s zedonk or whatever. So it would be like kinds can transfer information. If they’re different kinds, there’s no transfer.”
Dr. Smith: “Yea. And”

Audience 1: “I believe the same premise will be seen in the animal kingdom. That’s what I believe.” (L13, emphasis original)

Audience 1 suggested that the donkey/zebra hybrid is possible because they are “like kinds,” but “different kinds” are unable to produce offspring. By implication, the same principle would apply to plasmid transfer—“like kinds” could exchange plasmids, but “different kinds” could not. In response, Dr. Smith reminded the audience that most hybrids of this sort are sterile, and afterward the discussion took another turn. In this exchange, Dr. Nichols raised a potential anomaly, it was briefly discussed, and a tentative solution was offered. The anomaly was not resolved, but rather it was tabled for lack of information. It was viewed as an interesting question rather than a potential crisis for creationism.

When patrons and staff at the Fossil Museum recognize potential anomalies to young-earth creationism, they treat them as puzzles to be considered and resolved at another time rather than crises. Young-earth creationism is never threatened. The reasoning appears to be analogous to that employed by mainstream scientists when they encounter anomalies—anomalies rarely threaten the theoretical framework, but rather they are deferred for future resolution.

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Plasmid exchange is one of several mechanisms for interspecific “horizontal gene transfer” (HGT). Exchanges between bacteria are only part of the story. For example, HGT has been documented from parasitic plant to host plant (Mower, Stefanovic’, Young, & Palmer, 2004) and from host plant to parasitic plant (Davis & Wurdack, 2004). In fact such exchanges occur between kingdoms, as when plants transfer genes to bacteria (de Vries, Hertzfeld, & Wackernagel, 2004). Therefore Dr. Nichols identified a true anomaly to the theory of “genetic barriers,” but as we have seen, anomalies do not constitute crises for creationists or for mainstream scientists.
Museum Visitors

Most Fossil Museum tours include at least one minor, and many include more than one child under the age of twelve. Tour groups range from as few as two (typically one adult and one child) to family, church or community groups of as many as thirty. In order to elicit reactions from Fossil Museum visitors, I interviewed a total of 35 Fossil Museum visitors over a three-month period. Each interviewed visitor had completed a museum tour in the company of at least one child before I interviewed him or her. I interviewed 29 of these singly, while six visitors chose to be interviewed in pairs. As opportunities arose, I approached individual adult visitors and requested an interview, or I approached groups of visitors and requested an interview. In the latter case, one or, in three cases, two visitors volunteered to be interviewed. In fewer than five instances I approached an individual or group to request an interview but was refused. I employed no randomization procedure in selecting individuals or groups to request an interview, and in particular I did not request an interview of individuals or groups who appeared to be distracted with childcare or other concerns. Therefore although nearly all of the people who I approached granted an interview, because of non-randomization on my part and self-selection on their part, I do not claim that the interviewees are a representative sample of Fossil Museum visitors.

Interviewee Demographics

Demographic information for the interviewed visitors appears near the end of Table 1. The 35 interviewed visitors ranged from ages 17 to 72, and the median age was
37. The only minor, age 17, interviewed together with his father at his father’s request. Thirteen of the 35 interviewed visitors (37%) were male and 22 were female. In answer to “what is your religious affiliation,” all self-identified as Christian. Ten (29%) answered that they were non-denominational Christians, ten (29%) answered that they were Baptists, and six (17%) answered that they were Catholic. By comparison, 10% of American Christians self-identify as non-denominational Christian, 21% of American Christians self-identify as Baptist, and 32% of American Christians self-identify as Catholic (calculated from Kosmin & Mayer, 2001, p. 11). Therefore the 35 interviewed visitors included a proportionately greater number of non-denominational Christians and fewer Catholics compared to the general U. S. Christian population.

The interviewed visitors were also highly educated: of the 33 visitors aged 25 or older, 16 (49%) reported their highest degree as a bachelor’s degree and six (18%) reported their highest degree as a master’s degree. Together, 22 (67%) of the 33 interviewed visitors aged 25 or older reported earning a bachelor’s degree or higher. By comparison, the U. S. Census Bureau reports that in the Midwestern United States, only 26% of adults aged 25 or older hold a bachelor’s degree or higher (U. S. Census Bureau, 2004). Seven (32%) of the 22 interviewed visitors holding bachelor’s or master’s degrees reported degrees in science, technology, engineering, or mathematics (STEM). These include one in engineering, one in anthropology, two in science/math education, and three in medical fields. This is comparable to the 28% of all postsecondary degrees awarded in STEM fields in the 2003-2004 academic year (U. S. Government Accountability Office, 2005).
Table 1

*Fossil Museum Visitor Interviews*

<table>
<thead>
<tr>
<th>Question</th>
<th>Responses</th>
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<tbody>
<tr>
<td>If you had to choose a part of the tour that you found especially thought-provoking or convincing, what would you choose?</td>
<td>Opening the Doors of Truth 5</td>
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<td>Classroom Presentation</td>
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<td>- Fossils &amp; Pictures 4</td>
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<td>- Rapid Fossilization 4</td>
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<td>- ID Arguments 2</td>
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<td>- Marine &amp; Terrestrial Fossils intermingled 1</td>
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<td>Noachian Flood</td>
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<td>- Vapor Canopy/Gigantism 7</td>
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<td>- Underground Water Source 1</td>
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<td>- Mountain Marine Fossils 1</td>
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<td>Dinosaur/human evidence</td>
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<td>- Petroglyphs 4</td>
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<td>- Ica Stones 2</td>
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<td>- Acambaro Figurines 2</td>
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<td>- Living Dinosaurs 2</td>
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<td>- Paluxy Footprints 1</td>
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<td>Polystrate Trees 1</td>
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<td>Astronomical Arguments</td>
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<td>Human Population Statistics 1</td>
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<td>Local Fossils 1</td>
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<td>Facts/Proof 2</td>
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<td>Nothing 1</td>
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<tr>
<td>Question</td>
<td>Responses</td>
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<td>-------------------------------------------------------------------------</td>
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</tbody>
</table>
| If you had to choose a part of the tour that you found to be unconvincing or uninteresting, what would you choose? | ID Arguments 4  
Opening the Doors of Truth 3  
God Resting on Day 7 1  
Ica Stones 1  
Exhibit of castings instead of fossils 1  
Local Fossils 1  
Living Dinosaurs 1  
Ambiguously Interpretable Data 1  
Everything 1  
Nothing 21 |
| Would you say that the Museum is presenting a religious point of view?    | Yes 25  
No 6  
Yes and No 3  
No Answer 1 |
| Would you say that the Museum is presenting a scientific point of view?   | Yes 34  
No Answer 1 |
| How would you distinguish between science and non-science?               | Science is fact-based, measurable, proveable, while non-science is opinion-based or theoretical 24  
Science is reproducible 2  
Science agrees with the bible 2  
Science follows the scientific method 1  
Science has no gaps/anomalies 1  
Science is theoretical 1  
Non-science (like math) is a tool for science 1  
Unable to distinguish science from non-science 5 |
Table 1 (continued)  
*Fossil Museum Interviews*

<table>
<thead>
<tr>
<th>Question</th>
<th>Responses</th>
<th>Responses Count</th>
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<tbody>
<tr>
<td>Do you think science is making positive progress?</td>
<td>Yes</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Yes and No</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Sometimes</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Creation science yes, but mainstream science no</td>
<td>2</td>
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<tr>
<td>Would you say that a worldwide Flood occurred?</td>
<td>Yes</td>
<td>31</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>No Answer</td>
<td>2</td>
</tr>
<tr>
<td>Why or why not?</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-Religious/biblical belief and physical arguments</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>-Physical arguments only</td>
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<td></td>
<td>-Religious/biblical belief only</td>
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<td></td>
<td>No</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-Physical arguments only</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>No Answer</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-Physical arguments only</td>
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<tr>
<td>How old would you say the earth is?</td>
<td>Thousands of years old</td>
<td>23</td>
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<tr>
<td></td>
<td>Millions of years old</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Billions of years old</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>No Answer</td>
<td>6</td>
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<tr>
<td>Would you say that complex plants and animals evolved from simpler forms?</td>
<td>Yes</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>24</td>
</tr>
<tr>
<td>Why or why not?</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-Human intervention</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(hybrids, grafting)</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>-Environmental adaptation</td>
<td>2</td>
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<tr>
<td></td>
<td>-New varieties develop</td>
<td>1</td>
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<td></td>
<td>-Learned evolution in school</td>
<td>1</td>
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<tr>
<td></td>
<td>-No Answer</td>
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Table 1 (continued)  

<table>
<thead>
<tr>
<th>Question</th>
<th>Responses</th>
</tr>
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<tbody>
<tr>
<td>No</td>
<td></td>
</tr>
<tr>
<td>- Belief in sudden, complete creation</td>
<td>9</td>
</tr>
<tr>
<td>- Varieties &amp; hybrids do not represent evolution</td>
<td>7</td>
</tr>
<tr>
<td>- The biological world is declining</td>
<td>5</td>
</tr>
<tr>
<td>- No evidence for evolution</td>
<td>2</td>
</tr>
<tr>
<td>- Lamarckian evolution rejected</td>
<td>2</td>
</tr>
<tr>
<td>- New discoveries ≠ new species</td>
<td>2</td>
</tr>
<tr>
<td>- No Answer</td>
<td>1</td>
</tr>
<tr>
<td>Can you imagine any evidence that would cause you to change your mind about a worldwide flood or the age of the earth or evolution?</td>
<td>Yes 9</td>
</tr>
<tr>
<td></td>
<td>No 22</td>
</tr>
<tr>
<td>Flood no, age yes, evolution unsure</td>
<td>1</td>
</tr>
<tr>
<td>Flood no, age yes, evolution no</td>
<td>1</td>
</tr>
<tr>
<td>No Answer</td>
<td>2</td>
</tr>
<tr>
<td>In what ways is our culture improving?</td>
<td>Religious &amp; cultural tolerance 9</td>
</tr>
<tr>
<td>(Six interviewees supplied two answers.)</td>
<td>Health &amp; Medicine 5</td>
</tr>
<tr>
<td></td>
<td>Evangelism 4</td>
</tr>
<tr>
<td></td>
<td>Technology 3</td>
</tr>
<tr>
<td></td>
<td>Increased leisure time 2</td>
</tr>
<tr>
<td></td>
<td>Education 2</td>
</tr>
<tr>
<td></td>
<td>Globalization 1</td>
</tr>
<tr>
<td></td>
<td>Families discuss God more 1</td>
</tr>
<tr>
<td></td>
<td>More self-awareness 1</td>
</tr>
<tr>
<td></td>
<td>Homeschooling accepted 1</td>
</tr>
<tr>
<td></td>
<td>More environmental protection 1</td>
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<tr>
<td></td>
<td>No Answer 11</td>
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*Fossil Museum Interviews*
<table>
<thead>
<tr>
<th>Question</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>In what ways is our culture getting worse?</td>
<td>Morality &amp; values 13</td>
</tr>
<tr>
<td></td>
<td>Less time with family 3</td>
</tr>
<tr>
<td></td>
<td>Crime 3</td>
</tr>
<tr>
<td></td>
<td>Abortion 2</td>
</tr>
<tr>
<td></td>
<td>Consumerism 2</td>
</tr>
<tr>
<td></td>
<td>Internet &amp; media 2</td>
</tr>
<tr>
<td></td>
<td>God out of schools 2</td>
</tr>
<tr>
<td></td>
<td>Less tolerance for Christianity 2</td>
</tr>
<tr>
<td></td>
<td>Decline expected before end times 2</td>
</tr>
<tr>
<td></td>
<td>Stem-cell research 1</td>
</tr>
<tr>
<td></td>
<td>Terrorism 1</td>
</tr>
<tr>
<td></td>
<td>Religious conflict 1</td>
</tr>
<tr>
<td></td>
<td>Lack of curiosity 1</td>
</tr>
<tr>
<td></td>
<td>Lack of accountability 1</td>
</tr>
<tr>
<td></td>
<td>Lack of discipline of children 1</td>
</tr>
<tr>
<td></td>
<td>Lack of courtesy 1</td>
</tr>
<tr>
<td></td>
<td>World hunger 1</td>
</tr>
<tr>
<td></td>
<td>No Answer 1</td>
</tr>
<tr>
<td>(Five interviewees supplied more than one answer.)</td>
<td></td>
</tr>
<tr>
<td>Overall, would you say that our culture is improving or getting worse?</td>
<td>Improving 8</td>
</tr>
<tr>
<td></td>
<td>Getting worse 22</td>
</tr>
<tr>
<td></td>
<td>Improving and getting worse 1</td>
</tr>
<tr>
<td></td>
<td>Neither improving nor getting worse1</td>
</tr>
<tr>
<td></td>
<td>No Answer 3</td>
</tr>
<tr>
<td>Would you like to see the ideas in the Museum presented in the public</td>
<td>Yes 34</td>
</tr>
<tr>
<td>schools?</td>
<td>No 1</td>
</tr>
<tr>
<td>Why or why not?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yes 19</td>
</tr>
<tr>
<td></td>
<td>-Fair to present both sides</td>
</tr>
<tr>
<td></td>
<td>-Counterbalance to secularism 4</td>
</tr>
<tr>
<td></td>
<td>-Because it is true 4</td>
</tr>
<tr>
<td></td>
<td>-To think about 3</td>
</tr>
<tr>
<td></td>
<td>-No reason offered 4</td>
</tr>
<tr>
<td></td>
<td>No 1</td>
</tr>
<tr>
<td></td>
<td>-No religion in public school 1</td>
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Table 1 (continued)  

<table>
<thead>
<tr>
<th>Question</th>
<th>Responses</th>
</tr>
</thead>
</table>
| Do you consider yourself to be a creationist? | Yes 33  
<p>|                                   | No 1                                           |
|                                   | No Answer 1                                    |
| Why or why not?                   | Yes -Religious belief only 18                  |
|                                   | -Religious belief and physical arguments 6      |
|                                   | -Physical arguments only 2                     |
|                                   | -No Answer 7                                   |
|                                   | No -No Answer 1                                |
|                                   | No Answer -Religious belief only 1             |
| What is your religious affiliation? | Non-denominational Christian 10               |
|                                   | Non-denominational/Baptist 3                   |
|                                   | Baptist 7                                      |
|                                   | Catholic 6                                     |
|                                   | Assembly of God 2                              |
|                                   | Mennonite 2                                    |
|                                   | Evangelical Friends 2                          |
|                                   | Church of Jesus Christ of 1                    |
|                                   | Latter-Day Saints 1                            |
|                                   | United Methodist 1                             |
|                                   | Christian not attending a church 1             |
| Would you say that you are “saved?” | Yes 32                                         |
|                                   | No 2                                          |
|                                   | No Answer 1                                    |
| Gender                            | Male 13                                        |
|                                   | Female 22                                       |
| Age                               | 17-72 years old, median age = 37               |</p>
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<thead>
<tr>
<th>Question</th>
<th>Responses</th>
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<tr>
<td>What is your highest degree?</td>
<td>High school student 1</td>
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<td></td>
<td>High school 7</td>
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<td></td>
<td>College student 2</td>
</tr>
<tr>
<td></td>
<td>Technical school degree 2</td>
</tr>
<tr>
<td></td>
<td>Associate’s degree 1</td>
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<tr>
<td></td>
<td>Bachelor’s degree 16</td>
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<tr>
<td></td>
<td>Master’s degree 6</td>
</tr>
<tr>
<td>What was/is your major?</td>
<td>College student</td>
</tr>
<tr>
<td></td>
<td>-Education 2</td>
</tr>
<tr>
<td></td>
<td>Bachelor’s Degree</td>
</tr>
<tr>
<td></td>
<td>-Education (including 2 in science/math education) 7</td>
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<td></td>
<td>-Business 3</td>
</tr>
<tr>
<td></td>
<td>-Nursing 1</td>
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<tr>
<td></td>
<td>-Cardiovascular Technology 1</td>
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<tr>
<td></td>
<td>-Math and Electrical Eng. 1</td>
</tr>
<tr>
<td></td>
<td>-History 1</td>
</tr>
<tr>
<td></td>
<td>-No Answer 2</td>
</tr>
<tr>
<td></td>
<td>Masters Degree</td>
</tr>
<tr>
<td></td>
<td>-Business 2</td>
</tr>
<tr>
<td></td>
<td>(One with a B. A. in anthropology.)</td>
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<tr>
<td></td>
<td>-Theology 2</td>
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<td></td>
<td>-Social Work 1</td>
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<td></td>
<td>-Exercise Science 1</td>
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Table 1 (continued)  

<table>
<thead>
<tr>
<th>Question</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is your current occupation?</td>
<td>Homeschool Teacher 5</td>
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<tr>
<td></td>
<td>Student 5</td>
</tr>
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<td></td>
<td>Business 4</td>
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<td>Factory Worker 3</td>
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<td>Homemaker 3</td>
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<td></td>
<td>Retired 3</td>
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<td></td>
<td>Nurse 1</td>
</tr>
<tr>
<td></td>
<td>Physical Therapist 1</td>
</tr>
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<td></td>
<td>Administrative Assistant 1</td>
</tr>
<tr>
<td></td>
<td>Social Worker 1</td>
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<tr>
<td></td>
<td>Pastor 1</td>
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<td></td>
<td>Teacher 1</td>
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<tr>
<td></td>
<td>Information Technologist 1</td>
</tr>
<tr>
<td></td>
<td>Commercial Driver 1</td>
</tr>
<tr>
<td></td>
<td>School Bus Driver 1</td>
</tr>
<tr>
<td></td>
<td>Librarian 1</td>
</tr>
<tr>
<td></td>
<td>Freelance Lecturer 1</td>
</tr>
<tr>
<td></td>
<td>No Answer 2</td>
</tr>
</tbody>
</table>

*Satisfaction with the Museum*

Interviewed visitors were generally satisfied with the Museum experience. In answer to “if you had to choose a part of the tour that you found to be especially thought-provoking or convincing, what would you choose,” no single argument or exhibit received more than seven votes, and only one person answered that nothing was especially thought-provoking or interesting (see Table 1). However, in answer to “if you had to choose a part of the tour that you found to be unconvincing or uninteresting, what
would you choose,” 21 of the 35 participants (60%) answered that they could identify nothing uninteresting or unconvincing.

In answer to “would you say that the Museum is presenting a religious point of view,” 25 (71%) of the 35 interviewees answered yes. In answer to “would you say that the Museum is presenting a scientific point of view,” 34 (97%) of the interviewees answered yes. In answer to “how would you distinguish between science and non-science,” 24 (69%) of the 35 interviewees answered that science is fact-based, measurable, or provable, while non-science is opinion-based or theoretical. Since twenty-three of these 24 stated that the Museum is presenting a scientific point of view, then 23 (66%) of the 35 interviewees indicated that the Fossil Museum presents a fact-based, provable case unspoiled by opinion or theory.

Creationism Among Interviewed Visitors

In answer to “do you consider yourself to be a creationist,” 33 (94%) of the 35 interviewees answered “yes.” When asked “why or why not,” 18 (55%) of the 33 cited only religious belief and another 6 (18%) cited both religious belief and physical argument. Unsurprisingly, religious belief appears to be very important to justifying creationism among interviewed visitors.

However, other questions revealed that “creationism” is not a unitary concept. For example, two of those who self-identify as creationists did not accept a worldwide flood, and both of the two who did not self-identify as creationists accepted a worldwide flood. Overall, in answer to “would you say that a worldwide flood occurred,” 31 (89%)
answered yes. Faith and physical arguments appear to be equally important in justifying acceptance of a worldwide flood. In answer to “how do you know,” 24 (77%) of the 31 who accept a worldwide flood cited religious/biblical belief, 25 (81%) of the 31 cited physical arguments, and 19 (61%) of the 31 cited both physical arguments and faith-based reasons. On the other hand, all four of the interviewees answering “no” and “don’t know” cited physical arguments.

Other questions further revealed the diversity among the 33 who self-identify as creationists. In response to “how old would you say the earth is,” only 23 (70%) of the 33 answered as young-earth creationists, i.e. in the thousands of years. In answer to “would you say that complex plants and animals evolved from simpler forms,” only 24 (69%) answered no. However, few of the 11 interviewees who answered “yes” demonstrated an understanding of natural selection. For example, four of them cited human intervention (hybridization and grafting) as examples of evolution.

Overall, of the 33 interviewed visitors who self-identified as creationists, only 17 (52%) answered all three questions as strict young-earth creationists, i.e. that a worldwide flood occurred, that the earth is thousands of years old, and that present-day life forms did not evolve from simpler forms. By contrast, none of the 35 interviewed visitors, including the two who did not self-identify as creationists, answered all three questions according to standard scientific theory, i.e. that a worldwide flood did not occur, that the earth is billions of years old, and that present-day life forms evolved from simpler life forms. It should also be noted that the 17 interviewees who answered all three questions as young-earth creationists were neither better- nor worse-educated than
the other interviewees. Among the 17 who answered as strict young-earth creationists, 16 were 25 or older. Of these 16, eleven (69%) held at least a bachelor’s degree, nearly the same percentage as all interviewees (67%).

In answer to the question “can you imagine any evidence that would cause you to change your mind about a worldwide flood or the age of the earth or evolution,” 22 (63%) of the 35 interviewees answered no. Of the 22 interviewees who answered that they could imagine no evidence that could change their minds, all 13 who responded to “why not” cited their religious beliefs. The following answers are typical:

“Because I believe that the bible is the inspired word of God and it’s the foundation for my, it’s the foundation of who I am. And to change that means that everything that I believe is for nothing. I guess I can’t pick and choose.” (B228)

“Because I was raised in church, I go to church, and for me the bible is absolute fact. I believe the stories are there for a reason and that’s it. (laughs)” (C228)

A229: “’Cause I, it is just so much evidence in my, in my life personally of God that I can’t refute that.”

PW: “OK. (pause) So I’m gonna say no?”

A229: “So it’s pretty unimaginable at this point in my life.” (A229)

To imagine evidence that could change their minds about a worldwide flood, the age of the earth, or evolution would require changing how they situate themselves in the world. Such a change of mind was beyond imagination. The answers were about the same for the 17 who expressed strict young-earth creationism: 13 (76%) of the 17 answered that they could not imagine such evidence.
Finally, 34 of the 35 interviewees answered yes to “would you like to see the ideas in the Museum presented in the public schools.” The one person who answered “no” was one of two who did not self-identify as creationists. Nineteen (56%) of the 34 offered fairness as their reason. The following answer is representative:

“Well, I believe, I mean evolution is just a theory. And I mean even if people that are for evolution probably see creation as a theory. So why not present both? And because I mean there’s both sides. People believe evolution, people believe in creation. And as far as, I mean as a parent, you know, I would want my kids to I guess know both sides. I said they are both, if you want to say theories, as far as from other people’s perspectives.” (A88)

For this visitor, evolutionists regard creationism as “a theory” and creationists regard evolution as “just a theory.” Therefore they are equivalent and both views should be presented in order to provide a complete education.

**Progress and Decline**

As an entryway to themes of progress and decline, I asked “in what ways is our culture improving?” Eleven (31%) of the 35 interviewees did not supply an example. In answer to “in what ways is our culture getting worse,” only one of the 35 interviewees did not supply an answer. In answer to “overall, would you say that our culture is improving or getting worse,” 22 (63%) of the 35 interviewees answered that it is getting worse and only 8 (23%) answered that it is getting better. Taken together, all of this indicates a sense of cultural decline.

However, most of the visitors did not apply a sense of cultural decline to science. In answer to “do you think science is making positive progress,” 21 (60%) of the 35
interviewees answered yes, and only 5 (14%) answered no. Perhaps more strikingly, ten (45%) of the 22 visitors who answered that our culture is getting worse also answered that science is making positive progress. Unsurprisingly, 7 of the 8 visitors who answered that our culture is improving answered that science is making positive progress. Therefore science is progressing in the view of nearly all of those who stated that our culture is getting better, and science is progressing in the view of nearly half of those visitors who stated that our culture is getting worse.

Although the general opinion of science was high, a few of the interviewed visitors linked cultural decline to technology, and two of them implicated science in that decline. As one visitor put it:

D197: “Look at how many kids are born that have flaws and have problems. And we have cancer and we have everything. It’s, man is in charge of the earth, but what have we done to the earth today to cause all of these problems? . . . Look, who invented the atomic bomb? Who invented DDT? I mean, all these people with birth defects. Hiroshima.”

E197: “Yea.”

D197: “You know, all of these. I mean not just that, but the hormones in our food, like you’re saying meat. I stay away from meat ‘cause I’m afraid of the hormones. We did that” (emphasis original).

Here the visitor implicates science via the development of the atomic bomb, but it stands as an indictment of “us” rather than “those scientists.” In other words, this visitor recognizes science and technology as a cultural product—something that “we did” rather than something that “they did.” She is not a scientist, but she accepts the guilt of science, despite the fact that she accepts a worldwide flood, believes that the earth is thousands of
years old, and rejects evolution. By contrast, she does not accept the guilt of the
American Civil Liberties Association:

D197: “I would love [to see the ideas in the Museum presented in the public
schools], but how would we go about that? When we have the ACLU?
You know what I’d like to do with the ACLU? You want me to tell you?
I’d put ‘em where the sun don’t shine.”

PW: (laughs)

D197: “I’m serious, that group has just been unbelievable.”

PW: “The ACLU?”

D197: “They were meant not to do what they’re doing. They were meant to help
people, but now they have their own agenda and they do whatever they
feel. I think half of ‘em are atheists. You know? And look at atheists,
Madalyn Murray O’Hair. Her son is now a preacher! And that woman
started all of the athe, you know, the atheist movement here in the United
States. Yea, I, it’s, without God how can you survive in the world?”

For this visitor, science is something good which occasionally goes astray, consistent
with her answer of both yes and no to “do you think science is making positive
progress?” By contrast, she asserted that atheists have hijacked the ACLU and it is now
irredeemable. This visitor identifies with and respects science in a way that she does not
identify with or respect the ACLU.

Interviewed visitors rarely expressed a sense of biological decline. For example,
24 of the 35 interviewees answered “no” to “would you say that plants and animals
evolved from simpler forms.” However, only five (21%) of these 24 answered “why not”
in declinist language such as “things denigrate, they don’t get better” (B714) and “like
when DNA damage or you see species lose, not having all the information they had in
their genes before or, and there’re problems, not being able to reproduce” (A148).
Anomalies

I interviewed each of the 35 visitors just after they completed a Fossil Museum tour. Since many of the exhibits consist of alleged anomalies to the theory of evolution or the geological time scale, it is unsurprising that some of the visitors wondered why these anomalies don’t cause a change in mainstream science. For example, a visitor offered the discovery of polystrate trees and soft tissues in dinosaur bones\(^4\) as obvious counterevidence to evolution and geologic time. She concluded:

“We study—I’m a home school mom and we use Apologia Science,\(^2\) and everything that we do in home science . . . the children can see that couldn’t just happen. It’s very obvious to their—in their minds without me even provoking anything to them that it can’t just happen. So when I see something else that’s new, you know it strengthens my thinking of why don’t people—why are people prolonging, persistent in the evolutionary theory when there is so much evidence and why don’t they give this other evidence a chance scientifically?” (A229)

Since the evidence makes it obvious even to children that “it can’t just happen,” i.e. that the world must have been created rather than evolved, this visitor expressed vexation that mainstream scientists don’t take creationism seriously. Later in the interview, she reiterated her complaint that scientists ignore the evidence:

A229: “There are many scientists who are not really validated by the scientific community but they’re finding things that are very much supporting this [a worldwide flood].”

PW: “Mm.”

\(^4\) Fossilized trees which cut across sedimentary layers are known as polystrate trees. Flood geologists cite them as evidence for rapid deposition of sedimentary layers. See Appendix B for a discussion of the discovery of soft tissues in dinosaur bones.

\(^2\) Apologia Science is a Christian/creationist science curriculum for home schooled children (Apologia Educational Ministries, 2007).
A229: “That they’re, they’re saying there’s no other way to explain this phenomenon that they’re finding”

PW: “Mm hm”

A229: “But they’re not accepted by the scientific community because they don’t fit in.”

PW: “Sure.”

A229: “And I’d like to find out why, I’d like to know why they’re just poo-pooed as nonscientists when the evidence is pretty strong. When you find a dinosaur bone that still has collagen in it, I mean that shows you that it cannot be millions or even hundreds of thousands of years old.” (emphasis original)

This visitor was clearly frustrated that in her view scientists ignore significant anomalies to mainstream science. She felt that the correct course of action would be a re-examination of standard theory in light of the evidence, but suspected that mainstream scientists fail to do so because creationists “are not really validated by the scientific community” and “they don’t fit in.” For her the evidence is clear, but scientific prejudice prevents mainstream scientists from accepting its implications.

Another visitor agreed that various anomalies effectively falsify the geologic time line. Referring to some of the Fossil Museum’s “common sense” arguments about the leap second, the size of the sun, and antediluvian oxygen levels, this visitor said:

“I don’t have a real big science background, but those seem very difficult to refute. They want to claim millions of years. And how do you argue against something like that? It just doesn’t make any sense.” (B178)

Like the visitor discussed above, this visitor was satisfied that these anomalies were unassailable and effectively refute mainstream science. However, this visitor approached anomalies to biblical accounts without a sense of crisis:
PW: “Would you say that a worldwide flood occurred?”

B178: “Yes.”

PW: “OK, and how do you know?”

B178: “I’ve read and studied the evidence. It makes a lot of sense. I’ve heard of the arguments on both sides. I believe the bible is true. I believe the prophecies are true in the bible. It can be relied on from beginning to end. And even if, at this point, even if there are things in the bible that don’t have scientific proof for because the rest of it, I believe is true. God’s word can be relied on. You know, they’re, they can continue to find things archaeologically that they said that cities that didn’t exist, people that didn’t exist and recently they’re finding evidence that, the, what, the things that are stated in the bible are true.”

When archaeology appears to contradict the bible, this visitor counseled patience rather than panic: since “God’s word can be relied on,” apparent contradictions have been resolved in the past and will continue to be resolved in the future. Note the difference in approaches, however: scientific anomalies falsify mainstream science but biblical anomalies represent temporary glitches to biblical faith. This visitor’s confidence resembles the practical approach to anomalies that Kuhn and Lakatos attribute to scientists—biblical anomalies are puzzles to be deferred rather than occasions for crisis.

Such differing responses to scientific and biblical anomalies may contrast with one another, but for some of the Fossil Museum visitors they are not incompatible with one another because the bible is permanent and reliable in a way that science is not. As one visitor expressed it:

“The interesting thing to me is that creation science doesn’t have to change their ideas about how something occurred. Evolution is constantly in flux.” (B118)

In response to “how would you define science,” another visitor said:
A48: “OK, I think it would be the study of life and matter, and it’s not always factual. I think science should be stable. And it’s not.”

PW: “Mm hm. What do you mean by stable?”

A48: “I think it should never change.”

PW: “Oh.”

A48: “And it does. I think that’s the reason why the bible holds what it does is because it doesn’t change but it’s always right.”

PW: “Gotcha.”

A48: “And science isn’t always right. That’s why it changes.”

Since science is human and fallible, revision is to be expected. Since the bible is divine and infallible, revision is out of the question. Therefore different approaches to scientific and biblical anomalies are to be expected.

Conclusion

Fossil Museum staff respect science, promote science, and wish to practice science. This respect for science can be observed in the Creek Study, but it is also visible in Fossil Museum educational programs. Children and adults alike are taught that mainstream science has made wrong turns (in evolution, the geological time scale, radiometric dating, etc.), but that bible-friendly science is possible and desirable. Fossil Museum staff express respectful disagreement rather than hostility toward mainstream science. Although visiting lecturers may accuse mainstream scientists of foolishness or deception, Fossil Museum staff attribute their disagreements with mainstream scientists to differing assumptions, interpretations, and worldviews. Interviewed visitors, who were
largely sympathetic to the young-earth creationist view, echoed this respect for science. Although a majority of interviewed visitors indicated that our culture is getting worse, a majority of them also indicated that science is making positive progress. In fact nearly half of those who indicated that our culture is declining also indicated that science is progressing.

Yet for all of their respect for science and scientists, Fossil Museum exhibits include numerous scientific and factual errors (see Appendix B). Consequently, leading young-earth creationists reject many of the arguments displayed there. These errors appear to result from a lack of scientific training and from a tendency to uncritically trust certain sources. Although the interviewed visitors were highly educated, most of them did not notice these errors and reacted favorably to Fossil Museum arguments and exhibits. Sixty percent of interviewed visitors could name no unconvincing or uninteresting exhibit or argument, and all but one expressed a desire to see the ideas in the Museum presented in the public schools.

Fossil Museum exhibits, staff, and speakers describe natural history as an ongoing decline from a better time. Fossil Museum staff counter evolution, which they link to progress, with the Second Law of Thermodynamics, whose origins they trace to the Fall. They characterize antediluvian times as an era of enhanced environmental conditions resulting in larger plant, animal, and human life and greater longevity. They assume that antediluvian people were more intelligent and technologically able than today. They extend the idea of decline to include genetic decline or devolution. Although a majority of interviewed visitors expressed a sense of cultural decline, few expressed a sense of
biological decline. Among those who did so, I observed no link between cultural decline and biological decline—they appeared to be separate phenomena among interviewed visitors.

Fossil Museum staff and visitors speak of “data” apart from human assumptions about and interpretations of data. For Fossil Museum staff, the geological timescale and the theory of evolution represent instances in which human worldviews, assumptions, and interventions have contaminated the data. Where possible, Fossil Museum staff prefer that theories be induced from assumption-free data. Interviewed visitors expressed the same opinion—about 2/3 of interviewed visitors agreed that science is fact-based, measurable, and observable, while non-science is opinion-based or theoretical. This emphasis on assumption-free data found expression in Fossil Museum staff and speakers’ expressed preference for operational science over historical science. Some speakers and staff even suggested that the relative untestability and unrepeatability of historical science disqualifies it as science.

Fossil Museum staff and interviewed visitors deal with anomalies in a way that closely resembles the way scientists deal with anomalies. They do not regard them as crises, but rather as problems to be resolved where possible or otherwise deferred for future resolution. On the other hand, staff and interviewed visitors regard anomalies to mainstream science as falsifications, and they wonder why mainstream scientists don’t recognize that their own theories are in crisis.
CHAPTER V
DISCUSSION

Amateur Scientists

Respect for Science

We have seen that with the occasional exception of guest speakers, Fossil Museum staff and visitors respect science, educate their children about science, and describe their own practice as scientific. Given creationism’s record of defeat in the U. S. courts and censure by mainstream scientists, this identification with science might be surprising. I believe that perhaps ironically, the Fossil Museum’s respect for science is rooted in their religion and accompanying certainty in their young-earth beliefs. Because of their confidence, they believe that any fair examination of the evidence will reveal the earth’s youth and the sudden appearance of biological “kinds.” They perceive most scientists to be honest, fair-minded, evidence-driven thinkers who have simply not been exposed to the huge amount of data which, as they see it, falsifies standard science. They believe that the few scientists who have been exposed to this evidence likely remain unconvinced because of their assumptions and worldviews. They hope that as they present empirical evidence and point out unwarranted assumptions, science will come to their point of view. Therefore the Fossil Museum does not withdraw from science, but attempts to contribute to science’s self-reform.
The Fossil Museum’s respect for science is sincere in my view, but it also plays a strategic role. Fossil Museum staff members recognize that science carries so much weight among the general public that anti-science rhetoric would be counterproductive. The attraction of “science” appears to draw visitors, and the Fossil Museum also tacitly recognizes that insulting the scientific community would reduce their chance of winning their support. To this end Dr. Smith and Zebediah are surely counterproductive when they characterize mainstream scientists as incompetent or deceitful. Perhaps they are more socially naïve than Fossil Museum staff, but more likely they perceive their primary audience to be insiders, i.e. fellow young-earth creationists, so that their role is analogous to a preacher rallying the faithful. By contrast, Fossil Museum staff members work under the assumption that their audience includes outsiders who could become allies with careful handling, in which case their role is more of the evangelist trying to win converts. However, all of the interviewed visitors expressed support for at least one of the young-earth positions, so their audience may actually include few outsiders.

Ignorance of Science

The paradox is that while Fossil Museum staff members demonstrate a high regard for science, we see in Appendix B that many Fossil Museum exhibits and arguments are founded in erroneous information and/or ignorance of basic science, and consequently leading young-earth creationists have rejected a substantial portion of them. How is such high regard for science compatible with ignorance of science? One answer is that respect for science does not appear to be incompatible with a lack of scientific
training or knowledge. In a study of U. S. adult attitudes toward science, Bak (2001) found that education level is an important determinant of a positive attitude toward science. He also found that an elementary understanding of science correlates to a positive attitude toward science. However, Bak also found that among college graduates, science majors and non-science majors exhibited no significant difference in attitude toward science. This indicates that the level of advanced understanding of science does not correlate to a positive attitude toward science. Therefore just as Toumey (1996) characterizes the general American attitude toward science as “respect without understanding,” so Fossil museum staff can value science despite having only an amateur-level understanding of it.

Another answer to the Fossil Museum paradox of high respect for science coupled with scientific errors lies in the Fossil Museum’s trust in a few particularly unreliable sources such as Carl Baugh and Kent Hovind. Following Good (2003; 2005), who argues that deference to authority characterizes the religious habit of mind, we might conclude that authoritarianism is the problem. However, we saw in Chapter 2 that authoritarianism is a normal part of science, partly because science is so specialized that scientists cannot avoid trusting other scientists. The difference is not so much that the Fossil Museum trusts young-earth colleagues, but that they have placed their trust in the least reliable and most poorly trained of young-earth creationists. Therefore trust alone is not the problem.

Instead, I believe that in addition to limited scientific training, the Fossil Museum’s strength of conviction in young-earth creationism is responsible for their failure to notice, investigate, or correct Baugh and Hovind’s errors. Having observed the
“wrong” conclusions of science (e.g. evolution and earth antiquity), Fossil Museum staff members approach mainstream science with considerable skepticism. In many cases they attribute the perceived errors of mainstream science to its assumptions, some of which they trace to religious and philosophical commitments. By contrast, Fossil Museum staffers trust biblical literalist Christians such as Baugh and Hovind because they make the “right” assumptions about science and scripture and, consequently, reach the “right” conclusions. Having judged them to be trustworthy on religious and philosophical grounds, they see little reason to investigate the substance of their degrees, the accuracy of their evidentiary claims, or the logical consistency of their scientific reasoning.

**Supportive Visitors**

Bak (2001) found that regardless of major field of study, highly educated people tend to view science positively. Therefore we should not be surprised that interviewed visitors were highly educated (2/3 of those over 24 years of age hold at least a Bachelor’s degree) and also expressed a high regard for science. However, we also saw that all of the 35 interviewed visitors rejected at least one facet of mainstream science and nearly half of them answered as strict young-earth creationists. The high educational levels of these creationists might be surprising at first glance, since several studies strongly correlate creationist belief to low educational achievement (Eve & Harrold, 1986; Handberg, 1984; Shankar & Skoog, 1993; Toumey, 1987). However, three factors can clarify the creationism of such highly educated people. First, other studies indicate that understanding of the theory of evolution does not appear to correlate with acceptance of
the theory of evolution (Demastes, Settlage, & Good, 1995; Sinatra et al., 2003). Second, Eckberg (1992) confirmed a correlation between creationism and low educational level among non-conservative Christians, but he found no such correlation among conservative Protestants. This suggests that faith over-rides education among conservative Protestants. Together, these studies indicate that high educational levels are not incompatible with creationism. Finally and most importantly, Toumey (1987) found that although only 21% of North Carolinia creationists held at least a bachelor’s degree, 70% of the activist creationists that he studied in North Carolina, i.e. those who write letters to the editor, attend creationist events, etc., held a bachelor’s degree or higher. Since all of the interviewed Fossil Museum visitors had taken the time to further educate themselves and/or their children about young-earth creationism, they may fall into Toumey’s “activist” category. Therefore higher educational levels may actually be expected among visitors to creationist institutions.

Yet we still must wonder why these highly educated visitors did not notice the Fossil Museum’s scientific errors. Overall they expressed little skepticism, and a majority of interviewed visitors named nothing in the Fossil Museum that they found to be unconvincing or uninteresting. Perhaps the sheer speed of the Museum tour allows little time to recognize dubious material. However, an alternative explanation may be found in their religious identification with the Fossil Museum. All of the visitors self-identified as Christians. Recognizing Fossil Museum staff as people who share their religious convictions, visitors probably judged Fossil Museum staff to be trustworthy. Prepared to enjoy science in a “safe” environment, supportive visitors likely suspend the
sort of skepticism they might employ at a mainstream museum. In this regard the visitors’ lack of critical insight into Fossil Museum exhibits may parallel the Fossil Museum’s gullibility with respect to its sources.

Baconian Science

Assumption-Free Data

We have seen that Fossil Museum staff and visiting speakers described data as a pristine ideal that tends to be polluted by the assumptions, worldviews, and interpretations with which people study the data. Ward explained that the determinative power of worldviews cause different people to look at the “same evidence” in completely different ways, and Ben extended this idea to embrace an inductive/Baconian view of scientific discovery. Interviewed visitors agreed that opinions or theories contaminate facts, as two thirds of them said that non-science is opinion-based or theoretical, while science is fact-based, measurable, or provable. Fossil Museum associates regularly indicated that at least in principle, facts can and should speak for themselves.

In describing assumption-free data as the common ground of all observers, the Fossil Museum takes part in a broader movement in creationist rhetoric. Answers in Genesis’s Ken Ham writes, “Too many people think it’s a battle of sorting out DIFFERENT evidences . . . The real battle is over the SAME evidence” (Ham, 2003, emphasis original). In a book intended to help public school students counter evolutionary instruction, Roger Patterson writes “The argument is not over the evidence—the evidence is the same—it is over the way the evidence should be
interpreted” (Patterson, 2006, p. 25). Like the Fossil Museum, these writers appeal to the common-sense idea that theories may vary but data remains constant.

Philosophers of science disagree with the characterization of data as assumption-free. One of the strongest critics of this idea is Norwood Russell Hanson (1958; 1969), who describes observations and data as inextricably “theory-loaded.” Of Galileo’s formulation of kinematics and William Harvey’s discovery of blood circulation, Hanson writes:

Thus Harvey’s circulation hypothesis and Galileo’s constant-acceleration hypothesis make sense only against the considerable background of their respective collections of stable knowledge. To one who lacked the background of either of these great investigators, letting the facts about blood motion or falling-body motion merely speak for themselves would have issued in an unearthly silence. And for one who possessed the background knowledge of a Harvey or a Galileo, but who refused to pinpoint his inquiry with sharp hypotheses constructed out of specific questions, letting the facts speak for themselves would have resulted in a deafening confusion. (N. R. Hanson, 1969, pp. 233-234, emphasis original).

Here Hanson indicates that scientists do not contaminate otherwise pristine data with theory-based assumptions and interpretations. Instead, scientists use theories to create data. Therefore assumption- or theory-free data cannot exist. A scientist such as Stephen Hawking, an unequivocal realist, agrees:

[W]e cannot distinguish what is real about the universe without a theory . . . It is no good appealing to reality because we don’t have a model independent concept of reality. In my opinion, the unspoken belief in a model independent reality is the underlying reason for the difficulties philosophers of science have with quantum mechanics and the uncertainty principle (Hawking, 1993, pp. 44-45).

Contrary to the common-sense appeal of Art’s statement that “the facts are cast in stone” but “assumptions” and “interpretations” are not, there are no facts without assumptions
and interpretations, and truly different assumptions lead, in fact, to different data. This is partly what Kuhn means when he writes that different research paradigms are incommensurable with one another (Kuhn, 1970b). Therefore in adopting a theory-free view of data, the Fossil Museum has taken a poorly supported position.

Although poorly supported, the notion of assumption-free data serves the Fossil Museum (and other young-earth creationists) in several ways. First, assumption-free data supports the Fossil Museum belief that fair-minded examination of the evidence leads to the young-earth creationist point of view. Unlike Dr. Smith or Zebediah, who attribute some of their disagreements with mainstream science to dishonesty or incompetence, Fossil Museum staff members blame their quarrel with mainstream science on its assumptions. They believe that if scientists could only follow the data without these contaminating assumptions, it would lead them to the young-earth position. Even if this does not happen, the rhetoric of theory-free data encourages visitors to recognize their assumptions and suspend judgment until observing the evidence first-hand. In short, the notion of theory-free data can help to disarm the skeptical visitor.

The notion of assumption-free data also creates a common ground on which creationists and evolutionists can debate. Scientists typically view creationists as outsiders attempting to invade and corrupt legitimate science. But in laying claim to the “same data” that scientists have, Fossil Museum associates elevate themselves from the outside status of marginalized pseudoscientists to the insider status of rival interpreters. Here creationist assumptions become neither more nor less reasonable than scientists’
assumptions—after all, both are “assumed” rather than “derived” or “proven.” Only the (theory-free) “facts” are “set in stone”—the rest is a matter of assumption.

Science/Non-Science Demarcation

Historical Science

Despite their respect for science, we have seen that Fossil Museum associates argue that historical science is unreliable or perhaps not science at all. The historical science/observational science distinction is part of a rhetorical move on the part of the larger creationist community aimed at invalidating evolution and the standard geologic timescale. For example, we saw in Chapter 2 that for five years, Alabama biology textbooks bore a warning label that read in part: “No one was present when life first appeared on earth. Therefore, any theory about life’s origins should be considered as theory, not fact” (Alabama Citizens for Science Education, 2004). Since there were no eyewitnesses, “no one was present,” theories about life’s origins are presented as being inherently suspect. In the same way, Answers in Genesis trains elementary students to interrupt and derail objectionable historical science lessons by asking “were you there” (Ham, 2004; Ham & Davis, 2004)? By implication, evolution, the Big Bang, and other objectionable theories are inferred rather than observed, so such accounts are particularly open to doubt.43 By contrast the bible is represented as an authoritative eyewitness account of human history, so biblical revelation will always trump historical science.

43 Intelligent Design proponent Stephen C. Meyer also distinguishes historical science from nomological (law-seeking) science (Meyer, 1996). However, Meyer does not
We saw that the distinction between operational and historical science depends upon the notion of reproducibility and upon a sharp distinction between observation and inference. Yet reproducibility is not as straightforward a criterion as it might appear. For example, Sharon Traweek observed that high-energy particle detectors are never duplicated because high-energy physicists would not receive credit for original research and because funding for duplicates of such expensive machines would be denied (Traweek, 1988, p. 159). Confidence rises in an experimental result when physicists use different procedures on the same detector to cross-check the result or when closely related detectors confirm the result. However, in such cases experiments are reproduced in the sense that physicists judge the results to be equivalent rather than in the sense of exact duplication. Furthermore, Collins and Pinch describe several case studies in which experiments are reproduced but lead to different results (H. M. Collins & Pinch, 1998). In these cases disputes arise over the criteria for experimental reproduction. In a particularly controversial set of experiments, up to 70 variables were cited to argue that an experiment had not been successfully reproduced (H. M. Collins & Pinch, 1998, pp. 11-12). In those cases that scientists are unable to reach a consensus over whether or not an experiment has been successfully reproduced, “reproducibility” is weakened as a demarcation criterion between operational and historical science.

The notion that operational science is “observed” while historical science is inferred constitutes a second serious flaw in the distinction between them. Almost none distinguish them by observation and inference, he does not privilege nomological science over historical science, and he accepts the geological time scale.
of modern science is directly “observed.” For example, Dr. Nichols mentioned several
everyday quantities in his description of operational science, including velocity, kinetic
energy, and potential energy. Yet none of these are observable, but rather must be
inferred with the assistance of mediating theories. The same could be said for some of
the most fundamental and uncontroversial objects of science such as quarks or genes.
Each is inferred with the assistance of mediating theories rather than directly observed.
In each case we find that operational science is no more observable than historical
science.

Although there is no clear divide between inference and observation, the Fossil
Museum and the larger young-earth community may be attracted to observability as a
criterion for scientific reliability simply because vision is the dominant sense in humans.
Possibly for this reason, scientists tend to privilege images over other kinds of knowledge
(see, e.g., Weinstein, 1998, pp. 27-31). Lay consumers of scientific knowledge also
privilege images. Brain scans, for example, evoke a sense of certainty among the general
public that far exceeds the confidence of the scientists who produce them despite the
scientists’ cautions and disclaimers (Dumit, 2004). Since seeing is believing, an
observational emphasis appeals to Fossil Museum staff, speakers, and visitors.

Although the historical science/operational science distinction does not withstand
scrutiny, it confers an important benefit to the Fossil Museum. In rejecting biological
evolution, the geological time scale, and modern cosmology, the Fossil Museum is open
to the charge that they are anti-science. Yet the historical science/operational science
distinction enables the Fossil Museum to respond that they reject only speculative,
observable aspects of science. Like most creationists, Fossil Museum associates accept and rely on a great deal of modern science such as chemistry, particle physics, ecology, and medicine (Faulkner, 2007; Patterson, 2006), and such information is routinely included in creationist home school materials (e.g. Apologia Educational Ministries, 2007). Therefore the historical science/operational science distinction enables the Fossil Museum to reject entire scientific fields while preserving the pro-science stance needed to maintain credibility in a pro-science society.

**Tentativeness**

Major scientific organizations such as the American Association for the Advancement of Science (1990; 1993), the National Research Council (1996), and several other international science organizations argue that scientific knowledge is durable but it is also tentative (McComas, Almazroa et al., 1998; McComas, Clough et al., 1998). We saw in Chapter 2 that opponents of creationism explicitly used the tentative nature of science to disqualify creationism as science, and we examined the weaknesses of this demarcation criterion. Consequently it may have come as a surprise that Fossil Museum staff and visitors were well acquainted with the tentative nature of science, but they represented this tentativeness as a *weakness* compared to biblical revelation, i.e. science is tentative and changing but the bible is certain and permanent.

Other creationists express the same opinion. For example, a major source for the Fossil Museum, Carl Baugh, says:
Now we don’t dare marry ourselves to a current concept in astrophysics or quantum mechanics, because history has shown that you’ll be a widow in the successive generation, because all of these concepts pass with using and are replaced with newer, more modern, more progressive concepts (Baugh, 1996, vol. 1, 31:30).

Therefore science is always in flux, but the bible is permanent and dependable. Although Baugh is correct that science is tentative, he and Fossil Museum associates misrepresent the situation in at least two ways. First, this description understates or omits science’s relatively durable nature. Science is tentative, but once-speculative theories such as heliocentrism have lasted for hundreds of years. Second, this description overstates or omits the impermanence of biblical interpretation. Biblical literalism and Christian fundamentalism are relatively recent developments in Christian history, representing an application of Enlightenment ideas to Biblical interpretation beginning in the 19th century (Marsden, 1984, 1991). This wholly inductive approach to scriptural interpretation would seem strange to Martin Luther and other leaders of the Protestant Reformation. Even a relatively recent figure such as Jonathan Edwards (1703-1758) recognized that scripture is not self-interpreting (Ruse, 2005b). Yet like many fundamentalist Christians, Baugh and the Fossil Museum reveal an ahistorical understanding of their religious tradition, misrepresenting their particular biblical beliefs as timeless and independent of philosophical movements.

The notion that science is wholly tentative and the bible is wholly permanent misrepresents both. Nonetheless, this argument serves an important purpose at the Fossil Museum. The historical/operational science distinction helps to shield the Fossil Museum from the anti-science charge, but the fact remains that the Fossil Museum rejects
a great deal of science. Distorting the tentativeness of science and the permanence of the bible helps pro-science visitors to adjust to the rejection of entire scientific fields. Since all of the interviewed visitors are Christian and a majority expressed pro-science leanings, this argument is probably effective.

Falsifications and Anomalies

Falsifications

We have seen that both Fossil Museum associates and anti-creationists use the idea of non-falsifiability to disqualify their opponents, but both do so in opportunistic and logically inconsistent ways. Most of the Fossil Museum’s arguments and exhibits amount to falsifications of objectionable science, and the Fossil Museum gift shop carries titles such as *Evolution: A Theory in Crisis* (Denton, 1986) and *Darwin’s Black Box* (Behe, 1996), which describe evolution as a falsified theory. Fossil Museum staff, speakers, and visitors expressed astonishment that scientists continue to accept the theory of evolution in the face of so much counterevidence. Apparently such arguments and materials are effective, as every interviewed visitor was satisfied that at least one aspect of mainstream historical science is wrong.

Yet within mainstream science, counter-instances are insufficient to falsify a theory. According to Imre Lakatos, highly productive “research programmes” are often burdened with anomalies right from the beginning:

The classical example of a successful research programme is Newton’s gravitational theory: possibly the most successful research programme ever. When it was first produced, it was submerged in an ocean of ‘anomalies’ (or, if
you wish, ‘counterexamples’), and opposed by the observational theories supporting these anomalies (Lakatos, 1972, p. 133).

Lakatos does not judge the success of a research program by the number of anomalies associated with it, but by its ability to make positive progress. Kuhn agrees with Lakatos on this point: “scientists fail to reject paradigms when faced with anomalies or counterinstances. They could not do so and still remain scientists” (Kuhn, 1970b, p. 78). Like Lakatos, Kuhn cites Newtonian gravitational theory as an example, including an anomaly in the moon’s orbit that was left unresolved for 60 years and a discrepancy in Mercury’s orbit that was tolerated for over 200 years (p. 81). Kuhn notes that a new theory may resolve anomalies, but it also creates anomalies where none existed before (see, e.g. pp. 130-131). In short, Kuhn and Lakatos argue that scientists are rewarded for judging that various anomalies are not fatal to an otherwise useful scientific theory.

Since a considerable volume of creationist research amounts to identifying and exploiting anomalies in mainstream science, it is not surprising that young-earth creationists typically disagree with Kuhn and Lakatos. For example, young earth creationist Barry Setterfield addresses the problem that astronomical objects are billions of light-years away and yet are visible in a universe that is only thousands of years old by arguing that the speed of light was much faster during creation week and gradually slowed, reaching its present value in about 1960. (Setterfield’s light-speed theories are

44 On the other hand, neither Kuhn nor Lakatos imply that anomalies don’t matter. The ability to resolve anomalies is one of Lakos’s criteria distinguishing progressive from degenerative research programmes. Kuhn describes historical periods in which anomalies become intolerable and a paradigm is thrown into crisis. Yet whether or not a theory is in crisis is a matter for scientific judgment.
featured at the Fossil Museum--see Appendix B for a discussion.) Since his arguments rely on anomalous historical light-speed measurements, anomalies are essential to Setterfield’s theory. Setterfield writes:

It is never good science to ignore anomalous data or to eliminate a conclusion because of some presupposition. Sir Henry Dale, a one-time president of the Royal Society of London, made an important comment in his retirement speech. It was reported in *Scientific Australian* for January 1980, p. 4. Sir Henry said: “Science should not tolerate any lapse of precision, or neglect any anomaly, but give Nature’s answers to the world humbly and with courage.” To do so may not place one in the mainstream of modern science, but at least we will be searching for truth and moving ahead rather than maintaining the scientific status quo (Setterfield, 2007a, 2007b).

Here Setterfield marshals the support of a deceased Nobel laureate to argue that proper science does not tolerate anomalies, that is, that deferral of anomalies is unscientific. *Creation Ex Nihilo* magazine quotes another leading scientist to argue that tolerance of anomalies is not only unscientific, but absurd:

Readers may be interested in the following excerpt from an article by the famous Australian biologist, Sir MacFarlane Burnet, writing in the Medical Journal of Australia (Jan 1/8, 1977) titled “Morphogenesis and Cancer” . . .

No critical biologist doubts the broad validity of modern evolutionary theory, but it can never be susceptible to experimental disproof. When observations in some particular field seem to cast some doubt on one aspect of evolution or another, no one dreams of disputing the whole notion of evolution. Any hypothesis to account for the anomaly must be within the standard evolutionary framework.45

No creationists could have put it better—how obvious it is that scientists are not evolutionists because the evidence demands it—if the evidence doesn’t fit, let’s make it fit! The tragedy is that brilliant minds such as Prof. Burnet’s cannot see out of the valley of this sort of vacuous reasoning and refuse to consider alternatives ("Excerpt from article by Sir MacFarlane," 1979).

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45 Taken from Burnet (1977, p. 7).
Burnet’s reaction to anomalies is consistent with Kuhn and Lakatos’s descriptions, but to the editors of *Creation Ex Nihilo*, such tolerance of anomalies amounts to cheating. The Institute for Creation Research’s Henry Morris lists several alleged anomalies to evolutionary theory and expresses amazement that evolutionists are not embarrassed by them (H. M. Morris, 2005). Setterfield, Morris, and *Creation Ex Nihilo* imply that true science allows no exceptions, and that a single counter-instance should be sufficient to falsify a theory (see Allchin, 2003, p. 334; Raup, 1983, pp. 160-161). Lakatos (1972) labeled this strong and unrealistic form of falsificationism as dogmatic or naïve falsificationism.

The Fossil Museum’s naïve falsificationism works hand-in-glove with their notion of assumption-free data: If “the evidence is the same for everyone,” then surely fair-minded scientists would acknowledge their falsifications of mainstream science. If the assumptions of mainstream science are the main problem, then atheoretical data falsifying mainstream science stands the best chance of winning a hearing. Yet when mainstream scientists are aware of these supposed falsifications, they typically recognize that they are pseudo-anomalies or reject them out of hand because of their underlying religious motivations or most typically they simply ignore them. This must be very frustrating to creationists. In order to win the attention of scientists, they may feel forced to advance the position that even a single counterexample should be sufficient to falsify mainstream science. Yet even if the Fossil Museum’s naïve falsificationism does not win a hearing among scientists, it likely encourages sympathy among visitors for the perceived injustice that scientists ignore problems with their own theories.
Anomalies

Evolutionists typically fail to credit creationists with the honest discovery or resolution of problems in their own research. Instead, mainstream scientists are likely to describe creationists as intellectual sloths more devoted to vindicating the biblical account of creation than carefully examining evidence. For example, Alice Kehoe accuses creationists of disengagement from empirical data or even of abusing it:

The scientific creationist refuses to admit the nature of facts or the critical importance of unbiased—uncommitted—mulling over accumulated observations. Instead, he claims to know the truth by divine revelation and he arranges observations to conform to what is already written in the Bible (Kehoe, 1983, p. 10).

The Fossil Museum’s scientific gaffes tend to support Kehoe’s accusation that creationists ignore data, especially considering that only a small investment of research is sufficient to reveal the more egregious of these errors. Similarly Alters and Alters accuse creationists of simply throwing up their hands with a “God did it” whenever they encounter contrary evidence:

[M]any scientists freely contend that evolution could be falsified in many ways for them personally . . . [T]here are potential discoveries that would cause scientists to reject evolution. However, if an equally devastating find is made against creationism (which has occurred many times), it is merely attributed to an act of God’s indiscernible will (Alters & Alters, 2001, p. 86).

One can find support for this accusation in creationist literature. For example, consider the creationist conundrum that astronomical objects on the order of billions of light-years away are visible in a universe on the order of thousands of years old. As we have seen, Whitcomb and Morris answered that God created the universe with an “appearance of age” in which light emanating from distant astronomical objects was created along with
the objects themselves (Whitcomb & Morris, 1961, p. 369). Indeed, this sort of ad-hoc reasoning amounts to an appeal to “God’s indiscernible will.” At the Fossil Museum, the miraculous creation of a vapor canopy, the earth’s magnetic field, and other exhibits in “Opening the Doors of Truth” can likewise be described as acts of God’s will without further explanation (see Appendix B). In such cases the charge of intellectual laziness may be justified.

Yet these descriptions do not fully characterize the attitudes or actions of Fossil Museum staff and visitors. At times they exhibit a forthright commitment to evidence, particularly when Fossil Museum staff, speakers, and visitors identify anomalies. Audience members raised the question of why giant reeds wouldn’t have been crushed during the Flood and struggled with the lack of archaeological evidence for ancient superiority. Perhaps they were simply preparing for the possibility that these anomalies would be pointed out by their critics, but there was no sense of satisfaction with “quick answers.” In his discussion of fossil-included gastroliths, Ben laid out the problem publicly and in considerable detail and rejected the simple-minded explanation that a marine fossil could have become encased in rock, eroded out, and become a gastrolith in the relatively short time between the Fall and the Flood. When Dr. Nichols recognized that horizontal gene transfer threatened the notion that boundaries separate biological “kinds,” he questioned the speaker publicly for several minutes in an attempt to resolve the issue. These discussions weren’t always informed by scientific expertise, but in all cases Fossil Museum associates appeared to be motivated by the desire to understand as much as the need to defend the faith.
We also saw that speakers, staff, and interviewed visitors described perceived anomalies as falsifications to mainstream science, but they did not view gastroliths or other creationist anomalies as falsifications to creationism. Instead, they viewed them as puzzles or interesting problems to be resolved at some future time. A cynic might suggest that Fossil Museum associates react to anomalies in a strictly self-serving manner, publicizing anomalies that support their point of view while ignoring anomalies that do not. However, their behavior is consistent with Kuhn’s description of science, in which scientists judge some anomalies to be relatively mild problems that do not threaten the theoretical framework, while judging other anomalies to be serious problems whose long-term irresolution can initiate a crisis. Setting aside the cynic’s point of view for the moment, perhaps the Fossil Museum and mainstream scientists simply make opposite judgments. To Fossil Museum staff, the extraction of soft tissue from dinosaur bones is fatal to the theory that the dinosaurs went extinct 65 million years ago (see Appendix B). To mainstream scientists, such unexpectedly long-term preservation of tissues is an occasion for suggested explanations rather than crisis (Schweitzer et al., 2007). In the same way mainstream scientists would undoubtedly view the discovery of fossil-included gastroliths as a falsification of young-earth flood geology, but in the Fossil Museum fossil-included gastroliths are an oddity to be puzzled out in the future. I side with the mainstream scientists on both points, but in reaching the opposite conclusions I believe that Fossil Museum associates act in good faith. By Kuhn’s account there is no rule for choosing whether to defer or pursue an anomaly. It is a matter of judgment, not logic. Furthermore, since Fossil Museum staff, speakers, and visitors brought these anomalies
to light, they cannot be justly accused of “arrang[ing] observations to conform to what is already written in the Bible” or “merely attribut[ing them] to an act of God’s indiscernible will.” They resolved some anomalies and deferred others, but they did not ignore them or try to hide them.

The Fossil Museum’s commitment to science, emphasis on empirical data, and confidence in the young-earth position are all evidenced in their frank identification and discussion of young-earth anomalies. Since they sincerely believe that unbiased examination of the world will vindicate their point of view, bits of empirical counter-evidence do not concern them. I have argued that this confidence in the young-earth position contributes to negative consequences such as the uncritical acceptance of scientifically untenable arguments and a belief in theory-free data. In the case of anomalies, however, this confidence confers a benefit, namely that it encourages Fossil Museum associates to produce and discuss all physical evidence, not merely evidence that supports their point of view. Although these discussions are scientifically under-informed at times, they constitute a potential common ground for discussion with mainstream scientists, i.e. a genuine opportunity to converse with one another rather than across one another (see below).

On one hand, there is no question that in relying on the bible as source material to resolve scientific questions, the Fossil Museum is engaging in a religious practice. This practice is clearly different from the practice of mainstream scientists, for whom no religious text is admissible to resolve scientific questions. It is also clear that mainstream scientists are more knowledgeable and careful regarding theories and evidence than the
amateur and often flawed efforts displayed in Fossil Museum exhibits. On the other hand, both mainstream scientists and Fossil Museum staff are interested in discovering the truth, both value physical evidence, both employ practical reason and judgment regarding what counts as evidence and what does not, and both discover anomalies and deal with them in a practical way. Good (2003; 2005) argues that creationists and mainstream scientists exhibit fundamentally different habits of mind, but as Fossil Museum associates engage physical evidence in this honest way, it becomes clear that Fossil Museum associates’ habits of mind are similar. They differ in the level of training and the ground rules they accept, but not in their habits of mind.

Decline

An obvious tension can be seen in popular creationist literature between a sense of rapture over the world’s beauty and a sense of sorrow over the world’s degradation. For example, a creationist writer describes the Grand Canyon as “God’s gargantuan cathedral” on one hand and “a chilling museum of death” on the other (Vail, 2007, p. 69). Others write of the Grand Canyon’s “awe-inspiring vistas, colors and beauty” but also describe the Grand Canyon as “a monument to remind us of God’s judgment of a sinful world” (Nutting & Nutting, 2006, p. 45). Predatory animals provide a particularly acute instance of this tension between wonder and sorrow. A creationist writer describes tigers as “perfect killing machines—powerful, silent, camouflaged, with large teeth, retractable

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46 As noted in Appendix B, scientifically trained creationists have rejected many of the arguments employed at the Fossil Museum.
claws, and barbed tongues for scraping meat off bones” but also notes that “We know from Scripture that the original cat kind was vegetarian” and suggests that some of its predatory features may result from “God’s curse” (Christian, 2007, p. 22).

This tension between admiration over the world’s wonders and sorrow over its decline is less obvious at the Fossil Museum. For example, although Fossil Museum staff believe that Tyrannosaurus Rex’s predatory features result from the Fall, they do not mention it during a typical tour, and in fact they describe Tyrannosaurus Rex and other predatory dinosaurs with enthusiasm and awe. No doubt part of this enthusiasm, together with the ferocious-looking Tyrannosaurus Rex incorporated into the Fossil Museum’s logo, is calculated to exploit public interest in dinosaurs, particularly among children. But at root, this enthusiasm appears to be genuine and to be based in curiosity about the natural world and interest in science. To cite another example, Diana’s excitement over discovering a hydra appeared to be undiminished by her belief that it was not originally created for predation. I never recognized an instance in which Fossil Museum associates’ belief that they are studying a fallen world appeared to temper their interest in it.

**Genomic Devolution**

Environmental decline has been part of young-earth creationist literature since the time of Whitcomb and Morris (1961), but more recently the notion of genomic decline

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47 Exploitation of dinosaur interest is observable throughout the young-earth creationist world (discussed in Stokes, 1989). To cite two recent examples, Answers in Genesis president Ken Ham describes dinosaurs as “missionary lizards” (Ham & Davis, 2004), and Kent Hovind’s Pensacola, Florida theme park is named “Dinosaur Adventure Land” (2008).
has gained traction among young-earth creationists. For example, based on biblical accounts of gigantism and extraordinary human longevity, Fossil Museum associates believe that humans are weaker today and that human lifespans are considerably shorter today than they were in the past. Like most young-earth creationists (e.g. Patten, 1982), the Fossil Museum blames declining environmental conditions. However, other creationists have recently begun to blame genomic decline (e.g. C. Wieland, 1994, 1998). As another example, past creationists have expended considerable effort arguing that all vestigial organs serve a present-day purpose and therefore should not be taken as evolutionary remnants (e.g. Bergman & Howe, 1990). Although antievolutionists have not given up this effort, some have begun to take the opposite tack, citing vestigial organs (Batten & Sarfati, 2008; C. Wieland, 2000) and impacted wisdom teeth (Doolan, 1996) as evidence of genomic devolution.

Compared to fellow creationists, Fossil Museum associates deploy genomic decline in a measured and subtle way, mostly restricted to explanations of natural selection and genetic barriers between “kinds.”48 This restrained approach to genomic decline may result, in part, from their knowledge of the complexity of microbiological processes. During the classroom portion of the tour, Fossil Museum staff repeat the Intelligent Design (ID) argument that the bacterial flagellum is irreducibly complex, and they play a portion of the Unlocking the Mystery of Life DVD (Meyer & Allen, 2002) illustrating the marvel of protein synthesis. Should the Fossil Museum argue for more than a modest genomic decline, it would become difficult to explain how such

48 Zebediah’s apocalyptic declinism is the notable exception.
astonishingly complex and apparently fragile biological systems could survive. Instead, the Fossil Museum balances devolution and design, arguing that devolution has taken place and is continuing, but not to such an extent that the activity of a Designer is no longer visible.

Three Independent Forms of Decline

The Fossil Museum explains various phenomena based on environmental decline, genomic decline, and cultural decline. They trace the source of each of these to Adam’s sin, but otherwise these three types of decline appear to function independently of one another. For example, it would seem natural to argue that the decline in the human genome has lead to cultural decline, but I noticed such an argument only once.\(^49\) Perhaps this would interfere with the Christian belief that sin leads to cultural decline and that humans are fully culpable for that sin—if cultural decline were caused by genomic devolution, then sinners would be less culpable. Since the notion of genomic decline is a fairly new and complex development in creationist rhetoric, perhaps its potential has simply not yet been realized. This may explain why so few of the interviewed visitors mentioned genomic decline. Similarly it would seem natural to argue that cultural decline causes environmental degradation, but I never noticed such a connection. Instead, these forms of decline appeared to function as three independent “curses” on the creation.

\(^{49}\) On page 132, we saw that while wrestling with the lack of archaeological evidence for past superiority, Audience 2 said that he expected that there would have been more people of the caliber of Newton, Einstein, Faraday, or Maxwell in the distant past “because our genome is decaying.”
An Opportunity for Productive Dialogue

Fossil Museum staff, speakers, and visitors proved to be an interesting and complex group of people. Perhaps most interesting of all is their love affair with their historical “enemy,” mainstream science. They believe that whole areas of mainstream science have gone wrong, and yet they continue to respect and emulate mainstream science. I have argued that a pro-science stance is strategically useful to the Fossil Museum in our pro-science society, but it is equally clear that they are not faking it for strategic purposes—they believe that science can reveal the truth about the world, and they hope that some day science might come around to the young-earth creationist position. This belief in science’s truth-revealing potential is particularly clear in their frank discovery, appraisal, and discussion of anomalies. If they had any doubts about young-earth creationism or about the potential of physical evidence to confirm those beliefs, they would have been tempted to hide anomalies rather than expose them. As I began this study and discovered errors in some of their exhibits, I wondered whether, perhaps deep in their hearts, Fossil Museum staff harbored nagging doubts and whether they would be willing to float white lies in order to disguise those doubts or to win converts. Their discussions of anomalies convince me otherwise.

The guilelessness of the Fossil Museum hints that civil, respectful dialogue is possible between mainstream scientists and some creationists. This is not to say that the typical creation/evolution debates are of any use. For many years, creationists such as Duane Gish and Kent Hovind have staged public debates with mainstream scientists before non-scientific audiences, but in these exercises the well-practiced creationists
typically blind-side the scientists with gross oversimplifications and win the crowd through humor. Such exercises only further de-legitimize young-earth creationists in the eyes of mainstream scientists and vice versa. Instead, I suggest that in public discourse with the grass-roots creationists represented by the Fossil Museum or with fair-minded, scientifically trained creationists, points of evidence could be respectfully discussed. In a respectful dialogue, mainstream scientists would admit points of difficulty such as the multi-million-year preservation of soft tissue or the lunar recession problem. Similarly creationists would admit points of difficulty in their theories. Open discourse could be conducted via lecture series or in print. A model for such conversation might be the volume co-edited by Intelligent Design creationist William Dembski and evolutionist/philosopher Michael Ruse (Dembski & Ruse, 2004). Furthermore, I believe that this was the spirit in which Art and Ben invited me to lecture in their monthly series on my criticisms of Fossil Museum exhibits.

Fossil Museum associates believe that science can vindicate the young-earth creationist point of view partly based on faith in science and partly based on their conviction that young-earth creationism is true. I have argued that the latter conviction supports their curiosity of the natural world and leads to their frank discussion of creationist anomalies. However, I have also argued that their conviction in young-earth creationism is partly responsible for several unfortunate results, including a failure to critically examine the claims of unreliable sources and their belief in assumption-free data coupled with a naïve falsificationism. In any case, given Fossil Museum associates’ religiously-based certainty in young-earth creationism, the goal of civil discussion with
creationists should not be to change their minds. Young-earth creationism is too closely linked to a way of life for such a goal to be realistic. A more achievable goal of discourse would be increased understanding of one another’s positions, which might reduce the rancor between creationists and mainstream scientists and, I dare to hope, reduce the incidence of law suits over public school curricula.

We have seen that when creationists point out legitimate areas of difficulty to mainstream science, scientists view them as anomalies rather than threats. We have also seen that when Fossil Museum associates encounter potential falsifications to their point of view, they deal with them in much the same way. These observations suggest that dialogue between creationists and scientists will not progress through exchange of counterexamples. Instead, mainstream scientists can advance the goal of mutual understanding by emphasizing the evidentiary basis and explanatory power of mainstream science rather than emphasizing the difficulties of creationism. Laudably, the National Academy of Sciences takes this approach in its response to creationism.

While briefly noting faults in creationism (e.g. National Academy of Sciences, 1999, pp. 7, 8, 20-21; National Academy of Sciences & Institute of Medicine, 2008, p. 38), the National Academy presents a thorough case for the explanatory and predictive power of modern cosmology and evolution. Given the religious certainty observed at the Fossil Museum, these arguments are unlikely to “convert” young-earth creationists, but it might persuade some of them that the standard scientific view is reasonable and carries evidentiary support. This could go a long way toward reducing public rancor and increasing mutual understanding.
We have observed several areas in which Fossil Museum associates take weakly supported philosophical positions. Like some mainstream scientists, they advance falsifiability as a science/non-science demarcation criterion. Together with the idea of a sharp distinction between observation and inference, the falsifiability criterion supports the distinction between historical science and operational science. They also indulge a form of naïve falsificationism which, in turn, is supported by the notion of theory-free data. The falsifiability demarcation criterion, the notion of theory-free data, the assumption of an observation/inference divide, and naïve falsificationism risk leading dialogue between creationists and mainstream scientists into unproductive directions. Therefore these philosophical issues might represent early points for discussion. The goal would not be to “correct” creationists’ philosophical views, but to raise a sense of awareness that reasonable alternatives exist. This might facilitate creationists and mainstream scientists in talking to each other rather than across one another.

One could argue that if scientists engage in the sort of dialogue that I advocate, it might legitimate creationism. Just as the notion of assumption-free data helps the Fossil Museum and other creationists to claim the status of coequal, rival interpreter rather than subordinate outsider, perhaps fair dialogue will further advance this claim. I concede the possibility, but I also believe that this could actually reduce creationist pressure on the public schools. If creationists perceive that they are receiving a fair hearing outside the public schools, perhaps they will feel less of a desire to use the public schools as a
platform for debate. “Rival interpreter” status might be a reasonable price to pay to satisfy creationists’ sense of disenfranchisement.\textsuperscript{50}

On Nature of Science Education: A Role for Educators

Many scientists and science educators have argued that teaching the nature of science is key to reducing resistance to evolutionary instruction (Attie et al., 2006; Barclay, 2006; Clough, 1994; Farber, 2003; Flammer, 2006; Narguizian, 2004; National Academy of Sciences, 1998; National Association of Biology Teachers, 2001; National Science Teachers Association, 2003; Nickels et al., 1996; S. Olson, 2004; Scharmann & Harris, 1992). My studies of the Fossil Museum suggest that this is true. Given the absolute conviction in young-earth creationism displayed by Fossil Museum associates, nature-of-science instruction (or any other kind of instruction) stands little chance of turning young-earth creationists into old-earth evolutionists. Also, given the Fossil Museum’s faith that science can and will confirm young-earth creationism, there is little hope of convincing creationists that creationism is an illegitimate subject for empirical inquiry. However, nature of science education stands an excellent chance of reducing the rancor in public debate between creationists and allies of mainstream science, and in that sense perhaps reduce resistance to evolutionary instruction.

\textsuperscript{50}At present, creationists argue that students should hear “both sides” of the “controversy,” to which mainstream scientists answer that since there is a virtual scientific consensus regarding evolution and earth antiquity, there is only \textit{one side} and there is no \textit{controversy}. Of course there is a controversy, although one can argue that it is not a purely scientific controversy but a religious/cultural/scientific controversy.
For example, creationists and scientists express mutual vexation that their
counterexamples are ignored. If science educators acknowledge that scientific theories
are anomaly-peppered rather than anomaly-free, this could reduce the mutual sense that
scientists or creationists are cheating or ignoring evidence. In the same way, teaching the
theory-laden nature of observation can help creationists as well as scientists to see that
arguments are not resolvable by “data” alone, further relieving the sense of mutual
vexation. Teaching the inseparability of inference from observation may ease the sense
among creationists that historical science amounts to guesswork but operational science
is reliable. In the same way, teaching that science is tentative but also durable may
reduce the tendency of both creationists and scientists to exaggerate either pole in the
heat of argument. In each example, the role of science educators is not to lure
creationists into acceptance of mainstream science, but rather to contribute to the mutual
understanding necessary for productive discourse.

Conclusion

The primary question motivating this study was how creationists view the
relationship between creationism and science, including the status ascribed to science, the
extent to which they view their own practice as scientific, and how they separate science
from non-science. This is a complex question, and we have seen that the answers are
equally complex. Despite this complexity, an esteem for science is always present at the
Fossil Museum, characterized by a pleasure in learning about the natural world, a respect
for science, and a belief that properly practiced science can confirm biblical revelation.
Considering that the scientific establishment shuns creationists, their tenacious belief in the compatibility of science with biblical revelation confirms the “plenary authority of science” (Toumey, 1996) in our society. They respect and want to practice science, but they also believe that contemporary science is broken in significant ways. Their prescription for repairing science relies mostly on a reversion to a Baconian view of science, including a sharp inference/observation distinction and an appeal to theory-free data. Because their supposed falsifications of mainstream science are mostly ignored, they also argue for the strongest, i.e. the most naïve, form of falsificationism. The result is a complex attitude of esteem for science tempered by criticism of science, perhaps analogous to efforts to reform a wayward lover.

The secondary question motivating this study was whether narratives of progress or decline are employed in creationism. Although I found less to report on this question, I found that environmental decline, genomic decline, and cultural decline are powerful theoretical and explanatory principles at the Fossil Museum. However, I was surprised to find that they appear to function independently of one another and that staff and speakers use genomic decline as an explanatory principle but visitors rarely do so. On balance, I found that declinist rhetoric was employed selectively rather than generally, and this rhetoric did not interfere with their interest in the natural world or optimism about science.

To conclude, I argue that the Fossil Museum’s complex attitude toward science and scientists opens the possibility for meaningful dialogue between creationists and mainstream scientists, aimed at mutual understanding rather than conversion. Some
leading creationists indulge strident public rhetoric and we have seen that scientists such as Richard Dawkins write that “It is absolutely safe to say that if you meet somebody who claims not to believe in evolution, that person is ignorant, stupid or insane (or wicked, but I’d rather not consider that)” (Dawkins, 1989, p. 35). However, this study indicates that at the grass roots, many creationist activists would be willing conversational partners, eager to discuss evidence rather than exchange barbs. I also argue that science educators can contribute to mutual understanding and improve public discourse by targeting some of the nature-of-science issues revealed here. Even a modest reduction in public rancor would, in my view, be welcome.
APPENDICES
APPENDIX A

VISITOR INTERVIEW QUESTIONS
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If you had to choose a part of the tour that you found especially thought-provoking or convincing, what would it be?

Why?

If you had to choose a part of the tour that you found to be unconvincing or uninteresting, what would it be?

Why?

Would you say that the museum is presenting a religious point of view?

Why or why not?

Would you say that the museum is presenting a scientific point of view?

Why or why not?

How would you define science?

How would you distinguish between science and non-science?

How could you tell the difference between good science and bad science?

Do you think that science is making positive progress?

Why or why not?

Would you say that a worldwide flood occurred?

How do you know?
How old would you say the earth is?

How do you know?

Would you say that complex plants and animals evolved from simpler forms?

Why or why not?

Can you imagine any evidence that would cause you to change your mind about a worldwide flood or the age of the earth or evolution?

What would that evidence be?

In what ways is our culture improving?

In what ways is our culture getting worse?

Overall, would you say that our culture is improving or getting worse?

Why?

Would you like to see the ideas in the museum presented in the public schools?

Why or why not?

Do you consider yourself to be a creationist?

Why or why not?

What is your religious affiliation?

Would you say that you are “saved?”

Gender: Age:

What is your highest degree?

What was your major?

What is your current occupation?
APPENDIX B

ANALYSIS OF FOSSIL MUSEUM EXHIBITS
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Unreliable Sources

Kent Hovind

A major source of material at the Fossil Museum is a young-earth creationist from
Pensacola, Florida named Kent Hovind. Hovind’s academic credentials are from
unaccredited institutions. Hovind claims a 1974 Bachelor of Religious Education from
Midwestern Baptist College of Pontiac, Michigan (Hovind, 2005a), a 1988 Master of
Education from Patriot University in Colorado Springs, Colorado (now Patriot Bible
University of Alamosa, CO), and a 1991 PhD in Education, also from Patriot University
(Hovind, 2005b, seminar 7, slide 1119). Midwestern Baptist University is not listed in
the U. S. Department of Education Database of Accredited Postsecondary Institutions and
Programs (U. S. Department of Education, 2007), and Hovind admits that Patriot Bible
University is unaccredited (Hovind, 2005b, seminar 7, slide 1129). At the graduate level,
Patriot Bible University charges only $50 per credit hour, holds no class meetings (in
person or on line), and employs no professors:

Patriot’s courses are self-directed correspondence studies and as such do not
employ professors. Patriot is curriculum-based learning rather than professor
based classroom teaching. Our courses are assembled by and under the direction
of Dr. Lonnie Skinner of Patriot Bible University . . . Our primary teacher is the
Holy Spirit (Patriot Bible University, 2006).
Although Hovind earned his PhD under such questionable circumstances, he normally presents himself as either “Dr. Hovind” (see, e.g. Hovind, 2005a) or “Dr. Dino” instead of the more befitting title of “Reverend.”

In addition to claiming questionable credentials from unaccredited institutions, Hovind spreads conspiracy theories and scientific nonsense. For example, Hovind preaches against the practice of vaccination and spreads the claim that the polio vaccine administered between 1955 and 1961 was infected with HIV (Hovind, 2005b, seminar 5, slide 100). He teaches that airplane contrails are actually chemical sprays (“chemtrails”) intended to control world population levels through manipulation of food and water supplies (Hovind, 2005b, seminar 5, slides 110-118). Hovind repeats fantastic and unverifiable claims from such sources as the *Reader’s Digest Mysteries of the Unexplained* (Calkins, 1982), including the report of a nine-foot-eight-inch-tall human skeleton found in 1879 but (of course) all of the physical evidence was lost in a flood in 1937 (Calkins, 1982, p. 40; Hovind, 2005b, seminar 2, slide 253).

In addition to a taste for conspiracy theories and a reliance on unscholarly source material, Hovind appears to misunderstand basic scientific ideas such as petrification. In order to demonstrate that petrification can take place in less than 100 years, Hovind cites the examples of petrified flour, a petrified pickle, and petrified charcoal briquettes (Hovind, 2005b, seminar 6, slides 290-296, 300). If these examples were insufficient to raise questions about Hovind’s definition of “petrified,” then he removes all doubt when he cites two different cases in which “petrified” fetuses were surgically removed from their (living) mothers’ bodies (Hovind, 2005b, seminar 6, slides 285-287). These
gruesome examples demonstrate that Hovind’s use of the word “petrified” bears little relationship to the normal use of the word, in which water-borne minerals gradually replace organic materials.

Until recently, Hovind’s carelessness has not injured his ministry or diminished his popularity. In 1989 Hovind founded his Creation Science Evangelism organization, and by 2004 he was appearing at over 900 public speaking engagements annually (Hovind, 2005a). In 2001 he opened “Dinosaur Adventure Land,” which Hovind describes as “a combination Creation Museum, Science Center, and Theme Park” (Hovind, 2005a, p. 3). By 2005 Hovind boasted that Dinosaur Adventure Land employed a staff of nearly 40 and had hosted approximately 50,000 visitors (Hovind, 2005b, seminar 4a, slides 9, 22). However, because of Hovind’s conspiracy-theory-laced legal and tax theories, including his belief that churches and other religious organizations should not register as tax-exempt organizations (see, e. g., Hovind, 2005b, seminar 5, slides 693-695), Hovind paid his employees in cash without income taxes or FICA taxes. As a result, in November of 2006 Hovind was indicted on 58 federal tax-related charges (Martinez, 2006) and he was sentenced to a 10-year prison term in January 2007 (National Center for Science Education, 2007b). He presently resides in the Federal Correctional Institution of Edgefield, South Carolina (Federal Bureau of Prisons, 2007).

Many Fossil Museum exhibits and arguments are adopted directly from Hovind (see below), and Fossil Museum/Fossil Park is partly modeled on Hovind’s Dinosaur Adventure Land (Hovind, 2005b, seminar 1, slides 71-110). Both combine a creation museum with a theme park, and both emphasize dinosaurs throughout the park. Like
Fossil Museum and Park, Dinosaur Adventure Land has a zip line near a sign reading “Pterodactyl Territory,” virtually identical rubber-band-launched paper airplanes (slide 110, see also Dinosaur Adventure Land, 2007), a sandbox in which a dinosaur skeleton is buried, and a “horse power” game identical to Fossil Park’s “dino power” (slide 97). Fossil Museum and Park’s similarity to Dinosaur Adventure Land is unsurprising, as Hovind encourages construction of such facilities (Hovind, 2005b, seminar 3a, slide 488).

**Carl Baugh**

Many of the exhibits and displays at the Fossil Museum are based on the work of young-earth creationist Carl Baugh of Glen Rose, Texas. Unfortunately, Baugh is a particularly unreliable source. To begin, the quality and circumstances of Baugh’s academic credentials are as questionable as Hovind’s. Baugh claims to have earned a 1959 undergraduate degree in theology, a 1984 Masters degree in Archaeology from the Pacific College of Graduate Studies, a 1989 PhD in Education from the Pacific College of Graduate Studies (Baugh, 1996, 1999, 2007a; Baugh & Wilson, 1992), and a 2005 PhD in Theology from Louisiana Baptist University (Baugh, 2007a). However, as of July 2007, Louisiana Baptist University was not listed in the U. S. Department of Education Database of Accredited Postsecondary Institutions and Programs (U. S. Department of Education, 2007). The Pacific College of Graduate Studies is primarily a correspondence school founded in the 1980s in Melbourne, Australia by Baugh’s close associate Dr. Clifford Wilson (Baugh & Wilson, 1992, p. 57). However, Glen Kuban reports that the College of Advanced Education in Irving, Texas originally
granted Baugh’s PhD in Anthropology and later it was reassigned to the Pacific College of Graduate Studies (Kuban, 1989a) as a PhD in Education. Both Kuban (1989a) and Hastings, Neeley, and Thomas (1989) report that the College of Advanced Education is a “missions” school without instructional facilities, run out of a house adjacent to Sherwood Baptist Church in Irving, Texas. As Hastings, Neeley, and Thomas note: “There is apparently no other campus, nor is there a science library or research facilities. There are no course descriptions, catalogs or written degree requirements” (Hastings et al., 1989, p. 1). Furthermore, Kuban reports that on Baugh’s diploma, the College for Advanced Education was listed as the Graduate Division of International Baptist College of Missouri. The U. S. Department of Education (2007) lists no accreditation for the College of Advanced Education or the International Bible College. Worse yet, Kuban reports that Carl Baugh and Clifford Wilson were listed together in the incorporation papers as founders of International Bible College. In a piece of International Bible College letterhead, Carl Baugh was listed as President, and (beneath a layer of correction fluid), Clifford Wilson was listed as Vice President for International Studies (Kuban, 1989a). As Kuban concludes, “[A]ll of Baugh’s alleged science degrees seem to trace circuitously back to Baugh himself and his partner Wilson—through their own . . . religious schools and/or branches of them” (Kuban, 1989a, p. 16). In short, Baugh’s graduate degrees were initially granted through a U. S. institution which he co-founded with Clifford Wilson and then reassigned to an Australian institution which Clifford Wilson founded. None of this inspires confidence in Baugh’s education or credibility.
Baugh’s publications do not improve his credibility. To begin, Baugh tends to exaggerate. Describing efforts to find Noah’s Ark, Baugh explains:

Ararat is the world’s most treacherous mountain: it has greater electromagnetic and electrostatic energy than any other mountain on record. Dr. John Morris related how he and his colleagues were pinned to a huge boulder by the electrostatic energy, with their arms and legs extended out into thin air (Baugh & Wilson, 1992, p. 15).

Baugh fails to mention that Morris’s colleague was being struck by lighting at the time (J. D. Morris, 1973, p. 60), preferring to let the reader assume that the mountain has unusual “electromagnetic and electrostatic” qualities. Some of Baugh’s stories are astonishingly naïve. As proof that dinosaurs survived until recently, Baugh recounts a 19th-century story about a pterodactyl that was found alive shortly after it was released from its encasement in solid limestone (Baugh, 1989, pp. 19-21). Baugh defends the account on the grounds that it was reported in a “verifiable publication” by Reader’s Digest (Calkins, 1982, pp. 45-46) based on a mid-nineteenth century newspaper account (“Very like a whale,” 1856). The original newspaper account’s odd title, “Very Like a Whale,” suggests its tongue-in-cheek nature. Baugh offers no evidence to support the story, physical or otherwise, but it is clear that he takes it seriously.\[^{51}\]

Even when Baugh attempts to produce evidence-based arguments, his lack of scientific training hampers his efforts. For example, Baugh appears to misunderstand radiometric dating. Knowing the half-life of a radioactive element in a sample is not

\[^{51}\] Baugh appears to believe that pterodactyl-like creatures may still be living. According to Woetzel (2006), Baugh has made two expeditions to Papua New Guinea to pursue rumors of a living pterosaur which can be seen flying at night (it is believed to glow in the dark via bioluminescence).
sufficient to date the sample. Instead, the ratio between the daughter nucleus and the parent nucleus determines the age. A new sample will have a relatively high ratio of parent to daughter nuclei, while an old sample will have a relatively low ratio of parent to daughter nuclei. However, Baugh seems to misunderstand this basic principle:

[I]t has been embarrassing to certain evolutionary scholars to find that in the laboratory those involved in this discipline have been able to produce synthetic or man-made [sic] isotopes which are not found in nature, and which have been found to be [comparatively] stable. These are radioactive materials and they have been produced in the laboratory. Yet in that point in time, and by production in the laboratory, these particular elements have half-lives which indicate that they are billions of years old—yet they were made in the laboratory by synthetic man-made [sic] methods . . . These long-life isotopes were first created by man [sic] in the laboratory. They already had the appearance of having been there for millions or even billions of years—that is, if we use the standard interpretation that the half-life indicates how long they have been around (Baugh, 1992b, pp. 138-139).

The evolutionary community has postulated that since uranium-235 [sic] takes a little over four billion years to lose half its mass,\(^5\) therefore the earth is a little over four billion years in age. That’s a non sequitur. That doesn’t match. Just because uranium-235 [sic] has in excess of four billion years in half-life does not say that the earth is four billion years old (Baugh, 1996, vol. 1, 1:14:00).

In both passages, Baugh appears to assume that under standard radiometric dating methods, samples containing relatively long-half-life elements must be older than samples containing relatively short-half-life elements. That is, half-life enables direct inference of age. Instead, the abundance of daughter nuclei relative to parent nuclei, together with inferences regarding the ratio of parent to daughter abundance at some time in the past, is used to calculate age. Baugh appears to lack the basic scientific understanding required to recognize this error.

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\(^5\) The half life of Uranium 235 is about 700 million years. Baugh is probably referring to Uranium 238, whose half life is about 4.5 billion years (Lide, 1997, pp. 11-138, 11-139).
Creationists rarely criticize one another publicly or by name. However, in the cases of Carl Baugh and Ron Wyatt (see below), the young-earth creationist organization Answers in Genesis (AiG) makes an exception:

We are sorry to say that, while AiG thinks he’s well meaning, Baugh unfortunately uses a lot of material that is not sound scientifically. So we advise against relying on any “evidence” he provides unless supported by creationist organizations with reputations for biblical and scientific rigor. Unfortunately, there are talented creationist speakers with reasonably orthodox understandings of Genesis who continue to promote some of the . . . Baugh “evidences” despite being approached on the matter (Answers in Genesis, 2007b).

Although Answers in Genesis recognizes that some of Baugh’s arguments are scientifically insupportable, we will see that the Fossil Museum promotes many of Baugh’s “evidences.”

*Don Patton*

Although wielding a smaller influence on the Fossil Museum than Baugh or Hovind, Don Patton’s influence is noticeable. As of 1989, Patton held no post-secondary degree, but he claimed to be a candidate for a PhD in Geology from Queensland Christian University, an unaccredited Australian University associated with Clifford Wilson (Kuban, 1989a, p. 16). Apparently this PhD did not materialize. Since 1993 he has claimed, like Baugh, to hold a PhD in Education from the Pacific School of Graduate Studies in Melbourne, Australia, although he identifies himself as a geologist (Patton, 2000b, 2007c).
Dennis Swift

A frequent collaborator with Don Patton and an important figure in the Fossil Museum’s “Evidence from Archaeology” section, Dennis Swift claims an extensive education. For example, in describing his initial skepticism regarding the Ica stones, Swift writes:

I had studied at nine different universities and colleges and obtained three post-graduate degrees. Having more degrees than a thermometer assured me that I was absolutely, one hundred percent certain that dinosaurs and man living together was an urban legend, and the lithic library of the Ica Stones was a big fat fraud (Swift, 2006b, p. 11).

Swift does not mention, however, that these degrees are not in archaeology, geology, paleontology, or any other scientific field. In 2006, Swift served as faculty to the unaccredited (U. S. Department of Education, 2007) Master’s International School of Divinity of Evansville, Indiana (Master's International School of Divinity, 2007). At that time, Master’s International School of Divinity described Swift’s credentials as:

Dennis Swift, B.A. Point Loma Nazarene University; M.A. Philosophy, Point Loma Nazarene University; M.Div. Nazarene Theological Seminary; Th.D. University of South Africa. In addition, Dr. Swift has completed archaeology and pre-Columbian Indian studies at the University of New Mexico and Western New Mexico University. He is the founder of the Dinosaur Institute and has done archaeological work in the United States Southwest, Mexico, Peru, Bolivia, Egypt, and Turkmenistan (Master's International School of Divinity, 2006).

All of Swift’s U. S. degrees are from accredited institutions (U. S. Department of Education, 2007), and the University of South Africa is a well-regarded institution. Yet degrees in philosophy and theology do not qualify Swift to conduct archaeological studies, and the nature or extent of his studies at the University of New Mexico and Western New Mexico University are not revealed. Despite the fact that Swift has earned
no degrees in any science, Swift criticizes a rival researcher for his lack of archaeological credentials: “Skeptics marshall [sic] the support of Neil Steede who is a freelance archaeologist without a degree” (Swift, 2006b, p. 125). Swift’s philosophy M. A., his M. Div., and his Th.D. are from legitimate institutions, but these degrees place him in no position to denigrate others who, like himself, do freelance archaeological work without a degree in the discipline. Furthermore, in his web page Swift correctly lists his degree as “Dr. Dennis Swift, THD” (Swift, 2006a), but in other documents he claims the title of “PhD” (see, e. g., Swift, 2007), an inaccuracy which may lead people to assume that he is a trained archaeologist or geologist rather than a theologian.

**Clifford Burdick**

Clifford Burdick (deceased in 1992) is responsible for one of the Fossil Museum’s most dramatic specimens, a casting of a giant footprint. Burdick’s credentials were always in question. At various stages he claimed to hold an M. A. in theology from Emmanuel Missionary College and an M. A. in geology from the University of Wisconsin, but neither was true. He submitted a thesis for the former but was awarded no degree, and he attended classes for the latter but failed his oral examinations (Numbers, 1992, p. 383, note 8). While in his sixties he attended geology courses at the University of Arizona, but he failed the oral examinations for both the PhD and the Masters thesis defense. In private correspondence Burdick admitted that he had performed poorly in both instances (Numbers, 1992, pp. 259-261). Nonetheless, in 1966 Burdick acquired a PhD from the University of Physical Sciences of Phoenix, AZ. A
creationist colleague, Walter E. Lammerts, thought that his diploma resembled a driver’s license. Although Burdick claimed that his degree was recognized by the State of Arizona, Lammerts discovered that the University of Physical Sciences was simply a registered trademark without a campus, professors, tuition, permanent address, or phone number. In its literature, the University of Physical Sciences specified that it was not an educational institution (Numbers, 1992, p. 262). Nonetheless, Burdick became known as “Dr. Burdick.” Apart from his illegitimate credentials, Burdick’s frequently sloppy work and misleading statements regularly caused problems for the creationist movement (Numbers, 1992, pp. 263-265, 415-416).

Ron Wyatt

Some of the claims in the Fossil Museum’s Noah’s Ark display originate with the late Ron Wyatt of Cornersville, Tennessee (deceased 2000). Wyatt was a nurse anesthetist who claimed astonishing biblio-archaeological discoveries. These include discovery of chariot wheels at the bottom of the Red Sea (left when Pharaoh’s army was drowned), the Ark of the Covenant, the site of the crucifixion, the tablets of the Ten Commandments, and numerous Noah-related sites including Noah’s Ark, house, grave, and his wife’s grave and jewelry ("Has the Ark of the Covenant been found?," 1999; Snelling, 1992). Wyatt even claimed to have discovered Jesus’ blood including chromosomal evidence that Jesus had no earthly father ("Has the Ark of the Covenant been found?," 1999). Wyatt’s organization continues to promote many of these claims (Wyatt Archaeological Research, 2007). Fellow young-earth creationists have roundly
criticized Wyatt’s claims ("Has the Ark of the Covenant been found?," 1999; Snelling, 1992), and Answers in Genesis has unequivocally denounced Wyatt: “There is not the slightest substantiation for Wyatt’s claims, just excuses to explain away why the evidence is missing” (Answers in Genesis, 2007b).

Exhibit Hall

The Fossil Museum offers dozens of arguments and displays in its major exhibit room. In the following, exhibits are chosen for analysis based on emphasis in the museum tour and/or reference in visitor interviews.

Young Earth Evidence from Archaeology

The Acambaro Figurines

This exhibit consists of seven slides displaying photos of clay reptilian figurines, allegedly about 2,000 years old, excavated near Acambaro, Mexico. By juxtaposing the Acambaro figurines with illustrations of dinosaurs, the exhibit and the tour guides suggest that the ancient people of Acambaro produced these figurines based on sightings of living dinosaurs. Two of the slides are Hovind’s (Hovind, 2005b, seminar 3a, slides 303, 305), which in turn are reproductions from Hapgood (2000, cover, pp. 75, 124). Three are from Don Patton’s internet store (Patton, 2007b).

The first reason to doubt the authenticity of the Acambaro figurines is that they were collected under conditions vulnerable to fraud. In 1944, Waldemar Julsrud, a German immigrant to the Acambaro area, began purchasing artifacts from Odilon
Tinajero, a local farmer (Hapgood, 2000, pp. 75-80). According to Hapgood, Tinajero and his sons excavated the artifacts and brought them to Julsrud’s house. Julsrud paid one peso for each complete piece, provided that it had been washed and repaired if it had been broken. This proved to be a lucrative occupation for Tinajero, as over the next decade Julsrud purchased over 32,000 figurines. Julsrud gradually filled his house with the figurines, and upon the death of his wife, Julsrud filled the bedroom with figurines and slept in the bathroom. Since Julsrud purchased most of the figurines directly from Tinajero without witnessing their excavation, he was utterly dependent upon Tinajero’s skill and honesty.

Yet early critics raised questions about Tinajero’s skill and honesty. Since the Acambaro region is rich in genuine prehistoric objects, in 1952 the Amerind Foundation sent an archaeologist, Charles Di Peso, to study the artifacts and report on their authenticity (Di Peso, 1953a, 1953b). First, Di Peso examined Julsrud’s collection and found:

[N]one of the specimens were marred by patination nor did they possess the surface coating of soluble salts characteristic of objects of more certain antiquity coming from the same area. Upon the word of the owner none of the figures had been washed in acid. Examination showed the edges of the depressions forming eyes, mouths, or scales to be sharp and new. No dirt was packed into any of the crevices . . . [I]t appeared that the manufacturers willfully broke legs, necks, tails, etc., to suggest age. No parts were missing. Further, none of the broken surfaces were worn smooth. In the entire collection of 32,000 specimens no shovel, mattock, or pick marks were noted. This would indicate that the excavators possessed a digging technique exceeding anything known to professional archaeologists or that they knew precisely where to dig (Di Peso, 1953a).

DiPeso also reported that the interiors of hollow pieces were unstained, and he witnessed the “excavation” of a delicate, unbroken clay pipe whose bowl and stem were unclogged
with dirt (Di Peso, 1953b). All of this indicates that the pieces were recently manufactured and that Julsrud was a victim of fraud.

Charles Hapgood, the most prominent champion of the antiquity of the Acambaro figurines, offered no explanation for the unworn edges of eyes, mouths, or scales or the absence of dirt in any crevices. However, Hapgood argued that as the figurines were discovered in sandy soil, water-borne salts would have drained away before a patina could form (Hapgood, 2000, p. 89). Based on an interview with Tinajero, Hapgood claimed that an ancient culture deliberately buried the artifacts in caches, which enabled Tinajero to use long knives to probe for each cache and then carefully excavate them through a process of undermining (Hapgood, 2000, p. 77). In other words, Hapgood argued that the Acambaro figurines were in unusual condition compared to other ancient pieces because they were buried and discovered under atypical circumstances.

However, Di Peso found that the Acambaro figurines were buried and discovered under fraudulent circumstances. Di Peso witnessed two days of excavation by an unnamed father and son team (identified by Hapgood, 2000, p. 90, as Tinajero and his son) beneath a prehistoric ruin which contained genuine artifacts. Yet Di Peso witnessed none of the care which Hapgood had described:

[D]uring the course of their search they managed to break a number of authentic prehistoric objects. On the second day the two struck the cache and the author examined the material in situ. The cache had been very recently buried by digging a down sloping tunnel into the black fill dirt of the prehistoric room. This fill ran to a depth of approximately 1.30 m. Within this stratum were authentic Tarascan sherds, obsidian blades, tripod metates, manos, etc., but these objects held no concern for the excavators. In burying the cache of figurines the natives had unwittingly cut some 15 cms. below the black fill into the sterile red earth floor of the prehistoric room. In back-filling the tunnel they mixed this sterile red
earth with the black earth; the tracing of their original excavation was, as a result, a simple task.

In their attempt to disguise the figurines they had packed the bowls and crevices with dirt, the same mixed dirt as characterized the backfill of their new-cut tunnel. Not only was the dirt thus mixed but small chips of limestone, chipped from the boulder walls of the prehistoric room during excavation of the tunnel, were also in evidence.

As if to cap the case, finger prints were visible on the freshly packed earth which filled a small bowl. This bit of evidence, plus the presence of some fresh animal manure in the tunnel fill, offered proof enough that the material had been recently planted (Di Peso, 1953a).

Di Peso also noted that Tinajero and his son had supposedly been excavating artifacts for eight years, yet their hands were un-calloused and the blades of their shovels were covered with dried concrete which would have worn from the edges had they been used daily (Di Peso, 1953b). On a third day of excavation Di Peso did not present himself at the site but observed from a distance. He observed no digging, but observed considerable activity near Tinajero’s home (Di Peso, 1953b), which is located directly in front of the site (Gardner, 1969, p. 232). Yet at mid-day Tinajero arrived at Julsrud’s home, where Tinajero reported that he had been excavating all morning and had uncovered an additional thirty pieces (Di Peso, 1953b, p. 114).

Even in the face of such conclusive evidence of fraud, Hapgood continues to defend the honesty of the excavators. Hapgood offers the defense that Tinajero had re-buried the cache in order to prevent children from uncovering it:

In Fig. 1 the reader will note the cluster of small children who accompanied Mrs. Regler and me in our excavation of the Bull Mountain. They wanted to be in on the dig. They scrambled through the dirt looking for pieces for us and found a good many. Many times Odilon Tinajero would have to stop work for the day when a cache was only half removed from the ground. He did not dare leave the cache open because of the small boys, so he refilled the hole. Then, when Mr. Di Peso wanted to see a dig Tinajero, not understanding the mistake he was making,
did not take him to a new site, but simply reopened a site where he had already worked and where he had done a refill. Di Peso saw this and naturally assumed that Tinajero had himself buried the pieces. It was an honest mistake, but it was disastrous (Hapgood, 2000, p. 90).

Yet if Di Peso witnessed Tinajero’s recovery of a half-excavated cache, why did Tinajero dig for over a day before recovering the cache? Why did a back-filled tunnel lead directly to the cache? Why would Tinajero back-fill a cache which had been liberated on every side and 15 cm below? Why would Tinajero carefully pack the artifacts with fill? As Hapgood’s explanation leaves these questions unanswered, one must logically conclude, along with Di Peso, that Tinajero or his associates had planted a cache in order to deceive Di Peso and Julsrud.

There are additional reasons to believe that the artifacts are of recent manufacture. Writing in 1969, Gardner reported that only fifty miles from Acambaro, a group of artisans maintained a thriving industry of manufacturing figurines and then selling them to tourists as excavated artifacts. Gardner believes that this industry began at about the time that Julsrud was assembling his collection (Gardner, 1969, pp. 237-244). Several of the local residents told Di Peso that figurines were manufactured for sale to Julsrud (Di Peso, 1953b). Furthermore, the Acambaro figurines are disconnected in style and appearance from the genuine artifacts found in the area, and their sheer variety in influence and style points to a modern origin. For example, several of the artifacts appear to imitate ancient Egyptian forms. Di Peso offers the pedestrian explanation that the National Museum in Mexico City houses an extensive Egyptian collection, and that Mexico City is readily accessible from Acambaro by train. Apparently the (modern)
Acambaro sculptors had visited the museum. Undaunted, Hapgood suggests not only that the ancient Acambaro sculptors may have been ancestral to all American cultures (Hapgood, 2000, p. 89), but that the Acambaro sculptors may have inspired the ancient Egyptians: “When we consider the Egyptian-looking artifacts in the Julsrud Collection, we now must wonder whether some of that culture, including pyramid building, did not originate in America” (Hapgood, 2000, p. 88). Such an explanation is highly unlikely to say the least.

Both Hapgood and Patton cite radiocarbon dates from three samples and extensive thermoluminescent data indicating antiquity (Hapgood, 2000, pp. 92-95; Patton, 2000b, 14:45 - 18:30). Yet these radiocarbon dates do not inspire confidence, as they range from 1110 BC to 4530 BC. Such a range is not surprising, since these radiocarbon measurements were taken in 1968, prior to the significant advances in radiocarbon dating methods in the 1970s (Currie, 2004). Furthermore, later investigation revealed that the thermoluminescence data was in error and the figurines must have been manufactured recently (Carriveau & Han, 1976). In fact, the original investigators retracted the original thermoluminescence findings only four months after their original report, which Patton attributes to pressure from fellow scientists (Patton, 2000b, 17:30).

Yet for all of this, the most serious reason for skepticism is the absence of standard in situ archaeological study of the figurines. In his video, Don Patton lists ten witnesses to the authenticity and/or excavation of the Acambaro figurines (Patton, 2000b, 51:40), immodestly expanded to include Dennis Swift and Patton himself on his web site

53 Thermoluminescence is a technique for dating fired pottery.
Among these witnesses is Carlos Perea, identified as the “Director of Archaeology in the Acambaro zone for the Museum of Anthropology in Mexico City” (Patton, 2007a). Yet even this regional Director of Archaeology never conducted a proper excavation of the figurines. Swift tells several tales of scientists, including Di Pesa, who supposedly confirm the antiquity of the Acambaro figurines in person and then represent the opposite view in print (Swift, 2007). Yet in the absence of any scientific study conducted and published under peer-reviewed conditions, there is little choice but to continue to assume that the Acambaro figurines are of recent origin.

Oddly enough, even if the Acambaro figurines had proven to be ancient, they would have made a poor case that the artists had seen dinosaurs. Supporters make extravagant claims for the quality and detail of the Acambaro figurines. For example, Dennis Swift claims that “Each of the clay pieces had been . . . skillfully sculpted and carefully decorated” and “The ceramic collection has unsurpassed variety and beauty that has won the admiration of professional artists” (Swift, 2007). Perhaps this is true of isolated pieces in the collection, but such sculptural skill is not observable among the “dinosaurs.” Of the 20,000 figurines which are still in the collection, Patton identifies 2,600 of them as dinosaurs (Patton, 2000b, 39:30). Yet the “dinosaur” samples which Patton displays and the photos in Hapgood’s book, presumably the most convincing in the collection, are so crude that they could just as well be interpreted as other creatures or be classified with the hundreds of figurines which Hapgood acknowledges to be fictitious creatures (Hapgood, 2000, p. 86). Furthermore, adding to the implausibility of the “dinosaur” interpretation of these creatures is the fact that they are often depicted as
interacting with people. However, supposedly huge dinosaurs are represented as being about the same size as people. Patton’s answer to this problem is creative, but remarkable for its naïveté:

Usually juvenile forms [are] represented with the humans and I think I can understand that—if I were gonna be messing with a dinosaur, I think I’d want to hang around the babies, and some of them are just kinda cute (Patton, 2000b, 23:45).

Clearly no disconfirming evidence is strong enough to withstand Patton’s determined mind.

*The Ica Stones*

The Fossil Museum devotes an entire display case to the Ica burial stones, presented as evidence that humans saw living dinosaurs. The Ica stones are smooth river stones with images engraved upon them. They are believed to have been found in ancient tombs near Ica, Peru, and some of them are said to portray dinosaurs. The display consists of six Hovind slides (Hovind, 2005b, seminar 3a, slides 256, 257, 274, 288, 297, 300), five slides from a web site which sells casts of Ica stones for $75 each (Mt. Blanco Museum, 2007b), five casts of Ica stones, a cast of something described as fossilized dinosaur skin, and a replica of an ancient piece of pottery from the Moche people, decorated with a dragon-like creature. The Fossil Museum has also purchased an original Ica stone, but this is not on display. Two of the Hovind slides locate Ica near the Nazca plain of Peru. Another features a photo of an Ica stone and reads, “Over 50,000 ‘Ica stones’ have been found in Peru since 1961.” A slide from the web site (Mt. Blanco Museum, 2007b) includes several photographs and reads:
ICA BURIAL STONES (500 B.C. – 1500 A.D.)
Dr. Dennis Swift is credited with the original research of these artifacts since 1979 and first met with Dr. Javier Cabrera in 1993. Dr. Cabrera’s family established the city of ICA [sic], Peru in 1563 and he was ICA’s [sic] cultural Anthropologist for many years. Dr. Cabrera founded the San Luis Gonzaga, ICA [sic] National University and was a Physician [sic] until his death in 2001. Dr. Swift was allowed to examine Dr. Cabreras [sic] collection of over 11,000 burial stones, almost a third of which depict various types of dinosaurs interacting with man [sic] as you see here. Dr. Swift, along with his associate, Dr. Don Patton, have been able to corroborate the authenticity, by laboratory tests, of many of these ancient burial stones. Research is ongoing.

A Hovind slide features a photo including two Ica stones and the fossilized dinosaur skin.

The caption reads in part:

Fossilized dinosaur skin found in Bolivia. Notice the rosette patterns. Now in Creation Evidences Museum in Glen Rose, TX[.] Tim and Holly Nyquist of Santa Cruz, Bolivia found dinosaur skin.

Neither the slide nor the tour guides explain how the “fossilized dinosaur skin” was discovered or authenticated. The tour guides explain that the 1/4 inch circular bumps on the “dinosaur skin” correspond to the pairs of concentric circles decorating many of the “dinosaurs” on the Ica stones, indicating that the artists had actually seen the dinosaurs.

Another Hovind slide shows a photograph of a seated mummified person covered in fabric along with four skulls and some pieces of pottery. The caption reads “Ica mummy from Peru. Textiles have dinosaurs on them. Dr. Don Patton.” The final Hovind slide features a piece of ancient fabric decorated with creatures claimed to represent dinosaurs,

54 Apparently this is a cast of the “dinosaur skin” which Patton and Swift retrieved from Bolivia. Patton insists that it is not a fossilized imprint of dinosaur skin, but actual fossilized dinosaur skin (Patton, 2000a, 30:30), although he does not describe how or where it was discovered or how he can tell the difference.
although these rather non-descript shapes look more like camels with long tails rather than dinosaurs. The remaining slides feature views of Ica stones.

The first of the five castings of Ica stones portrays a cartoonish figure of a Tyrannosaurus Rex-like figure apparently using its forelimb to attack a man from behind. In addition to various decorative lines, the Tyrannosaurus is decorated with six pairs of concentric circles on its torso and legs, each about the size of the Tyrannosaurus’s eye or the man’s hand. A second stone portrays a serpent-like creature biting a man’s arm. A third stone portrays a man who is apparently spearing a Tyrannosaurus-like creature. A fourth portrays a man with a dragon-looking creature, decorated with spinal plates and pairs of concentric circles. The final stone portrays a man with two dragon-like creatures, possibly in an embrace. One of the creatures is decorated with four pairs of concentric circles. The “Moche vase” is painted in red and white, features two handles, and shows a man battling a dragon-like creature with an axe. Yet the dragon appears to have two heads—one on its neck and one on its tail, and the warrior is attacking the dragon’s posterior end.

The history of the discovery and collection of the Ica stones is remarkably similar to the history of the Acambaro figurines, and like the Acambaro case, the history of the Ica stones is ideally suited for fraud. Once again an eccentric wealthy townsman, Dr. Javier Cabrera in this case, purchased the artifacts from local farmers without witnessing or documenting their excavation. In fact in this case, most of the artifacts are said to come from a single cave whose location is kept secret to prevent looting (Swift, 2006b, p. 44). One would think that such a site could be investigated using standard archaeological
methods. Furthermore, in a 1975 interview in the Spanish-language *Mundial* magazine (reported in Polidoro, 2002, p. 25), a farmer named Basilio Uchuya and his wife, Irma Gutierrez, confess to having carved and sold stones to Cabrera. Both Swift and Patton explain that selling antiquities in Peru is a crime punishable by imprisonment, but making and selling imitation artifacts is not. Swift and Patton argue that since the police were present for the *Mundial* interview, Uchuya and Gutierrez claimed to have made the Ica stones in order to avoid imprisonment, but in fact they sold legitimate artifacts (Patton, 2000a, 17:50; Swift, 2006b, pp. 24-25). Whether or not this is true, once again we have a case in which artifacts were not left *in situ* for study using standard archaeological techniques. Given that standard radiological techniques cannot be used with such materials, the Ica stones cannot be accepted as genuine without a proper excavation validated by peer review.

As he does with the Acambaro figurines, Swift makes extravagant claims for the technical and artistic merits of the Ica stones. For example, he claims that “The pre-Hispanic cultures of Southern Peru must have seen dinosaurs to etch their portraits on stone with chilling accuracy” (Swift, 2006b, p. 51), and he asks, “How did Basilio [Uchuya], in a solo effort, carve thousands of stones with such artistic mastery that would rival a Rembrandt masterpiece” (Swift, 2006b, p. 13)? Yet study of the stones reveals the opposite. Most of the publicly available photographs of the Ica stones depict cartoonish images resembling children’s art. On a technical level, some of the stones are particularly absurd, such as an image of a man riding on the back of a (presumably flying) pterosaur (Swift, 2006b, p. 42), or Swift’s description of a stone depicting “men
performing a heart transplant using the amniotic hormone from a pregnant woman to irrigate the heart, evidently as an anti-rejection hormone to get the patient to accept, rather than reject, the transplant” (Swift, 2006b, p. 88). Even the Fossil Center’s five casts reveal inaccuracies. The “rosette” patterns on the casts, which Swift (p. 51), Hovind, and the museum guides cite as evidence that the artists actually saw the dinosaurs, appear to be decorative additions, and they are at least an order of magnitude larger than the “scales” observable on the “dinosaur skin” displayed by the museum. Of course the depiction of a two-headed creature is an obvious counterexample to Swift’s claims to “chilling accuracy.” Perhaps more serious is the number of toes depicted on the “dinosaurs” (see Meyers, 2007). The Tyrannosaurus had three toes on each limb, yet two of the Museum’s Ica casts depict Tyrannosaurs having five toes on each limb. Furthermore, the five toes are parallel and occupy about half of the length of the foot rather than splayed like a tyrannosaurus foot and occupying the majority of the total foot length. As a result, the hind feet look more like human feet than Tyrannosaurus feet, which adds to their child-art appearance. Since Swift cites images of an extinct five-toed llama on ancient pottery as evidence that people saw the five-toed llama (Swift, 2006b, pp. 10, 18), Swift is in a poor position to argue that the number of toes on a tyrannosaurus is an insignificant detail. Nonetheless, Swift suggests that the “chilling accuracy” of these representations could lead to a revolution in paleontology: “Were the Ica Stones a paleontologist’s passport into paranoia that could create panic sending evolutionists stampeding as their tower of time toppled from the avalanche of evidence” (Swift, 2006b, p. 11)? Given the poor quality of the evidence, the answer is, in short, no.
The Fossil Museum’s replica of a Moche vase depicts a dragon having a head on its neck and a second head on its tail. This is obviously an imaginative creation on the part of the artists rather than a realistic representation of a living dinosaur. Yet along with the Acambaro figurines and the Ica stones, the Fossil Museum cites this image as evidence that the artists saw living dinosaurs. In this regard, the Fossil Museum follows Swift, who stresses the realism of Moche images:

The Moche Indians inhabited the North Coast of Peru from roughly 100 A.D. to 800 A.D. The Moche are distinguished by their pottery. They are famous for their singular mastery and realism in recording a variety of animals, portraits of people, and scenes of daily life, all captured in ceramic . . . Our research revealed that the Moche, who are known for their realism and being species specific, had indeed painted vases with dinosaurs in red on white (Swift, 2006b, pp. 77-78).

Swift makes these claims of realism despite the fact that he must be aware that some of the Moche vases depict two-headed dragons. The Fossil Museum’s vase is a replica of a vase which Swift has studied and which is featured in Swift’s book (Swift, 2006b, color plate 12, top right), although this photograph is taken from such an angle that only one of the dragon’s heads is visible. Yet on a young-earth creationist web site, a photograph stamped with Swift’s copyright notice shows the same vase with both of the dragon’s heads (Abramson, 2007, Nazca19). Stephen Meyers (2007) identifies two other Moche vases, also pictured in Swift’s book, depicting dragons having heads at both ends. In Swift’s description of his first tour of the Rafael Larco Herrera Museum in Lima, Peru, he describes a possible excuse for his failure to mention the obvious non-realism of these images:
I found a shelf enclosed in glass with vases excavated from Moche, Nazca, Vicus, and other Indian tombs with dinosaurs on them. They had a dinosaur with dermal spines and stegosaurus-like dinos. The vases were all turned so you could only see about half of each dinosaur. Not one had the dinosaur in full view (Swift, 2006b, p. 30).

Although the position of the vases may have left Swift initially ignorant of the fictional nature of these images, Swift also reports that on his April 2, 2002 visit to the Rafael Larco Herrera Museum, the caretaker opened the display case and allowed Swift to handle and photograph twelve Moche dragon vases (Swift, 2006b, pp. 78–79). Meyers notes that at a creationist web site, several Swift-copyrighted photographs can be seen which depict Moche vases displaying two-headed dragons (Abramson, 2007, Nazca11, Nazca19, Nazca24, Nazca25, Nazca27). Therefore Swift must be aware of the problem. Since the two-headed dragons depicted on the Moche vases are obviously fictional, neither Swift nor the Fossil Museum can logically maintain that the Moche dragon vases are evidence of encounters between humans and dinosaurs.

Native American Petroglyphs

Beneath the Acambaro display is a series of three Hovind slides (Hovind, 2005b, seminar 3a, slides 237, 238, 249) and a fuzzy photograph with a hand-written caption, apparently based on another Hovind slide (seminar 3a, slide 252). The first slide reads in part: “Indian pictograph, from the Grand Canyon. Found in the Havasupai Canyon in Grand Canyon.” The accompanying photograph shows a variety of shapes scratched onto the canyon wall, suggesting but not closely representing humans or animals. In the foreground of the picture an outline of a creature with an egg-shaped torso stands upright, possibly balancing on its hind legs and tail, and bears a long neck and a hook-shaped
head. Another slide outlines this petroglyph in white beside a color drawing of a
dinosaur in the same position labeled “Edmontosaurus” (i.e. Hadrosaurus). Although the
Hadrosaurs were known in 1931, James Churchward interpreted the same petroglyph as a
Tyrannosaurus (Churchward, 1931, p. 217). The petroglyph is so sketchy that it can be
interpreted as a variety of species, modern or extinct. Yet in Hovind’s slide, the outline is
enhanced with details which increase its resemblance to the accompanying dinosaur
drawing.

Another Hovind slide reads “Natural Bridges State Park, Blanding, UT.
Petroglyphs by the Anasazi A.D. 400-A.D. 1300.” It shows a picture of a petroglyph,
helpfully outlined in black to reveal a shape similar to the front half of sauropod.
Although tour guides frequently emphasize the discovery that sauropods had dermal
spikes, no dermal spikes are visible on this petroglyph. The final image is labeled with a
hand-written note “Agawa Rock Art from Misshepezhieu, Lake Superior Provincial Park
Ontario, Canada.” The accompanying photograph shows a petroglyph resembling a bull
with long horns and a long, thick tail with dorsal spikes from the neck to the tip of the
tail. So far as I am aware, it represents no living or extinct creature. These slides are
intended to demonstrate that Native Americans saw and accurately drew dinosaurs, but
since these petroglyphs are clearly not representational art, they make a weak case.

*Out-of-Place Artifacts*

Under the heading “Evidence from Geology—Human Artifacts,” the Fossil
Museum displays information about several “out-of-place artifacts.” Proponents claim
that these human-made objects were discovered in geological formations which,
according to the standard geological time scale, predate humanity. Therefore out-of-place artifacts are offered as counter-evidence to the geological time scale and confirmation that the earth is young.

Most of the Fossil Museum’s examples of out-of-place artifacts amount to hearsay, i.e. reports of human artifacts having been found in such places, but without physical evidence or *in situ* examination. In many cases the whereabouts of the discovered object is no longer known. For example, a Hovind slide reads:

On June 11, 1981, the Morrisonville Times reported; [*sic*] “A curious find was brought to light by Mrs. S. W. Culp last Tuesday morning. As she was breaking a lump of coal apart [*sic*], embedded in a circular shape a small gold chain of about 10 inches in length of antique and quaint workmanship . . .” The Hidden History of the Human Race Michael A. Cremo p. 113.

Although the quotation is edited, it accurately represents the original story from the *Morrisonville Times* of Morrisonville, Illinois ("A necklace of a prehistoric god," 1891).

Yet neither the coal nor the chain is available for examination. Only the story remains.

A Hovind slide (Hovind, 2005b, seminar 2b, slide 228) features a photograph of a finely decorated bell-shaped vessel and reads in part:

4 1/2 inch high zinc and silver vessel found in solid rock “over 600 million years old” in Dorchester, Mass. in 1851. *Readers Digest Mysteries of the Unexplained* p. 46. Also *Scientific American* June 1851 p. 289-299 [*sic*]

As Hovind states, this artifact is featured in *Readers Digest Mysteries of the Unexplained* (Calkins, 1982, p. 46), which adopted the story from *Scientific American* ("A relic of a by-gone age," 1852), which, in turn, excerpted the story from the *Boston Transcript* newspaper. From the *Scientific American* piece we learn that the artifact was found in two parts among pieces of rock which had been blasted from a hill in Dorchester. Since
the vessel was never observed in the rocks, but was simply found among the pieces, it was not “found in solid rock.” Having reached the same conclusion, the editor of Scientific American wryly concluded that it was “perhaps made by Tubal-Cain, the first inhabitant of Dorchester.” I have been unable to discover the present whereabouts of the vessel. As in the case of the chain, perhaps only the story remains.

Replicas of Out-of-Place Artifacts

In addition to various slides repeating similar hearsay, the Fossil Museum displays replicas of out-of-place artifacts. The first is of an iron cup partially embedded in coal, available for $25 from Baugh’s organization (Creation Evidences Museum, 2007a) and sold in the Fossil Museum gift shop. Fossil Museum tour guides explain that a human artifact embedded in coal contradicts the geological time scale. However, there is more to the story. Accompanied by extensive documentation, creationist Wilbert H. Rusch describes the story as follows:

It would seem that about 1915, a fireman in a power plant in Oklahoma was shoveling native coal into the boiler. Upon reaching an overly large chunk, he had to break it with a sledge, and out of the resulting two pieces fell an iron pot (see Figure 1). He threw the two pieces of coal into the fire, but passed on to others the pot, which ultimately wound up in a private collection in Missouri . . . Since then, the owner died and the pot has been lost (Rusch, 1971, p. 201, emphasis added).

The cup’s discoverer signed an affidavit stating in part: “This iron pot fell from the center, leaving the impression or mould of the pot in the piece of coal” (Rusch, 1971, p. 201), but Rusch reports that only the fireman and his co-worker saw the coal before it was burned. Neither the Fossil Museum tour guides nor Baugh’s replica sales web page (Creation Evidences Museum, 2007a) disclose the fact that since only the pot survived,
the coal is entirely an artist’s impression. Elsewhere on Baugh’s web site one finds a recent-looking color photograph of the iron cup with a separate piece of coal in the background, but no mention is made of the fact that the original coal was burned (Creation Evidences Museum, 2007b). Apparently Baugh’s Creation Evidences Museum has acquired the iron cup.

The second replica is of the “London Hammer,” consisting of a hammer head and part of a wooden handle which appear to be partly embedded in stone. The London Hammer is housed in Baugh’s museum, but both Baugh’s and Hovind’s organization sell replicas for $25 (Creation Evidences Museum, 2007a; Creation Science Evangelism, 2007b). At the Fossil Museum an accompanying page (Baugh, 1999, p. 93) reads in part:

Max Han was fishing with his family near London, Texas in 1934 when he found a rock with wood protruding from it. When the rock was cracked open, this octagonally shaped iron hammer was exposed. The wood handle is partially coalified with quartz and calcite crystalline inclusions. Tests performed at Batelle Laboratory document the hammer’s unusual metallurgy: 96.6% iron, 2.6% chlorine; and 0.74% sulfur (no carbon). Density tests indicate forging of exceptional quality. A unique coating of FeO, which does not readily form under present atmospheric conditions, appears to inhibit rusting. The enclosed rock contains Lower Cretaceous fossils. It is a concretionary sandstone nodule from the nearby cliff which is made up of such nodules. This cliff is part of the Lower Cretaceous Edwards Plateau which evolutionists tell us was formed 140 million years ago . . .

An accompanying Hovind slide excerpts this description (Hovind, 2005b, seminar 2b, slide 220). This paragraph supports several of the Fossil Museum’s theses. First, if a human artifact is found embedded in 140 million-year-old stone, the geological time scale must be wrong. Second, if the hammer was forged under different atmospheric conditions than those prevailing today, perhaps it was forged before the vapor canopy
collapsed and produced the Flood. Third, exceptional technology supports the notion that humans have not advanced to our present state, but have declined from a superior condition.

Like the other artifacts, no in situ scientific study was performed. The hammer appears to be a mining tool from the nineteenth century (Godfrey & Cole, 1986). It appears to be embedded in an actual stone concretion, but under the correct conditions, concretions can form around objects in a relatively short time (Cole, 1985). For example, bottle caps, glass shards, and World War II artifacts have been found embedded in limestone (McKusick & Shinn, 1980). Therefore the concretion is not necessarily the same age as the surrounding rocks, although it may incorporate material from them (Cole, 1985). Yet the surrounding rocks are an issue as well. Kuban documents the fact that through the early and mid 1980s, Baugh claimed that the surrounding rocks were Ordovician (about 450 million years old) (Kuban, 2006b), but now Baugh claims that they are Cretaceous (about 100 million years old), which does not inspire confidence that he has correctly identified the fossils in the concretion. Kuban also notes that the surface of the concretion appears to be smooth, indicating that it was not chiseled loose from a larger formation. Furthermore, Kuban documents Baugh’s acknowledgement that the hammer and its surrounding concretion were found loose. This seriously weakens the case for the hammer’s association with the surrounding rocks. To date, Baugh has publicly refused to allow the hammer’s handle to be carbon dated, although in the late 1990s a Baugh supporter named David Lines claimed that carbon dating had shown the hammer to be somewhere between the present and 700 years old (Kuban, 2006b). No
documentation was offered, and unless Lines is claiming that Lower Cretaceous rock formed within the past 700 years, this does not support the case for an old hammer. Obviously all of this casts serious doubt on the association of the hammer with the Lower Cretaceous period.

In addition to Baugh’s refusal to conduct/publicize Carbon-14 test results on the hammer handle, Baugh has never released the Batelle Labs report or any other documentation of the hammer head’s allegedly special metallurgical properties (Kuban, 2006b). According to Cole, at one point Baugh inferred from the hammer’s composition that it was forged under ten times the present level of atmospheric ozone. As Cole notes, such an increase in ozone would not produce gigantism or Edenic conditions but “would be fatal to most trees and cause a massive plague of animals and human cancer and mucous membrane searing” (Cole, 1985). Such absurdities aside, without documentation or independent testing, Baugh is in no position to claim that it was forged under unusual atmospheric conditions or that past societies possessed unusual metallurgical knowledge. Answers in Genesis reinforces this point:

The allegation about the apparently anomalous metal structure of the hammer has never been, to our knowledge, published in the peer-reviewed creationist literature, e.g. testing the assertion that ‘an alloy of iron with chlorine cannot be made in its present atmospheric condition.’ But in any case there is no such thing—chlorine is simply not an element that can form a metallic alloy, as opposed to an ionic compound with a metal (Answers in Genesis, 2003).

Thus Baugh’s claims about the London Hammer have been opposed by the largest creationist organization in the U. S.
In general, Answers in Genesis lists such out-of-place artifacts as doubtful and inadvisable to use as young-earth arguments:

Several artifacts, including gold objects, have been documented as having been found within coal, but in each case the coal is no longer associated with the artefact [sic]. The evidence is therefore strictly anecdotal . . . This does not have the same evidentiary value as having a specimen with the artifact still associated (Answers in Genesis, 2007b).

Here Answers in Genesis acknowledges that without supporting evidence, the evidentiary value of such artifacts is very limited. Young-earth geologist Andrew Snelling notes that the absence of in situ documentation and the failure to preserve supporting evidence “have made it well nigh impossible to reconstruct and/or prove where fossils or artifacts came from, thus rendering such fossils virtually useless” (Snelling, 1991). Therefore in displaying these out-of-place artifacts, the Fossil Museum present arguments which fellow young-earth creationists reject on evidentiary and procedural grounds.

*The Baghdad Battery*

An additional replica, known as the “Baghdad Battery,” also purports to demonstrate that humanity was more sophisticated in the past. The Fossil Museum displays a 6-inch tall replica of a clay jar with a black stopper. A Hovind slide (Hovind, 2005b, seminar 2b, slide 231) shows a cutaway view of the clay jar. It encloses a copper cylinder which, in turn, houses an iron rod. The (properly cited) illustration is taken from David Down’s 1994 article in *Creation Ex Nihilo* magazine (Down, 1994). The Fossil Museum guides explain that if the copper cylinder is filled with vinegar or grape juice, it becomes a battery. The Fossil Museum displays the “Baghdad battery” in order to
demonstrate that technology was highly sophisticated in the past and that human history is one of intellectual descent rather than intellectual improvement.

Baghdad batteries have been found at three locations near Baghdad, all dated to between 100 BCE and 100 CE (Keyser, 1993). Wilhelm König, an Austrian national working for the Baghdad Museum, first described the device in 1938 and suggested that it was used as an electrochemical cell, possibly for electroplating. Keyser constructed and experimented with models of Baghdad batteries, from which he discovered that even with the most effective electrolyte (vinegar), they produce only 0.5 V at a few thousandths of an ampere. By comparison, Keyser notes that a flashlight battery produces 1.5 V at a few tenths of an ampere. Given their low power and the absence of archaeological evidence for electroplating apparatuses or electroplated artifacts, Keyser suggests that they were used for pain control (Keyser, 1993). Of course these may not be batteries at all, serving an altogether different purpose.

The Fossil Museum exhibits the Baghdad battery to illustrate the sophistication of past civilizations and the devolution of humanity. Yet the Baghdad battery does not readily support this case. Since the Baghdad batteries are only 2,000 years old, they post-date the intellectual achievements of the likes of Pythagoras, Aristotle, and Archimedes. An “antediluvian” battery (before 2,500 BCE on the creationist time scale) might make this point, but such a Roman Empire-era device supports the point no better than the Aqueduct. Yet in David Down’s article, on which the Fossil Museum display is based, the author implies that a conspiracy of silence surrounds the Baghdad battery because it threatens standard history:
You had not heard about this sensational discovery? We can tell you why. It did not fit in with the established viewpoint, and most archaeologists did not want to know about it. They hoped it would go away (Down, 1994, p. 11).

So, let’s bring the batteries out into the open and recognize that we may not be so advanced after all. It is only because of the accumulation of knowledge during the centuries that we have computers, rockets and atomic bombs today—not because we have evolved intelligence (Down, 1994, p. 13).

The premise of the former point is that embarrassment prevents Archaeologists from discussing the Baghdad battery. Judging from his citations, Down relied on only two sources—Rene Noorbergen’s popular and unreferenced Secrets of Lost Races (Noorbergen, 1977) and Paul Keyser’s scholarly and well-referenced article (Keyser, 1993). Yet Keyser cites at least twelve articles on the Baghdad battery, two of which appear in the highly accessible Science Digest magazine. Therefore Down should be well aware of the scientific attention these artifacts have received, and his insinuation of an academic cover-up is without merit. Furthermore, the premise of Down’s latter point seems to be that evolutionists believe that human technological progress over the past 3,000 years is the result of biological evolution. But evolutionists claim no such thing because biological evolution proceeds far too slowly. Since evolutionists agree that technological progress is the result of the accumulation of knowledge, Down has merely set up a straw-man argument. Therefore the well-documented Baghdad battery supports neither the case for a young earth nor the case for human devolution.
Evidence from the Paluxy Area

A large display consists almost entirely of evidence from the Paluxy River near Glen Rose, Texas. This forms the climax of a typical tour. Part of the display consists of thirteen pages of photographs with extensive captions, available for purchase through Don Patton (Patton, 2007b). With only minor differences, the same illustrations and captions appear in one of Carl Baugh’s books (Baugh, 1999, pp. 92-101, 103-105). These pages make the case that human and dinosaur footprints and other traces have been found in the same rock layers. These pages are augmented by castings described as two oversized human footprints, a hand print, and a fossilized human finger, all claimed to have been discovered in the same rock layers in which dinosaur tracks are found. Tour guides explain that evidence of human and dinosaur cohabitation contradicts the standard geological time scale and confirms their understanding of scripture.

Such claims have been associated with the Paluxy Riverbed for about 100 years (Milne & Schafersman, 1983; J. D. Morris, 1980). The Paluxy River runs along a bed of approximately 100-million-year-old Cretaceous limestone, in which many well-documented dinosaur trackways have been found. In the fall of 1938, a paleontologist from New York City’s American Museum of Natural History, Roland T. Bird, discovered two outsized and obviously carved human footprints at a souvenir shop in Gallup, New Mexico (Bird, 1939, 1954, 1985).\(^{55}\) When he learned that carvings of dinosaur tracks

\(^{55}\) Bird was alternately bemused and distressed that creationists such as Clifford L. Burdick (see below) subsequently cited Bird’s statements as support of the authenticity of giant human tracks (Bird, 1985, pp. 215-216). Yet he knew that the tracks were carved as soon as he saw them. Upon first observing them, he said to the clerk at Jack Hill’s
also existed, and that both came from the Paluxy River area, he visited the area and
discovered many dinosaur tracks. Bird eventually discovered a magnificent set of
Sauropod tracks. He excavated the tracks and they are presently on display at the

The Burdick Track

Bird’s mention of the giant human tracks drew the attention of the young-earth
creationist Clifford L. Burdick in the 1940s (J. D. Morris, 1980, p. 21). Burdick
eventually acquired a pair of loose giant human footprints, supposedly excavated from
limestone along a tributary to the Paluxy River (J. D. Morris, 1980, p. 117). Burdick was
the third owner of the prints. The left print has been lost, but Carl Baugh purchased the
right print from Burdick in the early 1980s (Baugh, 1992a, p. 116; Kuban & Wilkerson,
2005). The Fossil Museum displays a casting of the sixteen-inch-long (right) Burdick
print.

Since the Burdick print was never examined in situ and its origin and history are
uncertain, its positive evidentiary value is severely limited. Moreover, there is
considerable reason to doubt its authenticity. In otherwise enthusiastic defenses of the
Paluxy “man track” claims, John Morris and Carl Baugh separately note that during the
Great Depression, several giant human tracks were carved on loose limestone slabs in the
Paluxy area (Baugh, 1992a, p. 117; J. D. Morris, 1976, 1980, pp. 109-126), a fact which
skeptical observers emphasize (Kuban & Wilkerson, 2005; Neufeld, 1975). Furthermore,

souvenir shop: “I’m afraid your Jack Hill has found himself a pair of fake footprints”
(Bird, 1939, p. 255).
physical examination of the Burdick track reveals a variety of problems. Harvard-trained
anthropologist and footprint expert Laurie R. Godfrey notes that in the Burdick prints, the
toes are “far too long,” the big toe is “far too narrow,” the ball is “too wide, too far
forward and too deep,” the toes are artificially fanned, “the heel is too narrow, the
forefoot too wide,” and the arch is exaggerated (Godfrey, 1985, p. 19). Godfrey notes
that even the general shape of the print is wrong for soft mud. She also points out that the
foot proportions of a giant human would in fact differ from those of a normal human, but
in the opposite directions—the great toe would be proportionately shorter rather than
longer, there would be little or no arch, and the toe imprints would be proportionately
light compared to the proportionately strong toe imprints displayed in the Burdick tracks
(Godfrey, 1985, pp. 19-21). For these and other reasons, Godfrey concludes that the
Burdick track is credible neither as a modern human track which has been enlarged, nor
as a track made by an unusually large human.

Other physical evidence indicates that the Burdick track is not genuine. In a
genuine print, lower layers of sediment typically conform to the shape of the print,
whereas a carved print would typically cut across sedimentary layers. In some cases a
cross-sectional cut of the print can resolve the question. In the 1970s, a team of three
creationists from Loma Linda University cut a cross section of the Burdick print, but
because the Burdick print limestone does not display horizontal laminations, they could
reach no firm conclusion (Chadwick, 1987; Neufeld, 1975). Baugh had three other cross-
sectional cuts of the Burdick print made, and claims to have discovered “very definite
lamination distortion pressure lines under the heel” and “very definite lamination
pressure lines” under the toes (Baugh, 1992a, pp. 118-119; see also Baugh, 1999, p. 95). However, Glen Kuban and Harvard-trained paleontologist/creationist Kurt Wise consider these features to be algal structures rather than pressure laminations, and observe that since the track cuts across these structures, they serve as evidence that the track was carved rather than genuine (Kuban & Wilkerson, 2005). Furthermore, Kuban and Wilkerson note that algal limestone grows in a characteristic pattern with definite “up” and “down” directions. They note that the algal structures beneath the Burdick print appear to be inverted, indicating that the print was carved on the bottom of the limestone slab rather than the top (Kuban & Wilkerson, 2005). It stretches the imagination to picture a way that a genuine human footprint could be made on the underside of lime mud.

The Caldwell Track

Another sixteen-inch human track is known as “the Caldwell track.” It appears to be an enlarged version of a modern human track and therefore looks more realistic than the Burdick track. The Fossil Museum displays a casting of the Caldwell track together with a label attributed to Hovind’s Creation Science Evangelism seminars. It reads in part: “The Caldwell track (found by Bill Osborne [sic]) is one of many footprints found alongside dinosaur tracks in Glen Rose, Texas. The span between prints measures six feet! Apparently, they belonged to a large individual . . .” Casts of this track are available for sale ($28.00) from Hovind’s organization (Creation Science Evangelism, 2007a). Reportedly discovered and excavated by a Glen Rose area resident named Billy Osborn, Caldwell purchased the print without having seen it in situ, and it was
subsequently purchased from Caldwell in the 1960s with the understanding that it was a carving (Hastings, 1986, pp. 25-26, 1987, p. 11). Claims for its authenticity apparently developed later. By 1970 and at least as late as 1988 the Caldwell track was housed at Columbia Union College in Maryland (Hastings, 1988).

In the early 1970s, the Loma Linda team sectioned several tracks housed at Columbia Union College, including the Caldwell track. In each case they found that “the rock layers end abruptly at the edge of the track, indicating that they are not the result of a foot stepping into soft mud but are produced by carving” (Neufeld, 1975). Because the Burdick and Caldwell “tracks” were not studied in situ and because of the evidence against them, even (former) Paluxy track enthusiasts such as Morris never endorsed the authenticity of such giant tracks (J. D. Morris, 1976, 1980, pp. 109-126). Therefore in displaying the Burdick and Caldwell tracks, the Fossil Museum takes a weak position with respect to the evidence and an awkward position with respect to creationist colleagues.

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56 Morris correctly noted that the discovery of counterfeit tracks does not disprove the existence of real tracks, but he optimistically and illogically noted that “it could only have been the existence of genuine tracks that made the manufacture of counterfeits profitable” (J. D. Morris, 1976). Four years later, Morris repeated the same claim: “A counterfeit usually implies an original. In fact, it could only have been the reported existence of genuine tracks that made the manufacture of counterfeits profitable” (J. D. Morris, 1980, pp. 109-110). Yet financial success and/or popularity do not constitute archaeological evidence. By analogous reasoning, the success of the “International UFO Museum and Research Center” in Roswell, New Mexico (International UFO Museum, 2007) would constitute evidence that an actual human/extraterrestrial alien interaction occurred.
Handprint and Finger

The Fossil Museum also features a casting of a “human hand print” (Baugh, 1999, p. 105) and a “fossilized human finger” (Baugh, 1999, p. 104). Castings of the finger can be purchased from Baugh’s museum for $25.00 (Creation Evidences Museum, 2007a). Baugh attributes both to the Paluxy River area, although neither were studied in situ. The “finger” was found in a gravel quarry an unspecified distance from the Paluxy River (Creation Evidences Museum, 2007a). Its only finger-like details are its oblong shape with a finger-nail looking tip. Isaak points out that the “finger” is “remarkably similar in size and shape to the cylindrical sandstone infillings of Ophiomorpha or Thalassinoides shrimp burrows commonly found in Cretaceous rocks” (Isaak, 2007, p. 112). But Baugh claims to have expert testimony: “It has recently been sectioned to reveal the typical porous bone structure expected in a human finger. Examination by means of a CT scan and MRI allowed Dr. Dale Peterson, M. D. . . . to identify joints and to trace tendons throughout the length of the fossil” (Baugh, 1999, p. 104). According to Baugh and Wilson, an unnamed and unreferenced group of “nineteen different medical experts” verified that it is a human finger, of which some determined that it is from a female, and that “even the epidermis (the outer skin) is preserved” (Baugh & Wilson, 1992, pp. 42-43). Yet Baugh has published only the claims, not the evidence, and no independent study has been done. Even less is known about the handprint.

Like all of the most dramatic finds associated with the Paluxy area, both the handprint and the finger were removed from their alleged original locations before they could be authenticated. The handprint would be expected to be associated with other
prints, but since it is not *in situ*, no such follow-up studies can be done. For these reasons, Answers in Genesis’ Ken Ham singles out a “human hand print” and other “human hand fossils” as examples of “flaky evidence” having “virtually no documentation or credible research” and offering “no credible substantiation” (Ham, 2003). In displaying castings of a supposed human hand print and a so-called fossilized human finger, the Fossil Museum places itself in a marginal position with respect to creationist colleagues such as Ken Ham and his Answers in Genesis organization.

*Trails along the Paluxy River*

The nature of the *in situ* prints along the Paluxy River are something else altogether. Even creationist track enthusiasts do not attribute most of these prints to giant humans: “The great majority of these tracks are in the normal range of adult foot size today, from about shoe size 7 to 13. However, a number of prints of small children are found with the larger ones” (J. D. Morris, 1976). They also note that many dinosaur tracks are found in the same area, which they take as evidence that humans and dinosaurs lived simultaneously. However, even the best of these “human” prints (see, e. g. Baugh, 1999, pp. 96-103) are highly indistinct. As Godfrey observes: “Excellent dinosaur tracks abound in the Cretaceous rocks of central Texas. In contrast, all of the alleged mantracks are miserable” (Godfrey, 1985, p. 35, emphasis original)

Because of the poor print quality together with frequently sloppy excavation and documentation procedures (Hastings, 1986; Milne & Schafersman, 1983), creationist accounts and measurements of the trackways tend to contradict one another (Godfrey,
For example, a published account describes a particular print as a left human print, while two other published accounts describe the same print as a right human print, identifying different big toe marks on opposite sides (Godfrey, 1985, p. 33). Hastings found similar inconsistencies at a different site (Hastings, 1987).

These inconsistencies created doubt about the claims of the human track enthusiasts. Other observations, however, lead nearly all creationists to abandon such claims. Beginning in the early 1970s, critics noted that many of these “human” prints included dinosaurian features. Godfrey found that careful measurements of the Taylor trail (the “best” mantrack trail) reveal that stride, pace, and step angles are inconsistent with human footprint trails but consistent with those of a bipedal dinosaur (Godfrey, 1985). The Loma Linda team, which unlike Godfrey was sympathetic to the young-earth creationist cause, noted that anterior to many of the in situ tracks, traces of three splayed toe marks could be seen. They concluded that the tracks were not human but were left by three-toed dinosaurs (Chadwick, 1987; Neufeld, 1975). Others also observed these features (e.g. Godfrey, 1985), but this evidence was strengthened in the summer and fall of 1984 when particularly dry weather exposed many trackways which are normally submerged beneath the river. When Glen Kuban and Ronnie Hastings carefully cleaned

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57 In her extensive analysis of the “mantrack” data assembled in John Morris’s book Tracking Those Incredible Dinosaurs . . . and the People Who Knew Them (J. D. Morris, 1980), Laurie Godfrey found that “some” measurements from different creationists agree remarkably well; they are, in fact the same measurements republished . . . Striking differences among values for the same features appear when they were measured by different creationists at different times” (Godfrey, 1985, p. 25, emphasis original).
and dried the Taylor trail, they found stains surrounding the “human” footprints in the limestone. These stains unequivocally revealed that the Taylor prints were made by a bipedal dinosaur rather than a human, and they soon found such stains in other trails as well (Hastings, 1987, 1988; Kuban, 1989b, 2006a). Kuban invited members of the Institute for Creation Research to observe this evidence first-hand. In October of 1985, Kuban was joined at the Paluxy by a delegation of human track enthusiasts including John Morris, who had written the definitive book on the Paluxy tracks (J. D. Morris, 1980), and Paul Taylor, whose late father Stan Taylor had produced the popular Paluxy human track documentary *Footprints in Stone* (S. E. Taylor, 1972). After observing the stains, Taylor and Morris became convinced that the Paluxy tracks were dinosaurian rather than human. Taylor stopped sales of *Footprints in Stone* (Films For Christ Association, 1986; Jones, 1986). Morris publicized the new evidence in conferences and in print, concluding that creationists should no longer cite the Paluxy tracks as evidence that humans and dinosaurs coexisted and announcing the withdrawal of his book (Holroyd, 1987; Jones, 1986; J. D. Morris, 1986a, 1986b; Thulborn, 1986). Soon afterward the Institute for Creation Research Museum in San Diego removed its Paluxy display (Jukes, 1986; Rosnau et al., 1989a).

Baugh has been excavating and discovering new prints in the Paluxy area since the early 1980s, but by 1986 Morris was unimpressed by Baugh’s discoveries: “The

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58 By June of 1982, Baugh had placed a bronze plaque at one of his excavation sites, naming the limestone layer the “Wilsonian Strata” after Clifford Wilson and naming the “human” track maker “Humanus Bauanthropus.” Baugh claims that the latter is not in honor of himself, but of a Fijian hero named Caka(m’)bau (Hastings, 1985, p. 6).
various controversial prints labeled as human by Carl Baugh in recent years are of
certain origin, and at best are not comparable in quality to prints at the sites discussed
above, thereby providing no support for the original position” (J. D. Morris, 1986a, p. iii).
A few enthusiasts still try to find human and dinosaur tracks elsewhere (e. g. Rosnau et
al., 1989a; Rosnau, Auldaney, Howe, & Waisgerber, 1989b), but most young-earth
creationists have given up the prospect of finding them along the Paluxy River. Yet
Baugh does not give up so easily. Like other creationists, Baugh admits that the Paluxy
tracks are dinosaurian, but unlike the others he now claims that humans walked within
these tracks. He explains:

Apparently the individual, this human, had seen that the dinosaur footprints were
ahead, with a bit of mud and water having seeped back into the print. You need
to realize that anyone walking in uncured calcium carbonate unlithified limestone
will have his feet burned. It is like walking in uncured concrete. So the
individual chose to step within the dinosaur tracks, in all probability to keep his
feet washed, and thus relieve the irritation on his feet. This all makes perfect
sense when you remember our belief that these were humans seeking higher and
higher ground as they sought to escape the rising waters of the flood in Noah’s
day (Baugh, 1992a, p. 123).

This theory is laudable more for its creativity than its plausibility. Since all of the
“human” footprints are found in dinosaur tracks, Baugh must argue that every person
who ran across the lime mud followed this procedure and managed to land in the same
part of each dinosaur track every time. Baugh also assumes first of all that lime mud
cures quickly like concrete and that secondly the resulting exothermic reaction would be
sufficient to cause discomfort to a person walking or running across it. Even if lime mud
cured like concrete, it should be noted that the layer of lime mud would be analogous to a
large, flat slab of concrete exposed to the air. Such a slab typically cures without a
significant elevation in temperature (Callaway, 2001). Baugh inadvertently confirms this observation in another of his books, in which a photograph shows a smiling barefoot junior high school student standing in wet concrete as part of a footprint study (Baugh, 1999, p. 95). The Fossil Museum displays the same photograph and caption.

Although firmly believing that dinosaurs and humans lived simultaneously, Answers in Genesis includes the Paluxy River tracks in its list of “Arguments we Think Creationists Should NOT Use” (Answers in Genesis, 2007b). In a review of a creationist book (Petersen, 2002), Answers in Genesis strongly criticizes the author for citing the “fossil finger” and Paluxy River prints as evidence that humans and dinosaurs lived together and laments that “Due to the widespread potential sales of this book, creation ministries will probably have to spend many hundreds of hours explaining why reputable creationist speakers don’t use Paluxy, etc. in creation ministry—sowing confusion in the process” (Answers in Genesis, 2003). Presumably Answers in Genesis would criticize the Fossil Museum on the same grounds.

Evidence of Dinosaurs Still Living

A relatively large display, entitled “Evidence of Dinosaurs Still Living,” presents purported evidence that dinosaurs are alive today or were alive until very recently. All of the 37 slides are Hovind’s. For example, a series of three slides (Hovind, 2005b, seminar 3a, slides 449, 451, 452) describes sightings of a large creature known locally as “Mokele-Mbembe” in the Likouala Swamp of the Republic of the Congo and the Democratic Republic of the Congo (formerly Zaire). According to the slides, local
residents even report killing a Mokele-Mbembe in 1959, and the accompanying drawing shows several men throwing spears at a Sauropod. Yet no physical evidence remains—only stories. (Mackal, 1987 records a variety of Mokele-Mbembe-related tales.) Another slide relates an eyewitness report of a Sauropod in South America
(Hovind, 2005b, seminar 3b, slide 48), and several slides describe reported sightings of the Loch Ness Monster in Scotland and news reports or grainy photographs of similar sightings in the U. S. (Hovind, 2005b, seminar 3b, slides 62, 68, 73, 132, 136, 166, 170, 175, 179, 181, 182, 209, 211, 215, 218). Others describe various legendary accounts of dragons attributed to Marco Polo, Alexander the Great, St. George, the epic poem of Beowulf, and various local stories (Hovind, 2005b, seminar 3b, slides 205, 208, 215, 224, 225, 236, seminar 3b, slide 249). The tour guides explain that since “dinosaur” is simply the modern word for “dragon,” these stories likely resulted from first-hand encounters between humans and dinosaurs.

The assumption that legends imply a factual source is problematic, but a more serious problem is the lack of physical evidence. Despite numerous eyewitness accounts, living dinosaurs or parts of deceased dinosaurs are never available for examination. Either the physical evidence was inaccessible or nobody thought to collect it or it has been lost. Carl Sagan points out that because of historical events such as witch trials, our legal system emphasizes physical evidence over eyewitness testimony. Experience has taught us that eyewitness testimony is unreliable (Sagan, 1996, p. 181). Yet in cases such as alien abduction, the physical evidence always seems to be just out of reach:
Since the middle of the twentieth century, we’ve been assured by proponents of the extraterrestrial hypothesis that physical evidence—not star maps remembered from years ago, not scars, not disturbed soil, but real alien technology—was in hand. The analysis would be released momentarily . . . Now it’s decades later and we’re still waiting . . . Their absence must tell us something (Sagan, 1996, pp. 186-187).

In the same way, physical evidence of these living dinosaurs is always just out of reach. The swamp is inaccessible and unexplored (Hovind, 2005b, seminar 3a, slide 451; Mackal, 1987), the animals are shy and feed only once monthly (Woetzel, 2006), etc., etc. Hovind presents 9,000 reported Loch Ness Monster sightings, including eighteen by a single person, as strong evidence for the existence of the Loch Ness Monster (Hovind, 2005b, seminar 3b, slides 65, 73). However, each fresh sighting should also increase the likelihood of finding physical evidence. Yet as Sagan notes, we’re still waiting. Until physical evidence appears, such accounts simply cannot be accepted as evidence.

However, two parts of the exhibit involve photographic or physical evidence which can be studied. A series of five slides describes the events of April 25, 1977 in which the Japanese fishing boat Zuiyo Maru raised the 4,000 lb partly decomposed carcass of an unknown animal, later identified in the Japanese press as a Plesiosaur, thought to have gone extinct 65 million years ago. Combined with the Loch-Ness-Monster-like sightings, the Fossil Museum presents this as evidence that Plesiosaurs are alive. Although the Zuiyo Maru fishermen dropped the carcass back into the sea after about an hour, they took five photographs of the carcass and took tissue samples. Most of the Japanese scientists involved in studying this evidence concluded that the fishermen had raised a basking shark carcass rather than a Plesiosaur carcass (Kuban, 1997, p. 22).
Although many young-earth creationists described it as a Plesiosaur for a time, most now accept the basking shark explanation. The young-earth creationists Pierre Jerlström advances a detailed argument that the carcass is a basking shark (Jerlström, 1998, 1999). Answers in Genesis includes the *Zuiyo Maru* find in its list of “Arguments we Think Creationists Should NOT Use” (Answers in Genesis, 2007b). Walt Brown, who is often cited in the Fossil Museum via Hovind’s slides, has reversed his position:

> In the 1995 edition of this book, this animal was incorrectly labeled as a “possible plesiosaur.” After reading English translations of opinions of other Japanese scientists and seeing similar pictures of decaying basking sharks, it seems more likely that this was a large basking shark. Decay patterns near the shark’s head gives the appearance of a neck. My apologies for the error (W. Brown, 2001, p. 249).

Only a few creationists continue to defend the Plesiosaur interpretation (e.g. Goertzen, 2001). Therefore in advancing the Plesiosaur interpretation, the Fossil Museum has followed Hovind into a minority view even among creationists.

The second example is an acknowledged hoax. Hovind’s slide reads:

> On 9-22-98 I talked with Pete Peterson from L&D Bait Shop [in] Lakewood, OH . . . He told me he was walking on the beach of Lake Erie about 6 years earlier and found a dead baby creature. It was 3 feet long, had four flippers, a small head and a long neck. He brought it back and mounted it (He is a taxidermist). He sold it to Carl Baugh . . . (Hovind, 2005b, seminar 3b, slide 184)

A second slide displays an unidentified man with a seal-like creature having several small dorsal plates and four small flippers (Hovind, 2005b, seminar 3b, slide 186). Yet Glen Kuban called Petersen, who told him that he had found a fish carcass and modified it to make it appear dragon-like. He trimmed the dorsal fin into triangular shapes, bent the neck into an S-shape, and fashioned flippers from pieces of skin. Kuban writes:
He said the display--which was basically a "joke"--was a hit, and that many people at the [taxidermy] trade show enjoyed it, especially children. He said he did not think anyone would take it seriously, until Baugh showed up, and seemed to assume it was a real lake monster, and wanted to buy it (Kuban, 2007).

Baugh’s Creation Evidences Museum now explains that although “[t]he science teacher who informed us about the ‘rare discovery’ suggested that it had the appearance of a juvenile plesiosaur,” they no longer accept this view (Creation Evidences Museum, 2007c). However, the Creation Evidences Museum does not acknowledge that it is a hoax, suggesting instead that it is a newly discovered species. To its credit, the Fossil Museum recently covered these slides, although it has not yet removed them.

**Dinosaur Tissue**

An exhibit consisting of two pages argues that since dinosaur tissue has been discovered, the dinosaurs cannot be more than a few thousand years old. The first page reproduces part of a March 24, 2005 Associated Press news story entitled “Scientists Recover T. Rex Tissue,” followed by commentary by James Taylor of the young-earth creationist Mt. Blanco Fossil Museum of Crosbyton, Texas. The story describes Mary Higby Schweitzer’s discovery of Tyrannosaurus Rex soft tissues deep in 70-million-year-old fossils. Taylor asks, “Could soft tissue really survive for 70,000,000 years? Or is it more likely that soft tissue could only survive a few years,” thereby implying that the standard geological time scale is several orders of magnitude too long.

For nearly ten years, Mary Higby Schweitzer and her colleagues have been able to use chemical techniques to extract soft tissues from fossilized dinosaur bones
(Schweitzer, Chiappe, Garrido, Lowenstein, & Pincus, 2005; Schweitzer & Staedter, 1997; Schweitzer et al., 2007; Schweitzer, Wittmeyer, Horner, & Toporski, 2005), some of which “may retain some of their original flexibility, elasticity, and resilience” (Schweitzer, Wittmeyer et al., 2005, p. 1952). Since theoretical considerations would indicate that biomolecules could survive for no more than a million years (Schweitzer et al., 2007), scientists are struggling to find mechanisms which could preserve such material for so long. One of the explanations under consideration is that extremely rapid mineralization of soft tissues prevents post-mortem decay (Schweitzer, Chiappe et al., 2005). Ironically, this echoes the Fossil Museum argument that fossil mineralization is a relatively rapid process. In any case, this unexpected result poses a challenge to the standard geological timeline, and at present there is no scientific consensus regarding an explanation. Therefore this is one of the Fossil Museum’s strongest arguments.

**Geophysical and Astrophysical Arguments**

*The Leap Second*

A display case entitled “Evidence from the Earth” begins with four slides arguing that the earth’s spin rate is slowing. First, a slide with a picture of a globe reads, “The earth is spinning over 1000 mph at the equator.” The next slide is entitled “Time to Kill” and reads:

“Earth’s Rotation is slowing down. To compensate for this lagging motion, June will be one second longer than normal. This ‘Leap Second’ announced by the
International Earth Rotation Service in February, will keep calendar time in close alignment with international time.” – *Astronomy Magazine*, June 1992, p. 24

The third reads, “But regular clocks use days as a measure, which are growing longer by a thousandth of a second or more daily as Earth’s rotation slows. Pensacola News Journal, 12/6/1990.” The fourth slide is a cartoon of three dinosaurs having been flung into outer space because of the earth’s high rate of spin. The implication (emphasized by tour guides) is that at this rate of deceleration, the earth would have been spinning impossibly fast at the time of the dinosaurs under the accepted geological time scale.

These are all either Hovind slides or closely based on Hovind slides (Hovind, 2005b, seminar 1, slides 470-472, 477). However, this argument is not unique to Hovind. For example, Baugh writes:

Atomic clocks which have measured for many years the earth’s spin rate to the merest billionth of a second, have consistently found that the earth is slowing down at a rate of one second a year. If the earth were billions of years old, its initial spin rate would have been so great that centrifugal force would have greatly deformed the earth, and we do not see that as being the case. Therefore, losing a second per year would indicate that we simply have thousands—not millions—of years in the calculation (Baugh, 1992b, p. 137).

Yet Hovind, Baugh, and the Fossil Museum have misunderstood the leap second. They are correct that tidal forces slow the earth’s rotation rate. They are also correct that because of this deceleration of the earth, the International Earth Rotation Service (IERS) periodically inserts a leap second to produce a day that is 86,401 seconds long rather than the usual 86,400 seconds in order to keep atomic clocks in synchrony with the earth’s

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59 This quote is entitled “Time to Kill” because this is the title of the original article, a 150-word blurb from the “AstroNews” section (“Time to kill,” 1992).
60 1 day = (24 hours) (3,600 seconds / hour) = 86,400 seconds
rotation. The IERS has done so on 23 occasions since 1972 (Steyaert, 2005). Yet the (accurately quoted) *Pensacola News Journal* piece is incorrect: the average length of a day increases by about 1.4 ms per century, not a thousandth of a second per day (Nelson et al., 2001). Although the average over the last millenium is about 1.4 ms per century, the day can actually shorten from year to year and season to season because tidal friction is one of several factors affecting the earth’s spin rate. The atomic second was defined in 1967, but for technical reasons the 86,400.000 second day was set to match the earth-rotation-based day in about 1820. At present, a day is about 86,400.0025 seconds long because of the gradual slowing of the earth’s rate of rotation (Nelson et al., 2001).

Hovind, Baugh, the *Pensacola News Journal*, and the Fossil Museum all seem to misapprehend the fact that if the earth were to stop decelerating today, i.e. if the earth were to maintain its present rate of spin in the future and no change were made to the atomic-clock-based definition of the second, leap seconds would continue to be needed. This is because atomic clocks run 0.0025 seconds faster per day than the earth’s spin rate would indicate. Therefore every 400 days or so a leap second is necessary, even if the earth continues at its present rate of spin. The fact that the earth is slowing means that over time, leap seconds will become more frequent. One hundred years from now, about two leap seconds will be needed per year (Nelson et al., 2001, p. 524). On the other hand, 22 leap seconds were added from June 1, 1972 to December 31, 1998 (nearly one per year), but the next leap second was not added until December 31, 2005 (Steyaert, 2005). This seven-year hiatus indicates that the earth actually sped up slightly during this

\[ \frac{0.0025 \text{ seconds}}{\text{day}} \times 400 \text{ days} = 1.000 \text{ second} \]
time. Thus a leap second does not, in itself, signal the slowing of the earth’s rotation, but rather the increased or decreased frequency of leap seconds over time signals the slowing down or speeding up of the earth’s rotation.62

As noted above, the earth-rotation-based day presently lengthens by 1.4 ms every century, but Hovind, Baugh, the Pensacola News Journal, and the Fossil Museum assume that the day lengthens by 1 second every year. At the latter rate of deceleration, the earth would have spun twice as fast only 43,000 years ago.63 But at the former and accurate rate of deceleration, the earth would have spun twice as fast about 3 billion years ago.64 This estimate is substantiated by fossil corals which exhibit daily growth rings as well as annual growth rings. Study of these corals reveals that about 370 million years ago, a year included between 385 and 410 days (Nelson et al., 2001, p. 512).

**Lunar Recession**

A series of Hovind slides (seminar 1, slides 420, 421, 423) is used to argue that given the present recession rate of the earth from the moon, the moon would have been catastrophically close to the earth’s surface about a billion years ago. By implication, the earth-moon system could not be 4.5 billion years old. The first two slides explain and illustrate the gravitational inverse-square law for Newtonian mechanics: “The force of attraction between two objects is inversely proportional to the square of the distance

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63 At twice the spin rate, the day would have been 12 hours = 43,200 seconds shorter. (43,200 seconds) ÷ (1.000 second / year) = 43,000 years.
64 At twice the spin rate, the day would have been 12 hours = 43,200 seconds shorter. (43,200 seconds) ÷ (0.0014 seconds / hundred years) = 3.1 billion years
between them,” and “If the distance is 1/3 the force of attraction between two objects is 9
times greater. 1/3 inverted is 3/1. $3^2 = 9.$” A third slide illustrates the earth-moon system
and tides and concludes: “This fact alone puts the age of the Earth/Moon system at less
than 1.2 billion year [sic] max. In the Beginning Walt Brown p. 177.” By implication, if
the moon were 1/3 of its present distance from the earth, the tidal forces would be much
larger, resulting in a much greater recession rate in the past.

Although the Fossil Museum displays the “Leap Second” argument and the
“Lunar Crisis” argument in separate displays, they are closely related. The gravitational
attraction between the moon and the earth is primarily responsible for the oceanic tides,
and the friction associated with the oceanic tides is primarily responsible for the
diminishment of the earth’s rotation rate. The same phenomenon causes the moon to
recede from the earth. Therefore estimates of the angular deceleration of the earth is
coupled to estimates of the moon’s recession rate, presently measured at $3.82 \pm 0.07$
cm/year (Dickey et al., 1994, p. 486).

Walt Brown’s derivation of the problem, to which Hovind’s slide refers, is an
estimate based on introductory-level classical mechanics and numerous simplifying
assumptions (W. Brown, 2001, pp. 302-306), including the undemonstrated and dubious

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$^{65}$The gravitational interaction between the sun and the earth adds a comparatively minor
collection to the behavior of the oceanic tides, and tidal flexing of the earth’s mantle
adds a minor contribution to the earth’s deceleration (Dickey et al., 1994).

$^{66}$If the earth-moon system is treated as an approximately isolated system, angular
momentum is approximately conserved in the earth-moon system. Therefore as tidal
friction causes the earth to lose angular momentum, the moon must gain angular
momentum by receding from the earth.
proportional to tidal height (p. 303). Brown concludes that the moon would have been catastrophically close to the earth only 1.2 billion years ago. Yet Louis Slichter conducted a far more detailed and credible study of the problem in 1963, concluding that the moon would have been catastrophically close only 1.4, 1.8, or 2.3 billion years ago, depending on the assumptions adopted in the calculation (Slichter, 1963). Therefore despite Brown’s simplified treatment of a complicated problem, the “lunar crisis,” as Brown refers to it (p. 302), is a genuine geophysical problem.

Yet significant progress has been made toward solving this problem (for a thorough history, see Thompson, 1999). First, Webb found the counterintuitive result that when the earth spun faster in the past, the rate of tidal energy dissipation was markedly reduced so that the moon would have been catastrophically close to the earth about four billion years ago (Webb, 1982). Next, with the advent of plate tectonics, geophysicists began to recognize in the 1980s that the rate of tidal energy dissipation depends critically upon the configuration of the continents on the earth’s surface, and that the present configuration may dissipate unusually high amounts of energy (Kagan, 1997). Therefore our present recession rate of 3.82 cm/s may be unusually high. When continental configuration is taken into account, lunar recession rates become compatible with standard geologic time scales (Kagan, 1997, p. 115). Third, analysis of sediments deposited under tidal conditions indicates that tidal energy dissipation was lower in the past, averaging only 2.16 cm/year over the past 0.62 billion years and having even lower rates between 2.5 billion years ago and 0.62 billion years ago (Williams, 1997). Yet despite these advances, few geophysicists would declare the lunar recession problem to
be “solved.” Therefore if the Fossil Museum abandons Brown’s oversimplified version of the “lunar crisis” promulgated by Hovind, lunar recession remains a viable argument for the time being.

**Conservation of Angular Momentum**

According to the nebular hypothesis of solar system formation, the solar system originated as a large slowly-turning nebula which gravitationally collapsed to form our present solar system. The nebular hypothesis is attractive because it explains why all of the planets revolve in nearly the same plane and in the same direction, why the sun spins in the same direction as the planets revolve, and why nearly all of the planets spin in the same direction that they revolve. Evidence from the composition of meteorites tends to support the nebular hypothesis (Russell, 2007), and protoplanetary discs have been observed around young stars since 1983 (Encrenaz, 2001a). As a result, astrophysicists have reached a “virtual consensus” (Russell, 2007, p. 481) that the solar system resulted from the collapse of a primordial nebula.

However, the Fossil Museum displays a series of four Hovind slides which object to the nebular hypothesis. The first (Hovind, 2005b, seminar 1, slide 171) notes that under the nebular hypothesis, the sun should carry most of the solar system’s angular momentum. Instead, the sun carries only 2% of the solar system’s angular momentum, and the balance is carried by the planets. The slide concludes that the sun’s relatively slow rate of spin contradicts the nebular hypothesis.

The relatively low angular momentum of the sun was identified long ago as a problem for the nebula hypothesis, and no later than 1924 physicists began to suggest
mechanisms by which angular momentum could be transferred from the sun to the planets (Encrenaz, 2001a, p. 81). Today it is generally agreed that the sun transferred angular momentum to the planets by a magnetic mechanism (Bertotti, Farinella, & Vokrouhlidy´, 2003, pp. 511-512; Russell, 2007) and/or a process analogous to fluid friction (Bertotti et al., 2003, pp. 511-512; Lin, 1986). These hypotheses are strengthened by observational evidence that among stars of the same type, young stars spin faster than middle-aged stars and middle-aged stars spin faster than old stars (Baliunas et al., 1995), indicating that stars gradually slow down as they age. Since the angular momentum anomaly is effectively resolved, Hovind and the Fossil Museum are using an outdated argument.

The remaining slides spotlight a similar objection to the nebular hypothesis, namely that Venus, Uranus, and a few of the moons in the solar system do not spin in the same direction as the other planets and a few of the moons even orbit in reverse (Hovind, 2005b, seminar 1, slides 170, 172-173). Yet these are not the problems they appear to be. In the case of the moons, many are simply believed to be gravitationally captured asteroids. In the case of the planets, astrophysical models predict that near the end of planetary formation, planets are typically struck by bodies ranging from 0.1% to 25% of the planet’s mass. These impacts likely altered Venus and Uranus’s rotations (Bertotti et al., 2003, p. 526). Therefore these “angular momentum” problems for the solar nebula hypothesis are relatively weak arguments for the Fossil Museum, especially in the face of the large body of observational data which tends to support the nebula hypothesis.
Jupiter Cooling Rate

An altered version of a Hovind slide (Hovind, 2005b, seminar 1, slide 413) shows a cartoon of Jupiter drawn with a face and holding a thermometer. It reads: “Jupiter is cooling off. It is losing heat twice as fast as it receives it from the sun. See also: In the Beginning Walt Brown p. 30.” Astrophysicists first recognized that Jupiter radiates more energy than it receives from the sun in the late 1960s (Aumann & Gillespie, 1969). Soon afterward, others recognized that Jupiter is unlikely to have simply cooled from a primordial temperature 4.5 billion years ago (Bishop & DeMarcus, 1970). Therefore Jupiter’s excess energy output likely comes from other sources. At present, astrophysicists believe that Jupiter’s excess energy output results from a combination of ongoing gravitational collapse and a process of helium condensation (Encrenaz, 1999, 2001b; Gautier & Owen, 1989; von Zahn, Hunten, & Lehmacher, 1998). The relative depletion of helium in Jupiter’s outer layers serves as observational evidence for the latter mechanism. Here the Fossil Museum has identified a genuine anomaly, but it is an anomaly whose resolution appears to be imminent.

Another Hovind slide makes a similar argument regarding one of Jupiter’s moons (Hovind, 2005b, seminar 1, slide 414):

Jupiter’s moon Ganymede has a strong magnetic field. “Magnetic fields are generated by the liquid motion of molten metal inside a body. Yet Ganymede should have cooled solid billions of years ago.” Denver Post Dec. 13, 1996

It is true that the Galileo probe discovered Ganymede’s magnetic field in 1996, but Ganymede’s magnetic field strength is only 1% of the earth’s magnetic field strength (Chaisson & McMillan, 2005, p. 297). Consequently Ganymede’s present magnetic field
could result from residual magnetism in iron-rich rock layers (e.g. Crary & Bagenal, 1998) or a high interior temperature (and field-producing currents) could be maintained by tidal flexing (e.g. Rochette, 1997). Although the source of Ganymede’s magnetism is unknown, this is simply an open question in planetary physics, not a true anomaly.

The Earth’s Magnetic Field

A Hovind slide bearing an illustration of the earth’s surrounded by magnetic field lines reads in part:

The Earth’s magnetic field is getting weaker.
1. It cannot be billions of years old.—25,000 max.
2. Carbon dating cannot work for more than a few thousand years . . .
Earth’s magnetic field strength has declined 6% in the last 150 years.

Astronomy and the Bible Donald DeYoung, p. 18
See ICR’s Impact #188 for more on this.

Referencing the same sources, Hovind’s updated version of this slide now reads “Earth’s magnetic field has declined 10% in the last 150 years and 40% in the last 1,000 years” (Hovind, 2005b, seminar 1, slide 459), although DeYoung has the figure at 6% in the past 150 years (DeYoung, 2000, p. 18) and Impact #188 has the figure at 7% in the past 150 years (Humphreys, 1989). An accompanying un-scaled graph illustrates the point that at its present rate of decline, the earth’s magnetic field strength would have been prohibitively high in 20,000 BCE.

“ICR Impact #188” refers to an Institute for Creation Research newsletter authored by D. Russell Humphreys (1989). Humphreys argues that God created the earth’s magnetic field as part of the six-day creation (Humphreys, 1983) and that it is maintained by electrical current in the earth’s core. As electrical resistance gradually
reduces this current, the magnetic field has gradually declined. Assuming that it declines exponentially, the earth’s magnetic field would have been too strong for life about 10,000 years ago. Relying on empirical data and theoretical considerations, Thomas G. Barnes originally advanced this argument in the 1970s (Barnes, 1971, 1972, 1973, 1984). Barnes also asserted that radiocarbon dates of longer than 10,000 years are in error because a stronger magnetic field in the past would have shielded the earth from cosmic rays (Barnes, 1971). This is why Hovind’s slide claims that “[c]arbon dating cannot work for more than a few thousand years.”

Barnes’ critics (Brush, 1983; Dalrymple, 1983; Johns, 1984) pointed out extensive paleomagnetic evidence that the earth’s magnetic field normally fluctuates in intensity and has reversed its polarity many times in its history. In fact the earth’s polarity has reversed eleven times over the past five million years (Dalrymple, 1983). Therefore the present weakening of the earth’s magnetic field may signal a period of decline preceding reversal over the next several thousand years (Monroe & Wicander, 2005, p. 298). Undaunted, Barnes steadfastly denied that the earth’s magnetic field has ever reversed (Barnes, 1972, 1984). Hovind goes further than Barnes, referring to claims of magnetic field reversals as lies (Hovind, 2005b, seminar 6, slides 56-57).

Geomagnetic field reversals might have been fatal to Barnes’ theory, but Humphreys accepted the evidence for magnetic field reversals and modified Barnes’ theory to accommodate them (Humphreys, 1986, 1988a, 1989, 1993, 2002b). In Humphrey’s revision of Barnes’ model, all of the geomagnetic field reversals occur and are geologically recorded during the geological upheavals of the Flood year, followed by
a gradual return to a steadily decaying magnetic field. Other creationists have adopted Humphreys model (e.g. Sarfati, 1998b). Therefore except for Hovind, all parties now agree that the earth’s magnetic field has reversed many times in the past and is presently declining, but creationists and mainstream geologists offer competing explanations for these observations. Therefore the Fossil Museum offers the geomagnetic field decline argument as proof that the earth is young, but it is more accurately an explanatory model in competition with mainstream geology, i.e. it does not point to a genuine problem in the standard geological account.

Speed of Light

A single slide, entitled “Speed of Light,” reads: “The speed of light is slowing down. Studies in the decay of the speed of light are ongoing by Trevor Norman and Barry Setterfield.” In The Atomic Constants, Light, and Time, Setterfield and Norman (1987) offer an answer to the question of how astronomical objects which are billions of light years away could be visible if the universe is only a few thousand years old. Based on a statistical study of 163 measurements of the speed of light since 1675, they conclude that between 1675 and 1960 the speed of light has slowed by an average of 38 km/s per year, settling to its present rate in about 1960. They conclude that the speed of light was several orders of magnitude faster during creation week, enabling light from distant astronomical objects to reach the earth in a short time. Setterfield and Norman also recognize that the speed of light is coupled to various physical constants such as Planck’s constant and electron mass. Analyzing historical measurements of these and other
constants, they offer statistical arguments that these constants have varied in a manner consistent with the slowing of the speed of light.

Fellow young-earth creationists have roundly criticized The Atomic Constants, Light, and Time. Critics have impugned Setterfield and Norman’s data analysis, concluding that no statistically significant decline in the speed of light is observable in historical data (Aardsma, 1998; R. H. Brown, 1988, 1990; see also Humphreys, 1988b), although a defender of Setterfield and Norman has confirmed their results (Montgomery, 1990). Aardsma noted that since a higher light speed implies an increased nuclear decay rate, the radiation intensity during creation week and the early years of the earth would have rendered life impossible and the earth’s surface molten (Aardsma, 1998). Setterfield attempts to address this question, but his answer misses the point (Setterfield, 1989). Holt pointed out that Setterfield’s results are incompatible with pulsar observations and violate the first law of thermodynamics (Holt, 1988). Humphreys pointed out numerous instances of careless scholarship on the part of Setterfield and Norman, including misquotes of personal correspondence, misquoted data, a failure to report evidence which would tend to weaken their conclusions, and a misrepresentation of an earlier researcher’s work (Humphreys, 1988b).

As a result, most young-earth creationists do not accept a decline in the speed of light (see, e. g., DeYoung, 2000, pp. 141-143). Answers in Genesis notes that the theory’s defenders have been unable to answer some of these objections (Ham, Sarfati, & Wieland, 2007), and lists decline in the speed of light among its “arguments which are doubtful, and hence inadvisable to use” (Answers in Genesis, 2007b). Yet Answers in
Genesis supports Russell Humphrey’s alternative explanation to the visibility of distant objects in a young universe (Answers in Genesis, 2007b; Ham et al., 2007). Humphreys’ alternative relies on a relativistic effect known as gravitational time dilation together with an alternative to the Big Bang cosmology (Humphreys, 1994). However, Humphreys’ explanation has fallen under considerable criticism at the hands of fellow physicists (Byl, 1997; Conner & Page, 1998; Conner & Ross, 1999; Fackerell & McIntosh, 2000; Kulikovsky, 2002), some of which is quite strident and some of which is levied by specialists in general relativity. Apparently Humphreys’ attempts to answer these criticisms are sufficient to satisfy most young-earth creationists (Humphreys, 1997, 1998, 2002a). In any case, the Fossil Museum adopts a minority view among young-earth creationists in supporting Setterfield and Norman’s model instead of Humphreys’ model.

*Atmospheric Helium*

A slide entitled “The Age of the Atmosphere” shows a cut-away view of the earth and its atmosphere. It shows large amounts of helium entering the atmosphere from the earth’s crust and small amounts of helium exiting to “outer space.” The slide concludes, “All of the helium now in the atmosphere would accumulate in a maximum of 2 million years!” The guides explain that since a 4.5-billion-year-old earth would have much greater helium levels, the earth cannot be that old.

This slide describes a known problem in geophysics. Nearly all atmospheric helium (here we are considering only \(^4\text{He}\)) is produced when radioactive materials within the earth produce \(\alpha\)-particles (helium nuclei). Since helium is a noble gas (i.e. it is chemically inert), the earth’s crust gradually releases helium into the atmosphere at a
known rate. Some of this helium eventually reaches escape velocity in the earth’s outer atmosphere (the exosphere), which enables the helium to leave the earth without gravitational return. This process is known as thermal or evaporative escape, and it also occurs at a known rate. As early as 1928, physicists recognized that the rate at which helium enters the atmosphere from the crust far exceeds its rate of evaporative escape (Spitzer, 1952, p. 233), so atmospheric helium rates should have risen over the course of the earth’s history. However, atmospheric helium levels are far lower than would be expected after 4 billion years (Bates & McDowell, 1957; Cook, 1957), and in fact present atmospheric helium levels would be reached after only two million years (MacDonald, 1963). Consequently, this geophysical problem has been a favorite young-earth argument for at least 25 years (W. Brown, 2001, pp. 31, 79; D. R. Humphreys, 1999; Malcolm, 1994; H. M. Morris & Parker, 1982, pp. 251, 254-259; Sarfati, 1998a; Vardiman, 1985, 1990).

Since the problem of low atmospheric helium was identified, geophysicists have sought non-evaporative mechanisms by which helium could escape from the atmosphere. Several non-thermal mechanisms were proposed, but the currently accepted explanation was proposed in 1968 (Hunten, 1990, p. 8). Geophysicists presently believe that helium is ionized by collisions with other atoms and is then expelled via the earth’s magnetic field through a process analogous to the expulsion of the solar wind (Catling, 2006; Hunten, 1990; Lie-Svendsen & Rees, 1996; Shizgal & Arkos, 1996). The details are subject to ongoing study (e. g. Lie-Svendsen & Rees, 1996), but the promise of non-thermal escape mechanisms is clear. For their part, creationists dismiss non-thermal
escape as inadequate (Sarfati, 1998a; Vardiman, 1990) or highly speculative (Malcolm, 1994; Vardiman, 1985, 1990). These critics are correct that the issue of atmospheric helium abundance is not resolved, but geophysicists appear to be near a consensus regarding non-thermal escape of atmospheric helium. Here the Fossil Museum has identified a genuine anomaly in atmospheric physics, but it will likely experience a short shelf life.

Unfortunately, in two publications Vardiman quotes Chamberlain (1978) in support of his dismissal of non-thermal escape:

None of the rates of these proposed processes have been accurately quantified nor have adequate observations even begun to confirm or deny them. Chamberlain states that the helium escape problem “will not go away and it is unsolved” (Vardiman, 1985, 1990, p. 25).

Chamberlain wrote these words, but clearly he meant them rhetorically. Earlier in the text, Chamberlain wrote:

The loss of H and He from a planet may occur by several means. The Jeans “thermal evaporation” . . . gives a lower limit to the escape flux, but other processes may work as well. The importance of other mechanisms—and how they might vary over geological periods—has not been appreciated until recent years. Consequently, much of the earlier (and some of the current) literature on atmospheric evolution should be read with caution (Chamberlain, 1978, pp. 274-275).

In the passage from which Vardiman quotes, Chamberlain concludes:

The problem will not go away and it is unsolved. It appears now that He escape, like the loss of H, must occur through some process other than Jeans thermal evaporation, although much of the He loss may occur in the form of He⁺ out the open magnetic field lines over the poles. Another possibility that holds promise is charge exchange between He or H and hot He⁺ in the plasmasphere to produce energetic He atoms (Chamberlain, 1978, p. 278).

The full quote demonstrates that Chamberlain is a poor ally to Vardiman’s skepticism regarding non-thermal escape, and Vardiman’s quotation of Chamberlain is misleading.
Moon Dust

A series of Hovind slides makes the case that if the moon were 4.5 billion years old, it would have accumulated a layer of dust several miles thick over its surface (Hovind, 2005b, seminar 1, slides 682-684, 687, 690). The first slide, an un-attributed direct quote from Brown (W. Brown, 2001, p. 80), reads

Lyttleton felt that x-rays and UV light striking exposed moon rocks “could during the age of the moon be sufficient to form a layer over it several miles deep” Monthly Notices of the Royal Astronomical Society of London Vol. 115, 1955, pp. 585-604 [sic]68

The remaining slides attempt to demonstrate that scientists in general and the National Aeronautics and Space Administration (NASA) in particular believed that such dust would be encountered in the moon landings. A NASA photograph taken on the lunar surface shows an astronaut standing on the moon beside a lunar lander’s foot. The text reads, “The landing pads were added and the legs lengthened because of concerns over the predicted layers of dust.” In another slide, a photo of an un-referenced museum exhibit shows an astronaut standing on a lunar lander’s foot. A ladder is visible whose bottom rung is just below the astronaut’s waist. The text reads, “The ladder was 18 inches too short in anticipation of a thick dust layer.” Two final slides quote Isaac Asmov:

I get a picture, therefore, of the first spaceship, picking out a nice level place for landing purposes, coming in slowly downward tail-first and sinking majestically out of sight.
Isaac Asmov, Science Digest, Jan., 1959 p. 36

68 Here Hovind cites the wrong reference. Brown correctly attributes the Lyttleton quote (to Lyttleton, 1956, p. 72). However, Hovind’s citation, also borrowed from Brown, refers to a paper by Thomas Gold (1955), another proponent of thick lunar dust.
The tour guides explain that NASA expected a deep layer of dust but found only a few inches. The guide concludes that since there is so little moon dust, the moon cannot be billions of years old.

The history of this argument begins with Hans Pettersson, who attempted to measure the influx of meteoric dust into the earth by direct atmospheric capture (Pettersson, 1958, 1960). Based on these experiments, Pettersson estimated that about 28.6 million metric tons of cosmic dust is suspended in the atmosphere. Noting that the finest volcanic ash reached the ground about two years after the 1883 Mt. Krakatoa eruption, Pettersson estimated that roughly the same time would be required for suspended meteoric dust to settle out of the atmosphere. Consequently he estimated the influx rate of meteoric dust at 28.6 million (metric) tons ÷ 2 years = 14.3 million metric tons per year (Pettersson, 1958). Despite the precision of this estimate, it is clearly intended as a round figure, and in 1960 Pettersson gave the figure as 14 million tons per year but noted that five million tons per year might be more plausible (Pettersson, 1960, pp. 125, 132). However, when Isaac Asimov (1959) restated Pettersson’s results, only Pettersson’s 1958 piece was available. Using Pettersson’s estimate of 14.3 million tons per year, Asimov calculated that the equivalent of 54 feet of meteoric dust would have fallen over the entire surface of the earth in five billion years. The moon would have been covered to a comparable depth, but since the moon is geologically and atmospherically inactive, this dust would remain on the surface. Based on such a back-
of-an-envelope calculation, Asimov dramatically concluded that a lunar lander might be lost in lunar dust.

Almost immediately, John Whitcomb and Henry Morris pressed Pettersson and Asimov’s calculations into service as a young-earth argument (Whitcomb & Morris, 1961, pp. 379-380). They noted that nickel, cobalt, and iron are found in much higher concentrations in meteorites compared to the earth’s crust. Whitcomb and Morris argued that the amounts of nickel, iron, and cobalt found in the earth’s crust would have been much higher had the earth experienced such an influx for billions of years. After the Apollo program revealed that the moon was covered with only a thin layer of dust, Slusher (1971) presented the moon-dust version of the argument, and others followed (e. g. Barnes, 1982; W. Brown, 2001, pp. 33, 80, 307-309; H. M. Morris, 1985, p. 152). Yet in the creationists’ hands, much of the tentative character of Pettersson and Asimov’s calculations were lost.

Mainstream scientists have critiqued the moon-dust argument (e. g. Shore, 1984), but young-earth creationists Andrew Snelling and David Rush wrote the most thorough and comprehensive study of the moon dust issue (Snelling & Rush, 1993). From an examination of fourteen scientific studies of meteoric dust influx conducted between 1960 and 1991, they conclude that Pettersson’s estimate (14,300,000 tons/year) is an outlier, and that the correct value is closer to 20,000 tons per year on the earth. They also reviewed seven studies of cosmic dust on the lunar surface conducted between 1971 and 1983, from which they conclude that the influx rate to the moon is approximately 10,000 tons per year, commensurate with the earth influx rate. They conclude: “It thus appears
that the amount of meteoric dust and meteorite debris in the lunar regolith and surface
dust layer . . . does not contradict the evolutionists’ multi-billion year timescale (while
not proving it)” (p. 3). Snelling and Rush also demonstrate conclusively that belief in a
thick lunar dust layer (including Lyttleton’s) had always been a minority view among
scientists and the question had been conclusively resolved by numerous methods at least
three years before the Apollo missions. Hovind claims that the lunar lander’s legs were
too long, its landing pads too big, and its ladder too short because of an anticipated deep
layer of dust, but Snelling and Rush demonstrate that these claims are groundless. Citing
Snelling and Rush’s paper, Answers in Genesis includes the moon-dust argument in its
list of “Arguments we think creationists should NOT use” (Answers in Genesis, 2007b).
Therefore in continuing to use the moon dust argument, the Fossil Museum spreads a
theory that is outdated and insupportable.

*Red Sirius*

Sirius is blue-white in color, but some ancient authors described it as “reddish.”

The Fossil Museum displays three Hovind slides citing the “red Sirius anomaly” as
evidence that the astronomical time scale is wrong (Hovind, 2005b, seminar 1, slides
410-412). The first slide reads:

> Egyptian hieroglyphs from 2000 B. C. described Sirius as red.
> Circero, in 50 B. C., stated Sirius was red.
> Seneca described Sirius as being redder than Mars.
> Ptolemy listed Sirius as one of the six red stars in 150 A. D.
> Today it is a white star-binary.
> Textbooks say it should take billions of years for this to happen.

*It’s a Young World*  Paul Ackerman
The second slide includes a Hertzprung-Russell diagram (illustrating modes of stellar evolution) taken from a physical science textbook and reads: “Textbooks teach it takes billions of years for a star to ‘evolve’ from a red giant to a white dwarf.” The final slide captures a stellar evolution diagram from an earth science textbook and reads: “Textbooks say Red Giant Stars evolve into white dwarf stars over billions of years.”

In addition to Hovind, only a few young-earth creationists use this argument (e.g. Ackerman, 1986, p. 67; DeYoung, 2000, p. 71). Much of Hovind’s information is accurate or nearly accurate. Sirius is a bright white star, the brightest in the night sky, and yet some ancient witnesses described Sirius as being red. However, contrary to Ackerman’s unreferenced assertion (Ackerman, 1986, p. 67), Egyptian glyphs assign no color to Sirius (Brecher, 1979, pp. 96-97). Sirius is a binary system consisting of Sirius A, a bright blue-white star, and Sirius B, a much dimmer white dwarf. According to Whittet (1999), it is highly unlikely that Sirius B evolved from a red giant into a white dwarf within the past 2,000 years because: (a) a nebula of ejected material would surround the star system, and none is observed, and (b) this process would take tens or hundreds of millions of years (not billions of years as asserted by Hovind). Other stellar processes which would change the appearance of the Sirius system from red to white also seem to be unlikely (Whittet, 1999).

Yet nearly half of the known ancient references to Sirius refer to it as white or blue (Ceragioli, 1996, p. 116), including all of the Chinese references (Jiang, 1993; van Ghent, 1984). In the West, Sirius is never described as red until astrology becomes widely accepted (Ceragioli, 1996, pp. 117-118). All of this points to a cultural
explanation for the references to red Sirius rather than a physical explanation. The classicist Roger Ceragioli (1996) describes several textual and astrological factors which could lead to the ancient descriptions of Sirius as red, including Sirius’s astrological association with heat, fire, and war (a simplified version of Ceragioli's suggested explanations appear in Ceragioli, 1992). Nonetheless, the reason for the large number of red Sirius references will probably never be known. Given the lack of evidence for an explanation based on stellar evolution and the nearly equal number of white Sirius and red Sirius references, the red Sirius references are poor evidence for an incorrect astronomical timescale. The red Sirius references are genuinely anomalous, but they are more accurately explained as a historical anomaly rather than an astronomical anomaly.

*Population Growth*

A Hovind graph shows world population levels since the creation of the world in 4000 BCE (Hovind, 2005b, seminar 1, slide 352). Time is represented on the horizontal axis and the vertical axis is labeled “Billions of Souls.” From 4000 BCE until 2400 BCE (the purported date of Noah’s Flood), the graph shows (presumably exponential) population growth from 0 to about a billion people. In 2400 BCE the graph drops to nearly 0 and is labeled “Noah’s Flood (8 Survivors).” The graph steadily rises (presumably exponentially) from the 8 flood survivors in 2400 BCE to 6 billion people in the year 2000 CE. At the point in the graph labeled “Birth of Christ,” an annotation reads “estimated population 1/4 billion.” Fossil Museum guides explain that if the population curve is traced backward from today, it leads to 8 people in 2400 BCE.
Young-earth creationists have argued from population statistics for nearly 50 years, and they continue to do so today (Batten, 2001; J. N. Hanson, 1977; H. M. Morris, 1966, 1985, pp. 167-169; Rodabaugh, 1975; Whitcomb & Morris, 1961, pp. 396-398; White, 2006). Yet Hovind and the Fossil Museum have misleadingly simplified the argument. Assuming a steady exponential population growth rate from 8 people in 2400 BCE to 6.6 billion people in 2007 (Central Intelligence Agency, 2007), the growth constant is 0.0047 per year and the average population growth rate is 0.47% per year. Yet as Isaak (2007, p. 81) notes, the assumption of this steady rate produces unhappy consequences for the creationist timeline. For example, Morris (1966) dates the Tower of Babel at 101 years after the Flood. At this growth rate the worldwide population would have risen from 8 to only 13. If the Exodus occurred 1,000 years after the Flood, the worldwide population would be only 850 people, yet Exodus reports that Moses lead 600,000 men (plus women, children, and non-Israelites) out of Egypt (Exodus 12:37-38). At the time of the birth of Christ there would be only 600,000 people, yet as Hovind’s graph correctly notes, the population at that time was about 300 million people. For these reasons, creationists generally posit extremely rapid population growth immediately after the Flood, followed by more moderate rates afterward (e.g. Batten, 2001; J. N. Hanson, 1977; H. M. Morris, 1966; Rodabaugh, 1975). Since one cannot conclude that the population growth curve leads smoothly to 8 people in 2400 BCE, this argument is logically flawed.

\[ P = P_o e^{kt}, \]  
\[ \text{where } P = \text{current population}, P_o \text{ is the original population, } k \text{ is the growth constant, and } t \text{ is the growth time. The annual percentage growth rate } r = 100 \left( e^k - 1 \right). \]  
In this case \( P_o = 8, P = 6.6 \text{ billion, and } t = 4,400 \text{ years.} \)
Table 2

*Exhibit Analysis Summary*

<table>
<thead>
<tr>
<th>Exhibit</th>
<th>Credibility of Argument/Evidence</th>
<th>Rejected by Leading Creationists</th>
<th>Based on a Scientific Anomaly</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acambaro Figurines</td>
<td>Poor: No <em>in situ</em> examination, extensive evidence of recent fabrication/fraud</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ica Stones</td>
<td>Poor: No <em>in situ</em> examination, extensive evidence of recent fabrication/fraud</td>
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<td></td>
</tr>
<tr>
<td>Native Am. Petroglyphs</td>
<td>Poor: Apparently genuine but non-representational artwork.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Out-of-Place Artifacts</td>
<td>Poor: No <em>in situ</em> examination or physical evidence</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Cup Found In Coal</td>
<td>Poor: No <em>in situ</em> examination, only cup remains</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>London Hammer</td>
<td>Poor: No <em>in situ</em> examination, limited study, claims unsubstantiated</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Baghdad Battery</td>
<td>Fair: Documented archaeological puzzle but weak support for creationist position.</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Burdick Track</td>
<td>Poor: No <em>in situ</em> examination, extensive evidence of recent fabrication/fraud</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Caldwell Track</td>
<td>Poor: No <em>in situ</em> examination, extensive evidence of recent fabrication/fraud</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Handprint</td>
<td>Poor: No <em>in situ</em> examination, limited study</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Fossil Finger</td>
<td>Poor: No <em>in situ</em> examination, claims unsubstantiated</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Exhibit</td>
<td>Credibility of Argument/Evidence</td>
<td>Rejected by Leading Creationists</td>
<td>Based on a Scientific Anomaly</td>
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</tr>
<tr>
<td>“Human” Paluxy Footprints</td>
<td>Poor: Extensive evidence that they are dinosaur footprints rather than human footprints</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Evidence for Living Dinosaurs</td>
<td>Poor: Based entirely on legends, no physical evidence</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zuiyu Maru Discovery</td>
<td>Poor: Extensive evidence that it was a basking shark</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Dinosaur Tissue</td>
<td>Good: Documented in peer-reviewed scientific journals</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Leap Second</td>
<td>Poor: Based on a misunderstanding of the leap second</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lunar Recession</td>
<td>Good: Documented in peer-reviewed scientific journals, unresolved</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Conservation of Angular Momentum</td>
<td>Fair: Documented in peer-reviewed scientific journals, but largely resolved</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Jupiter Cooling</td>
<td>Fair: Documented in peer-reviewed scientific journals, but largely resolved</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Geomagnetic Decay</td>
<td>Poor: Standard geological theory consistent with geomagnetic change</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speed of Light</td>
<td>Poor: Based on questionable scholarship, leads to nonsensical consequences</td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>
Table 2 (continued)  

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**Exhibit Analysis Summary**

<table>
<thead>
<tr>
<th>Exhibit</th>
<th>Credibility of Argument/Evidence</th>
<th>Rejected by Leading Creationists</th>
<th>Based on a Scientific Anomaly</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atmospheric Helium</td>
<td>Fair: Documented in peer-reviewed scientific journals, but largely resolved</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Moon Dust</td>
<td>Poor: Based on incorrect measurements</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Red Sirius</td>
<td>Fair: Likely a historical rather than a physical anomaly, but unresolved</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Human Population</td>
<td>Poor: Internally inconsistent argument</td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

**Conclusion: Exhibit Hall**

Consulting Table 1, of 25 examined exhibits, 18 are judged to be poor, i.e. the evidence is highly suspect or does not support the conclusion. Of these 18 poor exhibits, 12 have been rejected by leading creationists and/or leading creationist organizations. None of them are based on a documented scientific anomaly. Five of the exhibits are judged to be fair, i.e. they are based on genuine scientific anomalies, but in three cases the anomalies are largely resolved, in one case the evidence does not support the conclusion, and in one case the anomaly is likely of a historical rather than a physical nature. Two of the exhibits are good, i.e. they are based on genuine and unresolved scientific anomalies which bear logical consequences for the standard geological time. The “biological complexity” argument in the classroom presentation might also qualify
as a good argument, since the origin of complex processes necessary for even the simplest life forms is presently unknown to science.

Opening the Doors of Truth

We have seen that the Fossil Museum adopts several of Carl Baugh’s evidences and arguments in the first exhibit room. However, Baugh’s influence is particularly obvious in the Opening the Doors of Truth (ODT) exhibit room, which is best described as a summary of Baugh’s *Creation in Symphony* lecture (Baugh, 1996). Recall that most of the ODT exhibits consist of posters mounted onto vertical doors. Nearly all of the illustrations on these posters reprint sections of Jack Hamm’s “Creation in Symphony” panoramic painting. Hamm based his painting on Baugh’s theories, and it is mounted in Baugh’s Creation Evidences museum in Glen Rose, Texas. However, Hamm is not credited anywhere in the ODT exhibit, and Baugh is mentioned by name only once in the ODT exhibits.

*Baugh’s Vapor Canopy Theories*

Since Baugh’s highly idiosyncratic version of the vapor canopy theory is essential to his “Creation in Symphony” cosmology, I begin with a discussion of this theory. In *The Genesis Flood*, Whitcomb and Morris (1961) popularized the idea that a significant portion of the water for Noah’s Flood originated in a water vapor canopy in the upper atmosphere.

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70 The Creation Evidences Museum sells a seven-and-one-half foot long print of Hamm’s “Creation in Symphony” painting for $75.00 plus a $10.00 shipping and handling fee (Baugh, 2007b).
atmosphere. In the decades following the publication of *The Genesis Flood*, scientifically trained young-earth creationists began to find fault with the idea. Kofahl (1977) calculated that if a water vapor canopy were sufficient to add 1,000 feet of water everywhere on the earth’s surface, then (a) only a little of the sun’s light would reach the earth’s surface, (b) the nearly 30 atmospheres of pressure at the earth’s surface would result in nitrogen and oxygen toxicity, and (c) in order to prevent condensation of the vapor canopy, atmospheric temperatures would be over 400°F at the earth’s surface. Kofahl also calculated that neither a stationary nor an orbiting ice canopy would be structurally tenable. Worse yet, a collapsing ice canopy would be heated as it fell through the atmosphere to initiate the Flood. Kofahl calculated that even if an orbiting ice canopy began with a temperature of absolute zero (0 Kelvin), following collapse the ice canopy would reach the earth’s surface as super-heated steam and kill all of the passengers on the ark. Others calculated that a substantial vapor canopy would result in an enormous greenhouse effect, easily elevating the temperature at the earth’s surface to above the boiling temperature of water (Morton, 1979), or noted that the latent heat of vaporization released in a condensing vapor canopy would increase atmospheric temperatures even further (Walters, 1991). All of these writers concluded that only a very modest vapor canopy (capable of covering the earth with no more than two feet of water) was physically compatible with life on earth. Partly because of empirical problems with the vapor canopy theory, the majority of creationists now favor theories which source nearly all of the Flood waters in underground reservoirs (Akridge et al., 2007), including “hydroplate” theory (W. Brown, 2001) and “catastrophic plate
tectonics” (Austin, Baumgardner, Humphreys, Snelling, & Wise, 1994). Even so, as recently as 1998 the Institute of Creation Research has continued to teach that a large portion of the Noachian Flood waters originated in a vapor canopy (J. D. Morris, 1998). Even those young-earth creationists who reject the vapor canopy on empirical grounds as a substantial source of Noachian floodwater may advocate a thin vapor canopy (e.g. Kofahl, 1977). Both Morris and Kofahl continue to accept a vapor canopy because of the words of Genesis:

And God said, “Let there be an expanse [firmament] between the waters to separate water from water.” So God made the expanse and separated the water under the expanse [firmament] from the water above it (Genesis 1:6-7, NIV).

[All]l the springs of the great deep burst forth, and the floodgates of the heavens were opened (Genesis 7:11, NIV).

In order to maintain a belief in the literal truth of scripture, Morris and Kofahl need to retain some mechanism by which the “waters below” can be separated from the “waters above,” and by which the “floodgates of the heavens” can be opened. One might also guess that John Morris is reluctant to abandon his father Henry Morris’s theory.

Like Morris and others, Baugh supports a vapor canopy. However, Baugh’s version of the vapor canopy is highly idiosyncratic and riddled with physical implausibilities. Unlike writers such as Henry Morris, John Morris, and Kofahl, Baugh theorizes that “the firmament” in the first chapter of Genesis does not refer to the atmosphere, separating the oceans (“the waters below”) from “the waters above,” but rather that “the firmament” refers to part of an ice canopy, namely a thin layer of metallic hydrogen sandwiched between two thicker layers of ice (Baugh, 1989, p. 46). Baugh
hypothesizes that during creation week, the earth’s magnetic field (assumed to be considerably stronger at that time) caused some of the primordial water to separate into hydrogen and oxygen (Baugh, 1996, vol 1, 41:00). Somehow the hydrogen was compressed by the earth’s magnetic field, causing the hydrogen to form a stable superconducting solid spherical shell, several inches thick and suspended about eleven miles above the earth’s surface. Baugh theorizes that this spherical shell of superconducting metal magnetically levitated on the geomagnetic field (Baugh, 1989, pp. 59-60, 1996, pp., vol 1, 57:00; Baugh & Wilson, 1992, p. 35). This metallic hydrogen, in turn, was sandwiched between two shells of ordinary ice, producing a canopy of ten to twenty feet in thickness (Baugh, 1989, p. 46).

The world under Baugh’s canopy was wondrous indeed. The canopy would screen solar and stellar “shortwave radiation” (which he does not define) and “enhance” and “photomultiply” stellar light (Baugh, 1996, vol 1, 58:00): “Each photon of light which strikes the configuration is multiplied by ten because of the interaction in the atoms” (Baugh, 1989, p. 61). Both the canopy and sand grains would behave like crystal radios. The canopy would receive radio waves emitted by stars and planets and emit pleasing musical sounds all over the earth (Baugh, 1989, pp. 63-66; 1996, vol 2, 6:00), and the underwater sand grains would vibrate, generating a mist in the earth’s atmosphere (Baugh, 1989, p. 70). Apparently based on the observation that hydrogen gas glows pink when electricity is passed through it (i. e. its visible spectrum includes strong red and blue lines), Baugh concludes that sunlight, moonlight, and starlight would cause the canopy to emit a “gentle pink glow” (Baugh, 1989, p. 49). The “fiber optic nature” of the
canopy would have transmitted this pink light throughout the canopy, so even at night people could see by its glow (Baugh, 1989, p. 50). This pink light would encourage plant growth and improve the moods of people because “[r]esearchers have found that when a person is affected by the right spectrum of pink light, the brain secretes norepinephrine. Norepinephrine is a natural tranquilizer and neurotransmitter” (Baugh, 1989, pp. 50-51). Temperatures would remain between 72 °F and 78 °F (Baugh, 1989, p. 62). Furthermore, beneath the ice canopy the atmospheric pressure would have been 2.18 times greater than it is today (Baugh, 1989, p. 55), enabling humans to “run up to 200 miles without suffering fatigue,” “an open wound [to] heal over night,” and live to be hundreds of years old (Baugh, 1989, p. 56). Large pterodactyls could not have flown at present atmospheric pressures, but could have done so in the increased pressures under the canopy (Baugh, 1989, p. 59, 1992b, p. 143). Taken together, the canopy’s provision of steady beneficial pink light, shelter from harmful radiation, and hyperbaric atmospheric conditions enabled all creatures (plants, animals, and people) to live longer and grow larger (Baugh, 1989, pp. 57-58; 1996, vol 2, 51:00): “Adam and Noah were probably about seven feet tall, and there were others who were even taller” (Baugh, 1989, p. 57).

None of this withstands scrutiny. Baugh’s explanations are sketchy to say the least. Baugh describes no plausible physical mechanism which would separate hydrogen from oxygen in a primordial canopy, nor does he provide a physical mechanism by which the earth’s magnetic field would compress the hydrogen at all, much less compress it to the millions of atmospheres of pressure which he admits are needed to metallize hydrogen (Baugh & Wilson, 1992, p. 35). Nor does he account for the fact that at the
proposed height of the canopy (11 miles above the equator), the relatively high atmospheric temperatures (-60˚ C) would further hinder the formation of solid hydrogen. Baugh’s suggestion that the canopy and sand grains alone could serve as crystal radios betrays a fundamental misunderstanding of the crystal radio circuit. He does not explain how or why the canopy would “photomultiply” incident light, nor is his assumption of a “gentle pink glow” justified in the case of metallic hydrogen. Despite a thorough search, I find no evidence in the literature of a connection between “certain shades of pink” and the secretion of norepinephrine. Baugh does not describe how he calculated that atmospheric pressure would be 2.18 atmospheres under the canopy or that surface temperatures would range from a comfortable 72 ºF to 78 ºF. I can find no justification in the literature for his claims that under hyperbaric conditions an open wound would

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71 The 2.18 atmospheres of pressure is probably borrowed from young-earth creationist Joseph Dillow, who calculates this figure as follows:

We assume a flood rainfall rate of 0.5 inches per hour. This implies that the ancient canopy contained 12.19 m of water (0.5 inches/hr x 24 hr x 40 days = 40 ft = 12.19 m). Thus, the surface pressure was 2.18 Atm (Dillow, 1982a, p. 7).

Dillow repeats this calculation elsewhere (Dillow, 1982b, p. 137). It is strange that Dillow begins with a “back-of-the-envelope” assumption that the rainfall rate was 0.5 inches per hour, from which he concludes that there was the equivalent of 12.19 m of water in the canopy (instead of about 12 m) and a pressure of 2.18 atmospheres (instead of about 2 atmospheres). It is equally strange that Baugh does not recognize that Dillow calculated this 2.18 atmospheres under the assumption that the canopy was held aloft by atmospheric pressure. Since Baugh’s proposed canopy is held aloft by magnetic levitation rather than air pressure, there is no calculable relationship between canopy thickness and atmospheric pressure. Nonetheless, Baugh confidently repeats the figure of 2.18 atmospheres.

72 Dillow states that temperatures would have been moderated worldwide and he discusses geological evidence for moderated temperatures, but he never offers a temperature range of 72° F to 78° F (Dillow, 1982b, pp. 139-143).
heal overnight,\textsuperscript{73} or that a person could run 200 miles without growing weary. In short, Baugh presents many extraordinary claims without explanation, justification, or documentation.

Each of Baugh’s books on the vapor canopy offer fewer than ten in-text references, and neither includes a bibliography (Baugh, 1989; Baugh & Wilson, 1992). On the other hand, his videotaped lecture flashes over 100 references onto the screen (Baugh, 1996). However, these references do little to bolster his case. Fewer than 10% of the references are taken from peer-reviewed scientific journals such as \textit{Science} or \textit{Nature}. The rest are biblical citations, encyclopedia articles, newspaper articles, and quite a few refer to general-interest science magazines such as \textit{Discover}, \textit{Scientific American}, and \textit{Popular Science}. Yet even these sources do not support Baugh’s scientific claims. For example, a crucial point in Baugh’s argument is the claim that hydrogen in the upper atmosphere could become compressed to become metallic, superconductive, and transparent. In the following transcript, Baugh makes his case for this claim. Baugh’s on-screen references are added in brackets:

\begin{quote} 
[A]t Lawrence Livermore National Laboratories, later verified in other labs internationally, they took the elements of water, compressed them under super cold conditions, added energy. The oxygen of water simply turned blue. [67] But when they took the hydrogen of water, or hydrogen separately, compressed it
\end{quote}

\textsuperscript{73} This claim is probably also borrowed from Dillow:

When a team of aquanauts were submerged in a diving bell for two weeks at 10 atmospheres, a striking healing occurred after one of them severely cut his hand. It was reported that the wound healed completely in 24 hours (Dillow, 1982b, p. 155).

Dillow cites no source for this story, nor does he supply any contextual information.
under super-cold conditions, that hydrogen, which is at the top of the Mendeleevian chart of metals, [68] that hydrogen bonded into a crystalline lattice, took upon itself actual crystalline form, [69] and became transparent to rays of light. As they compressed in more, in one trillionth of a cubic inch diameter encapsulization [70], as they compressed it more, most of the material—most of that metallic material, [71] hydrogen, under those conditions took upon itself the form of a metal, crystalline in form. That metallic crystalline hydrogen in the laboratory remained, for the better part, or the larger part, transparent, at least translucent to light. But in very tiny grains it became opaque and became superconductive (Baugh, 1996, vol 1, 54:00).

Each reference flashes onto the screen for about 5 seconds. They appear as follows:

Ref. #67 (The Firmament was Crystalline)
R. Laird Harris, Gleason L. Archer, Jr., and Bruce K. Waltke, *Theological Wordbook of the Old Testament* pp. 47, 862.

Ref. #68 (Josephus Cites Crystalline Firmament)
*Josephus Antiquities*, Book one, Chapter one

Ref. #69 (Metallic Hydrogen Transparent to Light Until Superconductive)

Ref. #70 (Opaque Metallic Hydrogen in Tiny Veins)

Ref. #71 (Ice Clouds)

The authors of the first part of reference 67 (Harris, Archer, & Waltke, 1980, p. 47) do not mention the crystalline firmament (presumably the citation is erroneous), while in the second part of reference 67 (Harris et al., 1980, p. 862), the authors argue against a solid firmament, suggesting that this Greek concept was foreign to the original Hebrew.

Reference 68 cites Flavius Josephus, a first-century Romanized Jew who had hybridized the Hellenic concept of concentric crystalline spheres surrounding the earth with the
Hebraic concept of a firmament. At most the Josephus reference indicates that an ice canopy may not have been incompatible with first-century Jewish thought. Reference 71 is a 250-word piece in Discover magazine, only the first sentence of which seems relevant to Baugh’s case: “Noctilucent clouds are thin sheets of ice crystals that form so high, 50 miles up, that the sun can illuminate them at night when it is well below the horizon” ("Gravity waves in the clouds," 1994). Perhaps it supports Baugh’s contention (later in the video) that an ice canopy would glow at night, but it certainly does not support his case for transparent superconductive metallized hydrogen. References 69 and 70 cite a peer-reviewed scientific study (Mao & Hemley, 1989), but this study actually produces an obstacle to Baugh’s model, namely that metallic superconducting hydrogen appears to be opaque to visible light. In order to maintain both the transparency and the superconductivity of his firmament, Baugh postulates small grains of superconductive hydrogen surrounded by transparent material (Baugh, 1996, vol 1, 56:00). Mao & Hemley’s piece supports Baugh’s case only insofar as it confirms the existence of solid metallic hydrogen at extraordinarily high pressures. The other three citations offer neither biblical nor scientific support for the plausibility of Baugh’s case that hydrogen could form a stable, transparent, superconductive crystalline lattice capable of supporting an ice canopy by magnetic levitation. Therefore in addition to its numerous logical flaws,

74 Interestingly, Mao and Hemley include a sketch of their experimental apparatus including small pieces of ruby (used to measure pressure) mixed with the hydrogen gas (Mao & Hemley, 1989, p. 1463). Baugh displays a modified version of this sketch as a microscopic illustration of his hydrogen canopy, including the rubies (Baugh, 1996, vol 1, 58:30). Obviously Baugh’s canopy includes no rubies. Either Baugh was unconcerned by this inaccuracy or he misunderstood the illustration.
Baugh’s citations offer little support for his vapor canopy theory. Yet as we shall see, the Fossil Museum repeats many of Baugh’s water-canopy claims.

_Day 1_

Baugh’s influence becomes apparent at Day 1 of the ODT exhibit. The first panel of Day 1 consists of the text of Genesis 1:1-5 and Hamm’s illustration of the Spirit of God (in the form of a dove) over a spherical earth consisting entirely of water. The second panel lists the “Acts of God” during Day 1, and reads in part:

The universe created by Elohim is a tri-universe of space (“heaven”), matter/energy (“earth”), and time (“beginning”), each of which “occupies” the whole universe. The “earth” matter/energy at this stage was “without form,” possibly consisting only of water and the elements of matter with which God would shortly make all material bodies in the universe.

Note: Neither the Godhead nor the tri-universe is a “trio” (three parts making up the whole), but a “trinity.” A trinity consists of three parts, each of which is the whole.

Here the Fossil Museum restates part of a numerology introduced by Nathan R. Wood (1932) and repeated by Baugh. Wood and Baugh assert that space, time, and matter constitute a trinity, and that each of these, in turn, constitute trinities: space is a trinity of height, length, and width; time is a trinity of present, past, and future; and matter is a trinity of energy, motion, and phenomena (Baugh, 1996, vol 1, 33:30; N. R. Wood, 1932). Baugh concludes:

So since all that we find in the cosmos is a trinity in expression, yet the cosmos is one entity, it is then logical that the first cause of this cosmos, being one in full synchronization with Himself, would also be expressed as . . . the Father the source, as the Son the tangible expression, and as the Spirit the influence (Baugh, 1996, vol 1, 34:30).
The Fossil Museum repeats only the first of these trinitarian claims (space, matter/energy, and time), but nonetheless connects it to the Christian doctrine of Father, Son, and Spirit.

I never heard a tour guide verbalize this numerological claim at Day 1 of the ODT exhibit, but a separate numerological claim is typically verbalized on Day 7 (see below).

The third panel of Day 1 explicates the idea that the primordial world consists of pure water. Entitled “More Science,” this panel begins:

When first created, the earth was simply a mass of water. By calling it earth, the inference is that the Creator had futuristic intentions with design and purpose. Beginning with water, we have the basic elements of earth’s reactions, and the essential ingredient of life’s processes. In water you have the integration of hydrogen and oxygen.

By comparison, in his “Creation in Symphony” lecture, Baugh states:

It was simply a sphere of water. Now by calling it “earth,” that means that He had futuristic intentions. He had design and purpose. By using water we have the very nature of the life processes and the essential ingredients of life processes. For in water you have an integration of hydrogen and oxygen (Baugh, 1996, vol 1, 29:25).

Comparing these, the Fossil Museum text is clearly an edited transcription of Baugh’s lecture, even retaining Baugh’s odd turn of phrase in the final sentence. The belief that the primordial earth was pure water originates in Genesis 1:1-2: “In the beginning God created the heavens and the earth. Now the earth was formless and empty, darkness was over the surface of the deep, and the Spirit of God was hovering over the waters” (emphasis added), and II Peter 3:5 (NIV): “[L]ong ago by God’s word the heavens existed and the earth was formed out of water and by water.” Baugh probably adopted this view from the young-earth creationist Russell Humphreys (Humphreys, 1978, 1983), who Baugh cites a few minutes later in the Creation in Symphony video (Baugh, 1996,
vol 1, 39:30). Of course one must agree that water is an “essential ingredient of life’s processes,” but on the other hand many other essential ingredients (such as carbon) are missing. According to Baugh’s narrative, God corrects this on Day 3, when He uses water as a base material to create dry land and the rest of the periodic table of elements (Baugh, 1996, vol 1, 30:00).

The third panel of Day 1 continues:

The water molecule, $\text{H}_2\text{O}$, is a unique combination of elements, which include [sic]:
- A negative and positive pole
- A charge
- Its own tiny electromagnetic field
- In random tendency
- Be solid, liquid, or gas

The reasons for listing these characteristics are unclear at the Fossil Museum, but the list is somewhat clarified in the portion of Baugh’s lecture from which it is derived:

Now $\text{H}_2\text{O}$ is a very unique and special combination of elements. $\text{H}_2\text{O}$ has, first of all, a pole, a negative and a positive pole. And it has charge. And it has a tiny electromagnetic field. Water also operates in a very special dimension. In operating in that dimension, water, because it is self-contained with its own little electromagnetic field, operates in random charge and in random tendency. That means that in the future as God would use this, water operating in random tendency would be expressed again in a trinity and in various composites of the trinity. It has solid, liquid, and gaseous forms (Baugh, 1996, vol 1, 37:50).

This passage further illustrates Baugh’s tendency to misunderstand basic science concepts. It is well known that a water molecule is electrically polarized and therefore produces an electric field characteristic of a dipole (see, e. g., Dorsey, 1940, pp. 175-177), so water does indeed have a negative and a positive pole. It is also well established that a water molecule has a very weak magnetic dipole moment (see, e. g., Dorsey, 1940,
pp. 384-386). One could refer to the resulting field as a “magnetic field” or an
“electromagnetic field,” so Baugh is correct that a water molecule possesses “its own
little electromagnetic field.” On the other hand, water molecules are typically
electrically neutral, not “charged.” Perhaps Baugh is confusing the concepts of
“magnetic moment” with “electric charge.” In the Baugh passage, the reference to solid,
liquid, and gas states of water is another instance of numerology. Since the Fossil
Museum does not explain the three states of water as a numerological concept, its

75 The electric field could also be described as “electromagnetic,” although this may not be standard usage (e. g. see the "electromagnetism" entry in Parker, 1997, p. 128). Baugh is correct in referring to a water molecule’s “little electromagnetic field,” but he appears to believe that “electromagnetic fields” and “magnetic fields” are fundamentally different kinds of fields. For example, in describing a laboratory demonstration of magnetic levitation, Baugh says:

You will see adjacent to this explanation an actual laboratory experiment where we took some materials, took an element with a magnetic field—electromagnetic field simulated—put a superconductive material above that element, and it actually rides in the lines of electromagnetic energy. That’s what superconductivity does (Baugh, 1996, vol 1, 56:00).

A magnetic field is an electromagnetic field, not a simulation of an electromagnetic field. This passage also highlights Baugh’s repeated use of the non-standard phrase “lines of electromagnetic energy,” which suggests an additional misunderstanding. It is true that the potential energy of a magnetic field is a sensible concept. It is also true that physicists use magnetic lines of flux to describe magnetic fields. However, “lines of electromagnetic energy” is not a meaningful phrase as Baugh uses it, partly because flux lines are vector (directional) quantities (see, e. g., Radin & Folk, 1982, p. 550), while energy is a scalar (non-directional) quantity. It would make no sense to refer to the “direction” of “electromagnetic energy,” as Baugh tacitly does when he points to Hamm’s illustration of the earth’s magnetic field lines and refers to them as “lines of electromagnetic energy.” If Baugh were inclined and competent to do so, he could define equipotential surfaces whose cross-sections could be described as “lines of electromagnetic energy.” However, these would run perpendicular to the magnetic field lines and would not resemble the conventional magnetic field lines in Hamm’s illustration.
inclusion on a list of unique properties of water becomes nonsensical because many substances exhibit solid, liquid, and gaseous states. “Random tendency” is also nonsensical as a “unique” property of water, although Baugh’s reason for emphasizing water’s “randomness” is explained below.

The ODT exhibit’s Day 1 concludes:

By adding energy and specific motion to a watery mass, it takes on a spherical shape. The water molecules align, and a global electromagnetic field is formed. There is super charged water in the lines of electromagnetic energy. At the surface where the greatest concentration of energy is located, normal electrolysis would occur, breaking the H\textsubscript{2}O bond and allowing for free hydrogen and free oxygen. (Electromagnetic energy around bodies of water produces free hydrogen.) The moving of the Spirit of God would have caused free hydrogen, free oxygen, and an electromagnetic field. All biological systems are dependent upon an electromagnetic field for cellular communication.

All of this is derived from Baugh’s lecture (mostly Baugh, 1996, vol 1, 39:20), and again, misunderstandings abound. The first sentence implies that “energy and specific motion” must be added to a large mass of water to form it into a sphere. This derives from Baugh’s comments: “Adding the energy gives a spherical shape to the earth,” and “the electromagnetic field would keep the sphere in shape” (Baugh, 1996, vol 1, 39:20). Yet no special “energy,” or electromagnetic field would be needed to maintain the spherical shape of an earth-sized mass of water because it would assume a spherical shape via gravitational attraction alone.\textsuperscript{76}

The second sentence, “The water molecules align, and a global electromagnetic field is formed,” ultimately derives from young-earth creationist Russell Humphreys’

\textsuperscript{76} Baugh could not protest that gravity had not been created on Day 1 because in the absence of gravity, liquid water would immediately vaporize and disperse through space.
creative hypothesis for the origin of the earth’s magnetic field (Humphreys, 1983). Humphreys suggests that in the beginning, God aligned a significant portion of the earth’s water molecules so that their weak magnetic fields were oriented in the same direction. Yet within a few seconds, thermal collisions between the molecules caused them to return to random orientation. By Lenz’s Law, this return to random orientation would induce an electric current in the earth-sized sphere of water, which in turn would maintain the magnetic field. This is why the Fossil Museum adds “in random tendency” to its list of special properties of water, although again it is nonsensical because thermal randomization of molecule orientation is by no means unique to water. Baugh cites Humphreys’ paper while he explicates and adds to Humphreys’ theory:

Adding the energy gives a spherical shape to the earth. But it does something else. It overrides the natural tendency of the water molecules to operate in a random tendency. And it aligns those water molecules. Because there is independent energy added, superintending over these elements, the entire spherical body takes on an electromagnetic field commensurate with the sum total of all the individual electromagnetic fields of the composite patterns. Did you understand what I just said? By the activity of the Spirit of God, hovering over, fluttering over, brooding over that spear [sic] of water, you now have an electromagnetic field generated around the entire body, and in the Scriptures that is a specific activity that the Spirit of God exercised. Therefore when He concluded that activity, the normal water molecules would again go back to random tendency, yet the electromagnetic field would keep the sphere in shape and keep the electromagnetic field above it in place. It would also do something else. When these water molecules would go back to their natural random tendency, that means that normal electrolysis would occur. You would have some supercharged water molecules by the trillions in the pole area which would then continue along the lines of strengthened electromagnetic energy. What I’m saying is you would have supercharged water in these lines of electromagnetic energy supervised by the sphere’s electromagnetic field. In addition to that, normal electrolysis would occur, breaking some of those apart so that you would have free hydrogen and free oxygen available (Baugh, 1996, vol 1, 39:20).
Apparently Baugh believes that the electrical currents, which would be induced in the watery earth, would result in electrolysis. Yet Baugh fails to recognize that if water is to be separated into hydrogen and oxygen by electrolysis, an electrochemical reaction must occur at the anode and cathode (see, e.g., Dickerson, Gray, & Haight, 1979, pp. 26-30). Yet in Humphrey’s model, induction would result in closed loops of electric current, so there would be no anode or cathode, and electrolysis could not occur. Also, the meaning of “supercharged” water is unclear. Does this refer to an electrical charge, in which case the molecules would repel one another? Perhaps “supercharged” refers to a magnetic moment, but in that case they would be attracted to the earth’s magnetic poles rather than “continue along the lines of strengthened electromagnetic energy.” Perhaps they are “supernaturally supercharged,” in which case science becomes useless.

The Fossil Museum notes parenthetically that “Electromagnetic energy around bodies of water produces free hydrogen.” This derives from Baugh’s misunderstanding of a newspaper article. Baugh explains (on-screen reference indicated in brackets):

Also, it has been found in recent physical research that if you have activity of energy—in motion—around a body—any body, around the Earth, around stellar bodies in the universe, you generate new hydrogen atoms. [49] Recently it has been found that around the earth there is an aura matching the area of solar winds, an aura of hydrogen. Around galaxies they’ve found auras of free hydrogen. Thus if you have any electromagnetic activity, there is a tendency in the physical universe to produce free hydrogen (Baugh, 1996, vol 1, 41:40).

Ref. #49 (Hydrogen wall around earth and solar system)
Jeffrey Linsky, “CU Researchers Discover Wall Around Solar System”
Joint Institute for Laboratory Astrophysics
In the mid-1990s, astronomical observations appeared to confirm the existence of a “hydrogen wall” surrounding the solar system (Gayley, Zank, & Pauls, 1997; Linsky & Wood, 1996; B. E. Wood, Alexander, & Linsky, 1996; B. E. Wood, Müller, Zank, Izmodenov, & Linsky, 2004). The sun emits a steady stream of particles known as the solar wind, including electrons and hydrogen nuclei (protons). At the edge of the solar system, this solar wind meets other particles known as the local interstellar medium (LISM), an interstellar equivalent to the solar wind. The interaction between the solar wind and the LISM is believed to slow the solar wind and produce a band of relatively high-temperature hydrogen atoms known as the hydrogen wall. This is Baugh’s “aura of free hydrogen.” Note that the sun ejects these hydrogen nuclei. They are not “new hydrogen atoms” created by “activity of energy,” and there is no warrant for his claim that “if you have any electromagnetic activity, there is a tendency in the physical universe to produce free hydrogen,” nor any reason to think that such an “aura of hydrogen” would surround the earth. These ideas are not to be found in his only cited source—a newspaper article (Roberts, 1996), nor does Baugh cite any other support for these claims. They appear to originate in Baugh’s imagination, and unfortunately the Fossil Museum repeats them.

Day 1 appears to end with a non sequitur: “All biological systems are dependent upon an electromagnetic field for cellular communication.” Baugh’s lecture clarifies this statement:
Russian scholar Dubrov and American scholar Arol [sic] Becker spent decades analyzing data and running experiments and found that all biological systems are dependent upon the earth’s magnetic field for cellular communication . . . Thus, the work of the Spirit of God on Day #1 was necessary for living systems that would be created in the future in the week of creation (Baugh, 1996, vol 1, 51:00).

Citing Aleksandr Dubrov (1978) together with Robert Becker and Gary Selden (Becker & Selden, 1985), Baugh argues that the earth’s magnetic field is necessary for life. This adds to the list of reasons that the Creator made the earth’s magnetic field.

Day 2

The first panel of Day 2 shows a portion of Hamm’s mural illustrating the formation of a pink-colored canopy around a watery earth. Beneath the illustration is the text of Genesis 1:6-8

And God said, Let there a firmament in the midst of the waters, and let it divide the waters from the waters. And God made the firmament, and divided the waters which were under the firmament from the waters which were above the firmament: and it was so. And God called the firmament Heaven. And the evening and the morning were the second day.

The second panel of Day 2 is entitled “Acts of God”:

1. Division of waters into two great bodies.
2. Establishment of an atmosphere (or “firmament” or “heaven”) between the waters. The Hebrew word is raqia, meaning “stretched-out expanse” or, simply “space” (Genesis 1:7)
3. Waters Below—at this point, a shoreless ocean.
4. Waters Above—probably an extensive canopy of transparent water vapor and possibly small ice crystals (rather than a blanket of liquid water or ice) above the atmosphere. This would allow the stars to be seen through the canopy. (Like a greenhouse).

The Fossil Museum takes its biblical quotations from the King James Version.
Here the Fossil Museum appears to depart from Baugh’s ice canopy. Where Baugh interprets “firmament” as solid hydrogen sandwiched between two layers of ice, the Fossil Museum interprets “firmament” in the conventional manner, i.e. as the atmosphere. Whereas Baugh advocates an ice canopy, the Fossil Museum advocates a canopy of water vapor or small ice crystals. However, under the heading “More Science,” the second panel of Day 2 reverts to Baugh’s canopy theories:

In response to the Creator’s expression of energy, the concentrated hydrogen in the magnetic canopy bonded into crystalline lattice among the water molecules. A thin, solid firmament was thus created, suspended by its own superconductivity as a canopy over the watery earth. Its natural physical properties permitted mid-spectral and long-wave radiation to be transmitted and photo-multiplied. Shorter wave lengths [sic] of radiation were assimilated into the magnetic field, providing a mechanism of re-supply for use by living systems yet to be created.

The Fossil Museum does not resolve the contradiction between the top of the panel’s conventional description of a “firmament” as an atmosphere surrounded by a water canopy composed of vapor or small ice crystals with the description of a “thin, solid firmament” in the lower part of the panel. Here the Fossil Museum paraphrases Baugh’s theory of canopy formation (1996, vol 1, 56:50) as well as Baugh’s theory that the canopy “photo-multiplied” the “mid-spectral” and “long-wavelength” light and that the “short-wavelength” light “re-energized” the earth’s magnetic field (1996, vol 1, 1:00:10).

Implicit in this paragraph is Baugh’s misperception that if living things rely on the earth’s magnetic field (Baugh cites Becker & Selden, 1985; and Dubrov, 1978), then living things must also consume the energy of the earth’s magnetic field:
Thus we find orchestrated a beautiful design, as living systems would be created for planet earth that would need the electromagnetic field and would use the energy of the electromagnetic field. That field was gently and slowly re-supplied by the energy of the stellar bodies (Baugh, 1996, vol 1, 1:00:30).

If we accept the premise that living things rely on the earth’s magnetic field, it does not follow that living things weaken that field or draw energy from it. This would be equivalent to arguing that since living things rely on earth’s gravity, life gradually weakens the earth’s gravitational field. Baugh’s conflation of field, force, and energy is indicative of his lack of scientific training, and unfortunately the Fossil Museum repeats these errors.

*The Atmosphere was Different Before the Flood.*

On the next “door,” below a placard announcing “The atmosphere was different before the flood,” seven 8.5” x 11” posters make the case that the vapor canopy was responsible for the gigantism exhibited in the fossil record and the longevity recorded in the bible. Two small posters at the bottom of this display continue Baugh’s version of the Water Canopy story. One is entitled “Water Canopy” and states: “Water (H₂O) when compressed—in a supercold [sic] state turns oxygen blue and hydrogen to metal,” then continues with the same Josephus quote Baugh used as Reference 68 (described above) to justify a crystalline firmament. The second lists:
Most of this derives directly from the Baugh model. However, Baugh’s explanation of superconductive levitation implies that the superconductive vapor canopy is suspended by induced current in the canopy (Baugh, 1996, vol 1, 56:00). This is not the same as claiming that the ice canopy is ferromagnetic, i.e. a permanent magnet. The “65/63 angstrom magenta” appears to result from a misunderstanding of Baugh’s description of the pink light emanating from the canopy: “What kind of light would it be? Hydrogen glows pink. Magenta—sixty-three sixty-five Angstrom magenta” (Baugh, 1996, vol 2, 3:30). Here the Fossil Museum inverted Baugh’s “sixty-three sixty-five” and misinterpreted it to mean 63/65. Since visible light ranges from about 4,000 angstroms to about 7,500 angstroms (Physical Science Study Committee, 1965, p. 300), Baugh obviously intended 6,365 angstroms. However, Baugh appears to be unaware that no single wavelength of light corresponds to magenta/pink, but rather magenta/pink is a mixture of red and blue light, i.e. pink requires contributions from both the long-wavelength and the short-wavelength ends of the visible spectrum. Excited hydrogen
produces two strong lines at 6563 angstroms (Lide, 1997, p. 10-41), so presumably Baugh actually meant 6563 angstroms. However, light at 6563 angstroms is red in color rather than pink (see, e.g., Physical Science Study Committee, 1965, p. 300). Excited hydrogen glows with a pink color because it also produces strong blue lines at 4341 angstroms and 4861 angstroms (Lide, 1997, p. 10-41). Both Baugh and the Fossil museum appear to be unaware that no single wavelength of light can produce a pink color.

The rest of this panel/door displays reproductions of Kent Hovind’s slides. The first states, “Dr. Kei Mori at Kao University in Tokyo raised tomato plants under a plastic greenhouse that filtered out UV sunlight. I was told he pressurized CO$_2$ to the stems of the pl[ants] [sic],” and includes a photo of Mori and an un-attributed newspaper photo of a giant tomato plant at the 1985 World’s Fair is Tsukuba, Japan. Another slide includes another photo of the same plant and reads in part:

One 16 foot (4.9m) tall plant produced 907 tomatoes! Dr. Mori died in 1993 [sic]$^{78}$, but his work continues today. I have been told the plants can still be purchased in the towns of Ohtama and Aki, Japan.

Dave Woetzel has lots of info on this plant . . . Also see Himawari-net.co.jp, LaForet Engineering, 1985 expo.

Sonic Bloom article in *Creation Illustrated* Summer 2000, p. 24

A third slide continues “1985 ‘Expo attraction. Plant that may bear 10,000 tomatoes grows under lenses that filter out sun’s harmful rays’” and includes another un-attributed newspaper photograph of the giant tomato plant from the 1985 World’s Fair (the same photograph is in Simons, 1985, p. 164) and a diagram of Mori’s “Himawari” system.

$^{78}$ Dr. Mori died in 1990 (La Foret Engineering Co., 2006).
which employs an ultraviolet (UV) light filter, Fresnel lenses, and fiber optic cables to capture UV-filtered sunlight and transmit it to the interior of buildings (Gilmore, 1988). A color photo of a cherry tomato plant, apparently adapted from an advertisement, completes the series. As emphasized by the tour guides, the point is that surplus carbon dioxide and the absence of ultraviolet light encourages gigantism among plants.

Although all of these slides are Hovind’s (Hovind, 2005b, seminar 2a, slides 194-197), the Fossil Museum does not attribute them to Hovind, so the museum patron has no way of knowing that the “I” in the slides refers to Hovind. Furthermore, these slides are misleading in a variety of ways. First, an exhibit grew lettuce in a sealed chamber containing surplus carbon dioxide at the 1985 World’s Fair in Tsukuba, Japan (Hiroshi, 1987, p. 18; E. Hoffman, 1985, p. 45). This exhibit was placed near Mori’s giant tomato plant, but there is no indication that surplus CO₂ was involved in growing the giant tomato plant, and since this plant was grown in an open building, accessible to visitors, such a practice would have raised health concerns. Perhaps more misleading is that Hovind’s slides do not explain that the Expo ’85 tomato plant was grown in a special nutritive solution rather than soil (Hiroshi, 1987, p. 19), or that the Himawari system enabled light to be distributed around the plant to maximize growth (Simons, 1985, p. 162). Therefore absence of ultraviolet light was only one of many contributors to the gigantic size of this plant. The referenced “Sonic Bloom” article makes no mention of Dr. Mori’s tomato plant and offers no support to the hypothesis that surplus atmospheric CO₂ or absence of ultraviolet light increases plant growth, but instead describes a method of increasing plant production via a combination of sound waves and the use of a
nutritive plant spray (McComb, 2000). Therefore these slides do not support the Fossil Museum’s thesis that a water canopy would have resulted in gigantism.

The door offers two supports for the argument that atmospheric oxygen concentrations were once higher and contributed to the gigantism observed in the fossil record. The first is a Hovind slide entitled “Air bubbles in amber” showing a fossil insect trapped in amber, captioned “fossil fly in amber.” An arrow points to a cavity near the fossil insect (Hovind, 2005b, seminar 2a, slide 169). The second prop is a fist-sized amber specimen showing several cavities. The tour guide explains that analysis of the air trapped in amber reveals that pre-Flood air was as much as 35% oxygen, compared to present values of about 21%. No connection is offered between the hyperbaric conditions supposedly produced by a canopy, which would increase all atmospheric gas pressures proportionally, and an increased proportion of oxygen relative to other atmospheric gases.

In the late 1980s to early 1990s, researchers studied the gases released when amber samples were crushed. Berner and Landis (1988) found that the gases released from late Cretaceous amber samples, about 75 to 95 million years old, were more than 30% oxygen. Bellis and Wolberg (1991) found that over the past 120 million years, older amber samples released a higher percentage of oxygen than younger amber samples, and concluded that the late Cretaceous atmosphere was at least 24% oxygen. However, critics questioned these results, primarily on the grounds that amber is unable to trap ancient air. Hopfenberg and Witchey (1988) demonstrated that amber readily absorbs and diffuses propane, whose molecules are much larger than atmospheric gases. They
also suggested that the relatively high oxygen levels in Berner and Landis’s experiments result from the fact that amber absorbs oxygen more readily than nitrogen. Horibe and Craig (1988) demonstrated that amber readily absorbs and diffuses atmospheric gases and, together with Beck (1988), noted that since oxygen reacts with amber, all ancient atmospheric oxygen would be consumed. Horibe and Craig suggested that atmospheric gases would diffuse out of typical amber samples in a matter of years, and the oxygen would be consumed over even shorter time scales (Horibe & Craig, 1988). Cerling even produced evidence that oxygen-amber reactions proceed so fast that oxygen is measurably consumed during the experiment (Cerling, 1989). However, others presented evidence that gas exchange between amber and the atmosphere proceeds sufficiently slowly that these experiments can yield information about the paleo-atmosphere (Bellis & Wolberg, 1991; Landis & Snee, 1991). Yet because of the problems stemming from oxygen consumption and exchange of gases between amber samples and the atmosphere, scientists have largely abandoned the practice of crushing amber in order to study the ancient atmosphere. However, scientists continue to investigate the ancient atmosphere by other means, and there is some indication that atmospheric oxygen levels peaked at about 35% during the Carboniferous period (about 300 million years ago) at about the same time that some insects reached enormous size (Berner et al., 2000). Therefore a correlation between insect gigantism and elevated oxygen levels can be made, but unfortunately the Fossil Museum follows Hovind in relying on questionable evidence to support this correlation.
The door also includes two slides intended to demonstrate that canopy-produced hyperbaric conditions would have lead to Edenic conditions. Tour guides typically repeat Baugh’s (1989, p. 56) unsupported claims that under hyperbaric conditions one could run up to 200 miles without growing weary and a cut would heal over night. A slide showing a microscopic photo of blood cells reads: “Under double atmospheric pressure blood plasma will become oxygen saturated.” A second slide displays an unreferenced and undated newspaper clipping and photograph of a hyperbaric chamber intended to treat divers suffering from decompression sickness. A caption to the photo reads, “The chamber creates an oxygen-rich environment in which patients can be placed for up to two hours. It speeds healing of wounds and treats ‘the bends.’”

*Day 3*

Day 3 includes a cutaway view of the earth from Hamm’s mural and the text of Genesis 1:9-13, in which God forms the seas, dry land, and plant life. A panel labeled “Acts of God” explicates these events, including, for example, the explanation that “The volume of water in this ocean was less than in the present ocean, which has been increased by waters of the great Flood.” At the bottom of this panel, a paragraph entitled “After its Kind” explains that variation within “kinds” of plants and animals can occur, but this variation is limited. The reader is left to infer that therefore evolution could not have occurred. A third panel is composed of two paragraphs. The first, entitled “Which came First,” explains that plants, animals, Adam and Eve, and the universe did not evolve, but were created “as mature, fully functional systems.”
The rest of the third panel is entitled “More Science” and reads:

On day three the dry land and all its attendant elements appeared. A solid granite crust provided form for the surface of the young planet. The ferromagnetic core maintained alignment of the magnetic field. Radioactive elements with adjacent moderating units formed foundations and a controlled nuclear reactor within earth’s interior. Masses of hydrocarbon assumed their role as a “swaddling band” to moderate temperatures in the adjacent water reservoirs. These warm waters fountained up through granite, clays, and sands to re-circulate back into the subterranean reservoir and form a dynamic hydrocycle. A great supercontinent was outlined on the planet’s surface. Luxuriant plants were created with their fruit and seeds fully formed, thus incorporating “immediate youth” and “functional maturity.”

This paragraph summarizes more of Baugh’s theories (Baugh, 1989, pp. 66-68; 1996, vol 1, 1:10:00 - 1:16:00). The closing phrase, “immediate youth and functional maturity” is Baugh’s (1996, vol 1, 1:16:15), as is the belief that the antediluvian earth’s core was a nuclear reactor which circulated warm water to the earth’s surface. Baugh briefly mentions the latter idea and he offers no support for it, so it must be treated as a flight of fancy on Baugh’s part, unfortunately repeated as “More Science” by the Fossil Museum. The “ferromagnetic core,” borrowed directly from Baugh, attributes the earth’s magnetic field to a permanent magnet at its core. However, at temperatures above the Curie temperature, a ferromagnetic material can no longer maintain a permanent magnetic field. The Curie temperature for iron is 1,043 K and the Curie temperature for nickel is 627 K (Lide, 1997, p. 12-117), yet the temperature of the earth’s core is at least 2,500 K and could be much higher (Monroe & Wicander, 2005, p. 288). Consequently, the earth’s magnetic field cannot be attributed to a ferromagnetic core, and for this reason geologists assume that the earth’s magnetic field is generated by electrical currents in the liquid outer core (Monroe & Wicander, 2005, pp. 294-295).
Days 4 and 5

The first panel of Day 4 consists of a portion of Hamm’s mural showing stars, galaxies, and planets. Below the mural, Genesis 1:14-19 is quoted, in which God divides night from day and creates the sun, moon, and stars. The second panel addresses a difficult question for biblical literalists, namely how God could have created light, day, and night on Day 1 (Genesis 1:3-4) before creating the celestial bodies on Day 4. The panel reads in part:

Replacing the general “light” (Hebrew or) on Days One to Three with specific “lights” (mar-or). These “light sources” would permanently divide day and night, and light from darkness (compare Genesis 1:4 with Genesis 1:14, 18).

Under the heading “More Science,” the panel reads

On day four stellar heavens were formed from the mass and energy inherent in the universal flood of light registered on day one. Designed in harmony with the biorhythms of earth’s living systems, these stellar instruments provided functional time and energy to the universe as a whole.

Here the Fossil Museum adopts Baugh’s solution to the dilemma of light, day and night preceding the creation of the stars, sun and moon, namely that God organized the light created on Day One into the celestial bodies: “So on Day #4, God coalesced the energy of the light that was already vibrating in nature into star bodies, into galaxies, into beautiful heavens” (Baugh, 1996, vol 2, 8:00). Ironically Big Bang cosmology suggests that something similar happened in the early universe, but of course these events predate the creation of the earth. For Baugh this is still a matter of a miraculous creation, not natural development.
The first panel of Day 5 features a portion of Hamm’s mural showing a view of the earth, consisting mostly of land surrounded by a pink vapor canopy. The foreground shows a Sauropod dinosaur, a large dragonfly, orcas, and pelicans. Beneath the mural is the text of Genesis 1:20-23, in which God creates sea life and birds. The second panel explicates this text, and includes “Plants are complex, reproducing systems, but do not have ‘life’ in the Biblical sense. Therefore, they do not ‘die’ when eaten.” Here the Fossil Museum addresses an important issue for some biblical literalists. Romans 5:12 reads: “[J]ust as sin entered the world through one man, and death through sin, and in this way death came to all men, because all sinned.” Based on this verse and Genesis 1:29-30, in which God gives plants to animals for food, some creationists reason that there was no death before Adam’s sin, and consequently there could have been no carnivores before the Fall—all were herbivores (see, e.g. Whitcomb & Morris, 1961, pp. 461-466). This, in turn, raises the question of whether plants die when eaten, or even of whether leaves die when they fall from trees (Todhunter, 2006). The Fossil Museum answers that plant and animal life are qualitatively different, so pre-Fall plants could experience a complete life cycle without “death.”

*Creation in Symphony*

The next door displays part of Hamm’s mural, including the earth surrounded by a transparent pink canopy and an image of pelicans, orcas, plants, a dragonfly, a leopard, a Sauropod, and Adam and Eve. Adam has one hand on the Sauropod and is gazing
skyward. He is Caucasian, clean-shaven, and wears dark short hair parted on one side.

Eve is also Caucasian and wears long brown hair neatly parted on one side. Beside Hamm’s mural, a panel entitled “Creation in Symphony” reads in part

Dr. Carl Baugh in his presentation “Creation in Symphony” explains that the original creation was much more brilliant and harmonious in its original state . . . Perhaps audibilized radio signals that came forth from the stellar bodies which when striking the earth, vibrated the sand in the water causing a mist to water the earth.

Although Carl Baugh is central to the displays in Opening the Doors of Truth, this is the only display in which he is mentioned by name. Here the Fossil Museum repeats Baugh’s physically impossible claim that sand grains could act as crystal radios, receiving radio waves from stars and vibrating to create a mist in the atmosphere (Baugh, 1989, p. 70). Under the “More Science” heading, it even repeats one of Baugh’s more imaginative claims:

A crystalline firmament suspended above the planet filtered out short-wave radiation, and with its physical structure in place universal radio signals serenaded the earth with morning melodies. Planets in the Solar System were distributed at harmonic intervals on a large scale, consistent with the energy fields living seeds produce on a small scale.

This derives from Baugh’s theory that the canopy acted as a crystal radio which enabled radio waves from the stars and planets to become audible (Baugh, 1996, vol 2, 5:00), and that the resulting tones were harmonious and beneficial to life on earth (Baugh, 1996, vol 2, 9:00). The rest of the panel reiterates much of the Baugh model, attributing plant gigantism to warm water from within the earth, filtration of harmful radiation, and pink

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79 Claire and Francis told me that this image of Adam resembles Ronald Reagan. I see the resemblance.
light produced when sunlight strikes the canopy. It attributes animal gigantism to the abundance of food plants and hyperbaric conditions.

**Days 6 and 7**

Day 6 opens with previously viewed sections of Hamm’s mural. Below the mural is the text of Genesis 1:24-31, in which God creates land animals and Adam and Eve “in our image and after our likeness,” gives Adam and Eve “dominion” over the earth and its creatures, and gives the plants to the animals for food. The next two panels explicate this text, emphasizing that since man and woman were created in God’s image and were granted dominion over the creation, man and woman enjoy a special status with respect to the rest of creation. The last sentence of Day 6 emphasizes the vegetarianism of all living creatures.

The first panel of Day 7 shows Hamm’s mural of birds, insects, and land animals converging onto Noah’s ark. Below the mural is the text of Genesis 2:1, in which God rests following the creation. The next panel connects God’s rest on the seventh day to the institution of the seven-day week and the commandment to rest on the seventh day (Exodus 20:9-11). A section entitled “Significance of the Week” reads:

All calendar divisions have astronomical foundations (e.g., days, months, seasons, years) except the week! Yet, all nations of the world throughout history have kept time in weeks of approximately seven days. Attempts to change this in the French and Russian revolutions failed. The only reason for the week is that God rested on the seventh day. Even those who reject the Genesis record of six-day Creation inadvertently acknowledge it by taking off one day each week.
The ethnocentric notion that “all nations of the world have kept time in weeks of approximately seven days” may comfort biblical literalists, but it is historically inaccurate. Partly because of the influence of the Roman and British empires, the seven-day week is in widespread use today, but this was not always true. Historically West Africans observed a four-day week while central Asians observed a five-day week (Safra, 2007, p. 417). Several long-lived empires observed varying week lengths. The Assyrians used a 5-day week, the Incas observed a 9-day week, and the ancient Egyptians used a 10-day week (Safra, 2007, pp. 417, 428). Throughout most of the history of the Roman Empire, the Romans observed an eight-day week until Constantine established the seven-day week in 321 CE (Duncan, 1998, p. 44). All of this contradicts the Fossil Museum’s claim that the “natural” length for a week is seven days. The qualified phrase “approximately seven days” does not rescue the Fossil Museum from this error, since the argument becomes nonsensical if “approximately seven days” includes a range of four to ten days.

80 Baugh engages in an extensive numerology of sevens when he claims that there are seven shells of star clusters to the galactic north and seven shells of star clusters to the galactic south. He asks:

Why seven? Why not six or eight or ten? Written into the very nature of life are sevens. Written into the week, the biological structure, are sevens. Written into the gestation period of mammals and man are sevens. Written into the very oscillations of life itself are sevens. Thus it would be logical that in the stellar bodies you would have seven spheres of material whose vibrations we receive . . . From a biological standpoint we are being hugged by energy in vibration in symphony that God designed originally for the benefit of all living systems” (Baugh, 1996, vol 2, 8:50).
The third panel of Day 7 begins with a paragraph entitled “First Law of Thermodynamics.” It reads:

The law of conservation of energy (also known as the first law of thermodynamics) is the best-proved and most universal law of science. It states that energy (capacity to do work) can change forms, but can be neither created nor destroyed. Energy includes everything in the physical universe (even matter); therefore, nothing is now being created. This reflects the completion of God’s work of creating and making all things (Genesis 2:1-3), and refutes the evolutionary concept of an ongoing “creation.”

It is true that under a relativistic understanding of the First Law of Thermodynamics, the total amount of matter-energy in the universe (assumed to be an isolated system) is constant. In this sense, the Fossil Museum is correct that no new matter-energy is being created. However, both biological and astronomical evolution require only the reconfiguration of existing matter-energy, not the creation of new matter-energy. Therefore the first law of thermodynamics neither confirms nor refutes biological or astronomical evolution.

The panel continues with a second paragraph entitled “Creation of Functional Maturity.” Here the Fossil Museum repeats the young-earth argument (e. g. Whitcomb & Morris, 1961, pp. 344-346) that just as Adam was created on Day 6 as a fully mature human having the “appearance of age,” so “the rocks would possess a variety of isotopes and elements.” Therefore “IF one denies the true revealed history of the world [the bible], and attempts to date the object or the world, this functional maturity could be mistaken for age.” By implication, radiometric and astronomical evidence for the antiquity of the universe are misleading because God created the universe only a few thousand years ago having the appearance of billions of years of age. This “appearance
of age” argument can be used at will, effectively trumping all evidence for the antiquity
of the earth and effectively preventing scientific inquiry into such matters.

The panel concludes with a section entitled “Date of Creation.” It begins with the
assertion that Biblical chronology indicates a creation date of 6,000 to 10,000 years ago,
followed by:

Older ages must be derived from some physical process (e. g., radioactive decay)
and based on at least three untestable and unreasonable assumptions.
1. Unchangeable Process Rate (but all natural rates can change)
2. Process Operating in Isolated System (but no truly isolated system exists).
3. Denial of Creation of Functioning maturity (but this begs the question as to
whether God can create, and thus is atheistic).
Many processes will yield ages too young for evolution, however, even with these
assumptions.
Therefore, there is no reason not to take God’s Word at face value. God is able to
say what he means!

Only biblical literalism justifies the assumption that creation came into being suddenly
but having the appearance of age. Taken to the extreme, all stars and galaxies further
than 6,000 light years from the earth need not exist. They could be simply a set of
photons which God set in motion 6,000 years ago, a light show created by God to
maintain the “appearance of age.” Therefore the Fossil Museum is correct that most
scientists accept assumption #3. Whether or not this implies atheism is another question.

Furthermore, the first two assumptions of constant process rate and system
isolation are made only where warranted. For example, geophysicists assume that
radioactive decay rates are constant because of the observed independence of decay rates
from such factors as temperature and pressure. On the other hand it is well established
that atmospheric carbon-14 levels have changed over time because of both human and
non-human activities, so radiocarbon dates are measured via a calibration curve which corrects for these variations (Currie, 2004). Therefore scientists assume a constant process rate where it is justified and correct for variable process rates where it is not—or abandon a line of inquiry altogether.

In the same way geophysicists assume that a process is isolated only when such a conclusion is warranted. Ironically the Fossil Museum features a display of young-earth creationist Robert Gentry’s studies of radiohalos in granitic rock (Gentry, 2003). Gentry’s conclusions hinge on the assumption that no radioactive material is transferred from one region to another, i.e. that the radioisotopes are an isolated system. Yet this erroneous assumption proved to be the fatal flaw in his work (Snelling, 2005; Wise, 1989). Therefore the Fossil Museum follows Gentry in assuming system isolation where evidence indicates otherwise. Like the assumption of constant process rates, scientists assume that a process is isolated when evidence warrants the assumption and abandon that assumption where surrounding evidence does not warrant it.

The Fall

The center of these three panels, entitled “The Fall of Man,” features a large photograph of a human skull and the text of Genesis 3:14-19, in which Adam and Eve eat the forbidden fruit and are punished for doing so. The rest of the display describes the spiritual/material consequences of the Fall. This includes an extensive theological argument that no people or animals died before the Fall and asserts that all animals were vegetarian. Consequences of the Fall are described for humanity, animals, plants, and the
earth. A section addresses the question, “Why did God allow sin?” and another addresses “Why do the righteous suffer?”

At the bottom of the third panel, a paragraph entitled “Second Law of Thermodynamics” reads:

The universal Second Laws [sic] is the scientific reflection of God’s curse on His created world because of sin. There is no known exception. All processes (whether operating on open or closed systems) tend to go in the direction of increasing entropy (or “disorder”). This tendency can be reversed only by the application of outside, specially programmed energy or information. This tendency directly precludes any natural evolution toward higher order.

As shown in Chapter 2, creationists such as Whitcomb and Morris (1961, pp. 224-228) argue that evolution violates the Second Law of Thermodynamics. However, the Second Law of Thermodynamics applies only to closed systems, so the argument is fundamentally flawed. The Fossil Museum attempts to address this problem by asserting the opposite: “All processes (whether operating on open or closed systems) tend to go in the direction of increasing entropy . . .” Yet decreases in entropy occur routinely in open systems. Mark Isaak notes that snowflakes, ripples in sand dunes, and eddies in streams all represent local open-system decreases in entropy which are offset by increased entropy elsewhere (Isaak, 2007, pp. 191-192). Therefore the Fossil Museum simply compounds the error when it baldly claims that the Second Law applies to open systems.

Like Whitcomb and Morris (1961, pp. 224-225) and others (e.g. DeYoung, 2000, p. 146), the Fossil Museum attributes the Second Law of Thermodynamics to the Fall: “The universal Second Laws [sic] is the scientific reflection of God’s curse on His created world because of sin.” Other young-earth creationists have rejected this
argument for practical reasons. For example, Answers in Genesis explains that without
the Second Law of Thermodynamics, Adam and Eve could not have digested food,
walked without slipping, breathed, or been warmed by the sun (Answers in Genesis,
2007b). They wisely conclude that the Second Law of Thermodynamics must have
predated the Fall. Thus the Fossil Museum is in the awkward position of advancing a
fallacious argument despite a powerful ally’s advice to the contrary.

Noah’s Flood

A six-foot-long wooden model of Noah’s Ark is protected behind a clear acrylic
sheet. About twenty slides are attached to the walls nearby, including eight Hovind slides
(Hovind, 2005b, seminar 3b, slides 88, 96, 114, 127, 128, 133, 136, 141). Most of the
slides discuss the size of Noah’s ark and make a case that it was able to carry all of the
animals and supplies needed for a year in the ark. Three of the Hovind slides present
claims of the late Ron Wyatt of Cornersville, TN (Wyatt Archaeological Research, 2007).
These include Wyatt’s claim to have recovered an iron rivet and to have discovered huge
“drogue stones” (stone anchors) from Mt. Ararat, all attributed to Noah’s Ark (Hovind,
2005b, seminar 3b, slides 114, 133, 136).

With regard to the rivet, young-earth creationist Andrew Snelling observes that in
three separate lab tests, the chemical content of the “rivet” was found to be consistent
with the basaltic rock found in the area. Furthermore, Wyatt refused to allow the “rivet”
to be sectioned, which would have settled the issue (Snelling, 1992). With regard to the
“drogue stones,” Snelling observes that all but one was found at least 10 miles from the
site which Wyatt claims to be Noah’s Ark and that the stones appear to be made of the basaltic rock characteristic of the area. Furthermore, the holes in the stones are too close to the edges to have supported their weight, and the holes show no sign of rope wear (Snelling, 1992). Young-earth creationist John Morris observes that these stones appear to be tombstones whose inscriptions date from within the past 1,000 years (J. D. Morris, 1990). Therefore in displaying information about the “rivet” and the “drogue stones,” the Fossil Museum popularizes evidence which young-earth creationist colleagues have discredited.

**Conclusion: Opening the Doors of Truth**

As shown above, many of the “scientific” arguments in the Opening the Doors of Truth exhibits are untenable. Most of them rely on Baugh’s statements and theories, but as we have seen, Baugh gets a great deal of his “science” wrong. When he cites source material, as he rarely does in two of his books about the vapor canopy (Baugh, 1989; Baugh & Wilson, 1992), he tends to misread/misinterpret them. We have seen that Baugh misunderstands advanced concepts such as the nature of a crystal radio circuit, superconductivity, and magnetic levitation. We have seen that elementary science concepts confuse Baugh as well. He confuses magnetic moment with electric charge. He conflates force, field, and energy. He misunderstands the process of electrolysis. He believes that “pink” is a monochromatic part of the visible electromagnetic spectrum. In spite of all of this, the Fossil Museum promotes Baugh’s theories.
Where the Fossil Museum does not rely on Baugh in Opening the Doors of Truth, it still gets into trouble. Following Hovind, the Fossil Museum misrepresents the “giant tomato plant” exhibit from the 1985 World’s Fair and makes unsound claims regarding the ability of amber to trap ancient air. The Fossil Museum illogically claims that the Second Law of Thermodynamics was introduced with the Fall. It promotes Ron Wyatt’s discredited claims about Noah’s Ark. All of this indicates deep and persistent misunderstandings of science among the designers of Fossil Museum exhibits.
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