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The Menace of Darwinism

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The Danger of the Simple

The popular perception of the history of science imagines a series of revolutions in which old theories are abruptly cast on the dust heap as new theories take their place. This scenario was reinforced by physicist-philosopher Thomas Kuhn, whose widely read *The Structure of Scientific Revolutions* (Kuhn 1970) introduced the now familiar term *paradigm shifts* to our common vocabulary. But, the notion that science proceeds by abrupt transitions is, at best, an exaggeration. Nobel laureate physicist Steven Weinberg maintains that the history of science shows only a few examples of true Kuhnian paradigm shifts (Weinberg 1998). In fact, most of the changes that take place in science are gradual, with old theories often remaining in use long after new ones have come along. New theories tend to expand into new territory rather than take over the old.

For example, classical, Newtonian physics still constitutes the bulk of the physics curriculum and remains in wide use a century after the quantum revolution supposedly showed it was "wrong." Weinberg notes that even Kuhn taught classical physics to his students at Harvard when they were colleagues there. Quantum mechanics encompasses the classical domain, but its unique applications occur in other domains, such as the atomic and subatomic, where no data to check against theory existed at the time Newtonian mechanics was being developed.

Nevertheless, at least two scientific advances in the last half-millennium merit the label of significant paradigm shifts: Copernicus's sixteenth century proposition of the earth's motion around the sun and the nineteenth century hypothesis of the evolution of species by natural selection put forth by Charles Darwin (1859) and Alfred Russel Wallace (1859).

Both of these developments moved human thinking into new territory, but also took over the old, displacing previously existing, deeply entrenched systems of thought. Most notably, they explicitly contradicted traditional beliefs based on holy scriptures that were believed to infallibly reveal the word of God. At the time it

appeared, each proposal was seen as mortal threat to the Christian faith. In this chapter we will see how Darwinism still is regarded by a vocal minority of Christian believers, mainly in the United States, as a deadly menace to their faith that must be fought against by all possible means.

The sixteenth century Roman Church forced Galileo to disavow any implications from his writings that the Copernican theory of the solar system was a fact of reality and not simply a mathematical model as Copernicus's publisher had claimed. Scripture is quite precise that the earth is the immobile center of the universe: Psalm 103 states, "The Lord God laid the foundation of the earth, that it not be moved forever." However, within a century or so, theological resistance to the Copernican cosmology had largely dissipated. The supporting evidence was simply too overwhelming and religion had to adapt or die. In a kind of natural selection, it adapted and sanctioned the notion that the earth, in reality, moves about the sun. This forced churchmen to admit that what is written in the Bible cannot always be taken literally.

By the nineteenth century, ecclesiastical power had greatly diminished in Europe and Darwin did not meet the same fate as Galileo. In fact, he ended his illustrious life interred alongside Newton in Westminster Abbey. (Galileo rests in a place of honor in Santa Croce cathedral in Florence.) Still, what philosopher Daniel Dennett has called "Darwin's dangerous idea" (Dennett 1995), that humans and other living things evolved from less complex forms of life by purely natural processes unguided from above, was hardly accepted with open arms at the time. Today, Darwin's dangerous idea remains the primary battleground in the war between science and fundamentalist religion.

In his monumental work, *A History of the Warfare of Science and Theology in Christendom,* first published in 1896, Andrew Dickson White, the first president of Cornell University, reported the reactions of churchmen when Darwin's work exploded on the scene. The following quotations are taken from White, which can be consulted for the original references.[1]

Bishop Samuel Wilberforce of Oxford (d. 1873) protested that "The principle of natural selection is absolutely incompatible with the word of God. [It] contradicts the revealed relations of creation to its Creator. "Wilberforce, interestingly, uses an argument from parsimony similar to what we hear from modern theists, that there is "a

simpler explanation of the presence of these strange forms among the works of God . . . the fall of Adam." Scientists also rely heavily on parsimony, and the many atheists among them see nature as the simpler alternative to God.

Wilberforce is best known as the unlucky recipient of a zinger from "Darwin's bulldog," Thomas Huxley (d. 1895). During a confrontation at Oxford in 1860, at a time when Darwin was ill, Wilberforce sniffed that he was not descended from a monkey. Huxley replied (the quotation is probably not exact): "If I had to choose, I would prefer to be the descendent of a humble monkey rather than of a man who employs his knowledge and eloquence in misrepresenting those who are wearing out their lives in the search for truth."

White quotes an unnamed theological authority who lamented the depth of the implications of Darwin's idea: "If the Darwinian theory is true, Genesis is a lie, the whole framework of the book of life falls to pieces, and the revelation of God to man, as we Christians know it, is a delusion and a snare."

An also unnamed representative of the American branch of the Anglican Church agreed with this dire assessment, "If this hypothesis be true, then the Bible is an unbearable fiction; . . . then have Christians for nearly two thousand years been duped by a monstrous lie."

A certain Dr. Schund in Germany likewise viewed evolution as marking the death of Christianity, contending that "every idea of the Holy Scriptures, from the first to the last page, stand in diametrical opposition to the Darwinian theory. . . . if Darwin be right in his view of the development of man out of a brutal condition, then the Bible teaching in regard to man is utterly annihilated."

Following a pattern that has continued to the present day, many books appeared that purported to "disprove" Darwin. In 1877, a French physician Dr. Constain James published *On Darwinism, or the Man-Ape.* Pope Pius IX (recently beatified on the road to sainthood) was delighted, writing the author that he "refuted so well the aberrations of Darwinism. . . . [A system] which is repugnant at once to history, to the tradition of all people, to exact science, to observed facts, and even to reason itself, would seem to need no refutation."

It is interesting to note that the Pope's objections were not stated in theological

but in scientific terms, referring to "observed facts" and "reason." He continued in that vein, "But the corruption of this age, the machinations of the perverse, the danger of the simple, demand that such fancies, altogether absurd though they are, should—since they borrow the mask of science—be refuted by true science." Note that the Pope, in contradiction to Wilberforce, seemed to accept evolution as the simpler explanation but warns of "the danger of the simple." And he calls upon science, not theology, to refute Darwinism.

Not all believers reacted unfavorably to Darwinism. White relates that the "High Church party" at Keble College in Oxford (where I once had the honor of dining at High Table) called evolution "an advance in our theological thinking." The Bishop of London argued, "It seems something more majestic, more befitting him to whom a thousand years are as one day, thus to impress his will once and for all on his creation, and provide for all the countless varieties by his one original impress, than by special acts of creation to be perpetually modifying what he had previously made." And, despite the pronouncements of Pius IX, a statement from American Catholic sources declared that "the doctrine of evolution is no more in opposition to the doctrine of the Catholic Church than is the Copernican theory or that of Galileo."

By the mid-twentieth century, the Catholic Church had fully accepted evolution. In 1950 Pope Pius XII asserted that no conflict existed between faith and evolution. This was explicitly reaffirmed in 1996 by Pope John Paul II, who stated before the Pontifical Academy of Sciences that "fresh knowledge leads to the recognition of the theory of evolution as more than just a hypothesis."

The Science of Evolution

The battle over the validity of evolution has been publicly posed as a scientific one. However, you will find little sign of this in scientific journals, where such quarrels as exist are over details, not the basic concept. Since Darwin's time, the empirical evidence in support of natural selection has multiplied manyfold. Evolution has proved so useful as a paradigm for the origin and structure of life that it constitutes the foundation of the science of biology.

We know so much more today than Darwin did, and what we have learned has

deeply confirmed his essential intuitions and inferences. Most importantly, we now understand the fundamental ingredients of genetics and the role played by DNA. All of these developments have confirmed Darwin's basic mechanism. Today, the intimate connections between all living things, their histories and common origin, can be read in their genomes. As I write, the results of the human genome project have just been published. The genome of every living organism that has been studied to date shows many common DNA sequences, providing strong evidence that all life arose from the same source—just as posited by Darwin. The evolution by natural selection of bacteria, fruit flies, and other organisms has been observed in the laboratory. Evolution has proved an invaluable tool in medical research. Undoubtedly, many lives have already been saved because of the knowledge provided by evolutionary theory.

While, as we will see below, considerable debate exists on what criteria define an activity as being scientific, there can be little dispute that evolution is science. It deals with empirical observations and makes many testable predictions that have been confirmed. In particular, evolution by natural selection, as originally posed by Darwin and Wallace, was eminently falsifiable!

At the time of Darwin and Wallace, most people believed that the age of the earth was of the order of 6,000 years, as indicated in the Bible. Geologists were just beginning to gather evidence for a much older earth, and this knowledge had great influence on Darwin. who took Charles Lyell's classic *Principles of Geology* with him on the voyage of the Beagle.

In the first edition of *On the Origin of the Species by Natural Selection,* Darwin made a crude estimate of the earth's age, based on geology, of the order of several hundred million years. This, he reasoned, was sufficiently long for the processes of natural selection to take place and produce the wide range of species on earth.

The great physicist William Thomson, later to become Lord Kelvin, disputed Darwin's estimate, arguing that the sun had a much lower age. Obviously, life could not exist without the sun. Thomson had made major contributions to thermodynamics, formulating the second law of thermodynamics and establishing the absolute temperature (Kelvin) scale, and so was highly qualified to make this calculation. At the time, the only known sources of energy that could account for solar radiation were

chemical and gravitational. Thomson calculated the age of the sun for each mechanism and found that gravity gave the largest value, on the order of a few tens of millions of years. This was a factor of ten lower than Darwin's estimate. Using thermodynamics, Kelvin also calculated that the temperature of the earth would have been too hot a million years ago to allow for life.

Thus, based on the best physics knowledge of Darwin's day, evolution by natural selection was highly suspect. Darwin admitted as much in a letter to his co-founder Wallace: "Thomson's views on the recent age of the world have been for some time one of my sorest troubles." If Thomson's calculations had been correct, Darwinism would have been falsified.

But, Thomson's calculations were wrong and Darwinism was not falsified. Thomson cannot be faulted, for he used the best information available at the time. However, with the discovery of nuclear energy early in the twentieth century, a new source of energy became known that was far more efficient than either gravity or chemical reactions. Also, the natural nuclear radioactivity of the earth provides significant heat and upsets Thomson's energy balance calculation for the age of the earth.

By the mid-twentieth century, the nuclear processes that fuel the sun were well established and described by theory. By the end of the century, the observation of neutrinos from the sun had directly confirmed the validity of a nuclear source of energy for the sun and a potential lifetime of tens of billions of years (Bachall 2000). Radioactive dating also verified that the earth is several billions of years old and paleontologists have found signs of life going back almost that far.

Thus, evolution is as close to being a scientific fact as can be possible, given that science is open-ended and no one can predict with certainty what may change in the future. Nevertheless, the probability that evolution by natural selection, at least as a broad mechanism, will be overthrown in the future is about as likely as finding out some day that the earth is really flat. Unfortunately, those who regard these scientific facts as a threat to faith have chosen to distort and misrepresent them to the public.

The Creationists

By the end if the Victorian era, Darwinian evolution had become widely accepted by the intellectual elite in Britain, including many churchmen as well as scientists. Being mainly confined to scholarly circles, this knowledge did not substantially seep into public consciousness. In particular, the great majority of Americans continued to believe in special creation as described in the Bible. They were not hearing from the pulpit what was being discussed in the top divinity schools. Gradually, the press began to take note of the stark contradiction between evolution and common belief, and by 1890 or so the creation / evolution debate had moved into the public arena where it has remained, at or near the surface, to the present day.

As mentioned, what smoke on evolution you will discover in the pages of scientific journals is raised by conflicts over details, not the basic validity of natural selection. For a century now, the creation / evolution war has not been fought in academia but on political and legal fronts, in the media, legislatures, school boards, and courtrooms.

These venues are not particularly noted for their facility to establish truth. Even with their elaborate formalities, the courts are primarily configured to settle disputes and declare winners and losers. Truth is often sacrificed in the name of another noble ideal—justice—but, of course, even this is rarely served . In the political arena, truth is even lower on the agenda. One can hardly imagine a politician these days gaining re-election by always telling the truth, though they all profess a commitment to "honesty" and "integrity." Similarly, the journalistic media pay lip-service to truth, but commercial interests and political correctness rule in that domain.

While truth may be difficult to define, and even more difficult to establish, at least science sets it above all else. The self-correcting nature of the enterprise makes it virtually impossible for scientific fraud to succeed for very long. Scientists are not more or less moral than anyone else, but they are engaged in an enterprise that has evolved methods that make dishonesty a poor strategy for success. Most likely, the great power and success of science is as much or more the result of its institutions than the merit of its individual practitioners.

Once evolution moved out of the ivory tower into the open, powerful forces

went to work to suppress it. These forces apparently feared an undermining of the social fabric by which they maintained their power. Religion has almost always been used by those in power to keep the masses in line, to justify their positions by divine right. In the 1920s, the legislatures of the states of Oklahoma, Tennessee, Mississippi, and Arkansas banished the teaching of evolution in public schools.

The tension reached a peak in the famous Scopes "Monkey trial" that took place in Dayton, Tennessee in 1925 (Numbers 1982, Webb 1994). A high school teacher named John Thomas Scopes was tried for teaching evolution. His chief prosecutor was renowned orator, William Jennings Bryan, three-time losing Democratic candidate for president of the United States. Scopes was defended by the celebrated lawyer and freethinker Clarence Darrow.

Bryan argued, "democratically," that a few thousand scientists should not dictate to forty million Christians what should be taught in schools. While he relied on the support of the majority, he also sought scientific backing for his position. A handful of scientists of the time had written anti-evolutionary tracts, but they proved to be either unwilling or unsuitable witnesses. Bryan could not find two who agreed with each other (Numbers 1982).

Although Scopes was found guilty and fined $100 (later overturned on appeal), Darrow, aided by the acerbic pen of reporter H.L. Menken, triumphed in this public opinion skirmish. The worn-out Bryan died a few days after the completion of the trial.

The Creation Scientists

Although creationists continued to work, with some success, to limit the amount of evolution taught in schools, the conflict did not break out into the headlines again until the 1960s with the rise of *creation science.*

The leader of the new movement was a hydraulic engineer, Henry M. Morris. In 1961, Morris and John C. Whitcomb Jr. published *The Genesis Flood,* which argued for the recent creation of the universe and a worldwide flood that laid down all the geological strata in one year (Whitcomb and Morris 1961). Although it wildly disagreed with conventional geology, *Flood* appeared to non-experts as a legitimate scientific publication that brought intellectual respectability to the Biblical accounts.

This set the pattern for the creationist strategy that has continued to this day: conduct research and publish articles and books with the goal of establishing an ostensible scientific basis in the public mind for the creation story described in Genesis. In 1963, Morris and others formed the Creation Research Society (CRS). Members were required to be Christians and sign a statement of belief accepting the inerrancy of the Bible. Notably, this is incompatible with the unwritten pledge of every scientist to pursue the truth whatever it may be, whether one likes it our not. CRS projects included expeditions to search for Noah's ark and theoretical studies to demonstrate the recent origin of the earth. A journal, *Creation Research*, allowed creation scientists to claim publication in a "peer-reviewed" scientific publication. Their peers were, of course, other creation scientists.

In 1972, an Institute for Creation Research (ICR) was established in San Diego under Morris's leadership. He made the purposes of this institution very clear:

> The approach we try to take here [ICR] is to assume that the word of God is the word of God and that God is able to say what He means and means what He says, and that's in the bible and that is our basis. And then we interpret the scientific data within that framework (Morris as quoted in Alters 1995; see this reference for more details on the ICR).

And, on the current ICR Worldwide Web page I found this statement:

> We believe God has raised up ICR to spearhead Biblical Christianity's defense against the godless dogma of evolutionary humanism. Only by showing the scientific bankruptcy of evolution, while exalting Christ and the Bible, will Christians be successful in "the pulling down of strongholds; casting down imaginations, and every high thing that exalteth itself against the knowledge of God, and bringing into captivity every thought to the obedience of Christ" (II Corinthians10:4, 5).
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> The record shows that nothing on creation science of scholarly merit has been

published in the scientific literature by anyone associated with these organizations. A search of 68 journals to which scientific creationists could submit articles failed to find a single published paper by people associated with ICR. Of the 135,000 total submissions to these journals from 1980 to 1983, only 18 dealt with empirical or theoretical support for creationism. At the time of this study, three were still pending and 12 had been rejected for poor scholarship. The editors commented that the articles seemed to be written by laymen rather than professional scientists (Scott and Cole 1985). The situation has not materially changed in the time since this study.

Nevertheless, the creationists established, in their own minds and that of a popular majority, the legitimacy of creation science. Sniffing votes in all this, the politicians went back to work. The new strategy was no longer to eliminate the teaching of evolution, an approach that the U.S. Supreme Court had declared unconstitutional in 1968. Rather, equal time would be demanded for what creationists saw as two alternative scientific models, creation and evolution. The line became that it is dogmatic and thus very unscientific to teach a single model of human origins—evolution—when that model is "deeply flawed" and creation science is a viable alternative.

The use of the term "model" here, in place of "theory," needs elaboration. While evolution is often excoriated in public debates as "theory and not fact," sophisticated creation scientists do not make the common error of equating theory with "speculation." They understand that the label *scientific theory* is only applied to a well established body of knowledge that meets certain stringent criteria, though, as we will see, no clear consensus exists among philosophers of science on what precisely these criteria should be. In this regard, creation scientists argue that neither creation nor evolution are legitimate scientific theories. Rather, they are simply models that one can chose between based on the evidence. As Duane T. Gish presents this view,

> Thus, for a theory to qualify as a scientific theory, it must be supported by events or processes that can be observed to occur, and the theory must be useful in predicting the outcome of future natural phenomena or laboratory experiments. An additional limitation usually imposed is that the theory be capable of

> falsification; that is, one must be able to conceive some experiment the failure of which would disprove the theory. It is on the basis of such criteria that most evolutionists insist that creation be refused consideration as a possible explanation for origins. Creation has not been witnessed by human observers, it cannot be tested scientifically, and as a theory it is non-falsifiable.
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> The general theory of evolution (molecules-to-man theory) also fails to meet all three of these criteria.(Gish 1973)

Creationists contend that evolution can never be established since it was not witnessed by human observers. But then, neither have the early big bang and live dinosaurs been observed. Humans cannot observe electrons inside atoms or quarks inside atomic nuclei. Yet these are all phenomena that are (1) supported by events or processes that can be observed to occur, (2) useful in predicting the outcome of future natural phenomena or laboratory experiments, and (3) described by falsifiable theories. Certainly, evolution also meets Gish's criteria. As we saw above, it was even falsifiable at the time Darwin and Wallace first made their proposal of the natural selection mechanism.

The use of the term "model" is very common in science. In physics, for example, we talk about the *standard model* of elementary particles and forces. While that was an appropriate designation when it was first developed in the 1970s, the standard model by today has been so successful in describing observations that it certainly merits being formally recognized as a legitimate *theory*. Similarly, the big-bang model in cosmology is sufficiently well established that it can be called the big-bang theory. This does not imply that these theories will never be supplanted or refuted, just that they fit all the data we now possess with a high degree of reliability. So, a "model" represents a step on the way to becoming a "theory." It may fail to make that final step, but even so it remains a legitimate part of the scientific process.

By calling their proposal a model rather than a theory, the creation scientists were able to evade the application of too-strict criteria and still claim what they were doing was science. In order to avoid constitutional problems involving church-state separation, Morris urged that public schools teach only the "scientific aspects of

creationism." In 1974, ICR produced a textbook *Scientific Creationism* that had one edition for public schools and another for Christian schools which contained an extra chapter on "Creation According to Scriptures" (Morris 1974). As we will see with current efforts, the sectarian motives of the creationists has never been heavily veiled.

Besides Morris, the other big gun of the creation science movement of the same period was Duane Gish. Holding a doctorate in biochemistry, Gish is a master debater. In the 1980s he travelled coast-to-coast debating sometimes witless biologists, usually before audiences of hundreds, even thousands, that in large majority supported his position. The debate format allowed little opportunity for discussion of the complex scientific issues involved. Though often conducted on college campus to give them an aura of academic respectability, these debates bore no resemblance to the type of collegial discussion that characterize normal scientific discourse. While scientific disputes can become quite heated, they never degenerate into popularity contests that are settled by the loudest applause.

The popular success of the creation scientists under Morris's and Gish's leadership soon resulted in further legislative action. In the early 1980s, Arkansas, Louisiana, and various local school boards adopted the "dual model" approach and passed laws mandating equal treatment. However, pro-evolution forces quickly mobilized. The American Civil Liberties Union (ACLU) filed a federal suit against the State of Arizona asking that Act 590, the "Balanced Treatment for Creation-Science and Evolution-Science Act," be declared unconstitutional. The ACLU provided attorneys for an assortment of plaintiffs that notably included bishops and clergy from a wide range of religious groups—Catholic, Protestant, and Jewish—as well as teachers and parents.

The trial was held in Little Rock in December, 1981, judge William R. Overton presiding without a jury. The ACLU was able to gather an impressive list of expert witnesses, including famed paleontologist Stephen Jay Gould, geneticist Francisco Ayala, and philosopher Michael Ruse. The State chose not to call Morris and Gish as witnesses and did not put on a spirited defense (Ruse 1996). The creationists were routed. Gould says that they had a victory celebration two days into the two week trial.

On January 5, 1982, Judge Overton ruled against the State of Arkansas, tossing out Act 570. He based his decision on a number of precedents, including the 1971 case

Lemon v. Kurtzman that produced the famous threefold "Lemon test" for determining whether a law meets the Establishment Clause of the U.S. Constitution:

> First, the statute must have a secular legislative purpose; second, its principle or primary effect must be one that neither advances nor inhibits religion . . . ; finally, the statute must not foster "an excessive government entanglement with religion" (Stone v. Graham, 449 U.S. 39 (1980)).

Overton declared that the evidence strongly confirmed the sectarian purpose of the act. He stated that the statute amounted to "a religious crusade, coupled with a desire to conceal this fact." He found "the evidence is overwhelming that both the purpose and effect of Act 590 is the advancement of religion in the public schools" (Overton 1982).

Besides this constitutional issue, which was sufficient to sink Act 570, Judge Overton made some additional rulings concerning whether "creation science" is really science and what constitutes science. He observed that the methodology employed by the creationists

> . . . is indicative that their work is not science. A scientific theory must be tentative and always subject to revision or abandonment in light of the 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. (Overton 1982).

To demonstrate that this was not what creation scientists practice, Overton noted that they "do not take data [and] weigh it against the opposing scientific data" to reach their conclusions. He quotes Morris: "If man wishes to know anything about Creation (the time of Creation, the duration of Creation, the order of Creation, the methods of Creation, or anything else) his sole source of true information is that of divine revelation" (Morris, Plaintiffs' Exhibit 312).

The State of Arkansas decided not to appeal. A similar "equal time" Louisiana

law was struck down by the U.S. Supreme Court in 1987 on the grounds that it promoted religion by advancing the view that a supernatural being created the universe. The Court also ruled that science education would be compromised is schools were forbidden to teach evolution. Anti-evolution politicians did not give up, however. The recent strategy has been to enact laws requiring textbook disclaimers. Once such disclaimer prepared by the Louisiana Tangipahoa Board of Education in 1994 read:

> Whenever, in classes of elementary or high school, the scientific theory of evolution is to be presented, whether from textbook, workbook, pamphlet, or other written material, or oral presentation, the following statement shall be quoted immediately before the unit of study begins as a disclaimer from endorsement of such theory.
>
> It is hereby recognized by the Tangipahoa Board of Education, that the lesson to be presented, regarding the origin of life and matter, is known as the Scientific Theory of Evolution and should be presented to inform students of the scientific concept and not intended to influence or dissuade the Biblical version of Creation or any other concept.

With the ACLU again leading the legal battle, in 1997 the disclaimer was ruled unconstitutional in State court. On June 19, 2000, the U.S. Supreme Court voted 6-3 not to hear an appeal of this ruling. By mentioning the "Biblical version of Creation," the disclaimer failed the Lemon test. However, Justice Anthony Scalia's dissent, concurred to by Chief Justice William Rhenquist and Justice Clarence Thomas, argued that the biblical reference "is only an illustrative example" (Scalia 2000). This has left room for further attempts at disclaimers, so the story is far from over.[2]

But Is It Science?

After the 1983 Arkansas case, a significant dispute on the validity of Judge Overton's decision arose among philosophers of science. These philosophers agreed that creation science should not be taught in schools—but for different reasons.

As mentioned, the Judge ruled that creation science was, in fact, not science. In

this he relied heavily on the testimony of prosecution expert witness, philosopher Michael Ruse. Ruse had written on the philosophical implications of evolution and so was an appropriate choice to take the stand in Arkansas. Another well-known philosopher of science, and former colleague of mine at the University of Hawaii, Larry Laudan, disagreed strongly with Overton and Ruse (Laudan 1982). Laudan has studied the so-called *demarcation problem* which occupied philosophers of science for a good part of the twentieth century (Laudan 1983, 1984, 1996). This problem arises from the attempt to agree on a set of criteria that clearly distinguishes science from non-science

While most practicing scientists think they have a good idea what differentiates science from non-science, philosophers (or scientists) have never been able to cast this into a formal principle that can be applied to all cases. Laudan and most other philosophers would agree that the criteria used by Gish described above are inadequate. Under Ruse's counsel, Judge Overton arrived at the following five criteria for defining whether or not something is scientific:

(1) It is guided by natural law;
(2) It has to be explained 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
(5) It is falsifiable. (Overton 1982)

Laudan asserts: "At various key points in the Opinion, Creationism is charged with being untestable, dogmatic (and thus non-tentative), and unfalsifiable. All three charges are of dubious merit." He points out that creationism makes a wide range of assertions that can be tested empirically. They say the earth is of a recent origin (6,000 - 20,000 years) and that the earth's geological features are the result of the Noachian deluge. They make other factual claims based on the Bible, such as the co-creation of animals and humans. These are all testable and, in fact, have failed the tests. Furthermore, creation scientists have modified their positions over time" (Laudan 1982).

Let me try to indicate the problems with Overton's criteria, which are

characteristic of most other attempts to define science. One would like criteria that are both necessary and sufficient, so that any statement could be tested against these criteria and declared scientific or not.

The first two criteria above involve natural law. While it is true that up until now science has been confined to natural phenomena, as opposed to what would be labelled supernatural or perhaps just not natural, nothing demands that this always be the case. If scientific instruments uncover non-natural phenomena, scientists would study them just as they currently study natural phenomena. All they need are the data. This is a point I will return to frequently in this book, so let us not worry too much at this point defining what is natural and what is not.

In any case, even if dealing only with natural phenomena were a necessary condition for an activity to be scientific, it is not a sufficient condition. Many commonly accepted nonscientific activities, such as plumbing and basket-weaving deal with natural phenomena. Furthermore, plumbing, at least, is certainly guided by natural laws such as Bernoulli's principle.

What about empirical testability and falsifiability? No doubt science deals with the empirical, that is, observational or experimental data, and this may be regarded as a necessary condition for being labelled science. But this, too, is not sufficient, unless you want to call astrology, palm reading, and every other occult practice scientific. Astrology, for example, makes falsifiable predictions that have been falsified. The falsification criterion would say the astrology is science, just wrong science. While that might be acceptable to some, most philosophers of science think this opens up so much room for activities to be called science that the designation would cease to carry much meaning.

Laudan accuses Overton of applying a false dichotomy (we will encounter many in this book): "since Creationism is not 'science,' it must be religion" (Laudan 1982). He predicted that the Arkansas decision would come back to haunt us by "perpetuating and canonizing a false stereotype on what science is and how it works." The decision left plenty of space for creationists to re-arrange their arguments to meet Judge Overton's now precedent-making legal criteria and, as we will see below, they have exploited this possibility. Rather than rely on questionable criteria to declare the whole of creationism

non-scientific, Laudan argued that we should examine its claims one-by-one and see which can be fairly tested against the evidence and then proceed to make those tests.

Reacting to Laudan's criticism, Ruse defended Overton's ruling by pointing out that the plaintiffs needed to show that creation science was religion in order to have Act 590 ruled invalid on constitutional grounds (Ruse 1982). There was ample evidence from the creation scientists' own writings that a religious rather than secular purpose would be served by teaching their version of creationism, which is clearly based on the Bible, in public school science classes. He pointed out that the constitution does not bar the teaching of weak science so the plaintiff's tactic was to show it was not just bad science but not science at all.

Laudan responded by re-iterating that the emphasis on defining science did more harm than good (Laudan 1983). In this he was supported by philosopher Philip L. Quinn who analyzed the case and concluded that "Scientists and their friends should derive little comfort from the outcome" (Quinn 1984).

Intelligent Design: The New Creation Science

Creationists responded quickly to the legal developments in Arkansas and a new version of creation science soon took over the spotlight. This re-creation of creation science parades under a banner labelled *intelligent design.* Just as the Morris and Gish brand of creation science learned from the mistakes of those preceding who sought to outlaw the teaching of evolution outright, the new intelligent design creationists learned from the mistakes of Morris and Gish. While intelligent design differs in substantial ways from its previous incarnations, unabashed religious creationism it remains.

The intelligent design creationists learned three lessons from the history of their movement: First, do not appear as if you are promoting any one particular sectarian belief system but simply presenting "evidence" for a generic creator that need not even be supernatural. Second, do a better job than previous creation scientists in avoiding claims that are outrageous or easily falsified, such as the earth being only 6,000 years old. Third, and here is where Laudan's prediction has come true, argue that conventional science has a built-in dogmatic attachment to naturalism that prevents it

from even considering supernatural causes. Thus, it is "censorship" to prevent intelligent design from being taught in public school science classes.

Despite these adjustments in strategy, intelligent design proponents are almost exclusively Christians and have not managed to hide very well the identity of the creator they have in mind. And, they have only partially succeeded in avoiding the appearance of doing bad science. While they have gone one better than previous creation scientists in bringing many non-scientific academics as well as laypeople along to their point of view, they have had no success with the experts in the fields they address.

Intelligent design has implications that go beyond the creation / evolution controversy. We can be grateful for one improvement that has come about: at least part of the discussion is now being conducted in the academic forum where reason has some chance of prevailing. For the rest of this chapter, however, I want to continue to discuss the events that have continued to unfold in the political and legal arenas. Unsurprisingly, the current leader of the new creationists is a lawyer.

Prosecuting Naturalism

The battle against evolution, or more generally, "naturalism," is being spearheaded at this writing by University of California at Berkeley criminal law professor Phillip E. Johnson. He has a no-holds-barred, winner-take-all approach that one would expect in the prosecution of a Mafia chieftain.

Johnson has no sympathy with those theists, such as the leaders of the Catholic church and many liberal Protestant theologians, who view evolution as compatible with belief in God:

> "Evolution doesn't mean God-guided, gradual creation. It means unguided, purposeless change. The Darwinian theory doesn't say that God created slowly. It says that naturalistic evolution is the creator, and so God had nothing to do with it" (Johnson 1997, 19).

Johnson sees evolutionary naturalism as a cause of many of the "evils' of modern

society including homosexuality (1995b, 22), abortion , pornography, divorce, bestiality (1995b, 41), and genocide (1995b, 144)—as if the world had none of these before Darwin came along. Tom DeLay, current Majority Whip of the U.S. House of Representatives, agrees: "Our school systems teach the children that they are nothing but glorified apes who have evolutionized out of some primordial soup of mud."

Johnson's description of evolution in his writing has been characterized by biologists as a "crude caricature" (Provine 1990, 20). But, clearly, they are not his audience. As philosopher Robert T. Pennock described Johnson's method:

> . . . he knows how to draw upon his strengths and makes a classic courtroom move of shifting the locus of argument in a way that seeks to undermine the expert testimony of his scientist adversaries. His key argument is broadly philosophical, but Johnson also uses his considerable rhetorical skills to try to turn the tables on scientists by portraying them as naïvely doctrinaire and intolerant, while portraying creationists as rational and fair-minded skeptics." (Pennock 1999, 184).

This view is echoed by biologist, and theist, Kenneth R. Miller (1999, 123):

> When I first read Phillip Johnson's book, *Darwin on Trial,* I read it as a scientist and it puzzled me. In every chapter he attacked what he considered to be a weak spot in evolutionary theory, implying in each and every case that there might be another explanation, a better one than evolution. This is a common strategy in a scientific argument. As I neared the end of the book, I expected Johnson to do what one of my scientific colleagues would do at the conclusion of a provocative seminar—to lift the curtain and reveal that better explanation. Like any scientist, I expected him to present a model that would fit the data more precisely, a model that would possess powers of explanation and prediction well beyond they theory he had attacked. But Johnson did nothing of the kind.

Miller continues,

> Gradually I realized that the case he and his associates bring against evolution is *not* a scientific case at all but a legal brief. The goal of his brief is to raise reasonable doubt. to create a climate in which the intellectual claims of evolution seem shaky, even unreasonable. What it never does is present an alternative—any alternative—to the seamless integration of theory and natural history provided by evolution

Furthermore, Johnson has not come up with a scientifically novel case against evolution, reciting the usual arguments one hears over and over again in creationist literature that have been refuted time and time again. His central argument seems to be that "in our universal experience, unintelligent material processes do not create life" (Johnson 1995b, 108). I would daresay that human experience is hardly "universal," living as we do in a tiny region of space and time. Human experience tells us that the world is flat.

Unlike creation scientists who at least pay lip service to science and scientific method, Johnson is out to convict science of fraud in the court of public opinion:

> Scientific naturalism is a story that reduces reality to physical particles and impersonal laws, [and] portrays life as a meaningless competition among organisms that exist only to survive and reproduce (Johnson 1995b, 197).

Pennock summarizes Johnson's case against science as follows:

> Evolution is a naturalistic theory that denies by fiat any supernatural intervention. The scientific evidence for evolution is weak, but the philosophical assumption of naturalism dogmatically disallows consideration of the creationist's alternative explanation of the biological world. Therefore, if divine interventions were not ruled out of court, creationism would win over evolution. (Pennock 1999, 185).

Johnson equates naturalism to materialism (Johnson 1997, 15). Thus a creationist, he claims, has no chance to present his or her views in an academic environment:

> In our greatest universities, naturalism—the doctrine that nature is "all there is"—is the virtually unquestioned assumption that underlies not only natural science but intellectual work of all kinds" (Johnson 1995a, 7).

Pennock points out that Johnson is presenting the argument as a dichotomy in which creationism and evolution are the only alternatives. As we saw above, this is a common creationist tactic that can easily be dismissed. If one wishes to establish divine creation, it does not suffice for one to simply refute evolution. One must argue independently for the validity of creationism.

Johnson does not ignore this issue. But he does not accept that science is the only method by which the validity of creation can be established. He mentions sacred books and mystical experiences, that is, divine revelation, as other sources of evidence. He also adopts the ancient *argument from design*: "from the very fact the universe is on the whole orderly, in a manner comprehensible to our intellect, is evidence that we and it were fashioned by a common intelligence (Johnson 1990, 13).

In Johnson's latest book, *The Wedge of Truth: Splitting the Foundations of Naturalism,* he seems to back off from his previous direct assault on evolution: “if nature is all there is, and matter had to do its own creating, then there is every reason to believe that the Darwinian model is the best model we will ever have of how the job might have been done” (Johnson 2001, p?). This is not to say that he has come around to the evolutionist view. In fact, he now has an answer for the question raised by Miller above and often asked of Johnson after his speeches: If the blind, processes of natural selection was not the mechanism for the development of life, then what was the mechanism?

Johnson has previously dismissed the question as an "ad hominem attack." However, now he tells us that the mechanism was the Logos of the Gospel of John. In a review of *Wedge,* Jesuit theologian Edward T. Oakes notes that Johnson leaves aside "the uncomfortable fact that no biblical or doxological text in either Judaism or

Christianity praises God as the Celestial Cell Constructor or Divine Bauplan Architect" (Oakes 2001).

Oakes adds:

> Throughout Johnson's book, and indeed throughout all his writings on this subject, there lurks, like the Ghost of Christmas Past, clanking chains and all, the unexorcised spirit of the Anglican Archdeacon William Paley (1743–1805), whose lucubrations on the "clockmaker God" so impressed Darwin in his undergraduate days. In my opinion, anyone who follows that hyper–cheerful, almost Candide–like clergyman down the designer road is asking for trouble later on; and indeed once Darwin became a naturalist (in the nineteenth–century meaning of that word: an investigator and collector of species), his departure from Christian orthodoxy was well–nigh inevitable (Oakes 2001).

Meeting the Challenge

It is not my intention in this book to review all the arguments for and against evolution. That takes a book in itself, and many such books are already available, along with numerous other resources such as journal articles and Worldwide Web sites.[3] My purpose in this chapter is to show that many Christians regard evolution as such a great threat to their faith that it must be fought against by every means at their disposal, even when those means are less than scrupulous. While these are not the majority, and we will later be meeting a number of Christian theologians and scientists who have woven evolution into their belief systems, the anti-evolution crusade in the United States is too powerful to ignore. The effects can easily spill over into a general assault on science to its great detriment and to the great detriment of society.

Anti-evolution cannot be dismissed simply because of its absence of scientific merit and often ridiculous and downright false assertions. Despite this, and because of the unfortunately rather low level of scientific understanding among the general public which renders them credulous to false assertions, this crusade maintains the support of a popular majority in the United States. Polls indicate that, while most Americans think that evolution should be taught in schools, they also want to see creation theory

presented and view it as a viable scientific alternative. It follows that the proponents of the creation crusade are able to collect funds to promote their views in the media. With both public support and money, they can easily attract politicians only too willing to make public policies that support creationist views in return for votes. Thus, if science is to avoid being stigmatized as dogmatically atheistic, it must respond in a carefully controlled fashion that is consistent with its avowed claim of seeking the truth whatever it may be.

When Phillip Johnson accuses science of refusing to consider non-natural causes, a common response from scientists has been to argue that science only deals with the natural. This is a dogmatic response that plays right into his hands. Recall, from above, that the first two of Judge Overton's criteria for science demanded that it be guided by and explained with reference to natural law. Even if that has been the case until now, it need not be so forever. Scientists should accept Johnson's challenge and reply that it is open to the consideration of non-natural causes. As Pennock (1999) and others have pointed out, the naturalism of science is *methodological* and not necessarily *ontological*. If the evidence for non-natural causes is there, as many theists are now claiming, then scientists can proceed to examine that evidence fairly and openly. While naturalism has proven to be a useful working assumption in science, and economy of thought demands that all natural causes be exhausted before adding new assumptions, we have no need to rule all such assumptions out of hand. Show us the data. Unfortunately, all Johnson and his colleagues have done so far is attack evolution and not present us with any alternative mechanism that can be tested against the data in normal scientific fashion.

If creationists say they want to play on the scientific ball field, how can scientists object? This is their game and they know the rules very well. Furthermore, it gives them the home field advantage. If a theist makes an empirical claim, then scientists can investigate that claim scientifically. At least that will demonstrate a willingness to search for the truth, whatever it may be. After seeing some of the tactics described in this chapter, however, scientists cannot be too naive and fail to object when creationists attempt to move the discussion to another venue. No matter how smart we think we are, creationists have a good chance of winning any contest that is played in the public

media or political arenas. Only by sticking strictly to the science can we expect a rational outcome.

In 1979, Duane Gish wrote:

> whether evolution happened or not can only be decided, scientifically, established by the discovery of fossilized remains of representative samples of those intermediate types which have been postulated on the basis of indirect evidence. . . . As a matter of fact, the discovery of five or six of the transitional forms scattered though time would be sufficient to document evolution (Gish 1979, 49)

Thus Gish presents evolutionists with a demand to provide specific empirical evidence that if met, he promises, will bring him and his fellow creationists around to accepting evolution.

Gish's challenge has been taken up by many biologists and paleontologist (see, for example, Halstead 1984, Blackburn 1995, Miller 1999). Unsurprisingly, their data have not so far converted Gish or any other creationists to evolutionism.

The alleged absence of "transitional forms" has been a long-standing argument made by creationists against evolution. In the evolutionary scheme, every species is in some sense a transitional form between two other species. Paleontologists have presented numerous examples of what they regard as transitional forms But creationists still dispute the examples given, the most famous being *Archaeopteryx*, which exhibits features of both bird and reptile. Since it has feathers, creationists argue that it is a bird by definition and so not a transitional form.

Geologist Keith Miller has given this nice summary of the situation with respect to whales (private electronic mail communication):

> One of the currently best documents of transitional fossil sequences is for the evolution of whales from a terrestrial hoofed animal. There are now 26 fossil species of primitive whales known that have been assigned to four families. These together provide an impressive fossil sequence of

transitional forms—the "walking whales." This progression of fossil forms shows a clear trend from more terrestrial to fully marine adaptations. Associated with this is a progressive change in swimming from limb propulsion to tail undulation. The fossil record of early whales is even more impressive because of its paleoenvironmental and geographic aspects. Not only do the fossils occur in the correct chronological order, but they are found in progressively more marine settings.

Numerous other examples of this sort can be found in the record, but obviously they can always be defined away by specious arguments. Died-in-the-wool creationists will never be convinced by any scientific data, despite Gish's promise. They already know the truth and the data must conform to it. But this does not mean that their assertions should be ignored. Scientists must continue to respond to make sure that the public record is not limited to one side of the dispute.

When all is said and done, however, the creation/evolution debate has little to do with the debate over evidence for the existence of God. As I have noted, it is a false dichotomy to think that by debunking evolution one is providing evidence for a creator with the human-like features of the Judeo-Christian-Islamic God. If this God exists, his face should be seen in the heavens. Only the immense self-centeredness of humanity leads us to seek evidence for purpose in the thin layer of carbon that coats the surface of a minor planet.

Notes

1. The quotations have been taken from the 1993 edition of White's two volumes (White 1993), published in a single volume by Prometheus Books, pp. 70-88.

2. For the view from the U.S. National Academy of Sciences, see National Academy of Science 1998, 1999.

3. Rather than make a long list of references, which would be out of date the

moment this book is published, the reader is urged to used the search engines on the World Wide Web to find the most useful sites. These include many links to articles that can be downloaded, FAQs (lists of answers to frequently asked questions), and lists of the latest references.