In the Beginning …

I succumbed rather early to the corrupting influence of mathematical logic. It began with my geometry teacher, drilling into us how it wasn't good enough just to get the right answer. You had to have arrived at it through a correct line of reasoning; otherwise you had "proven" nothing at all. Then there was that impish college professor who took a day out from advanced matrices to maliciously warp our minds and demolish all notions of "common sense" by demonstrating how parallel lines can meet, and some infinities are bigger than others. Hovering over all, of course, like the smile of the Cheshire cat, was the insidious mathematician Gödel, who undermined smug certainty itself by establishing how even the most carefully defined logical system might nonetheless generate menageries of inherently undecidable propositions.

Now if you take that healthy skepticism, mix in a sense of historical continuity, you get the foundation of the scholarly method. Hypotheses are only the beginning. Can you *prove* it? How *does* one go about "proving" things? What are the standards of evidence? Most importantly, how exactly would you know if you were *wrong*? Such is the creed of the unregenerate methodologist.

But back to mathematics. Set the Wayback Machine for high school, late Sixties.

At mine there existed a notorious, though good-natured, rivalry between the physics instructor and calculus teacher, who were an entertaining bookend set of diminutive gentlemen in chalk-encrusted white lab coats. Anyone taking the physics elective soon discovered mathematics existed simply as a convenient tool for that discipline, while calculus students were equally assured physics was merely an example of "applied mathematics." While those hapless enough to take both courses in the same quarter felt a bit like a badminton shuttlecock, in the end I am still impressed at how their interdisciplinary crossfire helped considerably in our appreciation of arcane topics like gravitational acceleration.[1]

One day our physics teacher interrupted the assigned lesson plan to digress on something called the "ice canopy" theory, which purported to offer a physical rationale for the reality of the Biblical Flood. The idea being floated, as it were, was that an ancient layer of atmospheric ice had collapsed onto the earth in a terrible watery catastrophe. Although offered as strictly scientific speculation, the religious implications were obvious, though the class discussion remained congenially free of sectarian intensity. It was nonetheless an odd topic for physics class (as distinct from earth science), and therefore as diagnostic as hearing a social studies teacher veer off on the "proletarian struggle against imperialist hegemony." As there was no sequel, I have no idea to what extent my amiable physics instructor was in fact a "creationist."[2]

I might never have given this isolated episode another thought were it not for the seemingly unrelated fact that, like any kid worth their salt, I had once avidly collected dinosaur models. But not just *any* models. In the early 1960s a series of particularly well crafted replicas were issued, based on the spectacular color mural, "The Age of Reason," painted by Rudolph Zallinger decades before for Yale University.[3]

As long as sales held up, whoever was responsible for the set appeared entirely willing to make available for little fingers and parental wallets every animal on the Yale mural. These included many that were distinctly not dinosaurs, such as the flying reptile *Pteranodon*, nor even contemporary with them (though in this regard you can imagine what I might have believed had I been reared on Duane Gish instead of the *World Book Encyclopedia*). While the woolly mammoth and sabertooth tiger were clearly more recent than *Brontosaurus* or *T. rex*, the set included a trio of reptiles not to be found in modern prehistoric life series, creatures far more ancient than the dinosaurs. These were *Dimetrodon*, *Sphenacodon*, and *Moschops*, which lived during the Permian period just preceding the Mesozoic "Age of Dinosaurs."

The fin-backed *Dimetrodon* was, of course, a familiar cliché from many a prehistoric beast movie, when before the era of facile computer graphics, the only alternative to laborious stop-motion animation was to attach a fin on some cooperative Gila monster and call it *Dimetrodon*.

That was what was done for the geologically preposterous, but nonetheless highly entertaining 1959 film version of Jules Verne's *Journey to the Center of the Earth*.

But those two other Permian creatures, *Sphenacodon*, and *Moschops*, were dull indeed compared to my mighty dinosaurs. Low-slung quadrupedal predator *Sphenacodon* might be mildly exciting in its Permian heyday, but the herbivorous *Moschops* was a complete disappointment. To my juvenile prejudice it looked exactly like an overgrown frog, with splayed legs and a congenitally dippy expression I could barely tolerate. Fortunately they belonged to an earlier age, which meant they could be safely segregated on chronological grounds, and need never actually hobnob with the noble dinosaurs during imaginative play.

Beyond the pressing concerns of reptile esthetics, I had even more trouble grasping the matter of dinosaur *size*. It was apparent the *Tyrannosaurus* model was much too large compared to *Brontosaurus*, but my encyclopedia reading only compounded the problem by illustrating yet another sauropod, *Diplodocus*, which was supposedly even longer. Nor could I clarify what it meant to be a "lizard-hipped" Saurischian dinosaur as opposed to a "bird-hipped" Ornithischian one. Without scale models representing all these types, I simply couldn't keep them straight, and for years there the problem rested.

Then came the dinosaur revolution of the 1980s, and my aestivating interest revived with a bang. A comprehensive series of uniform scale models appeared, based on the specimens at the British Museum (now known as the London Natural History Museum), joined later by equally extensive editions representing the Carnegie and Boston Museum collections. Now I could compare and contrast differing taxa as easily as if observing zoo specimens. A veritable torrent of profusely illustrated works by a new generation of highly articulate dinosaur paleontologists fully cured my youthful confusion. In two shakes of a theropod tail, I had become a dedicated student of the Dinosauria.[4]

Indeed I was not only catching up on lost time but confronting in the process the very nature of scientific inquiry. Being extinct animals, almost everything about their study had an inferential character about it. When I was young, dinosaurs were tamely characterized as stupid, sluggish creatures that only managed to lumber on as long as they did because the supposedly "superior" mammals had yet to dislodge them. But that conception was being thoroughly overturned by the increasingly vibrant paleontology of the 1980s, which recovered for science more new dinosaur genera than in all the preceding century's activity.

Were dinosaurs warm-blooded after all? Or did they possess a uniquely "dinosaurian" metabolism? Without living examples, how could you tell? To examine this *one issue alone* requires understanding the full range of animal thermoregulation. The implications of body stance and herding characteristics and bone histology all have to be carefully evaluated. Some dinosaurs turn out to have lived in ancient polar regions. That means you have to know paleoclimatology to decide just how nippy the Mesozoic arctic was. In the quest to make sense of the dinosaurs, you could *see* the science being done, and exactly *how* it was being done. Thus clearly on display was the technique whereby any aspect of the natural world might be understood.[5]

And that's just the tip of a very big inferential iceberg. Asking whether dinosaurs traveled in herds, like many an active endothermic mammal today, carried with it presumptions about their underlying biology. Learning that the mammals had coexisted as seemingly trivial denizens of a dinosaur-dominated habitat only added to the mystery of why these wonderfully successful animals had become extinct at all. And that necessarily raised questions about *patterns*, for the dinosaur exit was only the most recent of many such vast gearshifts of life. One system collapses, and the survivors build a new one, only to have it fall apart in turn. Have they just "worn out," carrying with them the seeds of their own decay? Or was it just the luck of the draw, mere contingency?[6]

Nor was this idle speculation; for whatever answer might eventually carry the day would have profound implications for our living ecosystem now. Why? Because if mass extinctions have natural causation, whether one or several, identifying those factors would have relevance in determining whether or not we might be artificially engineering comparable conditions today. No one wants to be on the wrong end of the extinction curve.

Science inevitably breeds just such a chain of implications. That is, it does so provided that it sticks close to the truth, for there has always been a *fecundity* about notions that are actually so.

But who decides "what is so" in the first place? The "facts" of any discipline cannot exist apart from the methodological framework that produced them. Every step of scientific knowledge is taken along a path of that certain *method*. There is no getting around it.

Another question about dinosaur extinction: *did* the dinosaurs become extinct? Had birds evolved from theropod dinosaurs (the bipedal predators and their kin), as opposed to some earlier thecodont reptile (regarded as earlier cousins of those archosaurs ancestral to the dinosaurs)? This was no taxonomical hairsplitting, for if birds are the direct descendants of dinosaurs, their present behavior and fundamental genetic structure provide invaluable clues in deciphering the nature of their extinct brethren, animals thought permanently beyond the reach of direct investigation.

Understanding the true nature of dinosaurs was thus inextricably linked to working out their correct evolutionary history. Presuming, of course, they *had* an evolutionary history to begin with, for by the 1980s creationists were also swinging into high gear in their effort to persuade the secular community that everything about evolutionary theory was an egregious crock, entirely unsupported by the "true facts" of science. Here, then, was quite a test. If the creationists' view of natural history was the correct one, should they not be able to account for such matters as the dinosaurs with greater clarity and explanatory power than their evolutionary opponents? Their version should have about it what physicist Philip Morrison has dubbed "the ring of truth." Such is the resonance of all genuine knowledge.

From the evolutionary side, scientists like David Norman were explaining the specific development of dinosaurian musculature over time, and exploring the coevolutionary relationship between the jaw structure of herbivorous dinosaurs and the changing nature of the plants they were eating. Meanwhile, what were the gems of insight being offered apropos the dinosaurs by creationists? That they *must* have been on Noah's Ark, you see, for according to the Bible all land animals had been thus included. Some theorists ventured even further, insisting on scriptural authority alone that only subsequent to the Flood had carnivory entered the animal kingdom at all, which meant those carnosaurs conventional paleontology erroneously viewed as ferocious predators had in fact been initially docile herbivores.

Let's not put too fine a point on it. What I was hearing from the creationist community about dinosaurs was arrant drivel. There was no physical evidence that dinosaurs and people coexisted in any sense whatsoever, while claims about the presumed plant eating features of tyrannosaurs flew in the face of everything that had been learned about comparative anatomy over the last few centuries. And in furtherance of this Flintstones version of paleontology, creationists were actively bullying legislatures and school boards to adopt this nonsense as though it were credible science. My high school physics teacher's benign "ice canopy" theory had grown sharp teeth indeed.

And that is how my childhood interest in dinosaurs led first to my following the creation/evolution debate, and ultimately escalated into my writing this present volume. The more I studied what creationists were asserting, the more discordant their worldview appeared in contrast to the real science I could observe regarding not only the dinosaurs, but everything else in the natural world. Instead of that "ring of truth," what I was getting from creationism was a very dull thud.

But all this resounds very differently to creationists, and therein lies the crux of the problem. While evolutionists are talking "science," creationists are really addressing serious social concerns. For them, evolutionary theory is not about discovering to what extent the herbivorous iguanodontid dinosaurs differentiated from the earlier camptosaurids during the Cretaceous; it is a battle to expunge what they perceive as the pervasive corruption of a modern secular age. Creationists are concerned not about the morphology of Permian reptiles, but about teenage pregnancy, abortion, and homosexual rights. Their struggle against evolution is part of a much larger culture war, and cannot be understood apart from that context.

The problem for science is that in the pursuit of this social agenda creationists jettison the common practices of scholarly method. Sources are read for ammunition, not understanding. Relevant information is misrepresented or ignored altogether. It is this aspect of the creationist enterprise that is potentially so destructive, for no legitimate science can be long sustained on the foundation of sloppy methodology that lies at the heart of creationist thinking.

Now if creationists are indeed such "transparent blockheads" why are their views still accepted by roughly half the population, and even about a quarter of schoolteachers?[7] Partly because the general public passively participates in the process by not being particularly well-informed on matters of science generally, and of the niceties of analytical logic specifically. The consistently cynical H. L. Mencken once observed how no one ever lost a dime underestimating the intelligence of the American public. This is corroborated at every grocery store checkout line today by the gauntlet of gaudy tabloid papers proclaiming yet another amazing revelation from the Dead Sea Scrolls, next to the latest Elvis and Bigfoot sightings. They exist only because the public continues buying them and, to some extent, believing them.

Or consider the popularity of astrology columns in daily newspapers. Even by the standards of professional astrologers (let alone the scientific critics who disassemble their every presumption), the general horoscope based only on the sun sign cannot possibly have any relevance beyond chance, yet they persist because the devouring public finds them entertaining or comforting. They perform a reassuring social function, which is not about to be vitiated simply because it has no scientific merit.

Nor can social pressures be overlooked. I doubt there is an American teenager alive who has not been made aware of the dangers of smoking, yet the knots of underage puffers around public schools during breaks suggest there is indeed a functional limit to education when it has to compete with social convention. Critics of creationism must not delude themselves into thinking throwing just the facts at their target will serve to counteract the powerful social metaphysic that drives acceptance of creationism.

Add to this already potent stew the pedagogical phenomenon that most practicing scientists are not in the habit of having to explain, especially impromptu, the underlying logic of their discipline to outsiders, especially those with little or no grasp of the basic terminology involved. The typical geophysicist is too busy *using* radiometric dating to justify its validity to creationists asserting the contrary, and such confident but insufficiently articulated expertise appears to the believer as exactly the sort of blind arrogance their source books warned them about.

For this reason, those called upon to actively defend the conventional scientific position are not always sufficiently skilled in the rhetorical techniques necessary to make their case clearly to a public already suspicious of them. An example of this occurred just as I began writing this book. In April 1998 a new science education guideline on the teaching of evolution was being proposed by the National Academy of Sciences, and sparked the customary creation/evolution media debate. PBS's *News Hour* duly assembled a quartet of appropriately balanced guests to thrash out the issue. A representative of the institution that helped draft the guidelines was countered by someone from Jerry Falwell's Liberty University, while from the "front lines" of high school education came two science teachers. One was a pro-evolution biology instructor, the other an earth science teacher who expressed at least an open mind towards creationist views (actually a *very* open mind, as it turned out).

What struck me most about their exchange was how quickly the creation advocates launched into certain specific claims, and how slow the evolutionists were to respond. Practically the first words out of the Liberty University spokesman's mouth concerned how the late evolutionary paleontologist Stephen Jay Gould had supposedly admitted to the lack of transitional fossils in the geological record. Likewise the creationist-ready earth science teacher noted how he found it difficult to believe in the evolution of whales because there were no known intermediate forms.

In the study of the debating tactics of creationists, the Gould matter is particularly notorious. Gould most emphatically did *not* believe there are no intermediate forms in the fossil record, as even a casual reading of his monthly columns in *Natural History* magazine would attest, and was downright annoyed at how often his views were misrepresented by creationists.[8] The remarks evolution critics have latched onto, and obviously adhere to with limpet-like tenacity, concern the *pace* of evolutionary change, not its *occurrence*. Gould and other advocates of what is called "punctuated equilibrium" contend that the fossil record is, in many instances, detailed *enough* to have preserved the sort of gradually changing forms predicted by conventional Darwinian theory. But instead of the smooth ramp-like progression suggested by that model, they argue that the available evidence favors a more staircase-like succession, representing comparatively rapid bursts

of evolutionary change (and by "rapid" we're talking about, say, under a million years), followed thereafter by relative stability.[9]

Given how persistently this misrepresentation is made by creationists, by now the evolutionary response ought to be primed on a Pavlovian hair-trigger (especially so given the debating principle to strike quickly and decisively). Instead, there intervened a painfully long chasm of airtime before the academic defender got around to it. Although it was admirable for him to note how Gould participated in drawing up the NAS guidelines in the first place, the fact remained that by then much of the advantage of momentum had been lost.

An even more interesting blundered opportunity for the pro-evolution side concerned the whale transitionals alluded to by the earth science instructor. Had he actually read much outside the creationist literature (which you would think a "science teacher" ought to), I can't imagine how he could have been unaware of the existence of intermediate whale fossils. For example, David Lambert's informative compendium, *The Field Guide to Prehistoric Life*, has been available since 1985, which discussed several early whales whose characteristics differ so markedly from modern ones to constitute at least intermediate aquatic forms. But more significantly, by the mid-1990s a whole sequence of even earlier "whales with legs" had turned up to clinch the case for their descent from land mammals.[10]

The details of these fossil whales will be breaching with some regularity later on, for they carry an import far beyond their evident utility as yet another "smoking gun" of evolution. Observing just how creationists contort themselves around such evidence represents the inversion of Polonius' suspicions about Hamlet's aberrant behavior: *There is a madness to their method*.

That screwball methodology is the common thread spiraling through the history of modern creationism, and is what isolates it from what might have served as its potential scientific roots. The major lights of mid-19th century science, from Baron Cuvier and Louis Agassiz on down, would all be regarded today as "creationists." They did not subscribe to any evolutionary explanations for life, but then neither did they accept the sort of simplistic Flood Geology favored by so many of today's Biblical creationists. Whether by Cuvier's catastrophism or Agassiz's glaciation, a catch-all Deluge was not prominent on the 19th century scientific menu, and became less so as the uniformitarian approach of Charles Lyell (at that time another non-evolutionist) came to dominate geological thinking. With the present now the key to the past, by the time Darwin appeared to give it his particular evolutionary spin, the essential outlines of the geological sequence were well established.[11]

Just how all these eminent 19th century creationist scientists might have amended their attitudes toward "evolution" in light of subsequent discoveries belongs to the undecidable contingencies of history. Cuvier, for example, never had a crack at explaining the weird Cambrian fauna of the Burgess Shale in British Columbia, which were only discovered at the turn of the 20th century (and their full evolutionary implications were not recognized until modern paleontologists reexamined them beginning in the 1970s).[12]

What we do know is what happened within science after Darwin's *On the Origin of Species* was published in 1859, and how certain believers in a Biblical interpretation of the world ultimately responded. Creationism never presented a rival theoretical structure, vying for scientific acceptance on the merit of its explanatory power. No substantive fieldwork or analytical experimentation was ever undertaken. Instead, creationism has been an entirely *reactive* enterprise, one of finding "reasons" not to believe whatever new information evolutionary science kept uncovering.[13]

To begin with, if all life had indeed been changeless since Creation (nice familiar lions and tigers and bears, oh my), with nothing else appearing on the stage since, there would have been nothing for evolutionary theory to explain. Under such conditions, Darwin might well have ended up but a scientific footnote for his methodical taxonomy of barnacles. But the record of ancient life was exactly the opposite. Strange extinct forms had existed in the past, and the farther back you went, the less they seemed like modern ones.

This looked enough like some sort of evolutionary process might be at work that many leading thinkers before Darwin (including his own grandfather, Erasmus Darwin) took a stab at explaining it. But always they snagged on the matter of *mechanism*, for modern science isn't very comfortable with just isolated observation. If you don't end up discovering some coherent substratum of

natural causation, from the scientific point of view there isn't much point in bothering. This attitude, by the way, is one some modern creationists rather pointedly do not adhere to, as shall be explored in due course.

The leading pre-Darwinian form of evolution was that ultimate "by-your-bootstraps" model of biological improvement, Lamarck's theory of inheritance of acquired characteristics. The idea was that, if only you pumped iron thoroughly enough, you might pass on those hefty muscles to your descendants without their actually having to work at it themselves. It was a very attractive idea (Darwin himself dallied with such explanations, as with the giraffe's neck), that hung over general science until modern genetics finally knocked it out of the court.

So what was this new "Darwinian" evolutionary theory that creationists get so riled up about? It has exactly two central doctrines. First, that every living thing is related, somehow, by common descent. And that means *everything* … from Madonna to the mushroom on her dinner salad—though which one (fungus or pop star) ought to be more upset at this relation is anybody's guess. But since there has been such substantial and observable *change*, evolution means more than just genealogy. It signifies descent with *modification*, and that idea constitutes what might be called the General Theory of Evolution. Darwin's special contribution concerned supplying for the first time a plausible naturalistic candidate for the engine responsible for all this modifying, the principle of "natural selection."

It took him quite a while to come up with the idea, though. First, there was his lengthy sea voyage as resident naturalist aboard HMS *Beagle* in the 1830s. Having just been exposed to Lyell's new uniformitarian geology, it was the biogeographical epiphany he experienced en route that started to drop the pieces into place. Unlike museum-bound experts like Cuvier, meticulously examining specimens submitted from afar, Darwin was bumping firsthand into life in the raw. Island after isolated island, each featured inhabitants simultaneously distinctive, yet curiously restricted only to types that might have migrated there naturally. And these in turn were so suspiciously similar to those of nearby landmasses to further suggest, not only where the newcomers had migrated from originally, but that, once arrived, they had evidently adapted to their special environments by somehow becoming separate species.

After he returned home, he encountered the gloomy views of Thomas Malthus, who argued more people were born than could possibly survive, and this got Darwin thinking about the fate of individual variations for animals in general. If useful and inheritable, would these not be preserved by a process of "natural selection" (akin to the artificial selection he was already familiar with from pigeon breeding), and so accumulate over time to generate entirely new species?

This was one of those deceptively simple concepts with far-reaching consequences, as Darwin himself evidently recognized early on. Like Copernicus cautiously sitting on heliocentrism until safely on his deathbed, Darwin kept the idea pretty much to himself for years, while he collected ever more buttressing data to withstand whatever storms of controversy might rage in the event he ever got around to publishing anything about it. And there matters might have remained, had his hand not been forced by another young naturalist, Alfred Wallace. Having knocked about his own set of isolated islands on the opposite side of the world, out past the Indian Ocean in the Malay Archipelago, Wallace had independently hit on exactly the same idea, and wrote the famed elder expert Darwin for his disinterested opinion of it.

Once out of the box, of course, the fuss over Darwinism was both understandable and inevitable. However much it might ostensibly embody the cherished icons of 19th century society, namely progress through individual competition, most everybody involved knew precisely where all this "common descent" stuff would lead if given half a chance. Whether they were scientists grappling with the technical argument or fulminating clerics defending their sacred turf, there was simply no way to cordon off the idea to preclude the eventual investigation of *human* ancestry (Darwin sidled around to the topic finally himself in 1871, with *The Descent of Man*).

Still, it is rather surprising how quickly the general concept of "evolution" (a.k.a. common descent) took hold in the sciences. By the 1880s even an academic backwater like the United States could barely scrape together a handful of practicing naturalists who didn't accept it, even if most couldn't quite yet swallow Darwin's particular mechanistic explanation for it. Over the next half-century what few non-evolutionary scientists hung on suffered the "death of a thousand cuts,"

as their views were rendered increasingly irrelevant and obsolete, buried under a pile of discovery. Mendelian genetics began to show how inheritable characteristics were preserved in little packets, and so wouldn't mush up into an averaged blend the way earlier non-evolutionists had expected. This realization eventually paved the way for the "Neo-Darwinian Synthesis" of the 20th century.[14]

And let's not forget the fossils. "Cave men" kept turning up, though in the rush a few would turn out to be hoaxes or misidentifications (like "Piltdown Man" and "Nebraska Man"), which later creationists would duly trot out as evidence of scientific mendacity. Furthermore, under the rubric of Herbert Spencer's Social Darwinism, human "evolution" was also being extrapolated willy-nilly to justify everything from Andrew Carnegie's abysmal labor relations to the ineluctability of European colonial dominance. Then as now, political doctrines and social prejudices were not isolated from the scientific process.[15]

As this tumult drew all the heavy fire, off in the disparate crannies of paleontology the last vestiges of non-evolutionary thinking were dissolving. Evolutionary theory dictated that every animal had precursors, and in the case of the mammals that meant some sort of reptile, one which would have lived in the period immediately preceding the earliest known appearances of true mammals. With the rowdy "dinosaur wars" behind them, 20th century paleontologists were poking around deposits of the earlier Permian period to see what the fossil record had to say. What turned up was a whole lineage of extinct reptilian models possessing exactly the sort of incrementally mammalian features evolutionary theory expected. In case you hadn't guessed, these included our trusty little Permian friends from my old dinosaur collection. Stars at last.

If all this had just been a matter of physical evidence, the issue would have been settled long ago. But along with the 20th century came all the anxiety and uncertainty sufficient to ignite the first modern effort to back pedal evolutionary science. Waves of immigration had dramatically changed the demographic character of America, and threatened to marginalize the formerly dominant Protestant culture. Then a surge in public school attendance began to expose the children of many devout families to the realities of modern scientific thinking for the first time, a science which had absorbed the evolutionary view decades before.[16]

The disillusionment brought on by the exhausting apocalypse of the First World War was abruptly followed by such diverse threats as Bolshevism and a permissive Roaring Twenties morality that openly flaunted the Prohibition movement so many of the creationists embraced. And if all that weren't bad enough, the arts and physical sciences were also in convulsion, from modernist art and music to quantum theory and Einstein's relativity. The same progressive urges that had inspired many activist Christians to promote child labor laws and the income tax at the turn of the century, now saw in "modernity" much to save their children from.[17]

Darwinism specifically became the focus for that conflict in 1921 when William Jennings Bryan unexpectedly launched an anti-evolution campaign. Having run unsuccessfully for president three times as a leading Democrat in the populist movement, Bryan had recently served as President Wilson's secretary of state, only to resign in pacifist outrage over the administration's increasingly bellicose response to Germany's employment of unrestricted submarine warfare. It was during his later war relief work that Bryan came to believe German militarism (which many regarded as the primary cause of the war) was but the virulent outcome of an unyielding "survival of the fittest" evolutionary philosophy. Bryan and others feared that such a mentality, left unchecked, would only bring on more war and labor exploitation.

That the popular perception of evolution included the not-unfounded conviction that it was the willing tool of atheism drew religious organizations into Bryan's crusade, most notably the World's Christian Fundamentals Association (founded in 1918). Over the next few years many state legislatures were importuned to ban the teaching of human evolution in public schools. It was this effort that attracted the attention of the newly-formed American Civil Liberties Union, and their decision to challenge the constitutionality of a new Tennessee statute resulted in the famous 1925 Scopes "Monkey" Trial that put the issue of evolution on the front burner in America.[18]

While the ACLU defense lined up squads of scientists to argue the scientific legitimacy of evolution, the Tennessee prosecutors discovered to their chagrin there *were* no scientific witnesses to call to testify for their side. This forced an abrupt change in tactics, from one upholding the statute's validity on empirical merit, to one resting solely on the state's legislative authority to

direct the content of public education. With *all* scientific testimony thus excluded (which meant a gaping hole in the defense's case), Clarence Darrow pulled the now-legendary maneuver of calling Bryan to the stand as expert on the only field remaining, namely the Bible. Darrow's withering cross-examination of Bryan on the peculiarities of Biblical exegesis elevated the proceedings to both farce and tragedy, for a week after the media circus concluded Bryan fell ill and died.[19]

The outcome was a draw for both sides. Scopes was duly convicted, but the ACLU was robbed of the opportunity to challenge the ruling at the federal level when the Tennessee high court overturned the conviction on a technicality. Press accounts of the proceedings painted creationism in very broad strokes, not only as retrograde defenders of religious bigotry, but as parochially *southern* ones. Though this was not representative of Bryan's movement initially, after Scopes the course of anti-evolution legislation shrank to a largely southern rural constituency.

In a pattern that would be replayed half a century later, the salient effect of all the publicity over the Scopes Trial was to induce a severe chill among textbook publishers. High school science books either downplayed or removed altogether references to evolution, including the one Scopes had used to trigger the Tennessee court challenge in the first place.[20] For this reason it was unnecessary to enforce any of these anti-evolution laws in the next decades, for no human evolution was actually being taught. This quiet lulled many in the scientific community into thinking that creationism had "gone away," when it had only dozed off.

Like Caesar's Gaul, 20th century creationism may be divided into three parts. God, of course, was always in charge, but the details of Genesis were open to considerable interpretation. The dominant view embraced by conservative Christians circa 1920 was what would eventually be known as the "Day-Age" theory. It accepted the basic outlines of conventional geology, and allowed fossils (including ancient man) to belong to past creation "days" of unspecified duration. For these Day-Agers, the "facts of science" were no problem at all.

But down in the trenches, significant changes were brewing regarding the finer points of creation chronology. Presbyterian minister Harry Rimmer promoted the more specific requirement that the history of *human* life not exceed the confines of traditional Biblical teaching, though non-human fossils could still be ascribed to a Pre-Adamic age of indeterminate length. Referred to variously as the "Gap" or "Restoration" theory, this second side of creationist doctrine has enjoyed broad denominational appeal. Believers as disparate as C. L. Scofield (of the influential *Scofield's Reference Bible*) and Herbert W. Armstrong's Worldwide Church of God favored it, as did those "bad boys" of modern televangelism, Jimmy Swaggart and Jim Bakker. The Jehovah's Witnesses have embraced support for both positions.

The distinctive third form of creationism sprang from the brow of Ellen White, founder of the Seventh-Day Adventists. Instead of passively accepting the standard geological framework, White insisted fossil life was actually the recent detritus of Noah's Flood (an event which "higher criticism" had supposedly banished to the moribund basement of mythological fantasy), and so stuff the entire picture back into a Bishop Ussher-sized chronological box. By thus reinterpreting the context of the fossil record, in one bold stroke White simultaneously resuscitated the theologically momentous deluge as a verifiable hydrologic event, and deftly pulled the rug from under evolution, which depended so heavily on the fossil sequence.

In 1923, self-taught "geologist" and Adventist convert, George McCready Price, tidied up White's Flood Geology for a more secular clientele in his book, *The New Geology*. Price, incidentally, was the lone "scientist" the Scopes prosecution could scrape up in 1925. Away in Europe at the time, though, he had to decline his spot in legal history. As for his arguments, mainstream science was still not impressed, including those evangelical scientists who founded the American Scientific Affiliation in 1941 when the American Association for the Advancement of Science (AAAS) began to seem too evolutionary for them. But all accepted the findings of uniformitarian geology, so en bloc dismissed Flood Geology as rank pseudoscience.

For those who wanted their Bible straight up, Flood Geology might have seemed ideal but for its Adventist associations. Flood Geologists also tended to regard Day-Agers as hopelessly spineless compromisers with standard geology. So for many years sectarian squabbling kept the three branches of creationism either at each other's throats, or at least glowering at each other over their stout denominational fences. That this distinctly fringe view would eventually be taken up by

most modern Biblical creationists may be credited to the unflagging enthusiasm of Henry Morris, a civil engineer whose study of Rimmer in the early 1940s led him to Price's book. Cleaving off any remaining Adventist connotations, Morris mutated Price's Flood Geology into the formidable doctrine of today's "Scientific Creationism."

All it took was the customary social crisis, this time after another World War had brought on even more upheaval. Though we tend to view the 1950s with "Leave It To Beaver" nostalgia, beyond the surface conformity of the suburban tract lots lurked the grimy paranoia of Joe McCarthy. With one well-aimed pelvic wiggle, Elvis Presley could send fundamentalist preachers into paroxysms of concern over modern "degeneracy," as pessimistic as their 1920s predecessors. When the Soviet Union was first into space with Sputnik, America's political leaders had to deal with the unsettling prospect of perhaps being fatally behind on the Cold War learning curve. Amid the furious effort to revamp the high school science curricula that ensued, the Biological Sciences Curriculum Study (BSCS) duly reinstated all the evolutionary work that had piled up since Scopes' day, and with that stimulus the somnolent creationist movement perked up in a hurry.[21]

That 1920s fundamentalism might stem from a profound dissatisfaction with modern life was understandable. What was to prove so unexpected for secular science was how these same processes acted along entirely new demographic lines, one accompanying the growth of large metropolitan areas. "Scientific Creationism" was no longer a rural southern eccentricity, but this realization had yet to invade the cultural and scientific establishments. This misperception was further reinforced by the evocative 1950s hit play about the Scopes Trial, *Inherit the Wind*, brilliantly filmed in 1960 by the leading issues director of the day, Stanley Kramer, just as the seeds of the new creationism were being sown. Those who relegated creationism to somewhere between "monkey gland" medical quackery and Salem witchcraft were in for a shock.[22]

As noted by anthropologist Christopher Toumey, there was also a deep theoretical division between 1920s creationism and its 1950s Flood Geology reincarnation. Those earlier creationists had focused on the issue of *human* descent, and did not (at least in theory) necessarily preclude significant evolution for everything else. Their objections hinged on the seeming determinism of evolutionary postulates, and its proponents were usually clergy. The new creationism of Henry Morris was enamored of "scientific" geological exposition, and affirmed the "slippery slope" implications of Darwinist thinking by opposing *all* significant naturalistic evolution. In a fascinating about-face, though, it was now not the *determinism* of that process that so bothered them, but its supposed *randomness*.[23]

While the BSCS project woke creationists up, it took a legal decision to get them moving. In 1968 the Supreme Court struck down a 1929 Arkansas statute actively banning the teaching of evolution, passed in the waning days of the post-Scopes chill. With the country thrashing out the issues of school desegregation and the Vietnam War, anti-evolution laws seemed as anachronistic as doilies on Danish modern furniture. All save Justice Black thought such laws *ought* to be unconstitutional; they just had difficulty agreeing on *why*. Some felt the law vaguely worded, others that it infringed on educators' free speech, but the tack the court majority ended up taking was that it sought religious establishment.[24]

This ruling set up a constitutional hurdle that forced creationists to adopt an equally gymnastic legislative strategy, one promoting "equal treatment" for creation and evolution. Provided one were thorough enough, a seemingly Bible-free "creation model" might be offered as an equally scientific contender with the "evolution model." (That the results just happened to coincide *exactly* with the old Biblical creationism could be sidestepped as further indication of how "genuine science" served in the end to affirm scriptural truth.) Many creationists would have preferred no evolution be taught at all, of course, but given the new legal circumstances, at least this approach attached to any exploration of evolution an appropriate creationist riposte.

Others in the creation movement tackled this equivalence issue differently. When Dale Crowley of the National Bible Knowledge Association unsuccessfully sued the Smithsonian Institution in 1978 over its evolution exhibits, it was on the grounds that taxpayer money was being spent to promote the "religion" of evolution (atheism in its trendy new garb of "secular humanism"). In the "equal time" taffy pull, while one camp insisted how *nonreligious* Creation

Science could be, their compatriots were simultaneously trying to haul evolution over the metaphysical wall to declare it just as *religious* as creation.[25]

The high water mark for this new phase of anti-evolution legislation came in the early 1980s. An increasing activism among conservative Christians was invigorated by the more general conservative realignment going on in American politics. The new Reagan administration sent encouraging signals to both abortion opponents and creationists, although neither sentiment translated into any substantive action at the federal level. While Jerry Falwell's "Moral Majority" duked it out with Norman Lear's "People For the American Way" in the public arena, efforts to affect the content of public school science education proceeded in about half the states.[26]

One of the first off the block was the 1981 "balanced treatment" act in Arkansas. Since it was the rejection of their 1929 anti-evolution statute by the Supreme Court that had started all this brouhaha, there may have been some haste in redressing the state's dishonor. The legislator who offered the bill manifested no familiarity with the scientific issues involved, and had simply copied the text from one proposed by creationist activist Paul Ellwanger, who in turn had relied on a draft concept by lawyer Wendell R. Bird. The law was promptly challenged, mainly by Arkansas clergy appalled at so bald an attempt to codify a rather narrow interpretation of Genesis in the public schools, as though it were the only rigorous alternative to evolution.[27]

In a turnabout of the Scopes era, the state's case now depended on demonstrating competent scientists accepted this particular category of creationism as sound science rather than sectarian mandate. They had a tough time. Mathematician Chandra Wickramasinghe was called to question the probability of life arising purely through random processes (which no evolutionist believed to begin with), but in the process repudiated the very creationism being offered as the alternate model. When physical chemist, and creationist, Donald Chittick was asked whether he could accept a scientific fact which conflicted with the Bible, he would not commit himself.[28] Given such testimony, the presiding Federal District Court judge found no reason to regard the law as any other than trying to further a religious purpose, and so ruled in 1982.

A parallel effort in Louisiana resulted in a 1981 equal time statute similar to the Arkansas act, except it was more deliberately worded to avoid triggering court disapproval. This survived all the way to the Supreme Court, which bluntly declared it unconstitutional in 1987, and signaled that mere packaging was not going to solve the problem.[29] Since then creationists have tended to focus on either revising the curriculum at the grass roots school board level, or bypassing the public school process altogether by disseminating their information directly through home schooling or Christian academies, as they had done for many years. With that, the situation fell into a reprise of the 1920s cease fire, again abetted by some textbook publishers who turned circumspect about offending potential markets with inadequately veiled references to evolutionary thinking in their high school science texts.[30]

Just as evolutionists were gearing up to joust with Creation Science, along came the "Intelligent Design" movement to turn the tables. In a way, it was the revenge of the American Scientific Affiliation approach to creation, which had never clutched at the deadening anchor of Flood Geology to begin with. Distracted by the glare of Henry Morris' fireworks, evolutionary writers were often too busy targeting the carrying capacity of Noah's Ark to notice the subdued emergence of religiously devout scientists and philosophers from the halls of academe. These new antievolutionists were holding up the Big Bang as the ultimate act of creation, while endeavoring to undermine the viability of naturalistic theories on the origin of life by challenging its very chemistry.

Of course, they still had to deal with that pesky fossil record, and resolve its many evolutionary implications. Arguably the most influential work here was Australian molecular biologist Michael Denton's 1985 *Evolution: A Theory in Crisis*. While Morris and Gish were wallpapering over their Biblical convictions to appear innocuous enough for secular consumption, Denton restricted his arguments exclusively to scientific issues and evidence, and consequently impressed a lot of people for whom "Creation Scientist" was just a synonym for crank. Following Denton's lead, lawyer Phillip Johnson put *Darwin on Trial* in 1991, biochemist Michael Behe pried open *Darwin's Black Box* in 1996, only to supposedly find nothing inside, and in 2000 biologist Jonathan Wells claimed to have exposed the faulty *Icons of Evolution*.

Well, maybe. Just how persuasive their concrete arguments are shall be thoroughly examined, but it is relevant to look beneath the rhetorical veneer, where lurks the same anxiety about living in "interesting times." As familiar external adversaries like the USSR disintegrated, and the PRC began trading in their Mao jackets for cellular phones and satellite launch contracts, closer to home, universities suffered infestation by "politically correct" pomposity, and the body politic convulsed over thorny diversity issues and gay rights legislation. In the end, the call to "round up the usual suspect" of Darwinism should not come as much of a surprise.

Although ostensibly unconcerned with the Flood, and adept at composing extended paragraphs utterly devoid of scriptural citation, the substantive content of Intelligent Design is not far removed from traditional beliefs. In their 1991 study of Biblical creationism, sociologists Eve and Harrold delineated these core concerns:

> 1) *The origin of the universe.* Was the universe divinely created, or has it always existed, or did it come into existence without any supernatural cause?
> 2) *The age of the universe and of the earth.* Are they billions of years old, or only thousands?
> 3) *The origin of life.* Was life divinely created out of nothing, or did it result from chemical processes in the "primeval soup" of the early earth?
> 4) *Biological evolution.* Once it appeared, has life changed through a process of evolution (descent with modification), in which new species appeared while others became extinct, or have all the kinds of living things remained the same (with only minor changes within categories)?
> 5) *Human origins.* Did humanity evolve by a process like that posited for other life-forms, or were humans especially and distinctly created?[31]

Measured by this taxonomy, Intelligent Design would part company with Creation Science only over the second issue (the age of the earth and universe), and consequently could be awarded a solid 80% on the "creationism index." By comparison, a theistic evolutionist who believed God really had "rested" after launching the Big Bang and archaebacteria billions of years before would drop to only 40%, while Phillip Johnson's bête noire, Richard Dawkins, could pitch his metaphysical tent squarely at ground zero.

One thing the new Intelligent Design wing has not had time to develop is the broad subculture characteristic of traditional Biblical creationism. Toumey has studied that structure in detail, and has discerned three levels of participation. A core leadership is surrounded by an inspired cadre, who then relate the authoritative position to a receptive (and surprisingly passive) body of general sympathizers.[32] That *passivity* is an important feature, for the creationist rank and file are apt to accept the pronouncements handed down to them with very little critical examination. When it comes to scientific criticisms of those views, however, they manifest exactly the opposite attitude, an unflinching *skepticism*. Though customary for those receiving revealed truth in a religious context, such hermetically sealed credulity is the very antithesis of the inquiring curiosity essential for the scientific process.

While those occupying the base of the creationist pyramid tend to reflect the attitudes of the population at large, the demographic mix of the upper two tiers is far more distinctive. The picture of an activist creationist is one of a socially conservative white male Christian, usually a Protestant, and predominately Republican—thus contrasting with the often marked radical progressivism of their 1920s counterparts. Furthermore, the serious creationist is more likely to be a scientist than a professional theologian, and more often deriving from a technical background like engineering or computer science, than one of the life sciences where the fiddly bits of nature cannot be so handily avoided.[33]

The exceptions to this overall picture are rare enough to be noteworthy. Eve and Harrold remarked how few Roman Catholics were involved in the creationist movement, citing Paul Ellwanger's involvement in the Arkansas legislative effort.[34] Michael Behe is a similar example from the Intelligent Design side, while political critics of evolution count among them Pat Buchanan and William F. Buckley (whose *National Review* magazine and *Firing Line* series on

PBS gave early prominence to Phillip Johnson). Part of the reason for this may be because the church hierarchy still smarts from the last time it weighed in on matters scientific, the Galileo case. (In that instance it only took the church 350 years to get around to admitting it had been a little bit mistaken there). But a more likely factor is that Catholic scientific thinking has adapted itself to aspects of evolutionary thought for long enough that the institutional support a Duane Gish might rely on from an evangelical pulpit is less available to someone of that faith drawn to creationist explanations.

An analogous situation is found with the Mormon Church, another popular denomination conspicuously absent from the creationist tide. While polling data suggest individual Mormons are more likely to hold creationist views than the general population, only Melvin Cook has managed to play even a minor role, seldom emerging above footnote status in the creationist literature.[35] With a far more recent experience of active persecution (including the martyrdom of founder Joseph Smith), and a practice of realistic political accommodation (abandoning polygamy as price for Utah's admission to the union), the leadership appears rather skittish about becoming embroiled in potentially contentious public debate, especially over issues that might spill over into unwelcome examination of essential church doctrine. So however much the Book of Mormon's version of pre-Columbian events may diverge from the conventional view, in marked contrast to the strident anti-Darwinist crusade of Protestant creationists, there has been no comparable effort to promote it as an alternative for public school history consumption.

Venturing farther afield, one encounters asterisks. While religion editor of the Washington *Evening Star* William Willoughby unsuccessfully sued the National Science Foundation in 1971, trying to force it to spend as much money promoting creationism as it had the BSCS project. Subsequently he moved on to edit a Scientology magazine. Those of us old enough to remember when L. Ron Hubbard's Dianetics inverted its collar to become the Church of Scientology, have watched its subsequent development from a safe distance.[36] Awash in controversy over its paranoid abhorrence of ex-Scientologists and mainstream psychotherapy, so far the Church institution hasn't ventured into the creationist fray, although a recent series of their cable channel commercials for Hubbard's books (caricaturing a shrill evolutionary lecturer) hints there is nothing doctrinal to stop them.

When it comes to the divisive issue of human origins, where there are still plenty of theological toes to be trod on, fairly few non-Christians have ventured into print about it. In 1995 Vine Deloria, Jr. articulated a Native American form of creationism in *Red Earth, White Lies*, while Michael Cremo and Richard Thompson's 1993 book, *Forbidden Archaeology*, presented a Hindu (Hare Krishna edition) conception projecting human activity far back through geologic time. A few antievolutionists profess no religious motivations at all, such as the prickly British neo-catastrophist Richard Milton, who exported his 1992 book, *Facts of Life*, to America in a 1997 edition, *Shattering the Myths of Darwinism*. Whether other religions, from Buddhism to Islam, can resist the temptation to weigh in on this subject, only time and good sense will tell.

Such exceptions do not detract much from the general observation that "creationism" remains a rather reactionary Christian hobby, and one restricted primarily to the English-speaking bloc. While there are a smattering of creationist societies around the world, such as the Netherlands and Turkey, what "international" flavor the movement has rests chiefly on foreign language editions of the works of Henry Morris. In this respect creationism might well be regarded as yet another insidious American social export, along with fast food franchises and stone-washed jeans.[37]

Isaac Asimov once observed the solar system consisted of "Jupiter plus debris." In the cosmos of professional creationism, Henry Morris performs the Jovian role. Outside the collegiate palisades of Intelligent Design, of eleven main creationist associations listed by Toumey, five are Morris' handiwork.[38] He was among the seminal "Team of Ten" who founded the Creation-Research Society (CRS) back in 1966. He and Rev. Tim LaHaye established the Christian Heritage College, and with Kelly Segraves these three set up the Creation-Science Research Center there in 1970. Morris has also had a long, though unofficial, link with the Center for Creation Studies at Jerry Falwell's Liberty University. Finally, after a schism with Segraves over denominational neutrality and political activism (Morris favored retaining church affiliation and focusing on

educational efforts), he established the influential Institute for Creation Research (ICR) in 1972, which serves as base of operations for the indefatigable Duane Gish.[39]

All these modalities serve to scatter creationist ideas out onto a conservative religious mindscape that absorbs them as readily as New Age believers do tales of crashed Roswell saucers or benign angelic messengers. Venture beyond Toumey's three tiers into the vox populi, and the average "creationist-in-the-street" customarily does not really *read* creationist writings directly, let alone the many scientific works critical of them. They may be absolutely certain there is something seriously wrong with radioactive dating, for example, but not because they have the foggiest notion what isochron calibrations are. Such lethargy is hardly the exclusive property of creationists, of course; the "evolutionist-in-the-street" can suffer from it too. But as we'll see in the coming chapters, the common failures of conventional thinking are compounded for the creationist by the congenitally flawed character of their original sources.

Creationism's success as *Kulturkampf* relies then on a pervasive antievolution mythology held by people only marginally familiar with the relevant sciences. Just how far up the philosophical food chain this extends was illustrated when former Supreme Court nominee Robert Bork felt disposed to sideswipe evolution in his 1996 diagnosis of the ills of modern American society, *Slouching Towards Gomorrah*:

> The major obstacle to a religious renewal is the intellectual classes, who are highly influential and tend to view religion as primitive superstition. They believe that science has left atheism as the only respectable intellectual stance. Freud, Marx, and Darwin, according to the conventional account, routed the believers. Freud and Marx are no longer taken as irrefutable by intellectuals, and now it appears to be Darwin's turn to undergo a devaluation.
>
> The fossil record is proving a major embarrassment to evolutionary theory. Though there is ample evidence of evolution and adaptation to environment within species, there is not evidence of the gradual change that is supposed to slowly change one species into another. A compelling argument for why such evidence is missing is provided by the microbiologist Michael Behe. He has shown that Darwinism cannot explain life as we know it. Scientists at the time of Darwin had no conception of the enormous complexity of bodies and their origins. Behe points out that for evolution to be the explanation of features such as the coagulation of blood and the human eye, too many unrelated mutations would have to occur simultaneously. This may be read as the modern, scientific version of the argument from design to the existence of a designer.[40]

This passage exhibits in dehydrated form all the methodological delinquencies of the creationist worldview. There is the ubiquitous conflation of evolution with atheism and radical politics, with the presumption that once these annoying obstacles are elbowed aside the business of spiritual regeneration will proceed unimpeded. Just what functional bearing all this could have on substantive questions like dinosaur phylogeny or variations in genetic sequencing never occurs to Bork, who is in far too much a hurry sprinting for the light to offer adequate citation. He did refer us to Behe's aforementioned book, *Darwin's Black Box*, which unfortunately did not discuss the fossil record or the speciation process at all. In fact, in one of the more remarkable declarations in the antievolutionist canon, Behe actually agreed that all living things are apparently related by common descent—a notion more prosaically known as "evolution." That Bork could skip past this stupefying concession should not be unexpected, for Behe managed to sidestep all its implications rather gingerly himself.[41]

As the evidence in the following chapters shall make plain, far from being a "major embarrassment" to evolution, the fossil record has abundantly comported to its expectations. Furthermore, despite Bork's authoritative tone about evolution only occurring "within species," the fact remains virtually all creationists (let alone evolutionists) admit quite the opposite. They endeavor to cordon off its nasty effects, of course, by dismissing the process as merely "microevolution" within amorphous "types" (the current buzzword replacement for the more

obviously scriptural term, "kinds"). Like Behe and his shallow acquiescence to common descent, though, creationists "accept" speciation with one hand and push it away with the other, for they *never* apply this insight to evaluate life in the past. For quite sound reasons, as it happens, for once you start playing the speciation "connect-the-dots" game you end up with theologically unacceptable chains of "macroevolutionary" transformation. Better then to just not play.[42]

Bork evidently thought it perfectly acceptable analytical protocol to submit these sweeping generalities without even a nod at documentation. He may well have thought them so apparent and reasonable no corroborative citation was necessary, just as some pages ago I saw no need to buttress my claims about the scientific vacuity of astrology (though rest assured I am perfectly capable of it). But since the evolutionary character of the fossil record and the objective status of speciation are so at odds with Bork's account, something more than thin air should have been tendered in defense. This is doubly ironic, given how finicky Bork was about several Supreme Court rulings during his confirmation hearing, criticizing their supposed reliance on "penumbral" constitutional rights inadequately specified to his satisfaction. Here Bork has conjured up his own penumbral fossil record, and hung on it the sins of the modern secular world.

What effect this cavalier conceit might have had on matters of creationist litigation had Bork been confirmed to the court is anybody's guess. We already have the example of Justice Scalia, who dissented from the 1987 ruling striking down the 1981 Louisiana "balanced treatment" law, and was joined in this opinion by Chief Justice Rehnquist. Neither jurist apparently discerned anything even remotely scientifically spurious about the "creation model" under consideration, giving one pause to wonder to what degree a grounding in basic scientific principles has penetrated American legal education.[43]

Creationism is thus far from constituting a dead horse, so calling it soundly to task ought not to invoke the ASPCA. It is a most lively creature, trotting about as close as the Supreme Court or your neighborhood school board. The specific impulse for my writing this book, in fact, was an effort by activists in a nearby community to tilt the public school curriculum in the creationist direction. Amid all the editorial exchanges printed in our local newspaper commenting on this hubbub, it transpired defenders of the antievolutionary hard line were no longer firing Henry Morris or Duane Gish as their heavy bombards, but Phillip Johnson, Michael Behe, and Richard Milton. Clearly a thorough examination of this "new" creationism was in order, even if it did mean adding another title to the already voluminous bibliography of critics of traditional Biblical creationism.[44]

My analysis of creationism will consist of as thorough a presentation of the evidence as I can muster. But because so much of my complaint concerns the methodology by which such information is evaluated, I will have much more to say about the level of scholarship manifested by those I examine. That is one lesson drummed into me from my university methods course—you can often tell a lot about an argument just by the character of the reference trail. And there, creationist authors are the veritable mother lode. No gaff in Aristotelian logic is beyond their reach.

Underlying all this is the presumption that there are objective standards of evidence. Ones that not only can be openly displayed, but *must* be, and most rigorously applied. Without that, no discipline can survive, for nothing can be concluded if nothing is allowed to *mean* anything. In the case of creationism, there is the singular temptation, when the factual going gets especially rough, to chuck it all overboard and deny the very applicability of scientific inference. The current record holder in this event is Phillip Johnson, who has devised a "theistic realism" to replace the "methodological naturalism" that, left unattended, permits all those evolutionary conclusions he is certain ought not to be.

In the real world, the utility of a tool is established by the using of it. Not *promising* to use it—one of these days, once you bother to get around to it. And a dead giveaway of a sterile philosophy is one reluctant to step down from rarified theory and actually *explain* things. Besides, when truly in command of the evidence, nothing is more entertaining than calling your opponents to account on matters of fact. So no one but a blockhead is going to willfully avoid taking their best shot. And when they don't (and creationists consistently don't), I know something is up, for an idea worth having is one worth defending.

Or put another way: *By their fruits shall ye know them*.[45]

NOTES to the Introduction

[1] For example, in the absence of atmospheric drag the second integral of acceleration quantifies how far an object will fall over a specified time. A plot of the changing velocity produces a diagonal line (which would be shallower for lunar gravity, steeper for Jupiter). At any given moment, the acceleration is the slope of that line (which happens to be a constant), while the accumulated area beneath represents the distance covered. That there was a *spatial* aspect to these seemingly abstract formulas was for me a most exhilarating connective discovery.

[2] Years later I discovered Donald Patten's 1966 work, *The Biblical Flood and the Ice Epoch*, and suspect this was my physics teacher's inspiration. Besides the fact that Patten came from our state of Washington, the revealing feature was that he specified an *ice* canopy for his deluge source, when the preferred creationist term was *vapor*. Ronald Numbers (1992, 254) noted Patten's efforts at formulating a purely "scientific" explanation for the Flood failed to impress the more theologically fastidious creationist.

[3] Though the Yale mural included some of the early eccentric reptiles that will figure so prominently in the creation/evolution debate, Peter Ward (2000, 49-51) noted the conspicuous absence of the most important protomammals then known. Gould (1993, 8-9) illustrates the famed dinosaurian segment, while the full panorama is available at the Peabody Museum website (peabody.yale.edu/mural/). The molds for many of the "Yale series" are still in sporadic use today, though rarely executed with the comparative precision of the originals.

[4] I must commend David Norman's excellent dinosaur encyclopedia (1985a), which particularly ignited my imagination. A world authority on the large Cretaceous herbivores, the iguanodontids (which also turned out to play a recurrent role in this present work), Norman concisely described both the fine details and legitimate controversies of modern paleontology, while John Sibbick's stunning illustrations captured the vitality of these long lost creatures.

[5] While Bakker (1986) defends dinosaur endothermy (warm-bloodedness), Fastovsky & Weishampel (1996, 328-355), Kevin Padian, "Physiology," in Currie & Padian (1997, 552-556) and Dingus & Rowe (1998, 224-227) favor a metabolic mix: functionally endothermic predatory theropods versus large herbivores managing quite well on ectothermy (cold-bloodedness). Cf. Dalton (2000d), Stokstad (2001c) and sciencemag.org/cgi/content/full/291/5505/783a on the problematic *Thescelosaurus* "heart" fossil of Fisher *et al.* (2000).

[6] A sample of perspectives: Gore (1989), Eldredge (1991b), Jon Erickson (1991), Raup (1991), Whitfield (1993, 182-187), Glen (1994), Peter Ward (1994; 2000), Palmer (1999, 90-91, 126-129, 196-197), Ward & Brownlee (2000, 157-188), Gibbs (2001c), Jablonski (2001), Kerr (2001), Zimmer (2001g, 143-186) and Becker (2002). Cf. also Robert Ehrlich (2001, 102-121) on the iffy "Nemesis star" theory and Parker (2003, 293-295) for arguments on a galactic scale. Erwin (1996) and Hoffmann (2000) cover the intense Permian event that decimated even the usually imperturbable insects, and Walkden *et al.* (2002) notes a possible Triassic impact event. Another culprit may be magmatic plume breaches, Malcolm W. Browne, "New Clues to Agent of Life's Worse Extinction," in Wade (1998a, 73-79) and Courtillot (1999). Spun off by plate subduction, these normally spawn volcanic chains like the Cascades or Hawaiian Islands, but the Permian Siberian Traps and Cretaceous Deccan Traps of India may represent plumes reaching the surface. Volcanic gas emissions (notably carbon dioxide and sulfur, but also chlorine and fluorine) have been implicated in the collapse of marine ecosystems, Malcolm W. Browne, "Mass Extinction of Permian Era Linked to Gas," in Wade (1998a, 80-85). Carlisle (1995) defends the Chicxulub (Yucatan peninsula) asteroid impact as *coup de grace* for the dinosaurs, while Dingus & Rowe (1998, 11-104), Courtillot (1999, 119-134) and Lubick (2001) place this in the larger context of the many competing theories. Keller *et al.* (2004) indicate the impact predates the actual K-T boundary by some 300,000 years, which may suggest it contributed to a cascade of events rather than initiating a rapid die-off on its own. These flash points aside, about 95% of all extinctions occur as a sort of natural background level, Raup (1994, 6760). Fastovsky & Weishampel (1996, 388-390) note, though, there appears to be a general *decline* in this background rate at the *family*

level—all the more interesting, given the increasingly sparse nature of the fossil record the farther back in time one samples.

[7] See Ecker (1990,10), Eve & Harrold (1991, 4, 32, 163-166), McKown (1993, 65n) or Ruth Brown (2002, 280) on polling data, with the numbers falling only slightly below belief in UFOs. Teachers reflect creationist sympathy in the general population when it comes to "equal time" public school instruction, William E. Ellis, "Creationism in Kentucky: The Response of High School Biology Teachers," in Hanson (1986, 73-90), Aguillard (1999, 185) on Louisiana, Schick & Vaughn (1999, 6-7) and the Weld & McNew (1999) survey. My old high school physics teacher was therefore not so anomalous. Cf. Cole (1987) polling college students.

[8] See Gould (1983, 259-260; 2002a, 986-990), Laurie R. Godfrey, "The Flood of Antievolutionism," in Eldredge (1987, 219-221), or Ecker (1990, 158-159).

[9] See Eldredge (1991a, 34-58) or Gould (2002a, 745-1024) for punctuated equilibrium from the horses' mouths, and Sonleitner (1987), Schwartz (1999, 320-330) or Shermer (2001, 97-116) on the controversy. Rather than seeing speciation as a case of A "slowly" adapting into B, equilibrium contends B is more often a "rapid" geographic spin-off from a parent A (which may persist relatively unchanged on its own). That this is less revolutionary than it sounds is seen in Levinton & Futuyma (1982), Simpson (1983, 171-176), Dawkins (1986, 223-252), Berra (1990, 48-50) and Kenneth Miller (1999, 111-121). Gamlin & Vines (1986, 18-19) and Whitfield (1993, 178-181) illustrate this regarding the remarkably detailed 4.5 million year showcase of fossil invertebrates at Lake Turkana in Kenya.

[10] Lambert & The Diagram Group (1985, 198-199) and Gould (1994c). See Zimmer (1998) on the new whale fossils and their implications for macroevolutionary processes in nature.

[11] See Simpson (1983, 59-62), Strahler (1987, 296) or Eldredge (1982, 98-101; 2000, 103-107) for compact surveys of the development of the 19th century geological system, and Gohau (1990) for a fuller discussion. The latest absolute chronology for the various periods may be found in any good encyclopedia or geology source (the advent of radiometric dating greatly expanded the time frame of the Precambrian era). Palmer (1999) from the *Discovery Channel* is topical and effectively illustrated, particularly on global continental configurations—but for a grand overview of the current picture, Hartmann & Miller (1991) is a hoot. The digest version: once the initial bombardment of planetary material that formed the earth dropped to the point where things like an atmosphere and oceans could avoid being obliterated by incoming, life originated. Whether this occurred by brute chemical processes or divine fiat is the hotly contested issue, of course. But whatever the cause, this still took place *very* early in earth's history (by around 3.5 billion years ago, if not before). Life then spent the next three billion years in a bacterial rut, such as the plucky cyanobacteria, whose toxic excretion (oxygen) so many later life forms would grow so fond of. Once animal life worked out first how to be multicellular, and then how to devour one another more expeditiously, around 540 million years ago there commenced the "Paleozoic Age," consisting of the Cambrian, Ordovician*, Silurian, Devonian*, Carboniferous, and Permian* periods (the asterisks denote those punctuated by the most severe mass extinctions). Fish, land plants, insects, amphibians, and reptiles had all developed by the time the Permian stumble took place about 245 million years ago, which ushered in the "Mesozoic Age" (the Triassic*, Jurassic, and Cretaceous* periods) the dinosaurs and early mammals and birds called home. The lesser K-T gearshift 65 million years ago brought on the present "Cenozoic Age" of Henry Morris and Phillip Johnson.

[12] The range of modern interpretation of the Burgess Shale is well illustrated by contrasting Gould (1989, 1998c) with Conway Morris (1998a,b). The issue that has provoked some pungent debate concerns Gould's proposition that life's history was largely contingent (in which a replay would likely produce very different outcomes). While characterizing this as the "least interesting" feature of Gould's argument, Johnson (1991, 167) nonetheless endeavored to impress it into his "intelligent design" view of life, ironically reversing the stance of the Burgess's discover, Charles Walcott, who downplayed the anatomical disparity of the Cambrian fauna because it did not fit into his narrow Belle Époque brand of theistic evolution.

[13] Numbers (1992) provides the most thorough coverage of the history of traditional Biblical creationism. Eve & Harrold (1991) explore its sociological features, noting how only the radical animal rights movement has been so successful in challenging the presumptive authority of the scientific establishment (I would include anti-nuclear advocates as a third such group). Toumey (1994) examines creationism from the point of view of cultural anthropology, showing how the caricature of creationists as ill-educated Bible-thumping louts is both inaccurate and misleading to a genuine understanding of the source for their convictions. Larson (1985) surveys anti-evolution legislative efforts, especially as they related to science education. For 19th century scientific reactions to Darwinism, see Edey & Johanson (1989, 84-101); its subsequent "evolution" is concisely described in Futuyma (1982, 23-43) or Whitfield (1993, 10-17).

[14] See Edey & Johanson (1989), Mayr (1991), Schwartz (1999, 4-10), Zimmer (2001g, 3-55) or Gould (2002a, 503-591) for the genesis and development of Darwin's theory, and Gamlin & Vines (1986) or Whitfield (1993) for effective practical illustrations for a general readership. Eldredge (2000, 62-89) relates the issues to the creation/evolution debate. Bowler (1983) surveys the scientific rivals of "Darwinism" at the turn of the 20th century (by then no form of "creationism" was an active player, incidentally). Livingston (1987) examines how 19th century American evangelicals were not uniformly opposed to evolution—and creationism remains a minority position at American theological schools today, Witham (2002, 190-191).

[15] See John R. Cole, "Scopes and Beyond: Antievolutionism and American Culture," in Godfrey (1983, 18-21) on Social Darwinism and its relationship to populist antievolutionism. Ruse (2001, 170-185) noted how "evolution" has been pressed into service by a wide range of ideologies, from Karl Marx and Russian anarchist Peter Kropotkin to Herbert Spencer (who coined the phrase "survival of the fittest") and John D. Rockefeller. Though cf. Gould (1991, 325-339), Chernow (1998, 154) and Ryan (2002, 25-31, 35-36). Futuyma (1982, 208-213) contends such misuse of evolution stemmed from "the fallacy of naturalism" (whatever exists is necessarily good or desirable), a secular faith tracing back long before Darwin to Rousseau, and exemplified by evolutionists like Julian Huxley. Cf. also James Burke (1985, 268-273).

[16] Larson (1985, 24-27; 1997, 23-24) and Eve & Harrold (1991, 21). See Larson (1985, 15-24) for examples of the evolutionary content of science texts of the period.

[17] Larson (1985, 30-39; 1997, 33-39). See also Gould (1991, 416-430) on "William Jennings Bryan's Last Campaign." Further fueling the disquiet of postwar Biblical traditionalists was the fact that "higher criticism" of the Bible had begun among *German* scholars, thus allowing the conflation of pacifist xenophobia with fears about materialist assaults on the godly American way of life. Although the German element has understandably faded in importance in the decades since, conservative Christian analysts like Thomas & Farnell (1998) continue to relate the practice of Biblical criticism to underlying evolutionary presumptions.

[18] Larson (1997) is the new benchmark for the Scopes trial, garnering a Pulitzer Prize; Larson (1985, 58-72), Ecker (1990, 173-176) and Randy Moore (1998a,b) provide more condensed coverage.

[19] An ironic twist to the timing of Bryan's death: Larson (1997, 38-39) noted that "the aging Commoner moved to Miami for his wife's health and got in on the ground floor of the historic Florida land boom of the early twenties. Although publicly he played down his profits, the spectacular rise in land prices made Bryan into a millionaire almost overnight." Bryan did not live into the following year 1926, when a devastating hurricane burst the Florida real estate bubble (giving another meaning to "Inherit the Wind").

[20] See Grabiner & Miller (1974), John R. Cole, "Scopes and Beyond: Antievolutionism and American Culture," in Godfrey (1983, 22-23), Larson (1985, 84-88), Eve & Harrold (1991, 27) and Randy Moore (2001a). The downplaying of "evolution" in American science education extended into mid-century, as Gould (1999a, 139) and Kenneth Miller (1999, 10-11) recalled from personal experience. See also the 1961 essay by paleontologist George Gaylord Simpson, "One hundred years without Darwin are enough," excerpted in Mark Ridley (1997, 369-378). Incidentally, Gould (1991, 428-429) noted the Scopes textbook, *A Civic Biology* (1914) by William Hunter, made the "egregious claim that science holds the moral answer to questions about

mental retardation, or social poverty so misinterpreted." Similarly, Larson (1997, 23) reminded that the view of "Darwinism" being promoted in early 20th century American biology texts "was decidedly anthropocentric and heavily laced with the scientific racism of the day." See also Black (2003, 75-76). Alas, it took a lot longer to expunge those faulty interpretations from social science and popular culture than to excise references to Darwinian evolution.

[21] Toumey (1994, 23-24) describes the 1950s milieu. The BSCS project is still very much active, by the way, as noted by Witham (2002, 74-79).

[22] During this period arch-skeptic Martin Gardner (1957, 123-139) dissected Price and Rimmer as one might extinct life forms. Coming himself from a deeply religious background, Gardner had been impressed by Price in his youth, but that dalliance failed to survive a strong dose of college level geology. Ravitch & Finn (1987, 66) noted that a disconcerting 62.8% of students surveyed didn't know what the Scopes trial was about. Unfortunately, they still might not get an accurate picture if all they relied on was *Inherit the Wind*, since both play and film took considerable dramatic liberties with the trial, Randy Moore (1999e). William Jennings Bryan being a Day-Age believer, the fictional Brady's affirmation of literal 24-hour creation days was clearly an exaggeration. Likewise, the fairly sympathetic views Drummond on the defense expressed towards the Bible as philosophy contrasted with the uncompromising atheism and determinism of the real Clarence Darrow. All this has proved grist for social conservatives, such as one website (bible.ca/tracks/textbook-fraud-scopes-trial-inherit-wind.htm) which labeled the film "Intellectual Pornography!" The chapter Phillip Johnson (1997, 24-36) devoted to setting the record straight on the historical inadequacies and larger social impact of *Inherit the Wind* was only somewhat less effusive. Johnson (1997, 121) cited Larson (1997) as his primary source, along with the shorter Iannone (1997). Like Johnson, Iannone dissected the play's content without relating it to its historical context (smack-dab in the middle of the conformist 1950s McCarthy era). Incidentally, Iannone offered Phillip Johnson as her primary defense for the contention that "the proof for Darwin's theory remains spotty." Both Iannone and Johnson skirted the thorny topic of Biblical analysis. So, although calling the play "a bitter attack on Christianity, or at least the conservative Christianity that considers the Bible to be in some sense a reliable historical record," Johnson did not venture which Scripture (if any) being thrashed over by "Brady" and "Drummond" qualified as historically valid. Instead, this "smear" against all Christianity was embedded in Johnson's own experience: "Just how ugly the smear is came home to me the first time I saw the movie, in a theater next to Harvard University (at a time when I would have called myself an agnostic). The demonstrative student audience freely jeered at the rubes of Hillsboro, whooped with delight at every wisecrack from Hornbeck or Drummond, and reveled in Brady's humiliation. It occurred to me that the Harvard students were reacting much like the worst of the Hillsboro citizens in the movie. They thought they were showing how smart they were by aping the prejudices of their teachers and by being cruel to the ghost of William Jennings Bryan—who was probably a much better man than any of them," Johnson (1997, 30). Of course, it may be argued that theater and film are almost guaranteed to distort historical subject matter no matter what their philosophical perspective; see the assorted essays in Carnes (1995) ranging from Hollywood Biblical and costume epics to trendy liberal message pictures and Soviet agitprop. But given how subsequent college audiences would cheer as the Millennium Falcon jumped into hyperspace to escape the evil designs of Darth Vader, one ought to be careful about attributing too much depth to the temporary enthusiasms of young people responding to a dandy script and stellar acting. *Inherit the Wind* appeared just as the civil rights movement was getting into full swing, so I suspect a good measure of northern liberal collegiate response played off its stereotype of rural Southern bigotry as much as any ideological sympathy for naturalistic evolution. As for the sort of pseudoscientific arguments actually offered by Price or Rimmer back in the 1920s, Johnson has consistently restricted his commentary to such vagaries as "some creationists really have made crazy arguments," Johnson (1997, 41). The methodological issue of the means by which a particular argument might be determined to be "crazy" will recur as a persistent defect in Johnson's approach to the evolution debate.

[23] Toumey (1994, 49). Like it or not, stochastic (random) effects pervade biological processes—see Smolen *et al.* (1999), Azevedo & Leroi (2001) contrasting McAdams & Arkin (1997) and Britten (1998), or Fedoroff & Fontana (2002) re Elowitz *et al.* (2002). Interestingly, a deterministic orderliness can emerge from the underlying genetic "noise" via "stochastic focusing," Paulsson *et al.* (2000) and Berg *et al.* (2000). See also Kepler & Elston (2001), Swain *et al.* (2002) and Sasai & Wolynes (2003) on theoretical modeling. The downside: such leaky randomness can also be exploited by pathogens or otherwise lead to disease, Arkin *et al.* (1998) and Cook *et al.* (1998).

[24] See Ecker (1990, 79), Shermer (1997, 154-172) and Randy Moore (1998c,d; 1999a) on Epperson *v.* Arkansas; Larson (1985, 98-119) also covers the state adjudications leading up to the federal case. Larson noted Black's rural Alabama Baptist background may have influenced his differing opinion. Sharing the populist Democratic tradition with Bryan, Black had been elected to the Senate with strong support of the KKK (whose very long list of things they didn't like included evolution). Cf. Hamburger (2002, 422-434, 454-476). Larson (1997, 250-257) further relates the case to the Scopes mythos, noting that Abe Fortas ("a working class Jewish boy growing up in the Baptist citadel of Memphis") was a high school student during the 1925 Dayton trial. "Fortas dearly wanted to decide the Epperson case, and did so as one of his last majority opinions before a financial scandal forced him from the bench," Larson (1997, 254).

[25] Toumey (1994, 49).

[26] See Eve & Harrold (1991, 146-160) for a general survey, and Lloyd Bailey (1993, 202-204) for a short catalogue of specific state efforts.

[27] See Edwords (1982a), Ecker (1990, 133-138) and Randy Moore (1999b) for a discussion of the court challenge, McLean *v.* Arkansas. McKown (1982) explores the role of Wendell Bird's convoluted definitions in the Arkansas case, and Eldredge (1982, 86-87; 2000, 93-94) tellingly compares Bird's 1978 ICR summary of Creation Science beliefs with the very similar language of the Arkansas Act 590. Participants on both sides have offered commentary, from philosopher Michael Ruse, "A Philosopher's Day in Court," in Montague (1984, 311-342) to Gilkey (1985), a liberal theologian with considerable misgivings about the proposed law's implications for religion. Gilkey and Hanson (1986, 189-213) also included the full texts of the statute along with Judge Overton's ruling. The ruling solo appeared in Wilson (1983, 206-222) and Montague (1984, 365-397). Although affirming literal Biblical creation at the trial, Donald Chittick (1984, 253) discussed neither the details nor the ruling except to castigate the news media for its "distortions" of the case (none of which he enumerated). He referred the reader instead to "a fairly thorough documentation of this" by another of the creation witnesses, Dr. Norman Geisler of the Dallas Theological Seminary, in his book *The Creator in the Courtroom*. The Geisler is currently out of print, though McIver (1988a, 2; 1988b, 85) suggests it is useful but flawed. Geisler achieved some notoriety at the trial when he revealed UFOs were "a satanic manifestation in the world for the purpose of deception," and that he had gleaned this intelligence from that authoritative compendium, *Reader's Digest*, Gene Lyons, "Repealing the Enlightenment," in Montague (1984, 358), and Gilkey (1985, 76-77). Cf. McIver (1987, 9). Creationist physicist Robert Gentry (1986) sprinkled discussion of his and other testimony through his book, which is primarily a defense of his "polonium halo" claim for a young earth (see chapter three).

[28] Larson (1985, 160). Of those testifying for the creation model, Berra (1990, 134-136) noted half were members of the Creation Research Society (five in number, including Chittick). Wickramasinghe's better-known antievolutionary colleague is the late physicist Sir Fred Hoyle, whose barricading of Steady State cosmology from the encroaching Big Bang hordes is also pressed into service by Young Earth creationism. Rather disingenuously, Morris & Morris (1996b, 190) remarked that Wickramasinghe "was even willing to testify for the creationist side at the creation law trial in Arkansas in 1981." There were no references, and the Morrises did not explain to their readers that Wickramasinghe did not support the ICR version of creationism.

[29] The Edwards *v.* Aguillard case is discussed in Ecker (1990, 72-76) and Randy Moore (1999c,d). Larson (1985, 147-163) wrote prior to the 1987 Supreme Court ruling, but did describe the concurrent Arkansas and Louisiana legislative efforts in some detail, including Wendell Bird's more

active involvement in the latter case. Cf. also Ruth Brown (2002, 226-233) on creationism efforts in Tennessee.

[30] Stuart Hughes (1983) and Eve & Harrold (1991, 9-10).

[31] Eve & Harrold (1991, 3).

[32] Toumey (1994, 240-245).

[33] Toumey (1994, 231-237), who noted that Jerry Falwell entertained a career in engineering before heeding the call to evangelism. See also Ecker (1990, 77-79), and John W. Patterson, "An Engineer Looks at the Creationist Movement," in Zetterberg (1983, 151-161). Numbers (1992, 233) related why horticulturist Walter Lammerts expelled compatriot R. Laird Harris from the Creation Research Society in the mid-1960s as a heretic: "Harris not only opposed the majority view of a literal six-day creation but, worse yet, earned his living mainly as a theologian, a professional type Lammerts held in low esteem." Interestingly, Boyer (1992, 304-305) identified a similar science/engineering background and aversion to theologians among recent prophecy writers. Eldredge (1982, 16-17) recognized the populist streak underlying modern creationism, though that feature has followed an exclusively conservative trajectory in the decades since. While populists from the left and right are perfectly capable of intersecting over specific issues (as Ralph Nader and Pat Buchanan did recently in their surreal joint opposition to free trade legislation), antievolutionism appears not to be a unifying theme for those intractably suspicious of Big Business or Big Government.

[34] Eve & Harrold (1991, 126, 132).

[35] Numbers (1992, 308-314). "An official church position on the age of the earth (or the processes by which it was created) does not exist," according to Newell (2000, 14), and Witham (2002, 176-177) notes BYU teaches evolution. Cf. Ruth Brown (2002, 76).

[36] See Eve & Harrold (1991, 145, 201-202n) on the Willoughby matter. Despite its current popularity among the Hollywood glitterati (such as John Travolta and Tom Cruise) the organization's creepier past is difficult for me to overlook. I freely admit to having found Hubbard (1950) 400 pages of sustained drivel. Gardner (1957, 263-280) described its therapeutic inadequacies before it started running into opposition from medical review boards, whereupon (in America at least) it found refuge behind the constitutional shield offered by freedom of religion. For a litany of early criticism guaranteed to give current church members conniption fits, see Paulette Cooper (1971), Godwin (1972, 76-99), Evans (1974, 17-134), and for meringue, Randi (1980, 246-248). Rowley (1971, 42) described Scientologists he encountered back then as "people very on the ball, people very efficient, people always smiling in a forced way, people ludicrously nasty, people charming, suspicious, likable, touching, beautiful."

[37] See Numbers (1992, 323-335) on creationist organizations around the world; also Strahler (1987, 472), Numbers, "The Creationists," in Ruse (1988, 248), MacKenzie (2000, 38), Koenig (2001) and C. Brown (2002, 110). The listing of 100 "Creation Science Organizations" by Scott Huse (1997, 174-183) had 71 for the United States and 21 for Britain, Canada, Australia, New Zealand and South Africa—the remaining 8% were represented by one each for Brazil, Germany, India, Korea, Mexico, Netherlands, Spain and Sweden.

[38] Toumey (1994, ix).

[39] Besides the comprehensive account in Numbers (1992), see Eve & Harrold (1991, 120-135) for clear passage through the forest of creationist organizations, in and out of the Morris preserve. An interesting connection concerns Purdue-trained geneticist Lane Lester, an "alumnus of the BSCS textbook project, who had been rescued from evolution by Gish," Numbers (1992, 290). Having worked for many years as a research scientist for Morris, Lester became director of Liberty's Center for Creation Studies in the 1980s, and set up its "Museum of Earth and Life History," which Harding (2000, 219-226) explored during her research on Jerry Falwell. One display offered "evidence of the Flood: a bird's nest containing a fragment of Noah's diary (Birdis Nestialis Noahinsis); a piece of Indian Corn extracted from the mouth of a woolly mammoth (Acornis Copi); and a black frame case with a dozen small animal bones sticking out of a bed of unadorned plaster of paris," Harding (2000, 223). When Harding questioned Lester about this "overtly preposterous" exhibit he acknowledged it was a student joke. The problem was nothing on the display indicated

that to the unwary observer. Eventually the exhibit was removed—and the museum itself was closed in the mid-1990s (ostensibly for budgetary reasons).

[40] Bork (1996, 294). In his highly critical 1997 review of Behe's book for *Boston Review* 21(6):28 (available online at bostonreview.mit.edu/br21.6/orr.html, with responses by Behe, Phillip Johnson, and others) evolutionary biologist H. Allen Orr remarked: "Revealing his expertise on such things, Bork misidentifies Behe as a 'microbiologist,' not a biochemist." The review may also be found online at the "Talk.Origins Archive" website (talkorigins.org), a most useful clearinghouse for information on the creation/evolution controversy, with many links to sites pro and con.

[41] Behe (1996, 5), where he stated "I find the idea of common descent (that all organisms share a common ancestor) fairly convincing, and have no particular reason to doubt it." He then thought no more about it. Behe's serpentine concessions on common descent and related topics turn out to be play a pivotal philosophical role in how Behe has managed to avoid reaching evolutionary conclusions when inspecting the findings of biochemistry. That matter will be addressed in chapter four. But it is interesting to consider that *Darwin's Black Box* appeared the same year as Bork's own book, raising doubts about just how thoroughly the Supreme Court nominee could have digested its technicalities before deploying its "compelling argument" against evolution.

[42] There is a high degree of evasion (or plain confusion) among creationists on the matter of "microevolution" versus "macroevolution." Toumey (1994, 220) noted how the North Carolina study group he followed relied on an ICR slideshow that equated "macroevolution" with *speciation*. The similarly muddled views of Michael Denton and Phillip Johnson in this area will be explored in the chapter on Intelligent Design.

[43] See Strahler (1987, 528), McKown (1993, 153-155) and Randy Moore (1999d, 179) on Scalia, and Ecker (1990, 74) regarding Rehnquist. While the Rehnquist court inherited some rather flexible precedents when it came to separating church and state, Norman Redlich, "The Religious Clauses: A Study in Confusion," in Herman Schwartz (2002, 99-114), their application in the creationism venue has suffered from the limited understanding of the dissenting Justices. Gould (1991, 450-460) noted that Scalia's dissent was founded "in large part, upon a misunderstanding of science"—specifically, a persistent conflation of "evolution" with "how life began," rather than as the study of what has happened to life once it did appear (by natural or supernatural means). As we'll see, this misapprehension runs through creationist thought at every level, from strict scientific definitions through to the assumptions circling around religious conceptions of the origin of man. Wendell Bird (1989, Vol. 2, 445) quoted the Scalia/Rehnquist dissent with evident approval, while fellow lawyer Phillip Johnson (1997, 54) went beyond favoring Scalia's view to indulge in some Bork-style social commentary. In his Notes for the Edwards *v.* Aguillard decision, Johnson (1997, 125) opined that "The Justices probably did not mean to lay down a rule that the official theory of evolution may not be criticized or questioned in public school classrooms, but that was the effect of their decision. The Justices who signed the majority opinion seem to have been fooled by arguments from the science establishment that every claim made by the scientific elite about 'evolution' is a matter of neutral fact and that all opposition to materialism comes from people who want to read the Bible to students instead of teaching them science. Perhaps a Justice who drives home in the evening from the Court will by now have noticed the 'Darwin fish' bumper stickers on cars—showing a fish with legs in mockery of the Christian fish symbol on other cars—and will realize that the Supreme Court has been duped into taking sides in a religious debate." Thus did Johnson deftly sidestep the social and historical background for the Louisiana legislation, which has roots in literal Biblical creationism and not an Intelligent Design movement that didn't yet exist. Incidentally, it was interesting that Johnson used "mockery" to describe the "Darwin fish"—rather than, say, a "parody" in affirmation of naturalistic evolution. Johnson expressed similar umbrage later that year when he waved one of the Darwin tetrapods about during the "Firing Line" evolution debate. Ditto Johnson (2000, 82): "Why else would persons who want to mock the Christian fish symbol choose to decorate their automobile bumpers with a fish with legs?" Farther afield, the protagonist of Christopher A. Lane's 1999 creationist novel *Tonopah* (Zondervan press, p. 144) characterized a "Celebrate Diversity" bumper sticker and the Darwin medallion as "statements against Christianity—against God himself." By way of historical context, the "Darwin fish"

appeared when literal Creation Science criticisms of evolution were at their height, and the people most likely to be campaigning for equal time for creation in public schools were conservative Christians liable to sport the fish symbol. (Or write novels, like Lane—see note 57, chapter three.) A similar waggish sentiment found its way into a bumper sticker many years ago, advocating the ultimate in geographic self-determination: "Reunite Gondwanaland" (the southern half of the Pangea supercontinent, since fragmented into South America, Africa, Australia, and Antarctica). The creation/evolution bumper sticker war has continued apace, Johnson notwithstanding, with a creationist one labeled "Survival of the Fittest" showing a larger fish explicitly labeled "Jesus" devouring the Darwinian rival—and one on "Survival of the Forgiven," where an "IXΘYE" fish is about to swallow the fleeing (and obviously disconcerted) "Darwin" critter. There are also medallion versions where the fish is identified variously as "Jesus," "IXΘYE," or "Truth."

[44] Valuable criticism can still commence with biologist Futuyma (1982), who neatly presented both the reasons for believing in evolution and for questioning creationism—add to that the extensive compilation of the technical points marshaled by geologist Strahler (1987). Since paleontology is so critical to understanding what evolution is all about, McGowan (1984) is especially useful for laying out the fossil benchmarks. Other notable critical works include Kitcher (1982) and Berra (1990), while the somewhat duplicative Godfrey (1983) and Zetterberg (1983) employed the anthology approach, as did David Wilson (1983), Montague (1984), Hanson (1986), and Ruse (1988). McIver (1988b) provides a penetrating annotated bibliography of the antievolutionary literature, while the dictionary by Ecker (1990) is useful for quick research on spot topics. McKown (1993) and Tiffin (1994) illustrate the archetypal "secular humanist" response, though a bit on the repetitive side. Lloyd Bailey (1993) faults creationism's analytical credentials on the home turf of Biblical exegesis. Naturally, those older titles dealt only with the controversies surrounding traditional Biblical antievolutionism. Eldredge (1982) has recently been marginally revamped as Eldredge (2000) to reflect the newer Intelligent Design mutation. Pennock (1999) tackles the subject from a philosophical standpoint, and cell biologist Kenneth Miller (1999) from the biochemical end—both devote several chapters to dissecting the views of Michael Behe and Phillip Johnson. Sonder (1999) summarized many of the issues as part of a general science series for young adults, but did not deal with the Intelligent Design phase. And then there is Raztsch (1996), whose equivocal "plague on both your houses" approach coyly left the door propped open for the potential scientific credibility of the "creation hypothesis." In a related vein, Ferngren (2002, 277-288, 335-344) reprinted a 1986 essay on Biblical creationism by Ronald Numbers, while having Intelligent Design advocate William Dembski pick up the more recent ID thread. In this way "design" theory could be held at arm's length from its more overtly doctrinal cousins, who are not only very much active at the turn of the millennium, but also share a host of methodological conceits with their academic counterparts in the ID movement.

[45] Compare Matthew 7:16, 20 (particularly in the ASV translation). Because many traditional creationists are Biblical literalists, and regard only the King James Version as the legitimate word of God, unless otherwise specified all Biblical quotations will be drawn from the KJV. Thuesen (1999) ably traces the long-standing Protestant controversy over which translation of the Bible would be most suitable for an English readership. Though times are changing, as histories of eschatological beliefs in western culture indicate. Boyer (1992, 413n) noted that *The Amplified New Testament* is "a modern translation much admired by evangelicals." And Baumgartner (1999, viii) employed the New Revised Standard Version because "The King James Version's archaic English, for all its eloquence and tradition, is becoming ever more difficult for many people to understand, and only a minority of millennialists studied in this book use it." The difficulty wasn't helped by the "notoriously inconsistent" practice pointed out by Thuesen (1999, 111): the habit of the KJV translators *italicizing* words they had inserted for "clarity" (instances of which will be encountered in the texts quoted in this book).