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I. INTRODUCTION

A. *Culture And Creation Myths*

Every culture has its own creation story. Each story, generally speaking, offers a perspective on the world and its history and attempts to shed light on how we are to understand the purpose of human life and of our relationships to nature and to one another. Whether the story is about Yahweh or Elohim in Jewish and Christian traditions, Kanáti and Selu in Cherokee myth, or Pan Gu and Nü Wa in Chinese lore, there are distinct threads of commonality running throughout them.[1] There is, most significantly, a character of "beginningness" that is foundational in the storyteller's and listener's mindset, setting the stage for all that has, or will ever, come to pass in the world. Theologians frequently refer to this quality as "ultimacy"[2] and emphasize that

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1. *See* Bruce Railsback, *Creation Stories from around the World: Encapsulations of Some Traditional Stories Explaining the Origin of the Earth, its Life, and its Peoples*, July 2000 (4th ed.), http://www.gly.uga.edu/railsback/CS/CSIndex.html.

2. For an example of the way a theologian interprets the notion of

a creation story can never be divorced from its religious implications. Any creation story is religious insofar as it addresses the most fundamental issues concerning how we understand ourselves and others in a universal context.

B. *The Pre-Eminence of Darwin's Idea*

Contemporary Western culture, for the past century and a half, has looked to Charles Darwin to explain the origin and development of life. His idea occupies a place of importance not unlike that of the creation myths of old. It first appeared in Darwin's legendary work, *On the Origin of Species*,[3] and was nothing less than a Copernican event. The idea of a biological continuum, produced by natural selection acting upon random mutations, shook – or, some might say, devastated – the foundations of nineteenth century Western thought. The conviction that the biosphere was crafted according to a purposeful plan succumbed, thanks or no thanks to Darwin, to the notion that such design is merely apparent and without purpose or direction. The shock waves emanating from this seismic intellectual shift continue to ripple across contemporary culture. Indeed, one recently sympathetic expositor of Darwin's idea, in order to describe its power and influence, has employed another metaphor, referring to the idea as a "universal acid"[4] too caustic for any cognitive container to hold.

C. *The Idea's Religious Implications*

Darwin's theory has, beyond any doubt, had deep and far-

"ultimacy" with a view to understanding symbols and myths, see PAUL TILLICH, DYNAMICS OF FAITH 41-54 (Harper Torchbook 1958) (1957).

3. CHARLES DARWIN, ON THE ORIGIN OF SPECIES (Harvard Univ. Press 1966) (1859) [hereinafter DARWIN]. *See also* CHARLES DARWIN, THE ORIGIN OF SPECIES BY MEANS OF NATURAL SELECTION, OR THE PRESERVATION OF FAVOURED RACES IN THE STRUGGLE FOR LIFE (6th ed. 1872), *available at* http://pages.britishlibrary.net/charles.darwin/texts/orign6th_fm.html [hereinafter DARWIN (6th ed.)].

4. DANIEL C. DENNETT, DARWIN'S DANGEROUS IDEA 63 (Touchstone ed. 1996) (1995) [hereinafter DENNETT]. Dennett's book constitutes a sustained encomium to Darwin's idea. He writes, "Little did I realize that . . . I would encounter an idea – Darwin's idea – bearing an unmistakable likeness to universal acid: it eats through just about every traditional concept, and leaves in its wake a revolutionized world-view, with most of the old landmarks still recognizable, but transformed in fundamental ways." *Id.*

reaching religious implications.[5] Julian Huxley, grandson of "Darwin's Bulldog"[6] Thomas H. Huxley, saw these implications clearly and proclaimed to those assembled in Chicago at the 1959 centennial celebration of the initial publication of *On the Origin of Species,* both the death of God and of supernatural religion.[7] William Provine, the distinguished professor of the history of biology at Cornell University, in a 1998 keynote address on Darwin Day at the University of Tennessee, stated, "'evolution is the greatest engine of atheism ever invented.'"[8] Provine elsewhere underscored the conflict between evolutionary biology and religion, insisting "[t]here are no gods and no designing forces that are rationally detectable [in nature]," and that those devotees of religion, who happen to accept evolutionary biology "'have to check [their] brains at the church-house door.'"[9]

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5. Michael Ruse declares that "Evolution was even promoted as a secular religion, an alternative to Christianity both intellectually and socially. . . . Darwinism is as value laden as a religion . . . [and] . . . is a religion of a secular kind." Michael Ruse, *On Behalf of the Fool, in* DARWINISM, DESIGN, AND PUBLIC EDUCATION 475, 482-83 (John Angus Campbell & Stephen C. Meyer eds., 2003) [hereinafter DDPE].

6. PHILLIP E. JOHNSON, DARWIN ON TRIAL 28 (1991) [hereinafter DARWIN ON TRIAL]. Thomas Huxley, perhaps Darwin's staunchest advocate, debated Anglican bishop Samuel Wilberforce a year after Darwin's great book was published. Michael Behe describes the confrontation as follows: "It was reported that the bishop – a good theologian but poor biologist – ended his speech by asking, 'I beg to know, is it through his grandfather or grandmother that Huxley claims his descent from a monkey?' Huxley muttered something like, 'The Lord has delivered him into my hands,' and proceeded to give the audience and the bishop an erudite biology lesson. At the end of his exposition Huxley declared that he didn't know whether it was through his grandmother or grandfather that he was related to an ape, but that he would rather be descended from simians than be a man possessed of the gift of reason and see it used as the bishop had used it that day. Ladies fainted, scientists cheered, and reporters ran to print the headline: 'War Between Science and Theology.'" MICHAEL J. BEHE, DARWIN'S BLACK BOX: THE BIOCHEMICAL CHALLENGE TO EVOLUTION 236-37 (The Free Press ed. 2003) (1996) [hereinafter DARWIN'S BLACK BOX].

7. Phillip E. Johnson, *How to Sink a Battleship: A Call to Separate Materialist Philosophy from Empirical Science*, http://www.douknow.net/ev_sinkabattleship.htm (last visited Sept. 16, 2005).

8. *See* John Angus Campbell, *Intelligent Design, Darwinism, and Public Education Philosophy* (quoting http://fp.bio.utk.edu/darwin/frmain.html), *in* DDPE, *supra* note 5, 3, 24.

9. DARWIN ON TRIAL, *supra* note 6, at 124.

D. *What Do Most Scientists and the Public Believe?*

Polls show that approximately ten percent of the American public believes that life resulted from an accident followed by a mindless sequence of events and that "[m]an is," as the celebrated George Gaylord Simpson once phrased it, "the result of a purposeless and natural process that did not have him in mind."[10] The remaining ninety percent of the public is almost evenly divided between creationists on the one hand and theistic evolutionists on the other.[11] Of those pre-eminent biological scientists who have attained membership in the National Academy of Sciences (NAS), over ninety-four percent of them state that they do not believe in any form of deity, as compared to a group of randomly selected scientists without NAS membership, of which over sixty percent expressed disbelief or doubt in any god.[12]

It is not uncommon, or surprising, for a modern biologist to make a categorical statement like the following: "In the century and a half since Charles Darwin's *Origin of Species*, scientific research has conveyed one consistent message: evolution is an indisputable fact."[13] The meaning of such a pronouncement is not

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10. GEORGE GAYLORD SIMPSON, THE MEANING OF EVOLUTION 345 (rev. ed. 1967).

11. PHILLIP E. JOHNSON, DEFEATING DARWINISM BY OPENING MINDS 10 (1997). Consider the results of a poll taken by Gallup in 2001, inquiring into American beliefs regarding evolution. The poll indicated that only nine percent of the American people accepted Darwin's explanation of the origin and development of life. Gallup ran a later poll in November, 2004, that showed creationists at forty-eight percent, theistic evolutionists at thirty-eight percent, and those accepting natural selection and random variations at thirteen percent. *Newsweek* ran a similar poll in 2004, demonstrating virtually the same results, with forty-seven percent, thirty-six percent, and eleven percent respectively. *See* Matthew Nisbet, *Polling Opinion about Evolution,* SCIENCE AND THE MEDIA, Mar. 1, 2005, http://www.csicop.org/scienceandmedia/evolution/. To state that polls show the percentage of Americans who accept a straight Darwinian view is "approximately ten percent" is essentially correct.

12. John Angus Campbell, *supra* note 8, at 3, 23-24 (quoting Edward Larson & Larry Witham, *The More They Learn The Less They Believe,* NATURE at 313 (June, 1998)). *Cf.* DARWIN'S BLACK BOX, *supra* note 6, at 239 (in which the author states, "there is no reason to think that the figure of 90 percent of the general population that believes in God is much different for scientists"). Behe fails to support his statement with any data. It is at best anecdotal.

13. Mary Beth Saffo, *Accidental Elegance: How Chance Authors the Universe*, THE AM. SCHOLAR, Summer, 2005, at 18. Various meanings hover

only that modification occurs within species, as for example variances in the beak size of a finch population in response to environmental conditions, but the meaning is also that the development of life is unguided. Meanings become conflated. The point of interest is that the latter meaning, just as the former, is afforded "factual status" and enjoys the solid support of the scientific establishment. Most of the American public, by contrast, believe that the latter meaning is anti-religious and do not subscribe to it.

E. *Constitutional Questions*

This fact gives rise to several compelling legal questions: What should American public schools teach about the history of life? Does teaching Darwin's theory of evolution, or the accidental commencement and non-intelligent development of life, as "an indisputable fact," and at the expense of taxpayers who in overwhelming numbers disagree with the theory, create an atmosphere of religious (or anti-religious) orthodoxy in the classroom in violation of the Establishment Clause of the Constitution? These questions have yet to be answered clearly by the United States Supreme Court.

F. *The Scope of This Article*

The goal of this Article is a modest one. It is certainly not to demonstrate that evolutionary theory, in any of its forms, is false or that it should not be taught in public schools. Nor is the purpose to convince the reader that another theory of the history of life deserves special favor in the classroom. The objective is to show that evolution, *interpreted as an algorithmic expansion of life following its fortuitous appearance,* violates the Establishment

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over the term "evolution." *See infra* note 103. I suspect that Saffo is conflating meanings, when she moves from evolution as "an indisputable fact" (one might imagine that she is referring to microchanges within a given species) to evolution as the mindless, purposeless development of life. After insisting that evolution is a fact, she mentions, for example, a symposium she attended, where the question for discussion was whether life has a purpose, and she praises the response of a distinguished historian of science, Evelyn Fox Keller, who asked, "'Why do we feel compelled to ask this question?'" Mary Beth Saffo, *supra*, at 19. The truth of the matter is that the fallacy of equivocation is commonplace in discussions of the subject.

Clause whenever taught as "factual" or as orthodox doctrine in public schools, contrary to the religious viewpoints of most of the American people. Throughout this Article, such terms as "neo-Darwinism," "evolutionary theory," and "evolution" are defined always to mean that life occurred accidentally and developed mindlessly.

I propose to fulfill the above-stated objective in three parts. Part II of this Article will consider the position of a leading legal and social commentator, Kent Greenawalt, on the teaching of evolution in public schools. Part III will analyze several pertinent Supreme Court opinions along with one from a federal district court. Finally, Part IV will briefly outline how my position on the teaching of neo-Darwinism in public school accords with the theory of religion-jurisprudence that I have explicated elsewhere.[14]

II. FROM GREENAWALT'S PERSPECTIVE

Kent Greenawalt, a Columbia University law professor, is a careful and thoughtful commentator on jurisprudential issues. He has written prolifically on subjects such as the relationship between law and morality, the connections between religious belief and political decision-making, and the inter-workings of church and state.[15] In his latest book, provocatively entitled *Does God Belong in Public Schools?*, he discusses the role of religion in public education and sets forth his views regarding the teaching of evolution in the public classroom.[16]

A. *Darwin's Biological Theory and Its Resultant Conflicts with Religion*

Greenawalt explains that, although Darwin was not the first

14. *See* L. Scott Smith, *From Typology to Synthesis: Recasting-Casting the Jurisprudence of Religion*, 33 CAP. U. L. REV. (forthcoming Jan. 2006) [hereinafter *From Typology to Synthesis*].

15. *See generally* KENT GREENAWALT, CONFLICTS OF LAW AND MORALITY (Oxford paperback ed. 1989) (1987); KENT GREENAWALT, RELIGIOUS CONVICTIONS AND POLITICAL CHOICE (1988); KENT GREENAWALT, PRIVATE CONSCIENCES AND PUBLIC REASONS (1995); Kent Greenawalt, *The Role of Religion in a Liberal Democracy: Dilemmas and Possible Resolutions*, 35 J. OF CHURCH AND ST. 503 (1993).

16. *See* KENT GREENAWALT, DOES GOD BELONG IN PUBLIC SCHOOLS? (Princeton Univ. Press 2005) (1936) [hereinafter GREENAWALT].

to suggest the idea of evolution,[17] he was the first to offer a sustained scientific treatment of the topic.[18] His central thesis "[was] that species are not fixed and immutable . . . [and that] [f]rom one original species, a number of different kinds may be generated."[19] Modification of organisms takes place gradually over time through a process of natural selection acting on random mutations. Whether a characteristic is passed to offspring depends upon the extent to which the characteristic aids in survival and reproduction.[20]

Greenawalt emphasizes that Darwin supported his theory by empirical observation.[21] He viewed selective breeding, for example, as an analogue of how natural selection could occur.[22] He studied animal embryos and anatomical structures and was impressed by similarities between them.[23] Fossils, he thought, demonstrated the gradual development of complex forms of life from simple ones.[24] Disparate species found in isolated areas, such as the Galápagos Islands, underscored for him the reality of variant forms of life emerging from common ancestry.[25] Greenawalt explains that Darwin's original theory has been supplemented and modified over time, resulting in what is now referred to as the "neo-Darwinian synthesis."[26]

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17. Gould relates that Patrick Matthew, a Scottish naturalist who was Darwin's contemporary, was the first to hit upon the idea of natural selection and presented it in the appendix of a book published in 1831, *Naval Timber and Arboriculture*. Following Darwin's immediate ascent to fame in Britain, Matthew published a letter in *Gardener's Chronicle*, announcing that it was he who had been the first to articulate the theory. Darwin conceded the matter. *See* STEPHEN JAY GOULD, THE FLAMINGO'S SMILE 336, 345-46 (1985).

18. GREENAWALT, *supra* note 16, at 91 (quoting JEFFRIE MURPHY, EVOLUTION, MORALITY, AND THE MEANING OF LIFE 47 (1982)).

19. *Id.* at 91 (quoting PHILIP KITCHER, ABUSING SCIENCE: THE CASE AGAINST CREATIONISM (1982) and ROBERT T. PENNOCK, TOWER OF BABEL 55 (1999)).

20. GREENAWALT, *supra* note 16, at 91.

21. *Id.*

22. *Id.*

23. *Id.*

24. *Id.*

25. *Id.*

26. *Id.* Behe points out that, during the middle of the twentieth century, scientific leaders representing the many branches of biology, such as genetics, paleontology, comparative anatomy, and embryology, held a series of interdisciplinary meetings to combine their insights into "a coherent theory of evolution based on Darwinian principles." The result [was] the 'evolutionary

The dawning of "Darwin's theory," Greenawalt notes, "understandably disturbed many traditional Christians."[27] For it is an explanation of human life "without reference to God's creative hand."[28] Human beings are viewed as only "one link in a long continuous chain,"[29] where no vast qualitative distinctions exist between them and similar species. Far from being the consummation of all life, humanity appears to represent only a series of steps in a biological continuum, which by its purposeless, algorithmic expansion one may reasonably postulate the generation of future life-forms superior to that of *Homo sapiens*.[30] Greenawalt additionally observes that, according to many evolutionary biologists, a brief consideration of the harsh process of natural selection and the imperfect results that it renders strongly suggests that any "creator" about which religion may speak is neither divinely loving nor is such creator's work product immutably perfect.[31]

Neo-Darwinian theory continues today to evoke conflicts with religion. Greenawalt acknowledges these.[32] He is cognizant that there are many religious persons in this country who believe in a Creator-God, a deity that not only intervenes in human life, but also fashioned man to be a little "'lower than the angels . . . [and subsequently] crowned him with glory and honor, putting

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[neo-Darwinian synthesis.'" DARWIN'S BLACK BOX, *supra* note 6, at 24. Perhaps the best explanation and defense of neo-Darwinism belongs to Richard Dawkins. *See* RICHARD DAWKINS, THE BLIND WATCHMAKER (1996) [hereinafter THE BLIND WATCHMAKER]. He describes the pivotal work in population genetics of R. A. Fisher and his colleagues and states they "showed that Darwinian selection made sense," because what changes in evolution is "the relative *frequency* of discrete hereditary particles, or genes . . . ," which either are or are not in evidence in any particular human body. *Id.* at 114-15. Populations never, in other words, become so uniform that "there will be no variation left for natural selection to work upon." *Id.* at 114. Dawkins writes, "Darwinism post-Fisher is called neo-Darwinism." *Id.* at 115.

27. GREENAWALT, *supra* note 16, at 92.

28. *Id.*

29. *Id.*

30. *Id.*

31. *Id.* at 97. *See* Massimo Pigliucci, *Design Yes, Intelligent No: A Critique of Intelligent Design Theory and Neo-Creationism, in* DDPE, *supra* note 5, 463, 469. The author insists that ailments like "hemorrhoids, varicose veins, backaches, and aching feet" point, if anything, to an incompetent intelligent designer. *Id.*

32. GREENAWALT, *supra* note 16, at 92.

everything in subjection under his feet.'"[33] These people regard the "blind watchmaker"[34] model of life's expansion as a direct, frontal assault upon their "religious belief and morality."[35]

B. *The Boundaries of Reflection upon the Problem*

Greenawalt isolates "five fundamental premises"[36] by which to reflect upon the boundaries of instruction in science class concerning the origin and history of life. They are the following:

> (1) Schools should not teach the truth of religious propositions. (2) For many people, the domains of science and religion overlap significantly. (3) Anyone's assessment of what is true, overall, will include an evaluation of all relevant sources of truth, including any religious sources he or she credits. (4) Modern science is committed to methodological naturalism. (5) Scientific conclusions can bear on the likely truth of religious propositions.[37]

I will briefly take up and explain each of these, although not in Greenawalt's order. Numbers (1) and (5) and numbers (2) and (3) I will explicate together.

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33. *Hebrews* 2:7-9 (Revised Standard).

34. "The Blind Watchmaker" is of course the title of Richard Dawkins's book. *See* THE BLIND WATCHMAKER, *supra* note 26. The title is intended to stand in contraposition to a noteworthy analogy, found in the famous work, *Natural Theology*, written by the eighteenth century theologian, William Paley. *See* WILLIAM PALEY, NATURAL THEOLOGY (1802). Paley argues that, just as we may happen upon a watch and reason that it had been designed by an artificer, the same can be inferred of the world, with its intricate designs, in relation to God. *Id.* at 1, 9-10. While a theology student at Cambridge University, Darwin studied Paley's arguments for intelligent design and considered that part of his university training to be what was most permanently valuable to him. *See* John Angus Campbell, *supra* note 8, at 3-5. Darwin used Paley's thinking as a foil throughout *The Origin of Species* and attempted to demonstrate to his reader that all design in the biological world is merely apparent, not real, and that an enlightened person cannot "look at an organic being as a savage looks at a ship . . . ." DARWIN (6th ed.), *supra* note 3, at 426.

35. GREENAWALT, *supra* note 16, at 92.

36. *Id.* at 95.

37. *Id.*

1. *The Overlap of Science and Religion As Sources of Truth*

Greenawalt affirms that scientific propositions and religious beliefs overlap for many people and that attempting to place the two in airtight compartments ultimately "founders on the reality that scientists and religious believers both care about what is really true, overall."[38] Both scientists and religious believers make truth claims about physical reality that interest each other, although there are some religious people, Greenawalt acknowledges, who understand all religiously authoritative statements about physical reality nonliterally; in essence, they interpret such statements symbolically and mythically.[39] The overarching point is that there is ample room for science and religion to rub against each other, and they do.

While the perspectives of science and religion may conflict at times, they may also harmonize. Greenawalt identifies two traditional religious perspectives that are compatible with vigorous scientific investigation. The first is that God made the matter from which everything is fashioned and "set things in motion according to scientific laws that . . .[he or she] established."[40] The second is that the creator upholds the universe and all life within it, although "things [within the universe] run wholly in accord with scientific principles."[41]

Whether one is impressed primarily with the conflicts or the compatibilities between science and religion, the fundamental interest that underlies the impression is generally a concern with truth across disciplinary lines. Most people, Greenawalt maintains, would agree that scientific investigation yields truth. Yet many scientists and others would not concur that religion is a source of truth. The problem arises when those who accept both science and religion as sources of truth are compelled to decide what to believe when the two differ in their account of the truth. In that event, he states, opposing conclusions are weighed and evaluated. A weak scientific theory may sometimes give way to the truth of a strong religious belief and, conversely, a weak religious belief to a strong scientific theory. Some religious

38. *Id.* at 96.
39. *Id.*
40. *Id.*
41. *Id.*

believers capitalize upon the weaknesses of evolutionary theory to bolster their doctrine of God, while evolutionary biologists emphasize, for example, the vulnerabilities inherent in the notion of divine perfection to buttress their scientific theory. These conflicts are inevitable so long as there are those who are concerned with what is true overall.[42]

2. *Teaching the Religious and the Scientific*

Greenawalt agrees with those Supreme Court pronouncements, mandating that "public schools may not teach particular religious doctrines as true or as false."[43] He conditions his agreement upon the "basis"[44] of a teacher's instruction: if she instructs students that the earth is six thousand years old, and her instruction is *based* solely upon the Bible, the instruction is, or should be, legally impermissible. But if she teaches her students that the earth is over four billion years old, and she does so *based* upon scientific methods of dating, the instruction will pass constitutional muster. The kind of rational support underlying the teaching is what is decisive for determining its constitutionality. It follows from Greenawalt's understanding that, if neo-Darwinism is taught as a scientific theory and happens to offend religious people, there is no constitutional violation.[45] If on the other hand so-called "creation-science," such as that advocated by Duane Gish, Harold Slusher, and Kelly Segraves,[46] is taught in science class, the instruction is constitutionally offensive. The difference between the two is that the former is supported by scientific evidence, whereas the latter is not and owes its primary inspiration to religious belief. The respective bases of the doctrines differ radically from each other.

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42. *Id.* at 96-97.
43. *Id.* at 95.
44. *Id.*
45. *Id.* at 95-96.
46. *See* McLean v. Ark. Bd. of Educ., 529 F. Supp. 1255, 1260 (E.D. Ark. 1982) (where a United States district court in Arkansas considered a civil rights action brought to enjoin the enforcement by the Arkansas Board of Education and others of a state statute requiring public schools to give balanced treatment to creation science and to evolution science and ordered a permanent injunction against such enforcement, deciding that evolution is science, although creationism is not). The court's opinion specifically mentions these proponents of creationism. *See also infra* IV(C).

One may wonder what happens when a student who is taught neo-Darwinism vigorously questions the instructor about how the notion of gradual modification can explain the intricate biochemical mechanisms of intracellular life? There are, Greenawalt admits, "present uncertainties"[47] in modern evolutionary theory and "[a]ny evidence for a kind of order of a sort not yet integrated into the dominant theory should be fairly presented."[48] Yet he hastens to add that teachers must indicate that neo-Darwinism has not been shown to be "incapable of explaining everything important."[49] Furthermore, they "should not get far into the question of whether any as yet undiscovered principles of order in evolution, were they to exist, are likely to have proceeded from a creative intelligence."[50] The reason for the reluctance "is that students with religious objections to standard evolutionary theory may build much more than is warranted from any scientific perspective from conjectures about intelligent design."[51]

3. *The Method of Science*

"Methodological naturalism,"[52] Greenawalt points out, is the way of modern science. To describe his position in Aristotelian terms, modern science has to do exclusively with material and efficient causes. It searches for explanations according to uniform laws. It makes no reference to transcendent realities, purposes, or intelligent causes. Formal and final causation is not part of modern scientific methodology, which refuses to appeal to the supernatural.

Greenawalt observes that "[m]ethodological naturalism has proven very productive; scientists have discovered natural explanations for countless phenomena not previously explicable according to scientific principles."[53] He mentions, but does not discuss, Alvin Plantinga's suggestion that Christian scientists abandon methodological naturalism in favor of "'theistic science,'"

47. GREENAWALT, *supra* note 16, at 115.
48. *Id.*
49. *Id.*
50. *Id.*
51. *Id.*
52. *Id.* at 97.
53. *Id.* at 97-98.

although he states that the suggestion would mean dispensing with "a shared, universal methodology that has proven highly valuable."[54] Part of his point may be that scientists comprise a distinct community and that one of its bonds is a commonly accepted method.[55]

C. *The Plausibility of Neo-Darwinian Theory*

Greenawalt prefaces his view of neo-Darwinism with a confession of possessing no special scientific competence. He defends himself by maintaining that his views concerning neo-Darwinism are nonetheless worth expressing, because anyone interested in the truth overall must invariably address issues in a field where he is not an expert, and because many education officials and judges also lack scientific competence.[56]

He writes, "[i]f a theory, while relying on scientific evidence, has almost no scientific plausibility, science teachers, and textbook authors, should not present it as having a substantial probability of being true."[57] Although scientific theories are revisable and tentatively held, it does not follow from this, he insists, that the classroom door should be opened wide to "every conceivable" theory.[58] Proponents of the "flat earth" theory should not be provided equal classroom time with those who regard the earth as spherical.[59]

Neo-Darwinism provides "the most convincing scientific theory about the development of species" among the ranks of "[r]esearch scientists within the fields that count overwhelmingly."[60] Frequently heard objections, such as that the theory assumes progress or is nonfalsifiable, are incorrect.[61] One need only consider experiments with the peppered moth to

54. *Id.* at 98.

55. Ian G. Barbour emphasizes that the scientific community has its own standards, including its heroes, creeds, orthodoxies and heresies. *See* IAN G. BARBOUR, ISSUES IN SCIENCE AND RELIGION 151-74 (Prentice-Hall 1966). Changing its method would be seriously far-reaching and might serve to fracture the community.

56. GREENAWALT, *supra* note 16, at 101.

57. *Id.* at 101-02.

58. *Id.* at 102.

59. *Id.*

60. *Id.*

61. *Id.*

illustrate the way "we can clearly see that organisms better suited to survive in the environment do survive and pass on their characteristics to descendants."[62] Greenawalt stresses, "[i]f any theory of the development of life on earth qualifies as plausible, evolution does so."[63]

Consider some of the arguments against evolutionary theory. How can it satisfactorily explain the gradual development of an eye or a wing, when only an incremental part of either organ would confer no competitive advantage and would, according to Darwin, result in the death of the organism? Greenawalt contends that a degree of sensitivity to light is an improvement over blindness, "so we can imagine a slow progression from blindness to the full eye."[64] He states that even if the theory were not adequate to explain the development of complex mechanisms such as the human eye, it would still be a distant stretch that Genesis creationism or intelligent design theory is true.[65] He suggests, as a possibility, that other naturalistic views, like Stuart Kauffman's "self-organization" theory, might explain the complexity in organisms.[66] After all, when we consider the development of a baby from a single-cell human embryo, "programmed according to the DNA in its genes," we must realize that complexity in organisms may be fully explicated without invoking "an intelligent creator."[67]

Arguments that oppose the idea of natural selection may aid in the construction of a suitable alternative theory, although Greenawalt stresses that they "do not support a single alternative that involves an intelligent creator."[68] Reliance upon the notion of an intelligent creator to explain a phenomenon in nature means that any naturalistic explanation that one may give of the

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62. *Id.*
63. *Id.*
64. *Id.* at 104.
65. *Id.*
66. *Id.* For an explanation of self-organization theory, see Stephen C. Meyer, *DNA and the Origin of Life: Information, Specification, and Explanation*, *in* DDPE, *supra* note 5, 223, 248-49 [hereinafter *DNA and the Origin of Life*]. Instead of attempting to explain the origin of biological information by chance, theorists began searching for laws of self-organization and properties of chemical attraction in order to do so. The emphasis was upon necessity as opposed to chance.
67. GREENAWALT, *supra* note 16, at 104.
68. *Id.*

phenomenon is false.[69] A supernatural method will then trump a natural one.

Greenawalt discounts challenges to evolution based upon differences between evolutionary theorists. He observes that, while two experts may differ about *why* a thing happened, they do not disagree *that* it happened.[70] He may have in mind the difference between Dawkins's gradualist theory that modification occurs slowly and incrementally in organisms and Gould's and Eldridge's punctuated equilibrium theory that postulates rapid speciation followed by long periods of stasis.[71] Yet it is not clear to what particular disagreements, if any, he is referring.

Greenawalt likewise discounts the challenge to neo-Darwinism based upon probability theory, the point of which is to question whether the complex development of life is explicable in terms of chance variations. "Before-the-fact probabilities," he contends, "are irrelevant once we are aware what actually happened."[72] So what difference does it really make that we might imagine an extraterrestrial guest, vastly intelligent and informed, who considered the conditions of planet Earth over four billion years ago and concluded that mammalian life was extremely unlikely? After all, in a random process in one legal case, Greenawalt reminds us, Democrats topped the ballot on forty of forty-one occasions.[73] The purpose of the improbability argument is, it seems, only to render more plausible the theory of intelligent design.[74]

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69. *Id.* at 105.

70. *Id.*

71. *See* THE BLIND WATCHMAKER, *supra* note 26, at 223-52. Here, Dawkins minimizes, like Greenawalt probably would, the differences between Dawkins's neo-Darwinian gradualism and Gould's and Eldridge's punctuationism, by speculating as follows: that a herd of animals (B) could separate from its mother-herd (A); the geographical differences in B's circumstances would cause B to evolve over time; by the time B wanders back to A, the two have effectively become different species; when paleontologists, like Gould, explore for fossils, they find B's fossil remains in a stratum of rock immediately above A's, giving the impression of sudden change. *Id.* The differences between the theories are, for Dawkins at least, only apparent, because gradualism explains them both. *Id.* at 238-41.

72. GREENAWALT, *supra* note 16, at 106.

73. *Id.*

74. *Id.*

D. *The Lack of Plausibility of Competing Positions*

Greenawalt makes short work of Genesis creationism, pointing out that "[f]ew research biologists and paleontologists believe that . . . [its] attack on evolutionary theory is anything close to compelling."[75] Creationists' contentions that the earth is only 10,000 years old and that the Genesis Flood has called into question all modern methods of dating by altering geological processes, when combined with the fact that the theory is established upon a nearly total lack of reliable scientific evidence, make creationism either "nonscience or very bad science"[76] and a weak challenger of neo-Darwinism.[77]

Greenawalt is less negative toward the theory of intelligent design. Provided that it does "no more than challenge the completeness"[78] of evolutionary theory and address "details the dominant theory fails to explain,"[79] the intelligent design approach may be "consistent with the empirical evidence."[80] The theory, however, is not established by scientific evidence.[81]

E. *The Limits of Science and Scientific Instruction*

So might either creationism or intelligent design be incorporated into a public school's science curriculum? According to Greenawalt, the answer is, generally, no. These theories should be disqualified from the science curriculum, because (1) the concept of an intelligent designer is not scientific, (2) the explanations provided by the theories are not naturalistic, (3) the proponents of the theories are not open to contrary evidence, and (4) only a dearth of scientific evidence favors the theories.[82]

Greenawalt questions language like "'abrupt appearance'"[83] when used by these theorists to describe the advent of complex animal systems. Because such language suggests that life

75. *Id.* at 107.
76. *Id.* at 115.
77. *Id.* at 107.
78. *Id.* at 108.
79. *Id.*
80. *Id.*
81. *Id.*
82. *Id.* at 108-09.
83. *Id.* at 109.

resulted from "a supernatural creative force,"[84] the language is unscientific. He carefully balances this view with the observation that, just because a theory may make the existence of a divine creator more probable, one is not free to conclude that the theory is "*necessarily* unscientific."[85]

Perhaps the foremost problem with intelligent design theory, Greenawalt ventures, is that its proponents are unconvinced that "natural explanations"[86] will ever be able to solve the mystery of life. Their position is misguided, he argues, because "we can never be sure that ordinary scientific explanations will remain unsatisfactory."[87] It does not follow from this premise that science lends itself to the certainty that we may conceive a scientific explanation for each and every physical event. What we can reasonably affirm is that many events once attributed to supernatural causes have now been explained in terms of natural ones.[88] So both creationism and intelligent design theory, insofar as they take a position beyond science, are, according to Greenawalt, really about its limits.[89]

To put the matter another way, intelligent design theory may be able to tell us *what* a superior intelligence has done, but it cannot explain *why* it has done it. Without an explanation of why the intelligent designer created the complex biological systems that it did, "[there is] no scientific explanation," insists Greenawalt, "for what has occurred."[90] Intelligent design theory is about the limits of science because the theory does not explain, pursuant to empirical evidence, why the creative force acts as it does or how physical phenomena exemplify any general principles whatsoever.[91]

The limitations of science might be an appropriate topic for science class, but the topic has little relevance to whether students should be instructed on the theory of intelligent design.[92] Greenawalt believes that the limitations of science definitely

84. *Id.*
85. *Id.*
86. *Id.* at 110.
87. *Id.*
88. *Id.*
89. *Id.* at 111.
90. *Id.* at 112.
91. *Id.*
92. *Id.* at 113.

deserve mention, although "[t]he full development of [its] intrinsic limits belongs outside the domain of science."[93] Certainly, science cannot explain why there is something instead of nothing, why life has meaning (if it does), and why ethics are important.[94] In spite of acknowledging the limits of science, Greenawalt suggests teachers and textbooks should state it is premature for the student to conclude that any difficulties with evolutionary theory cannot and will not be rectified by natural explanations.[95]

F. *Greenawalt's Conclusions*

With a concluding burst of clarity and emphasis, Greenawalt contends that teaching Genesis creationism amounts to teaching religion. Teaching intelligent design theory may be permissible provided the instructor accepts most features of neo-Darwinism, including the blind, purposeless hand of natural selection, and refrains from asserting that intelligent design resolves the problems of the dominant theory.[96]

A school board's decision not to teach neo-Darwinism,[97] just because it offends traditional religious views, means little more than that religious views are dictating the content of science classes. Greenawalt argues that such an ill-advised decision constitutes the state endorsement and promotion of a religious view opposed to evolutionary theory.[98] The same is true when students are taught that evolution is "only 'a theory'" and are given the impression that the theory is on weaker footing than other scientific explanations.[99] The state is to make sure that religious beliefs are not inculcated, directly or indirectly, into the science curriculum, although proper instruction in science can, and often does, offend religious beliefs and with impunity from the

93. *Id.*
94. *Id.*
95. *Id.* at 114.
96. *Id.* at 116-17.
97. Some scientists argue that "science has nothing to contribute on questions pertaining to the origin of physical reality or the origin of life" and that "[t]hese matters are properly part of religion and not of science." *See* Brig Klyce & Chandra Wickramasinghe, *Creationism Versus Darwinism: A Third Alternative, in* DDPE, *supra* note 5, 543, 547.
98. GREENAWALT, *supra* note 16, at 117.
99. *Id.*

state.[100]

Greenawalt is not advocating that students with religious beliefs incompatible with evolutionary theory be intellectually bludgeoned into submission. "[A] science [instructor] may raise the issue whether the record science reveals is what we should expect from a creator acting directly; but the teacher should not attempt to resolve that question or discuss it in depth."[101]

No one's religious views, not even those of the children's parents, should be allowed to determine whether standard scientific material is taught in public schools. Evolutionary theory should be presented as the dominant theory with an indication of its deficiencies. The instructor should note that the theory is compatible with the religious views of some regarding the origin of human life, but not with others. Any alternative theory, Greenawalt insists, should be taught in science class only if it adheres to and supports principles of methodological naturalism. The student should be informed that there is no present basis on which to assume that any biological phenomenon "will prove beyond natural explanation and will point decisively to intelligent design."[102]

III. ANALYSIS OF GREENAWALT'S POSITION

A. *Preferential Treatment for the Religious Implications of Evolutionary Theory*

Neo-Darwinism is, in Greenawalt's view, "the dominant theory" and unquestionably the one to be taught in science class. Because the theory is, in his opinion, as well-supported as any other scientific theory, it should be taught as fact. He takes this position even as he is fully aware that the religious implications of neo-Darwinism contradict the religious beliefs of many students.

The word "evolution" is used in a number of diverse ways.[103]

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100. *Id.* at 118.
101. *Id.* at 120.
102. *Id.* at 121.
103. "Evolution" may refer to (1) change over the course of time; (2) "changes in the frequencies of alleles in the gene pool of a population"; (3) "limited common descent" or "the idea that particular groups of organisms have descended from a common ancestor"; (4) mechanisms responsible for change, such as natural selection and random mutations; (5) "universal

Greenawalt uses it in the same way that Dawkins does, to include a process of biological development that is without direction, purpose, or intelligence. This meaning is absolutely integral to the theory. As Daniel C. Dennett expresses it:

> Darwin's dangerous idea cuts much deeper into the fabric of our most fundamental beliefs than many of its sophisticated apologists have yet admitted, even to themselves. . . .
>
> The kindly God who lovingly fashioned each and every one of us (all creatures great and small) and sprinkled the sky with shining stars for our delight – *that* God is, like Santa Claus, a myth of childhood, not anything a sane, undeluded adult could literally believe in. *That* God must either be turned into a symbol for something less concrete or abandoned altogether.[104]

The term "evolution," when given its full neo-Darwinian meaning, carries an enormous load of theological freight. So the question becomes how Greenawalt, or any other liberal thinker, can insist upon the teaching of a particular theological point-of-view as factual. When did the notion of a liberal state necessitate that students be taught that a "kindly God who lovingly fashioned each and every one of us" is akin to a belief in Santa Claus?

B. *Knowledge and Belief in Liberal Theory*

Based upon the position he has staked out for himself, Greenawalt might respond that liberalism distinguishes between "knowledge" and "belief," and that neo-Darwinism is about the former, not the latter. Assuming, *arguendo,* that he would be correct in this assertion, does it still not strike one as odd that any type of liberal, whether traditional or modern, would be willing to elevate a theological claim to a position of "empirical knowledge"?

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common descent" or the idea that all organisms emerge from a common ancestor; and (6) the "'[b]lind watchmaker'" idea that change over time is an unguided, mindless, and purposeless process, rendering only apparent, not real, design in the biosphere. *See* Stephen C. Meyer & Michael Newton Keas, *The Meanings of Evolution, in* DDPE, *supra* note 5, 135, 136-37. The sixth meaning of the term is the one that is primarily under scrutiny in this Article.

104. DENNETT, *supra* note 4, at 18.

Mill and Kant were not willing to do it, nor has Greenawalt himself previously shown the inclination.[105] If his present position is that there is no Creator-God, that the idea is false based upon the dictates of neo-Darwinian theory, then Greenawalt should show us how it is within the province of science to derive this or any other such conclusion.

C. *The "Apparent" Subtlety of Greenawalt's View*

Perhaps he would protest that I am missing the point of his subtly nuanced treatment of the subject. He has, after all, been careful to maintain that, while neo-Darwinism should be taught as the well-supported scientific theory it is, science teachers should not tarry over its religious implications by discussing them in depth.

Since any substantive discussion of neo-Darwinian theory jars open the door to a consideration of whether the biological world is "designed" (how could it not?), Greenawalt's position is neither subtle nor liberal. It is analogous to that of a history or political science instructor declaring that the topic for the week is Marxism in the Soviet Union, although no questions will be entertained regarding that ideology's harshly adversarial stance against traditional religions. Is this strait-jacketed approach to teaching science, with severe limits on what teachers can and cannot say, the place where liberalism has finally brought us? Greenawalt cannot have it both ways: either (1) neo-Darwinian theory is taught as factual, in which case traditionally religious students who closely question their instructors on the religious implications of the theory must be told categorically and unequivocally that all beliefs in a deity who designed and created life are false, or (2) the theory is not taught as factual, which would mean that Greenawalt's estimation of it must be radically revised.

D. *God and Evolutionary Theory*

But am I not interpreting Greenawalt's position in a

105. *See* KENT GREENAWALT, RELIGIOUS CONVICTIONS AND POLITICAL CHOICE (Oxford University Paperback ed. 1991) (1988); *see also* PRIVATE CONSCIENCES AND PUBLIC REASONS (1995). In neither of these works does Greenawalt take the position that any traditional religious belief comprises "knowledge" that is readily accessible by all.

perversely pejorative light? Has he not explained to us that neo-Darwinism is compatible with at least two religious perspectives? There is no reason, is there, why a creator (1) could not have made original matter and set the evolutionary process in motion, or why a creator (2) could not continue to sustain the universe and life within it? The first position is deistic; the creator is *deus absconditus* with no capacity to be touched by prayer, to intervene in the world, or otherwise to make a present difference in the here and now. The second position also, in its own way, places deity outside the world of human understanding and experience. One need only ask Greenawalt to explain how a god who sustains the universe and life within it does so? If he does not refer us to theologians or religious philosophers, he will probably reach for a word, such as "faith," in an effort to cover a host of rationally and empirically questionable truth-claims. The point is that, for him, there are no rules of understanding or of experience, which render a single compelling conclusion about a divine creator. That is because the creator to which he refers is outside the realm of knowledge.[106] Greenawalt is, in effect, stating to his readers that neo-Darwinian theory is factual, while there are at least two narrow theological positions compatible with it, which actually comprise mere subjective beliefs. If and when a teacher presents evolutionary theory in keeping with Greenawalt's unvarnished view of the matter, specifically, when the teacher's presentation does not attempt to soft-pedal the theory by restricting discussion of its religious implications as Greenawalt suggests, it is far from mysterious which position most students will be inclined to adopt. The choice is, after all, between "knowledge" on the one hand and "belief" on the other or, to be bluntly straightforward, between "fact" and "fantasy."

106. It is curious that Greenawalt criticizes the "separate discourses" approach to science and religion, arguing that there are points of convergence between the two disciplines. The particular religious perspectives that he regards as compatible with scientific investigation place the notion of deity in a realm separate and distinct from that of science, very comfortably outside the empirical world. In the final analysis, contrary to what he tells us, he cannot escape the "separate discourses" position since, for him, there can be no real dialogue between the two, because each is in its own universe and shares no common ground with the other. *See* GREENAWALT, *supra* note 16, at 96.

E. *Teaching Contrary to a Student's Religion*

Even if one were to admit with Greenawalt that neo-Darwinism is factually correct and that the biological universe is without any real design, teaching the theory, along with its religious implications, as "knowledge" is profoundly illiberal. Parents who are taxed to pay for public education should not, according to the most basic tenets of liberalism, be made to place their children in a position where they are forced to accept religious views contrary to those they and their family hold. Was this not the rationale of *West Virginia State Board of Education v. Barnette*?[107]

All liberals everywhere who happen to agree with Greenawalt will doubtless remonstrate in unison, "No, *West Virginia State Board* concerned an enforced devotional exercise, whereas teaching evolutionary theory has to do with the conveyance of scientific knowledge!" Maybe there is a principled difference between a student who is forced against his religious convictions to salute a flag and one who is compelled against her religious views to write, in answer to an exam question, that the history and development of life on earth is an unguided, unintelligent, and purposeless process, that human life is no more favored in the evolutionary process than that of an insect or a reptile, and that life arose accidentally from nonliving matter and has developed in a mindless way ever since. If there is a legal distinction between these two cases other than that one is termed "religious" while the other "scientific," it is not immediately obvious. Both have religious relevance. So if liberalism is correct in its assertion that religious beliefs are, one and all, subjective, no religious belief deserves precedence or priority over another.

F. *Is Neo-Darwinism Fact?*

But, my critic asks, cannot liberalism be understood to provide for the teaching of religious views that follow ineluctably from scientific fact? Consider the devastating consequences that Copernicus's heliocentricism had upon the theologies of his time.

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107. *See* 319 U.S. 624, 642 (1943) (holding, on free exercise grounds, that public school students who were Jehovah's Witnesses could not be made to salute the United States flag and thus to declare a belief in violation of their religion).

No one would presently dare make the absurd argument that Copernican theory should not have been taught as factually true simply because Luther and other religious persons were offended by it.[108]

Is neo-Darwinian theory on par with Copernicus's discovery? Sooner or later, one must inquire into the merits of the assertion that evolutionary theory is factual. This Article is not the place for that protracted inquiry, although a brief consideration of several of Greenawalt's points is in order.

1. *Neo-Darwinism and the Fossil Record*

Darwin theorized that infinitesimal changes in animal morphology occur gradually over time as a result of the mindless natural process that he described. He assumed a complete fossil record would demonstrate the truth of his theory. He was so convinced of gradual change that he wrote, "If it could be demonstrated that any complex organ existed which could not possibly have been formed by numerous, successive, slight modifications, my theory would absolutely break down."[109] Nature, in other words, makes no sudden leaps, "'*natura non facit saltum*.'"[110] Darwin equated such leaps with miracles. Neo-Darwinism thus predicts the gradual emergence of biological complexity, which manifests itself in the existence of many transitional forms leading to new phylum-level morphologies.

Although the fossil record is imperfect, a century and a half of paleontological exploration have not been sufficient to confirm Darwin's prediction. An abundance of intermediate animals has not been found. Gould himself described "'the extreme rarity of transitional forms in the fossil record' as 'the trade secret of paleontology.'"[111] Of the reputed intermediates that have been unearthed, it is unclear the extent to which they bolster Darwin's theory.

Consider the fossil *Archaeopteryx*, an animal that apparently possessed a combination of reptilian and avian characters. While

108. *See* Donald H. Kobe, *Luther and Science,* Jan. 2004 (updated), http://www.leaderu.com/science/ kobe.html (last visited Oct. 20, 2005).
109. DARWIN, *supra* note 3, at 189.
110. *Id.* at 194.
111. DARWIN ON TRIAL, *supra* note 6, at 59.

some investigators have pronounced it a forgery,[112] others wonder whether it was not merely an odd variant, like the duck-billed Platypus, with characteristics resembling a class to which it does not belong.[113] Alan Feduccia, a leading ornithologist, has stated, "[m]ost recent workers who have studied various anatomical features of *Archaeopteryx* have found the creature to be much more birdlike than previously imagined . . . [and] the resemblance of [the creature] to theropod dinosaurs has been grossly overestimated."[114] Also of significance, since theropod dinosaurs are found in the fossil record after *Archaeopteryx*, it becomes increasingly problematic to think of the latter as a transitional animal between theropod dinosaurs and birds.[115]

2. *Neo-Darwinism and the Cambrian Explosion*

The fossil record, far from illustrating in a powerfully trenchant manner the numerous gradual changes predicted by Darwin, actually demonstrates "a consistent pattern of sudden appearance followed by stasis . . . [and] that life's history is more a story of variation around a set of basic designs than one of accumulating improvement. . . ."[116] Consider the so-called Cambrian Explosion, which occurred 530 million years ago, and lasted a maximum of only five million years.[117] During this time,

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112. FRED HOYLE & CHANDRA WICKRAMASINGHE, ARCHAEOPTERYX, THE PRIMORDIAL BIRD: A CASE OF FOSSIL FORGERY (1986).

113. DARWIN ON TRIAL, *supra* note 6, at 78.

114. ALAN FEDUCCIA, THE ORIGIN AND EVOLUTION OF BIRDS 81 (1996).

115. See the informative article, *Why Birds Aren't Dinosaurs, in* Explore: Thought and Discovery at the University of Kansas, http://www.research.ku.edu/exsplore/v2n2/dino2.html, in which it is explained that Larry Martin, the paleontology curator at the University of Kansas Natural History Museum, states that *Archaeopteryx* is 150 million years old, while theropod dinosaurs appear 30 million years later.

116. DARWIN ON TRIAL, *supra* note 6, at 58-59. *See also* GEORGE GAYLORD SIMPSON, THE MAJOR FEATURES OF EVOLUTION 360 (1953). Here, he states, "[I]t remains true, as every paleontologist knows, that *most* new species, genera, and families and that nearly all new categories above the level of families appear in the record suddenly and are not led up to by known, gradual, completely continuous transitional sequences." *Id.* If Simpson was willing to speak of "sudden" appearances, then what is the legitimacy of Greenawalt's complaint about the word "abrupt"? *See* GREENAWALT, *supra* note 16, at 109.

117. *See* Stephen C. Meyer, Marcus Ross, Paul Nelson & Paul Chien, *The Cambrian Explosion: Biology's Big Bang, in* DDPE, *supra* note 5, 323, 326.

between nineteen and thirty-five phyla appeared on earth. Compared to the over three billion-year-old earth, a period of five million years is comparable to a single minute in a twenty-four-hour-day.[118] In terms of geological time, the emergence of complex life may, contrary to Greenawalt's criticism, be properly and reasonably described as "sudden."[119] Whereas the neo-Darwinian theory of Dawkins and the punctuated equilibrium theory of Gould predict that the fossil record will show morphological diversity (or small-scale variations) preceding morphological disparity (or large-scale variations), the evidence from the Cambrian Explosion shows just the opposite, particularly, "a 'top-down' pattern in which morphological disparity between many separate body plans emerges suddenly and prior to the occurrence of species-level (or higher) diversification on those basic themes."[120] Another commentator phrases the matter this way: "The known fossil record fails to document a single example of phyletic evolution accomplishing a major morphologic transition and hence offers no evidence that the gradualistic model can be valid."[121]

3. *Neo-Darwinism and Embryological Evidence*

Greenawalt mentions that Darwin formulated his theory of evolution based, in part, upon his observations regarding animal embryos. Specifically, he noticed that the embryos of mammals, birds, fishes, and reptiles bear close similarities, but become radically dissimilar once they have fully developed. His contemporary, Ernst Haeckel, propounded the "'Biogenetic Law'"[122] that "'ontogeny recapitulates phylogeny,'"[123] in essence, that the embryological development of animals repeat the alleged stages undergone during ancestral evolutionary descent. This

118. *See id.*
119. *See id.* at 325.
120. *Id.* at 346.
121. STEVEN STANLEY, MACROEVOLUTION: PATTERN AND PROCESS 39 (1979).
122. *See* Jonathan Wells, *Haeckel's Embryos and Evolution: Setting the Record Straight*, *in* DDPE, *supra* note 5, 179, 179 [hereinafter *Haeckel's Embryos*].
123. *Id.* George Gaylord Simpson stated five decades ago, "It is now firmly established that ontogeny does not repeat phylogeny." GEORGE GAYLORD SIMPSON & WILLIAM S. BECK, AN INTRODUCTION TO BIOLOGY 241 (Harcourt, Brace & World 1965) (1957).

"law," however, was disproved during Darwin's own lifetime.

Haeckel is perhaps most famous for his drawings, still featured in many biological textbooks, of animal embryos, which purport to show similarities with one another. Yet the drawings neglect to illustrate the earliest stages of embryological development in vertebrates that, significantly enough, leave the impression of difference, not similarity.[124]

4. *Neo-Darwinism and Experiments with the Peppered Moth*

In 1896, J. W. Tutt noted that light forms of the peppered moth flourished in unpolluted woodland areas, but that dark forms thrived in areas where industrial pollution had darkened the tree trunks.[125] He theorized that natural selection was the decisive factor accounting for the modification in color.[126] Dark color in polluted areas helped the peppered moth to survive.[127]

In the mid-twentieth century, Bernard Kettlewell tested Tutt's theory experimentally.[128] Kettlewell released several hundred peppered moths, light as well as dark, onto tree trunks in a polluted woodland.[129] He observed at a distance that darks were less noticeable than lights and that birds were prone to prey upon the lights.[130] He confirmed that darks had, in fact, survived the threat of predation better than lights.[131] He concluded from the experiment that birds acting as agents of natural selection and the

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124. Jonathan Wells points out that the drawings "ignore[ ] groups that did not fit neatly into Haeckel's scheme." *Haeckel's Embryos, supra* note 122, at 179, 181. Two of the seven vertebrate classes were, for example, conveniently omitted. There is also evidence in recent embryological studies that Haeckel intentionally distorted his drawings as there are significant differences between the various embryos even at the stage at which Haeckel declared that they were most similar. *Id.* at 181-82. Gould writes, "[W]e do, I think, have the right to be both astonished and ashamed by the century of mindless recycling that has led to the persistence of these drawings in a large number, if not a majority, of modern textbooks!" Stephen Jay Gould, *Abscheulich! – Atrocious! –The Precursor to the Theory of Natural Selection,* NATURAL HISTORY, Mar., 2000, at 44, 45.

125. Jonathan Wells, *Second Thoughts about Peppered Moths, in* DDPE, *supra* note 5, 187, 187.

126. *Id.*

127. *Id.*

128. *Id.* at 188.

129. *Id.*

130. *Id.*

131. *Id.*

darkening of peppered moths to survive the effects of industrial pollution underlined the truth of evolutionary theory.[132]

Biologists later noted that dark peppered moths did not replace light ones even in heavily polluted environments as evolutionary theory predicts.[133] In some areas, like East Anglia, where there was little industrial pollution, the frequency of dark moths was eighty percent, prompting some studying the peppered moth to conclude that frequencies in darks to lights are determined by many factors other than what birds can and cannot easily see.[134] Furthermore, Kettlewell released his moths onto tree trunks, and it has since become clear that tree trunks are not the normal resting place for peppered moths. Natural selection, in Kettlewell's experiment, may have been a stark example of unnatural selection.[135]

5. *Neo-Darwinism and the Biochemical Challenge*

Michael J. Behe has questioned whether neo-Darwinian gradualism can explain the intricate and "highly sophisticated molecular machines [that] control every cellular process."[136] He calls our attention to such mechanisms as the cilium, which some cells may use much like a boatsman would use an oar for transportation. When a cilium is studied through an electron microscope, which is an opportunity that was unavailable to Darwin, one discovers a meticulously and irreducibly complex mechanical system that does not function unless all of its constituent parts are doing so. The question that Behe poses for the neo-Darwinist is whether this system could have evolved gradually, given that every component is needed for its operation.[137] Behe demonstrates that, in addition to the cilium, every biochemical mechanism within a cilium is irreducibly complex.

It is not as if Darwin himself did not ponder how organs of seemingly "irreducible complexity" could develop in a gradual way. Greenawalt describes Darwin's and Dawkins's understanding of

132. *Id.* at 188.
133. *Id.*
134. *Id.* at 188-89.
135. *Id.* at 190.
136. DARWIN'S BLACK BOX, *supra* note 6, at 5.
137. *Id.* at 59-65.

human vision as a series of gradual changes from a light sensitive spot to the full eye. But, again, there are more questions than answers. From the standpoint of gross anatomy, why would natural selection favor five percent of an eye, since it would still be visionless?[138] From the standpoint of biochemical analysis, how can an evolutionary account of vision pass the basic credibility test when it merely assumes the presence of many necessary chemical ingredients, such as 11–*cis*-retinal (a molecule) and rhodopsin (a protein), both of which are essential for sight? Is Dawkins not aware that the cup of the eye, as "[a] ball of cells," is held in its perfectly rounded shape by molecular supports?[139] There are, in other words, complex and irreducible biochemical mechanisms that he and his theory cannot explain.

6. *Neo-Darwinism and Artificial Breeding*

The main problem with trying to find support for evolutionary theory in artificial breeding is that the latter is a product of intelligent effort, whereas the former is a theory of the mindless development of life.

There are those who may point to the fact that fruitflies have been artificially bred to produce a new species that cannot breed with the parent species. Yet there is no evidence that this can be done with dogs, monkeys, and humans, or that a fruitfly can be produced from a bacterium.[140] One plausible way to interpret the fruitfly evidence is as Johnson has done: "What artificial selection actually shows is that there are definite limits to the amount of variation that even the most highly skilled breeders can achieve."[141]

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138. *See* DARWIN ON TRIAL, *supra* note 6, at 34.

139. *See* DARWIN'S BLACK BOX, *supra* note 6, at 36-39 (providing a breathtaking discussion of the biochemical ingredients of human vision).

140. The point should be emphasized that, in order to support intelligent design theory, one need not object to microevolutionary change. The issue is whether cumulative microevolutionary changes result in macroevolutionary change. Many commentators correctly make this point, but none does so better than Jeffrey F. Addicott. *See* Jeffrey F. Addicott, *Storm Clouds on the Horizon of Darwinism: Teaching the Anthropic Principle and Intelligent Design in the Public Schools,* 63 OHIO ST. L.J. 1507, 1536 (2002).

141. DARWIN ON TRIAL, *supra* note 6, at 18.

7. *Neo-Darwinism and Probability Theory*

Fred Hoyle, the famous British astronomer, once compared the probability of life occurring by accident to that of a typhoon blowing through a junkyard and constructing a Boeing-747.[142] His calculations were apparently based upon the fact that a yeast cell and a Boeing-747 each have six million parts.[143] Sheer chance is no longer regarded as a credible explanation for the origin of life. As one commentator has stated, "Almost all serious origin-of-life researchers now consider 'chance' an inadequate causal explanation for the origin of biological information."[144] Although probability calculations assume optimal prebiotic conditions, more time than was available on the early earth, and theoretically maximal reaction rates among proteins DNA or RNA, such calculations show that the probability of randomly obtaining functionally sequenced biomacromolecules is extremely small.[145]

Concerning the neo-Darwinian explanation of life, Dawkins admits, "We can accept a certain amount of luck in our explanations, but not too much. Cumulative selection, Dawkins argues, is the key to all our modern explanations of life."[147] But that explanation, he acknowledges, assumes "some minimal machinery of replication and replicator power,"[148] which must certainly be explained by luck.

Does the theory assume too much luck? According to Dembski's calculations, the answer is yes. He has calculated a conservative "universal probability bound" of 1 in 10^{150} that he maintains corresponds to the probabilistic resources of the known

142. FRED HOYLE, THE INTELLIGENT UNIVERSE 19 (1983).

143. Gert Korthof, *"A Memorable Misunderstanding": Fred Hoyle's Boeing-story in the Evolution / Creation Literature,* WAS DARWIN WRONG?, Oct. 10, 1999 (updated Aug. 6, 2005) http://home.wxs.nl/'gkorthof/ kortho46a.htm.

144. *See DNA and the Origin of Life*, *supra* note 66, at 240.

145. *Id.* at 240. Storage within living cells is a chemical process. Molecules that join together in long chains are called "polymers." When the chains are sufficiently long and are composed of heterogeneous molecules, the storage of information becomes possible. The polymers used by living cells to store genetic information are termed "polynucleotides." There are within living cells two families of polynucleotides, which are deoxyribonucleic acid (DNA) and ribonucleic acid (RNA).

147. THE BLIND WATCHMAKER, *supra* note 26, at 139.

148. *Id.* at 140-41.

universe.[149] The "improbability of assembling and sequencing even a short functional protein approaches this universal probability bound," and the improbability for longer proteins is far beyond the bound.[150] Greenawalt's flippant treatment of probability theory glosses over a large problem for neo-Darwinian theory.

8. *Neo-Darwinism and the Issue of Falsifiability*

The preceding discussion of some of the gaps in neo-Darwinism brings us to Greenawalt's contention that the theory is falsifiable; in essence, disprovable. A common complaint leveled against most, if not all, religious statements is that one cannot think of evidence which might falsify them. Regardless of the empirical circumstance or situation under consideration, the idea of God can, its critics contend, always accommodate it. Their point is that the idea of God is essentially empty, because it explains too much.

But might the very same point be made about neo-Darwinism? David Berlinski observes that, within nature, there is radical individuality, oddness, quirkiness, and "just plain weirdness."[151] He points out that "[t]he male redback spider . . ., for example, is often consumed during copulation."[152] As he puts it, the male spider passes "from ecstasy to extinction in the course of one and the same act."[153] How does this act exemplify the principles of neo-Darwinian theory? Or, to take a step down the ladder of abstraction, what conceivable advantage might this act confer upon the male redback spider, since he is essentially committing suicide? Evolutionary theorists might reply that various organisms fashion through trial and error a multitude of responses to their environment; they keep what works and discard the rest. But, as Berlinski protests, this kind of reply is much too

149. WILLIAM A. DEMBSKI, DESIGN INFERENCE: ELIMINATING CHANCE THROUGH SMALL PROBABILITIES 175-223 (1998). The formulation of a "universal probability bound" is a way of answering the question of how improbable something has to be before it may be deemed implausible and eliminated as a reasonable explanation.

150. *DNA and the Origin of Life*, *supra* note 66, at 223, 242.

151. David Berlinski, *The Deniable Darwin*, *in* DDPE, *supra* note 5, 157, 161.

152. *Id.*

153. *Id.*

broad and explains far too much, never providing us with a concrete answer to "why" this particular behavior was chosen. He writes, "[A] theory that can confront any contingency with unflagging success cannot be falsified. Its control of the facts is an illusion."[154] A neo-Darwinian reply similar to what Berlinski describes is more akin to a religious mantra than to a scientific explanation. The irony bears noting that Greenawalt criticizes intelligent design theory for telling us "what" a superior intelligence has done, but not "why" it has done it.[155] Is the quality of explanation that neo-Darwinism gives for the sexual cannibalism of the redback spider, along with a host of other variant behaviors in nature, any more satisfactory?[156]

A thoughtful person might wonder what specific body of evidence it will take to falsify neo-Darwinian theory. It does not, as Behe argues, even begin to account for the molecular structure of life. The fossil record exhibits a relative paucity of intermediate animals, contrary to Darwin's prediction; furthermore, most, if not all, animal phyla appeared during a brief moment of geological time and appear to constitute a radical leap in nature. Finally, the evidence for the theory that textbooks have long inculcated into students concerning similarities between embryos and natural selection in peppered moth experiments has been correctly labeled, at best, misleading and, at worst, fraudulent. America's most acclaimed evolutionary paleontologist, Stephen Jay Gould, declared in 1980 that "[the neo-Darwinian synthesis] is effectively dead, despite its persistence as textbook orthodoxy."[157] Notwithstanding these points, scientists and others continue to hail the theory as factual.[158] Remembering that religious

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154. *Id.* at 162.

155. Greenawalt insists, "One who lacks any idea *why* the creator acted certainly has no scientific explanation for what has occurred." GREENAWALT, *supra* note 16, at 112. If he is implying that neo-Darwinism, by contrast, can always tell us "why," he is simply mistaken. If he is daring to suggest that neo-Darwinism is not always obliged to tell us "why," then he is guilty of the selective application of a standard, is he not?

156. Renowned philosopher of science, Karl Popper, who pioneered the "falsifiability" criterion of meaning, at one point in his illustrious career wrote that natural selection is an all-purpose explanation that accounts for everything and, hence, nothing. *See* DARWIN ON TRIAL, *supra* note 6, at 21.

157. Stephen Jay Gould, *Is a New and General Theory of Evolution Emerging?*, 6 PALEOBIOLOGY 119, 120 (1980).

158. Charles Krauthammer writes that "[e]volution is one of the most

statements have been criticized as nonfalsifiable, it is intriguing to reflect upon Lynn Margulis's insightful pronouncement that history will judge neo-Darwinian theory as simply "'a minor 20th-century religious sect within the sprawling religious persuasion of Anglo-Saxon biology.'"[159]

G. *Neo-Darwinism and Methodological Naturalism*

One of the concerns, which most occupies Greenawalt about non-evolutionary theories of life like creationism and intelligent design, is that they are not naturalistic. He emphasizes repeatedly that science must look only for natural explanations. Teachers must therefore build confidence in students that "present uncertainties by no means show that the dominant theory is incapable of explaining everything important."[160] It is well to pause here and to ask: where in the theory of liberalism is it part of a public school instructor's job description to tell students what they should think about "present uncertainties" regarding anything, including modern evolutionary theory? Such instruction is certainly not "factual knowledge."

If not knowledge, then what is its cognitive status? One thoughtful commentator, William A. Nord, whom Greenawalt himself quotes,[161] describes methodological naturalism as "a faith"[162] and warns of the danger that one's commitment to it may result in "uncritically trusting that all of reality can be explained

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powerful and elegant theories in all of human science and the bedrock of all modern biology." Charles Krauthammer, *Let's Have No More Monkey Trials: To Teach Faith as Science Is to Undermine Both*, TIME, Aug. 8, 2005, at 78, 78. This is his artful manner of saying that neo-Darwinism is fact, while intelligent design theory is faith, which "has no place in science class." *Id.* Keith Lockitch, a physicist and junior fellow at the Ayn Rand Institute, criticizes President George W. Bush's suggestion in August 2005, that intelligent design theory also be taught in science class as "nothing more than a crusade to peddle religion by giving it the veneer of science." Keith Lockitch, *Bush Backs Teaching Intelligent Design*, CORPUS CHRISTI CALLER-TIMES, Aug. 4, 2005, at 11A. The assumption implicit in Lockitch's criticism is that evolutionary theory alone, as fact, should be taught in science class. *Id.*

159. Charles Mann, *Lynn Margulis: Science's Unruly Earth Mother*, 252 SCIENCE 378, 381 (1991).

160. GREENAWALT, *supra* note 16, at 115.

161. *Id.* at 16 n.25.

162. Warren A. Nord, *Intelligent Design Theory, Religion, and the Science Curriculum*, *in* DDPE, *supra* note 5, 45, 56.

in naturalistic categories."[163] Nord reflectively comments, "[n]ow it may be that a measure of faith is essential to the practice of any intellectual tradition . . . , but public schools should not be in the business of nurturing faith, whether it be in religion, politics, economics, or science. A liberal education should encourage critical thinking . . . ."[164]

If Nord is correct that methodological naturalism boils down to a faith of sorts, one may then ask whether subscribing to this faith is reasonable. The question may be put as follows: if the function of our cognitive faculties is about insuring our survival, how do we know that the function also includes the production of true beliefs?[165] The answer is that we do not. Darwin himself troubled over this problem and was doubtful. He expressed his doubt as follows:

> [W]ith me the horrid doubt always arises whether the convictions of man's mind, which has been developed from the mind of the lower animals, are of any value or at all trustworthy. Would any one trust in the convictions of a monkey's mind, if there are any convictions in such a mind?[166]

The most that a Darwinist or neo-Darwinist can say on this subject is that he or she has adopted a faith that may have nothing whatsoever to do with true beliefs. Neo-Darwinism is finally hoisted on its own pitard by placing a giant question mark over its own content. To be a neo-Darwinian means, first of all, admitting that any truth-claim that one may make is suspect.

One may question why studying the biological sciences requires adopting a naturalistic method. Why, if as Behe claims, the "cumulative efforts to investigate the cell – to investigate life

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163. *Id.*

164. *Id.* Nord's comment is helpful insofar as it highlights that methodological naturalism is a faith, which must be held critically, if it is held at all, although one may disagree with the implication that it is feasible for public schools to remain neutral on all matters regarding the inculcation of faith.

165. I express my indebtedness to Alvin Plantinga for this observation. *See* Alvin Plantinga, *Is Naturalism Rational?*, *in* AN ANALYTIC THEIST: AN ALVIN PLANTINGA READER 72 (James F. Sennett, ed., 1998).

166. Charles Darwin, *Letter to W. Graham, July 3, 1881, in* THE LIFE AND LETTERS OF CHARLES DARWIN 284, 285 (Francis Darwin ed., D. Appleton and Co. 1896).

at the molecular level – is a loud, clear, piercing cry of *'design!'*,"[167] should scientists have to turn their backs on this reality? It is not as if purpose and intelligence are otherwise unknown or mysterious in human experience.[168] A theory that incorporates them might lead to the interrogation of experience in novel ways and to the production of fresh insights.

Alfred North Whitehead adroitly reminded us that "theory dictates method."[169] By this, he meant that a theory determines what observations are significant and hence relevant to the solution of a particular problem.[170] It accounts for the way in which the data of experience are analyzed. In order to gain new insights, one must interrogate experience with new theories, which will in turn dictate new methods. He emphasized that the secret to scientific progress is found in the development of large schemes of thought which are able to lend significance to what he termed our "chance experiences."[171] He pointed out, for example, that while many individuals had seen apples fall from trees, Newton had in mind the mathematical theory of dynamic relations; and though many had witnessed lamps swinging in temples and churches, Galileo was contemplating a vaguer form of the same theory; and while countless observers had watched animals preying upon one another, Darwin was thinking of the Malthusian scheme.[172] The inspiration of genius is in the formulation of novel theory, which may result in a fresh way to look at experience.[173] Far from being castigated as pariahs,

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167. DARWIN'S BLACK BOX, *supra* note 6, at 232.

168. *See* William A. Dembski, *Reinstating Design within Science, in* DDPE, *supra* note 5, 403, 407. Dembski points out that the concept of design is found in fields such as forensic science, intellectual property law, insurance claims investigation, cryptography, and random number generation. *Id.* He argues that, in order to infer design in the biological world, we must establish complexity and specification. The former "ensures that the object in question is not so simple that it can readily be explained by chance. Specification ensures that the object exhibits the type of pattern that signals intelligence." *Id.* at 409.

169. ALFRED NORTH WHITEHEAD, THE ADVENTURE OF IDEAS 283 (1933).

170. *See id.*

171. ALFRED NORTH WHITEHEAD, THE FUNCTION OF REASON 72-73 (Beacon Books 1958) (1929).

172. *Id.*

173. For a thorough discussion of Whitehead's approach to philosophic and scientific method, see L. Scott Smith, Critical Observations on Whitehead's Approach to Speculative Metaphysics in the Light of Kant's Criticism 73-148

theorists with approaches other than that of methodological naturalism should be welcomed into the science classroom in the hope of providing novel insights for discussion and analysis.[174]

Teaching in *utramque partem*, or on both sides of the question, is a venerable educational tradition. There is no reason why evidence cannot be analyzed from more than one theoretical perspective. William Provine, a prominent and outspoken evolutionist at Cornell University, has refused in his class on evolutionary biology to dismiss opposing points of view[175] and has even invited Phillip E. Johnson, a searing critic of neo-Darwinism, to participate in the class. Provine assigns Johnson's book, *Darwin on Trial,* for his students to read. The result has been well-received by all.[176]

Yet Greenawalt's concern to safeguard methodological naturalism at all costs, to inculcate its precepts, to monitor carefully what may and may not be addressed in the classroom and, even then, to exercise a severe vigilance over the extent to which teachers may respond to particular questions, hardly brings to mind an atmosphere of free and open inquiry in a broad liberal tradition, but rather the very opposite of it.[177] While he is willing to give students an indication of the problems with evolutionary theory, his paramount concern seems to be that of furthering a particular agenda by scrutinizing what the student ultimately believes. Education is again hobbled by political correctness.

IV. EXAMINING AND ANALYZING CASE LAW

A. *Teaching Evolution in Public School*

The United States Supreme Court first addressed the

(1976) (unpublished Ph.D. dissertation, Columbia University) (on file at Columbia University Office of Dissertations).

174. Phillip E. Johnson wrote a delightful essay on Paul Feyerabend, a premiere scientist of our time, who "denied that there is any single form of reasoning that can be labeled 'the scientific method' and asserted brazenly that the basic rule in science is 'anything goes.'" PHILIP E. JOHNSON, OBJECTIONS SUSTAINED: SUBVERSIVE ESSAYS IN EVOLUTION, LAW & CULTURE 121, 122 (1998).

175. William Provine, *Design? Yes! But Is It Intelligent?, in* DDPE, *supra* note 5, 499, 509-11.

176. DARWIN ON TRIAL, *supra* note 6, at 124-25.

177. GREENAWALT, *supra* note 16, at 115.

teaching of evolution in public schools in *Epperson v. Arkansas.*[178] In 1928, Arkansas enacted an "anti-evolution" statute, prohibiting teaching the theory in its public schools and universities. In 1964, the Little Rock school system adopted and prescribed for the coming year a biology textbook, which included a chapter on evolutionary theory. Susan Epperson, a tenth-grade biology teacher, when confronted with having to teach from the statutorily prohibited text, brought an action to have the Arkansas statute declared void.[179] The Court struck the statute down on the ground that it violated the Establishment Clause of the First Amendment. The crucial fact, as the Court saw it, was that the statute disallowed in the classroom a segment "from the body of knowledge" because of its submission to a fundamentalist interpretation of the creation story in the Book of Genesis.[180]

The Court, speaking through Justice Fortas, stressed that the state's position toward religion should be a neutral one. Justice Fortas stated, "The First Amendment mandates governmental neutrality between religion and religion, and between religion and nonreligion." [181] He further emphasized that there can be no toleration of "laws that cast a pall of orthodoxy over the classroom."[182] While a state has the right to prescribe a curriculum for its public schools, that right must be executed in accordance with the dictates of the First Amendment.[183] The *raison d'etre* of the Arkansas statute was nothing more than "fundamentalist sectarian conviction"[184] and could not be defended as "an act of religious neutrality."[185]

In a concurring opinion, Justice Black expressed the view that the statute should have been voided for vagueness, not for violating the Establishment Clause.[186] Justice Black was not willing to assign a motive to the statute, because he thought it too

178. 393 U.S. 97 (1968).
179. *See id.* at 98-100.
180. *Id.* at 103.
181. *Id.* at 104.
182. *Id.* at 105 (quoting Keyishian v. Bd. of Regents, 385 U.S. 589, 603 (1967)).
183. *Id.* at 107.
184. *Id.* at 108.
185. *Id.* at 109.
186. *Id.* at 112 (Black, J., concurring).

difficult to ascertain the motive behind the statute's enactment.[187] He also astutely raised a question regarding the doctrine of neutrality in its application to the teaching of evolution. "If the theory [of evolution] is considered anti-religious . . .," he reasoned, "how can the State be bound by the Federal Constitution to permit its teachers to advocate"[188] it to schoolchildren? Justice Black continued, "Unless this Court is prepared simply to write off as pure nonsense the views of those who consider evolution an anti-religious doctrine, then this issue presents problems under the Establishment Clause far more troublesome than are discussed in the Court's opinion."[189]

Comparing and contrasting the perspectives of Justices Fortas and Black on the issue is illuminating. Both Justices were liberal voices on the Court who doubtless saw in the case an issue of religious freedom. But Black was reluctant to determine by judicial fiat that the doctrine of evolution constitutes "knowledge," while Fortas was not. When any doctrine is assigned by judicial decision to the world's "body of knowledge," the doctrine ceases, for traditional and modern forms of liberal thought, to be a matter of mere private cognizance. Black saw the danger and was circumspect in his concurrence. He did not state that neo-Darwinism is nonfactual; he was not ready or willing to do that. Yet he was fully aware that the theory conflicts with many Americans' religious convictions, and he did not wish to negate those. It was as if he stepped over a trap.

One question raised by his opinion is the following: is it the proper role of the federal judiciary to decide what can and can not pass for "knowledge" in public schools? Or, phrased another way, should the Supreme Court decide what schoolchildren should be taught and urged to believe about the origin and development of human life? An affirmative response allows the Court to place the power and prestige of the federal government behind a doctrine with undeniable religious implications, which the majority of the American people do not accept. For those who disagree with neo-Darwinism, the Court's endorsement of it smacks of a religious (or anti-religious) establishment. Justice Black was correct: the

187. *See id.* at 113.
188. *Id.*
189. *Id.* (Black, J., concurring).

majority decision is indeed "troublesome" in this respect.[190]

B. *Teaching Creationism in Public School*

In *Edwards v. Aguillard,*[191] the Court struck down a Louisiana statute providing for the teaching of "creation science," which was defined by the statute as "the *scientific evidences* for creation and inferences from those *scientific evidences.*"[192] Although no school was required to teach either evolution or creationism, the statute provided that, if either were taught, both must be.[193] The Court decided that the statute lacked a clear secular purpose and was for that reason a violation of the Establishment Clause.

Justice Brennan, who wrote for the majority, stated "[t]he goal of providing a more comprehensive science curriculum is not furthered either by outlawing the teaching of evolution or by requiring the teaching of creation science."[194] The statute, insisted Justice Brennan, does not expand academic freedom in the least, because it "does not grant teachers a flexibility that they did not already possess to supplant the present science curriculum with the presentation of theories, besides evolution, about the origin of life."[195] He emphasized that, had the Louisiana Legislature really been interested in academic freedom, "it would have encouraged the teaching of all scientific theories about the origins of humankind."[196] Citing the majority opinion in *Epperson*, the Justice made clear that the First Amendment does not permit a State to tailor the science curriculum to the mandates of religious

190. No decision more than *Epperson* illustrates the nonfeasibility of religion-neutral jurisprudence, which, interestingly enough, was set forth by Justice Black in *Everson v. Board of Education.* 330 U.S. 1 (1947). Black declared that the First Amendment "requires the state to be a neutral in its relations with groups of religious believers and non-believers . . . ." *Id.* at 18. For a discussion of religion-neutral jurisprudence, see L. Scott Smith, *"Religion-Neutral" Jurisprudence: An Examination of Its Meanings and End,* 13 WM. & MARY BILL RTS. J. 815 (2005) (hereinafter *'Religion-Neutral' Jurisprudence*).

191. Edwards v. Aguillard, 482 U.S. 578 (1987).

192. *Id.* at 611 (Scalia, J., dissenting).

193. *See id.* at 586.

194. *Id.*

195. *Id.* at 587.

196. *Id.* at 588.

sects and their dogmas.[197] That, stated Justice Brennan, was precisely what Louisiana was attempting to accomplish by this statute.[198]

Justice Scalia, dissenting, admitted "[i]t is undoubtedly true that what prompted the legislature to direct its attention to the misrepresentation of evolution in the schools . . . was its awareness of the tension between evolution and the religious beliefs of many children."[199] But he was quick to highlight "that a valid secular purpose is not rendered impermissible simply because its pursuit is prompted by concern for religious sensitivities."[200] The people of Louisiana, he stressed, are entitled to convey to their schoolchildren the gaps and deficiencies in the theory of evolution, "just as Mr. Scopes was entitled to present whatever scientific evidence there was for it."[201] Justice Scalia contended, based upon the evidence before the Court, it would be reasonable to assume that a legitimate concern of the statute was "'academic freedom,'" which the statute's legislative sponsor understood to mean "freedom from *indoctrination*."[202]

If the goal of education is for students to learn how to listen to ideas, to evaluate them, and to decide what they think and why, it is difficult to fathom how subjecting them to either evolutionary theory or to creationism is misguided.[203] It is possible that, by schools' juxtaposing the two theories, many students might

197. *Id.* at 543 (quoting Epperson v. Arkansas, 393 U.S. 97, 106 (E.D. Ark. 1968)).

198. *Id.* at 596-97.

199. *Id.* at 633 (Scalia, J., dissenting).

200. *Id.*

201. *Id.* at 634.

202. *Id.* at 627.

203. Greenawalt criticizes the dissent in *Edwards*. *See* GREENAWALT, *supra* note 16, at 123-24. He questions whether the Louisiana Legislature had a legitimate secular purpose for the statute, since teachers were free not to teach either evolutionary theory or creationism. In *Epperson v. Arkansas*, Justice Black explicitly suggests that, in order to avoid the high level of emotion and controversy which accompany the subject of evolution, deleting it from the curriculum altogether might be the preferred solution. 393 U.S. 97, 113 (1968). Additionally, the Justice proposed that eliminating the theory from the curriculum might make sense in order to foster genuine neutrality toward religion. *Id.* The Louisiana statute did nothing more egregious than to follow Justice Black's proposal. Query: Would Greenawalt say of Justice Black's reasoning, "The law's allowing of a failure to teach either theory is hard to explain except by religious objections to evolution"? GREENAWALT, *supra* note 16, at 123. I doubt it.

themselves come to regard creationism as poorly supported and nonscientific, if indeed it is. If creationism is as monstrously deficient as Greenawalt and many others argue, what better way to insure its eventual defeat than by exposing students to it? But the question, again, is whether the decision is one for a paternalistic federal judiciary to make, thereby short-circuiting the student's educational process.

Justice Brennan stated the Court was open to the presentation of any "scientific" theory of the origin and development of life in science class, but his expression of toleration and open-mindedness begged important questions.[204] He neglected to specify what the term "scientific" means and who will decide it. If the term is understood to include only approaches, which utilize methodological naturalism and are faithfully endorsed by the authoritative "priesthood"[205] of the National Academy of Science as well as by the academic elite, then these conditions will effectively eliminate from the science curriculum not only creationism and intelligent design theory, but also all theories which in any measure invoke the concept of mind, purpose, intelligence, and especially God[206] in science. An empirical approach to science will always, under these restrictions, be correlated with the adoption of naturalistic philosophy. The scientific circle will be drawn to encompass only those methods of interrogating experience that possess naturalistic underpinnings. Because *Edwards* fails to address this issue, it is unclear how it will be appropriated as a precedent.

Justice Brennan's opinion assumed that neo-Darwinism is science and that creationism is religion. The former is about fact

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204. *Edwards*, 482 U.S. at 594.

205. "Priesthood" is Phillip E. Johnson's term, which I believe accurately embodies the notion of the heteronomous authority of elite cultism, constituting an ideal description of the NAS as well as academe. *See* PHILLIP E. JOHNSON, REASON IN THE BALANCE: THE CASE AGAINST NATURALISM IN SCIENCE, LAW & EDUCATION 198 (1995).

206. *See* David DeWolf, Stephen C. Meyer & Mark E. DeForrest, *Teaching the Controversy: Is It Science, Religion, or Speech?, in* DDPE, *supra* note 5, 59, 92. Here the authors argue that "the Court's ruling in *Edwards* does not apply to design theory and can provide no grounds for excluding discussion of intelligent design from the public school science curriculum." *Id.* I do not think that *Edwards* should give proponents of intelligent design such sanguine hope, precisely because the majority opinion is not clear about what "science" is.

and knowledge, while the latter is about subjective belief. Justice Brennan's assessment was an oversimplification. As we have seen, neo-Darwinism has profound implications for religious understandings of the meaning of human life and has itself been termed "religious." Riddled with many troubling questions, it hardly rises to the level of "scientific fact" in the same sense as a statement such as "blood is pumped from the human heart."

Justice Brennan's reasoning might be interpreted to mean that propositions, such as "all design in the biological world is merely apparent" and that "human life appeared on the earth without either purpose or direction," are not theological while their opposites are. If this interpretation of his reasoning does not lead inexorably to the threat of religious establishment, then nothing does.

Justice Scalia was not willing to strike down the Louisiana statute, because he was convinced that the legislature had acted from a secular purpose to teach the controversy to students and to allow them to decide. Students, by being taught on both sides of the issue, may still learn evolutionary theory, but they will neither be told that it is factual nor that their religious views are false. Students who, by contrast, accept the theory will have the opportunity to learn why many oppose it and to develop a rejoinder to the opposition. Those who think Justice Scalia's solution is imprudent and misinformed appear to be the same ones who regard neo-Darwinism as largely, if not entirely, correct. Their certainty is not, however, shared by the majority of the American public.

For this reason, comparisons of creationism and intelligent design theory with belief in flat-earth doctrine, astrology, and alchemy are inapposite. There is an overwhelming consensus throughout all reaches of American society that the earth is not flat, that the location of the stars at any given moment is not determinative of one's life, and that base metals cannot be changed into gold. These viewpoints are not open and living options of thought. Although there is also a consensus in American society against the theory of evolution in one or more of its aspects, the commitment of scientists and other thoughtful people to the theory continues to give it life. The exploration and discussion of a theory that is viable, although vigorously disputed, belongs in the public marketplace of ideas. People should be not

only allowed, but also encouraged, to study and to discuss the theory, especially when it concerns the origin of life with deep-seated and far-reaching consequences for how people understand themselves and others. This liberty is John Stuart Mill's legacy to us.

C. *The Definition of "Science"*

In *McLean v. Arkansas Board of Education*,[207] a civil rights action was brought to enjoin the enforcement of an Arkansas statute requiring public schools to give balanced treatment to creation science and to evolution theory. The Court ordered a permanent injunction[208] and declared that "[t]he State failed to produce any evidence which would warrant an inference or conclusion that . . . anyone [had] considered the legitimate educational value . . ."[209] of the statute. The Court opined that "[e]volution does not presuppose the absence of a creator or God . . . ."[210] Evolutionary theory was further acknowledged by the court to be the "cornerstone of modern biology."[211]

These statements, as significant as they are, are not the crux of Judge Overton's opinion. The court went on to define the essential characteristics of "science." They were set forth as follows: (1) being guided by natural law, (2) explained by reference to natural law, (3) testable empirically, (4) tentative in its conclusions, and (5) falsifiable.[212] Evolutionary theory constituted science according to these criteria, while creationism was religion.[213]

Attempting to define science in terms of a set of abstract demarcation criteria is a precarious endeavor. Consider, for a moment, the criteria that science must be tentative in its conclusions and falsifiable. When Newton first formulated his theory of universal gravitation, he made a number of predictions, the truth of which he was unable to confirm, concerning the position of planets. Rather than telling himself and others that

207. 529 F. Supp. 1255 (E.D. Ark. 1982).
208. *Id.*
209. *Id.* at 1264.
210. *Id.* at 1266.
211. *Id.* at 1273.
212. *Id.* at 1267.
213. *See id.* at 1274.

his theory was falsified and that his predictions were merely tentative, he unyieldingly held to his theory, refining some of his peripheral assumptions (such as that the planets were perfectly spherical). The explanatory flexibility of the theory, upon encountering falsifying data, did not bar its entitlement to be called "science."[214]

The *McLean* court emphasized that the propositions of creationism could not be falsified. If that were true, it would follow that creationism is devoid of empirical assertions. That is clearly not the case. Creationists assert that complex organisms suddenly appeared in geological time and that the fossil record illustrates it. They also assert that there is limited variation among species. These are claims that are clearly falsifiable.[215]

The requirement that a proposition must be falsifiable in order to qualify as science raises another thorny issue: specifically, how can this requirement itself be falsified? The requirement does not withstand the challenge of reflexive inquiry. This fact is a reminder that the *McLean* requirements are philosophical, not scientific. The court, far from describing the character of scientific knowledge, was unwittingly investing in a philosophical point of view, which is far from invulnerable. What moral right does a federal court have to dictate a philosophy of knowledge? In a liberal state, that right belongs to each and every individual, does it not?

V. A BRIEF STATEMENT ABOUT THE JURISPRUDENCE OF RELIGION AND TEACHING EVOLUTIONARY THEORY

In a recent article, I attempted to recast, in a creative synthesis, the jurisprudence of religion in an effort to accommodate the basic political points of view allowable by the Religion Clauses. Insights from classical or traditional liberalism, communitarianism, revised liberalism, and de facto establishmentarianism are brought together in my jurisprudential approach to religion.[216] My discussion here will seek briefly to

214. *See* David DeWolf, Stephen C. Meyer & Mark E. DeForrest, *supra* note 206, at 76 (citing Imre Lakatos, *Falsification and the Methodology of Scientific Research Programmes*, *in* SCIENTIFIC KNOWLEDGE: BASIC ISSUES IN THE PHILOSOPHY OF SCIENCE 173, 175, 192 (J.A. Kouvray ed., 1987)).

215. *See id.* at 77.

216. *From Typology to Synthesis*, *supra* note 14.

show how that jurisprudential approach to religion addresses the teaching of neo-Darwinism in public schools.

A. *Beginning Assumptions*

As a preface to the discussion, I must highlight several assumptions, which I accept as factual. First, neo-Darwinism is a theory that characterizes the origin and development of life in a way that is fundamentally at odds with the religious beliefs of many people. Secondly, these people do not accept what they regard as the anti-religious implications of the theory. Thirdly, the theory contains significant evidentiary gaps or deficiencies. Fourthly, it is based upon adductive reasoning, or the principle of inference to the best explanation, with the "best" explanation being a matter of intense controversy.

B. *Revised Liberalism: Discussion and Debate in the Public Square*

When one accepts the foregoing assumptions, there is room for honest discussion and debate. Citizens should not be under a gag-order in the utilization and enjoyment of their public institutions. Public school instructors who teach evolutionary theory should be able to express whatever doubts, if any, they may entertain about the theory or about any alternative theory, provided that their objective is to compel students to think critically rather than to proselytize them to a particular point of view (or faith). Greenawalt's suggestion, previously noted, that science teachers should curb their explanations regarding possible order in evolutionary development because of inferences students may draw about creative intelligence is shockingly antithetical to the best and most noble tradition of education in a liberal state. If a student in high school, for example, spends her summer reading, let us say, *The Origin of Species, The Blind Watchmaker*, and *Darwin's Black Box*, and is sufficiently enthusiastic about the topic of whether design in the biosphere is real or apparent to propound questions regarding the subject, the instructor should fully address her questions, and may even do so in the presence of the rest of the class if it will assist other students to understand the issues involved.

Through the dialectical point-counterpoint, give-and-take of

the educational process, students will be able to avail themselves of the opportunity to forge their own respective views concerning the truth or falsity of neo-Darwinian theory. I do not dispute that they should study it in a serious manner and be informed that it is currently the dominant theory among scientists. But it is not the job of public school teachers to manipulate the student's intellectual process by presenting only one perspective on an admittedly controversial topic, when a number of viewpoints are embraced in the student population and the community where the school is located and funded, not to say in the scientific community itself.

At least part of my point concerns effective pedagogy; a teacher must meet the students where they are and, as William Provine has learned, "[v]iewing half or more of your students as 'the enemy' is weird."[217] He gives his students a forum to discuss their views and makes an effort to help them to think critically about their views.[218]

The remainder of my point concerns the character of the study itself – it is adductive. This means that, given the gaps in the evidentiary record and the multiplicity of questions that can be raised at virtually every turn, judgments can reasonably differ concerning which inference is best. There is no room for dogmatism.[219]

Courts should facilitate open and honest intellectual inquiry. When they foreclose public discussion and debate on an intensely disputed topic such as evolutionary theory, official state pronouncements pre-empt individual inquiry and decision. The result is often citizen resentment and cultural war.

C. *De Facto Establishmentarianism: Religious and Moral Values*

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217. Provine, *supra* note 175, at 511.

218. *Id.*

219. Or so it would appear. An inquisitional spirit is still alive and well, even among scientists. Punishment is reserved for those who veer from orthodoxy and the established doctrine of the origin of life. Consider the recent case of evolutionary biologist, Richard Sternberg who, while editor of *Proceedings of the Biological Society of Washington,* accepted for publication an article that made a case for "intelligent design." An independent fact-finding agency found that senior scientists at the National Museum of Natural History not only defamed Sternberg, but ran him from his position as a Smithsonian research associate. *See* Michael Powell, *Editor Explains Reasons for 'Intelligent Design' Article,* WASH. POST, Aug. 19, 2005, at A19.

in Political Outcomes

The citizenry, through its elected representatives, should decide fiercely contested curriculum issues. Citizens can make their most persuasive arguments and give their best reasons concerning how the science curriculum should be fashioned. It is the responsibility of elected representatives to execute the will of their constituents. Religious and moral beliefs will certainly shape political outcomes; neutrality is not now, nor has it ever been, an option.[220] In the decision-making process of a liberal state, some values will be chosen over others. Public school curricula will reflect this fact. As I have argued elsewhere, this country's religious values are undeniable and are sure to influence political choices.[221] There is no reason why a vital and dynamic relationship between religion and science should be lamented because, as Greenawalt himself maintains, viewing the two disciplines as separate discourses founders on the reality that, for many, there is common ground between them. No citizen can ultimately live in rigid dichotomies, where science is cut off from religion and morality. The challenge for the enlightened citizen is to understand the many varieties and cascades of experience as parts of an integrated whole. Attempting to meet the challenge results in only tentative and asymptotic steps to ultimate truth, but this reality in no way discounts the significance of the

220. *See "Religion-Neutral" Jurisprudence, supra* note 190. Jay D. Wexler argues, by implication, that evolutionary theory is religion-neutral. *Cf.* Jay D. Wexler, *Of Pandas, People, and the First Amendment: The Constitutionality of Teaching Intelligent Design in the Public Schools,* 49 STAN. L. REV. 439, 456 (1997). Wexler, writing of intelligent design theory states, "[D]espite its muddled Establishment Clause jurisprudence, the Court has consistently applied the most exacting scrutiny in the context of public schools and would surely strike down any attempt to communicate a religious belief in the public school classroom." *Id.* at 456. The implicit argument that neo-Darwinian theory does not convey a religious (or anti-religious) message is an implausible one. So why is neo-Darwinian theory permissible and intelligent design theory is not? If an intelligent source for life is religious, why is a non-intelligent source for life not nonreligious or anti-religious? Both would be unconstitutional under *Everson.* Everson v. Bd. of Educ., 330 U.S. 1, 15-16 (1947). Correct? Wexler's opposition to intelligent design theory reflects little more than a thinly veiled political agenda. There is nothing improper about having a political agenda so long as the fact is admitted and there is not an attempt to describe it as religion-neutral.

221. *From Typology to Synthesis, supra* note 14.

challenge.

Given the large diversity of opinion regarding neo-Darwinian theory and the way in which it challenges many religious beliefs, there is nothing shocking about the prospect of a State policy allowing science teachers to bring before students a wide range of theoretical perspectives from respected scientists, including some who espouse evolutionary theory and others who argue against it.

D. *Communitarianism: The Strengthening of Associational Bonds*

There are numerous groups of various stripes, who are interested in the manner in which the origin of life is taught in this country's public schools. Regardless of the organization, whether the National Center for Science Education (promoting evolutionary theory) or the Discovery Institute (advocating intelligent design), it serves to foster democratic life by fueling discussion and debate, while at the same time strengthening associational bonds between citizens. When they join together to make common cause on behalf of an idea that inspires them, they learn the virtues of civility and cooperation.

Federal courts, by exercising judicial restraint, can empower the citizenry. When courts, as elite bodies of men and women, pronounce from Mt. Olympus on the truth-claim of an intensely contested intellectual issue, they obstruct the individual's right to decide. As individual citizens feel increasingly disempowered, they become lethargic in the political process; associational bonds weaken, and democratic life suffers.

E. *Classical Liberalism: The Autonomous Individual in the Liberal State*

A government of, by, and for the people means entrusting to them the right to decide, even if wrongly, how public school curricula are structured. Such a decision must include the guarantee that each student will be afforded a full and fair opportunity to determine what he or she believes about any matter that incites intellectual controversy. Just as there are no stupid questions when honestly asked, there is no illegitimate controversy in which there is sincere engagement. It should follow that the student has a right to hear, presented as objectively as possible, the evidence on evolutionary theory and any of its

challengers (which have substantial support and viability within the student community), and to assess the truth of the matter in his or her own way.

No student should be expected to deny his or her religious beliefs in order to study science. There should be no official position, propounded and issued by federal authority, regarding what constitutes "science" or "knowledge," or what can or cannot be taught in public schools, provided that schools remain generally free and open institutions. When various points of view are studied and discussed, it may happen that a student will either modify his or her religious views or renounce them altogether. But such decisions belong exclusively to the student, whose autonomy must be honored and respected in a liberal state.