

I

The 2005 decision by Judge John E. Jones in *Kitzmiller v. Dover Area School District* was celebrated by all red-blooded American liberals as a victory over the forces of darkness. The result was probably inevitable, in view of the reckless expression by some members of the Dover School Board of their desire to put religion into the classroom, and the clumsiness of their prescribed statement in trying to dissimulate that aim.¹ But the conflicts aired in this trial—over the status of evolutionary theory, the arguments for intelligent design, and the nature of science—reveal an intellectually unhealthy situation. The political urge to defend science education against the threats of religious orthodoxy, understandable though it is, has resulted in a counterorthodoxy, supported by bad arguments, and a tendency to overstate the legitimate scientific claims of evolutionary theory. Skeptics about the theory are seen as so dangerous, and so disreputably motivated, that they must be denied any shred of

1. The whole case was about the following text, which was to be read to students in ninth-grade biology class:

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

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

“Intelligent Design is an explanation of the origin of life that differs from Darwin’s view. The reference book, *Of Pandas and People*, is available for students who might be interested in gaining an understanding of what Intelligent Design actually involves.

“With respect to any theory, students are encouraged to keep an open mind. The school leaves the discussion of the Origins of Life to individual students and their families. As a Standards-driven district, class instruction focuses upon preparing students to achieve proficiency on Standards-based assessments.”

Kitzmiller v. Dover Area Sch. Dist., 400 F. Supp. 2d 707 (M.D. Pa. 2005), at pp. 708–09.

legitimate interest. Most importantly, the campaign of the scientific establishment to rule out intelligent design as beyond discussion because it is not science results in the avoidance of significant questions about the relation between evolutionary theory and religious belief, questions that must be faced in order to understand the theory and evaluate the scientific evidence for it.

It would be unfortunate if the Establishment Clause made it unconstitutional to allude to these questions in a public school biology class, for that would mean that evolutionary theory cannot be taught in an intellectually responsible way. My aim is to address the constitutional issue, but first I want to discuss the relation between evolutionary theory and the despised alternative. For legal reasons that alternative is called intelligent design, with no implication that the designer is God, but I shall assume that we are talking about some form of divine purpose or divine intervention. Nevertheless, there is a distinction between the arguments for intelligent design in biology and the traditional argument from design for the existence of God. ID (as I shall call it, in conformity to current usage) is best interpreted not as an argument for the existence of God, but as a claim about what it is reasonable to believe about biological evolution if one independently holds a belief in God that is consistent both with the empirical facts about nature that have been established by observation, and with the acceptance of general standards of scientific evidence. For legal reasons it is not presented that way by its defenders, but I think that is a mistake.

From the beginning it has been commonplace to present the theory of evolution by random mutation and natural selection as an alternative to intentional design as an explanation of the functional organization of living organisms. The evidence for the theory is supposed to be evidence for the absence of purpose in the causation of the development of life-forms on this planet. It is not just the theory that life evolved over billions of years, and that all species are descended from a common ancestor. Its defining element is the claim that all this happened as the result of the appearance of random and purposeless mutations in the genetic material followed by natural selection due to the resulting heritable variations in reproductive fitness. It displaces design by proposing an alternative.

No one suggests that the theory is not science, even though the historical process it describes cannot be directly observed, but must be

inferred from currently available data. It is therefore puzzling that the denial of this inference, i.e., the claim that the evidence offered for the theory does not support the kind of explanation it proposes, and that the purposive alternative has not been displaced, should be dismissed as not science. The contention seems to be that, although science can demonstrate the falsehood of the design hypothesis, no evidence against that demonstration can be regarded as scientific support for the hypothesis. Only the falsehood, and not the truth, of ID can count as a scientific claim. Something about the nature of the conclusion, that it involves the purposes of a supernatural being, rules it out as science.

The problem cannot be just that the idea of a designer is too vague, and that nothing is being said about how he works. When Darwin proposed the theory of natural selection, neither he nor anyone else had any idea of how heredity worked, or what could cause a mutation that was observable in the phenotype and was heritable. The proposal was simply that something purposeless was going on that had these effects, permitting natural selection to operate. This is no less vague than the hypothesis that the mutations available for selection are influenced by the actions of a designer. So it must be the element of purpose that is the real offender.

I believe there is a reason for this, and that it depends on a premise that, though completely valid, does not have the consequences that are usually drawn from it. The premise is that the purposes and actions of God, if there is a god, are not themselves, and could not possibly be, the object of a scientific theory in the way that the mechanisms of heredity have become the object of a scientific theory since Darwin. We do not have much scientific understanding of the creative process even when the creator is human; perhaps such creativity too is beyond the reach of science. Leaving that aside: the idea of a divine creator or designer is clearly the idea of a being whose acts and decisions are not explainable by natural law. There is no divine scientific psychology.

So the purposes and intentions of God, if there is a god, and the nature of his will, are not possible subjects of a scientific theory or scientific explanation. But that does not imply that there cannot be scientific evidence for or against the intervention of such a non-law-governed cause in the natural order. The fact that there could be no scientific theory of the internal operation of the divine mind is consistent with its

being in large part a scientific question whether divine intervention² provides a more likely explanation of the empirical data than an explanation in terms of physical law alone. To ask whether there are limits to what can credibly be explained by a given type of scientific theory, or any theory relying only on universal physical laws, is itself a scientific question. An answer to the question that asserts such limits on the basis of empirical evidence is still a scientific claim, even if it also proposes an alternative cause whose internal operation is not governed by the kind of natural law that science can investigate. I suspect that the assumption that science can never provide evidence for the occurrence of something that cannot be scientifically explained is the principal reason for the belief that ID cannot be science; but so far as I can see, that assumption is without merit.

I assume it will be granted by everyone that, even though the past cannot be directly observed, a scientific argument against the Darwinian theory of evolution is not impossible. If it were impossible, that would cast doubt on whether the theory is itself science. The theory makes claims about the causes of evolution that are inferred from the available evidence, and that could be undermined by further evidence. For example, as we learn more about the behavior of the genetic material, and more about how the properties of organisms depend on it, it will be possible to give more precise answers to questions about the rate at which viable mutations can occur randomly as a result of physical accident, the kinds of phenotypic changes they can generate, and the number of generations within which specific changes would have had to occur to make the theory fit the development of organisms as we know them. Together with calculations of the numbers of individual organisms that have been involved in the major transitions in evolution, this should make it possible to evaluate the theory mathematically.

Most evolutionary biologists are confident about the answers to these questions, but there is no a priori guarantee that they will eventually be answered in a way that confirms the theory. One of the disturbing things about the public debate is that scientists engaged in it sometimes write as if the idea of fundamental problems with the theory (as opposed to

2. I shall use the term "intervention" to cover any kind of intentional influence, whether during the course of evolution or in the creation of the initial conditions that led to it.

problems of detail in its application) were unthinkable, and that to entertain such doubts is like wondering whether the earth is flat. This seems to me, as an outsider, a vast underestimation of how much we do not know, and how much about the evolutionary process remains speculative and sketchy. Since it is a scientific theory that makes large claims about what cannot be directly observed, there could be scientific evidence against it (and new evidence is constantly becoming available in this case, since molecular biology is so new).

There is one question whose legitimacy is particularly important for our purposes: whether the mutations on which natural selection has operated are entirely due to chance. Is this question decisively settled in the affirmative by the available evidence, or can a reasonable observer regard it as still open? Marc W. Kirschner and John C. Gerhart, who reject ID but who present a naturalistic theory of “facilitated variation” in their book, *The Plausibility of Life*, put the problem as follows:

In evolution, selection always acts on variation of the *phenotype*, which includes all the observable and functional features of the organism. . . . Selection does not directly act on the DNA sequence (also called the *genotype*). . . . The question unanswered by the two well-established pillars of evolutionary theory (selection and heredity) is whether, given the rate and nature of changes in the DNA, *enough of the right kind* of phenotypic variation will occur to allow selection to do its work, powering complex evolutionary change. . . . Is genetic variation purely random, or is it in fact biased to *facilitate* evolutionary change?³

Stuart Kauffman, a complexity theorist who defends a naturalistic theory of emergence, says this:

I propose that much of the order in organisms may not be the result of selection at all, but of the spontaneous order of self-organized systems. . . . The order of organisms is natural, not merely the unexpected triumph of natural selection. . . . Evolution is not merely

3. *The Plausibility of Life* (New Haven, Conn.: Yale University Press, 2005), pp. 12–13. They believe that facilitated variation, although nonrandom, is itself the product of earlier natural selection.

“chance caught on the wing,” in Monod’s evocative image. The history of life captures the natural order, on which selection is privileged to act.⁴

Are the sources of genetic variation uniformly random or not? That is the central issue, and the point of entry for defenders of ID. In his recent book, *The Edge of Evolution*, Michael Behe examines a body of currently available evidence about the normal frequency and biochemical character of random mutations in the genetic material of several organisms: the malaria parasite, the human immunodeficiency virus (HIV), the bacterium *E. coli*, and humans. He argues that those widely cited examples of evolutionary adaptation, including the development of immunity to antibiotics, when properly understood, cannot be extrapolated to explain the formation of complex new biological systems. These, he claims, would require mutations of a completely different order, mutations whose random probability, either as simultaneous multiple mutations or as sequences of separately adaptive individual mutations, is vanishingly small. He concludes that

alterations to DNA over the course of the history of life on earth must have included many changes that we have no statistical right to expect, ones that were beneficial beyond the wildest reach of probability.⁵

Like Kauffman, he believes that random mutation is not sufficient to explain the range of variation on which natural selection must have acted to yield the history of life: some of the variation was not due to chance. This seems on the face of it to be a scientific claim, about what the evidence suggests, and one that is not self-evidently absurd. I cannot evaluate it; I merely want to stress its importance for the current debate. Skepticism about the standard evolutionary model is not limited to defenders of ID. The skeptics may be right or they may be wrong. But even if one merely regards the randomness of the sources of variation as an open question, it seems to call for the consideration of alternatives.

4. *At Home in the Universe* (New York: Oxford University Press, 1995), p. 25.

5. *The Edge of Evolution* (New York: Free Press, 2007), p. 165.

II

The claim that ID is not a scientific theory implies that even if there were scientific evidence against evolutionary theory, which was originally introduced as an alternative to design, that would not constitute any scientific evidence for ID. We might have to give up evolutionary theory, but then we would be constrained by the canons or definition of science to look for a different scientific, i.e., nonpurposive, explanation of the development of life, because science prohibits us from even considering ID as a possible alternative explanation, one whose eligibility would otherwise be enhanced by the rejection of the leading scientific explanation, namely evolutionary theory.

What would it take to justify the claim that there are propositions such that the discovery of evidence against them can qualify as science, but evidence in favor of them cannot? Someone who accepts this view would probably extend it to propositions about ghosts or extrasensory perception. Research showing that effects that some benighted souls have attributed to ghosts or mental telepathy can be explained in a perfectly naturalistic way would count as science, but any argument that the evidence does not support those explanations, and that significant experimental or observational data are better explained by ghosts or by ESP, would not count as science, and could therefore be ruled out of consideration. On this view it would not even be a false scientific claim.

The idea is that any naturalistic or nonspiritual explanation of a phenomenon can be either confirmed or disconfirmed by empirical evidence together with causal and probabilistic reasoning. No empirical evidence against such a nonspiritual alternative, however, nor any other kind of empirical evidence, could provide a reason for believing the spiritual hypothesis. Belief in something like that is necessarily the result of a different cognitive process, having nothing to do with the scientific evaluation of empirical evidence (rank superstition or blind faith, to give it its true name). I submit that this way of drawing the boundaries around science depends not on a definition but on the unspoken assumption that all such propositions are obviously false—there are no ghosts, there is no ESP, and there is no god—so that to invoke such things to explain any observed phenomenon, even one for which no other explanation is available, reveals a disposition to take

seriously a possibility that a rational person would not consider. Without this assumption the exclusion of ID from consideration cannot be defended.

In order to think that the refutation or very low probability of all the available alternatives provides some evidence for an explanation E of some observation, one has to believe that E is at least possible. So if one thinks that the existence of ghosts is not a possibility, no spooky manifestations, however elaborate and otherwise inexplicable, will be taken as evidence, however weak, that a ghost is behind them. The real issue over the scientific status of ID is over what determines the antecedent belief in the possibility that a nonphysical being should intervene in the natural order. Opponents of the scientific status of ID are moved by the fact that those who believe this is possible, and who therefore can regard certain empirical observations as evidence for its actuality, usually believe in the possibility as a result of faith or ecclesiastical authority, rather than evidence. This nonscientific element, which is a necessary condition of their interpretation of the empirical evidence, is thought to undermine the scientific status of the whole position.

Unfortunately it also seems to undermine the scientific status of the rejection of ID. Those who would not take any amount of evidence against evolutionary theory as evidence for ID, like those who would not take evidence against naturalistic explanations of spooky manifestations as evidence for the presence of a ghost, seem to be assuming that ID is not a possibility. What is the status of that assumption? Is it scientifically grounded?⁶ It may not be a matter of faith or ecclesiastical authority, but it does seem to be a basic, ungrounded assumption about how the world works, essentially a kind of naturalism. If it operates as an empirically ungrounded boundary on the range of possibilities that can be considered in seeking explanations of what we can observe, why does that not undermine the scientific status of the theories that depend

6. An exclusionary assumption clearly can be scientifically grounded. For example, the existence of ghosts can be disregarded as a possibility in light of the consistently negative findings of the Society for Psychical Research during the nineteenth century. Of course some people would find it reasonable to rule out ghosts, like God, even without such evidence.

on it, just as much as a somewhat different assumption about the antecedent possibilities?

It is often said that this particular set of boundaries is just part of the definition of science. I suspect that this simply reflects the confusion pointed out earlier: the assumption that there cannot be a scientific argument for the presence of a cause that is not itself governed by scientific laws. In any event, a purely semantic classification of a hypothesis or its denial as belonging or not to science is of limited interest to someone who wants to know whether the hypothesis is true or false. He will be interested in evaluating both the scientific evidence for its falsehood and the evidence, whatever it may be called, for its truth (which would have to include arguments against the adequacy of the scientific evidence for its falsehood). The objector's claim is not just terminological: it is that in view of the basis of a belief in design, it has no right to be considered in competition with naturalistic accounts of the same subject matter, by those seeking to explain what is observed.

The denier that ID is science faces the following dilemma. Either he admits that the intervention of such a designer is possible, or he does not. If he does not, he must explain why that belief is more scientific than the belief that a designer is possible. If on the other hand he believes that a designer is possible, then he can argue that the evidence is overwhelmingly against the actions of such a designer, but he cannot say that someone who offers evidence on the other side is doing something of a fundamentally different kind. All he can say about that person is that he is scientifically mistaken.

Similar things could be said about differences in antecedent belief that assigned higher or lower probabilities, rather than just possibility and impossibility, to the existence of a designer. If these prior probabilities have a large effect on the interpretation of the empirical evidence, and if neither of them is empirically based, it is hard to imagine that one of them should render the resulting reasoning unscientific whereas the other does not.

I think there are only two possible justifications for this asymmetry. Either there is strong scientific evidence against the existence of God; or there is a scientific default presumption that the prior probability of a designer is low, and the only possible basis for assigning it a higher probability—high enough to make it eligible as an explanation of what is empirically observed—is faith, revelation, or ecclesiastical authority. Is

either of those things true, however? Is the opposition between these prior probabilities really an opposition between scientific rationality and unreasoned dogmatism?⁷

It seems to me that in this respect ID is very different from young earth creationism, and the “creation science” that it spawned. There are people who believe, on the authority of the Bible, that God created the earth and all the creatures on it about six thousand years ago. The fact that this proposition is inconsistent with various scientific theories of cosmology, geology, and biology does not make it a scientific claim.

Biblical literalism is not a scientific hypothesis because it is not offered as an explanation of the empirical evidence, but is accepted as a divine revelation. So long as no observations about the natural world are offered in its support, it is not even a false scientific claim. When, however, in response to the finding that the teaching of creationism in public schools was unconstitutional, the producers of creation science tried to argue that young earth creationism was consistent with the geological and paleontological evidence, they succeeded in putting forward a scientific claim, even though their reason for doing so was that they believed it to be true on other grounds, and their arguments were easily refuted.⁸ A scientific hypothesis can be false and unsupported by the evidence. That is a good enough reason not to teach it to schoolchildren. It is not necessary to argue that it is not science, not even hopelessly bad science.

ID is very different from creation science. To an outsider, at least, it does not seem to depend on massive distortion of the evidence and

7. Judge Jones adopted the position urged on him by expert witnesses for the plaintiffs, that the exclusion of purposive explanation is just one of the ground rules of science: “This rigorous attachment to ‘natural’ explanations is an essential attribute to science by definition and by convention. We are in agreement with Plaintiffs’ lead expert Dr. Miller, that from a practical perspective, attributing unsolved problems about nature to causes and forces that lie outside the natural world is a ‘science stopper’. As Dr. Miller explained, once you attribute a cause to an untestable supernatural force, a proposition that cannot be disproven, there is no reason to continue seeking natural explanations as we have our answer” (*Kitzmiller*, at p. 736).

Yet the idea that someone who admits the possibility of design as an explanation will have no reason to look for explanations in terms of natural law is completely unsupported, either epistemologically or historically. From Newton on down, scientists who believe in God have always been as intent as anyone else to discover universal natural laws that can be empirically confirmed.

8. See Philip Kitcher, *Abusing Science: The Case Against Creationism* (Cambridge, Mass.: MIT Press, 1982).

hopeless incoherencies in its interpretation. Nor does it depend, like biblical literalism, on the assumption that the truth of ID is immune to empirical evidence to the contrary. What it does depend on is the assumption that the hypothesis of a designer makes sense and cannot be ruled out as impossible or assigned a vanishingly small probability in advance. Once it is assigned a significant prior probability, it becomes a serious candidate for support by empirical evidence, in particular empirical evidence against the sufficiency of standard evolutionary theory to account for the observational data. Critics take issue with the claims made by defenders of ID about what standard evolutionary mechanisms can accomplish, and argue that they depend on faulty assumptions. Whatever the merits, however, that is clearly a scientific disagreement, not a disagreement between science and something else.

A great deal therefore hangs on the sources of differences between investigators in their attitude to this prior probability, and the relevance of those sources to the scientific character of their convictions. It is difficult to avoid the conclusion that the two sides are in symmetrical positions. If one scientist is a theist and another an atheist, this is either a scientific or a nonscientific disagreement between them. If it is scientific (supposing this is possible), then their disagreement is scientific all the way down. If it is not a scientific disagreement, and if this difference in their nonscientific beliefs about the antecedent possibilities affects their rational interpretation of the same empirical evidence, I do not see how we can say that one is engaged in science and the other is not. Either both conclusions are rendered nonscientific by the influence of their nonscientific assumptions, or both are scientific in spite of those assumptions.

In the latter case, they have a scientific disagreement that cannot be settled by scientific reasoning alone. The same could be said of a disagreement between two theists, one of whom considers divine tinkering in the natural order a possibility and the other of whom does not. Kenneth Miller, the leading scientific witness against intelligent design in the Dover case, is apparently an example of the latter. He is a Catholic, but his conception of God's relation to the creation is incompatible with intervention in the evolutionary process.⁹ That is part of his

9. "In obvious ways, the various objections to evolution take a narrow view of the capabilities of life—but they take an even narrower view of the capabilities of the Creator.

religious outlook, not a scientific belief, but it has consequences for his scientific interpretation of the evidence, specifically for his confidence that traditional evolutionary explanations exist for the development of the most complex biological systems, whether we are able to discover them or not.

I agree with Philip Kitcher that the response of evolutionists to creation science and intelligent design should not be to rule them out as “not science.” He argues that the objection should rather be that they are bad science, or dead science: scientific claims that have been decisively refuted by the evidence.¹⁰ That would certainly be enough to rule out their being discussed in science courses, although they might be of interest in courses on the history and philosophy of science. There is a problem, however. The claim that ID is bad science or dead science may depend, almost as much as the claim that it is not science, on the assumption that divine intervention in the natural order is not a serious possibility. That is not a scientific belief but a belief about a religious question: it amounts to the assumption that either there is no god, or if there is, he certainly does not intervene in the natural order to guide the world in certain directions.

The contrast between the rejection of ID and the rejection of creation science is instructive here. To reject the explanations creation scientists offer of the fossil record in terms of the biblical flood, we do not have to first assume that the Bible is not literally true. Even if we begin, for the sake of argument, with no prior assumptions about the literal truth of the Bible, and assume that, prior to the geological evidence, it could be true, we will very quickly find overwhelming evidence that it is not; evidence that does not depend on ruling out in advance the possibility that the world was created six thousand years ago. All the conclusion depends on

They hobble His genius by demanding that the material of His creation ought not to be capable of generating complexity. They demean the breadth of His vision by ridiculing the notion that the materials of His world could have evolved into beings with intelligence and self-awareness. And they compel Him to descend from heaven onto the factory floor by conscripting His labor into the design of each detail of each organism that graces the surface of our living planet” (Kenneth Miller, *Finding Darwin's God* [New York: Harper-Collins, 1999], p. 268).

10. Philip Kitcher, *Living with Darwin* (New York: Oxford University Press, 2007), pp. 8–11.

is not taking the literal truth of the Bible as an article of faith that cannot be refuted by any amount of contrary empirical evidence.

It is worth noting that this is a (negative) religious claim. To hold that empirical evidence can count against the literal truth of the Bible is to deny a religious belief that, remarkably, many people hold. That denial is a necessary condition of the teaching of much basic science. Since the Establishment Clause does not prohibit such teaching, it follows that there are certain religious beliefs whose implicit rejection in public education is not unconstitutional, precisely because they are inconsistent with the standards of scientific rationality.

ID is a different story. Its defense requires only that design be admitted as a possibility, not that it be regarded as empirically unassailable. It would be difficult to argue that the admission of that possibility is inconsistent with the standards of scientific rationality. Further, if it is admitted as a possibility, it would be difficult to argue that the presently available empirical evidence rules it out decisively, as it does young earth creationism. To rule it out decisively would require that the sufficiency of standard evolutionary mechanisms to account for the entire evolution of life should have been clearly established by presently available evidence. So far as I can tell, in spite of the rhetoric to the contrary, nothing close to this has been done.

A great deal depends on the likelihood that the complex chemical systems we observe arose through a sufficiently long sequence of random mutations in DNA, each of which enhanced fitness. It is difficult to find in the accessible literature the grounds for evolutionary biologists' confidence about this.¹¹ I am speaking as a layman, but it is to the lay public that the defense of scientific orthodoxy against ID is addressed. It is not enough to say, although it is true, that the incapacity of evolutionary mechanisms to account for the entire evolution of life has not been conclusively established. That is not required for an alternative to be considered seriously, provided the alternative is not ruled out in advance on other grounds. Those who offer empirical

11. Confidence expressed by Jerry Coyne, for example, in his review of *The Edge of Evolution*: "Behe furnishes no proof, no convincing argument, that [protein-protein] interactions cannot evolve gradually. In fact, interactions between proteins, like any complex interaction, were certainly built up step by mutational step, with each change producing an interaction scrutinized by selection and retained if it enhanced an organism's fitness" (*The New Republic*, June 18, 2007, p. 42).

evidence for ID do not have to argue that a completely nonpurposive explanation is impossible, only that it is very unlikely, given the evidence available. That is a scientific claim, though a contestable one. The next step depends, as I have said, on beliefs about the possibility of design that are not based on that evidence, whether they are positive or negative.

III

The consequence of all this for public education is that both the inclusion of some mention of ID in a biology class and its exclusion would seem to depend on religious assumptions. Either divine intervention is ruled out in advance or it is not. If it is, ID can be disregarded. If it is not, evidence for ID can be considered. Yet both are clearly assumptions of a religious nature. Public schools in the United States may not teach atheism or deism any more than they may teach Christianity, so how can it be all right to teach scientific theories whose empirical confirmation depends on the assumption of one range of these views while it is impermissible to discuss the implications of alternative views on the same question?

It would have to be argued that the assumption that divine intervention is impossible, or too improbable to be considered, is on a par with the assumption that the literal truth of the Bible is not immune to empirical counterevidence, and that just as the latter is a constitutionally permissible presupposition of the teaching of science, so is the former. In other words, not considering divine intervention a possibility is just a basic epistemological condition of modern science, a condition of scientific rationality, and cannot be constitutionally suspect, in spite of the fact that it is a religious assumption.

I know that many scientists would make this claim, and perhaps that is the nub of the issue. Yet it is inaccurate to assimilate the two religious positions whose official exclusion is being said to be constitutionally required. In order to teach about the history of the universe, the solar system, and life on earth it is indispensable to presuppose the falsity of fundamentalist epistemology. But the development of the theory of evolution did not depend on the assumption that design was impossible. On the contrary, it developed as an alternative to design, offering a surprising but illuminating account of how the appearance of design might

have arisen without a designer. The conceivability of the design alternative is part of the background for understanding evolutionary theory. To make the assumption of its falsehood a condition of scientific rationality seems almost incoherent.

What would a biology course teach if it wanted to remain neutral on the question whether divine intervention in the process of life's development was a possibility, while acknowledging that people disagree about whether it should be regarded as a possibility at all, or what probability should be assigned to it, and that there is at present no way to settle that disagreement scientifically? So far as I can see, the only way to make no assumptions of a religious nature would be to admit that the empirical evidence may suggest different conclusions depending on what religious belief one starts with, and that the evidence does not by itself settle which of those beliefs is correct, even though there are other religious beliefs, such as the literal truth of *Genesis*, that are easily refuted by the evidence. I do not see much hope that such an approach could be adopted, but it would combine intellectual responsibility with respect for the Establishment Clause. Further (although the issue is not likely to arise), I believe that if a state legislature or school board voted to prohibit discussion of ID in the classroom, that would contravene the requirement of religious neutrality, although not as obviously as the exclusion of the theory of evolution, because it too would depend on a view, atheism or theistic noninterventionism, that falls clearly in the domain of religious belief.

Judge Jones cited as a decisive reason for denying ID the status of science that Michael Behe, the chief scientific witness for the defense, acknowledged that the theory would be more plausible to someone who believed in God than to someone who did not.¹² This is just common sense, however, and the opposite is just as true: evolutionary theory as a complete explanation of the development of life is more plausible to someone who does not believe in God than to someone who does. Either

12. "Professor Behe remarkably and unmistakably claims that the *plausibility of the argument for ID depends upon the extent to which one believes in the existence of God*. As no evidence in the record indicates that any other scientific proposition's validity rests on belief in God, nor is the Court aware of any such scientific propositions, Professor Behe's assertion constitutes substantial evidence that in his view, as is commensurate with other prominent ID leaders, ID is a religious and not a scientific proposition" (*Kitzmiller*, at p. 720).

both of them are science or neither of them is. If both of them are scientific hypotheses, the ground for exclusion must be that ID is hopelessly bad science, or dead science, in Kitcher's phrase.

That would be true if ID, like young earth creationism, can be refuted by the empirical evidence even if one starts by assuming that the possibility of a god who could intervene cannot be ruled out in advance. So far as I can tell, however, no such refutation has even been offered, let alone established. What have been offered instead are necessarily speculative proposals about how the problems posed by Behe might be handled by evolutionary theory, declarations that no hypothesis involving divine intervention counts as science, and assurances that evolutionary theory is not inconsistent with the existence of God. It is also emphasized that even if evolutionary theory were false, that would not mean that ID was true. That is so, but it is still not a sufficient reason to exclude it from discussion.

My own situation is that of an atheist who, in spite of being an avid consumer of popular science, has for a long time been skeptical of the claims of traditional evolutionary theory to be the whole story about the history of life. The theory does not claim to explain the origin of life, which remains a complete scientific mystery at this point. Opponents of ID, however, normally assume that that too must have a purely chemical explanation. The idea is that life arose and evolved to its present form solely because of the laws of chemistry, and ultimately of particle physics. In the prevailing naturalistic worldview, evolutionary theory plays the crucial role in showing how physics can be the theory of everything.

Sophisticated members of the contemporary culture have been so thoroughly indoctrinated that they easily lose sight of the fact that evolutionary reductionism defies common sense. A theory that defies common sense can be true, but doubts about its truth should be suppressed only in the face of exceptionally strong evidence.

I do not regard divine intervention as a possibility, even though I have no other candidates. Yet I recognize that this is because of an aspect of my overall worldview that does not rest on empirical grounds or any other kind of rational grounds. I do not think the existence of God can be disproved. So someone who can offer serious scientific reasons to doubt the adequacy of the theory of evolution, and who believes in God, in the same immediate way that I believe there is no god, can quite reasonably

conclude that the hypothesis of design should be taken seriously.¹³ If reasons to doubt the adequacy of evolutionary theory can be legitimately admitted to the curriculum, it is hard to see why they cannot legitimately be described as reasons in support of design, for those who believe in God, and reasons to believe that some as yet undiscovered, purely naturalistic theory must account for the evidence, for those who do not. That, after all, is the real epistemological situation.

Would it be an unconstitutional endorsement of religion to point this out in a biology course? It presumably would not have a prayer of acceptability if it were introduced at the behest of a school board whose religious members had adopted it as a fallback from something stronger. Suppose it were introduced by a more neutral school board, however, or by a biology teacher without noticeable religious beliefs, just in order to explain what is uncertain about evolutionary theory and what the possible responses are to that uncertainty.

What I think about this question owes a great deal to Kent Greenawalt's subtle and judicious book, *Does God Belong in Public Schools?*,¹⁴ written before the Dover decision but addressing many of the same issues. The Dover decision relied on two interpretations of the Establishment Clause: the *Lemon* test and the endorsement test. The *Lemon*¹⁵ test requires that a law or practice must have a secular purpose, must not have a primary effect of either promoting or inhibiting religion, and must not foster excessive entanglement with religion. The endorsement test, enunciated by Justice O'Connor,¹⁶ requires that the law or practice not have the purpose or effect of endorsing a particular religion or religion in general.

Interpretation of the Establishment Clause is unsettled and evolving, but if we take these two tests as a guide, the mention of ID seems constitutionally defensible. If properly presented, it could be defended as having the secular purpose of providing a better understanding of evolutionary theory and of the evidence for and against it. Would it fail on the ground that one of its principal effects would be to advance religion?

13. This presupposes the admittedly controversial position that reasonable people can disagree—so that I do not have to give up my belief that p even if I believe that others who believe not-p are not necessarily being irrational but are just mistaken.

14. Princeton University Press, 2005.

15. *Lemon v. Kurtzman*, 403 US 602 (1971).

16. In *Wallace v. Jaffree*, 472 US 38 (1985).

It has to be admitted that, by suggesting that the existence of God is a possibility, and that if there is a god he might have played a role in the development of life, it would have such an effect. That might be too much religion by current standards. By the same token, such teaching would also advance atheism, by suggesting that the nonexistence of God was a serious possibility, so it might lose from both directions. Perhaps silence on the subject of the relation between evolutionary theory and religious belief is the only course compatible with the Establishment Clause.

It would be a shame if this were so. Greenawalt, after discussing the issue with great care, concludes that a very limited opening of the topic is warranted:

[S]cience teachers should cover the evidential gaps and controversies surrounding the neo-Darwinian synthesis. Any evidence for a kind of order of a sort not yet integrated into the dominant theory should be fairly presented. Teachers should indicate that present uncertainties by no means show that the dominant theory is incapable of explaining everything important. They should also explain that if the development of life has proceeded partly on the basis of an order that present neo-Darwinian theory neglects, that order may or may not reflect an intelligent designer; but that modern science has discovered naturally explicable principles of order for much that once seemed beyond explaining. Science teachers 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 creative intelligence. One reason not to engage this possibility at any length 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.¹⁷

Even something this cautious would probably be unacceptable to the scientific establishment, but I would like to believe that something less inhibited would be admissible, namely, a frank discussion of the relation of evolutionary theory to religion in some part of the high school curriculum. If biology teachers would be too burdened by this task, room should be found for it elsewhere.

17. *Does God Belong in Public Schools?* p. 115.

I think the true position of those who would exclude intelligent design from the domain of science is that things have changed fundamentally since 1859. In other words, when Darwin published *The Origin of Species* it may have been appropriate to present it as an alternative to design, just as Copernicus had to present the heliocentric theory as an alternative to the geocentric theory. Yet now, after all that has happened over the past century and a half, the very idea of design is as dead as Ptolemaic astronomy: a reductive and above all purposeless naturalism can be taken for granted as the only possible form of explanation in biology. To exclude the possibility of divine intervention in the history of life is scientifically legitimate, and to assign it any antecedent positive probability at all is irrational. To the extent that such a prior probability affects conclusions drawn from the evidence, they too are irrational, and cannot be taken seriously as scientific proposals.

Judge Jones is careful to say, "We express no opinion on the ultimate veracity of ID as a supernatural explanation."¹⁸ This is not the position of most evolutionary scientists, however. They believe that there are no supernatural explanations, and that trying to show that they are incompatible with the evidence is a waste of time. It is part of their basic epistemological and metaphysical framework, which either excludes the existence of God or, at best, places him entirely outside the boundaries of the natural universe. They do not think, Maybe there are supernatural explanations, but if there are, science cannot discover them. Rather, they think, Anybody who is willing even to consider supernatural explanations is living in the past.

We cannot, however, make this a fundamental principle of public education. I understand the attitude that ID is just the latest manifestation of the fundamentalist threat, and that you have to stand and fight them here or you will end up having to fight for the right to teach evolution at all. However, I believe that both intellectually and constitutionally the line does not have to be drawn at this point, and that a noncommittal discussion of some of the issues would be preferable.

18. *Kitzmiller*, at p. 746.