Lawful Design: A New Standard for Evaluating Establishment Clause Challenges to School Science Curricula

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The teaching about the origins of life in American public schools has long been bitterly contested, and consensus on what theories are sufficiently reliable to warrant inclusion in science curricula — as well as their constitutionality under the Establishment Clause — remains elusive. The intelligent design movement has renewed these disagreements, and recently in Dover, Pennsylvania, a district court found that a school board's requirement of a statement making reference to intelligent design emanated from an impermissible purpose, violating the Establishment Clause. More controversially, the court also examined the substantive reliability of intelligent design, and, in finding it deficient, raised a number of questions: Are courts competent to perform this kind of investigation? And if so, what standards should they use? This Note seeks to answer these questions by proposing a comprehensive standard of review for Establishment Clause challenges to science curricula. Drawing upon the Supreme Court's jurisprudence on the Establishment Clause as well as on the nature of scientific reliability in expert testimony, this Note not only explains why courts are fit to undertake such review, but fashions a standard for doing so, called "honest purpose and substantial reliability." The new standard can guide courts in their assessment of purpose as well as in their substantive scrutiny of proposed curricula, ensuring that what is taught as science is not just educationally proper, but constitutionally proper as well.

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I. INTRODUCTION

With the rise of the intelligent design ("ID") movement, the site of the most recent battle in the perennial war between the supporters and opponents of Charles Darwin's theory of evolution, high school biology curricula have again captured national attention.[1] In the recent case in Dover, Pennsylvania,[2] a one-minute statement[3] — to be read to students before the unit on evolution in ninth-grade biology class — was declared to be a violation of the Establishment Clause of the United States Constitution.[4] After months of litigation and mountains of expert testimony, Judge John E. Jones's 139-page opinion concluded that "ID

1. Searches in the Factiva database for news articles containing the phrases "high school" and "intelligent design" revealed a steady yearly increase in the number of articles written about the subject over the past two decades. In 2005, there were 1,431 such articles. These are the figures for the prior eighteen years:

Date	No. of Articles	Date	No. of Articles	Date	No. of Articles
1987	0	1993	1	1999	59
1988	0	1994	3	2000	66
1989	0	1995	6	2001	42
1990	1	1996	24	2002	142
1991	0	1997	18	2003	71
1992	4	1998	23	2004	214

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

3. On November 19, 2004, the Dover Area School Board of Directors announced that the following 159-word statement would be read by instructors, beginning in January 2005:

> 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.

Id. at 708–09.

4. *Id.* at 766.

is not science."[5] At the same time, Judge Jones sought to dispel any charges of judicial activism, writing, "[T]his is manifestly not an activist Court."[6]

The endurance of the conflict is astonishing. On one side, Judge Jones observed that support for "evolution, including common descent and natural selection, is 'overwhelmingly accepted' by the scientific community and [supported by] every major scientific association."[7] On the other side are the religious convictions of people such as former Dover school board member William Buckingham,[8] who see evolution as a threat to their foundational beliefs. High school biology class is one of the few situations in which a student with religious convictions *must* encounter views that are potentially dissonant with those convictions. This is the context giving rise to millions of dollars in litigation costs and a national obsession over one minute of high school class time in Pennsylvania, to say nothing of the costs and attention to come from the battles now brewing[9] in Kansas,[10] Ohio,[11] and Georgia.[12]

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5. *Id.* at 735.

6. *Id.* at 765.

7. *Id.* at 743 (quoting the unrebutted testimony of Dr. Kenneth R. Miller, "a widely-recognized biology professor at Brown University who has written university-level and high-school biology textbooks used prominently throughout the nation").

8. Buckingham, a former prison supervisor, openly acknowledged his religiousness when he testified in the Dover trial:

> Buckingham made several outwardly religious statements, which include the following remarks. "Nowhere in the Constitution does it call for a separation of church and state." He explained that this country was founded on Christianity. Buckingham concedes that he said "I challenge you (the audience) to trace your roots to the monkey you came from." He said that while growing up, his generation read from the Bible and prayed during school. He further said "liberals in black robes" were "taking away the rights of Christians."

Id. at 752; *see also* Margaret Talbot, *Darwin in the Dock: Intelligent Design Has Its Day in Court*, THE NEW YORKER, Dec. 5, 2005, at 70 (describing Buckingham's strained interactions with another board member, Bertha Spahr). Buckingham was part of the majority of school board members who voted in the change. In an election in November 2005, eight of the school board members lost their seats. *See infra* note 22.

9. *See* Jill Lawrence, *Pa. Ruling May Have Ripples; Court Loss for "Intelligent Design" Could Rally Either Side as Evolution Is Challenged in Three Other Cases*, USA TODAY, Dec. 23, 2005, at A5 ("Although the ruling against the Dover, Pa., school board is not binding outside Jones' Pennsylvania district, opponents of intelligent design hope it influences curricula in Kansas, Ohio and Cobb County, Ga. School boards in all three places have adopted policies that encourage skepticism about evolution.").

10. On November 8, 2005, the Kansas Board of Education voted six to four to approve changes to "science standards that are the most far-reaching in the nation in challenging Darwin's theory of evolution in the classroom." Jodi Wilgoren, *Kansas Board Approves Challenges to Evolution*, N.Y. TIMES, Nov. 9, 2005, at A14. The new standards recommend "that schools teach specific points that doubters of evolution use to undermine its primacy

As the journalist Margaret Talbot explained, proponents of ID make the following inferential argument against evolution: "If we walk down the beach and see the words 'John loves Mary' in the sand — an example offered by the intelligent-design textbook *Of Pandas and People* — we can infer that someone wrote them."[13] Or, as the Discovery Institute — a think tank closely associated with the promotion of ID[14] — has put it, "The theory of intelligent design holds that certain features of the universe and of living things are best explained by an intelligent cause, not an undirected process such as natural selection."[15] Although the proponents of ID assert that they make no claims about the identity of the designer,[16] observers have questioned their sincerity.[17]

. . . . Among the most controversial changes was a redefinition of science itself, so that it would not be explicitly limited to natural explanations." *Id.*

11. In 2002, the Ohio Board of Education voted unanimously to make two compromise changes to science standards. The first was to redefine science as "a systematic method of continuing investigation," a change intended to reject the concept that science is limited to natural explanations; the second change was to have teachers "describe how scientists continue to investigate and critically analyze aspects of evolutionary theory." Larry Witham, *Ohio Schools to Teach the Evolution "Controversy,"* WASH. TIMES, Oct. 17, 2002, at A1. After Judge Jones's opinion came down, however, the "Ohio Board of Education voted 11 to 4 . . . to toss out a mandate that 10th-grade biology classes include critical analysis of evolution and an accompanying model lesson plan." Jodi Rudoren, *Ohio Board Undoes Stand on Evolution*, N.Y. TIMES, Feb. 15, 2006, at A14.

12. In August of 2002, "Georgia's second-largest school district adopted a policy . . . that requires teachers to give a 'balanced education' about the origin of life, giving equal weight to evolution and biblical interpretations." Kate Zernike, *Georgia School Board Requires Balance of Evolution and Bible*, N.Y. TIMES, Aug. 23, 2002, at A10.

13. Talbot, *supra* note 8, at 68.

14. *See, e.g.*, Laurie Goodstein, *Intelligent Design Might Be Meeting Its Maker*, N.Y. TIMES, Dec. 4, 2005, § 4 (Week in Review), at 1 (characterizing the Discovery Institute as "the main organization supporting intelligent design").

15. DISCOVERY INSTITUTE, TOP QUESTIONS, http://www.discovery.org/csc/topQuestions.php (last visited Apr. 15, 2006).

16. *See id.* ("Unlike creationism, the scientific theory of intelligent design is agnostic regarding the source of design and has no commitment to defending Genesis, the Bible or any other sacred text.").

17. *See, e.g.*, Kitzmiller v. Dover Area Sch. Dist., 400 F. Supp. 2d 707, 718 (M.D. Pa. 2005) (observing and endorsing the view that, despite the assertions of defense expert witnesses Professors Michael J. Behe and Scott A. Minnich that ID's "official position" does not acknowledge that the designer is God, "anyone familiar with Western religious thought would immediately make the association that the tactically unnamed designer is God"); Talbot, *supra* note 8, at 68 ("The modern version of intelligent design . . . declines to specify who the master designer might be. Behe and other advocates will freely admit that, for them, the designer of life on earth is the God of Christianity."); Editorial, *Intelligent Design Derailed*, N.Y. TIMES, Dec. 22, 2005, at A32 ("The intelligent design movement holds that life forms are too complex to have been formed by natural processes and must have been fashioned by a higher intelligence, which is never officially identified but which most adherents believe to be God."). To be fair, however, it is neither inconsistent nor

As things have turned out, the Dover case has been a poor test case for the ID movement.[18] Because a crucial legal standard governing Establishment Clause challenges focuses on whether the government action at issue has a valid secular purpose,[19] the unabashed religiosity of the school board members who voted in the change was an insurmountable obstacle for the defense.[20] Indeed, comments by ID supporters such as William Buckingham — the former Dover school board member who made the oft-quoted remark, "Two thousand years ago, someone died on a cross. Can't someone take a stand for him?"[21] — and televangelist Pat Robertson — who after the Dover school board members were ousted in the November 2005 elections,[22] warned the citizens of Dover, "If there is a disaster in your area, don't turn to God, you just rejected him from your city"[23] — are unhelpful to

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illogical for a person to believe (1) that ID is agnostic about the identity of the designer and (2) that God is the designer based upon independent religious convictions. Such a position may be suspicious, but it is not self-refuting.

18. *See* Rachel Zoll, *Case Seen as Setback to Intelligent Design*, ASSOCIATED PRESS, Dec. 21, 2005, *available at* http://abcnews.go.com/US/wireStory?id=1430097 ("A federal judge's ruling that intelligent design is faith masquerading as science is being viewed by all sides involved with the issue as a setback, though not a fatal blow, for the movement promoting the concept as an alternative to evolution."). *But see Dover Decision on Intelligent Design "Legally Irrelevant for Ohio's Critical Analysis of Evolution Model Science Curriculum," Says Legal Scholar*, DISCOVERY INSTITUTE NEWS, Dec. 22, 2005, http://www.discovery.org/scripts/viewDB/index.php?command=view&id=3115&program=News&callingPage=discoMainPage ("'Judge Jones' decision about teaching intelligent design is legally irrelevant for Ohio's Critical Analysis of Evolution model science curriculum,' says legal scholar and Gonzaga University law professor David DeWolf, in response to calls from critics that the lesson plan should be repealed by the state board of education.").

19. *See infra* Parts II.A–B, III.A.

20. As Judge Jones wrote,

> We have been presented with a wealth of evidence which reveals that the District's purpose was to advance creationism, an inherently religious view, both by introducing it directly under the label ID and by disparaging the scientific theory of evolution, so that creationism would gain credence by default as the only apparent alternative to evolution.

Kitzmiller, 400 F. Supp. 2d at 747.

21. *Id.* at 752; Talbot, *supra* note 8, at 70.

22. *See* Laurie Goodstein, *A Decisive Election in a Town Roiled over Intelligent Design*, N.Y. TIMES, Nov. 10, 2005, at A24 ("[T]he residents of Dover ousted all eight school board members running for re-election who had put their town in a global spotlight and their school district on trial for being the first in the nation to introduce intelligent design as an alternative to evolution in science class.").

23. National Briefing Mid-Atlantic: Pennsylvania: *Town is Warned of God's Wrath*, N.Y. TIMES, Nov. 11, 2005, at A16 (internal quotation marks omitted).

lawyers who defend ID on the ground that it is not religion.[24] Furthermore, the school board members' lack of personal intellectual engagement with ID,[25] as well as their feeble deceptions,[26] belied any proper purpose, leaving Judge Jones to wonder at the "breathtaking inanity of the Board's decision."[27]

Despite the large role played by illegitimate purpose in the Dover case, Judge Jones also exhaustively addressed the purported scientific merits of ID.[28] Although this aspect of the opinion is sure to be controversial, raising questions about institutional competency and judicial propriety, this Note contends that this is a legitimate move for a court facing this kind of claim to make because it is consonant with two important aspects of Establishment Clause analysis: the effects inquiry of the *Lemon* test, and the endorsement test.[29] As the battles over science curricula continue, courts will increasingly be confronted by savvy actors who will be careful to articulate and substantiate secular purposes. In these cases, the purpose inquiry will become increasingly less effective, thereby creating a corresponding need to scrutinize the content of the proposed curricula to make determinations of scientific legitimacy. This is not to say that a theory

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24. Professor Kent Greenawalt has observed that legislators are often incautious about their motivations. *See infra* note 38. The same is likely to be true for school board members.

25. *Kitzmiller*, 400 F. Supp. 2d at 758–59 ("[O]ne unfortunate theme in this case is the striking ignorance concerning the concept of ID amongst Board members. Conspicuously, Board members who *voted for* the curriculum change testified at trial that they had utterly no grasp of ID.").

26. *Id.* at 752 ("[T]he record reflects that these witnesses [including two school board members] either testified inconsistently, or lied outright under oath on several occasions.").

27. *Id.* at 765.

28. *See id.* at 735–46. Summarizing his conclusion that ID is not science, Judge Jones wrote:

> We find that ID fails on three different levels, any one of which is sufficient to preclude a determination that ID is science. They are: (1) ID violates the centuries-old ground rules of science by invoking and permitting supernatural causation; (2) the argument of irreducible complexity, central to ID, employs the same flawed and illogical contrived dualism that doomed creation science in the 1980's; and (3) ID's negative attacks on evolution have been refuted by the scientific community.

Id. at 735.

29. The effects test from *Lemon v. Kurtzman*, 403 U.S. 602 (1971), and the endorsement test are laid out in basic form *infra* at Part II.A, and explored more thoroughly in their connection with science curricula *infra* at Part III.B. The effects and endorsement tests focus on whether an action by the government has the real — or perceived — effect of advancing religion.

that happens to comport with certain religious beliefs could never be taught in a classroom; rather, the question should be whether the science of the theory is sufficiently reliable to warrant inclusion in science curricula.

How should a court review Establishment Clause challenges to such proposed curricula? This Note seeks to answer this question by developing a new standard of review called "honest purpose and substantial reliability" — in which "honest purpose" refers to the quality of the legislative intent and "substantial reliability" to that of the underlying science. In addition to drawing on the Supreme Court's Establishment Clause jurisprudence, this Note also draws upon the Court's decision in *Daubert v. Merrell Dow Pharmacy, Inc.*,[30] which considered what the proper standard should be for allowing expert testimony in trials. Although *Daubert* has heretofore had no explicit doctrinal connection to the Court's Establishment Clause jurisprudence, its analysis is highly useful as a judicial model for resolving questions about the nature of science, and it has the practical benefit of being familiar to courts. Additionally, in formulating the new standard, this Note draws attention to the special context of public schools and the Court's view of schoolchildren.

Part II outlines the relevant jurisprudential framework, focusing on the Supreme Court's Establishment Clause jurisprudence generally, the evolution cases, the public school context, and the nature of scientific evidence in expert testimony. Part III builds upon the framework introduced in Part II, examining critically and in more detail the principles surrounding purpose, effects and endorsement, and — crucially — the nature of scientific reliability enunciated in *Daubert*. Part IV fashions these legal principles into an "honest purpose and substantial reliability" standard, and then applies this standard to a variety of proposed or adopted curricula to demonstrate its application. Finally, Part V concludes that most proposed curricula containing a religious purpose would not survive review for honest purpose and substantial reliability.

30. 509 U.S. 579 (1993).

II. RELEVANT JURISPRUDENTIAL FRAMEWORK

The Establishment Clause makes up the first ten words of the First Amendment: "Congress shall make no law respecting an establishment of religion."[31] Scholars agree that these words prohibit the creation of an official church.[32] Thus, for example, laws requiring an oath to a particular faith or mandating financial support for a particular church would be unconstitutional.[33] Beyond this, however, the particulars of the doctrine of separation of church and state engender little agreement among scholars and judges, which often makes the doctrinal landscape treacherous to navigate.

In order to synthesize a method for answering the specific question at issue in this Note — whether a proposed science curriculum violates the Establishment Clause — this Part introduces the necessary doctrinal ingredients. Thus, this Part begins with the usual route through the Supreme Court's general Establishment Clause jurisprudence, followed by the Court's specific consideration of the evolution cases. The subsequent discussion is less typical, consisting of a brief venture into the public school context, and lastly — to a truly rare topic to arise in the context of the Establishment Clause — consideration of the proper standard of admissibility of expert scientific testimony in a trial. This background lays the foundation for the critical analysis in Part III and the development of the "honest purpose and substantial reliability" standard proposed in Part IV.

A. ESTABLISHMENT CLAUSE JURISPRUDENCE

In recent years, the Supreme Court has used a number of approaches in resolving Establishment Clause questions.[34] Most

31. U.S. CONST. amend. I.

32. *See, e.g.*, KATHLEEN M. SULLIVAN & GERALD GUNTHER, CONSTITUTIONAL LAW 1546 (15th ed. 2004).

33. *See id.*

34. *See generally* KENT GREENAWALT, RELIGION AND FAIRNESS, VOLUME II: ESTABLISHMENT (forthcoming 2007) (manuscript, ch. 10 at 1, on file with the *Columbia Journal of Law and Social Problems*).

pertinent to the question of science education in secondary schools is the *Lemon* test, contrary to any reports of its demise.[35]

In *Lemon v. Kurtzman*, the Court established a three-prong test to evaluate whether a state practice violates the First Amendment's prohibition on government establishment of religion: "First, the statute [or practice] must have a secular legislative purpose; second, its principal or primary effect must be one that neither advances nor inhibits religion[;] finally, the statute [or practice] must not foster an excessive government entanglement with religion."[36] Of the three prongs, purpose seems the most relevant to Establishment Clause challenges to science curricula. As discussed below,[37] both of the Court's evolution cases were decided on purpose grounds, and the purpose prong is an obvious place to look when asking whether a proposed curriculum advances a religious interest.[38]

Entanglement, by contrast, is likely the least relevant of the prongs, as its independence from the effects prong has been somewhat discredited,[39] and most of the cases turning on entanglement have involved school vouchers and state funding of faith-based programs.[40] Because setting science curricula does not

35. *Id.* (manuscript, ch. 10 at 7) ("By 1995, seven justices had expressed doubt that *Lemon* should be employed as a comprehensive test for all establishment cases."); *see also* Lamb's Chapel v. Ctr. Moriches Union Free Sch. Dist., 508 U.S. 384, 398 (1993) (Scalia, J., concurring) ("Like some ghoul in a late-night horror movie that repeatedly sits up in its grave and shuffles abroad, after being repeatedly killed and buried, [the *Lemon* test] stalks our Establishment Clause jurisprudence once again, frightening the little children and school attorneys of Center Moriches Union Free School District.").

36. 403 U.S. 602, 612–13 (1971) (citations omitted); *see also, e.g.*, County of Allegheny v. ACLU, 492 U.S. 573, 592 (1989) (expanding *Lemon*'s reference to "statutes" to reach the broader notions of "practice" and "action").

37. *See infra* Part II.B.

38. *See* GREENAWALT, *supra* note 34 (manuscript, ch. 10 at 32) (noting that legislators are often incautious and candid about their motivations, "and, further, [that] many legislators now discern political advantage in coming out foursquare in favor of promoting religion. The remote possibility that down the road a court may rely on what they said to find an improper purpose may not affect their candor").

39. *See* Agostini v. Felton, 521 U.S. 203, 232 (1997) ("Regardless of how we have characterized the issue, however, the factors we use to assess whether an entanglement is 'excessive' are similar to the factors we use to examine 'effect.'").

40. *See* GREENAWALT, *supra* note 34 (manuscript, ch. 10 at 42–43) ("Most of the Court's decisions about excessive entanglement, as we shall see when we consider school aid and government funding of religious organizations providing social services, have turned on an intertwining of government with religious endeavors.").

usually result in a financial transfer between states and schools, entanglement is unlikely to be an issue in this context.[41]

Finally, the effects prong from the *Lemon* test can be grouped with Justice O'Connor's endorsement test,[42] which she proposed in a series of concurring opinions.[43] Justice O'Connor formulated the endorsement test in order to simplify the *Lemon* test, and it was first embraced by a majority of the Court in *County of Allegheny v. ACLU*.[44] The effects inquiry is whether the challenged conduct has the primary effect of advancing or inhibiting[45] religion.[46] The endorsement test proposes that "[t]he proper inquiry . . . is whether the government intends to convey a message of endorsement or disapproval of religion"[47] — in other words, whether a "reasonable observer" would perceive the statute at issue as

41. This is not to say that entanglement could never be part of the inquiry in an Establishment Clause challenge to a science curriculum. For the purposes of this Note, however, entanglement will not be considered as a factor capable of general applicability.

42. *See* Capitol Square Review v. Pinette, 515 U.S. 753, 787 (1995) (Souter, J., concurring) ("Effects matter to the Establishment Clause, and one, principal way that we assess them is by asking whether the practice in question creates the appearance of endorsement to the reasonable observer."); Sch. Dist. of City of Grand Rapids v. Ball, 473 U.S. 373, 390 (1985) ("[A]n important concern of the effects test is whether the symbolic union of church and state effected by the challenged governmental action is sufficiently likely to be perceived by adherents of the controlling denominations as an endorsement, and by the nonadherents as a disapproval, of their individual religious choices."). *But see* GREENAWALT, *supra* note 34 (manuscript, ch. 10 at 38–39) (noting that although "direct state sponsorship or endorsement of religious ideas would have the effect of advancing religion under *Lemon*," the standard effects test is not always going to be identical to the endorsement test, and that in some contexts, "the comparative emphasis on various factors is likely to shift depending on whether endorsement or the standard 'effects' test is at the center of the inquiry").

43. *See* County of Allegheny v. ACLU, 492 U.S. 573, 625–35 (1989) (O'Connor, J., concurring); Corp. of Presiding Bishop v. Amos, 483 U.S. 327, 348–49 (1987) (O'Connor, J., concurring); Wallace v. Jaffree, 472 U.S. 38, 76 (1985) (O'Connor, J., concurring); Lynch v. Donnelly, 465 U.S. 668, 687–88 (1984) (O'Connor, J., concurring).

44. *See County of Allegheny*, 492 U.S. at 592 ("In recent years, we have paid particularly close attention to whether the challenged governmental practice either has the purpose or effect of 'endorsing' religion, a concern that has long had a place in our Establishment Clause jurisprudence.").

45. It appears that the argument that evolution inhibits religion has only been proposed once. *See* Douglas Wilson, *Neutrality and Evolution in Public Schools*, 7 TEX. REV. L. & POL. 423, 457 (2003) ("The teaching of evolution has a primary effect of inhibiting religion.").

46. Effects is also an important inquiry when legislative intent is vague or confused. *See* Kent Greenawalt, *Establishing Religious Ideas: Evolution, Creationism, and Intelligent Design*, 17 NOTRE DAME J.L. ETHICS & PUB. POL'Y 321, 394 (2003) (arguing that "whatever the assumptions of legislators who enacted the law, teaching creation science is teaching religious ideas").

47. *Lynch*, 465 U.S. at 691 (O'Connor, J., concurring).

endorsing a particular religion.[48] Recently, the endorsement test has been refined to inquire "whether an *objective* observer, acquainted with the text, legislative history, and implementation of the statute, would perceive it as a state endorsement."[49] The effects and endorsement tests thus look to consequences, whereas the purpose prong of *Lemon* focuses on intent.

Another relevant Establishment Clause test that the Court sometimes uses is the coercion test.[50] Generally, this test is not directly relevant to whether science curricula would run afoul of the Establishment Clause because, as with the question of entanglement, the facts appropriate for a coercion analysis typically involve financial relationships. Yet coercion is relevant as it bears upon the psychology of schoolchildren, as in *Lee v. Weisman*,[51] where coercion was crucial to the analysis. This psychological aspect will be considered more directly below, as it relates to the special context of public schools.[52]

B. THE EVOLUTION CASES

The foregoing brief survey provides a general sketch of the tests the Supreme Court has used to resolve Establishment Clause questions. In this section, the discussion focuses on the Court's decisions in the previous legal battles over teaching evolution in public schools.

The Court first turned its attention to secondary school science curricula in 1968.[53] In *Epperson v. Arkansas*[54] and later in *Edwards v. Aguillard*,[55] the Court dealt severe blows to anti-evolutionists, holding that anti-evolutionist legislation violated

48. *County of Allegheny*, 492 U.S. at 631 (O'Connor, J., concurring).

49. Santa Fe Indep. Sch. Dist. v. Doe, 530 U.S. 290, 308 (2000) (emphasis added).

50. *See, e.g.*, Zelman v. Simmons-Harris, 536 U.S. 639, 655–56 (2002) ("The Establishment Clause question is whether Ohio is coercing parents into sending their children to religious schools.").

51. 505 U.S. 577 (1992).

52. *See infra* Part II.C.

53. Why 1968 — as opposed to 1927, the time of *Scopes v. Tennessee*, 289 S.W. 363 (Tenn. 1927), or 1859, when Charles Darwin published *The Origin of Species*, or another time — turns out to be an interesting question. "After the Soviet Union's launch of Sputnik in 1957 . . . government officials, concerned with the quality of science education, helped finance new series of science texts, including biology texts that treated evolution more fully." Greenawalt, *supra* note 46, at 330.

54. 393 U.S. 97 (1968).

55. 482 U.S. 578 (1987).

the Establishment Clause. While the current debate over science curricula has moved beyond these initial skirmishes, the cases provide crucial doctrinal insight into the Establishment Clause issues involved in science curricula.

In *Epperson*, Justice Fortas, writing for a unanimous Court,[56] held Arkansas's "anti-evolution" statute "contrary to the mandate of the First . . . Amendment to the Constitution."[57] Though the opinion predates the *Lemon* test,[58] Justice Fortas resolved the question using what later became the test's first prong — purpose:

> In the present case, there can be no doubt that Arkansas has sought to prevent its teachers from discussing the theory of evolution because it is contrary to the belief of some that the Book of Genesis must be the exclusive source of doctrine as to the origin of man. . . . It is clear that fundamentalist sectarian conviction was and is the law's reason for existence.[59]

While it is true that the *Lemon* test requires a secular purpose — an inquiry the *Epperson* Court did not conduct — rather than the absence of a religious one, the legislators did not seem overly cautious in concealing their motives.[60] Indeed, Justice Fortas found nothing more than an aversion to "sensational publicity" on the part of the Arkansas legislators in his comparison of the "candidly stated" purpose Tennessee had used in its famous "monkey law" to the "less explicit" one used by the Arkansas legislators.[61] Where the Tennessee lawmakers had made it unlawful "to teach any theory that denies the story of the Divine Creation of man as taught in the Bible and to teach instead that man has descended from . . . animals," the Arkansas anti-evolution law "eliminated" reference to the story of Divine Creation, taking a

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56. Justices Black, Harlan, and Stewart concurred.
57. *Epperson*, 393 U.S. at 109.
58. For an overview of the *Lemon* test, see *supra* notes 36–49 and accompanying text.
59. *Epperson*, 393 U.S. at 107–08.
60. As Justice Fortas observed, "The statute was a product of the upsurge of 'fundamentalist' religious fervor of the twenties. The Arkansas statute was an adaptation of the famous Tennessee 'monkey law' which that State adopted in 1925." *Id.* at 98.
61. *Id.* at 108–09.

more low-profile approach.[62] Far from being convinced, Justice Fortas found this disingenuous, a sham, and refused to see any distinction between these nominally different statements of purpose. He wrote, "[T]here is no doubt that the motivation for the law was the same: to suppress the teaching of a theory which, it was thought, 'denied' the divine creation of man."[63]

Nineteen years later — enough time for the appearance and significant erosion of the *Lemon* test — a very different Supreme Court[64] revisited the constitutionality of anti-evolutionist legislation. In *Edwards v. Aguillard*, Justice Brennan, writing for a majority,[65] held that the Louisiana Creationism Act violated the Establishment Clause because it sought to "employ the symbolic and financial support of the government to achieve a religious purpose."[66] The Creationism Act forbade the teaching of evolution unless it was accompanied by instruction in creation science.[67]

After noting that the Court "has been particularly vigilant in monitoring compliance with the Establishment Clause" in the school context,[68] Justice Brennan resolved the case under the purpose prong of the *Lemon* test, finding that "appellants have identified no clear secular purpose."[69] Justice Brennan rejected the Act's nominal purpose — to protect academic freedom — as a "sham," cautioning that "it is required that the statement of such purpose be sincere."[70] In finding no sincere secular purpose, Justice Brennan relied on the legislative history, with particular reference to the purposes of Senator Bill Keith, the legislative sponsor.[71] Senator Keith expressed a preference — based upon his own religious beliefs — that neither creationism nor evolution be taught, leading Justice Brennan and the Court to agree with the Court of Appeals that the "Act does not serve to protect academic

62. *Id.*
63. *Id.* at 109 (quoting Tennessee's "monkey law").
64. Justices White, Brennan, and Marshall were the only justices who participated in both the *Epperson* and *Edwards* decisions.
65. Justices Powell (joined by Justice O'Connor) and White concurred. Justice Scalia (joined by Chief Justice Rehnquist) dissented.
66. 482 U.S. 578, 597 (1987).
67. *See id.* at 581.
68. *Id.* at 583; *see also infra* Part II.C.
69. *Edwards*, 482 U.S. at 585.
70. *Id.* at 586–87.
71. *Id.* at 587.

freedom, but has a distinctly different purpose" of discrediting evolution at every turn.[72]

Although both *Epperson* and *Edwards* presented unflinching rebukes to anti-evolutionists, and the cases remain the Court's only stated position on evolution and the Establishment Clause, their reach has been thought to be limited.[73] Not only do *Epperson* and *Edwards* predate the adoption of Justice O'Connor's endorsement test in *Allegheny*,[74] but the cases' purpose-driven analyses do not make clear what the appropriate analysis is subsequent to a finding of permissible purpose.[75] Although the cases provide a clear starting point to resolving Establishment Clause questions, they do not provide a comprehensive analysis.

C. THE PUBLIC SCHOOL CONTEXT

A striking feature of Justice Brennan's opinion in *Edwards* — one that appears in many places in the Supreme Court's Establishment Clause jurisprudence — is the concern the Court manifests regarding the psychological and coercive power of the state in the public school setting. Thus in Part II of the majority opinion in *Edwards*, joined by all of the six justices in the majority except Justice O'Connor, Justice Brennan emphasized that in applying the *Lemon* test, the Court must be "mindful of the particular concerns that arise in the context of public elementary and secondary schools."[76] He wrote:

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72. *Id.* at 587–92.

73. *See* Greenawalt, *supra* note 46, at 330 (arguing that, even after *Epperson* and *Edwards*, "[t]he Court has not explicitly ruled that all decisions by school boards or teachers to present scientific creationism are necessarily unconstitutional"); *see also* Matthew J. Brauer et al., *Is It Science Yet?: Intelligent Design, Creationism and the Constitution*, 83 WASH. U. L.Q. 1, 19 (2005) ("Despite the Supreme Court's consistent refusal to uphold statutes that attempt to insert religious notions of creation into the public school science curriculum, creationism activists have not given up the fight. A new group of activists has begun pressing . . . proposals . . . to circumvent *Epperson* and *Edwards*.").

74. Kitzmiller v. Dover Area Sch. Dist., 400 F. Supp. 2d 707, 713 (M.D. Pa. 2005) (observing that both *Epperson* and *Edwards* "pre-date the [endorsement] test's adoption in *Allegheny*"); *see also supra* note 44 and accompanying text.

75. *Edwards*, 482 U.S. 578, 585 ("If the law was enacted for the purpose of endorsing religion, 'no consideration of the second or third criteria [of *Lemon*] is necessary.'" (quoting Wallace v. Jaffree, 472 U.S. 38, 56 (1985))).

76. *Id.* at 585.

> Families entrust public schools with the education of their children, but condition their trust on the understanding that the classroom will not purposely be used to advance religious views that may conflict with the private beliefs of the student and his or her family. Students in such institutions are impressionable and their attendance is involuntary. . . . [T]he public school is at once the symbol of our democracy and the most pervasive means for promoting our common destiny. In no activity of the State is it more vital to keep out divisive forces than in its schools.[77]

Consequently, Justice Brennan noted, the Court has often been required to invalidate statutes that advance religion in public schools.[78] In direct contrast, the Court has been far less likely to find violations of the Establishment Clause in cases involving nonmandatory or post-secondary school contexts.[79]

Justice Brennan's notion of an implicit agreement between parents and schools has considerable historical weight. Indeed, as Judith Areen writes, "State sponsored schools were the first serious intrusion into the right of parents to rear their own children."[80] Although there has been some relaxation to the rule of

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77. *Id.* at 584 (citations omitted).

78. Brennan cited six such cases: Grand Rapids Sch. Dist. v. Ball, 473 U.S. 373 (1985) (rejecting school district's use of religious school teachers in public schools); *Wallace*, 472 U.S. 38 (holding Alabama statute authorizing moment of silence for school prayer unconstitutional); Stone v. Graham, 449 U.S. 39 (1980) (striking down Kentucky statute requiring the posting of the Ten Commandments on public classroom walls); Epperson v. Arkansas, 393 U.S. 97 (1968) (rejecting statute forbidding teaching of evolution); Abington Sch. Dist. v. Schempp, 374 U.S. 203 (1963) (rejecting required daily reading of Bible); Engel v. Vitale, 370 U.S. 421 (1962) (rejecting recitation of "denominationally neutral" prayer). *See Edwards*, 482 U.S. at 584–85. The following are the cases postdating *Edwards* that invalidated religious establishment in public schools: Santa Fe Indep. Sch. Dist. v. Doe, 530 U.S. 290 (2000) (invalidating modified practice of prayer lead by chaplain before high school football game); Lee v. Weisman, 505 U.S. 577 (1992) (invalidating practice of holding prayer at public school graduation ceremony).

79. *See* Lamb's Chapel v. Ctr. Moriches Union Free Sch. Dist., 508 U.S. 384 (1993) (finding no Establishment Clause violation where school district was compelled to allow church group to use school facilities after school day ended); Widmar v. Vincent, 454 U.S. 263 (1981) (finding no Establishment Clause violation in rule allowing religious groups to use meeting places on a public university campus).

80. JUDITH AREEN, FAMILY LAW: CASES AND MATERIALS 1174 (4th ed. 1999). Somewhat ironically, the purpose indicated by the Colony of Massachusetts in 1647 for founding a state school system was plainly religious:

> It being one chief project of that old deluder Satan to keep men from the knowledge of the Scriptures, [i]t is so at least the true sense and meaning therefore

compulsory education,[81] it is the accepted understanding that the state has a strong interest in educating its youngest citizens. As the Court stated in *Wisconsin v. Yoder*, "[S]ome degree of education is necessary to prepare citizens to participate effectively and intelligently in our open political system . . . . [E]ducation prepares individuals to be self-reliant participants in society."[82] Thus, today all states require children to attend school for nine years or more.[83]

Given this significant state interest, the public school context has been consistently accorded special status because of the impressionable nature of children and adolescents in their formative years. As Justice Brennan wrote, "The State exerts great authority and coercive power through mandatory attendance requirements, and because of the students' emulation of teachers as role models and the children's susceptibility to peer pressure."[84] Indeed, because the Court has recognized the coercive and peer pressures schoolchildren face on many occasions both before and after *Edwards*,[85] consideration of the public school context is a

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> ordered, that every township in this jurisdiction, after the Lord both increased them to the number of fifty householders, shall then forthwith appoint one within their town to teach all such children as shall resort to him to write and read . . . .

Id. (quoting I CHILDREN AND YOUTH IN AMERICA 81 (Robert H. Bremmer et al. eds., 1970)).

81. *See* Norwood v. Harrison, 413 U.S. 455, 461 (1973) (explaining that "while a State may posit (educational) standards, it may not pre-empt the educational process by requiring children to attend public schools" (quoting Wisconsin v. Yoder, 406 U.S. 205, 239 (1972) (White, J., concurring))); *Yoder*, 406 U.S. 205 (holding that the impact of compulsory education on Amish children contravenes the basic religious tenets and practices of the Amish faith); Pierce v. Soc'y of Sisters, 268 U.S. 510 (1925) (holding that the power of the state is not so great that it can standardize children by forcing them to accept instruction from public teachers only).

82. *Yoder*, 406 U.S. at 221.

83. *See* AREEN, *supra* note 80, at 1175.

84. Edwards v. Aguillard, 482 U.S. 578, 584 (1987).

85. *See* Santa Fe Indep. Sch. Dist. v. Doe, 530 U.S. 290, 311–12 (2000) ("To assert that high school students do not feel immense social pressure . . . is 'formalistic in the extreme.' We [have] stressed the obvious observation that 'adolescents are often susceptible to pressure from their peers towards conformity, and that the influence is strongest in matters of social convention.'" (citations omitted)); Lee v. Weisman, 505 U.S. 577, 593 (1992) ("The undeniable fact is that the school district's supervision and control of a high school graduation ceremony places public pressure, as well as peer pressure, on attending students to stand as a group or, at least, maintain respectful silence during the invocation and benediction. This pressure, though subtle and indirect, can be as real as any overt compulsion."); Wallace v. Jaffree, 472 U.S. 38, 81 (1985) (O'Connor, J., concurring) ("This Court's decisions have recognized a distinction when government-sponsored religious exercises are directed at impressionable children who are required to attend school, for

necessary part of evaluating whether science curricula run afoul of the Establishment Clause.

D. THE NATURE OF SCIENTIFIC EVIDENCE AND EXPERT TESTIMONY

This section introduces an aspect of the Court's jurisprudence — that concerning scientific evidence — that rarely arises in the Establishment Clause context.[86] Because the Court's analysis for evaluating the sufficiency of scientific evidence will be useful for developing a standard for judicial assessment of science curricula, it is important to describe in detail the Court's most recent exhaustive analysis on this issue.

Daubert v. Merrell Dow Pharmacy, Inc.,[87] a Supreme Court decision from 1993, is a watershed in the law of evidence. In *Daubert*, the Court revisited the question of what is the appropriate standard for admitting expert testimony in a federal trial. The Court's answer rewrote seventy years of expert testimony jurisprudence, holding that the correct standard requires the judge, as gatekeeper, to admit such testimony if she determines that the expert is "proposing to testify to (1) scientific knowledge that (2) will assist the trier of fact to understand or determine a fact in issue."[88] In so doing, the Court unanimously made the

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then government endorsement is much more likely to result in coerced religious beliefs."); Marsh v. Chambers, 463 U.S. 783, 792 (1983) (distinguishing between adults not susceptible to "religious indoctrination" and children subject to "peer pressure"); Abington Sch. Dist. v. Schempp, 374 U.S. 203, 290–91 (1963) (Brennan, J., concurring) (citing "numerous experiments which indicate the susceptibility of school children to peer-group pressures, especially where important group norms and values are involved"); Engel v. Vitale, 370 U.S. 421, 431 (1962) ("When the power, prestige and financial support of government is placed behind a particular religious belief, the indirect coercive pressure upon religious minorities to conform to the prevailing officially approved religion is plain."); McCollum v. Bd. of Educ., 333 U.S. 203, 227 (1948) ("[N]onconformity is not an outstanding characteristic of children."); W. Va. Bd. of Educ. v. Barnette, 319 U.S. 624, 637 (1943) ("That [Boards of Education] are educating the young for citizenship is reason for scrupulous protection of Constitutional freedoms of the individual, if we are not to strangle the free mind at its source and teach youth to discount important principles of our government as mere platitudes.").

86. *But see* Matthew J. Brauer et al., *supra* note 73, at 146–48 (noting that "[i]ntelligent design proponents are fond of quoting [*Daubert*] in support of their position" and citing several authors who consider *Daubert* in its relation to the Establishment Clause).

87. 509 U.S. 579 (1993).

88. *Id.* at 592.

seemingly pedestrian finding that usefulness was what the drafters of Rule 702 of the Federal Rules of Evidence had in mind when they wrote that "a witness qualified as an expert . . . may testify" if such testimony will "assist the trier of fact."[89]

Prior to *Daubert*, judges had performed their gatekeeper function using the "general acceptance" test established by the D.C. Circuit in *Frye v. United States*.[90] In *Frye*, the D.C. Circuit held that, to be permissible, scientific testimony "must be sufficiently established to have gained general acceptance in the particular field in which it belongs."[91] In finding that the adoption of the Federal Rules of Evidence in 1975[92] superseded the "general acceptance" test, the Supreme Court in *Daubert* sought to loosen the standard for admissibility of expert testimony, holding that Rule 702's "basic standard of relevance . . . is a liberal one."[93] All nine justices agreed on this portion of the opinion.

Seven of the justices signed on to the rest.[94] In this portion of the opinion, the Court noted its "confiden[ce] that federal judges possess the capacity to undertake" review under the new usefulness standard.[95] The justices did "not presume to set out a definitive checklist or test" but added that because "[m]any factors will bear on the inquiry . . . some general observations are appropriate."[96] The Court then went on to identify four factors a gatekeeper might keep in mind: (1) "whether [the scientific theory or technique] can be (and has been) tested"; (2) "whether the theory or technique has been subjected to peer review and publication";

89. FED. R. EVID. 702.

90. 293 F. 1013 (1923).

91. *Id.* at 1014.

92. Why it took twenty-two years for the Court to alert the rest of the federal judiciary that the Federal Rules of Evidence had superseded the *Frye* "general acceptance" test is uncertain. The Court cites favorably to a number of works in which scholars and judges expressed dissatisfaction with the *Frye* test. One possibility suggested by these works — including Michael Green, *Expert Witnesses and Sufficiency of Evidence in Toxic Substances Litigation: The Legacy of* Agent Orange *and Bendectin Litigation*, 86 NW. U. L. REV. 643 (1992) and J. WEINSTEIN & M. BERGER, WEINSTEIN'S EVIDENCE (1988) — is that the increasing prevalence of huge class action suits involving complicated health and scientific claims required a more liberal standard for expert testimony. *See Daubert*, 509 U.S. at 586–87 nn.4 & 5.

93. *Daubert*, 509 U.S. at 587.

94. Justice Blackmun's opinion in *Daubert* represents the unanimous view of the Court with respect to Parts I and II-A. The opinion represents the majority view of the Court with respect to Parts II-B, II-C, III, and IV.

95. *Daubert*, 509 U.S. at 593.

96. *Id.*

(3) "the known or potential rate of error"; and (4) the "general acceptance" of the theory.[97]

It was this part of the opinion — the enunciation of these factors — that prompted Chief Justice Rehnquist and Justice Stevens to part company with the rest of the Court. Writing for the pair, Chief Justice Rehnquist cautioned against the majority's dangerous dicta:

> "General observations" by this Court customarily carry great weight with lower federal courts, but the [factors] offered here suffer from the flaw common to most such observations — they are not applied to deciding whether particular testimony was or was not admissible, and therefore they tend to be not only general, but vague and abstract.[98]

Chief Justice Rehnquist then noted the atypicality of the briefs submitted to the Court: "[The briefs] deal with definitions of scientific knowledge, scientific method, scientific validity, and peer review — in short, matters far afield from the expertise of judges."[99] In essence, Chief Justice Rehnquist and Justice Stevens argued that science is best left to the scientists — that judges are not cut out to resolve such questions. Chief Justice Rehnquist concluded the opinion by stating that he did "not think [Rule 702] imposes on [judges] either the obligation or the authority to become amateur scientists," preferring to leave the development of standards for admitting such testimony to specific cases and the common law.[100]

Experience has vindicated Chief Justice Rehnquist and Justice Stevens. *Daubert* has had two unintended and far-reaching effects. First, it has created a cottage industry of lawyers who do nothing but represent clients in "*Daubert* hearings."[101] These

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97. *Id.* at 593–94.
98. *Id.* at 598 (Rehnquist, C.J., dissenting).
99. *Id.* at 599.
100. *Id.* at 600–01.
101. Michael H. Gottesman, *Admissibility of Expert Testimony After* Daubert*: The "Prestige" Factor*, 43 EMORY L.J. 867, 877 (1994) ("Formulating additional factors that courts should consider in assessing the 'reliability' of an expert's methodology is likely to be a cottage industry in the wake of *Daubert*."); *see also* JoEllen Lind, *"Procedural* Swift*": Complex Litigation Reform, State Tort Law, and Democratic Values*, 37 AKRON L. REV. 717, 772 (2004) ("It has become commonplace for federal courts to conduct a '*Daubert* hearing' to test the admissibility of plaintiffs' crucial expert opinions early on in litiga-

hearings constitute a significant part of all complex litigation today in both state and federal courts.[102] The second effect of *Daubert* has been to restrict expert testimony. Despite the Court's attempt to liberalize the standard for expert testimony, *Daubert* has in fact achieved the opposite. Much to the joy of corporate defendants and the chagrin of the plaintiffs' bar,[103] the Court's gratuitous "observations" have stiffened the spines of gatekeepers, thus stifling lawsuits.[104]

Notwithstanding these concerns, since 1993 the Court has reaffirmed *Daubert* twice: In *General Electric Co. v. Joiner*, the Court established abuse of discretion as the standard of review for *Daubert* hearings,[105] and in *Kumho Tire Co. v. Carmichael*, the Court extended the rule in *Daubert* to cover all expert testi-

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tion."); Lawrence S. Pinsky, Comment, *The Use of Scientific Peer Review and Colloquia to Assist Judges in the Admissibility Gatekeeping Mandated by* Daubert, 34 HOUS. L. REV. 527, 528 n.8 (1997) ("*Daubert* . . . has given rise to a cottage industry in commentary suggesting various interpretations, as well as mechanisms to deal with the newly created tasks.").

102. *See* Lind, *supra* note 101, at 774–75 ("[A]s more mass tort class actions . . . are drawn into the federal system, the very same arguments about junk science from *Daubert* will be mustered to oppose class certification, thereby combining summary judgment substitutes — the *Daubert* hearing and the denial of class certification — to curtail the litigation altogether."); *see also* D. Michael Risinger, *Navigating Expert Reliability: Are Criminal Standards of Certainty Being Left on the Dock?*, 64 ALB. L. REV. 99, 138–39 (2000) ("When *Daubert* changed [the] general approach for federal courts, state courts . . . were somewhat influenced in civil cases, but have paid little attention in regard to prosecution evidence in criminal cases."). *But see* Note, *Improving Judicial Gatekeeping: Technical Advisors and Scientific Evidence*, 110 HARV. L. REV. 941, 943 (1997) ("Even [after *Daubert*], the general acceptance test remains firmly rooted in the state courts.").

103. *See* Margaret A. Berger & Aaron D. Twerski, *Uncertainty and Informed Choice: Unmasking* Daubert, 104 MICH. L. REV. 257, 262–63, 267 (2005) (observing that "[d]efendants immediately realized that *Daubert* furnished them with a new procedural opportunity, as they could make in limine motions asking the trial judge to exclude plaintiffs' experts as witnesses," and that "[p]reparing for and litigating *Daubert* issues has undoubtedly made litigation even more expensive than before[,] . . . [perhaps serving] as an efficient deterrent to bringing a credible cause of action").

104. *See* Mark S. Brodin, *Behavior Science Evidence in the Age of* Daubert*: Reflections of a Skeptic*, 73 U. CIN. L. REV. 867, 876 n.43 (2005) ("A RAND Institute for Civil Justice study concludes that *Daubert* has had the effect of narrowing the window of admissibility of expert testimony." (citing Katerina M. Eftimoff, *RAND Study: The Decade After* Daubert *Proves Tough on Expert Witnesses*, ABA LITIG. NEWS ONLINE, July 2002, at 2)); Lind, *supra* note 101, at 772 ("*Daubert* increased the power of federal trial judges to exclude relevant expert testimony by investing them with a 'gatekeeper' function to determine when proffered scientific proof was not reliable enough to be considered by the trier of fact, usually a jury. . . . It did not take long for defendants to waken to the potential impact of *Daubert* on summary judgment.").

105. 522 U.S. 136, 139 (1997).

mony.[106] *Daubert* thus stands as a strong pronouncement on the Court's attitude about the nature and justiciability of scientific questions, providing a model for the judicial resolution of questions of scientific reliability.

III. TOWARD A NEW STANDARD

The previous Part outlined the basic legal background that should bear on the inquiry courts conduct when reviewing challenges to proposed science curricula. In this Part, the analysis turns to developing some of this jurisprudence into principles for resolving Establishment Clause questions about science instruction. It begins with critical assessments of the purpose inquiry, as well as the effects and endorsement inquiries, before turning to one of the central considerations of this Note — how the *Daubert* analysis should apply to evaluating the reliability and constitutionality of proposed science curricula.

A. PURPOSE

If the aim is to develop a standard that builds upon the analyses of *Epperson* and *Edwards*, purpose seems an obvious place to begin. Not only is purpose the first prong of the *Lemon* test and a main focus of Justice O'Connor's endorsement test,[107] but both *Epperson* and *Edwards* were decided on impermissible intent.[108] The teaching of these cases is that in order to pass constitutional muster, the purpose in adopting the curriculum must be at least significantly secular (even if it is ultimately less secular than religious[109]) and honestly held.[110]

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106. 526 U.S. 137, 141 (1999).

107. *See* Lynch v. Donnelly, 465 U.S. 668, 690 (1984) (O'Connor, J., concurring) (arguing that the central question of endorsement requires examination both of what was intended to be conveyed and what message actually was conveyed, and that "the purpose and effect prongs of the *Lemon* test represent these two aspects of the meaning of the [government's] action").

108. *See supra* notes 59–69 and accompanying text.

109. *See* McCreary County v. ACLU, 125 S. Ct. 2722, 2735 (2005) (noting that a secular purpose must be more than "secondary to a religious objective"); Edwards v. Aguillard, 482 U.S. 578, 592 (1987) (referring to "primary purpose"); Stone v. Graham, 449 U.S. 39, 41 (1980) (referring to "pre-eminent purpose"). In order to give a fully nuanced characterization of the Court's jurisprudence in this area, this Note refers to the possibility of a permissible purpose that is ultimately less secular than religious in order to capture a very small set of circumstances. The case law has never gone quite as far as requiring

As a predicate to finding an Establishment Clause violation, there first should be a finding of some religious purpose, however small.[111] While it is conceivable to think that such a searching examination of purpose would always return a finding of impermissible purpose where there is some religious motivation, the Court in *Edwards* deliberately rejected this generalization. The door may not be open very wide, but it is open. At the conclusion of Part III of the opinion, Justice Brennan wrote:

> We do not imply that a legislature could never require that scientific critiques of prevailing scientific theories be taught . . . . [T]eaching a variety of scientific theories about the origins of humankind to schoolchildren might be validly done with the secular intent of enhancing the effectiveness of science instruction.[112]

Here, the Court appears to have been contemplating two ideas: first, that a science curriculum that presented evolution from a critical perspective (but without offering an alternative) could be acceptable; and second, and perhaps more surprisingly, that

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that the secular purpose be greater than or equal to an accompanying religious one, and, as a matter of semantics, it is possible that a sufficient secular purpose could be "more than secondary," "primary," or "pre-eminent," without being dominant. *See* GREENAWALT, *supra* note 34 (manuscript, ch. 10 at 8–9) ("According to the Supreme Court, this does not mean that its *exclusive* or *main* purpose must be secular. It is enough that it have a substantial secular purpose, even if it also has a religious purpose."). Yet, this Note also assumes that purpose is incapable of precise quantification. Thus, as a practical matter, the religious purpose should be at most roughly equal to the secular purpose. *See id.* (manuscript, ch. 10 at 3) ("The Court has said that the purpose standard is satisfied by *a* secular purpose, even if that is accompanied by an equally strong religious purpose.").

110. *See supra* notes 70–72 and accompanying text.

111. Even a scant religious purpose is sufficient to raise the Establishment Clause question. *See* KENT GREENAWALT, DOES GOD BELONG IN PUBLIC SCHOOLS? 122–25 (2005). In fact, Professor Greenawalt would require no explicit religious purpose in some cases. He argues that even if legislators were moved by wholly secular motivations — such as believing creation science *as science* or believing that constituents would be made happiest by a ban on teaching evolution — courts may examine the merits of the science *if the rationale* for the change in curriculum seems "hard to explain except by religious objections to evolution." *Id*. at 123. Though in most contemporary high school science curricula proposals there is likely to be some evidence of religious motivation, even if very small, the absence of such evidence should not stop a court from making a complete review. After all, if the proposal amounts to teaching religion under the guise of science, it is still forbidden by the Establishment Clause regardless of an irreproachable purpose. *See id.* at 124 ("[W]hatever the possible misapprehensions of not very well informed legislators, teaching scientific creationism *is* teaching religion, and that is not permitted.").

112. *Edwards*, 482 U.S. at 593–94.

there could be a "variety of scientific theories about the origins of humankind" presented to schoolchildren without running afoul of the Establishment Clause.

Of course, to be valid, the teaching of such theories would have to be motivated by the secular intent of "enhancing the effectiveness" of science instruction. Although this language is vague, it does have some implications for what constitutes valid secular intent. As the Court noted in both *Epperson* and *Edwards*, the intent of enhancing the effectiveness of science education must be one that is sincere.[113] It cannot be a sham. Courts may look past nominal purposes to examine the intent of those proposing the curriculum.

Another implication is that an honest intent to improve science education should not incorporate a view of science that results from religious convictions. Presumably, Senator Keith and all the other legislators truly sought to improve the efficacy of science instruction in Louisiana — by requiring the concurrent teaching of what they perceived as a superior brand of science — when they passed the Act.[114] Because their views on science resulted from their own religious beliefs, however, the secular educational intent was lost.

The reliance on legislative intent in *Edwards*, however, has been challenged. Dissenting vigorously, Justice Scalia attacked the purpose prong of the *Lemon* test, challenging Justice Brennan's attempt to "discern[ ] the subjective motivation of those enacting the statute" on the ground that this is an impossible task.[115] "To look for *the sole purpose* of even a single legislator is probably to look for something that does not exist."[116] Based upon the hazards of determining subjective and group legislative intent, Justice Scalia reasoned that the only way the purpose prong

113. *See supra* notes 59–72 and accompanying text.

114. In dissent, Justice Scalia exhaustively described the veracity of the scientific convictions of Senator Keith and the other Louisiana legislators. In summary, the senators testified as follows: (1) there are two and only two scientific explanations for the beginning of life — evolution and creation science; (2) the body of scientific evidence supporting creationism is as strong, or *stronger*, than that supporting evolution; (3) creation science is educationally valuable; (4) although creation science is educationally valuable and strictly scientific, it is now being censored from or misrepresented in the public schools; (5) the censorship of creation science has harmful effects. *See id.* at 622–25 (Scalia, J., dissenting).

115. *Id.* at 636.

116. *Id.* at 637.

of the *Lemon* test is defensible is "if the text of the Establishment Clause demands it," which is "surely not the case."[117] Thus, Justice Scalia concluded that the Court should abandon the purpose prong of the *Lemon* test.[118]

Justice Scalia is correct that the text of the Establishment Clause — "Congress shall make no law respecting an establishment of religion"[119] — does not seem to *demand* inquiry into congressional purpose. Nevertheless, the Court should not be so quick to exclude any examination into purpose from an Establishment Clause inquiry.[120] Professor Andrew Koppelman has characterized Justice Scalia's argument as an "evanescence objection."[121] Simply put, this means that Justice Scalia does not think that there is anything to find when looking for legislative purpose — there is no there there.

This is a dubious position. As Professor Koppelman points out, one simple answer to Justice Scalia's assertion that collective legislative intent is too multifaceted to be ascertainable is that "the secular purpose prong looks at legislative outcomes rather than legislative inputs."[122] Although the *Lemon* test purports to distinguish between purpose and effects, the Court's jurisprudence in the racial discrimination context provides an example of how effects can reveal purpose. Under challenges based upon the Equal Protection Clause, courts review de facto effects precisely because they are a proxy for impermissible legislative intent.[123] Indeed, as the Court observed in *Brown v. Board of Education*, "What others in Congress and the state legislatures had in mind cannot be determined with any degree of certainty," so courts "must look instead to the effect."[124]

It is possible, however, that Professor Koppelman concedes too much. It is unnecessary to reduce the *Lemon* test's purpose inquiry into one of effects. While purpose and effects are indeed

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117. *Id.* at 639.
118. *Id.* at 640.
119. U.S. CONST. amend. I.
120. *See generally* GREENAWALT, *supra* note 34 (manuscript, ch. 10 at 17–30).
121. Andrew Koppelman, *Secular Purpose*, 88 VA. L. REV. 87, 99 (2002).
122. *Id.* at 118.
123. *Id.* ("In the discriminatory purpose cases, subjective intent is necessarily the very thing that the Court is searching for, because the whole point of the judicial inquiry is to police the legislative process for contamination by prejudice.").
124. 347 U.S. 483, 489–92 (1954).

related,[125] and the former can sometimes be inferred from the latter, a more strident answer to Justice Scalia would be that legislative purpose *is* an easy inquiry in some cases. Recall the purpose stated by Tennessee when it passed its "monkey law" outlawing the teaching of "any theory that denies the story of the Divine Creation of man as taught in the Bible, and to teach instead that man has descended from a lower order of animals."[126] Justice Scalia has never claimed that purposes, such as this one, should not be inferred from the language of a statute.[127] Although the Tennessee "monkey law" might seem like an easy example, it makes clear the unreasonableness of the claim that subjective purposes never have anything to do with whether an official decision is invalid.[128]

Finally, and perhaps most importantly, as a matter of doctrine, removing the purpose inquiry from Establishment Clause questions is a move the Court has thus far been unwilling to make.[129] In *McCreary County v. ACLU*, Justice Souter wrote, "Examination of purpose is a staple of statutory interpretation that makes up the daily fare of every appellate court in the country."[130] Furthermore, in the specific context of Establishment Clause analysis, "scrutinizing purpose does make practical sense . . . . The cases with findings of a predominantly religious purpose point to the straightforward nature of the test."[131]

Purpose is thus a crucial inquiry for courts to make when considering Establishment Clause challenges to science curricula.

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125. *See infra* notes 139, 185.

126. Epperson v. Arkansas, 393 U.S. 97, 108–09 (1968).

127. *See* GREENAWALT, *supra* note 34 (manuscript, ch. 10 at 18) ("Justice Scalia has never insisted that purposes that can be discerned from the language of a statue cannot be used for interpretation.").

128. *Id.* (manuscript, ch. 10 at 20). Even in cases of unclear legislative motivation, purpose remains important because, as Professor Greenawalt has illustrated, right actions with wrong motivations can be invalid. *Id.* (manuscript, ch. 10 at 22) (explaining that an official acting pursuant to his discretion in manner that is discriminatory, but appears facially neutral, still "has done something wrong, not merely done the right thing for the wrong reason"). Professor Greenawalt concludes that "if the inquiry about invalidity is largely about whether legislation would have been enacted but for the wrongful purposes of legislators, legislative history is a promising source of information." *Id.* (manuscript, ch. 10 at 30–31).

129. *But see id.* (manuscript, ch. 10 at 13) ("Whether a majority of Supreme Court justices believed as of the summer of 2005 that subjective purposes of legislators are relevant is difficult to tell.").

130. 125 S.Ct. 2722, 2734 (2005).

131. *Id.*

This inquiry can involve scrutiny of the purported purpose set forth by the proposing body, examination of the sincerity with which the proposal is made, and review of any accompanying legislative history.

B. EFFECTS AND ENDORSEMENT

Although *Epperson* and *Edwards* do not provide a framework for Establishment Clause analysis beyond the purpose inquiry, the following analysis will show that effects and endorsement are necessary considerations for proposals that survive purpose review. Therefore, assuming such a proposal survives purpose review, the substance of the proposal must then be examined under either the effects prong of the *Lemon* test, or the endorsement test,[132] or both. Regardless of which approach is used, if a proposed curriculum passes the purpose inquiry despite some religious purpose,[133] the court must then review the content of the proposed curriculum.

Under the effects test of *Lemon*, it is necessary to consider what message a student would receive from the teaching of the proposed curriculum.[134] If a proposed curriculum lacks an adequate scientific basis, the effect of teaching the curriculum is an impermissible advancement of religion. By contrast, a curriculum with sound scientific support that happened to comport with a religious viewpoint would not have an impermissible effect of advancing religion because of the objective scientific basis upon which it rests. This is true even under the more formalist interpretation of the effects prong the Court has sometimes used.[135]

Similarly, under the endorsement analysis — which, as the Court has stated, emanates from the "prohibition against government endorsement of religion" and "preclude[s] government

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132. The endorsement test was first used by a majority of the Court in *County of Allegheny v. ACLU*, 492 U.S. 573 (1989). *See supra* note 44 and accompanying text.

133. Intuitively, a curriculum containing no religious purpose is unlikely to have the effect of advancing religion. *But see supra* note 111.

134. *See* Freiler v. Tangipahoa Parish Bd. of Educ., 185 F.3d 337, 346 (5th Cir. 1999) (citing *County of Allegheny* for the proposition that, "[i]n assessing the primary effect of the contested disclaimer, [the court should] focus on the message conveyed by the disclaimer to the students who are its intended audience").

135. *See, e.g.*, Mitchell v. Helms, 530 U.S. 793, 813 (2000) (noting that a program for allocating aid is permissible as long as it is allocated "on the basis of neutral, secular criteria").

from conveying or attempting to convey a message that religion or a particular religious belief is favored or preferred"[136] — whether an objective observer would perceive the curriculum to be an endorsement of religion would depend upon what message was communicated and hence the scientific strength of the proposed curriculum. Because the endorsement analysis requires the reviewing court to determine what message a challenged curriculum conveys to an objective observer "presumed to be familiar with the history of the government's actions and competent to learn what history has to show,"[137] the court must determine whether the curriculum rests upon a sufficiently reliable scientific basis. If the curriculum rests upon an unreliable scientific basis, an objective observer would conclude that the curriculum impermissibly endorses either a single religious viewpoint over other religious viewpoints, or religion over non-religion.[138]

Although the *Lemon* test is sometimes applied to — or thought to — conflate purpose and effects,[139] substantive review of a proposed curriculum makes the most sense as a separate inquiry under the effects or endorsement analysis. The characterization of this substantive review as part of effects or endorsement is most logical because a proposal that rests on insufficiently reliable science is more likely to have the effect of advancing or endorsing religion than it is to reveal a religious purpose. Thus, when a proposed curriculum passes the purpose test, courts should review its science to ensure that it does not have the impermissible effect of advancing or endorsing religion.

C. SCIENTIFIC RELIABILITY

Having discussed purpose through the lens of legislative intent, as well as substance via effects and endorsement, this Part now turns to using the Court's model for examining scientific questions in the courtroom to develop principles for resolving constitutional challenges to science curricula. In other words, this

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136. *County of Allegheny*, 492 U.S. at 593.

137. McCreary County v. ACLU, 125 S. Ct. 2722, 2736–37 (2005).

138. *Id.* at 2742 ("[T]he government may not favor one religion over another, or religion over irreligion.").

139. *See* GREENAWALT, *supra* note 34 (manuscript, ch. 10 at 34–35) (noting the "linkage between purpose and effect[s]" and discussing the distinctions); *see also infra* note 185.

section will explain how courts should perform their substantive review of science curricula under effects and endorsement.

As a threshold matter, some commentators have suggested that questions of science are nonjusticiable — that courts are institutionally incompetent to resolve issues about the nature of science.[140] The Court's holding in *Daubert*, and its subsequent reaffirmations of that holding in *Joiner* and *Kumho Tires*, reject this position.[141] *Daubert* requires judges, as gatekeepers, to examine proposed scientific evidence for relevance and reliability and to make judgments about such proffers.

Whatever the desirability of this situation,[142] judicial determinations of scientific sufficiency are important decisions that must be made. The outcome of a trial, for example, may come down to the question of whether a car was traveling at more than seventy miles per hour. A litigant may have a witness who will testify that based upon her analysis of the relative distortion in a photograph taken of the moving car as it passed a stationary object, she can extrapolate that the car was traveling at least ninety-five miles per hour. The testimony is certainly relevant, but is it admissible? Judges decide these and similar questions every day.

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140. *See, e.g.*, Wendy E. Wagner, *Choosing Ignorance in the Manufacture of Toxic Products*, 82 CORNELL L. REV. 773, 841–46 & n.251 (1997) (collecting and discussing a number of articles and opinions in which scholars and judges "have questioned the judiciary's competence to adjudicate cases involving disputes over complex scientific facts"); *see also* F. Arthur Jones II, *A Creative Solution?: Assessing the Constitutionality of a New Creation/Evolution Disclaimer*, 49 LOY. L. REV. 519, 539 (2003) (positing that a sham inquiry about the scientific soundness of a disclaimer referencing the evolution/creationism debate "raises serious issues of judicial competence . . . . The proper question is whether a curricular decision violates the Establishment Clause because it lacks a secular purpose or has the primary effect of advancing or endorsing religion; courts should not ask simply whether 'junk' science is being taught" (footnote omitted)); Jay D. Wexler, Note, *Of Pandas, People, and the First Amendment: The Constitutionality of Teaching Intelligent Design in the Public Schools*, 49 STAN. L. REV. 439, 466–68 (1997) (querying whether "courts [are] competent to make such technical distinctions [in defining science]," but arguing that judicial competency to evaluate ID is irrelevant because "the Constitution does not require teachers to teach science; it simply forbids teachers from teaching religion . . . . Because [*Of Pandas and People*] teaches religion, and because teaching religion in public schools violates the Establishment Clause, the Court need not determine whether the book also qualifies as science").

141. *See supra* Part II.D.

142. To be clear, the desirability of such judicial determinations is *not* what Chief Justice Rehnquist and Justice Stevens dissented about. (They dissented about the guidance the Court was suggesting for admitting expert testimony.) *See supra* notes 94–106 and accompanying text.

Moreover, judicial review of scientific questions must often go beyond simple factual determinations such as the foregoing car example. In the administrative law context, for example, the Supreme Court's complicated line of decisions on whether judicial review of agency action should focus on substance or procedure has suggested that review of substance is often more appropriate. Thus, the teaching of *Vermont Yankee Nuclear Power Corp. v. Natural Resources Defense Council, Inc.* is that a court may not impose additional procedures upon an agency.[143] The Court's decision in *Citizens to Preserve Overton Park, Inc. v. Volpe*, however, suggests that a court may use arbitrary and capricious review to determine whether the substance of an agency's decision is sound.[144] The resulting jurisprudence often requires courts to review abstract and sophisticated questions of science, such as the appropriate safety level of atmospheric benzene,[145] the amount of heat necessary to avoid botulism when cooking whitefish,[146] or the relative rates of mortality in automobile accidents involving automobiles equipped with seatbelts and/or airbags.[147]

Justiciability of scientific questions thus established, some inherent and key distinctions between expert testimony and science curricula must be made. In trials, judges determine what evidence would be useful to juries in resolving factual questions; by

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143. 435 U.S. 519, 524 (1978).

144. 401 U.S. 402, 415, 420 (1971) (observing that "[e]ven though there is no de novo review in this case . . . the generally applicable standards of § 706 [of the Administrative Procedure Act, which necessitates a finding that the actual choice made by the agency was not arbitrary or capricious] require the reviewing court to engage in a substantial inquiry," and remanding for the district court to perform a review "based upon the full administrative record that was before the Secretary at the time he made his decision"). In a subsequent case, the Court reconciled *Vermont Yankee* and *Overton Park* as follows:

> We begin by noting that although one initially might feel that there is some tension between *Vermont Yankee* and *Overton Park*, the two cases are not necessarily inconsistent. *Vermont Yankee* stands for the general proposition that courts are not free to impose upon agencies specific procedural requirements that have no basis in the [Administrative Procedure Act]. At most, *Overton Park* suggests that § 706(2)(A), which directs a court to ensure that an agency action is not arbitrary and capricious or otherwise contrary to law, imposes a general "procedural" requirement of sorts by mandating that an agency take whatever steps it needs to provide an explanation that will enable the court to evaluate the agency's rationale at the time of decision.

Pension Benefit Guar. Corp. v. LTV Corp., 496 U.S. 633, 654 (1990).

145. *See* Indus. Union Dep't, AFL-CIO v. Am. Petroleum Inst., 448 U.S. 607 (1980).

146. *See* United States v. Nova Scotia Food Prods. Corp., 568 F.2d 240 (2d Cir. 1977).

147. *See* Motor Vehicle Mfrs. Ass'n v. State Farm Mut. Auto Ins. Co., 463 U.S. 29 (1983).

contrast, it is the function of schools to prepare schoolchildren for intelligent participation in society.[148] These are crucially different situations. In trials, juries determine outcomes of lawsuits; in classrooms, students learn. It is not appropriate, therefore, to think of the classroom as a place where teachers need students to decide whether evolution or another theory is right — students are not juries.

Even when a court determines that a witness may testify as an expert, it is not deciding that the expert's approach is correct. Rather, it is making the related decision that the expert's theory has sufficient indicia of reliability that a jury would not be acting unfairly by relying upon it. In the foregoing car example, when the judge, as gatekeeper under *Daubert*, determines that the expert witness's theory of photographic distortion is unallowable, this is in essence a decision that a jury cannot reasonably rely upon such testimony. This is not the same thing as deciding that the theory is wrong. A judge faced with a question of whether an expert witness can offer anti-evolution testimony is therefore *not* in the same situation as one assessing the constitutionality of a science curriculum.

These distinctions can cut both ways. On one hand, because the outcome of a suit is not at stake, there might be a more liberal attitude towards what is scientific enough to be included in a school's curriculum. Proponents of this view might argue that the importance of teaching students critical and independent thinking skills militate toward letting in science that would not stand up in court. On the other hand, because class time is a valuable resource, it could be argued that it should only be spent on theories in which society has confidence. Under this argument, the person might say that judges will allow a marginal

148. *See supra* notes 82–83 and accompanying text; *see also* Bethel Sch. Dist. No. 403 v. Fraser, 478 U.S. 675, 681 (1986) ("The role and purpose of the American public school system were well described by two historians, who stated: '[P]ublic education must prepare pupils for citizenship in the Republic. . . . It must inculcate the habits and manners of civility as values in themselves conducive to happiness and as indispensable to the practice of self-government in the community and the nation.'"); NAT'L SCIENCE TEACHERS ASSOC., STANDARDS FOR SCIENCE TEACHER PREPARATION 2 (2003), http://www.nsta.org/main/pdfs/NSTAstandards2003.pdf ("The [National Science Education Standards] is a visionary framework for science teaching in precollege education, based upon the assumption that scientific literacy for citizenship should be a primary — if not exclusive — goal of science education at the precollege level.").

theory to come into court only because of the importance of reaching a factual resolution for one particular point of controversy, whereas there is no such necessity in a classroom. Indeed, because there is no single and correspondingly urgent point of controversy in the classroom, the decision to patiently present a comprehensive view of one area of the course may come at the cost of instruction in another. A recent publication about national science standards suggests that although both approaches could be acceptable pedagogy, the latter interpretation correctly grasps that the purpose of pre-college science education is to cover the *main* scientific theories.[149] Furthermore, it seems intuitive that theories that would fail to stand up in court are sufficiently peripheral to general science education to warrant omission from curricula.[150]

Given these considerations, if a proposed curriculum would fail to pass *Daubert*'s gatekeeping analysis, it is very likely unacceptable science teaching.[151] Even if a proposed curriculum could pass *Daubert*'s gatekeeping analysis, this fact alone may not be enough to make the curriculum constitutionally acceptable because, as the preceding analysis suggests, the standard for what gets into courts is likely more liberal than that which should determine what is appropriate science for classrooms.

The threshold questions thus confronted, the next step is to consider what a *Daubert* analysis would look like in the course of analyzing a proposed science curriculum. Of the four factors suggested by *Daubert* — testability, peer review, rate of error, and general acceptance[152] — three can meaningfully be translated into the Establishment Clause context, providing judges with the

149. *See* NAT'L SCIENCE TEACHERS ASSOC., *supra* note 148, at 2 ("In the broadest sense, scientifically literate citizens understand the subject matter of science, but also know and understand the evidence behind the major concepts of science, how such evidence was obtained and why it has been accepted.").

150. Opponents of ID often use absurd examples about the origins of species — such as the theory that aliens could be the intelligent designer(s), or the "five-second theory," which holds that everything, including all memories, was created only five seconds ago — to drive home the idea that not every theory is worth the time to learn about. *See, e.g.*, David Helfand, Remarks at the Columbia Law School Intelligent Design Panel (Nov. 2, 2005) (notes on file with author).

151. This is only to say that a proposed theory that fails *Daubert* review could not constitutionally be taught *as science*. What is permissible in history or history of science classes, however, is a different question.

152. *See supra* notes 94–97 and accompanying text.

means for evaluating the reliability of science curricula. The following sections consider each factor in turn.

1. *Testability*

Testability is a feature of scientific hypotheses that refers to whether a theory can be independently and repeatedly verified or confirmed. In articulating this factor, the *Daubert* Court cited approvingly to the work of three scholars: Michael Green, Carl Hempel, and Karl Popper.[153] Testability, sometimes also referred to as falsifiability or refutability, generally refers to a basic version of the scientific method — hypothesize, test, and revise. By including testability as a factor in the *Daubert* analysis, and by specifically referring to the work of Karl Popper,[154] the Court seems to have embraced a demarcation theory of science — the notion that science can be distinguished from nonscience.

This is not so. Popper's demarcationist view of science has come under significant attack,[155] which is why it is important to

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153. Daubert v. Merrell Dow Pharm., Inc., 509 U.S. 579, 593 (1993) (citing Michael Green, *supra* note 92, at 645 ("Scientific methodology today is based on generating hypotheses and testing them to see if they can be falsified; indeed, this methodology is what distinguishes science from other fields of human inquiry."); CARL HEMPEL, PHILOSOPHY OF NATURAL SCIENCE 49 (1966) ("The statements constituting a scientific explanation must be capable of empirical test."); KARL POPPER, CONJECTURES AND REFUTATIONS: THE GROWTH OF SCIENTIFIC KNOWLEDGE 37 (5th ed. 1989) ("The criterion of the scientific status of a theory is its falsifiability, or refutability, or testability.")).

154. Popper defined scientific inquiry as inquiry that is falsifiable. *See* POPPER, *supra* note 153, at 37. Popper's views in this area have been quite influential. In striking down Arkansas's Balanced Treatment Act, one judge sought to distill the "essential characteristics of science." According to Judge William R. Overton, science has the following features: "(1) it is guided by natural law; (2) it has to be explanatory by reference to natural law; (3) it is testable against the empirical world; (4) its conclusions are tentative, i.e., are not necessarily the final word; and (5) it is falsifiable." McLean v. Ark. Bd. of Educ., 529 F. Supp. 1255, 1267 (E.D. Ark. 1982). Note that characteristics (3)–(5) are all variations on testability/falsifiability.

155. *See, e.g.*, PHILIP KITCHER, LIVING WITH DARWIN: EVOLUTION, DESIGN, AND THE FUTURE OF FAITH (forthcoming 2007) (manuscript at 7–10, on file with author) (arguing against using testability to distinguish between "Science and Pseudo-Science" for the purpose of dissolving the claims of ID and suggesting instead that ID be rejected because history demonstrates that it is "discarded science") [hereinafter KITCHER, LIVING WITH DARWIN]; *see also* PHILIP KITCHER, ABUSING SCIENCE: THE CASE AGAINST CREATIONISM 44 (1982) (suggesting that the idea that falsifiability should be dispositive is "hopelessly flawed") [hereinafter KITCHER, ABUSING SCIENCE]; THOMAS S. KUHN, THE STRUCTURE OF SCIENTIFIC REVOLUTIONS (1962); Wexler, *supra* note 140, at 466–67 (citing KITCHER, ABUSING SCIENCE, *supra*, and KUHN, *supra*, and concluding that philosophers of science have "declared the entire project of demarcation 'a pseudo-problem'" (citation omitted)).

realize that the *Daubert* Court included testability as only one factor, not as the dispositive criterion. In some sense, Popper's definition of science therefore parallels the D.C. Circuit's repudiated *Frye* test[156] because both were single-factor approaches to determining, respectively, what counts as science and what counts as reliable science.[157] Although these tests ask different questions — Popper's test asked whether the theory was falsifiable whereas the *Frye* test asked whether the theory had "general acceptance in the particular field"[158] — it is significant that both have been incorporated into *Daubert*'s more nuanced and sophisticated inquiry. For all its drawbacks,[159] *Daubert* analysis does comparatively better in paralleling the views of current philosophers of science, who have sought to determine what features make for a compelling scientific theory, rather than search for dispositive features.[160]

Assuming that most controversial science curricula proposals will not involve theories that can be independently tested,[161] one

156. *See supra* notes 90–91 and accompanying text.

157. Unlike Popper's falsifiability test, the *Frye* test leaves open the possibility that what is unreliable science today could be acceptable to the scientific community tomorrow.

158. Frye v. United States, 293 F. 1013, 1014 (1923).

159. *See supra* notes 98–106 and accompanying text.

160. *See* KITCHER, ABUSING SCIENCE, *supra* note 155, at 48 (positing that three characteristics of successful science are independent testability, unification, and fecundity).

161. One hypothesis is testable independently of another when there are ways of checking the first without assuming the truth of the second. Independent testability is thought to be important because it is problematic if every way of investigating the truth of one hypothesis presupposes the acceptance of some other, perhaps controversial, assumption. For an example of a scientific theory that is independently testable, see Greenawalt, *supra* note 46, at 344–46. Professor Greenawalt describes an empirical study about the beneficial effects of intercessory prayer on Korean women hoping to become pregnant via in vitro fertilization. *Id.* Today the study has been withdrawn, remains unrepeated, and is thought to have been fraudulent. *See* Benedict Carey, *Researcher Pulls His Name from Paper on Prayer and Fertility*, N.Y. TIMES, Dec. 4, 2004, at A15 (describing how Dr. Rogerio Lobo, a researcher at Columbia University, pulled his name from the study after one of the authors of the study pleaded guilty in an unrelated fraud). According to another report:

> [The t]hree scientists were claiming fertility treatment was twice as likely to result in pregnancy if the couples were prayed for by strangers. The extraordinary result, published in September 2001 in the Journal of Reproductive Medicine, was publicised widely. . . . [However,] the journal that originally published the study recently withdrew it from its website, although it has yet to retract it formally. It is the closing twist in a drama that has seen one of the three authors, Daniel Wirth, unmasked as a fraudster with no medical qualifications who used fake identities, including that of a dead child, to fleece companies of more than $1 million. Wirth, under house arrest in California, was also found to head an organisation called Healing Sciences Research International, based at a PO box

way of assessing the weight this factor should have is to ask whether the theory is "minimally plausible."[162] For a theory to be minimally plausible, of course, is a far less rigorous requirement than for a theory to be confirmed. Indeed, a theory can be plausible without being confirmed, but no theory can be confirmed without being plausible (even if its plausibility results from the confirmation of a previously implausible hypothesis). Theories that are neither minimally plausible nor testable should be given even less weight under this factor than theories that are minimally plausible but not testable. Courts evaluating curricula should therefore determine whether a proposal is either minimally plausible or testable. The weight that a theory receives under testability thus depends upon whether it is minimally plausible, testable, both, or neither.

2. *Peer Review*

Peer review is the process by which experts, or referees, examine the work of authors. The purpose of peer review is to provide an evaluation of whether a publisher should accept or reject a work for publication or, alternatively, suggest changes that would make the piece of publishable quality. As Professor Lawrence S. Pinsky observes, "The general process of peer review is almost universal, and, in most cases, represents the sole mechanism for objective evaluation of the merits of proffered material."[163] In *Daubert*, the Court wrote that "submission to the scrutiny of the scientific community is a component of 'good science,' in part because it increases the likelihood that substantive flaws in methodology will be detected."[164]

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address in California, connected with research into the paranormal and faith healing. Joseph Horvath, an accomplice of Wirth, also masqueraded under false names and has pleaded guilty to posing as a doctor without a medical licence. The two con artists met while at the John F. Kennedy University in California, where Wirth, a lawyer, took a masters in parapsychology.

Anjana Ahuja, *The Murky Miracle*, THE LONDON TIMES, June 24, 2004, at T2-14. Without the likely fraud, this empirical study would be a good example of a religious finding with an independently testifiable hypothesis.

162. *See* GREENAWALT, *supra* note 111, at 102 ("To warrant its being presented as possibly accurate, a theory should pass a threshold of plausibility."); *see also* Greenawalt, *supra* note 46, at 352–55.

163. Pinsky, *supra* note 101, at 560.

164. Daubert v. Merrell Dow Pharm., Inc., 509 U.S. 579, 593 (1993).

In enunciating this factor, however, the Court noted that "[p]ublication (which is but one element of peer review) is not a *sine qua non* of admissibility; it does not necessarily correlate with reliability."[165] This is an important point. The court should not merely rely on publication or even publication in a peer-reviewed journal. Consistent with the *Daubert* Court's observations, a court should consider whether a proffered theory has undergone a bona fide peer review process.[166] Thus, a scientific theory that purports to have undergone peer review should have undergone peer review in the whole field — not a particular subset — and, to be reliable, should appear in a publication related to the topic.[167] Finally, courts should make sure that they understand the various distinctions between the processes for peer review in journals, books, and other fora.

The analysis under this factor is an examination of the process of review the scientific theory received. Thus, the ideas contained in a work published by an organization that performs a rigorous review should be entitled to more deference than one published by an organization that performs a superficial or cursory review.

3. *Rate of Error*

Rate of error is the only aspect of the *Daubert* analysis that cannot meaningfully be translated from the context of expert testimony. As previously noted, the purpose of expert testimony in a trial is to provide useful information that may assist the fact-finder in answering specific questions in need of resolution.[168] Error rate, as well as what *Daubert* referred to as "the existence and maintenance of standards controlling the technique's opera-

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165. *Id.*

166. *See* Daubert v. Merrell Dow Pharm., Inc., 43 F.3d 1311, 1318 n.6 (9th Cir. 1995) (referring to "publication in a generally-recognized scientific journal that conditions publication on a bona fide process of peer review" (citing *The* Journal's *Peer-Review Process*, 321 NEW ENG. J. MED. 837 (1989)).

167. A broader peer review decreases the likelihood that a well-reviewed idea represents only the views of a like-minded subset or minority of the field, and publication in a forum related to the topic of discussion is desirable because it increases the potential for expert scrutiny. *See* KITCHER, LIVING WITH DARWIN, *supra* note 155 (manuscript at 8) (arguing against rubber-stamping a theory simply due to the fact of publication because "publishing articles in 'peer-reviewed journals' say, are so easy to mimic, since any group . . . can institute the pertinent procedures").

168. *See supra* notes 142–148 and accompanying text.

tion,"[169] is useful to juries because it lets them know how heavily they ought to rely on findings made on the basis of, for example, genetic or fingerprint analysis. Error rates provide probabilities on which juries can rest their factual determinations.

To illustrate, an error rate inquiry might help the jury in the foregoing car example where the expert witness uses distortion in a photograph to extrapolate that the car is moving faster than ninety-five miles per hour. In such a case, the judge might ask whether the expert's technique is accurate when applied to instances in which the speed of the car is known. Whether the expert's technique returns the right answer nineteen times out of twenty rather than just ten times out of twenty makes a significant difference in whether a jury could reasonably rely on the expert's finding that the car was going ninety-five miles per hour.

Although the subcomponents of a theory of human origin might very well produce these sorts of outputs,[170] general theories about human origin simply do not. At the most abstract level, the hypotheses of evolution, creationism, and ID have no rate of error. The statements, "Humans and animals evolve," "God created all living things," and "All living things are the product of an intelligent design," are, to put it simply, either true or false. Therefore, the only role an error rate analysis should play is in evaluating the accuracy of the predictions set forth by the theory. While this is possible for the theory of evolution, it is hard to see how the same would apply to a theory such as ID, which currently seems to lack predictive models.

4. *General Acceptance*

The last of the *Daubert* factors, general acceptance, is a remnant of the *Frye* test. In reviving general acceptance as a factor, the Court wrote:

> A reliability assessment does not require, although it does permit, explicit identification of a relevant scientific com-

169. *Daubert*, 509 U.S. at 594.

170. An obvious example is the rate of error when using evolutionary theory to predict children's eye color using principles of dominance and recessiveness in alleles. Similarly, the rate of error in the prayer and pregnancy study, *supra* note 161, could be evaluated by a court.

> munity and an express determination of a particular degree of acceptance within that community . . . . Widespread acceptance can be an important factor in ruling particular evidence admissible, and a known technique which has been able to attract only minimal support within the community, may properly be viewed with skepticism.[171]

General acceptance is perhaps the most straightforward of the *Daubert* factors. As with the peer review analysis, the general acceptance inquiry should identify a "relevant scientific community" in which to query the degree of acceptance of the theory. Courts should also pay attention to whether a known idea has consistently attracted minimal support. Refutation, of course, is the strongest form of nonacceptance by the scientific community.[172]

While the general acceptance analysis might be thought redundant given the peer review evaluation, the two factors are distinguishable because the latter is a process inquiry while the former has a more qualitative component. In other words, a theory could be proposed in conformity with proper peer review practices yet garner little respect in the scientific community, and vice versa. Courts faced with evaluating the reliability of a proposed science curriculum should therefore evaluate the degree to which the theories underlying the curriculum have gained qualitative acceptance. As the approach is a balancing one, the degree to which an idea has been embraced or rejected by the field should determine the weight this factor carries.

IV. A NEW STANDARD: HONEST PURPOSE AND SUBSTANTIAL RELIABILITY

A. THE NEW STANDARD

The preceding parts have presented the doctrinal background and generated a number of useful principles for resolving Establishment Clause challenges to secondary school science curricula.

171. *Daubert*, 509 U.S. at 594 (internal quotation marks and citations omitted).

172. *See* KITCHER, LIVING WITH DARWIN, *supra* note 155 (manuscript at 7) (pronouncing ID "*dead science*, a doctrine that once had its day in scientific inquiry and discussion, but that has rightly been discarded" (emphasis in original)).

To recapitulate: (1) the public school context is a special one, as students of a certain age are impressionable and particularly vulnerable to social pressures;[173] (2) a purpose inquiry is necessary and strongly in line with the jurisprudential and theoretical framework for evaluating an Establishment Clause challenge to a proposed science curriculum;[174] (3) legislative purpose is not evanescent, and there are several avenues of review from which purpose and legislative sincerity can be inferred, including any accompanying legislative history;[175] (4) it may be necessary to review the substance of a proposed science curriculum to determine whether it will have an impermissible effect;[176] (5) questions about the nature of science are justiciable, and courts are used to conducting this kind of inquiry;[177] (6) students are not analogous to juries, and courts facing Establishment Clause questions over science curricula are not making precisely the same determinations as they are when determining whether the theory behind the curricula could be presented in court, and there is likely a lower threshold for what is allowable as expert testimony than what is allowable as science instruction;[178] (7) finally, *Daubert* is familiar to judges and provides three useful features that courts can look to when evaluating science curricula: testability, peer review, and general acceptance.[179]

Based upon these principles, courts should decide Establishment Clause challenges to high school science curricula using a searching inquiry. A court should be ready to review both the purposes of the proposing body — be it a school board or legislature — and the content of the curriculum. The purpose inquiry should examine the intent of the proposing body, looking to the legislative history, if necessary, to determine if the intent is at least substantially secular and honestly held. If the proposed curriculum contains some religious purpose but nevertheless passes the purpose review, the court should then review the curriculum to determine whether its science is sufficiently reliable

173. *See supra* Part II.C.
174. *See supra* Parts II.A–B, III.A.
175. *See supra* notes 115–131 and accompanying text.
176. *See supra* notes 132–138 and accompanying text.
177. *See supra* notes 140–147 and accompanying text.
178. *See supra* notes 148–151 and accompanying text.
179. *See supra* notes 153–172 and accompanying text.

under the teachings of *Daubert*. To withstand constitutional challenge, a proposed curriculum that contains some religious purpose must also have a substantial secular purpose *and* be sufficiently scientific under *Daubert* review. If a proposed curriculum with some religious purpose also presents a sufficient and substantial secular purpose but substantively rests upon an insufficiently reliable scientific basis, the court should conclude that the curriculum violates the Establishment Clause because it has the effect of advancing or endorsing religion. Because of the special nature of schools and schoolchildren, doubts should be resolved in favor of rejecting the proposed curriculum.

This review for honest purpose and substantial reliability is appropriate for several reasons. First, it ensures that school boards and legislators have an honest and substantial secular purpose and employ reliable science — as determined by the objective considerations of *Daubert* — when they propose science curricula. Second, it comports with the goals of the Establishment Clause by preventing religious teaching in public schools while still leaving constitutional room for the teaching of defensible science produced from religious motivations, regardless of any religious implications. Finally, this analysis comports with the doctrinal framework of the *Lemon* test, as well as the Court's attitude about the nature of scientific reliability.

B. APPLICATIONS

Having stated the new standard in general terms, this section considers honest purpose and substantial reliability review in a variety of contexts to demonstrate its application. In the following examples, the aim is to explore the general contours of the standard; in so doing, it is useful to make a number of assumptions, and this Note will not go into significant detail about the science that underlies these proposals. Furthermore, although all of the examples assume that the proposal could survive a purpose inquiry, this assumption would almost certainly not be true of many actual proposals, if *Epperson*, *Edwards*, and the trial in Dover are any indication of legislative indiscretion.

An analysis of the Dover case[180] under the new standard would likely conclude that the school board members' decision to adopt the one-minute statement violated the Establishment Clause. As noted above,[181] the plainly religious motivations of the school board members demonstrated an impermissibly religious purpose.[182] Indeed, the generally religious purpose of the ID movement has been documented extensively.[183] Yet despite this impermissible purpose, Judge Jones's analysis of the content of ID and *Of Pandas and People* also concluded that "ID is not science."[184] More specifically, he wrote: "ID has failed to gain acceptance in the scientific community, it has not generated peer-reviewed publications, nor has it been the subject of testing and research."[185] Though the opinion makes no mention of *Daubert*, observe that the three factors Judge Jones focused on — testability,[186] peer review,[187] and general acceptance[188] — are precisely the applicable three factors from the *Daubert* analysis. Because

180. The case is described *supra* at notes 2–28 and accompanying text.

181. *See supra* Part I.

182. *See supra* notes 19–27 and accompanying text.

183. *See* Kitzmiller v. Dover Area Sch. Dist., 400 F. Supp. 2d 707, 747 (M.D. Pa. 2005) ("We have been presented with a wealth of evidence which reveals that the District's purpose was to advance creationism, an inherently religious view, both by introducing it directly under the label ID and by disparaging the scientific theory of evolution, so that creationism would gain credence by default as the only apparent alternative to evolution."); *see also* Matthew J. Brauer et al., *supra* note 73, at 149 (examining the motivations behind the ID movement and concluding that "intelligent design is merely a stripped-down version of its more explicitly Biblical predecessors"); Wexler, *supra* note 140, at 452–54 (documenting the "clear religious agenda" behind *Of Pandas and People*).

184. *Kitzmiller*, 400 F. Supp. 2d at 735.

185. *Id.*; *see also id.* at 745 ("After this searching and careful review of ID . . . we find that ID is not science and cannot be adjudged a valid, accepted scientific theory as it has failed to publish in peer-reviewed journals, engage in research and testing, and gain acceptance in the scientific community."). Strictly speaking, however, review for honest purpose and substantial reliability would not have reached this question in the Dover case because the analysis would have ended with the impermissible purpose. Though it is uncommon for judges to resolve questions they do not have to reach, as Judge Jones would seem to have done in his decision, it is possible that he conceptualized the question of whether ID is science as encompassed within the purpose inquiry. Though this position is plausible given the connections between the purpose and effects prongs of the *Lemon* test, it should be clear that this Note rejects this understanding by conceptualizing the substantive review of the curriculum as part of effects or endorsement review. *See supra* Part III.B.

186. See *id.* at 735–43 for Judge Jones's discussion of testability.

187. See *id.* at 744–45 for Judge Jones's discussion of peer review.

188. See *id.* at 738–45 for Judge Jones's discussion of general acceptance.

the proposal relies on science that is untestable,[189] unsupported in the peer review literature,[190] and rejected by the scientific community,[191] it is insufficiently reliable under *Daubert*, meaning that its implementation would have had the impermissible effect of advancing religion. Or, to use the endorsement formulation offered by Judge Jones, "a reasonable, objective observer would, after reviewing both the voluminous record in this case, and our narrative, reach the inescapable conclusion that ID is an interesting theological argument, but that it is not science."[192]

Applied to the recent curricular changes passed by the Kansas Board of Education,[193] which included an altered definition of science and an instruction to teach shortcomings of the theory of evolution, the new standard would likely find that these changes violate the Establishment Clause. Even assuming that the school board provided an honest and substantial secular purpose, thus reaching the effects inquiry, the board's redefinition of science to allow non-natural explanations for physical phenomena[194] would encounter serious problems under the testability factor of the *Daubert* analysis. Non-natural explanations are inherently untestable. Moreover, even under minimal plausibility analysis, non-natural explanations of species origin run into conceptual problems, such as the problem with flawed or *unintelligent* anatomical designs[195] or the difficulty in reconciling failed anatomical

189. See *id.* at 738 ("ID fails to meet the essential ground rules that limit science to testable, natural explanations.").

190. *See id.* at 744 ("A final indicator of how ID has failed to demonstrate scientific warrant is the complete absence of peer-reviewed publications supporting the theory. Expert testimony revealed that the peer review process is 'exquisitely important' in the scientific process.").

191. *See id.* at 738 ("[D]efense experts concede that ID is not a theory as that term is defined by the NAS and admit that ID is at best 'fringe science' which has achieved no acceptance in the scientific community.").

192. *Id.* at 745–46. For Judge Jones's effects formulation of the same conclusion, see *id.* at 764 ("[S]ince ID is not science, the conclusion is inescapable that the only real effect of the ID Policy is the advancement of religion.").

193. *See supra* note 10.

194. *See* Wilgoren, *supra* note 10, at A14.

195. Daniel Dennett provides an example of a flawed anatomical design:

> Brilliant as the design of the eye is, it betrays its origin with a tell-tale flaw: the retina is inside out. The nerve fibers that carry the signals from the eye's rods and cones (which sense light and color) lie on top of them, and have to plunge through a large hole in the retina to get to the brain, creating the blind spot. No intelligent designer would put such a clumsy arrangement in a cam-

designs with an omnipotent designer. Similarly, assuming that the critical focus on the shortcomings of certain portions of evolutionary theory could sustain a finding of substantial secular intent, the shortcomings should be generally accepted and should appear in peer-reviewed scientific literature. If the curriculum design included critiques of evolution that were unaccepted and unsupported in the peer-reviewed scientific literature, the proposal might well have the effect of advancing religion or endorsing religion over nonreligion.[196]

For similar reasons, the proposals adopted in Ohio[197] and Georgia[198] would also likely fail honest purpose and substantial reliability review. Again assuming the purpose inquiry could be surmounted (and that it had not already been retracted by the state's school board[199]), Ohio's redefinition of science and teaching of evolution in a critical fashion would likely encounter the same problems as the Kansas proposal, and Georgia's "balanced education" proposal, which gives equal weight to evolutionary theory and biblical interpretations,[200] seems to advocate the teaching of creationism, which — even imagining that *Edwards* had not already found this unconstitutional — stands upon even shakier scientific ground than ID. In all of these cases, dependence upon non-natural explanations or biblical interpretations will produce problems with testability, the lack of peer review is going to effect a general count against reliability, and the hostility of the science community to anti-evolution perspectives[201] means that many of these theories will fail substantial reliability review.

Considering the steep obstacles this review would pose for such proposals, the best hope of passing constitutional muster under honest purpose and substantial reliability review would be a curriculum proposal that did not go beyond requiring a critical

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corder, and this is just one of hundreds of accidents frozen in evolutionary history that confirm the mindlessness of the historical process.

Daniel C. Dennett, *Show Me the Science*, N.Y. TIMES, Aug. 28, 2005, at A11.

196. *See* McCreary County v. ACLU, 125 S. Ct. 2722, 2742 (2005).

197. *See supra* note 11.

198. *See supra* note 12.

199. *See supra* note 11.

200. *See* Zernike, *supra* note 12, at A10.

201. *See* Kitzmiller v. Dover Area Sch. Dist., 400 F. Supp. 2d 707, 765 (M.D. Pa. 2005) ("Repeatedly in this trial, Plaintiffs' scientific experts testified that the theory of evolution represents good science [and] is overwhelmingly accepted by the scientific community . . . .").

presentation of evolution. Of course, such a scheme would make constitutional sense only if there were a permissible purpose as well as the appropriate testability, peer review, and general acceptance under the *Daubert* analysis. A good example of what could have been an acceptable critique of evolution was the controversy surrounding the development of the eye, criticism of which until now was at least minimally plausible.[202] Caution, however, is necessary: Even if the substantive review shows some indicia of scientific reliability, if the purpose is primarily to discredit evolution because of religious convictions, then the scheme might not even pass the purpose test.

V. CONCLUSION

The reemerging debate over high school science curricula is not likely to have much traction in the courts, nor should it. This Note has sought to develop a framework of analysis, drawing upon the Supreme Court's Establishment Clause jurisprudence, as well as its jurisprudence with respect to questions about the nature of science and reliability. Under this analysis, when courts review challenges to proposed science curricula, they should be prepared to review not only for illegitimate purpose but also for illegitimate content. The competency of courts to undertake review for substantive reliability is evident not only from the

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202. *See, e.g.*, Dennett, *supra* note 195, at A11. Dennett explains:

> Take the development of the eye, which has been one of the favorite challenges of creationists. How on earth, they ask, could that engineering marvel be produced by a series of small, unplanned steps? Only an intelligent designer could have created such a brilliant arrangement of a shape-shifting lens, an aperture-adjusting iris, a light-sensitive image surface of exquisite sensitivity, all housed in a sphere that can shift its aim in a hundredth of a second and send megabytes of information to the visual cortex every second for years on end.
>
> But as we learn more and more about the history of the genes involved, and how they work — all the way back to their predecessor genes in the sightless bacteria from which multicelled animals evolved more than a half-billion years ago — we can begin to tell the story of how photosensitive spots gradually turned into light-sensitive craters that could detect the rough direction from which light came, and then gradually acquired their lenses, improving their information-gathering capacities all the while.
>
> We can't yet say what all the details of this process were, but real eyes representative of all the intermediate stages can be found, dotted around the animal kingdom, and we have detailed computer models to demonstrate that the creative process works just as the theory says.

Id.

similar contexts in which courts already undertake such analyses, but also from the Supreme Court's statement in *Daubert* regarding which factors should properly be considered in these assessments.

Under review for honest purpose and substantial reliability, it is likely that most Establishment Clause challenges to proposed curricula will be successful, but this need not necessarily be the case. As Justice Brennan wrote in *Edwards*, "teaching a variety of scientific theories about the origins of humankind to schoolchildren might be validly done with the secular intent of enhancing the effectiveness of science instruction."[203] Before a school board or legislature becomes too emboldened by this language, however, its members should take care that the science is reliable. As Judge Jones wrote, concluding his opinion in the *Dover* case: "The students, parents, and teachers of the Dover Area School District deserved better than to be dragged into this legal maelstrom, with its resulting utter waste of monetary and personal resources."[204] This caution is worth heeding.

203. Edwards v. Aguillard, 482 U.S. 578, 594 (1987).

204. *Kitzmiller*, 400 F. Supp. 2d at 765 (M.D. Pa. 2005); *see also* Lisa Anderson, *School Board Paying Court Costs in ID Case*, CHI. TRIB., Feb. 22, 2006, at C4 ("The Dover Area School Board . . . agreed to pay $1 million in court costs incurred by 11 parents who charged the rural Pennsylvania district with unconstitutionally teaching intelligent design.").