

**FEDERAL RULE OF CIVIL PROCEDURE 26  
DISCLOSURE OF EXPERT TESTIMONY  
JOHN ANGUS CAMPBELL, Ph.D.**

Case: *Tammy Kitzmiller, et al. v. Dover Area School District and Dover Area School District Board of Directors*

Case No. 04-CV-2688

**Expert's Background and Experience:**

I am a Professor and Director of Graduate Studies in the Department of Communication at the University of Memphis. I have co-edited a book entitled, *Darwinism, Design, and Public Education*, which I have incorporated in this report by reference.

Attached to this report as Exhibit A is a copy of my curriculum vitae.

- I. The following includes a complete statement of my opinions to be expressed, the reasons and basis underlying them, and the data and other information considered in forming them.**

***Introduction.***

Science is properly understood as argument, and it should therefore be taught in that manner. To that end, making students aware of the arguments for and against Darwin's theory of evolution, including making students aware of the contemporary theory of intelligent design (ID), advances secular, pedagogical purposes and goals and enhances the effectiveness of science education. Indeed, debating Darwinism and comparing it with alternatives, such as ID, is the appropriate educational approach to this issue. See *Why Are We Still Debating Darwinism? Why Not Teach the Controversy?* attached as Exhibit 1 and incorporated herein by reference and *Intelligent Design, Darwinism, and the Philosophy of Public Education* attached as Exhibit 2 and incorporated herein by reference; see also Campbell, J. A. and Steve Meyer, eds. *Darwinism, Design, and Public Education*, (Michigan State University Press, November 2003), incorporated herein by reference.

While I do not advocate teaching ID in the schools or making it a requirement for students to learn ID, making students aware of ID--in the context of teaching Darwin's theory--has a legitimate role in motivating students to learn Darwin's theory and advances the notion that science is properly understood as a process of argument. Presenting science as argument has the salutary effect of improving science education. My position is not one as an advocate of ID as a scientific theory, but as an advocate of the pedagogical reasons for making students aware of the theory and to understand science as argument, including the arguments for and against Darwin's theory.

Undoubtedly, evolution is the subject of much debate. If one wishes to move our current educational and cultural discussion of Darwin's theory beyond its current stalemate one would be well advised to take seriously the motive that prompts school boards to single out Darwin's theory for attention and to attach stickers to textbooks, for example, or make other warnings about it—the fear that science is closed, dogmatic, and does not encourage students to consider all points of view.

The popular suspicion that science is not an open process of inquiry is a suspicion that scientists and science educators should meet with a welcoming, creative and vigorous pedagogical response. The core of the kind of response that I believe would be most productive is to seize the challenge and emphasize how all science, while aiming at precision, is also tentative, and proceeds by the serious play of to and fro argument. The prevailing, dogmatic approach to teaching Darwinism has, unfortunately, legitimized the suspicion that science is close-minded and has contributed to a lack of public confidence in science education in our public schools. My concern is not to assign blame for this condition (no doubt there is plenty to go around) but to find a constructive way out—a way of teaching our best science, protecting the professional integrity of our teachers, and reassuring parents that science education is an open process of inquiry aimed at educating their children, teaching them skills in reasoning and argument essential to their future, and preparing them to be informed citizens.

***Teaching science as argument promotes a more complete understanding of science and of Darwin's theory.***

Darwin's own sense of scientific method was as a performing art—an open, flexible, delicate amalgam of induction, deduction, hypotheses, and practical experience—that informed everything he wrote as a scientist. Although Darwin's *Origin* challenged the design hypothesis of his time, the design model structures the rhetoric of his epochal work at every turn and continues to provide the grammar of his contemporary defenders. Indeed, the design hypothesis was central in motivating Darwin to the study of science, and it was no less important in shaping the development of his evolutionary ideas.

For students to understand Darwin's argument, to say nothing of the contemporary questions that it continues to generate, there is a legitimate educational place and role for Darwinism's dialectical opposite: the intelligent design hypothesis. Again and again in the structuring of Darwin's arguments, a reader sees how Darwin uses contrast with the design hypothesis to explain his theory and the pattern of evidence and inferences necessary to understand it. By my count, in the first edition of the *Origin*, Darwin contrasts the explanatory power of his theory with its opposite approximately 105 times. Pertinent for the present concern with the teaching issues raised by the reemerging arguments for design today is Darwin's welcoming of readers' objections and his attempt to find resources, not only from nature but also from a reader's own perceptual resources, to overcome those objections. Acknowledging the legitimacy of different perspectives—such as those offered by advocates of ID—is one of the defining marks of a master

teacher as traditionally understood in the context of a liberal education, and, therefore, advances education, and, in this case, a better understanding of Darwinism.

***Argument was the engine that powered the evolution of Darwin's own method and scientific methods as we understand them today.***

However one weighs the claim that ID is not, and cannot be science, that claim should be considered in light of the arguments advanced by its proponents and in light of the historical character of the philosophy of science. Pronounced as is the parallel between Darwinism and design, as noted above, the parallel is perhaps nowhere more pronounced and symmetrical than on the charge that ID is not science. Various initial readers of Darwin's theory rejected it as science and regarded his book as an example of theorizing unrestrained by evidence. In his subsequent editions and particularly in his private letters, Darwin took pains to convince his readers that what he was offering was substantive science and not wish fulfillment.

Darwin's hostile or skeptical readers were, in a way, correct. What Darwin was presenting was not just an argument for evolution by natural selection but a revolution in scientific method. In 1859, few would have questioned whether design arguments were scientific. The book from which Darwin learned scientific method and logic (John Herschel's *Preliminary Discourse*) legitimated the design inference as one of the highest motives for studying science. A present reader, however, may conclude that ID is not science because it draws an inference to an unobservable, nonmaterial cause. Yet that reader has no greater certainty (to be consistently comparative about it) than the most ardent ID advocate that such a conclusion will be acceptable to scientists or philosophers of science in a hundred years—or for that matter, in twenty-five years, ten years, or next week. If the *Origin* provides any basis for surmise, it is within the bounds of historical possibility that a perspective that is at first rejected by today's best scientific and philosophic minds may eventually be accepted.

Those who reject making students aware of the theory of ID on the grounds that ID violates the current rules of scientific practice only beg the question. The present regime of methodological rules cannot prevent controversy for the simple reason that those rules may themselves be one of the subjects of scientific controversy. Science education, like science itself, must be constantly subject to revision in light of the demands of new generations of students and of new scientific knowledge. Indeed, advances in molecular biology, paleontology, and the information sciences have placed traditional questions of design on a new footing. Even should these new advances render a negative verdict on the design inference considering the issues involved advances the understanding of students as to why certain ideas pass muster as science and others do not. (Is "alternative medicine," for example, legitimate medicine, should it be covered as part of government funded health-care—should one seek it for oneself? Is mid-wifery a legitimate practice, or should birth only be encouraged in a hospital setting attended by medical doctors?) In the end a student who knows not just current scientific information, but who knows that information in the context of argument will be in a better position to make responsible, informed, and independent decisions about science as a citizen—

whether on matters of public policy (stem cell research, environmental questions, etc.) or concerning the kind of health care to seek for himself/herself and for family members.

***Teaching science as argument promotes good science education.***

Science advances not only by formal method but by argumentation and the history of science is, among other things, a series of controversies over great scientific questions as well as an activity that is deeply enmeshed in culture and informed by contestable philosophic assumptions. Much of the substance of science hinges on which theory among a group of competitors can provide the best interpretation of a set of data. It is in this sense—the sense of the comparative value of explanation and argument within the complex interrogation of nature we call science—that contemporary scientific theory has added its discriminating color to the terms *scientific reason* or *scientific method* or just plain *science*. The presentation of science and the critique of scientific reasoning, including the possibilities for error in fact, inferences, or theories need to be taught simultaneously. Science, over and over again having proven itself indispensable to society by that very feat, has underscored the need for critical thinking about science to be integrated into the fabric of scientific education. By making students aware that Darwin's theory rests on argument and inference and by introducing them to ID in the context of teaching Darwin's theory (as in teaching astronomy one would mention the opposing views of Aristotle and Ptolemy, or Newton in the context of teaching relativity theory) educators are advancing the pedagogical merits of comparison, criticism, and competition that are essential to a proper education. This promotes learning and is good for science.

Teaching Darwin's theory of natural selection comparatively is the mode Darwin himself followed in the *Origin*. It is the traditional method used in the humanities, it is used to teach values, it is explicitly sanctioned by Mill's *On Liberty*, and it fosters student interest in science. Further, it helps teach the skills of analysis and critical deliberation that are central to democratic citizenship.<sup>1</sup> Indeed, debating Darwinism and comparing it with alternatives is the appropriate liberal educational approach to this issue.

In closing, let me reiterate—with emphasis—my position. Because Darwin's theory of evolution is, at present, the only theory that is accepted by the majority of the scientific community, I believe that classroom instruction in biology should be devoted to his theory. At the same time, I believe that no theory should be presented in a dogmatic way that does not disclose to students the tentative nature of all scientific theories, as well as the gaps, problems, and weaknesses of any theory, regardless of its present dominance.

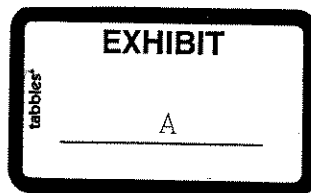
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<sup>1</sup> For myself, as a rhetorician and as a humanist educator, I cannot imagine anything more educationally salutary than a bold, rhetorically-based plan for harnessing the abundant, metaphysical energies of the American people for the study of science. The precise knowledge required to distinguish real from apparent design, the knowledge of biology required to discuss intelligently whether or not Darwinism stories were more plausible than intelligent design stories would unleash a tremendous—and perhaps even distinctly American—motivator to the study of science.

Similarly, I believe that it is a wholly legitimate pedagogical purpose to introduce students to rival theories such as ID for the purpose of fostering a critical assessment of reigning scientific theories and helping students to appreciate the historical, tentative—and frankly argumentative—nature of all scientific assertion. To that end, the efforts of the Dover Area School District seek to advance secular, pedagogical goals.

- II. My qualifications as an expert witness are included in my curriculum vitae, which is attached to this report as Exhibit A, and in my experience and background mentioned in this report.
- III. The compensation I will receive for my study, case preparation, and testimony in this matter is \$100.00 per hour. All travel expenses will be billed at cost.
- IV. I have not testified as an expert at trial or by deposition within the preceding four years.

Signed: John Angus Campbell Date: 3/29/2005



# CURRICULUM VITAE

(Chronological)

NAME: John Angus Campbell DEPARTMENT: Communication RANK: Professor

## DEGREES

DEGREE	DISCIPLINE	INSTITUTION	YEAR
B.S.	Speech Communication	Portland State University	1964
MA	Speech Communication	University of Pittsburgh	1967
Ph.D.	Speech Communication	University of Pittsburgh	1968

## EXPERIENCE

RANK/POSITION	DEPARTMENT/DIVISION	INSTITUTION/COMPANY/ORGANIZATION	PERIOD
Assistant Professor	Department of Speech	University of Washington	1968--76
Associate Professor	Department of Speech	University of Washington	1976--95
Professor	Department of Communication	University of Memphis	1995--

## HONORS/AWARDS

HONOR/AWARD	INSTITUTION/COMPANY/ORGANIZATION	YEAR
Golden Monograph	Speech Communication Association	1971
Golden Anniversary	Speech Communication Association	1987
Distinguished Teaching Award	University of Washington	1993
Dean's Recognition Award	University of Washington	1994
Communication Educator of the Year	Tennessee State Communication Association	2001
Oleg Ziman Award for Best Article	Journal of Interdisciplinary Studies	2003
Communicator of the Year	Tennessee State Communication Association	2004

## OTHER HONORS

Van Zelst Visiting Professor of Communication	Northwestern University	1990
Fellow Discovery Institute	Discovery Institute, Seattle, Washington	1995

## SPECIAL INVITATIONS

MacArthur Lecturer	University of Utah "In Darwin's Wake" series	1982
Brigance Lecturer	Wabash College	1999
Invited Lecturer	St. John's College, University of British Columbia	2000
University Lecturer	University of South Florida	2000
Invited Lecturer	University of Waterloo, Depts of English & Philosophy	2003
Invited Lecturer	University of Central Arkansas, Honors College	2003
Invited Lecturer	University of Mississippi Department of Biology	2004
Key Note Address	Denison University (Faculty Conf. Is Pub Speaking A Liberal Art?)	

	University of Minnesota: McLauren Institute	2004
Invited Lecturer	Tulane University, Dept. of Communication	2004
Invited Lecturer		2005

**TEACHING EXPERIENCE:** *(Specific information for past two years summarized in Appendix A. Use Appendix A to elaborate on teaching experience as needed.)*

SUBJECT <i>(indicate Undergraduate(U), Graduate (G), Other)</i>	INSTITUTION	
Rhetorical Theory (G)	University of Memphis	1995
Oral Communication (U)	" "	"
Rhetorical Perspectives In Intellectual Revolution (U)	" "	96
The Rhetoric of Science (G)	" "	96
Rhetorical Theory (G)	" "	97
Great American Speeches (U)	" "	97
Rhetorical Criticism (G)	" "	98
Classical Rhetoric (G)	" "	98
Great American Speeches (U)	" "	98
Senior Thesis (U)	" "	98
Modern Rhetoric (G)	" "	99
Rhetorical Theory (G)	" "	99
Great American Speeches (U)	" "	99
Classical Rhetoric (G)		2000
Independent Studies (Rhetoric of Science)		2000
Modern Rhetoric (G)		2000
Rhetorical Criticism (G)		2001
Classical Rhetoric (G)		2001
Rhetorical Theory (G)		2001
Independent Studies (G)		2002
Rhetoriography (G)		2002
Rhetorical Criticism (G)		2002
Rhetoric of Science (G)	" "	2003
Rhetorical Theory (G)		2003
Rhetorical Criticism (G)		2003
Modern Rhetoric (G)		2003
Rhetoric of Science (G)		2004
Independent Studies (G)		2004
American Public Address (UG)		2004
Rhetoric of Science (G)		2005
Independent Studies (G)		2005

**STUDENT ADVISING/MENTORING:** *(Use Appendix B to elaborate on advising/mentoring role as needed)*

Students involved in scholarly (research, creative) activities directly supervised (committees chaired).

Graduates (number): Undergraduate \_\_\_\_\_, Masters 1, Doctoral 16, Postdoctoral \_\_\_\_\_

Current	Name	Year of graduation (anticipated)
Undergraduate		1998
Masters	<u>Completed:</u>	
	Kris Nicole	1997
	Kevin Gallagher	1998
	Scarlett Thomas	1999
	Sally Bennett-Bell	1999
	Donna Bumgarden	1999
	Matt Steigmeyer	1999
	<u>Current:</u>	
	Kearney Lykins (Chair--Current)	2004
Doctoral	Jerome Mahaffey (Chair--Graduated)	2000
	Mahmoud Al-Sadi (Chair)	2005
	Sally Bennett-Bell (Chair)	2006
	Ryan Clark (Chair)	2006
	Brett Cooper (Chair)	2005
	Joe Delfin (Chair)	2005
	Matt Doggett (Chair)	2006
	Jill Greenman (Chair)	2007
	Ray Harris (Chair)	2006
	Andre Johnson (Chair)	2007
	Peg McCree (Chair)	2006
	Sally Paulson (Chair)	2006
	Jason Phillips (Chair)	2006
	Mary Richardson (Chair)	2008
	Cyd Ropp (Chair--Graduated)	2001
	Marcia Smith (Chair--Graduated)	2003
	Frank Thomas (Committee member)	2006
	Tim Viner (Chair)	2008
	Flora Wei (Committee member)	2005
	Mark Vail (Committee member)	2007
	Jonathan Woodall (Chair)	2007
	Chris Oldenberg (Chair)	2007
	Jon Camp (Chair)	2007
	Allison Shaskan (Chair)	2008

Postdoctoral



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Number of current Committee memberships (other than those chaired): Masters \_\_\_\_\_, Doctoral 2  
Number of students currently advised: Undergraduate \_\_\_\_\_, Graduate 19

**RESEARCH/SCHOLARSHIP/  
CREATIVE ACTIVITIES:** *(use Appendix C to provide additional information as needed.)*

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**PUBLICATIONS** (authors, title, reference) Include material in press and accepted for publication.

Books (authored, edited)

1976

An Overview of Speech Preparation, (Chicago: Science Research Associates, 1976). (textbook)

2003

Campbell, J. A. and Steve Meyer, eds. Darwin, Design and Public Education, (Michigan State University Press, November 2003).

Refereed journal publications (include book chapters)

1970

Campbell, J.A. (1970). "Darwin and the Origin of Species: The Rhetorical Ancestry of an Idea." Speech Monographs. 37, (March, 1970), 1-14. (lead refereed article)

1971

Campbell, J.A. (1971). "Argument from Circumstances in Edmund Burke's "Reflections on the Revolution in France." Studies in Burke and His Time. 12, (Winter 1971), 1764-1783. (refereed article).

1974

Campbell, J.A. (1974). "Charles Darwin and The Crisis of Ecology: A Rhetorical Perspective." Quarterly Journal of Speech, 60,(December 1974), 442-449. (refereed article)

Campbell, J.A. (1974). "Nature, Religion and Emotional Response: A Reconsideration of Darwin's Affective Decline. Victorian Studies, 18 (December, 1974), 159-174. (refereed article)

1975

Campbell, J.A. (1975). "The Polemical Mr. Darwin," Quarterly Journal of Speech," 61, (December, 1975), 375-390. (lead article, refereed)

1976

Campbell, J.A. (1976). The Fundamentals of Speech Preparation, (Palo Alto: Science Research Assoc. 1976), 175 pp. (Textbook)

1978

Campbell, J.A. (1978). "Hans-Georg Gadamer's Truth and Method," Quarterly Journal of Speech, 64, (February, 1978), 101-109. (lead essay review, invited)

1982

Campbell, J.A. (1982). "Eric Voegelin's Order in History," Quarterly Journal of Speech, 68, (February, 1982), 80-91. (essay review, invited)

1984

Campbell, J.A. (1984). "A Rhetorical Interpretation of History," Rhetorica, 2, (Autumn, 1984), 227-266. (refereed article)

1985

Campbell, J.A. (1985). "Insight and Understanding: The 'Common Sense' Rhetoric of Bernard Lonergan," Quarterly Journal of Speech, 71, (November, 1985), 476-488. (review essay, invited)

1986

Campbell, J.A. (1986). "Scientific Revolution & the Grammar of Culture," Quarterly Journal of Speech, 72, (November, 1986), 351-376. (lead essay, refereed)

1987

Campbell, J.A. (1987). "Charles Darwin: Rhetorician of Science" in John S. Nelson, Allan Megill & Donald N. McCloskey, eds. The Rhetoric of The Human Sciences, (Madison: Univ. of Wisconsin Press, 1987) 69-86. (competitively selected essay)

1989

Campbell, J.A. (1989). "The Invisible Rhetorician: Charles Darwin's 'Third Party' Strategy." Rhetorica, 7, (Winter, 1989), 55-85. (refereed) (The essays in this issue were papers delivered as part of a panel I organized for the ISHR conference in Tours, France the previous summer.)

1990

Campbell, J.A. (1990). "Scientific Discovery & Rhetorical Invention: The Path to Darwin's Origin," in Herbert W. Simons, ed. The Rhetorical Turn, Invention and Persuasion in the Conduct of Inquiry, (Chicago: University of Chicago Press, 1990), 58-90. (invited essay peer refereed book)

Campbell, J.A. (1990). "Darwin, Thales & The Milkmaid: Scientific Argument and Argument from Common Values and Common Sense," in Robert Trapp and Janice Shuetz, eds., Perspectives on Argumentation: Essays in Honor of Wayne Brockriede, (Prospect Heights, Illinois: Waveland Press, 1990), 207-220. (Invited book chapter, peer refereed book)

Campbell, J.A. (1990). "Between the Fragment and the Icon: Prospect for a Rhetorical House of the Middle Way," Western Journal of Speech Communication, 54, (Summer, 1990), 346-376. (Invited essay, peer refereed journal. I was also guest editor for this special issue devoted to rhetorical criticism.)

Campbell, J.A. (1990). "On The Way to The Origin: Darwin's Evolutionary Insight and Its Rhetorical Transformations," The Van Zelst Lecture in Communication, (Evanston, Illinois: Northwestern University, School of Speech). 40 pp. (Invited essay)

1993

Campbell, J.A. (1993). "Insight and Understanding: The 'Common Sense' Rhetoric of Bernard

Loneragan," (revised and expanded version of 1985 QJS essay), in Thomas J. Farrell & Paul A. Soukup, eds. Communication and Lonergan: Common Ground for Forging the New Age, (Kansas City, Mo.: Sheed & Ward, 1993), 3--22.

Campbell, J.A. (1993). "Annotated Bibliography." At the request of Thomas J. Farrell I did an annotated bibliography for my Lonergan essay (above) and expanded it to include some twenty works of rhetoric relevant for the general scholarly reader. See Thomas J. Farrell & Paul A. Soukup, eds. Communication and Lonergan: Common Ground for Forging the New Age, (Kansas City, Mo.: Sheed & Ward, 1993), 330--362.

Campbell, J.A. (1993). "Reply to Gaonkar & Fuller," The Southern Communication Journal, Vol. 58. 312--318. (Invited short essay).

1994

Campbell, J.A. (1994). "Of Orchids, Insects and Natural Theology: Timing, Tactics and Cultural Critique in Darwin's Post-Origin Strategy," Argumentation, Vol. 8 (February, 1994), 63--80. (Revised and expanded version of my 1989 Alta Conference paper.) (invited essay).

1995

Campbell, J.A. (1995). "The Comic Frame & the Rhetoric of Science: Ethics and Epistemology in Darwin's Origin," Rhetoric Society Quarterly, (Winter, 1995). Vol 24 pp. 27--50. (refereed journal)

1996

Campbell, J.A. (1996). "Topics Tropes and Tradition: Darwin's Reinvention and Rhetorical Subversion of the Argument to Design," in Ted McGuire & Trevor Melia, eds. Science, Reason and Rhetoric, (Pittsburgh: University of Pittsburgh Press, University of Konstanz Press, 1996), 25 pp. (invited essay, refereed volume).

Campbell, J.A. (1996). "Oratory, Democracy & the Classroom" in Roger Soder & John I. Goodlad, eds., Democracy, Education, & Schooling, (San Francisco: Josey-Bass): 211-243. (invited essay).

Campbell, J.A. & Benson, Keith R. (1996). "The Rhetorical Turn in Science Studies: A Review of Recent Literature," Essay review, Quarterly Journal of Speech, Spring or Autumn, 1996): 74-109. (invited essay refereed journal).

Campbell, J.A. (1996). "John Stuart Mill, Charles Darwin, and The Culture Wars: Resolving A Crisis in Education," The Intercollegiate Review: A Journal of Scholarship & Opinion, Vol. 31 (Spring, 1996): 44--51. (invited essay refereed volume).

1997

Campbell, J.A. (1997). "Strategic Reading: Rhetoric, Intention, and Interpretation," in Rhetorical Hermeneutics, Alan Gross and William Keith, eds. (Buffalo: University of New York, 1996): 113-137.

1998

Campbell, J.A. "Rhetorical Theory In The Twenty-First Century: A Neo-Classical Perspective" Southern Journal of Communication. 63 (Summer, 1998): 291-308.

Campbell, J.A. "Michael's Ruse's & But Is It Science?" Social Epistemology. 12 (1998): 157--65. (invited essay-review).

Campbell, J.A. "The Great Tradition," Two Be: A Journal of Ideas, No. 13 (1998): 85--87. (Invited short essay.)

Campbell, J.A. "Intelligent Design, Darwinism & The Philosophy of Public Education," Rhetoric and Public Affairs, 1 (Winter, 1998): 469—502. Introductory essay for a special edition of RPA on Intelligent Design of which I was guest editor.

1999

Campbell, J. A. "Why Was Darwin Believed? Darwin's Origin & The Problem of Intellectual Revolution," The Brigrance Forum: An Annual Public Lecture in memory of William Norwood Brigrance. Published and distributed by Wabash College, June, 1999. 42 pp.

2002

Campbell, J. A. "The Philosopher As Public Intellectual: Steve Fuller's Thomas Kuhn: A Philosophic History For Our Time," The Review of Communication, 2 (4) October, 2002, pp. 334-357. (Lead essay).

Campbell, J. A. "The Rhetoric of Charles Darwin: An Interview with John Angus Campbell." (2002). Focus on Origins Series. 1 hr 8 mins; Copyright: Access Research Network. ARN catalog #V027, (DVD/VHS).

2003

Campbell, J. A. "Evil As the Allure of Perfection." Rhetoric & Public Affairs, 6 (2), (Fall, 2003, 6): 523-530.

Campbell, J.A. (2003) "The Educational Debate Over Darwinism," Journal of Interdisciplinary Studies 15 (1/2): 43-60.

Campbell, J.A. "Why Was Darwin Believed? Darwin's *Origin* and the Problem of Intellectual Revolution," Configurations, 11 (2), (Spring, 2003): 203-237, (Revised and expanded essay on the theme of the Wabash Lecture of the same title).

2004

Campbell, J.A. "Reflections on Donald Bryant's 'Rhetoric Its Function and Scope,'" Advances in the History of Rhetoric, 7 (2004): 189-198.

2005

Campbell, J. A. "Darwin, Glen Roy and the Triumph of Invention Over Incommensurability," in Randy Harris, ed., Incommensurability, (West Lafayette, Indiana: Parlor Press, 2005): (70pps).

Campbell, J.A. "On The Way to Canterbury: A Rhetorician's Tale," Rhetoric and Public Affairs, 7 (4) (Winter, 2005): (35pps.)

Campbell, J.A.; Clark, Ryan, "Revisioning the *Origin*: Tracing Inventional Agency Through Genetic Inquiry," Technical Communication Quarterly, (in press 25 pps).

### Works Anthologized

Campbell, J.A. (1970) "Darwin and The Origin of Species: The Rhetorical Ancestry of An Idea," Speech Monographs, in Thomas Benson, ed., Landmarks in Rhetorical Criticism. (Berkeley:

Hermagoras Press, 1994).

Campbell, J.A. (1986) "Charles Darwin: Rhetorician of Science," in Randy Harris, ed. Landmarks in the Rhetoric of Science, (Berkeley: Hermagoras Press, 1995).

Campbell, J.A. (1974) "Charles Darwin and The Crisis of Ecology," in Craig Waddell, ed. Landmarks in the Rhetoric of the Environmental Movement, (Berkeley: Hermagoras Press, 1998).

Campbell, J.A. (1993). "Insight and Understanding: The 'Common Sense' Rhetoric of Bernard Lonergan," (revised and expanded version of 1985 QJS essay), in Thomas J. Farrell & Paul A. Soukup, eds. Communication and Lonergan: Common Ground for Forging the New Age, (Kansas City, Mo.: Sheed & Ward, 1993), 3--22.

### Work In Progress

Charles Darwin: A Rhetorical Biography. This is a book-length project examining the development of Darwin's self-understanding as a writer/polemicist of science from his early education, this formative Beagle years and culminating in his publication of the Origin in 1859.

Refereed conference publications

1981

Campbell, J.A. (1981). "Historical Reason: Field as Consciousness," in George Ziegelmüller and Jack Rhodes, eds., Dimensions of Argument: Proceedings of the Second Summer Conference on Argumentation, Speech Communication Association, 1981, pp. 101-113. (essay reviewed and selected by conference volume editors)

1983

Campbell, J.A. (1983). "Creationism: The Argument Time Forgot?" in George Ziegelmüller and Jack Rhodes, eds., Dimensions of Argument: Proceedings of the Third Summer Conference on Argumentation, Speech Communication Association, pp. 423-440. (article reviewed and selected by conference volume editors)

1987

Campbell, J.A. (1987). "Poetry, Science & Argument: Erasmus Darwin As Baconian Subversive," in Argument and Critical Practices: Proceedings of the Fifth SCA/AFA Conference on Argumentation, (Annandale, Virginia: Speech Communication Association 1987), 499-506. (article reviewed & selected by conference volume editors).

1989

Campbell, J.A. (1989). "Of Orchids, Insects and Natural Theology: The Evolution of Darwin's Strategy After the Origin," in Spheres of Argument: Proceedings of the Sixth SCA/AFA Conference on Argumentation, (Annandale, Virginia, 1989). (essay reviewed and selected by the volume editors).

Book Reviews

1978

Campbell, J.A. (1978). "Hans-Georg Gadamer's Truth and Method," Quarterly Journal of Speech, 64, (February, 1978), 101-109. (lead essay review, invited)

1979

Campbell, J.A. (1979). "Paul Ricoeur's The Rule of Metaphor," Quarterly Journal of Speech, 65, (October 1979), 335-338. (short review, invited)

1982

Campbell, J.A. (1982). "Rigor and Imagination," Journal of Applied Communication Research, (Autumn, 1982), 83-86. (short review, invited).

1991

Campbell, J.A. (1991). "Review of Beyond The Two Cultures: Essays on Science, Technology and Literature," Quarterly Journal of Speech, (invited short review), 499--501.

1993

Campbell, J.A. (1993). "Review of Walter Jost's Rhetorical Thought In John Henry Newman," (invited short review) Philosophy and Rhetoric, Vol. 26., 70--76.

1994

Campbell, J.A. (1994). "Review: J.V. Jenson's Thomas Henry Huxley: Communicating for Science," Quarterly Journal of Speech, 245--247. (Short, invited book review.)

1996

Campbell, J.A. (1996). "Eugene Garver's Aristotle's Rhetoric: An Art of Character," Rhetorica, (Summer, 1996). 8 pp.

1997

Campbell, J.A.(1997). Marouf A. Hassian, Jr. The Rhetoric of Eugenics In Anglo-American Thought, (Athens: The University of Georgia Press, 1996), 373--376.

Campbell, J.A. (1997). Frederick Burkhardt, ed. Forward by Stephen Jay Gould, Charles Darwin's Letters: A Selection 1825--1859, (Cambridge: Cambridge University Press, 1996). Bios, Vol. 68, no. 3, pp. 163-166.

1998

Campbell, J.A. (1998) George A. Kennedy, Comparative Rhetoric: An Historical and Cross-Cultural Perspective, (Oxford, Oxford University Press, 1997). to appear in Rhetorik: Eine Internationales Jarbuch, 3 pp.

2000

Campbell, J.A. (2000) "Carlo Gizburg, Rhetoric, History and Truth," Rhetoric and Public Affairs 3:2 : 300-302.

Nonrefereed publications

1994

John A. Campbell & Gerry Philipsen (1994). "Communication Essential To Today's World" Seattle Post Intelligencer for December 29.

1995

Campbell, J. A. (1995). "Response to Antczak," The Iowa Journal of Communication, (Winter). 3pp.

1996

Campbell, J.A. (1995). "Rhetoric and Democracy" The Commercial Appeal, Letters, B9, Sunday, February 11, 1996.

Campbell, J.A. (1996). "Monkeying with Science Education," The Commercial Appeal, Viewpoint, A9 Friday, March 18, 1996.

1997

Campbell, J.A. "Report on the Mere Creation Conference," Origins & Design, 18 no. 1 (Winter, 1997), 6--9.

1998

Campbell, J.A. "Response to Professor Pigliucci" Posting to "Darwin Day" website on why I would not sign Professor Pigliucci's "Open Letter" on the teaching of materialism. 3pp. February 18, 1997.

Campbell, J.A. "Science, Education and Democracy," Invited statement for Cyber-conference on the Public Understanding of Science convened by Professor Steve Fuller, University of Durham, UK. 2 pp. I was one of 25 scholars invited to offer a statement for this international "virtual conference." February 28--March 11, 1998.

2004

Meyer, Stephen C. and Campbell, J. A. (2004) "Incorporate Controversy Into the Curriculum," Atlanta Journal and Constitution (Sunday, February 15): Q1, Q4.  
<http://www.ajc.com/opinion/content/opinion/0204a/15design.html>

Meyer, Stephen C. and Campbell, J.A., (2004) "Students Should Learn to Assess Competing Theories," San Francisco Chronicle, (Friday, December 10): B9.

2005

Campbell, J.A., Meryer, Stephen C., "Teach Scientific Controversy About Origins of Life," Chattanooga Times Free Press, (Sunday, January 30, 2005): F1.  
[www.timesfreepress.com/archive/ArchiveSearch.asp?SearchWord](http://www.timesfreepress.com/archive/ArchiveSearch.asp?SearchWord)

PRESENTATIONS (authors, title, reference)

INVITED PRESENTATIONS

#### Conferences

1. "Edmund Burke & Argument From Circumstance," British Rhetoric-British Public Address Interest Group, SCA Convention, New York, December 1969. (competitively selected paper)
2. "The Polemical Character of Darwin's Origin of Species," SCA Convention, 1973. (competitively selected paper)
3. "Galileo, Marx and Freud: Persona & Argument," Part of a panel on Rhetoric and Science Rhetoric Division, SCA Convention, New York, 1974.
4. "Persona and Argument in the Rhetoric of Science," Northwest Communication Association Convention, British Columbia, 1977.
5. "Language, Symbolism & Tradition," Northwest Communication Association Convention, Coeur D'Alene, Idaho, April 1980.
6. "Elements of Philosophy as Conversation" (with John R. Stewart), Western Speech Communication Association Convention, San Jose, February 1981. (competitively selected paper)
7. "Historical Reason: Field As Consciousness," Second Summer Conference on Argumentation, Alta, Utah, July 1981. (competitively selected)
8. "The Centrality of the Spoken Word," SCA Convention, November 1981. (competitively selected paper)
9. Respondent/critic for Professor Douglas Collin's paper "The Found Object," American Academy of Religion Convention, Seattle, March 1982.
10. "Charles Darwin and the Analogy of the Breeder: Instrumental Reason and Environmental Rhetoric," SCA Convention, November 1982, Louisville, Kentucky. (competitively selected).
11. "Charles Darwin and the Ambiguities of Language," Northwest Communication Association Convention, Coeur D'Alene, Idaho, April, 1983. (competitively selected)
12. "Creationsim: The Argument Time Forgot?" Third Summer Conference on Argumentation, Alta, Utah, July 1983. (competitively selected)
13. "On The Rhetoric of History," Northwest Communication Association Convention, Couer D'Alene, March 1984.
14. "Scottish Common Sense Philosophy as Academic Rhetoric,," International Society for the History of Rhetoric, St. John's College, Oxford, England, August, 1985. (Competitively selected)
15. "Darwin's Notebooks and The Problem of Invention," ISHR colloquium, SCA convention, Chicago, 1986. (invited presentation).
16. "Tribute to Edwin Black: Reflections on the 20th Anniversary of Rhetorical Criticism: A Study in Method," SCA Convention, Chicago, 1986.
17. "Rhetoric and Science" I organized a panel of scholars from various American universities, for part of the ISHR meeting in 1987. I also gave a paper on the same panel "Topics, Tropes and Darwin's Inventional Process." ISHR Convention, Tours, France, July, 1987. (the panel program proposal was competitively selected).
18. "Science, Argument, Poetry: The Case of Erasmus Darwin," Fifth Summer Conference on Argumentation, Alta, Utah, August, 1987. (invited presentation)
19. "The Political Philosophy of Edmund Burke: A Rhetorical Perspective," SCA Convention, Rhetoric and Public Address Division, Boston, 1987. (invited presentation)
20. "Public Discourse & the Sacred:" An Analysis of Lincoln's Second Inaugural," Religious Speech Communication Association, Boston, 1987. (invited presentation).
21. "Response To Selected Papers in Rhetorical Criticism," Northwest Communication Association, Coeur D'Alene, Idaho, 1988. (invited response to a panel of papers).
22. "Teaching Rhetorical Criticism to Undergraduates," Western States Speech Communication Association, Spokane, Winter, 1989.
23. "Continuity, Revolution & Invention: Essays in Rhetorical Criticism," Panel of graduate papers which I organized, submitted and chaired. Northwest Communication Association, Coeur d'Alene, Idaho, Spring, 1989. (Panel was competitively selected).
24. "Of Orchids, Insects & Natural Theology: The Evolution of Darwin's Strategy After the Origin." Sixth Summer Conference on Argumentation, Alta, Utah, August, 1989. (invited presentation on competitively selected panel).
25. "Response to Papers on "Temporality in Rhetorical Theory and Criticism,""Sixty seventh annual Meeting SCA, New York, November, 1990. (invited presentation).
26. "After the Origin: Darwin's Post-Origin Strategy," International Society for the History of Rhetoric,



Baltimore, September, 1991.

27. "Teaching Public Speaking as Rhetorical Reason," SCA, Atlanta, October 1991.
28. "The Ethics of Rhetoric and Intellectual Revolution: The Case of Charles Darwin," SCA, Atlanta, October, 1991. (Paper was part of a competitively selected panel that I helped organize.)
29. "Edwin Black and the Humanist Tradition of Rhetoric" SCA, Miami, November, 1993. (Invited presentation.) I also read Prof. Steve Lucas' paper "Edwin Black: Rhetorical Critic" when Lucas was unable to attend a separate panel honoring Black.
30. "Response to Gaonkar and Fuller" SCA, Miami, November, 1993. Invited presentation in response to critique of my work by Profs. Gaonkar & Fuller. Attended & participated in organizing meeting of Society for the Rhetoric of Science.
31. Critic/respondent to several papers on a competitively selected panel on rhetoric and science at the 1995 Annual Meeting of the History of Science Society in Minneapolis October, 26, 29.
32. Critic/respondent to several papers on a competitively selected panel on rhetoric and science at the Annual Meeting of the Speech Communication Association in San Antonio, November, 1995.
33. "Rhetorical Reason In the Twenty-First Century". Seventh Biennial Rhetoric Society of America meeting in Tucson, Arizona May 30--June 1, 1996.
34. "Autobiography as Rhetorical Invention: Darwin's Autobiography", 82nd Annual Meeting of the Speech Communication Association. November 24, 1996
35. "Rhetorical Theory: An Appraisal" Western States Speech Communication Association, February 15, 1997.
36. "Theism, Naturalism and Darwin's Rhetorical Subversion of the Argument to Design," Naturalism, Theism and the Scientific Experience--A conference sponsored by the University of Texas at Austin, Department of Philosophy. February 21, 1997.
37. "Oratory Democracy and the Classroom" National Educational Research Association, Chicago Illinois, March 28, 1997.
38. "Rhetorical Theory In the Twenty-First Century," Presentation sponsored by Freedom of Speech Division, Southern States Speech Communication Association, Savannah, Georgia April 4, 1997.
39. "Why Darwinism Should Be Debated In the Public Schools" Southern States Speech Communication Association, Savannah, Georgia April 3, 1997.
40. "Rhetorical Theory In the Twenty-first Century," Tennessee State Communication Association, Nashville, September 27, 1997.
41. "Statistics, Prudence & The Rhetoric of Science," Response to papers by David DePew, Wade Kenny & Richard Thames. SCA Convention, Chicago, November 22, 1997
42. "Oratory, Democracy and the Classroom," Paper presented at SCA Convention, Chicago, November 22, 1997. (invited presentation).
43. "Leah Ceccarrelli's Contribution to The Rhetoric of Science," Presentation at the Award of Dissertation of the Year Ceremony, SCA Convention, Chicago, November 22, 1997. (invited).
44. "Of Friendship, Barnacles and Silence: Why Darwin Did Not Publish in 1844," Contributed Papers in Rhetoric & Public Address SSCA, San Antonio, Texas April 2, 1998. (competitively selected).
45. "Top Student Papers in Rhetoric & Public Address, " Respondent, San Antonio, Texas April 3, 1998.
46. "The Rhetoric of Science and the Rhetorical Tradition," Presentation, NCA New York Hilton, Nov 20, 1998.
47. "Medicine, Psychiatry & The Rhetoric of Science," Respondent, NCA New York Hilton, Nov 21, 1998.
48. "Insight, Discourse and Understanding: The Rhetorical Theory of Bernard Lonergan," NCA New York Hilton, Nov 24, 1998. (competitively selected).
49. "The Perils, Challenges and Rewards of Publishing In & Guest Editing an Interdisciplinary Journal," Presentation, SSCA/CCSA Joint Convention in St. Louis, April 7--10, 1999. (invited presentation).
50. "Creative Approaches to Teaching the Rhetoric of Science and Technology," NCA Seattle Nov, 2000. Respondent.
51. "The Interplay Between Theory & Practice: Perspectives From The History of Rhetoric," NCA Seattle, Nov. 2000. Respondent
52. "Engaging The Culture: Spirituality and Communication Scholarship" NCA Seattle, Nov. 2000.

Panelist.

53. "Terms of Engagement : Religious Discourse in the Public Sphere" NCA Seattle, Nov. 2000. Respondent.
54. "Rhetorioraphy: An Essay in Method" NCA paper co-authored with Angela Ray, 2002. This paper and the panel of responses we organized around it won the "top seeded position in the Rhetoric and Public Address Division.
55. "Edwin Black and the Enigma of Method" NCA 2002 on Issues Broached by Edwin Black' Studies of Rhetoric and Criticism.
56. "Evil in the Agora: Public Reaction Following the Events of September 11<sup>th</sup>—A Roundtable Discussion" NCA 2002
57. "Tainted Ethos: Scientists' Credibility Under Attack" NCA panel, 2002, Respondent.
58. Paper on Donald Bryant's "Rhetoric Its Function and Scope," NCA, Miami, 2004
59. "Classical Rhetorical Theory vs. Educational Process: Why Debating Darwin in the Public Sphere is Good for Science, Education and Democracy," SSCA Tampa, April 2004
60. "Darwin, Design and Public Education," National Faculty Leadership Conference, Washington D.C. June 24—27, 2004.
61. Roundtable Discussion: The Rhetoric of Science: Looking Forward, Looking Back. NCA Chicago, November 11-14, 2004
62. Roundtable Discussion: Allan Scult's "Being Jewish: Reading Heidegger," Chair/organizer. NCA Chicago, November 11-14, 2004
63. "So You Want to Give A Speech on Jesus," Panel on Religion, Civic Space and Appropriateness in the Classroom. NCA Chicago, November 11-14, 2004
64. William Jennings Bryan's "Imperialism" Speech. Short presentation/Discussion. NCA Chicago, November 11-14, 2004

Other (universities/industry)

1. "Gorgias and the Challenge of Criticism: A Case Study" "Great Speeches" series at Portland State University in Portland, Oregon, December 1981.
2. "The Rhetorical Tradition of Darwin's Origin". Invited presentation before the "Seminar in Science and Society" Fairhaven College, Bellingham, Washington, April 1982.
3. "Charles Darwin and the Rhetoric of Science," sponsored by Safeco Images Project and the School of Communications and Department of Speech Communication, University of Washington School of Communications, April 1982.
4. "The Community College and the Mission of the Humanities." By invitation to the North Seattle Community College Humanities Section, Faculty Retreat, November 1982.
5. Address before: Association Internationale Des Etudiants En Sciences Economiques et Commerciales: "Business and Oral Communication." May 1983, University of Washington.
6. "Charles Darwin: The Scientist As Rhetorician." Evening lecture as part of a continuing education course, "Personalities That Have Shaped the Western World." The course was conducted by Professor Robert Burke, Department of History, July 1983.
7. "Charles Darwin and the Idea of Progress." Honors seminar for students and faculty, Fairhaven College, Bellingham, October, 1986.
8. "Charles Darwin, The Scientist As Communicator." Invited Lecture, Humboldt State College, Arcata, California, February, 1987.
9. "On The Way To The Origin: Darwin's Evolutionary Insight And Its Rhetorical Transformations." Guest lecture Department of Speech Communication, University of Illinois, Champlain/Urbana, April, 1990.
10. "On The Way To The Origin: Darwin's Evolutionary Insight And Its Rhetorical Transformations." Guest lecture Department of Speech Communication, University of Wisconsin, Madison,

- Wisconsin, May, 1990.
11. "On The Way To The Origin: Darwin's Evolutionary Insight And Its Rhetorical Transformations," Van Zelst Lecture in Communication. Northwestern University, Evanston, Illinois, May, 1990.
  12. "The Promise and Oddness of Rhetoric As A Foundation For A Liberal Education," Alaska Pacific University, September, 1991.
  13. "The Comic Frame and the Rhetoric of Science: Ethics & Epistemology in Darwin's Origin," Rhetoric and Science Society, University of Oregon, Corvallis, Oregon. April, 1994.
  14. "Oratory, Democracy and the Classroom" Keynote Address, Society for Educational Renewal, Seattle June, 1994
  15. "Ethics, Evolution and The Rhetoric of Science: Why Huxley Must Always Debate Bishop Wilberforce," Featured Lecture 16th Annual Conference on Discourse Analysis, Temple University, Philadelphia, April, 1995.
  16. Guest Lectureship--Department of Communication Temple University, Philadelphia.  
Gave 4 presentations to 4 different groups at the invitation of Professor Herb Simons: 1) "The Impromptu Speaking Assignment"--demonstration class session. 2) "How to Make The Basic Course A Vital Component In Liberal Education"--discussion with basic course teachers. 3) "Democracy In The Classroom: A Challenge of Liberal Education"--presentation/discussion for faculty from various disciplines. 4) "Teaching Darwin's Origin"--presentation to the Western Heritage faculty. February, 16, 1998.
  17. Brigrance Forum, Department of Speech Wabash College, Crawfordsville, Indiana.  
"Why Was Darwin Believed?" Mon. March 29, 1999.
  18. St. John's College University of British Columbia  
"Ethos and argument in Darwin's Corpus" May, 2000.
  19. University of Waterloo, Waterloo, Ontario, "Darwin, Glen Roy and the Triumph of Invention Over Incommensurability," February 2003.
  20. University of Central Arkansas, Conway Arkansas, "Why Darwinism Should be Taught as Darwin Taught it: As An Argument." One of two featured speakers for Challenge Week, sponsored by The Honors College and the Department of Biology, March 4-6, 2003
  21. Key note address Religious Communication Association NCA, 2003, Miami, Florida.
  22. Hamilton College, Clinton, New York (November, 2003) "Debating Darwinism: Science As Argument And Civic Education"
  23. "The Origin of the *Origin*: How Darwin's Training In Argumentation Prepared Him To Turn Convention on Its Head," Department of Biology, University of Mississippi, Oxford, Mississippi 3/26/2004
  24. "Why Darwin's Theory Should be Taught As An Argument: Because That is What it Is" Presentation for science teachers Biola Conference on Intelligent Design, Los Angeles 4/29/2004

OTHER PRESENTATIONS (mark refereed presentation with asterisk (\*). (Perhaps these should go under "service")

1. Gave two talks on Plato's Gorgias to Katherine Hendrix's seminar for Teaching Assistants. Gave one presentation on Milton's Aeropagitica and John Stewart Mill's On Liberty. Autumn/Spring 1995'96.
2. "The Rhetoric of Science & The Nature of Science" Talk to the University of Memphis Honors Students Autumn, 1995.
3. "The Rhetoric of Science" Presentation to the Department of Geology, (U of M) January 17, 1997
4. "The Rhetoric of Science" Presentation to the Department of Physics, (U of M), February 27, 1997
5. "Expertise, Communication and the Public Sphere," (U of M) Talk and visit to Pradeep Sopory's graduate seminar 4/5/2001
6. "Galileo's *Dialogue on the Two World Systems* & The Rhetoric of Science," Guest Lecture Prof. Brad McAdon's Seminar, Department of English U of M, March 25, 2003.
7. "Why Aristotle Does Not Love Us But We Love Him After Our Fashion: A Sophist Looks At the

*Rhetoric*,” Guest Lecture Prof. Brad McAdon’s Seminar, Department of English, U of M, March, 18, 2004

8. “The Centrality of Argument to A Liberal Education,” Memphis Classical School, Memphis Tenn 3/22/2004

CREATIVE ACTIVITIES (productions, recitals, performances, compositions, exhibits, creative work)

ACTIVITY	DATES	LOCATION	SPONSORSHIP (if any)	INVITED (Y/N)
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**SUPPORT:** (Use Appendix D to provide additional information as needed.)

EXTERNAL (Funded or Pending. List funded support first)	AGENCY/SOURCE	AMOUNT	PERIOD
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	Discovery Institute	\$12,000	Fall, 2000
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INTERNAL	SOURCE	AMOUNT	PERIOD
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Semester Research Leave	College of Communication & Fine Arts		Spring, 2001
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**OUTREACH:** (Project/s summarized as needed in Appendix E.)

PROJECT	PARTICIPANTS	PERIOD	SPONSORSHIP (if any)
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High Ability Day	Highschool Students interested in Communication	1995--	
Urban Communication Conference	Community Activists, local government representatives, citizens and U of M students	1995--	
Optimist Club High School Oratory Contest	Served as a Judge 3/18/98 " " " 2/10/99	1998	Optimist's Club
Lecture	“Rhetoric & The Art of Preaching”	1997—1998	Harding Grad School of Religion, Prof David Bland Dr. of Ministry Seminar
Lecture	“Classical Rhetoric & Prophetic Rhetoric: A Necessary Tension?”	2000	Mid America Theological Seminary Prof Ken Easley
Attended Career Day; gave short Presentation	Department majors	2002	Professor McDowell

Met with Jim Carnes of the Classical School	Private school centered on rhetoric and the classics	2002 2003	
Lecture to Classical School Faculty & Students "The Centrality of Argument to A Liberal Education"	" " Lunch meeting Jan, 2004	2004	
Discussion faculty members Memphis Theological Seminary Board Member Mason YMCA	2 Professors from MTS & 2 grad students from our program	2004	Possibility of cooperation between our two programs & sharing expertise

### SERVICE:

UNIVERSITY	COMMITTEE/ ACTIVITY (if Chair, add [C])	PERIOD
Department		
COMMUNICATION	Graduate Program Committee (C)	1995--
	Tenure & Promotion	1996---2000
	TA Prioritizing Committee	1998---2000
	Departmental Planning	1998---2000
	Chair Search Committee	1998---1999
	Rhetoric Position Search Committee	2000---2001
	Chair Search Committee	2002---2003
	Tenure and Promotion	2002---2003
	Rhetoric Position Search Committee	2003---2004
	THEC Department Internal Study Document (Chair)	2003---2004
	Rhetoric Positions Search Committee	2004--2005
College/School		
	College Graduate Council	1995--
	Phone-a-thon	1995--1997
	College Tenure & Promotion	1996--2000
University		
	Grant Evaluation Committee	1995---1999
	Cecil Humphries Scholarship Interviewer	1996---1999
	Reform of University Tenure & Promotion Process	1997---1998
	Vice Provost Search Committee	2003---2004
	University Council (elected by College)	2002---2004
	Senator, From Department of Communication	2003---2005
	Committee on Committees (Faculty Senate)	2003---2005
	Under Graduate Task Force Committee (Faculty Senate)	2003---2004
	Academic Policies Committee (Faculty Senate) (Co-Chair)	2003---2005
	Committee on Committees (Faculty Senate)	2004---2005

### OTHER

Did an interview on Clinton's Grand Jury Tape Broadcast September 21,

ABC TV MEMPHIS AFFILIATE	on 5:00 news.	1999
URBAN MINISTRY CONFERENCE	Served on Board. Several Churches Sponsored Conf. I helped write rationale for grant application.	Spring, 2000
SHELBY COUNTY INTERFAITH	Active Member: Mayor Debate Committee; CHIPS Program	1998—2001
		2004--
BOARD MEMBER MASON YMCA		
Society/Organization/Journal	COMMITTEE/EDITORIAL BOARD/OFFICE (if Chair, add [C])	PERIOD
NCA	Associate Editor <u>Quarterly Journal of Speech</u>	1995—1998
		2000--
"	Associate Editor <u>Argumentation &amp; Advocacy</u>	1997--
	Associate Editor, <u>Southern Journal of Communication</u>	1998—
	Associate Editor, <u>Rhetoric and Public Affairs</u>	2000—
SSCA	Secretary American Branch Society for the History of Rhetoric	2003--2004
ARRN Access Resource Network	Associate Editor <u>Origins &amp; Design</u>	1997--
University of Iowa	Associate Editor Poroi (new electronic, peer reviewed journal to be published on the World Wide Web).	2000
	Guest Editor <u>Western Journal of Speech Communication</u> (Special summer issue on rhetorical criticism).	1990
	Guest Editor <u>Rhetoric and Public Affairs</u> (Special issue on Intelligent Design & Public Policy)	1998
	Wichelns/Winans Award Committee	1994
	Woolbert Award Committee	1994--
	Woolbert Award Committee (C)	1996
	Dissertation Award Committee	1999—
	Gerald R. Miller Dissertation Award Committee	2002
	Marie Hochmuth Nichols Award Committee	2002--2003
	NCA/NSF Conference in Leesburgh's Virginia	2002
	Gerald Miller Dissertation Award committee	2002--2003
American Association for the Rhetoric of Science & Technology	President	1997--1998
Tennessee State Communication Association	Rhetoric & Public Address Division (C)	1997--1999
Southern States Communication Association	Committee on Program Viability (C)	1995--1996
Arizona State University	Tenure/Promotion Assessment for Dr. Marouf Hasian	1997
University of Seattle	" " " " Dr. Jeff Philpott	1998
	" " " " Dr. William Purcell	1998

Seattle Pacific University	Grant Application Evaluation	" Dr. Judy Segal	1998
University of British Columbia	Tenure/Promotion Assessment for	Dr. Eric Gander	2002
Baruch College, City U of NY	Tenure/Promotion Assessment for	Dr. Ken Zagacki	2002
University North Carolina Southern States Communication Association	Secretary American Branch International Society for the History of Rhetoric		2003—2004
American Association for the Rhetoric of Science and Technology	Second Vice President (In charge of Program Planning)		2005--2006

**CONSULTING:** *(Optional)*

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ORGANIZATION/COMPANY	PERIOD
University of	

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## Why Are We Still Debating Darwinism? Why Not Teach the Controversy?

*John Angus Campbell*



From the Scopes trial in 1925 through the action of the Kansas State Board of Education in 1999, the teaching of evolution in public schools has been a flashpoint in American education.<sup>1</sup> As in all long-standing controversies, positions harden and disputants speak chiefly to rally their own supporters. The debate ebbs and flows in public awareness until a local school board's decision catapults it once again into the lead story or back onto page one.

Many suppose that the debate over teaching evolution in public schools has gone on so long that it is going nowhere. But all things historical are hostage to change. Although its implications are not yet fully evident, something new has happened in the debate over the teaching of evolution. The advent of a modern scientific theory of intelligent design (ID) and a scholarly research community advancing this theory (the ID movement) have reenergized and are now redefining the character of this once-stalled controversy.<sup>2</sup> ID is a science, a philosophy, and a movement for educational reform.

As science, ID is an argument against the orthodox Darwinian claim that mindless forces—such as variation, inheritance, natural



selection, and time—can account for the principal features of the biological world.

As a philosophy, ID is a critique of the prevailing philosophy of science that limits explanation to purely physical or material causes.

As a program for educational reform, ID is a public movement to make Darwinism—its evidence, philosophical presuppositions, and rhetorical tactics—a matter of informed, broad, and spirited public discussion.

ID in all its senses has clear implications for the teaching of science, particularly biology, in the public schools—irrespective of one's view of the merits of the contemporary design argument. A central claim of the ID movement is that if science education is to be other than state-sponsored propaganda, a clear and principled distinction must be drawn between empirical science and the materialist philosophy that drives contemporary Darwinian theories of biological origins.<sup>3</sup>

As critics of ID are quick to point out, design arguments are not new. The basic insight on which such arguments rest is one side in an ancient philosophical controversy. That is, the complexity of the world order, particularly as seen in the study of life, appears to have been produced by intelligence or mind rather than by self-sufficient material forces. In ancient times, Heraclitus, Empedocles, Democritus, and Anaximander upheld the self-sufficiency thesis, while Plato and Aristotle argued for mind.<sup>4</sup>

Why this argument should reemerge just now is easy to understand. At a time when contemporary cosmology speaks of "anthropic fine-tuning" and biology seeks to understand the "code of life" and the design of "molecular machines," the rise of the design hypothesis is as appropriate to our time as were the ideas of "natural selection" and "survival of the fittest" to the period of capitalist expansion and industrialization during the nineteenth century.<sup>5</sup> "Information" and the nonmaterial products of intelligence are part of our daily speech, as is evident by our use of such terms as *software*, *programs*, *gigabytes*, or *RAM* and our questions about the "compatibility" of computers and printers.

What is new about the theory of intelligent design is the shock it administers through its creative restatement, in contemporary scientific terms, of an old and presumably extinct intellectual tradition. The origin of biological novelty was thought to have been identified, if not precisely by Darwin in 1859, then at least by neo-Darwinians in their 1940s synthesis. Yet design theorists insist that natural selection acting on random genetic mutation does not account for the fundamental morphological innovations in the history of life—whether novel organs, body plans, or cellular ma-

chines. Instead, they insist that actual design, not just a natural process mimicking design, is responsible for the complex features and systems found in living things. Though this view may not be new, the evidence and modes of analysis that design theorists use to advance it clearly are.<sup>6</sup>

Thus, the ID movement has only recently come into public awareness. Nevertheless, such awareness is growing rapidly as a result of the books and public speaking of Berkeley law professor Phillip Johnson; the book *Darwin's Black Box* by Lehigh University biochemist Michael Behe; William Dembski's *The Design Inference*; Jonathan Wells's *Icons of Evolution*; Paul Nelson's *On Common Descent*; and the scientific and philosophical essays of Stephen Meyer in anthologies such as *Science and Evidence of Design*, *Mere Creation*, and *Debating Design: From Darwin to DNA*. The growth of this intellectual movement has recently attracted prominent news stories in the *New York Times*, *Los Angeles Times*, *Wall Street Journal*, and the *National Post* (of Canada) as well as an extensive two-part critique in the *New York Review of Books*.<sup>7</sup> Additionally, a recent Zogby poll shows strong support for the educational agenda of the design movement. Nearly 78 percent of those surveyed by Zogby favor including information about the scientific case for intelligent design in the public school science curriculum alongside standard Darwinian accounts of life's origins.<sup>8</sup> Congress has also expressed its support for teaching students about the scientific controversies that exist concerning biological evolutionary theory. The report language in the 2001 federal No Child Left Behind Act urges schools to adopt a science curriculum that "help[s] students to understand the full range of scientific views that exist" about controversial subjects "such as biological evolution" and "why such topics may generate controversy." Additionally, the Ohio State Board of Education recently adopted a provision in their state science standards requiring students to know why "scientists today continue to investigate and critically analyze aspects of evolutionary theory." While the Ohio State Board's decision did not mandate the teaching of intelligent design, it does require that students know about scientific criticisms of contemporary evolutionary theory. It also allows local school districts and teachers to present the theory of intelligent design if they so choose. One local school district, the Patrick Henry School District, has already announced its intention to teach students about the theory.<sup>9</sup>

Even so, many of the technical arguments of design theorists are not yet well known. The aim of this volume, *Darwinism, Design, and Public Education*, which itself has "evolved" or (if one prefers) was "redesigned" from a special issue of the journal *Rhetoric and Public Affairs*, is not to advocate the

theory of ID. Instead, this volume seeks to introduce science educators to the arguments of the design theorists and to those of prominent critics of ID, so that educators may consider the merits of the main pedagogical argument of this volume, namely, that science teachers would do well to “teach the controversy” or “controversies” over contemporary evolutionary theory.

Teachers who do so will advance public understanding of both the nature and rhetoric of science.<sup>10</sup> By the “rhetoric of science,” I mean the study of the argumentative tactics employed by scientists not only in their scientific writing but also in their public and educational pronouncements. The rhetoric of science also seeks to identify presumptive substance and to detect probable weaknesses (or obfuscation) in a scientific argument or discourse.<sup>11</sup> In addition, the rhetoric of science seeks to foster civility in public discourse. On this score, it is important to remember John Stuart Mill’s observation that in any controversy where the stakes are high, even the best people may present bad arguments with the best of intentions and, conversely, that those who do not prevail in public opinion may yet make many good arguments.<sup>12</sup>

### Organization of the Volume

With this in mind, *Darwinism, Design, and Public Education* will seek to advance public discussion of science education by presenting arguments for and against a more inclusive, controversy-based biology curriculum. In order to do this, the book will also present arguments for and against both contemporary Darwinism and the theory of ID itself.

*Darwinism, Design, and Public Education* is divided into four parts and appendices. The first part of the volume presents three essays arguing for a more inclusive approach to science education—indeed, one that would encourage science educators to teach students about scientific challenges to Darwinian theory and about the challenge posed to Darwinism by advocates of the theory of intelligent design. The second part includes several essays that provide scientific critiques of contemporary evolutionary theories or textbook presentations of these theories. The third part presents essays that develop the scientific case for intelligent design. The fourth part offers responses, chiefly critical, to the essays in the first three parts of the volume. The appendices present both supporting documents about the controversy over the teaching of evolution in the public schools (including the transcript of a recent hearing of the U.S. Commission on Civil Rights

and an essay by Donald Kennedy) and a technical supplement to the case by Stephen C. Meyer, Marcus Ross, Paul Nelson, and Paul Chien on the Cambrian explosion.

### Part I

Part I, “Should Darwinism Be Presented Critically and Comparatively in the Public Schools?: Philosophical, Educational, and Legal Issues,” sets the agenda for the book. The question considered throughout the volume is “Should public school science teachers be free to teach the controversies over biological origins?” In my opening essay, “Intelligent Design, Darwinism, and the Philosophy of Public Education,” I argue that teaching Darwin’s theory of natural selection comparatively is the mode Darwin himself followed in the *Origin*. It is the traditional method used in the humanities, it is used to teach values, it is explicitly sanctioned by Mill’s *On Liberty*, and it fosters student interest in science. Further, it helps teach the skills of analysis and critical deliberation that are central to democratic citizenship. In “Intelligent Design Theory, Religion, and the Science Curriculum,” Warren A. Nord argues that liberal education in a pluralistic democracy requires the inclusion of competing points of view, including design theory in science classes, “not because it is a better or more reasonable theory than its naturalistic counterparts . . . [but] because we disagree about whether it is a better theory.” That disagreement is of such a kind that educators are obligated to teach students about it. Throughout the essay, Nord develops his thesis: “By refusing to take seriously contending interpretations of nature, we teach science, in effect, as a matter of authority. Students typically come to accept its claims as a matter of faith in the scientific tradition rather than as a matter of critical reason.”

The first part concludes with “Teaching the Controversy: Is It Science, Religion, or Speech?” In this essay, David DeWolf, Stephen C. Meyer, and Mark E. DeForrest argue that the law allows, and good pedagogy requires, public school biology teachers to “teach the controversies” over biological origins. They examine several proposed curricular changes that would rectify what they regard as the current imbalance in the biology curriculum. Their hypothetical teacher, John Spokes, would like to correct errors in present biology texts, expose students to evidential challenges to evolutionary theory, and discuss alternative theories of biological origins.<sup>13</sup> The authors ask, “Does the law allow him to do so?” They argue that it does, by showing that exposing students to an evidentially based critique of standard theories and to a similarly evidentially based case for alternatives

constitutes good science. They also show that presenting ID as an alternative theory does not constitute an establishment of religion. They suggest instead that refusal to allow Spokes to teach his subject in this more open way could well constitute a form of legally prohibited viewpoint discrimination.

## Part II

The logic of the remainder of this volume follows directly from the educational and legal controversy that DeWolf, Meyer, and DeForrest address from the practical concerns of their hypothetical teacher, John Spokes. A teacher considering whether to “teach the controversy” will face practical pedagogical issues about the type of material that would be permissible, or desirable, to present.

In their legal essay, they ask a question: what exactly can Spokes (or any other public high school teacher) teach? Can teachers correct errors in the biology texts, including those that exaggerate the evidential support for Darwinism? Similarly, can teachers expose students to scientific critiques of neo-Darwinism and related evolutionary theories? If so, can they also tell students about alternative theories of origins, including specifically the theory of intelligent design? DeWolf, Meyer, and DeForrest argue that teachers may legally critique neo-Darwinism and present ID as an alternative. But this raises practical questions for science educators: First, what are the scientific critiques of textbooks or neo-Darwinism that students should know about? Second, what is the theory of intelligent design and what evidence, if any, supports it? And third, what scientific (or philosophical) critiques of design theory should students and educators know about?

The remainder of the book is organized mainly around these three questions to help science educators “teach the controversy” if they should so choose and to help policymakers assess the merits of the pedagogical argument made for this approach in Part I. Thus, Part IV includes not only substantive critiques of the scientific case in Parts II and III but also critiques of the pedagogical proposal—that is, the “teach the controversy” approach advocated in Part I.

Part II, “Scientific Critique of Biology Textbooks and Contemporary Evolutionary Theory,” first seeks to establish that there are many errors in present biology texts, errors that in some cases overstate the evidential support for neo-Darwinism and chemical evolutionary theory. Part II also seeks to establish the existence of a significant evidential challenge to reigning evolutionary theories, even if that challenge goes almost unreported in basic texts. In short, it seeks to show that there is an evidential

challenge to contemporary evolutionary theory that students need to know about. (Additional aspects of this challenge are addressed in Part III in the articles that also make a positive case for intelligent design.)

In the first essay in Part II, Stephen C. Meyer and Michael Newton Keas identify an important error of omission, not only in textbooks, but also in most public discussions of evolutionary theory. Their essay, “The Meanings of Evolution,” describes the multiple separate meanings associated with the term *evolution*. They recommend that teachers clearly define the separate meanings of that word and distinguish those meanings that enjoy strong evidential and scientific support from those that seem controversial or less conclusively established.

David Berlinski’s “The Deniable Darwin” shows how, contrary to popular reports, qualified researchers do in fact have serious scientific objections to Darwin’s theory. Berlinski uses probability theory to take exception to almost every major claim advanced for the explanatory power of Darwinian natural selection.

Turning specifically to the textbook issue, Jonathan Wells’s essays, “Haeckel’s Embryos and Evolution: Setting the Record Straight” and “Second Thoughts about Peppered Moths” (both published previously in science, or science education, journals), illustrate the pedagogically convenient errors tolerated in textbooks—in the case of Haeckel, for over a hundred years—by a science education regime that lacks motivation to correct its errors.

In “Where Do We Come From? A Humbling Look at the Biology of Life’s Origin,” Massimo Pigliucci summarizes the status and prospects of current origin-of-life research. He critiques many current texts for their overly sanguine discussion of chemical evolutionary theories of the origin of life. (Pigliucci is not a design theorist; his trenchant critique of ID is presented in Part IV.)

Finally, developing further the difficulties identified by Pigliucci and expanding on the Wells examples, Gordon C. Mills, Malcolm Lancaster, and Walter L. Bradley explore in “Origin of Life and Evolution in Biology Textbooks: A Critique” how current developments in biochemistry and origin-of-life studies contradict many current textbook presentations of chemical evolutionary theory.

## Part III

In Part III, “The Theory of Intelligent Design: A Scientific Alternative to Neo-Darwinian and/or Chemical Evolutionary Theories,” design theorists seek to bring the comparative or controversy-centered model set forth in

Part I to a critical point of development. They defend the comparative explanatory power of their theory with evidence from biochemistry, molecular biology, developmental biology, genetics, and paleontology. Here, design theorists argue their theory provides a better explanation of familiar biological phenomena—such as the information stored in DNA and proteins, molecular homologies, the complex structure of molecular machines, and the pattern of appearance in the fossil record—than do competing neo-Darwinian or chemical evolutionary theories.

Stephen C. Meyer initiates this line of argument in “DNA and the Origin of Life: Information, Specification, and Explanation.” He contends that intelligent design provides a better explanation than competing chemical evolutionary models for the origin of the information present in large biomacromolecules such as DNA, RNA, and proteins. Meyer shows that the term *information* as applied to DNA connotes not only improbability or complexity but also specificity of function. He then argues that neither chance nor necessity, nor the combination of the two, can explain the origin of information starting from purely physical-chemical antecedents. Instead, he argues that our knowledge of the causal powers of both natural entities and intelligent agency suggests intelligent design as the best explanation for the origin of the information necessary to build a cell in the first place.

In “Design in the Details: The Origin of Biomolecular Machines,” the biochemist Michael J. Behe sets forth a central concept of the contemporary design argument, the notion of “irreducible complexity.” Behe argues that the phenomena of his field include systems and mechanisms that display complex, interdependent, and coordinated functions. Such intricacy, Behe argues, defies the causal power of natural selection acting on random variation, the “no end in view” mechanism of neo-Darwinism. Yet he notes that irreducible complexity is a feature of systems that are known to be designed by intelligent agents. He thus concludes that intelligent design provides a better explanation for the presence of irreducible complexity in the molecular machines of the cell.

In “Homology in Biology: Problem for Naturalistic Science and Prospect for Intelligent Design,” Paul Nelson and Jonathan Wells reexamine the phenomenon of homology, the structural identity of parts in distinct species such as the pentadactyl plan of the human hand, the wing of a bird, and the flipper of a seal, on which Darwin was willing to rest his entire argument. Nelson and Wells contend that natural selection explains some of the facts of homology but leaves important anomalies (including many

so-called molecular sequence homologies) unexplained. They argue that intelligent design explains the origin of homology better than the mechanisms cited by advocates of neo-Darwinism.

Next, Stephen C. Meyer, Marcus Ross, Paul Nelson, and Paul Chien, in “The Cambrian Explosion: Biology’s Big Bang,” show that the pattern of fossil appearance in the Cambrian period contradicts the predictions of empirical expectations of neo-Darwinian (and punctuationalist) evolutionary theory. They argue that the fossil record displays several features—a hierarchical top-down pattern of appearance, the morphological isolation of disparate body plans, and a discontinuous increase in information content—that are strongly reminiscent of the pattern of evidence found in the history of human technology. Thus, they conclude that intelligent design provides a better, more causally adequate, explanation of the origin of the novel animal forms present in the Cambrian explosion. Meyer and his coauthors also note that (whatever its explanation) this dramatic event in the history of life is, with very few exceptions, not discussed in American basic biology texts.

With his colleagues having established an evidential basis for considering an inference to intelligent design, William A. Dembski provides a summary of his theory of design detection. In “Reinstating Design within Science,” Dembski argues that advances in the information sciences have provided a theoretical basis for detecting the prior action of an intelligent agent. Starting from the commonsense observation that we make design inferences all the time, Dembski shows that we do so on the basis of clear criteria. He then shows how those criteria, complexity and specification, reliably indicate intelligent causation. He gives a rational reconstruction of a method by which rational agents decide between competing types of explanation, those based on chance, physical-chemical necessity, or intelligent design. Since he asserts we can detect design by reference to objective criteria, Dembski also argues for the scientific legitimacy of inferences to intelligent design.

## Part IV

In Part IV, “Critical Responses,” several prominent scientists and scholars critique either the substantive arguments for intelligent design or the case for exposing students to these arguments, or both. Though most responses are sharply critical, a few support more inclusive science education and a few support some of the substantive scientific claims of ID advocates.

Phillip Johnson, the one ID proponent included among the respondents, supports both.

In the first response, Celeste Michelle Condit offers a spirited critique of Meyer's argument to design based upon the presence of information in DNA. She also dismisses ID as unscientific and defends a Darwinism-only approach to science education (though perhaps one taught less dogmatically than at present). She bases her critique in part on her studies of public controversies over genetic engineering. She also offers advice on how religion might take itself more seriously by relinquishing any claim to be an empirical discourse and warns of the dangers of religion in the public sphere, particularly in the classroom.

David Depew critiques the basic idea of design in biology as framed by the design theorists, though he acknowledges, with the ID authors, that a robust debate about the mechanisms of evolution is currently under way within biology. Depew notes, however, that Darwinism is not Darwin's science alone but a family of theories often holding very different views of the mechanisms and tempo of evolutionary change. He thus faults the ID proponents in Part III, specifically Michael J. Behe, for failing to acknowledge the promise of other fully naturalistic proposals—in particular, self-organizational models—that he believes can explain the origin of biological information and complexity. The concluding section of his essay suggests a provisional openness toward a larger role for deliberation in the science classroom.

Bruce H. Weber critiques Behe's notion of "irreducible complexity" and challenges Behe's claim that no intermediate structures have been reported in the literature. On matters of educational policy, Weber has recently developed a university course in which the ID model and the Darwinian model are contrasted and critiqued.

Massimo Pigliucci then provides a pointed response to Dembski's argument for "specified complexity" and offers a clear account of the meanings of design in biology. He shows why he believes that inferences to intelligent agency rest on bad science and faulty logic. Pigliucci has long maintained that, since only Darwinism is science, only Darwinism should be taught in public schools.

Philosopher Michael Ruse, whose testimony was instrumental in Judge Overton's decision in the Arkansas creation-science case, defends himself against the charge of inconsistency leveled in my essay in Part I. He reiterates the soundness of the fundamental tenets of neo-Darwinism and of his view that "professional Darwinism" is science and ID is not.

Eugene Garver urges that only Darwin's theory should be taught in the public schools and taught "dogmatically and intelligently." Garver critiques the central contentions of the "teach the controversy" model, including the notion that any important connection exists between the teaching of science and the democratic practices of the larger society.

Though William Provine disagrees with the substance of the case for ID, he does favor a more inclusive approach to teaching the controversy. He thus disagrees with the educational proposals of both Eugene Garver and Alvin Plantinga (see below). Provine argues that living organisms only appear designed. He reaffirms that this appearance can be fully explained by neo-Darwinian theory. Unlike many prominent neo-Darwinians, however, Provine encourages teachers to tell their students about scientific criticism of neo-Darwinism as well as the arguments for intelligent design. Having repeatedly invited Phillip Johnson for debates before his classes at Cornell, Provine is critical of science educators who refuse to debate the merits of Darwinism in the classroom.

In sharp contrast to Garver, who favors teaching only Darwinism, and Provine, who favors teaching both Darwinism and design, Alvin Plantinga challenges the propriety of teaching Darwinism at all. Plantinga argues that, in a pluralistic culture, elementary fairness and justice require that public schools cannot teach as true what its citizens hold—as part of their basic beliefs—to be false.

John Lyne reflects on the Darwinian debate from his experience in graduate and undergraduate teaching in the humanities and calls attention to how theories of the nature of things, no matter how scientific, always carry implicit worldview commitments.

Steve Fuller, while expressing caution on all metaphysical positions, sees no greater danger in ID than in Darwinism. On educational and cultural levels, he sees a positive role for ID, lending his support to the ID critique of Darwinism and to its effort to bring about a productive alliance between science and democratic culture.

Brig Klyce and Chandra Wickramasinghe (Wickramasinghe was a witness for the defense in the Arkansas creation-science case in the early 1980s) illustrate the pluralism of the design perspective in that, while they reject the idea of a designer, they also reject neo-Darwinist theory and fully accept the ID critique of conventional Darwinian science. They also support the "teach the controversy" model. Following the earlier lead of Sir Fred Hoyle, Klyce and Wickramasinghe make a positive case for space-

home spores as the basis for the development and differentiation of life on Earth.

In a concluding essay, ID godfather Phillip Johnson engages Stanley Fish's critique of liberalism. He suggests that open discussion of the theory of intelligent design would advance pluralism and liberal political ideals in general.

By design, we chose respondents who would provide mainly negative assessment and critique of ID. The only exceptions are Phillip Johnson, who helped launch the ID movement; Alvin Plantinga, who has long questioned the rationality of Darwinism on philosophic grounds; and Steve Fuller, whose positive response seems more directed to the democratic implications of the ID view of science and society than to the philosophic or scientific merits of its argument.<sup>14</sup>

## Appendixes

The appendixes present (A) the transcript of a briefing held before the United States Commission on Civil Rights Schools and Religion Project on 21 August 1998, in Seattle; (B) a short essay by Donald Kennedy, former president of Stanford University; and (C, D, and E) technical evidence supporting the case made by Meyer, Ross, Nelson, and Chien in "The Cambrian Explosion: Biology's Big Bang."

The briefing (appendix A) consisted of a panel on curriculum entitled "Curriculum Controversies in Biology." The two panelists were Stephen C. Meyer, a senior fellow of the Discovery Institute, and Eugenie Scott, who for many years has headed the National Center for Science Education. The testimony of Meyer and Scott, and their responses to the extensive questions posed by the commissioners, particularly on the issue of possible viewpoint discrimination in the current science curriculum, provides a clear contrast between the philosophic assumptions and educational practices advocated by the two principal sides in this dispute.

Donald Kennedy's essay (appendix B) summarizes the rationale for the "Darwin only" position presented in the National Academy of Science's booklet *Teaching About Evolution and The Nature of Science*, which was written by a group of research scientists and high school teachers headed by Kennedy.

Appendixes C, D, and E provide information and analysis supporting the paleontological arguments made by Meyer, Ross, Nelson, and Chien in their essay, "The Cambrian Explosion: Biology's Big Bang."

## An Objection to the Organization of This Volume

Clearly, even with a preponderance of negative responses, this volume gives greater voice to the arguments of the ID advocates and to those advocating discussion of ID in the public school curriculum. To some, this may seem unbalanced and even gratuitous. And indeed, from one perspective, the best plan for this volume might have been to assign equal space to each side. The problem with that approach, as Darwin himself was quick to realize, is that novelty requires time and repetition to sink in.<sup>15</sup> Darwin's uphill battle to distinguish his own position in the public mind and in the understanding of his peers from that of his predecessors is our warrant for giving greater space (in Parts I–III), but far from an unchallenged right of way (Part IV), to ID, the less familiar side in the current debate. Darwin, as in the case of contemporary defenders of ID, was not introducing a new idea for the first time but was attempting to establish his own explanation of the old and long discredited idea of "evolution." Darwin's challenge was to get his colleagues and the public to see how his proposed mechanism ("natural selection") put the whole argument for evolution on a very different footing from the arguments advanced by his grandfather, Erasmus Darwin, Jean Chevalier Lamarck, Robert Chambers, and Herbert Spencer.

Like Darwin's theory, as perceived by his peers and by the public in 1859, the contemporary argument for design is also a restatement of an old position. A key challenge for ID advocates is to distinguish their position, grounded in the information sciences and the method of "inferring to the best explanation," from its predecessors. Even as reviewers of the *Origin* identified it with earlier and discredited theories, so one will find in this volume respondents whose evaluation of intelligent design echoes the language of Darwin's initial reviewers.<sup>16</sup> The critical reaction here of the majority of respondents underscores the propriety of the organizational plan of this volume, providing balance to the dispute in a manner that is contextual and qualitative, not merely quantitative. Since Darwinism long ago replaced design as the established paradigm in science, readers of this volume are presumed to have learned Darwin's argument in school, as did their fathers and mothers, grandparents, and even great-grandparents.<sup>17</sup> For most readers, these pages will provide a first encounter with an alternative to the established paradigm by qualified authors who believe that Darwinism is false and wish to see it replaced. Our procedure of presenting the theory of intelligent design in detail and in the words of its defenders, even at the expense of not providing equal space for objections from the

established theory, is one that Darwin's contemporary, John Stuart Mill, in that other classic of 1859, *On Liberty*, recognized as just and equitable when evaluating an idea that has been marginalized and generally rejected.<sup>18</sup> It is a tribute to the quality of the respondents whose critiques appear in Part IV that, necessarily brief as are their comments, they omit no objection to ID whether considered as science, as philosophy, or as a program for educational reform.

### Two Additional Matters

Two additional considerations, the claim of ID to be science and the timing of this volume—why revisit this dispute?—deserve comment.

#### Is Intelligent Design Science?

However one weighs the claim that design theory is not, and cannot be, science—a decisive claim for some—that claim should be considered both in light of the design arguments advanced in Part III and in light of the historical character of the philosophy of science. Pronounced as is the parallel between Darwinism and design, at least in audience reaction and burden of proof, the parallel is nowhere more pronounced and symmetrical than on the charge that ID is not science. Various initial readers of Darwin's theory rejected it as science and regarded his book as an example of theorizing unrestrained by evidence.<sup>19</sup> John Herschel, an intellectual mentor whom Darwin highly respected, crushingly rejected the idea of natural selection.<sup>20</sup> Louis Agassiz characterized Darwin's theory "as a scientific mistake, untrue in its facts, unscientific in its method and mischievous in its tendency."<sup>21</sup> In his subsequent editions and particularly in his private letters, Darwin took pains to convince his readers that what he was offering was substantive science and not wish fulfillment.<sup>22</sup>

Darwin's hostile or skeptical readers were, in a way, correct. What Darwin was presenting was not just an argument for evolution by natural selection but a revolution in scientific method.<sup>23</sup> In 1859, few would have questioned whether design arguments were scientific; then, inferences to design in books on "natural philosophy" were commonplace and unremarkable. The book from which Darwin learned scientific method and logic, Herschel's *Preliminary Discourse*, legitimated the design inference as one of the highest motives for studying science.<sup>24</sup> By his careful attention to it in the *Origin*, Darwin certainly treated design as a potentially warranted scientific inference.<sup>25</sup>

A present reader, however, may conclude that ID is not and cannot be science because it draws an inference to an unobservable, nonmaterial cause. Yet that reader has no greater certainty (to be consistently comparative about it) than the most ardent ID advocate that such a conclusion will be acceptable to scientists or philosophers of science in a hundred years—or for that matter, in twenty-five years, ten years, or next week. If the *Origin* provides any basis for surmise, it is within the bounds of historical possibility that a perspective that would at first glance strike today's best scientific and philosophic minds as the height of the ridiculous may eventually be accepted.

Not that novel arguments in science or in life are necessarily good, any more than traditional or familiar ones are necessarily bad. Ernst Mach clearly held scientific views that Max Planck judged as reactionary, and it was these same "reactionary" views that nurtured Einstein's imagination and helped him formulate his epochal and notably counterintuitive theory of relativity (or to give it its proper name, the theory of invariance).<sup>26</sup> Views of science judged, for whatever reasons, as unacceptable to the scientific regime of a particular country or time have repeatedly shown themselves to be capable, under the right circumstances or in the right minds, of generating science as good as, or better than, the "legitimate science" of many an established paradigm.<sup>27</sup> As Darwin might have said, the rejection of novelty by a science establishment with a deep cultural and metaphysical investment in an alternative point of view seems to be part of some more general rhetorical law.

In any case, as Thomas Kuhn pointed out, debate about the methodological rules of science often forms part of the practice of science, especially during times when established paradigms are being challenged.<sup>28</sup> Those who reject the "teach the controversy" model on the grounds that ID violates the current rules of scientific practice only beg the question. The present regime of methodological rules cannot prevent controversy for the simple reason that those rules may themselves be one of the subjects of scientific controversy. Why not let students know about these debates as well? In the current context, that means letting students know that some scientists and philosophers (see, for example, Stephen C. Meyer's conclusion in his essay "DNA and the Origin of Life") challenge the convention of methodological naturalism and its prohibition on explaining phenomenon by reference to intelligent causes.

I have already mentioned the important role of computers and concepts from the information sciences in creating a climate of opinion that has

fostered a reemergence of design language in science.<sup>29</sup> Clearly, the theoretical imagination of our time is neither that of Darwin's nor that of the neo-Darwinian synthesis of the 1940s. But why, even given that fact, is it productive to revisit what, at least in outline, must seem to be a very familiar debate? The issue needs reconsideration because science education, like science itself, must be constantly subject to revision in light of the demands of new generations of students and of new scientific knowledge. Indeed, advances in molecular biology, paleontology, and the information sciences have placed traditional questions of design on a new footing.

### *The Changing Roster of Disputants*

An additional reason for revisiting the dispute is that the disputants have changed. The ID movement, comprising as it does academics, scientists, philosophers, humanist educators, and interested laypeople, is certainly not the same, except for purposes of histrionic exaggeration, as the young-earth, six-literal-days "creation science" of the past. Who is the designer? Who knows? ID advocates, unlike creation-science advocates, sign no confession of faith, nor could they gain agreement among themselves on one "broad tent" and amid lively disagreements on just about every fundamental issue except the need to critique Darwinism and to affirm the detectability of design in nature; one will find persons of many philosophical perspectives and metaphysical commitments.

Given the fundamental changes that have overtaken the parties to this dispute, the dispute itself must be reconsidered.

The changes now reframing this historic debate are both intellectual and social. The appearance of Thomas Kuhn's 1962 treatise, *The Structure of Scientific Revolutions*, sparked an intellectual revolution, which he himself called "a paradigm shift," in both the philosophy of science and the social understanding of science.<sup>30</sup> Contrary to the positivist climate that characterized science at the opening of the twentieth century—which *Spornik* revitalized and carried to the U.S. public schools well into its latter decades—in the early twenty-first century science is now acknowledged to be a highly interpretive enterprise.

The current interpretive understanding of science has developed through roughly three broad stages. In the heroic age of modern science, the seventeenth century, Bacon argued that theories emerged inductively from data.<sup>31</sup> We see remnants of this view of science even in Darwin's

*Origin*, where he spoke of how he began his species research "by patiently accumulating and reflecting on all sorts of facts which could possibly have any bearing on it." During all that time of fact collecting, he refrained chastely from any theorizing: "After five years' work I allowed myself to speculate on the subject."<sup>32</sup>

In the era of positivism, from the mid-nineteenth century through the mid-twentieth, theorizing was recognized as having a far more central role in science than Bacon gave it, but theory evaluation was still thought to be unproblematically data-determined.<sup>33</sup> Huxley, for example, kept trying to think of crucial experiments that would prove Darwin's theory up or down.<sup>34</sup> Darwin politely discouraged him, arguing that Huxley did not grasp that his argument was comparative.<sup>35</sup>

In the neo-positivist era, roughly from the 1940s until Kuhn, theory evaluation and explanation were thought to be pretty much what Huxley took them to be: formulaic. Karl Popper taught that one could test a scientific theory by making predictions and then determining by observation whether the predictions confirmed or falsified one's theory.<sup>36</sup> Similarly, Carl Hempel argued that successful explanation occurred when one could deduce an event or phenomenon from a set of specified initial conditions and laws.<sup>37</sup> Both of these models, for all their partial truths and separate and collective strengths, portrayed testing theories and formulating explanations as something that could take place without considering the merits of competing theories and explanations. More recent developments in the philosophy of science, from Imre Lakatos's "Falsification and the Methodology of Scientific Research Programs" to Peter Lipton's *Inference to the Best Explanation*, have stressed the comparative and competitive nature of theory evaluation.<sup>38</sup>

A key development in understanding theory evaluation since Hempel and Popper has thus been the realization that science rests on argument, that much of the substance of science hinges on which theory among a group of competitors can provide the best interpretation of a set of data.<sup>39</sup> It is in this sense—the sense of the comparative value of explanation and argument within the complex interrogation of nature we call science—that contemporary scientific theory has added its discriminating color to the terms *scientific reason* or *scientific method* or just plain *science*. Because theory evaluation is now understood to be a comparative process, the argumentative back-and-forth recognized under the ancient disciplines of dialectic and rhetoric has now been elevated within science to a dignity it has not enjoyed since the overturn of Aristotelian science in the seventeenth



century.<sup>40</sup> Though some have contended that recognition of the role of informal argument amid the rigors of science makes science “mere rhetoric,” it does nothing of the kind.<sup>41</sup> Rhetoric itself included logic, nor is there anything “mere” about knowing enough to participate meaningfully in a scientific discussion or, as a citizen bystander, knowing enough to know what the argument is about.<sup>42</sup>

The implications of these developments in the philosophy of science for the education of tomorrow’s scientists are anything but academic or abstract. For a modern scientist, early education in comparative argument, and persuasive communication forms a core of foundational skills indispensable for future achievement—irrespective of the content of tomorrow’s theories. A contemporary scientist must know not only how to put a hypothesis forward but how to put it across.<sup>43</sup> A scientist gets grants,<sup>44</sup> Having gotten them and done the experiments, the researcher must interpret the results, show what has been discovered, draw out its implications, and show why funding for more experiments, or experiments of a new kind, is now necessary. In addition, the scientist must defend his or her work against possible counterfindings of other independent peers working in the same field, sharing the same love of truth and competing for the same research dollars, promotions, prizes, and recognition. In today’s world, nature never speaks but with a human voice and never more authoritatively than after argumentation between research rivals leaves no refuge but consensus—if sometimes grudgingly and if only for now.<sup>45</sup>

Training in argument, essential for the education of tomorrow’s scientists, is no less important for tomorrow’s citizens. One has only to think of the stressful necessity that modern medicine routinely places on laypeople to challenge expert advice and seek a second or third opinion to realize that lay skepticism of natural science is a practical reality in our world—and on balance a good thing.<sup>46</sup> What better place than the biology class to understand the appropriateness of skeptical questions directed toward scientific authority and to learn how, from asking such questions in medical contexts, lives have been saved, and in research contexts, new discoveries made?

Nor is the thesis persuasive that critique must be postponed until the student achieves mastery.<sup>47</sup> Jerome Groopman tells the story of how he and his wife, though both doctors and reluctant to challenge the opinion of fellow professionals, twice did so and thereby saved the life of their son. He also cites the story of a couple that, with no formal medical education at all, made a similar challenge with similar results.<sup>48</sup> The presentation of

science and the critique of scientific reasoning, including the possibilities for error in fact, inferences, or theories, need to be taught simultaneously. Science, over and over again having proven itself indispensable to society, by that very feat has underscored the need for critical thinking about science to be integrated into the fabric of scientific education.<sup>49</sup>

### *The Merits of Comparison, Criticism, and Competition*

By showing that scientific reasoning is not one but many and does not stand alone but on a continuum with the reasoning of common life, the critical comparative model makes science education more rigorous and socially responsive than the Darwin-only model and at the same time addresses legitimate concerns of an increasingly informed, skeptical, and impatient public. The debate over educational vouchers continues. The home-schooling movement originated by religiously conservative parents has grown and diversified to include nonreligious parents fed up with the inability of schools to teach values or even to teach, placing increasing pressure on public education.<sup>50</sup> Whether public education can sufficiently reform itself to win the confidence of the people whom it is supposed to serve is an open question—and the debate about biological origins, while far from the whole, is an important part of it. The science that generated the debate over evolution has changed. So has the society that continues the debate. There is hope for a fresh beginning. What for Hannah Arendt was the political equivalent of grace is, just possibly, not in vain.<sup>51</sup>

In the late 1950s, at the height of positivism in science and under the urgency of national defense, the idea that a value-neutral science—even if it touched on questions of ultimate beginnings, endings, and the narrative that governed meanings—could be taught unproblematically seemed reasonable to many thoughtful people.<sup>52</sup> Those who dissented were regarded as a fringe minority whose opinions had already been assigned to history’s dustbin and whose opposition would abate with the spread of education and indoor plumbing. In the years since *Leave It to Beaver* and “Duck and Cover” those who dissent from Darwin’s master narrative, or variants thereof, have grown in number and self-confidence. Many turn out to be remarkably well educated and not particularly rural. A more important fact is that at the dawn of the twenty-first century the United States is clearly and robustly a pluralistic culture, becoming more diversified and energetic in its pluralism all the time.<sup>53</sup>

Many complain, "But teaching evolution is not an issue in Europe, or even in Canada; the issue is peculiar to the United States." And perhaps it is. But the implication that we are invited to draw from this statement, that as Europe now is, so America is destined to become, or that Americans should be ashamed of themselves for not regarding the teaching of evolution as do Europeans, is as an argument as patronizing and uninformed as it is self-defeating. America has always been different from Europe both in its cultural pluralism and in the seriousness of its religious engagement. Yet these differences have not prohibited America from participating in the scientific or technological leadership of the world.

That Americans, with their diverse cultural backgrounds and world-views (whether religious or secular), should disagree about an issue as fundamental as biological origins—that they should disagree for scientific, philosophical, or religious reasons (or even a mixture of all of these)—should neither surprise nor shame us. Nor should such disagreement paralyze our educational system as it seeks to educate students about the theory of Darwinian evolution, the scientific evidence relevant to adjudicating it, and possible competing interpretations of such evidence. Americans have often found ways to accommodate the pluralism of perspective that is inherent to our democratic culture. With the recognition that science, no less than politics or religion, necessarily involves the assessment of competing perspectives and interpretations, the pluralism that we have often incorporated into other modes of American life may now find a welcome home in the sometimes ideologically charged environment of our public school science classrooms.

There are three, and only three, options before us: teach evolution as Eugene Garver suggests, "dogmatically and intelligently"; avoid teaching it at all, as Alvin Plantinga suggests; or teach it in the spirit of the humanities as the current reigning, though contestable, theory and thereby honor in science education the integrity of informed dissenting opinion that grounds our American tradition of unity in diversity within politics, religion, and culture.

## Notes

1. Edward J. Larson, *Summer for the Gods: The Scopes Trial and America's Continuing Debate Over Science and Religion* (New York: Basic Books, 1997); Edward J. Larson, *Trial and Error: The American Controversy over Creation and Evolution* (Oxford: Oxford University Press, 1989).

2. Nancy Pearcey, "We're Not in Kansas Anymore," *Christianity Today* (22 May 2000): 42–50; Nancy Pearcey, "Intelligent Design," *Touchstone: A Journal of Mere Christianity* 12 (July/Aug. 1999): 25–28.
3. For a good account of the engagement of ID scholars with other scholars on these issues, see Jon Buell and Virginia Hearn, eds., *Darwinism: Science or Philosophy? Proceedings of "Darwinism: Scientific Inference or Philosophical Preference"* (Richardson, Tex.: Foundation for Thought and Ethics, 1994). Also, an excellent conference entitled "Naturalism, Theism and the Scientific Enterprise: An Interdisciplinary Conference," held at the University of Texas, Austin (20–23 Feb. 1997), sponsored by the Philosophy Department of the University of Texas and organized by Robert Koons, brought together over a hundred scholars from the natural sciences, humanities, theology, philosophy, and law. Principal speakers were Michael Ruse, Darwin scholar and philosopher of science, University of Guelph; Alvin Plantinga, University of Notre Dame, critic of philosophic naturalism; Frederick Ginnell, University of Texas Southwestern Medical Center, philosopher of science; and Phillip Johnson, University of California School of Law, leader of the ID movement. Proceedings of the conference may be accessed at <http://www.dla.utexas.edu/depts/philosophy/faculty/koons/ruse/nuse.html>.
4. David J. Depew and Bruce H. Weber, *Darwinism Evolving: Systems Dynamics and the Genealogy of Natural Selection* (Cambridge: MIT Press, 1997), chap. 2, esp. pages 36–42; J. P. Moreland, *Christianity and the Nature of Science* (Grand Rapids, Mich.: Baker Books, 1994), 214–15.
5. M. A. Corey, *God and the New Cosmology: The Anthropocentric Argument* (Lanham, Md.: Rowan and Littlefield, 1993); John D. Barrow and Frank J. Tipler, *The Anthropic Cosmological Principle* (Oxford: Oxford University Press, 1986); Jeremy Campbell, *Grammatical Man: Information, Entropy, Language and Life* (New York: Simon and Schuster, 1982).
6. On the relation of Darwin's thesis to the neo-Darwinian synthesis, see Peter J. Bowler, *Evolution: The History of an Idea* (Berkeley: University of California Press, 1984), 296–300; Leah Ceccarelli, "A Rhetoric of Interdisciplinary Scientific Discourse: Textual Criticism of Dobzhansky's Genetics and the Origins of Species," *Social Epistemology* 9: 91–112.
7. Phillip E. Johnson, *Darwin on Trial* (Downers Grove, Ill.: InterVarsity Press, 1997); Phillip E. Johnson, *Reason in the Balance: The Case Against Naturalism in Science, Law, and Education* (Downers Grove, Ill.: InterVarsity Press, 1995); Phillip E. Johnson, *Defeating Darwinism by Opening*

- Minds (Downers Grove, Ill.: InterVarsity Press, 1997); Philipp F. Johnson, *Objections Sustained: Subversive Essays on Evolution, Law, and Culture* (Downers Grove, Ill.: InterVarsity, 1998); Michael Behe, *Darwin's Black Box: The Biochemical Challenge to Evolution* (New York: Free Press, 1996); William A. Dembski, *The Design Inference: Eliminating Chance through Small Probabilities* (Cambridge: Cambridge University Press, 1998); William A. Dembski and James M. Kushiner, eds., *Signs of Intelligence* (Grand Rapids, Mich.: Brazos Press, 2000); Jonathan Wells, *Icons of Evolution* (Washington, D.C.: Regnery, 2000); Paul Nelson, *On Common Descent* (Chicago: University of Chicago Evolutionary Monograph Series, forthcoming 2004); Michael J. Behe, William A. Dembski and Stephen C. Meyer, *Science and Evidence of Design* (San Francisco: Ignatius, 2000); William A. Dembski, ed., *Mere Creation: Science, Faith and Intelligent Design* (Downers Grove, Ill.: InterVarsity Press, 1998); William A. Dembski and Michael Ruse, *Debating Design: From Darwin to DNA* (Cambridge: Cambridge University Press, forthcoming); James Glanz, "Darwin vs. Evolutionists' New Battle," *New York Times*, 8 Apr. 2001; Teresa Watanabe, "Enlistering Science to Find the Fingerprints of a Creator," *Los Angeles Times*, 25 Mar. 2001; Gregg Easterbrook, "The New Fundamentalism," *Wall Street Journal*, 8 Aug. 2000; George Sim Johnston, "Deism, signed for Living," *Wall Street Journal*, 15 Oct. 1999; Elizabeth Nickson, "God's Two Books: Nature and Scripture," *National Post of Canada*, 5 May 2001.
8. The Zogby poll may be viewed at <http://www.reviewevolution.org>. Among the new books on ID is Robert Pennock, *Intelligent Design Creationism and Its Critics: Philosophical, Theological, and Scientific Perspectives* (Cambridge: MIT Press, 2001).
  9. "Ohio Plan Would Teach Evolution Debate," *New York Times*, 15 Oct. 2002, A15.
  10. "Special Issue on the Intelligent Design Argument," *Rhetoric and Public Affairs* 1 (winter 1998).
  11. For an excellent exposition of the central features of the rhetoric of science, see Marcello Pera, *The Discourses of Science*, trans. Clarissa Boisford (Chicago: University of Chicago Press, 1994).
  12. John Stuart Mill, *On Liberty* (Harmondsworth: Penguin Books, 1980). On good people making bad arguments, see pages 116–17; on an aspect of truth being found on the side that may not prevail, see pages 108–15. "It is always probable that dissentients have something worth
- hearing to say for themselves, and that truth would lose something by their silence" (111).
13. That there is a problem with contemporary textbooks has been documented by a study commissioned by the American Association for the Advancement of Science (AAAS): "According to a new study, not one of 10 widely used high school biology textbooks is acceptable overall. . . . The textbooks are so bad, the study's authors say, that the best advice they can offer to schools faced with a decision about buying new biology books is: Don't." AAAS spokesperson George Nelson said, "They present the content in a disconnected way . . . [and they] camouflage the important ideas with details and trivia." In general, the books focus too much on details and pay scant attention to overall concepts unifying these details into an understandable picture. From "Biology Textbooks Miss Big Picture," *Boston Globe*, quoted in the *Commercial Appeal*, Memphis, Tenn., 28 June 2000. Clearly the kind of debate over evolution that ID would encourage, as set forth in the various essays in this volume, would not only address this problem on a conceptual level but would help to provide the broad cultural support necessary to bring about reform.
  14. Alvin Plantinga, *Warrant and Proper Function* (Oxford: Oxford University Press), 216–38.
  15. Francis Darwin, ed., *The Life and Letters of Charles Darwin*, vol. 2 (New York: D. Appleton, 1911). To Lyell, 6 June 1860: "I can only hope by reiterated explanations finally to make the matter clearer" (111).
  16. Anonymous, "Darwin on the Origin of Species," *North American Review* 90 (Apr. 1860): 475.
  17. Larson, *Trial and Error*, introduction and chap. 1.
  18. Mill, *On Liberty*: "On any of the great open questions just enumerated, if either of the two opinions has a better claim than the other, not merely to be tolerated, but to be encouraged and countenanced, it is the one which happens at the particular time and place to be in a minority. That is the opinion which for the time being, represents the neglected interests, the side of human well-being which is in danger of obtaining less than its share" (111).
  19. Adam Sedgwick, "Objections to Mr. Darwin's Theory of the Origin of Species," *Spectator* (24 Mar. 1860), reprinted in David Hull, *Darwin and His Critics* (Cambridge: Harvard University Press, 1973), 155–70; Samuel Haughton, "Biogenesis," *Natural History Review* 7 (1869): 23–32, reprinted in Hull, *Darwin*, 217–27.

20. Darwin, *Life and Letters*, vol. 2. To Lyell, 12 Dec. 1859: "[Natural selection] 'is the law of biggelydy-piggelydy.' What this exactly means I do not know, but it is evidently very contemptuous. If true this is a great blow and discouragement" (37).
21. Louis Agassiz, "Prof. Agassiz on the Origin of Species," *American Journal of Science* 30 (July 1860): 154. Agassiz also observed, "I must protest now and forever against the bigotry spreading in some quarters, which would press upon science doctrines not immediately flowing from scientific premises and check its free progress" (from Agassiz's *Essay on Classification* [1859], 71–72, cited in Hull, *Darwin*, 446).
22. Changes in the various editions of the *Origin* are numerous. See Morse Peckham, ed., *The Origin of Species by Charles Darwin: A Variorum Text* (Philadelphia: University of Pennsylvania Press, 1959). See especially chapter 7, which Darwin added chiefly to rebut the objections of St. George Jackson Mivart, and chapter 15, the final chapter. Among the many friends and later readers to whom Darwin patiently explained his doctrine were Joseph Hooker, Charles Lyell, and Thomas Henry Huxley. See John Angus Campbell, "The Invisible Rhetorician: Charles Darwin's 'Third Party' Strategy," *Rhetorica* 7 (winter 1989): 55–85, esp. note 24. On the extreme doubts about the explanatory adequacy of natural selection, see Lyell's letter to Huxley, 17 June 1859, in Frederick Burkhardt and Sydney Smith, eds., *The Correspondence of Charles Darwin*, vol. 7 (Cambridge: Cambridge University Press, 1985), 305–7.
23. Michael T. Ghiselin, *The Triumph of the Darwinian Method* (Berkeley: University of California Press, 1969).
24. John F. W. Herschel, *A Preliminary Discourse on the Study of Natural Philosophy* (Chicago: University of Chicago Press, 1987). "The testimony of natural reason . . . places the existence and principal attributes of a Deity on such grounds as to render doubt absurd and atheism ridiculous" (7).
25. See especially chapters 6–8 in Charles Darwin, *On the Origin of Species* (Cambridge: Harvard University Press, [1859] 1964). Darwin's attention in these chapters to objections and to the appearance of design, particularly in organs of special complexity (see pages 186–94), shows in particular the seriousness with which he took design as a rival scientific hypothesis.
26. Steve Fuller, *Thomas Kuhn: A Philosophical History of Our Times* (Chicago: University of Chicago Press, 2000). "Mach highlighted fundamental objections to Newtonian mechanics that remained just as potent as when

- they were first made nearly two centuries earlier, but had been suppressed from the professional training of physicists. The most famous of these objections pertained to the existence of absolute space and time, the ether, atoms, and even mass itself. Indeed Einstein credited Mach with keeping them alive long enough so as to suggest the need for what became relativity theory" (123).
27. One thinks of the rejection of the earth-centered view in the ancient world and of evolution itself, as well as of the contemporary ambiguous relation of alternative medicine or folk medicine to established medicine. Further, there is the ambiguous relationship of Goethe's science to established science and of the solid contributions of "idealist" or "essentialist" science, which in the hands of Linnaeus immeasurably advanced botany or in those of Cuvier helped establish the reality of past extinctions. Mill put the principle well: "Even in natural philosophy, there is always some other explanation possible of the same facts; some geocentric theory instead of heliocentric, some phlogiston instead of oxygen" (*On Liberty*, 98). For a good discussion of the scientific contributions of schools of thought operating from very different metaphysical premises, see Timothy Lenoir, *The Strategy of Life: Teleology and Mechanics in 19th-Century German Biology* (Chicago: University of Chicago Press, 1989). A suggestive recent example comes from the inventor of the DNA sequencer, Leroy Hood. Hood recently resigned his prestigious post at the University of Washington and delivered a stinging indictment that the blinkered department-centered specializations of universities make them unfit for contemporary biological research. In founding a new Institute for Systems Biology, he proposes to bring together biologists, computer scientists, engineers, physicists, and mathematicians. His research aim is to break with academic biology, take a systems approach, and by using computers look at the structure and behavior of cells or organisms and simulate their behavior as Boeing aircraft does an airplane. His research agenda seems markedly suggestive of what an ID program of scientific research might look like. Andrew Pollack, "Scientist At Work: Leroy Hood: A Biotech Superstar Looks at the Bigger Picture," *New York Times*, 17 Apr. 2001.
28. Thomas S. Kuhn, *The Structure of Scientific Revolutions*, 2nd ed. (Chicago: University of Chicago Press, 1970), 92–110.
29. Freeman Dyson, *Infinite in All Directions* (New York: Harper and Row, 1988). Dyson notes the reemergence of design in contemporary science and says a good word on behalf of the symmetry between the

- anthropic principle in cosmology and design in biology: "The argument from design still has some merit as a philosophic principle. I propose we allow the argument from design the same status as the Anthropic Principle, excluded from science but tolerated in metascience" (297).
30. Kuhn, *Structure of Scientific Revolutions*; see also Fuller, *Thomas Kuhn*.
31. Michel Malherbe, "Bacon's Method of Science," in *The Cambridge Companion to Bacon*, ed. Markku Peltonen (Cambridge: Cambridge University Press, 1996), 75–98.
32. Darwin, *Origin*, 1.
33. I use the term *positivism* in a broad sense to include the founding of the positivist program of thought by August Comte (1798–1857), especially his influential view that society progresses through theological, metaphysical, and positive stages of existence. I also include under the label "positivist" the specific school of twentieth-century positivists, the Logical Empiricists.
34. For Huxley's approach to science and how it differed from Darwin's, see Mario A. DiGregorio, *T. H. Huxley's Place in Natural Science* (New Haven, Conn.: Yale University Press, 1984), 34–50.
35. Burkhardt and Smith, *Correspondence*, vol. 7 (letter of 2 June 1859), 301.
36. Karl R. Popper, *Logic of Scientific Discovery* (New York: Harper Torchbooks, 1965), 265–81.
37. Carl G. Hempel, *Aspects of Scientific Explanation* (New York: Harper and Row, 1965).
38. I. Lakatos and A. Musgrave, eds., *Criticism and the Growth of Knowledge: Proceedings of the Colloquium in the Philosophy of Science, London 1965* (Cambridge: Cambridge University Press, 1970), 91–195; Peter Lipton, *Inference to the Best Explanation* (New York: Routledge, 1991).
39. For a model of science based on argument, grounded in the analogy between scientific and legal argument, see Stephen Toulmin, *Human Understanding: The Collective Use and Evolution of Concepts* (Princeton, N.J.: Princeton University Press, 1972), 239–41.
40. Marcello Pera and William R. Shea, *Persuading Science: The Art of Scientific Rhetoric* (Canton, Mass: Science History Publications, 1991), 29–37.
41. For an authoritative explication and defense of the legitimate role of rhetoric/dialectic in science, see Pera, *Discourses*; see also Lawrence J. Prelli, *A Rhetoric of Science: Inventing Scientific Discourse* (Columbia: University of South Carolina Press, 1989); Alan G. Gross, *The Rhetoric of Science* (Cambridge: Harvard University Press, 1996); Charles Taylor,

- Defining Science: A Rhetoric of Demarcation* (Madison: University of Wisconsin Press, 1996); Jeanne Fahnestock, *Rhetorical Figures in Science* (Oxford: Oxford University Press, 1999).
42. Eugene Garver, *Aristotle's Rhetoric: An Art of Character* (Chicago: University of Chicago Press, 1994); see also Pera, *Discourses*, esp. chaps. 2 and 3.
43. Thomas F. Gierlyn, *Cultural Boundaries of Science: Credibility on the Line* (Chicago: University of Chicago Press, 1999), 23–34; Margaret C. Jacob, ed., *The Politics of Western Science: 1640–1990* (Atlantic Highlands, N.J.: Humanities Press, 1990), 1–18, 81–102.
44. Stevenson and Byerly, *The Many Faces of Science*, 133–41. Leslie Stevenson and Henry Byerly, *The Many Faces of Science* (Boulder, Colo: Westview Press, 2000), 133–41.
45. Pera, *Discourses*, 31–36.
46. Jerome Groopman, *Second Opinions: Stories of Intuition and Choice in the Changing World of Medicine* (New York: Viking, 2000), 9–37.
47. John Dewey opposed teaching science in a manner that reduced it to mere memorization and recitation, stripped of its critical component. See John Dewey, "The Relation of Science and Philosophy as a Basis of Education," in *John Dewey on Education: Selected Writings*, ed. R. D. Archambault (Chicago: University of Chicago Press, 1964), 19; Jürgen Habermas speaks tellingly to this point when he observes, "Uncritical mastery of existing disciplines offers no hope that learners will suddenly undergo a change in attitude, becoming skeptical and analytical about ideas, or they will suddenly be able to criticize after having hidden this virtue away for so long" (in Robert E. Young, ed., *Critical Theory of Education: Habermas and Our Children's Future* [New York: Columbia University Teachers College Press, 1990], 33). See also Martin Eger, "A Tale of Two Controversies: Dissonance in the Theory and Practice of Rationality," *Zygon* 23 (1988): 291–325.
48. Groopman, *Second Opinions*, chap. 1.
49. Stevenson and Byerly, *The Many Faces of Science*, 226–30.
50. Dissatisfaction with public schools, of course, takes many forms, including a desire for greater intimacy or bonding with one's children and concerns for safety, as well as dissatisfaction with prevailing public education. See Peter T. Kilborn, "Learning at Home, Students Take the Lead," *New York Times*, 24 May 2000. See also Linda Tagliaterra, "More Families Opt for Home Schooling," *New York Times*, 5 Dec. 1999.
51. Hannah Arendt, *The Human Condition* (New York: Doubleday Anchor Books, 1959), 212–23.

52. For an excellent discussion, see the introductory and concluding chapters of Larson, *Trial and Error*.
53. Elmore Leonard, "With or Without Prayer: One More Hail Mary Story," *New York Times Magazine*, 27 May 2000, 84–85. In the same number, see Jennifer Egan, "Where Meditation Is Going," 86–88. See also Edward Larson and Larry Wilham, "The More They Learn the Less They Believe," *Nature* 394 (June 1998): 313.

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⌘ Part I

***Should Darwinism Be Presented Critically  
and Comparatively in the Public Schools?  
Philosophical, Educational, and Legal Issues***

## Intelligent Design, Darwinism, and the Philosophy of Public Education

*John Angus Campbell*



Intelligent design (ID) is hardly a new idea from the standpoint of either science or philosophy. Long before William Jennings Bryan, Billy Sunday, or the Christian Coalition were on the scene, before the canon of Scripture was closed—or parts of it even opened—the issues now raised by advocates of intelligent design were being debated by foundational figures of Western thought.<sup>1</sup> Whether Western science would look to Heraclitus and Democritus or to Plato and Aristotle for its philosophy of science has been one of the longest running issues in our tradition.<sup>2</sup> From the ancient world to Aquinas; from the middle ages to Paley; from Paley to Cuvier, Lamarck, and Darwin; to our own century and to such figures as Teilhard de Chardin, Stephen Hawking, and the latest speculations on “the anthropic principle” in cosmology, the idea that nature manifests the kind of order one associates with mind rather than with material self-sufficiency has found advocates as well as detractors among scientists and philosophers of science.<sup>3</sup>

Darwin had his first encounter with a philosophy making strong claims for the material self-sufficiency of nature when, as a medical student at Edinburgh, he pursued extracurricular studies under anatomist-zoologist Robert Grant. Grant was the first scientist Darwin had met who praised the genius of Lamarck, whose evolutionary views were analogous to those Darwin knew from the works of his grandfather, poet-philosopher Erasmus Darwin.<sup>4</sup> Grant's refusal to give Darwin credit for his independent discovery that the so-called ova of a bryozoan *Flustra* species were in fact the eggs of another species turned Darwin away in disgust from Grant's evolutionism and (already alienated from medicine) from professional science in general.<sup>5</sup>

As a divinity student at Cambridge, Darwin gained an in-depth exposure to the opposite view of nature, one that made strong claims for the role of an intelligent designer. In a more congenial and leisurely atmosphere, where Darwin was among young men of his own class, he developed a close friendship with the Reverend John Stephens Henslow, professor of botany. Under Henslow's direction, Darwin participated in Henslow's non-credit science courses and weekly informal science discussions at Henslow's home and read William Paley's *Evidences of Christianity* and *Natural Theology*. Quick to take a hint from his new mentor, whom he admired both as a man and as a teacher, Darwin read John Herschel's *Preliminary Discourse*, a major work in the philosophy of science, which presented design—indeed, the being of a designer—not only as a legitimate inference from science but as a motive to its study.<sup>6</sup> Darwin also read Wilhelm von Humboldt's *Personal Narrative*, which, along with Henslow's own unfulfilled travel just-fired Darwin with a desire to travel as a naturalist and eventually led to his appointment as naturalist aboard the *Beagle*.<sup>7</sup> Although Darwin's study of design was done in the context of his preparation for the Anglican priesthood, his education was truly liberal.

Darwin learned the standard arguments for design through dialectical engagement with their opposite. Rehearsing its reader through the proofs of design, Paley's *Natural Theology*—in the spirit and with the easy charm of a Michael Behe—urged the reader to think seriously of the claims for self-organization and of the evidentiary difficulties in addressing them.<sup>8</sup> Paley's *Evidences of Christianity* taught Darwin about Hume's case against miracles. Darwin learned from Paley how to chip away at large objections through accumulating small probabilities on the other side, a procedure Darwin would later use to great effect in his evolutionary works.<sup>9</sup> In fact, the only part of the academic instruction Darwin received at Cambridge that he

claimed was permanently valuable to him was his study of Paley's design arguments. The design model gave Darwin a valuable set of questions with which to approach the study of the natural world and a motive, both scientific and religious, for pursuing them. Of this model, Darwin observed in his *Autobiography*: "The logic of this book [Paley's *Evidences*], and as I may add of *Natural Theology* gave me as much delight as did Euclid. The careful study of these works, without attempting to learn any part by rote, was the only part of the Academical Course which as I then felt and as I still believe, was of the least use to me in the education of my mind. I did not at that time trouble myself about Paley's premises; and taking these on trust I was charmed and convinced by the long line of argumentation."<sup>10</sup>

Herschel's *Preliminary Discourse* similarly inspired Darwin; Herschel, he said, "filled me with a burning zeal to add something to the noble structure of natural science." It might also be added that Herschel gave him his sense of scientific method as a performing art—a delicate amalgam of induction, deduction, hypotheses, and practical experience—that informed everything he wrote as a scientist.<sup>11</sup> Although Darwin's epochal *Origin* challenged the design hypothesis as formulated by Paley and endorsed by Herschel (Darwin was disappointed when Herschel called natural selection "the law of higgledy piggedy"), the design model structures the rhetoric of Darwin's *Origin* at every turn and continues to provide the grammar of well-known Darwin defenders from Stephen Jay Gould to Richard Dawkins and Daniel Dennett.<sup>12</sup>

If the design hypothesis was central in motivating Darwin to the study of science, it was no less important in shaping the development of his evolutionary ideas, which began possibly as early as the last leg of the *Beagle* voyage and were certainly in place by the early months of 1837 following his return in October 1836.<sup>13</sup> No one can read Darwin's transmutation notebooks without being impressed with how he tested his nascent evolutionism against the counterview of ID.<sup>14</sup> Throughout his notebooks, Darwin worked to make his ideas seem an extension of the accepted scientific and religious premise that the organic sphere is part of a system of divinely designed laws. The theistic premise of received science is present in the very first entry of his first transmutation notebook. There, taking his title *Zoonomia* from his grandfather's encyclopedic medical work, Darwin also took his grandfather's distinction between asexual and sexual reproduction and his grandfather's deistic belief in a creator. He used both to argue that sexual reproduction, because it engenders variation, is the divinely ordained law by which biological structures are adapted to a world of



change.<sup>15</sup> Though Darwin's notebooks are filled with miscellaneous snippets of information and telegraphic sentences and fragments, whole sections show clearly how he argued to make his various theories clear and persuasive to an anticipated audience who saw, as he did (but in a more radical way), the whole of nature as a system of designed laws. In Darwin's notebooks as well as in the full development of his argument in his *Sketch* of 1842 and his *Essay* of 1844, one finds ample evidence of the same premise.<sup>16</sup>

Nowhere is the public and scientific character of the design argument, and its centrality to Darwin's thinking, more clearly manifest than in the structure of his own mature argument. The tone and context of that argument are set in the opening pages of his 1859 book. The flyleaf of the first edition of the *Origin* boasted two dedicatory citations from works of natural theology, one from Cambridge polymath and historian-philosopher of science William Whewell, that events in the natural world are "brought about not by insulated interpositions of Divine power . . . but by the establishment of general laws."<sup>17</sup> The other citation was from Bacon's famous *Advancement of Learning*, urging that no one can be too well read "in the book of God's word, or in the book of God's works."

In the second edition of the *Origin*, Darwin added a third citation, this one from Bishop Butler's classic warhorse against skepticism, the *Analogy of Revealed Religion*. Butler reversed the commonsense progression from "natural" to "supernatural" and argued that the "natural" depends upon and illustrates the supernatural, which is ontologically prior. With implicit approval, Darwin cited Butler's claim that "what is natural as much requires and presupposes an intelligent agent to render it so, i.e., to effect it continually or at stated times, as what is supernatural or miraculous does to effect it for once." In the sixth, final, and least expensive edition of the *Origin*, Darwin added an "advertisement" after his table of contents: "An admirable, and, to a certain extent, favourable Review of this work, including an able discussion on the Theological bearing of the belief in the descent of species, has now been separately published by Professor Asa Gray as a pamphlet. . . . It is entitled 'Natural Selection not inconsistent with Natural Theology.'<sup>18</sup>

In each chapter of the *Origin*, Darwin employs the concept of intelligent design as a foil in order to make the case for the modification of species by means of natural (rather than intelligent) selection. Chapter 1, "Variation Under Domestication," never mentions God or creation but instead invites the reader to recall what he or she knows already about how domestic

plants and animals are intelligently designed by skillful breeders. Citing a famous breeder (Youatt), Darwin secularized a quasi-supernatural image when he presented selection as "the magician's wand, by means of which he [the breeder] may summon into life whatever form and mould he pleases." By the end of the chapter, a reader begins to see how breeders working on nature recapitulate a process conceivably like nature's own and, as Darwin showed in the case of domestication in primitive societies, may not even require conscious art.<sup>19</sup>

Chapter 2, "Variation Under Nature," raises the question of design directly. In the fifth sentence of his first paragraph, Darwin affirmed that, difficult as the concept of a "species" might be to define, "[g]enerally the term includes the unknown element of a distinct act of creation." Later in the chapter, Darwin deconstructed the design argument through what today we would call a study in the sociology of scientific knowledge. Having pointed out how no two experts agreed on where a variety left off and a species began—and this on long-studied common European forms—he proceeded to show how the fixed features on which the design inference then depended were in fact an artifact of the social production of knowledge. Taking the case of "a young naturalist" first learning his trade, Darwin showed that the whole business of this person, his whole status in the scientific fraternity, depended on his coming up with distinct features by which to separate one species from another. Small variations—so central to Darwin's explanation of species change—naturally and on principle, Darwin argued, tended to be overlooked in this schema because they were a nuisance. Noting that greater numbers of varieties are produced by the larger genera, Darwin nicely substituted for the "magic wand" metaphor of chapter 1 the up-to-date image of a factory, referring to the larger genera as "the manufactory of species."<sup>20</sup> Change in animate forms is not just something that happened in the past. It is ongoing in the activity of breeders working with variation and continues in nature to turn out new forms, as we can infer from the fact that the largest families produce the most numerous varieties and subspecies.

In chapter 2, Darwin begins his epistemological critique of the design-based thinking of his time. He contrasted the naturalistic economy of his assumption that a species "is a more or less permanent variety" and a variety "an incipient species," with the apparent extravagance assumption of the fixity of species: "On the other hand, if we look at each species as a special act of creation, there is no apparent reason why more varieties should occur in a group having many species, than in one having few."<sup>21</sup>

In chapter 3, "Struggle for Existence," Darwin's evocation of design is again direct and explicit. The chapter begins by using the very language of reverent enthusiasm characteristic of Paley and the tradition of natural theology:

How have all those exquisite adaptations of one part of the organisation to another part, and to the conditions of life, and of one distinct organic being to another being, been perfected? We see these beautiful co-adaptations most plainly in the woodpecker and mistletoe [*sic*]; and only a little less plainly in the humblest parasite which clings to the hairs of a quadruped or the feathers of a bird; in the structure of the beetle which dives through the water; in the plumed seed which is wafted by the gentlest breeze; in short, we see beautiful adaptations everywhere and in every part of the organic world.<sup>22</sup>

In the body of the chapter, Darwin brilliantly introduced the Malthusian logic of differential reproduction, operating on random variation under changing conditions and over lengths of time, to turn what had been the rhetorical questions of the received design-based perspective into the dialectical questions of his evolutionary science. At the end of the chapter, Darwin invited the reader to use this new knowledge to provide a theoretically sophisticated answer to the reverent questions with which the chapter began. What could one do, Darwin asked, to extend the range of a plant just a little farther beyond its present farthest limit? One would have to give it some variation that would enable it better to survive in its conditions of life. Although Darwin reminded the reader that we do not know exactly what the needed variations would be, the lesson of the chapter is not humility at our ignorance, as Darwin insisted, but a dawning awareness of the potential power of a new mode of explanation.<sup>23</sup>

In chapter 4, "Natural Selection," Darwin turned the design argument against itself as a way of making the case for natural selection—and for philosophical naturalism. In an eloquent and lengthy paragraph that begins, "As man can produce and certainly has produced a great result by his methodical and unconscious means of selection, what may not nature effect?" Darwin invested nature analogically with the attributes of the breeder. In a long series of contrasts that read something like an altar call in which an evangelist magnifies the power of God and the littleness of humans—"Man can act only on external characters: nature cares nothing for appearances, except in so far as they may be useful to any being"—Darwin drove home the point that he had been preparing in his stair-step opening chapters. The reader's new knowledge, the knowledge of Malthusian laws plus variation,

inheritance, and time, is undergirded, summarized, and communicated through the metaphoric vehicle of an intelligent designer (the breeder); this is made evident in the gorgeous personification completing the sequence of Darwin's contrasts between nature and humans: "It may be said that natural selection is daily and hourly scrutinising, throughout the world, every variation, even the slightest; rejecting that which is bad, preserving and adding up all that is good; silently and insensibly working, whenever and wherever opportunity offers, at the improvement of each organic being in relation to its organic and inorganic conditions of life."<sup>24</sup>

Not least of the points of interest in this passage is its suggestion that the process he has in mind, for all its randomness, may have been divinely guided. Darwin's codiscoverer of natural selection, A. R. Wallace, interpreted the passage this way and for that reason begged Darwin to drop it.<sup>25</sup> Darwin's American defender Asa Gray took this passage as his hint and "baptized" the *Origin* by building an entire theological defense around it.<sup>26</sup> Striking as is this personification, it must be said immediately that Darwin did not depend merely on "metaphor" to convey his central concept. Although it is territory that only the most intrepid readers will frequent, in the middle of chapter 4 (which Darwin noted in a letter to his publisher was "the key-stone of my arch") Darwin presented a detailed hypothetical taxonomic tree illustrating how the key principle of "divergence from character" followed from the process of variation, inheritance, and natural selection.<sup>27</sup> Neither the tree nor Darwin's exposition is overtly figurative. Yet it is when Darwin was being least metaphorical that his contrast with ID is most potent and interesting.

What is most revolutionary about Darwin's *Origin* is not simply his case for natural selection as the explanatory mechanism of evolution or his case for evolution itself. The other, and equally important, revolution going on within his argument for species change is his case for naturalism, which slides insensibly between an innocent methodological precept and a prior metaphysical commitment. If one masters the argument centered on Darwin's taxonomic tree in chapter 4, one gains a piercingly clear vision of organic development unfolding without plan but according to natural law, while at the same time one gains more than enough scientific material for a complete materialist worldview.<sup>28</sup>

The first step in Darwin's case for metaphysical naturalism—the belief that reality coincides with what is accessible to the methods of the natural sciences—was taken in his flyleaf citations, all of which identified the ordinary mode of divine activity with natural laws. Implicitly and in chapter 2

explicitly, Darwin was laying the foundations for a revolutionary philosophy of science. Though space here prevents a thorough exposition, when Darwin was having a difficult time with an explanation or when he was particularly keen on the reader's realizing the consequences of a refusal to accept an explanation, he would sometimes draw on the reader's partial commitment to naturalism to negotiate yet further commitments. At some points Darwin would simply equate naturalistic explanations—evolutionary case histories with the blanks filled in by an "it must have been" story line—with reality itself.<sup>29</sup>

A good example of the terminus of that process where methodological naturalism teeters on the edge of metaphysical naturalism—and theism seems ready to dissolve into materialism—appears toward the end of chapter 5, "Laws of Variation." Darwin noted the presence of stripes on colts and said of those who refuse to recognize in these stripes the descent of the modern horse from an ancestor common to the hemionus, quagga, and zebra that they "reject a real for an unreal, or at least for an unknown, cause. It [their rejection of genetic descent] makes the works of God a mere mockery and deception."<sup>30</sup>

On the one hand, this passage gestures toward a materialism in which being, as opposed to active superintendence of nature, let alone intervention in it, is the only activity left for "God." On the other hand, the passage suggests that Darwin sought to reinterpret, not abolish, traditional religious language. At the least, the passage is an example of sections, found throughout the *Origin*, that cry out for interpretation and hint at what we can only call Darwin's theology of nature.<sup>31</sup> Does the passage mean that Darwin thought it appropriate to refer to God in a scientific work and to biological structures as "works of God"? Or is all of this a manner of speaking or rhetorical strategy aimed at putting God-talk on a course toward ultimate extinction? These are open interpretive questions arising from the language of the text.<sup>32</sup>

Chapters 6–8 in the *Origin*, "Difficulties on Theory," "Instinct," and "Hybridism," form a unit focused on addressing objections. Pertinent for our concern with reemerging arguments for design today is Darwin's welcoming of readers' objections and his attempt to find resources, not only from nature but also from a reader's own perceptual resources, to overcome these objections. Though Darwin never formally taught school, an opening line in chapter 6 acknowledges the legitimacy of different perspectives—one of the defining marks of a master teacher as traditionally understood in the context of a liberal education: "Long before having arrived at this

part of my work, a crowd of difficulties will have occurred to the reader. Some of them are so grave that to this day I can never reflect on them without being staggered." There is also, in the remainder of the line, the mark of a master dialectician/rhetorician: "but, to the best of my judgment, the greater number are only apparent, and those that are real are not, I think, fatal to my theory."<sup>33</sup>

In these three chapters, Darwin was not arguing simply for the competence of variation and natural selection to account for particular structures and to answer particular difficulties; he was at the same time leading readers to accept his philosophic premise of unlimited naturalism.<sup>34</sup> Much of the logic of these chapters develops lines of argument already in place by chapter 4, indeed implicit already in chapter 1. Whether dealing with structures of extreme perfection such as the eye or seemingly imperfect or trivial structures such as the tail of the giraffe, Darwin's approach was to pose an objection and then present a real or hypothetical sequence of intermediate stages capable of making a step-by-step evolutionary explanation plausible. As Darwin explained in these four chapters, the combination of imperfection of the geological record and extinction of transitional grades in the intense competition shaping the process of divergence of character traits would make transitional structures scarce; an important lesson a reader would learn was to get along without evidence.

Put positively, a reader learned to make inferences based on what Darwin argued were parallel cases. Darwin pointed out, for example, that the flying lemur, or *Galeopterus*, is unique; it had once been classed falsely among the bats but now stood alone in its class. To show how it may have been formed from its nonflying relatives, Darwin took the example of squirrels, where we do have a series of gradations from those that merely jump well to those that jump farther and to those that glide; that sequence illuminated all the graduated modifications in allied structures necessary to his argument.<sup>35</sup> After Darwin's argument, a reader understands how the lemur could have been formed, having been shown that variations in analogous or the same organs do occur in another mammal.

Central to the intellectual excitement of these chapters is the way Darwin seemed constantly to put his theory at risk and then rescue it. On the extreme perfection of the eye, Darwin began, "To suppose that the eye . . . could have been formed by natural selection, seems, I freely confess, absurd in the highest possible degree." Then he continued, "Yet reason tells me . . ." A reader is given not a particular lineage leading to the eye of the eagle, the focus of the argument, but a narrative explaining how organs of

sight in nature range from nerves sensitive to light all the way through more complex structures, right up to the eye of the eagle. What is so instructive about Darwin as teacher in these arguments is the way he stated his theory as something at risk, not as a necessary or initially "natural" way of seeing nature, and then tried to reason, cajole, and sometimes almost pry the reader over to his side. Again and again in the structuring of Darwin's argument, a reader sees the role of theory, inference, and constructive contrast with the design hypothesis: "Let this process go on for millions and millions of years; and during each year on millions and millions of individuals of many kinds; and may we not believe that a living optical instrument might thus be formed as superior to one of glass, as the works of the Creator are to those of man?"<sup>36</sup>

Space limitations require us to discuss only briefly chapters 9–12, two on the imperfection of the geological record and two on geographical distribution. Here Darwin wrestled with arguments against his theory where the evidence in his favor was admittedly thinnest. Like the preceding suite of chapters, 9–12 are of enormous instructive value in enabling a reader to grasp (or gasp at) the meaning of *inference* and the warranting of inference in science. The final sentence of chapter 9, truly a Darwinian signature line, serves to illustrate how much of his argument pertained to the conventions that were to govern interpretation of the evidence: "On this view, the difficulties above discussed are greatly diminished, or even disappear."<sup>37</sup>

Chapter 13, "Mutual Affinities of Organic Beings: Morphology; Embryology; Rudimentary Organs," concludes Darwin's presentation of his case. By this point, a conscientious reader has mentally rehearsed the argument presented in the first four chapters many times in a variety of distinct yet related contexts, from the barnyard to the fragmentary recesses of the fossil record. In the first part of the chapter, the naturalistic theme first introduced in chapter 2, about the natural meaning of classification, is enforced with emphasis. The resemblance of organic beings "is evidently not arbitrary like the grouping of the stars in constellations."<sup>38</sup> What the grouping of organisms illustrates, Darwin claimed, is genetic descent. Even if a reader rejects Darwin's argument, at this point in the book, she or he can scarcely help feeling its force. Moving on, although he did not use Theodosius Dobzhansky's words, Darwin clearly emphasized Dobzhansky's key point: nothing in morphology, embryology, or rudimentary organs makes sense without the premise of genetic descent, that is, evolution.

Chapter 14, "Recapitulation and Conclusion," is the peroration to what, as Darwin justly affirmed, had been "one long argument."<sup>39</sup> The central

change in the status of the design argument is well captured late in the chapter in one of the most famous of Darwin's images. Having rehearsed basic objections to his theory and his responses to them, Darwin set forth his vision, encompassing several sciences, of what difference the perspective he had offered would make to the study of natural history. Any reader interested in illustrations of "paradigm shift" can scarcely do better than to read Darwin's account of questions for research opened up by his theory and the alleged dead ends of research on any other assumption. What interests us now, however, is the way Darwin used an example of design to challenge the conventional meaning of design:

When we no longer look at an organic being as a savage looks at a ship, as at something wholly beyond his comprehension; when we regard every production of nature as one which has had a history; when we contemplate every complex structure and instinct as the summing up of many contrivances, each useful to the possessor, nearly in the same way as when we look at any great mechanical invention as the summing up of the labour, the experience, the reason, and even the blunders of numerous workmen; when we thus view each organic being, how far more interesting, I speak from experience, will the study of natural history become!<sup>40</sup>

In this passage, the advocate of intelligent design becomes a "savage" in the sense that Darwin used the term in his account of the *Beagle* voyage to describe the people of Tierra del Fuego. For Darwin, the Tierra del Fuegians were technically human animals, unwashed, without arts or clothes, and able intellectually to do little more than knock a limpet against a rock.<sup>41</sup> Though, of course, a ship is a product of intelligent design, from the view of the "savage" in Darwin's interpretation, the ship seems to be a miraculous creation, and the unenlightened "people" who gape at it are too degraded in mind even to recognize the artful process of its construction as manifest in occasional imperfections of its design or execution.

Darwin's message through this image seems to be that his account, via the analogy with the art of domestic breeding, has set a new standard for civilized scientific understanding appropriate to a technological age. The design hypothesis is now not just outdated but is a form of intellectual barbarism. Such is the invective under which design advocates have had to labor since Darwin's time.

Exactly how far Darwin wished to press the naturalist theme, with which the *Origin* is laced, is a legitimate and lively subject of disagreement. Certainly Darwin gave his readers a great deal of theological window dressing. In the first edition, the famous and eloquent final line read, "There is

grandeur in this view of life with its several powers, having been breathed into a few forms or into one; and that, whilst this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been and are being evolved."<sup>42</sup> By the second edition, "breathed" had become "breathed by the Creator."<sup>43</sup> In a letter to his friend Hooker, Darwin confessed to having "trucked to public opinion [when he] used the Pentateuchal term of creation."<sup>44</sup> As for his advertisement for Asa Gray's pamphlet, Darwin emphatically but privately rejected his argument that variations had been providentially guided along certain lines, and—although he promoted the pamphlet—he ridiculed those who believed it.<sup>45</sup> But Darwin used Gray knowingly and, depending on one's view, with either metaphysical magnanimity or cynicism to bring others around to an evolutionary worldview that affirmed the sufficiency of a fully natural process as the explanation for those features of life that had previously required explanation by reference to the activity of a designing intelligence.

In fact, it was at Darwin's urging, with his money and under his direction, that Gray's initially anonymous essays in the *Atlantic Monthly* were gathered into a pamphlet and distributed free of charge to leading scientific and religious figures and to various magazines.<sup>46</sup> Though he plainly said in his *Autobiography* that he held Christianity to be a "damnable doctrine" and repudiated the argument to design ("We can no longer argue that . . . the beautiful hinge of a bivalve shell must have been made by an intelligent being, like the hinge of a door by man"), he may have continued to believe in at least a version of the design argument. Indeed, at times he suggested that the laws of nature that produce evolutionary change might themselves have been designed.<sup>47</sup>

Thus, he acknowledged "the extreme difficulty or rather impossibility of conceiving this immense and wonderful universe, including man . . . as the result of blind chance or necessity." Like all Darwinian statements that seemed to favor ID or to reconcile evolution with it, that argument was inherently unstable and subject to a gradual slide into an all-pervasive naturalism: "This conclusion was strong in my mind . . . when I wrote the *Origin* . . . and . . . since that time . . . it has very gradually . . . become weaker." Developing the "weaker" theme, Darwin went on to ask how much confidence we ought to place in the reasoning of a mind that has "been developed from a mind as low as that possessed by the lowest animal . . . when it draws such grand conclusions?" Darwin seemed genuinely unaware of the irony of his point applied to his own thought, which

suggests his adherence to a metaphysical naturalism grown dogmatic. Or perhaps not. One paragraph after proclaiming his theism, Darwin concluded, "The mystery of the beginning of all things is insoluble by us; and I for one must be content to remain an Agnostic."<sup>48</sup>

It is tempting to conclude that, in the end, Darwin's naturalism was immune from the annoying doubt to which only his theism was subject. Donald Flemming seems to have gotten it right when he observed, "The grin of atheistic Cheshire Cat hangs over the last line of the *Origin*. But that is all, the cat has fled."<sup>49</sup> Nevertheless, one of the liveliest debates in contemporary Darwin scholarship revolves around how much we should see Darwin as remaining in the orbit of some form of traditional theism and how much we should see him as the author of what Daniel Dennett has called a "universal acid" of naturalist skepticism concerning traditional values, beliefs, and norms.<sup>50</sup>

Whether Darwin continued to believe in some kind of a deity and whether Darwinism can be reconciled with a meaningful form of theism remain topics of intense scholarly debate. Nevertheless, one thing seems clear: Darwin formulated his thesis of undirected evolution against the backdrop of science-based design arguments and he understood and defended his own theory as an alternative to these design arguments as promulgated by leading thinkers such as Paley, Herschel, Cuvier and others. He offered natural selection as an alternative explanation for, among other things, the exquisite adaptation of organisms to their environments and for "organs of extreme perfection"—features of living things previously thought to point unequivocally to the activity of a designing intelligence. As Stephen C. Meyer puts it in two later essays, Darwin understood natural selections as a kind of "designer substitute."

### ***ID and the Mission of Science Education in a Democratic Society***

It follows from our previous discussion that in order to understand Darwin's argument, to say nothing of the contemporary controversy that it continues to generate, students need to understand Darwinism's dialectical opposite: the intelligent design hypothesis. Further, with so many conflicting interpretations of key scientific and philosophical issues (both longstanding and now emerging), one would think that teaching about the argument of the *Origin*, and its opposites, would be a biology teacher's delight. How better to show the contested character of science, its periodic

"paradigm shifts," its conventions of argument, its use and interpretation of evidence, its connection to culture, its polemics, and its relationship to values and larger questions of meaning and purpose than through examining Darwin's text—or through presenting its tensions through age-appropriate secondary readings and discussions? What better plan could there be for giving students the opportunity to "earn their evolutionism" (as Darwin gave his readers the opportunity to earn theirs) than by having them compare the objections posed to Darwin's arguments in his time—as set forth in his text or in updated examples from contemporary science—with similar objections now being set forth by the advocates of ID?

Or so one might naively assume.

Rather than seeing an educational opportunity of the first order in the questions raised by contemporary critics of Darwinism and ID advocates, leaders of the scientific establishment have portrayed all dissent as yet another head of the hydra of "fundamentalism." A good example of this reaction can be seen in a recent essay by Donald Kennedy. Kennedy, president emeritus of Stanford and professor of environmental science, is one of the authors of a pamphlet on teaching evolution published by the National Academy Press. His essay in the *Chronicle of Higher Education* focuses attention on a need for evolution to be taught more widely than it currently is: "it is disheartening that in many parts of the United States, high-school science classes do not teach about evolution at all, or discuss it only briefly."<sup>51</sup> Kennedy raises a number of excellent points.

First, citing Dobzhansky's famous maxim that nothing in biology makes sense except in the light of evolution, Kennedy points out that "evolution is as basic to the rest of biology as atomic structure is to physics." Although design scholars challenge Dobzhansky's maxim, they do not dispute that a thorough knowledge of evolution and of neo-Darwinism is central to understanding the discourse of contemporary biology. Various versions of ID and various versions of evolutionary naturalism have shared a complex yin/yang relationship for the 2,500 years of Western intellectual history. Facets of both are vibrantly in play in Darwin's seminal text.<sup>52</sup> In insisting that a knowledge of evolution is necessary if high school students are to achieve scientific literacy, Kennedy is on the mark.

Second, Kennedy and his colleagues at the National Academy of Sciences (NAS) have set a worthy example in the time and attention they have devoted to improving the quality of high school teaching. Their effort to disseminate knowledge of evolution underscores a need for closer cooperation between university scholars and teachers on the front line of

education, all of whom face exceptional challenges in teaching controversial material in whatever field.

Third, Kennedy not only notes that "evolution is not an easy topic to teach well" but perceptively identifies two reasons, intrinsic to the subject, why that is so. One difficulty is "that the theory of evolution depends largely on inference," and another is that the term *theory* has different meanings in popular and learned discourse. In popular discourse, as Kennedy notes, *theory* often means "little more than an idea"; in science, however, "a theory is an explanation supported by a variety of observations and tests." As pointed out in the previous section, a host of productively contested issues about "theory" and "inference" are robustly at play in Darwin's text.

Finally, Kennedy notes the importance for science educators to approach the religious convictions of students with sensitivity. Referring to what he has learned from his own encounters with educators who disbelieve in evolution on religious grounds and noting particularly a debate he had with two such teachers on *The News Hour with Jim Lehrer*, Kennedy observes, "Perhaps the most useful lesson of these and other discussions is how important it is for scientists to treat religious conviction with respect." Despite the excellence of these points, Kennedy's essay is on balance disquieting.

First, consider Kennedy's philosophy of education. The NAS booklet was necessary, Kennedy affirms, because "in the United States, religious opposition to teaching evolution is deeply rooted and growing stronger." Rather than consider, in a dialectical spirit, how those disaffected with evolution might be engaged, Kennedy reacts defensively. The aim of the NAS pamphlet is "[t]o help teachers confront the objections of fundamentalist Christians." Here, Kennedy's essay raises a serious question of educational philosophy. Is it the business of teachers as representatives of the state to "confront" the worldviews of students with an eye to straightening them out, however mistaken, from the standpoint of the majority, those worldviews may be?

How does one apply that principle? And where does one place a limit on it? Should not biology teachers also "confront" Christian Science students with the truth of the germ-theory of disease or Jehovah's Witness students with the true facts about blood transfusion? And what of the creation accounts of Native Americans, belief in which is sometimes connected with negative attitudes toward anthropologists?<sup>53</sup> Why only certain beliefs? Why not belief in astrology? Or faith healing? And how many other scientifically "false" beliefs are common to the culture? Perhaps there should be an official government list—and science teachers should be charged to

confront them also. Given Kennedy's educational principle, education by confrontation, what prevents such a list from being drawn up?

However appropriate confrontation may be for maintaining discipline in the classroom—as, for example, when a student is disruptive or when the teacher has evidence of cheating—confrontation hardly seems an appropriate spirit for presenting subject material that, for all its scientific content, also centers on the great traditional human questions of origin, destiny, and purpose. Such questions, by their very character, are controversial in the classroom because they are controversial in the larger culture.

Kennedy's language also seems to place an ideological condition on teaching evolution. Are only biology teachers who subscribe to some authoritative version of evolution qualified to teach it? Or is it possible that evolution could be well taught even by teachers who have questions about it, the way Adam Smith might be well taught by a socialist or Marx by a free-enterpriser or Milton by an atheist? Second, Kennedy's tendency to label individuals with reservations about the received neo-Darwinian theory as opponents of teaching evolution (or even science) is clearly inaccurate. Kennedy comments favorably on his encounter with one of the other discussants on the *News Hour*: "One creationist was a very thoughtful young teacher from a Christian high school, who professed admiration for the NAS booklet and said that he had no problem with crediting small biological changes to evolution, but that he thought evolutionists hadn't given satisfactory accounts of big biological changes." How do "thoughtfulness," "admirability for the booklet," possibly even use of it to explicate the received view in his classes constitute opposition to teaching evolution? From Kennedy's description, it sounds as though this teacher was simply unconvinced; he did not believe that the processes explaining microevolution were adequate to account for macroevolution. As long as his students understood what the processes of variation, inheritance, and natural selection were and why they were accepted by the larger scientific community as an explanation for the development of unlimited biological novelty, what of it? Having learned reflection from their reflective teacher, some of this teacher's students may go on, as did Darwin in a similar milieu, to discover that they think differently, while others may, on further reflection, decide that their teacher was right to begin with. Here Kennedy appears less concerned with the effective teaching of evolution than with getting teachers who might read the NAS booklet, and especially students, to subscribe to the received theory. Clearly scientific literacy in a modern democratic society requires that students *understand* the theory of evolution. But does it

also require that students believe the theory? Is a pedagogical policy designed to produce intellectual assent, even belief, consistent with our liberal traditions?

Third, Kennedy incorrectly equates all attempts to challenge the theory, or to modify the way it is taught—central aims of the ID movement—with a sectarian religious agenda. Kennedy is quick to point to *Edwards v. Aguillard*, in which the court held that an Arkansas state law requiring that evolution be taught only in conjunction with creation science constituted "an impermissible endorsement of religion." Yet as David DeWolf and his colleagues make clear in a subsequent essay, there are clear legal, scientific, and methodological differences between the theory of intelligent design and creation-science. Further, the recent unanimous decision by the Ohio State Board of Education requiring students to learn about scientific criticism of evolutionary theory clearly illustrates that the public, and its leaders, increasingly understand the difference between using science to teach religion and allowing teachers to use critical questioning to teach science. Many leading and philosophically informed science educators (none of whom are associated with the ID movement) are now making very similar points.

For example, in a series of major essays, William Cobern has offered an unsparring critique of the philosophy of science that informs most science teaching.<sup>54</sup> Drawing on deep and well-established literature in the field of science education, Cobern describes most science teaching as based on "the myth of school science"—an amalgam of "classical realism, philosophical materialism, strict objectivity, and hypothetico-deductive method."<sup>55</sup> Along with various colleagues of his, he has begun to outline an alternative philosophy and curricular strategy. While a thorough discussion of Cobern's views is beyond the scope of this essay, we will mention a number of important points that he raises.

First, Cobern critiques the positivist dichotomy between knowledge and belief that characterizes most presentations of the nature of science in the school curriculum and emphasizes that all science requires presuppositions and assumptions. Cobern repeatedly stresses that these assumptions are pedagogic keys to making students partners in their own learning. In an essay coauthored with Cathleen C. Loving, "Defining 'Science' in a Multicultural World: Implications for Science Education," Cobern and Loving argue for the integrity of science as a way of knowing. They also argue for the importance of presenting it in the context of an epistemic pluralism that avoids—and indeed critiques—relativism. Cobern critiques the often

heard justification for teaching Darwinism dogmatically—that the theory is not controversial among scientists—by emphasizing the overlooked, and highly relevant, educational point that it is very controversial among students and with the larger culture. Cobern stresses that the controversial character of evolutionary theory among students has implications for their *learning* of it as well as for the way it is taught.<sup>56</sup> Cobern points out that many students simply do not believe in evolution—and that they are not likely to learn much about it either unless they learn more about what a theory is, how a theory comes to gain credibility, and how science relates to other great questions of life. Cobern argues that if science educators want to make teaching evolution a futile exercise, the current approach (even when supplemented with more, and clearer, presentation of facts such as those manifest in Kennedy's otherwise welcome pamphlet) will do the job. Only frank, open, historically and critically informed dialogue between students and teachers about how scientific theories are constructed and how they relate to the rest of life—in short, science taught as a fully invested branch of a liberal, humanistic education—will facilitate the higher order learning required for students to understand evolution.

Cobern is not alone in his advocacy of the presentation of historically grounded understandings of opposite points of view to teach Darwin's theory. In an essay entitled "Learning about Evolution: A Special Case of Intentional Conceptual Change," Cobern's science education colleagues, Sherry Southerland and Gale Sinatra underscore the difficulty of teaching evolution when students perceive it to conflict with their prior beliefs.<sup>57</sup> Rather than "confront" students in the spirit of Kennedy's approach, Southerland and Sinatra challenge the reigning educational model and urge an approach that enlists the "intentional beliefs" of the students about the nature of scientific knowledge and their willingness to question ideas (both their own and those commonly received as scientific) in the process of learning about evolution. Their approach includes role-playing, dramatizing the controversy, and the use of controversial readings in natural history accompanied by small group discussions.

In a paper similarly exploring "Knowledge, Belief, and Understanding in Science Education," Collin Gauld recommends that "[i]n the case of issues which are expected to be controversial, understanding the alternative positions of various stakeholders can be a prelude to the students choosing between them." Thus, he suggests that "care should be taken to ensure students understand the various positions before encouraging them to make a choice based on what they think is reasonable evidence."<sup>58</sup> He, as

well as Southerland and Sinatra, emphasize teaching students skills in argumentation and discussion, encouraging them to critique both the knowledge claims of science and of commonsense reasoning, and enabling them to understand competing perspectives.

That professional science educators, none of whom are associated with ID (and for all we know may be critical of it) would come to the same conclusions as ID advocates about how best to teach evolution is not surprising. The idea of teaching in *utramque partem* is arguably the oldest idea in our common educational tradition. Darwinism and design theory are clearly opposed philosophically and scientifically; however, considered from an educational standpoint each competing perspective is half of an ancient, unbreakable dialectical pair. The entangled roots of this pair run deep in our common tradition of education, science, theology and philosophy. Whatever the rising or waning fortunes of either hypothesis during one or another historical period, these two perspectives are sisters. They will likely continue their complex antagonistic relation into distant futurity—if for no other reason than that each requires knowledge of the other to define and explain itself.

Thus, contra Kennedy, the issue is not the intrusion of religion into scientific matters. The issue is the educational importance of acknowledging the scientific, philosophic, and theological questions raised by Darwinian evolution as matters for critical awareness, understanding, and individual judgment in the spirit of consumer protection. That evolutionary theories entail metaphysical commitments and make philosophic assumptions is a truth not in philosophic dispute. If scholars know this, why shouldn't the public be informed? And their children? The work of Cobern, Loving, Southerland, Sinatra, Gauld and their colleagues suggests that science education, like science itself, may soon be self-correcting.

Indeed, biology education needs an overhaul such as this since the philosophical and worldview issues arising from the teaching of evolution are not likely to go away any time soon. There are several reasons for this.

First, and most important, these issues will not go away because, as pointed out earlier, they are part of Darwin's text and part of his continuing legacy. The structure of Darwin's argument, in every chapter of the *Origin* without exception, is given as a debate or dialogue with various kinds of "design" arguments—from outright immediate young-earth creation, which Darwin along with most of his audience rejected, to more sophisticated versions, at least one of which he may have recommended. Certainly it is not the business of pressure groups with special agendas to set the



science curriculum. By the same token, it is not the business of science educators to pronounce on metaphysical issues or pretend that they do not exist or have been resolved by empirical research. When Kennedy comments, "Few scientists would object to creationist views expressed only from the pulpit," he is less reassuring than perhaps he intended to be about the neutrality of his colleagues toward such questions. Clearly he seems less informed than he ought to be about the general theological content in the *Origin*—and of the continuing philosophical disputes it engenders.

Second, if the opposition to evolution from popular religion sets the United States apart from other countries where evolution is more widely taught, the reason is closely connected with other historical differences that make our culture unique. Though Thomas Jefferson was certainly not orthodox Christian, when he sponsored the disestablishment of the Anglican Church in Virginia he inadvertently fertilized the ground that later would nourish our long-standing dispute about evolution.<sup>59</sup> Left to survive or perish according to their ability to garner support from the voluntary gifts and free association of individuals, and unencumbered by association with the state, democratically organized forms of religion became central to the American national character.<sup>60</sup> Tocqueville noticed the depth of religious belief in America and its institutionally independent form; he counted our religious faith as one of the great bulwarks of the celebrated American experiment in democratic freedom and civic order.<sup>61</sup>

It is hardly remarkable that large, impersonal, state-sponsored science, which has grown exponentially since World War II, should inherit something of the historic American distrust of centralized authority. That is particularly true when representatives of that authority use it to teach a grand master-narrative encompassing everything that is, including humanity's place in the scheme of things. And should we not distrust teaching young students to cultivate passive unquestioning minds concerning the assumptions, methods, and conclusions of so-called scientific authority?<sup>62</sup> In a country where religion is taken seriously and rests on a popular and independent foundation, science teaching of the totalitarian kind that Kennedy seems to have in mind stirs up the deep American suspicion of authority once reserved for state-sponsored hierarchies, whether temporal or spiritual.

Finally, philosophical and theological issues will not go away because suspicion that Darwinian evolution is ideologically rooted is justified. Darwinism's lack of ideological neutrality has been documented in meticulous, up-to-date, and indisputable detail.<sup>63</sup> Kennedy is particularly sensitive to this issue, as indicated by his response to another panelist on the *News Hour*

show. Unlike the discussant who approved of the NAS pamphlet while dissenting from it, another guest on the program, "a dean at a fundamentalist Christian university," was not at all impressed with the NAS booklet; he said that "evolutionists were 'brainwashing' their students while supported by tax dollars." Kennedy "found particularly telling his charge that many evolutionary biologists are atheists; the claim that scientists (and thus science) are inherently anti-religious is a perennial feature of the creationist case."

By coincidence, a few weeks prior to the appearance of Donald Kennedy's essay in the *Chronicle of Higher Education*, historian Edward Larson (winner of a Pulitzer Prize for his book *Summer for the Gods*, exposing the antislavery "Inherit the Wind" myth surrounding the Scopes Trial) and coauthor Larry Witham reported on the second phase of their study duplicating a famous survey done in 1914 and again in 1933 by James Leuba on the religious beliefs of American scientists.<sup>64</sup> In 1914, Leuba found that "58 percent of 1,000 randomly selected U.S. scientists expressed disbelief or doubt in the existence of God, and that this figure rose to near 70 percent among the 400 'greater' scientists within his sample." When Leuba repeated his study in 1933, he found that "these percentages had increased to 67 percent and 85 percent, respectively." When Larson and Witham repeated Leuba's 1914 study in 1996, they found "little change from 1914 . . . 60.7 percent expressed disbelief or doubt." When Larson and Witham repeated the second phase of Leuba's 1914 survey among "greater scientists," they found the rate of belief "lower than ever—a mere 7 percent of respondents." Leuba, as Larson and Witham note, "attributed the higher level of disbelief and doubt among 'greater scientists' to their 'superior knowledge, understanding, and experience.'"

Of the first stage of the Larson and Witham study, Oxford University scientist Peter Atkins had remarked, "You clearly can be a scientist and have religious beliefs. But I don't think you can be a real scientist in the deepest sense of the word because they are such alien categories of knowledge." Atkins's comment helped motivate Larson and Witham to redo the second stage of Leuba's 1914 survey of "greater" scientists. They selected as their sample group the distinguished organization of which Kennedy is a member:

Our chosen group of "greater" scientists were members of the National Academy of Sciences (NAS). Our survey found near universal rejection of the transcendent by NAS natural scientists. Disbelief in God and immortality among NAS biological scientists was 65.2 percent and 69 percent

respectively, and among NAS physical scientists, it was 79 percent and 76.3 percent.

Of particular significance to our present concerns was this finding: "Biological scientists had the lowest rate of belief (5.6 percent in God, 7.1 percent in immortality), with physicists and astronomers slightly higher (7.5 percent in God, 7.5 percent in immortality)."

Larson and Witham's concluding observation could not be more pertinent to Kennedy's claim of religious neutrality for evolution:

As we compiled our findings, the NAS issued a booklet encouraging the teaching of evolution in public schools, an ongoing source of friction between the scientific community and some conservative Christians in the United States. The booklet assures readers, "Whether God exists or not is a question about which science is neutral." NAS President Bruce Alberts said: "There are many outstanding members of this academy who are very religious people, people who believe in evolution, many of them biologists." Our survey suggests otherwise.<sup>65</sup>

Active hostility toward conventional theism (or, for that matter, philosophic theism) is almost a hallmark among evolutionary biologists and their philosophic allies: Daniel Dennett, William Provine, Richard Dawkins, E. O. Wilson, Richard Lewontin, and Stephen Pinker, to name a few, may not be household words, but they are hardly obscure figures in their respective fields.<sup>66</sup> Only six months before Kennedy's editorial appeared, William Provine, professor of the history of biology at Cornell, gave the 1998 keynote address at the Darwin Day celebration at the University of Tennessee. In his address, Provine asserted that evolution had buried any gods worth having and that "evolution is the greatest engine of atheism ever invented."<sup>67</sup> If, as Kennedy says, it is part of the creationist case to imply that evolution is irreligious, we find here solid agreement between opposed camps.

Militant atheism is an overt and inescapable inference of the evolutionist case as set forth by many of evolution's most distinguished public defenders. Those who recommend temporizing positions are met, at best, by "mild amusement" from their peers.<sup>68</sup> To pretend that evolutionary science, as understood by the vast majority of its most accomplished advocates, is religiously neutral will advance neither the public understanding of science nor the public discussion of the values and assumptions that inevitably inform its teaching.<sup>69</sup>

### ***Intelligent Design, American Pluralism, and Teaching the Controversy***

Donald Kennedy's position on evolution—to respond to all dissent on the part of students with "confrontation," and to regard any attempt to question evolution as a form of opposition to authoritatively certified truths of science—is hardly unique to him. Kennedy mirrors a philosophy of education still widely practiced and often articulated by many official spokesmen for science. It stands in sharpest contrast not with American "fundamentalism" but with the philosophy of education common to academics in the humanities. The tension between these two approaches has been carefully documented in a study by Martin Eger on the contrast between assumptions governing the teaching of science and assumptions reigning in the humanities. Eger's little-known essay is titled "A Tale of Two Controversies: Dissonance in the Theory and Practice of Rationality."<sup>70</sup>

Eger documents how, following the precepts of Mill's *On Liberty*, contemporary educational theorists Clive Bell and Lawrence Kohlberg have urged the importance of critical questioning as the ground of reason.<sup>71</sup> According to that line of thought, it is not enough that a person have a correct moral belief if that belief, and the orientation that underpins it, abides in the individual's mind as a prejudice. The important point is for the individual to be able to defend his or her beliefs. In geometry, it is not enough for an individual to know the answer to a problem without knowing how to perform the proofs; in ethics, it is not enough to know what is right and wrong without being able to say why. Clearly this position, that students be able to defend their ethical commitments, is closely connected with a second position: that students be able to consider alternatives, even radical, immoral, or socially unacceptable alternatives to present ethical practices.

Why teaching along those lines would create friction with parents should be clear. Such classroom practice, supported by the disciplinary theory, places a wedge between the moral education offered by the home and the moral education offered by the school. The parental burden—to encourage the child to develop a moral point of view, subscribe to particular ethical precepts, and follow prescribed models of conduct—is undermined when the school urges students to question those precepts and consider alternatives to those models. It can hardly be a source of delight to educational theorists or classroom teachers that such practice has placed schools and families at odds for over a decade. As Eger documents, the reason why educators, backed by the power of the state and the courts, insist on an

educational program guaranteed to be controversial and divisive is because fundamental issues are at stake.<sup>72</sup> Following Mill, it is a fundamental and settled conviction of educators that reason is a better alternative to decision-making than tradition or prejudice and that critical questioning and the consideration of alternatives are the defining characteristics of reason in ethical decision-making and values clarification.

Clearly, much in the pedagogical program could be improved. From the standpoint of ethical reason in the tradition of Aristotle and Edmund Burke, before one can reason about ethics one must first have a foundation of prior experience—or reason has nothing to work with. Burke's comment that through "just prejudice" an individual's virtue becomes part of that person's habit is as true now as it always was. To reason well on ethics one must have experience. But as Burke also remarked, when one reflects on traditional conduct, one will often discover its rationale and reaffirm the "just prejudice" along with the reason for its existence.<sup>73</sup> Many objections to ethics programs in public schools could be addressed by expanding what constitutes a good reason to include using "common sense" and respecting the advice of parents, spiritual leaders, experienced persons, and the testimony of traditional moral precepts. Defects of ethics programs, however serious, are, within age-appropriate limits, remediable, and their principle is worth defending. The pluses of an ethics education program are that it is based on argument; it offers training in seeing and discovering opposite points of view; and it encourages students to find and weigh evidence, to offer reasons, and to think for themselves.

In the teaching of science, particularly in biology, Eger finds a remarkably contrasting model. When it comes to science pedagogy, the advocates of contemporary neo-Darwinism sound like the parents complaining about the morally corrosive effects of the ethics curriculum. Philip Kitcher and Michael Ruse, two prominent defenders of orthodox Darwinism, urge that the very idea of exposing scientifically untrained minds to questions regarding a choice between evolution and "creationism" is a dereliction of educational duty. As Ruse puts it, "Teaching scientific creationism will stunt abilities in all areas. . . . Thus I say keep it out of the schools."<sup>74</sup>

What is of interest in these two cases is their agonistic symmetry. The mark of reason in one model is the criterion of unreason in the other. For educational ethicists, the giving of reasons for every belief differentiates reason from unreason. For educational theorists of science, the unquesting mastery of a prior system is the precondition for proper understanding. In ethics, consideration of unorthodox or conventionally

unacceptable alternatives (for instance, that dishonesty might be the best policy) is to be met without prejudice. In science, by contrast, even permitting the bare impression that there might be some arguments in favor of creationism—or in the present case, of ID—is a dereliction of educational responsibility.

Again, for ethical reasoning, training of the mind requires that students realize that something can be said in favor of almost any position. For science, any argument in favor of alternatives to current neo-Darwinian orthodoxy is false—in advance—and education consists in recognizing that fact, whether one knows the reason why or not.

Before the work of Thomas Kuhn focused attention on the logic of scientific revolutions, before the rise of the "rhetoric of science" movement, one might have claimed that the methods one follows in "science" and the methods one follows in ethics and the humanities are completely different. That position will no longer wash, and everyone conversant with contemporary work in the history and philosophy of science knows it.<sup>75</sup> Darwin himself pointed out that the kind of reasoning presented in the *Origin* is the reasoning of everyday life, and it was on that standard he would have his argument judged.<sup>76</sup> Anyone doubting that Darwin was right—that "science" (for all its emphasis on universality) follows methods of deliberation parallel to those of law, ethics, or practical reason—should read Marcello Pera's *Discourses of Science*.

We now come to the crux of the matter as set forth in Eger's essay and to the potential educational pertinence of ID. The impasse between present programs for teaching critical reason in ethics and the outright deliberate prohibition of critical questions in the teaching of Darwinism represents a fundamental incoherence in the model of reason presented in public schools. What kind of thinking has led to this impasse? The impasse has been created by the myth of "two cultures" and a positivist folk tale of a unique "scientific method" hermetically sealed off from ordinary life and the demands of practical reason, value, and philosophic perspective. The challenge before us now, as parents, teachers, academics, people of all faiths or of none, is to use what we know to develop alternatives to the present system. That system, which produces needless social conflict, is politically unsustainable, intellectually bankrupt, and ethically indefensible.<sup>77</sup>

As Richard Rorty has pointed out in *Achieving Our Country*, the time has come for new thinking on the part of American progressives—and by extension, on the part of all Americans of good will.<sup>78</sup> Ordinary citizens as well as academics have an important role to play in developing a revitalized

progressive politics, by developing creative new policies and bold unorthodox citizen-coalitions to help bring them about. Communication scholars and science educators could play a major role in exposing and offering concrete alternatives to disastrous public policies that continue to block accurate public understanding of science. Those who wish to return biology to its true Darwinian roots as a liberal study should not be stigmatized as bigots. It is not enough for academics to understand that positivism is false or wrong. The point is to enter the political arena with concrete alternatives, and through civic discourse improve science education and the public understanding of science.

Speaking as a citizen and drawing on what I have learned as a rhetorical educator and rhetorician of science, I offer three suggestions to help move the discussion forward:

First, the starting point for discussion of reform of science teaching should be Eger's diagnosis of a fundamental incoherence in American education. If Eger has demonstrated anything, it is that scientism has not served science education well. It has separated science from its history and roots in liberal education and wedded it to a dogmatic materialist ideology incompatible with the values of a democratic and pluralistic culture. The answer to dealing with philosophic or theological problems posed by the teaching of biology is not, as currently mandated in California, to have science apparatuses tell dissenting students that belief in the God of traditional theism is private and subjective with no basis in objective reality.<sup>79</sup> Of course, science teachers should not teach (in the sense of inculcating) "theism," or naturalism, or pantheism—except as philosophies relevant to the scientific subjects at hand and contested by other philosophies.<sup>80</sup>

But to discuss relevant presuppositions and possible philosophical implications of scientific theories, and to point out how different scientists and philosophers of science draw different conclusions about design in nature, would seem to be nothing other than basic liberal education and common sense.<sup>81</sup> At present, such a thought is very controversial.

Second, parents and concerned citizens need to be brought into the discussion about science education in some venue other than the courts. Laypeople have not been well served by experts in this matter. Philip Kitcher in his otherwise excellent essay on Darwin, "Persuasion," does not hesitate to justify lying to the public for its own good if that is what it takes to conceal the antitheistic implications of the Darwinian paradigm.<sup>82</sup> Michael Ruse—whose style, person, and writings are a delight—invented the rationale of the Overton decision in the Arkansas creation-science trial

to fit the criteria for a winning case as specified by his American Civil Liberties Union (ACLU) handlers. His position is a laughingstock among his professional peers and an ethical and conceptual embarrassment to his profession. Although he has staunchly defended his actions in the Arkansas case, to his great credit he has published an anthology of basic documents about the case and its philosophic aftermath in which he has allowed the weakness of his own defense to shine through in the devastating clarity of his colleagues' unanswered rebuttals.

As I have written in a review of Ruse's *But Is It Science?* the philosophy of science offered in his deposition and in his testimony on the stand is at odds with his published work.<sup>83</sup> When speaking to a learned audience in the German Democratic Republic (GDR) the month before his deposition in Little Rock, Ruse ridiculed demarcationism, made particular fun of Karl Popper (an arch-demarcationist), acknowledged the philosophical and theological issues raised by Darwin's theory, and emphasized the intimate and undemarcatable association between science and culture. A few weeks later in Little Rock, Ruse strongly defended demarcationism. He invented a five-point version of it beautifully contrived to meet the demands of his immediate rhetorical situation, whatever the cost to his consistency as a philosopher. The ACLU was correct in both assumptions they made about him and the judge in the case: Ruse could be depended on to fill in the philosophic details for the legal strategy they had already decided on before he arrived in Little Rock, and Judge Overton would find his testimony persuasive.<sup>84</sup>

Anyone who wishes to learn more about what Michael Ruse thinks about science and its relation to culture and religion could scarcely do better than to read his magisterial *Mondad to Man*, the thesis of his GDR lecture expanded to just under a thousand pages.<sup>85</sup> If one is interested in a very different subject—his cultural politics—one should read his deposition in the Arkansas case. His *Mondad* book affirms in meticulously documented detail a philosophy of science at odds with every major point of his deposition. No progressive science educator and no advocate of the teaching philosophy of ID could hope to surpass Ruse in documenting the religious functions that Darwinism has performed from the nineteenth century to the present. His book is an authoritative guide for showing how easily an all-encompassing worldview grounded in "science" becomes a cult, complete with shrines and its own iconography.

As Ruse aptly notes, "Not only has evolution functioned as an ideology, as a secular religion, but for many professional biologists that has been its

primary role<sup>86</sup> Venue relativism—positivism for the masses and constructivism for the elite—is an unstable position rhetorically, philosophically, and ethically. In a welcome development, Ruse seems to have publicly disavowed the defining tenet of the demarcationist position offered in his Arkansas testimony. “I think that philosophically one should be sensitive to what I think history shows, namely, that evolution . . . akin to religion involves making certain a priori or metaphysical assumptions, which at some level cannot be proven empirically.”<sup>87</sup>

Third, the innovative pedagogical ideas of Cobern, Southerland, and others and new pedagogic experiments should be tried. Recently, I learned of a new course being offered for the first time at Michigan State University. The course seems to be well designed to address interpretive questions raised by evolutionism and to provide a good model for the kind of approach that could work well in high schools. The course, “Critical Analysis of Controversies in Evolution,” is taught by James Smith, an evolutionary biologist. Its units include a class discussion entitled “Is Behe Correct? Is Darwin Correct?” Part of the assignment for that session reads, “Summarize the evidence used to support and refute Behe’s concept of Intelligent Design.” Coming as the unit does after earlier ones in which the details of Darwinism and evolutionism are carefully studied, Smith’s syllabus shows how learning real science can be part of a truly liberal education.<sup>88</sup>

Nothing as situationally sensitive as teaching can hope to find a single model equally appropriate to all contexts. What is needed as our culture moves out from beneath the epistemic tyranny of positivism and as we begin to repair the deep social damage that tyranny has done to science (in its conduct, teaching, and public understanding) is to recover the capacity to think clearly about public education.

A model for presenting controversial material without teachers either “confronting” dissenting students with the “correct” answer or backing down from teaching the best current evidence and theories is given in Gerald Graff’s *Beyond the Culture Wars: How Teaching the Conflicts Can Revitalize American Education*.<sup>89</sup> Though his book is not aimed at the teaching of science and his insights, like those of James Smith and others, would need to be adapted for high school courses, Graff’s perspective is profoundly consonant with the central insight of contemporary scholarship in the history and philosophy of science. Science is, among other things, a series of controversies over great scientific questions as well as an activity that is deeply enmeshed in culture and informed by contestable philosophic assumptions. Graff is clear that “teaching the conflicts has nothing to do with

relativism or denying the existence of truth.” Quite to the contrary, Graff emphasizes the importance of critical examination of difference as truth’s first and best line of defense: “The best way to make relativists of students is to expose them to an endless series of different positions which are *not* debated before their eyes. Acknowledging that culture [read science] is a debate rather than a monologue does not prevent us from energetically fighting for the truth of our own convictions [or from defending the received view]. On the contrary, when truth is disputed, we can seek it only by entering the debate—as Socrates knew when he taught the conflicts two millennia ago.”<sup>90</sup>

Donald Kennedy is right. Not to know the theory of evolution is to be scientifically illiterate. Beyond that, not to know evidential challenges to the theory, that the theory requires assumptions, carries philosophic implications, is open to different interpretations, and in the end is subject to the attrition of time and the inevitable convulsion of scientific revolution is also to be scientifically illiterate.

## Notes

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2. S. Sambursky, *The Physical World of the Greeks*, translated from the Hebrew by Merton Dugut (New York: Collier Books, 1962), 126–28; Benjamin Farrington, *Greek Science* (Baltimore: Penguin Books, 1963), 58–65, 144–48; F. M. Cornford, *Before and After Socrates* (Cambridge: Cambridge University Press, 1972), chap. 1, esp. pages 25–28, and chap. 4, esp. pages 99–109. See Collingwood, *Idea of Nature*, esp. the

introduction, pages 155–57, and conclusion. See also Daniel O'Connor, "Two Philosophies of Nature," in O'Connor and Oakley, *Creation*, 15–28; G. S. Kirk, "Natural Change in Heraclitus," in Mourelatos, *Pre-Socratics*, 189–96; W. K. C. Guthrie, "Flux and Logos in Heraclitus," in Mourelatos, *Pre-Socratics*, 214–28. The utility of the concept of mind and of form suggesting mind for morphology is well noted by E. S. Russell, *Form and Function: A Contribution to the History of Animal Morphology* (Chicago: University of Chicago Press, 1982), 1–16.

3. For the key role of the biblical idea of a divine creator in the development of Western science, see O'Connor and Oakley, *Creation*; see also David C. Lindberg and Ronald L. Numbers, *God and Nature: Historical Essays on the Encounter between Christianity and Science* (Berkeley: University of California Press, 1986). On medieval science and on the continuities and discontinuities between medieval and modern science, see A. C. Crombie, *Medieval and Early Modern Science*, vol. 1, *Science in the Middle Ages: V–XIII Centuries* (Cambridge: Harvard University Press, 1963), esp. 172–74; A. C. Crombie, *Medieval and Early Modern Science*, vol. 2, *Science in the Later Middle Ages and Early Modern Times: XIII–XVII Centuries* (Cambridge: Harvard University Press, 1963), 285–333. For the changing view of material self-sufficiency and design since the rise of modern science, see Richard S. Westfall, *Science and Religion in Seventeenth-Century England* (New Haven, Conn.: Yale University Press, 1958); Allen G. Debus, *Man and Nature in the Renaissance* (Cambridge: Cambridge University Press, 1978), 99–100 and chaps. 7 and 8; E. A. Burt, *The Metaphysical Foundations of Modern Science* (Garden City, N.Y.: Doubleday Anchor Books, 1954), esp. 25–35, 303–25; Hookeyaas, *Religion*, 7–28, 161–62; John C. Greene, *The Death of Adam: Evolution and Its Impact on Western Thought* (Garden City, N.Y.: Mentor Books, 1961), esp. 11–24; Charles Coulston Gillispie, *Genesis and Geology: The Impact of Scientific Discoveries Upon Religious Beliefs in the Decades before Darwin* (New York: Harper and Row, 1959), esp. chaps. 1 and 8. For the impact of material self-sufficiency on the idea of "form" in biology in the nineteenth century, see Timothy Lenoir, *The Strategy of Life: Teleology and Mechanics in Nineteenth-Century German Biology* (Chicago: University of Chicago Press, 1982), esp. the introduction and chap. 1; Russell, *Form and Function*, esp. chap. 13. For a contemporary statement of similar critiques, see Hans Jonas, *The Phenomenon of Life: Toward a Philosophical Biology* (Chicago: University of Chicago Press, 1982), 38–63; Stanley N. Salthe, *Development and Evolution: Complexity and Change in Biology*

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4. Gavin de Beer, ed., *Charles Darwin and Thomas Henry Huxley: Autobiographies* (Oxford: Oxford University Press, 1983), 26.
5. Janet Browne, *Charles Darwin, Voyaging: A Biography* (Princeton, N.J.: Princeton University Press, 1995), 80–88.
6. Darwin, in de Beer, *Charles Darwin and Thomas Henry Huxley*, 31–33, 35–38; John F. W. Herschel, *A Preliminary Discourse on the Study of Natural History* (Chicago: University of Chicago Press, 1987), 16–17, 37–38.
7. Darwin, in de Beer, *Charles Darwin and Thomas Henry Huxley*, 38; Browne, *Voyaging*, 133.
8. William Paley, *Natural Theology: Or, Evidences of the Existence and Attributes of the Deity, Collected from the Appearances of Nature* (Boston: Gould and Lincoln, 1863), esp. 1–13.
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10. Darwin, in de Beer, *Charles Darwin and Thomas Henry Huxley*, 32–33.
11. *Ibid.*, 38; Herschel, *Preliminary Discourse*, esp. Part II, chaps. 4–7.
12. Francis Darwin, ed., *The Life and Letters of Charles Darwin*, vol. 2 (New York: D. Appleton, 1911), to Charles Lyell, 12 Dec. 1859: "What this exactly means I do not know, but it is evidently very contemptuous. If true this is a great blow and discouragement" (37); John Angus Campbell, "Scientific Revolution and the Grammar of Culture: The Case of Darwin's Origin," *Quarterly Journal of Speech* 72 (1986): 351–76; John Angus Campbell, "Of Orchids, Insects, and Natural Theology: Timing, Tactics, and Cultural Critique in Darwin's Post-Origin Strategy," *Argumentation* 8 (1994): 63–81; John Angus Campbell, "The Comic Frame and the Rhetoric of Science: Epistemology and Ethics in Darwin's *Origin*," *Rhetoric Society Quarterly* 24 (1994): 27–50.
13. M. J. S. Hodge, "Darwin and the Laws of the Animated Part of the Terrestrial System (1835–1837): On the Lyellian Origins of His

- Zoonomical Explanatory Program," *Studies in the History of Biology* 7 (1983): 106; David Kohn, "Theories to Work By: Rejected Theories, Reproduction, and Darwin's Path to Natural Selection," *Studies in the History of Biology* 4 (1980): 67–170.
14. John Angus Campbell, "Scientific Discovery and Rhetorical Invention: The Path to Darwin's Origin," in *The Invention and Persuasion in the Conduct of Inquiry*, ed. Herbert W. Simons (Chicago: University of Chicago Press, 1990), esp. 62–78.
15. Paul H. Barrett, Peter J. Gaurty, Sandra Herbert, David Kohn, and Sydney Smith, eds., *Charles Darwin's Notebooks, 1836–1844: Geology, Transmutation of Species, Metaphysical Enquiries* (Ithaca, N.Y.: Cornell University Press, 1987), 167–74; Kohn, "Theories," 83–95; Campbell, "Scientific Discovery," 58–68; also John Angus Campbell, "On the Way to the Origin: Darwin's Evolutionary Insight and Its Rhetorical Transformation," Van Zelt Lecture in Communication (Evanston, Ill., 1990), esp. 14–21; Manner, *The Young Darwin*, chaps. 9 and 10; Dov Ospovat, *The Development of Darwin's Theory: Natural History, Natural Theology, and Natural Selection, 1838–1859* (Cambridge: Cambridge University Press, 1981), 60–86.
16. Gavin de Beer, ed., *Evolution by Natural Selection* (Cambridge: Cambridge University Press, 1958), 45–46.
17. All citations concerning variations among the various editions of the *Origin* are from Morse Peckham, ed., "The Origin of Species" by Charles Darwin: A Variorum Text (Philadelphia: University of Pennsylvania Press, 1959), 40.
18. *Ibid.*, 40, 57.
19. Single individual citations from the *Origin* will be from Charles Darwin, *On the Origin of Species: A Facsimile of the First Edition with an Introduction by Ernst Mayr* (Cambridge: Harvard University Press, 1964), 31, 34–36.
20. *Ibid.*, 44, 50, 51, 56.
21. *Ibid.*, 52–53, 55.
22. *Ibid.*, 60–61.
23. *Ibid.*, 77–79.
24. *Ibid.*, 83, 84.
25. A. R. Wallace to Darwin, 2 July 1866, in Francis Darwin, ed., *More Letters of Charles Darwin*, vol. 1 (New York: D. Appleton, 1903), 267–70.
26. Jane Loring Gray, ed., *The Letters of Asa Gray*, vol. 1 (Boston: Houghton, Mifflin, 1893), 321; A. Hunter Dupree, ed., *Darwiniana by Asa Gray* (Cambridge: Harvard University Press, 1963), 46, 51–71, 72–142.

27. Darwin, *Life and Letters*, vol. 1, 5 Apr. 1859, 510-11; Darwin, *Origin*, 111-25.
28. Campbell, "Comic Frame," esp. 41-46.
29. For a good account of the difference between "how possibly" versus "how actually" thinking in evolutionary biology and for how virtually the whole of the *Origin* is one long "how possibly" argument, see Robert O'Hara, "Homage to Clio, or, Toward an Historical Philosophy for Evolutionary Biology," *Systematic Zoology* 37 (1988): 142-55.
30. Darwin, *Origin*, 167.
31. Although I cannot here give full documentation, by my count, excluding the flyleaf citations, there are 108 references to "creation" or related terms for the action of God in the first edition of the *Origin*—including the term *mystery*. Here I give only the chapter, the raw number, and characteristic terms: Introduction = 3 "mystery of mysteries, created"; chap. 1 = 0; chap. 2 = 3 "created, creation"; chap. 3 = 0; chap. 4 = 3 "creation, created"; chap. 5 = 12 "creation, created"; chapter 6 = 7 "created, creation"; chap. 7 = 1 "endowed"; chap. 8 = 13 "endowed, specially acquired or endowed, mysterious"; chap. 9 = 1 "created"; chap. 10 = 2 "act of creation, gratuitous mystery"; chap. 11 = 12 "creation, created"; chap. 12 = 11 "independent creation, theory of creation"; chap. 13 = 11 "Creator, Plan of the Creator"; chap. 14 = 29 "special endowment, suddenly created, independent acts of creation."
32. For an excellent discussion of theological thought in Darwin's work, see Neal C. Gillespie, *Charles Darwin and the Problem of Creation* (Chicago: University of Chicago Press, 1982).
33. Darwin, *Origin*, 171.
34. For a more detailed analysis of the strategy of these chapters, see Campbell, "Comic Frame," 41-46.
35. Darwin, *Origin*, 180-81.
36. *Ibid.*, 186, 189.
37. *Ibid.*, 311.
38. *Ibid.*, 411.
39. *Ibid.*, 459.
40. *Ibid.*, 486.
41. Charles Darwin, *Journal of Researches into the Geology and Natural History of the Various Countries Visited by H.M.S. Beagle*, 1st ed. facsimile reprint (New York: Hafner, 1952), 226-30, 234-37.
42. Darwin, *Origin*, 490.

43. Peckham, *Vorticism*, 759.
44. Darwin, *Life and Letters*, vol. 2, 29 Mar. 1863, 202-3.
45. John Angus Campbell, "The Invisible Rhetorician: Charles Darwin's 'Third Party' Strategy," *Rhetorica* 7 (winter 1989): 60-63; Darwin, *More Letters*, vol. 1, 163-64, 190-93.
46. Campbell, "Invisible Rhetorician," 72-73.
47. Darwin, in de Beer, *Charles Darwin and Thomas Henry Huxley*, 50-51.
48. *Ibid.*, 54.
49. Donald Flemming, "The Centenary of the Origin of Species," *Journal of the History of Ideas* 20 (1959): 442-43.
50. Daniel C. Dennett, *Darwin's Dangerous Idea: Evolution and the Meanings of Life* (New York: Simon and Schuster, 1995), 61-84.
51. Donald Kennedy, "Helping Schools to Teach Evolution," *Chronicle of Higher Education* (7 Aug. 1998), Opinion Page: A48.
52. Browne, *Voyaging*.
53. Leslie Alan Horvitz, "Indians and Anthropologists Are Bawling Over Old Bones," *Washington Times*, 18 Nov. 1996.
54. William W. Cobern, "Point: Belief, Understanding, and the Teaching of Evolution," *Journal of Research in Science Teaching* 31 (1994): 583-90; Cobern, "Science Education as an Exercise in Foreign Affairs," *Science and Education* 4 (1995): 287-302; Cobern, "The Nature of Science and the Role of Knowledge and Belief," *Science and Education* 9 (2000): 219-46; William W. Cobern and Cathleen C. Loving, "Defining 'Science' in a Multicultural World: Implications for Science Education," *Science and Education* 85 (2000): 50-67.
55. Cobern, "The Nature of Science and the Role of Knowledge and Belief," 233.
56. Cobern, "Science Education as an Exercise in Foreign Affairs," 290-94.
57. Sherry A. Southerland and Gale M. Sinatra, "Learning about Biological Evolution: A Special Case of Intentional Conceptual Change," in *Intentional Conceptual Change*, ed. Gale M. Sinatra and Paul R. Pintrich (New York: Academic Press, 2003).
58. Colin Gauld, "Knowledge, Belief, and Understanding in Science Education" (paper presented at the sixth International History, Philosophy, and Science Teaching Conference, Denver, Colo., November 2001), 5.
59. For an extremely valuable discussion of this point, see George M. Marsden, *The Soul of the American University: From Protestant Establishment to Established Nonbelief* (New York: Oxford University Press, 1994), 327-30. Marsden draws particular attention to Walter Lippmann's



probing reflection on the Scopes trial in *American Inquisitors* and how Lippmann grasped the Jeffersonian tension in Bryan between refusal to support with one's tax dollars an abhorrent system of ideas and majority rule.

60. Arthur Schlesinger Jr., "The Age of Alexander Campbell," *Restoration Review* 1 (1959): 136–51.

61. Alexis de Tocqueville, *Democracy in America*, trans. George Lawrence (Garden City, N.Y.: Doubleday Anchor Books, 1969), 287–300. The parallel between those Euro-centric thinkers of de Tocqueville's day and those of our own time who deplore American religiosity—always from the standpoint of a materialist metaphysic—has to rank as one of the great continuities of American intellectual history. "But our pedants find it an obvious mistake; constantly they prove to me that all is fine in America except just that religious spirit which I admire; I am informed that on the other side of the ocean freedom and human happiness lack nothing but Spinoza's belief in the eternity of the world and Gahanis' contention that thought is a secretion of the brain. To that I have ready no answer to give, except that those who talk like that have never been in America and have never seen either religious peoples or free ones" (Tocqueville, *Democracy in America*, 294).

62. Stuart W. Leslie, "Science and Politics in Cold-War America," in *The Politics of Western Science: 1640–1990*, ed. Margaret C. Jacob (Atlantic Highlands, N.J.: The Humanities Press, 1992), 199–233; Ruse, *Monad to Man*.

63. Ruse, *Monad to Man*.

64. Edward J. Larson, *Summer for the Gods: The Scopes Trial and America's Continuing Debate over Science and Religion* (New York: Basic Books, 1997); Edward Larson and Larry Witham, "The More They Learn The Less They Believe," *Nature* 394 (June 1998): 313. See also story in the *Washington Times*, 30 July 1998.

65. Larson and Witham, "The More They Learn."

66. The case of Stephen Jay Gould, the obvious name missing from this list, is instructive. Gould's position on the worldview issue is politic. Unlike Dawkins and Dennett, Gould does not make a career of bashing theists. In his "Nonoverlapping Magisteria: Science and Religion Are Not in Conflict for Their Teachings Occupy Distinctly Different Domains," *Natural History* (Mar. 1997), Gould leaves science to deal with reality and religion and philosophy to address everything else. For a philosophic critique of the stance embodied in this position, see Craig and Smith,

*Theism; Polkinghorne, Faith; Koons, "Cosmological Argument"; and Leslie, Universes.* In this note, I can point out only that design theorists do not cede "reality" to metaphysical naturalism, content themselves with epistemic apartheid, and call it a day. The ID argument is, and has always been, that reality in all its fullness—including the physical nature studied by science—manifests marks of an intelligent designer. Theoretic reflection on design and purpose is not the property of some special domain set apart from science but an implication, however contestable, from the study of science. Gould understands this. By confining science to physical "reality" and "reality" to that which is known by the methods of the natural sciences, he makes metaphysical materialism coincident with all truly reliable knowledge. Gould's is a kinder, gentler version of the same materialist episteme he holds in common with Dawkins and Dennett. In this episteme, any affirmation of a creative intelligence in nature is a personal, aesthetic preference.

Gould's politic and hulling way of handling theists is usefully placed in perspective by the candor of his Harvard colleague Richard Lewontin in "The Demon Haunted World," *New York Review of Books*, 9 Jan. 1997: "It is not that the methods and institutions of science somehow compel us to accept a material explanation of the phenomenal world, but, on the contrary, that we are forced by our *a priori* adherence to material causes to create an apparatus of investigation and a set of concepts that produce material explanations, no matter how counter-intuitive, no matter how mystifying to the uninitiated. Moreover, that materialism is absolute, for we cannot allow a Divine Foot in the door" (31).

In light of Lewontin's candor, the remarkable thing is not the emergence of the ID movement but the length of time it has taken scholars who are neither materialists nor fundamentalists to catch on. Clearly, until we have the kind of thorough, open and critical kind of science education that progressive science educators are calling for, the most outrageous and extreme bits of positivist folklore will be blandly presented to the public as the epitome of moderation and common sense.

Interestingly, in his *Chronicle* essay, Kennedy points with pride to a 1984 National Academy of Sciences statement: "Science and religion represent different ways of knowing: Science is engaged in testing through experiments and research whereas [religious] belief rests on spiritual convictions that, by their nature, resist such challenges." The perspective of Kennedy and his colleagues, with its simple, untroubled,

- and thoroughly positivistic dichotomy between reason defined as objective, observational science and faith understood as subjective experience, is a textbook example of what Cobern and other science educators have identified as "the myth of school science." As Cobern notes, "The more appropriate dichotomy is that epistemology . . . requires both reason *and* faith versus reason *or* faith. All forms of knowledge including empirically demonstrated knowledge require some form of foundation that is not itself empirically demonstrable in any non-tautological fashion. Some will resist the use of the word 'faith,' but I think it is fair to say that we have 'faith' in these presuppositions. Faith and reason operate together, which suggests that there is no unambiguous epistemic distinction between knowledge and belief." Cobern, "The Nature of Science and the Role of Knowledge and Belief," 234.
67. <http://fp.bio.uk.edu/darwin/frmain.html>.
68. Scott Field, "Of Souls and Skybooks," *Trends in Ecology and Evolution* (July 1998): 296.
69. That high school science textbooks are far from neutral on these larger issues of meaning and purpose connected with the teaching of evolution is readily evident. See Stephen C. Meyer, "Don't Ask, Don't Tell in Biology Instruction," *Washington Times*, 4 July 1996. Meyer instances the following two examples as far from atypical. (1) "Each animal phylum represents an experiment in the design of body structures to perform the tasks necessary for survival. Of course there has never been any kind of plan to these experiments because evolution works without either plan or purpose. . . . Evolution is random and undirected" (quoted in Kenneth Miller and J. Levine, *Biology* [Englewood Cliffs, N.J.: Prentice Hall, 1993], 658). (2) "By coupling undirected purposeless variation to the blind unearring process of natural selection Darwin made theological or spiritual explanations of the life processes superfluous. Together with Marx's materialist theory of history and society and Freud's attribution of human behavior to influences over which we have little control, Darwin's theory of evolution was a crucial plank in the platform of mechanism and materialism—of much of science, in short—that has since been the stage of most western thought" (quoted in Douglas J. Futuyma, *Evolutionary Biology*, 3rd ed. [Sunderland, Mass.: Sinauer Associates, 1986], 3).
70. Martin Eger, "A Tale of Two Controversies: Dissonance in the Theory and Practice of Rationality," *Zygon* 23 (1988): 291–325.

71. *Ibid.*, 292–301.
72. *Ibid.*, 293–98.
73. Peckham, *Variorium*, "It has recently been objected that this is an unsafe method of arguing; but it is a method used in judging of the common events of life, and has often been used by the greatest natural philosophers" (748).
74. Eger, "Tale," 299.
75. For an excellent account of how thoroughly contentious and argumentative science is at the very highest levels, see David L. Hull, *Science As a Process: An Evolutionary Account of the Social and Conceptual Development of Science* (Chicago: University of Chicago Press, 1988).
76. Peckham, *Variorium*, "It has recently been objected that this is an unsafe method of arguing; but it is a method used in judging of the common events of life, and has often been used by the greatest natural philosophers" (748).
77. For "social conflict," see Eger, "Tale"; for "politically unsustainable," see Edward J. Larson, *Trial and Error: The American Controversy Over Creation and Evolution* (Oxford: Oxford University Press, 1989). Having surveyed the career of the teaching of evolution since the Scopes trial and in light of the Arkansas decision, Larson, a lawyer and legal scholar, concludes in his final chapter that laws in fundamental opposition to the values and beliefs of the people cannot ultimately be sustained. By "intellectually bankrupt" I mean that an old and thoroughly discredited philosophy of science—positivist demarcationism—is presented to the courts and to the people to justify the present teaching of evolution, and another and opposed philosophy of science is presented to professional peers. By "ethically indefensible" I mean that the present system requires fundamental deception about the obvious metaphysical implication of Darwinism as drawn by the overwhelming number of scientists who understand it best.
78. Richard Rorty, *Achieving Our Country: Leftist Thought in Twentieth-Century America* (Cambridge: Harvard University Press, 1998), 99–107. I endorse Rorty's trenchant critique of the ills of the postmodern university and his call for academics to form alliances with others outside the university and to become politically active. I support a "Bigger Tent" American pragmatism than does Rorty. In *Fundamentalism and American Culture: The Shaping of Twentieth-Century Evangelicalism, 1870–1925* (New York: Oxford University Press, 1980), historian George Marsden makes some suggestive observations on how large Big Tent pragmatism really

is in his comments on two of the most outstanding representatives of this broader American tradition: William Jennings Bryan and Billy Sunday. “[Bryan] abandoned, in the spirit of American pragmatism, not only the fine points of theology but also any attempt to present a theoretical defense of Christianity and relied on the evidence of practical results” (134). And “At his ordination examination for the Presbyterian ministry in 1903, [Billy Sunday’s] characteristic response to questions on theology and history was ‘That’s too deep for me,’ or ‘I’ll have to pass that up.’ I don’t know any more about theology than a jack-rabbit knows about ping-pong, but I’m on my way to glory” (130).

79. Kevin Padian, “The California Science Framework: A Victory for Scientific Integrity,” *National Center for Scientific Education Reports* 9 (1989): “At times some students may insist that certain conclusions of science cannot be true because of certain religious or philosophical beliefs that they hold. . . . It is appropriate for the teacher to express in this regard, ‘I understand that you may have personal reservations about accepting this scientific evidence, but it is scientific knowledge about which there is no reasonable doubt among scientists in their field, and it is my responsibility to teach it because it is part of our common intellectual heritage’” (20).
80. See comments on James Smith’s course in the final section of this essay.
81. For an exceptionally lucid and well-balanced account of the philosophical issues, and typical mistakes made on all sides of the contemporary evolution debate, see Del Ratzsch, *The Battle of Beginnings: Why Neither Side Is Winning the Creation-Evolution Debate* (Downers Grove, Ill.: InterVarsity Press, 1996), esp. chaps. 8–13.
82. Philip Kitcher, “Persuasion,” in *Persuading Science: The Art of Scientific Rhetoric*, ed. Marrello Pera and William R. Shea (Canton, Mass.: Science History Publications, USA, 1991), 19.
83. Michael Ruse, ed., *But Is It Science? The Philosophic Question in the Creation/Evolution Controversy* (Amherst, N.Y.: Prometheus Books, 1996); John Angus Campbell, “But Is It Science? The Philosophical Question in the Creation/Evolutionary Controversy,” *Social Epistemology* 12 (1998): 157–65.
84. Ruse, *But Is It Science?* See Ruse’s sections “Who Is Responsible for Legal Strategy?” and “What Is the Witness’s Responsibility?” 389–92, and Philip L. Quinn’s rebuttal, “Creationism, Methodology and Poli-

tics,” 395–99. The candor of Richard Lewontin on the role of expert opinion in such cases is again a breath of fresh air. What ultimately is revealed by our long-standing American debate over evolution, Lewontin notes, is “a deep problem of democratic self-governance” (“Demon Haunted World,” 32). As Lewontin sees it, we simply have to trust the testimony of experts in judicial proceedings involving science. “Anyone who has ever served as an expert witness . . . knows that the court may spend an inordinate time ‘qualifying’ the expert, who, once qualified, gives testimony that is not meant to be a persuasive argument, but an assertion unchallengeable by anyone but another expert” (32). Though Lewontin sees our current situation with regard to evolution from a rhetorical point of view, he cites Plato’s *Gorgias*, and in so doing reveals, perhaps inadvertently, an underlying uncertainty about the compatibility of at least his understanding of science with democracy. Lewontin criticizes his late friend Carl Sagan for “believ[ing] like the Evangelist John, that the truth shall make you free. But they are wrong. It is not the truth that makes you free. It is our possession of the power to discover the truth. Our dilemma is that we do not know how to provide that power” (32). In Lewontin’s materialist soteriology, only the elite few are capable of freedom. Theologically, Lewontin is a gnostic. Politically, for that very reason and to that extent, he is an antidemocrat. Here Abraham Lincoln, that great ID theoretician of our national experience, being at once more optimistic toward God and more pessimistic toward humans, offered better grounds for hope that ordinary people could understand what they needed to from experts. At least on the metaphysics informing (or in Lewontin’s case, constituting) his science, Lincoln’s great maxim is very much to the point: while some of the people will be fooled all of the time, and some of the people will be fooled some of the time, all of the people will not be fooled all of the time. How long the remainder will be fooled by Michael Ruse or by Donald Kennedy or by Stephen Gould is plainly not as long as without the ID movement—an intellectual movement with potentially very broad public support.

Is science compatible with democracy? It certainly was in Lincoln’s time. Whether the materialist metaphysic that currently masquerades as science is likewise compatible has yet to be shown—and is far from obvious. Whatever real problems there may be with science and democratic governance, without materialist metaphysics (as Darwin might say) the problem is greatly diminished, or rather disappears.

85. Michael Ruse, "The Ideology of Darwinism," in *Abhandlungen Der Akademie Der Wissenschaften Der DDR* (Berlin: Akademie-Verlag, 1983), 233–56.
86. Ruse, *Manad to Man*, 530.
87. Michael Ruse (speech given at the annual meeting of the American Association for the Advancement of Science, Boston, Mass., 1993).
88. My information comes from an e-mail communication from Levi Derek Boldt, Smith's graduate teaching assistant.
89. Gerald Graff, *Beyond the Culture Wars: How Teaching the Conflicts Can Revitalize American Education* (New York: W. W. Norton, 1992).
90. *Ibid.*, 15.

## Intelligent Design Theory, Religion, and the Science Curriculum

Warren A. Nord



The Great Temptation of educators is to teach students nothing but the truth—as they understand it, of course. When this happens, however, education is reduced to training or socialization or indoctrination, even if they turn out to be right. Properly understood, education requires the ability to think critically, to reason one's way through conflicting evidence and arguments. Students must learn about contending ways of making sense of the world if they are to be educated.

We disagree deeply in our culture (and, more specifically, in our intellectual life) about how to make sense of nature; we disagree about the relationship of science and religion; we disagree about evolution. This being the case, we are obligated to educate students about the alternatives rather than simply train them in any particular approach to making sense of the world, even if we educators, we scientists, are confident that it is the right one.

I am not going to argue that students should be required to learn about intelligent design (ID) theory because it is a better or more reasonable theory than its naturalistic counterparts. I don't know whether it is. Instead, I am going to argue that some study of ID theory should be included in the