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Distinguishing Science from Philosophy: A Critical Assessment of Thomas Nagel's Recommendation for Public Education

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THE FLORIDA STATE UNIVERSITY
COLLEGE OF ARTS & SCIENCES

DISTINGUISHING SCIENCE FROM PHILOSOPHY: A CRITICAL ASSESSMENT OF
THOMAS NAGEL'S RECOMMENDATION FOR PUBLIC EDUCATION

By

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For Warren & Irene Wilson

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ABSTRACT

The purpose of this dissertation is to argue that while a discussion of the nature of human knowledge might be a worthy goal to pursue in public education, the science classroom is not the appropriate place for this discussion. The concern that no claims to knowledge – including scientific claims – are void of a metaphysical and epistemological framework has been voiced recently by Thomas Nagel in his defense of intelligent design. Intelligent design theory is a contemporary version of creation science that has been used to challenge evolutionary theory in the US legal context surrounding public education. It has failed to date and a key reason for this is because it is not understood to be science by the courts. As a result, proponents of intelligent design have attempted to show that if intelligent design theory is not science, then neither is evolutionary theory.

A strategy pursued by Phillip Johnson, and more recently by Nagel, is to claim that evolutionary theory itself depends on a dogmatic metaphysical commitment – what Johnson calls ‘philosophical naturalism’ and what Nagel calls ‘scientism.’ However, there are two key differences between their approaches: 1) Johnson believes that the methodological naturalism assumed in science is motivated by a personal commitment of its proponents to philosophical naturalism, but he clearly states that there is no necessary connection between the two. Nagel, on the other hand, believes that methodological naturalism requires philosophical naturalism. If Nagel is correct, then science’s claim to metaphysical neutrality fails and this could pose a challenge to it in the legal context of US public education. 2) Johnson advances intelligent design theory as his positive thesis and aligns himself with creationist motivations in his publications, in his affiliation with the Discovery Institute, and in his personal life insofar as he is a self-professed born-again Christian. Nagel advances no such positive thesis and possesses no religious motivations. The extent of his concern seems to be his belief that humans do not possess – and perhaps will never possess – adequate conceptual frameworks to understand everything we might seek to understand. It appears that he has an affinity for intelligent design theory simply because its proponents reject the framework of naturalism assumed in the sciences.

Because Nagel believes that science – and he discusses evolutionary theory in particular – is not metaphysically neutral, he contends that it is intellectually irresponsible to exclude a discussion of the connection between evolutionary theory and religion in public education.

Critics have argued that he is further committed to the conclusion that intelligent design theory and evolutionary theory are equally viable candidates for biology curriculum. I don't believe this conclusion follows. Nagel is not advocating for intelligent design. Rather, he is arguing that the beliefs one holds about certain possibilities (such as whether or not an intelligent designer is possible) necessarily inform the methodologies and explanations one arrives at when doing science and that is the key issue he seems to think needs to be introduced in public education. There are a number of questions raised by Nagel's arguments such as what counts as scientific evidence, what standards of evidence are accepted to confirm or disconfirm a scientific hypothesis, and how should such standards be taught to students.

I take the position that it is important to investigate what scientists say about science and science education in order to determine whether this field has any necessary or particularly unique connection to one philosophical commitment over any other. I argue that no particular philosophical commitment is necessary or unique to science and that a noncommittal agnosticism can serve as a philosophical framework for scientific investigation and exploration. I also argue that individual commitments to philosophical naturalism or scientism can be understood as judgments that result from work in the sciences rather than antecedent beliefs that are necessary to the methods of science. While I do believe that critics have been less than charitable to Nagel and that he is ultimately pursuing an important project in philosophy, I argue that he is wrong to suggest that such a project be advanced in science classrooms.

CHAPTER ONE

INTELLIGENT DESIGN THEORY IN HISTORICAL & LEGAL CONTEXT

The 1991 publication of *Darwin on Trial* marked a new turn in the creationist movement that was led by its author, Phillip E. Johnson. This book and others publications by Johnson introduce a strategy of attacking the philosophical foundation of evolutionary theory, which he believes is a view called *naturalism*. Evolutionary theory alone, he claims, does not contradict creationism. Johnson contends that it is only when evolutionary theory is guided by philosophical naturalism that it becomes what he labels *Darwinism* and defines as a type of metaphysical dogma. His strategy, which he calls the ‘wedge strategy,’ is to eliminate philosophical naturalism from the sciences so that supernatural explanations can work their way in. Johnson is recognized by many as the founder of the intelligent design movement which aims to provide just those sorts of explanations. Intelligent design has been the most recent face of creationism but it has not found success in winning over the scientific community or in its attempts to affect US public education. In what follows, I will discuss key elements of the history of creationism until Johnson, focusing specifically on its legislative activism regarding public education in the US through the 1980’s. Next, I will explain arguments for intelligent design theory from Johnson and others and consider what objections have been raised to these. Finally, I will conclude with a discussion of *Kitzmiller v. Dover Area School District* in which intelligent design theory suffered its most recent courtroom defeat.

1.1 Creationism & Scopes

‘Creationism’ is a term that may be loosely understood as the view that what we understand as ‘reality’ – all of the universe, *especially us* – is the result of divine creation. This is about all that can be said about creationism in general, though, as creationists are not a homogeneous group. The term ‘creationist’, then, has little meaning in itself and academics have set out to identify and label different creationist positions. Ron Numbers, for instance, identifies two broad categories of creationism, ‘strict creationists’ and ‘progressive creationists.’¹ For Numbers, the key difference amongst creationists is how they understand the days of creation as described in Genesis. Strict creationists give a literal reading of the seven days of creation while

progressive creationists interpret them as much longer periods of time. As these are only broad categories, there are unique positions within each of them. Within the progressive creationist camp, for instance, there are differing views on the compatibility of religion and science. As I will discuss in what follows, the differences in creationist views have and continue to play an important role in the controversy that surrounds evolutionary theory.

Numbers explains that ideological differences among creationists have existed since the late 19th century. However, I am interested in the historical development of these views as they have been influenced by the US legal context. My focus here will be the debate about whether and how evolutionary theory should be introduced in US public education and it is the creationist sentiment that began and continues to drive the debate in that context. As such, I will discuss the history and fate of creationism as it has been advanced in the courts from the early part of the 20th century until Johnson fundamentally changed the discussion in the 1990's. In his book, *Tower of Babel*, Robert T. Pennock explains that creationists views themselves have been evolving.² I think this is correct, and the environment in which they evolve that is my concern here is the US courtroom.

I think the impact that the environment of the courtroom has had upon creationism is readily observable as demonstrating its changing nature there. Perspectives that were voiced and attitudes that were openly expressed in the early 20th century as represented at the Scopes Trial perhaps best reveal the initial concerns, or the goals, of creationists in their challenges to evolutionary theory within the social climate that accompanies the debate. Courtroom proceedings – especially testimony during *McLean* – have significantly shaped the debate by defining the measures by which creationist challenges might succeed or fail at affecting the science classroom. And, while this seems to be, at bottom, an academic debate, the courtroom setting has also introduced the relevance of legal strategy and defines legal scholars as experts of a certain sort in this area, though they are most often criticized as outsiders. For these reasons, it seems that the legal context of the debate is relevant in understanding and evaluating contemporary creationist views that have found their way into the courtroom as recently as 2005.

In the 60 years or so before Darwin's theory was first put on trial in the courtroom, opposition to it was building amongst religious fundamentalists who thought evolution threatened the moral fabric of society and the promise of eternal salvation. Still, textbooks increasingly included Darwinian evolution as the field of biology took shape and replaced botany

and zoology courses in high schools.³ A dramatic increase in secondary education ushered in by new laws and new schools introduced evolution to more and more students. In fact, the number of students in US high schools increased from about 200,000 in 1890 to about two million in 1920.⁴ This fact along with a powerful fundamentalist movement facilitated a charge against teaching evolutionary theory in state legislatures across the country. The charge was driven by William Jennings Bryan, who had been a US Representative from Nebraska before serving as Secretary of State under President Wilson from 1913-1915. Bryan was a charismatic politician, a skilled speaker, and an avid fundamentalist. He saw the fight against evolutionary theory in public schools as his personal battle and so he traveled across the South and Midwest delivering hundreds of speeches and supporting legislation to restrict or limit the teaching of evolution. For Bryan, evolution was speculative conjecture at best and religious heresy at worst. He was a supporter of popular democracy and this fact appears to have had an influence on the types of arguments he advanced. In addition to attacking evolution in its own right, Bryan made the legal argument that the general public has a right to influence what is taught in public education as that education is supported by its tax dollars. Bryan's arguments appealed to many and legislation was introduced in several states, though nearly all of it failed. The first that did pass, though, set the stage for one of the most famous trials in US history.

On March 21, 1925, Tennessee Governor Austin Peay signed the Butler Act into effect. The act had been introduced into the Tennessee House of Representatives by John Butler that year on January 21, and prohibited the teaching of evolutionary theory in universities and schools supported by state funds. Its passage made teaching any theory that denies the Biblical account of creation or teaching evolutionary theory a misdemeanor offense punishable by a \$100-\$500 fine. It quickly passed the House without a public hearing by a 71-5 vote, but the vote before the State Senate was preceded by a public outcry, particularly in the state newspapers and from several Presbyterian and Methodist preachers and ministers. Interestingly, the state's academic community at the University of Tennessee remained silent on the issue as its president was awaiting the outcome of a measure before the legislature to expand the University. The state's fundamentalist community did not remain silent, though, and over 200,000 demonstrated under the leadership of state and national religious leaders.⁵ After two trips to the Senate judiciary committee, the bill was eventually passed with a 24-6 vote. It was signed into law on the same day.

At the time the Butler Act was passed, the American Civil Liberties Union was a fledgling organization that had been formed to advocate for conscientious objectors to the military draft during World War I. They also defended the free speech of those circulating anti-war pamphlets and forged relationships with labor unions. The ACLU was composed of liberal minded New Yorkers who were concerned about the growing attitude of nationalism and majority rule over individual rights in the US. It was within this larger context that they found interest in the antievolution law in Tennessee and soon after its passing; they made a public appeal in the *Chattanooga Times* for a teacher who would be willing to be represented in a test case, offering reassurance that his or her job would not be at stake in doing so. John T. Scopes, a football coach and general science instructor, was offered up by Dayton civic leaders and what has become known as the Scopes Trial officially commenced on July 10, 1925.

The team of Scopes' defense attorneys included Clarence Darrow, who was perhaps the best known trial lawyer in the US at the time. He had become acquainted with the ACLU during their efforts to defend free speech in wartime and also through his work with labor unions. With a passion that rivaled Bryan's for religion, Darrow opposed traditional morality and religion and regarded the concept of original sin as deeply dangerous.⁶ He was not opposed to saying so publicly in courtrooms and in lectures and had challenged Bryan before on his Biblical literalism. As Bryan was accepted to assist the prosecution in the Scopes trial, the case became much more about the larger cultural debate in the US between modernists and fundamentalists than about a particular discussion of evolutionary theory in a classroom at Dayton High School.

The well-known activism of both ensured that the trial would be followed closely by enthusiasts on both sides and indeed, it was an exemplary instance of US cultural fanfare. Despite the implications of the matters at hand – a perceived threat to the majority religion of the area and the consideration of constitutional issues regarding individual rights vs. majority rule – the atmosphere was light and consisted of street vendors, carnival games, and generally good spirits all around, albeit with some exceptions. Even Bryan and Darrow were well acquainted due to their common political efforts in promoting the democratic platform and each regarded the other as a respectable man. The high profile maintained by each drew an international audience of spectators and media to Dayton in the days leading up to the trial. While Darrow made his way to the small town relatively quietly, Bryan was greeted by a large crowd cheering his arrival.

Their enthusiasm was repeated when he arrived at the courtroom and greeted Darrow on the morning of the trial.

At the beginning of the trial, the defense introduced a motion to quash the indictment by challenging the constitutionality of the Butler Act. Tom Stewart, chief prosecutor for the state, maintained that the state was within its rights in passing the act as it had a right to determine the use of state funds. He argued that the case was not a matter of individual rights. Darrow, on the other hand, argued that the act violated the state constitution as it established a particular religion in the public schools.⁷ He laid responsibility for this squarely at the feet of Bryan, claiming that evolution had been taught undisrupted for years before Bryan brought his fundamentalist agenda to Tennessee. After doing so, he turned his attack on the legitimacy of teaching the Biblical text as an accurate account of creation, noting its inconsistencies on the matter and its authors' ignorance of biology. Stewart returned that the case was about whether or not the law had been violated and that there were no relevant religious questions involved in that matter. Ultimately, the court ruled in favor of the prosecution and refused to recognize the Butler Act as unconstitutional.

Once the trial was underway, the prosecution was satisfied to call as witnesses the school children who could testify to what happened in the classroom, the Superintendent of Education, and a member of the school board who had a conversation with Scopes in which he recognized the unlawfulness of teaching evolution. The defense strategy, however, was more complex and introduced a now familiar strategy in negotiating the debate between evolution and creationism. Their strategy was to show that Scopes could not have violated the law because there is no necessary conflict between evolutionary theory and the creation story in the Bible. They argued that whether an individual interprets the two as conflicting, compatible, or equally true is a matter of personal faith that cannot be legislated. To support the compatibilist view, they brought witnesses regarded as experts in the scientific and religious communities. As Bryan had clearly argued for the incompatibility of the two in championing the legislation, the defense readily denounced him and claimed that he did not represent the whole of the Christian faith in the United States.

After the defense explained their strategy and called their first witness, Stewart immediately objected, saying that any testimony about evolution and whether or not it necessarily conflicts with religion was irrelevant because the law stipulated that evolution may

not be taught, regardless of its meaning or whether or not it conflicts with the Biblical account of creation. As history has shown, this has become a common, though less than academically honest, strategy of creationists with the political agenda of repudiating evolutionary theory in public schools. Because the outcome for education depends on the success of arguments in the courtroom, legal strategy is often employed in attempts to win the day for creationists, regardless of whether the logic of the academic debate is on their side. They have continued to be unsuccessful in such attempts, as they were on this day in the Scopes Trial when the court ruled that the defense witness would be heard, though the ruling was tentative. The legal context aided the defense here also, as the language of the act itself was appealed to insofar as it explicitly prohibited the teaching of evolution that denied the Biblical account of creation. The act introduced some measure of ambiguity as it prohibited the teaching of evolution *and* the teaching of any theory that denied the Biblical account of creation. Since the Scopes trial, legislation that has been proposed to challenge evolutionary theory has been a bit more carefully crafted.

As experts in biology and theology took the stand, the real debate began before the public eye. The involvement of the public is significant as it revealed the widely held attitude that human origins and religion are matters that any one person is as good a judge of as any other. The crowd scoffed at the expertise of scientists and theologians and prosecutors maintained that the will of the citizens must be done in public education despite expert consensus on the subject in question. A matter at stake here was the very nature of public education. Perhaps Butler revealed a popular view on this matter when he introduced the antievolution legislation as he aimed to “promote citizenship based on Biblical concepts of morality.”⁸ Speaking for the defense, Dudley Malone revealed another: “We feel we stand with science. We feel we stand with intelligence. We feel we stand with fundamental freedom in America.”⁹ The crowd was swayed by Malone on this matter as their sense of justice was roused. The court of public opinion leaned toward the defense, at least as far as the general purpose of education was concerned. They seemed to shift toward the prosecution, though, after a quick attack on one of the defense’s experts brought the focus back to the controversy over evolution. As the trial neared its close, it seemed that the prosecution had clearly won on all counts.

The defense, however, called Bryan to the stand as a Biblical expert. Realizing that he was being asked to defend his religion, he accepted. The trial had been moved to the courthouse lawn due to overcrowding in the courtroom so a large crowd was able to witness his testimony.

Darrow and Bryan finally met face to face, each fully intending to follow through on their indictment of the other. What can be seen from the exchange that followed is that Biblical literalism is quickly reduced to absurdity when subjected to sufficient analysis. Darrow questioned Bryan on such matters as whether he believed Jonah lived in the belly of a whale, whether evening and morning can exist before the sun comes into being, and where Cain found his wife. The questioning continued for two hours with Bryan increasingly revealing his ignorance of science and his willful adherence to nonsensical beliefs. After those two hours, the damage Darrow intended to inflict was done despite the fact that Scopes was found guilty that day and fined \$100.

The Scopes Trial effectively ended the fundamentalist movement of the 1920's to banish evolutionary theory from public education on the grounds that it is incompatible with a literal interpretation of the Bible. It also served to stake out the territory of the opposing sides of the debate and it set precedents for creationist strategies going forward. They abandoned their focus on state legislatures and began a crusade in local communities by revising textbooks, purging libraries, and appealing directly to teachers.¹⁰ Evolutionary theory effectively disappeared in public schools under social pressure. It returned in force, however, when the US moved to improve the quality of education, especially science education, during the cold war space race.¹¹ The Butler Act was overturned by the Tennessee State Legislature in 1967, but a new strategy aimed at challenging evolutionary theory was already in the works and in Tennessee, again, legislation was introduced.

1.2 Creation-Science & McLean

The new strategy was to require that equal emphasis be placed on the Genesis account of creation in textbooks where evolution was discussed. The Tennessee legislature passed a law requiring just that in 1973. What differed in the legal context by 1973, though, was that the US Supreme Court had interpreted the Establishment Clause of the US Constitution in its 1971 *Lemon v. Kurtzman* ruling. What is now known as the 'Lemon test' precludes any law that lacks a secular purpose, advances a specific religion, or excessively entangles religion and the state.¹² What Darrow had argued in his initial motion to dismiss the charges against Scopes was adopted at the federal level with the Supreme Court's ruling. The 1973 Tennessee law clearly violated the Establishment Clause and so was struck down by the US Court of Appeals in 1975. As a result,

creationist introduced ‘creation-science’, which sought to challenge evolutionary theory without making explicit reference to the Bible.

Initially introduced by John C. Whitcomb, Jr.’s book, *The Genesis Flood*, creation-science aimed to show that elements in the traditional creation story such as a sudden creation of the universe and a great flood are verified by scientific evidence.¹³ In this way the strategy was to suggest that creation-science actually was science, effectively abandoning Bryan’s strategy of willful adherence to Biblical literalism that proved disastrous for him during the Scopes Trial. The strategy, though, was also to introduce the ‘dual model’ argument that still persists in the creationist strategy today. The dual model argument suggests that of the two, evolution and creation, one is necessarily true and one is necessarily false. If this approach to the debate is adopted, then both positive evidence and successful attacks against the other side are evidence of truth. For this reason, creation-science attempts to use science to critique evolutionary theory and suggests that the evidence for it is far from complete.¹⁴

Creationists were successful in getting creation-science into Arkansas classrooms with the passage of Act 590 in 1981. This act applied to elementary and secondary schools and required the balanced treatment of creation-science and evolution-science. While the act succumbed to the fact that evolution was indeed science, a claim that was denied by creationists in the Scopes era, labeling it ‘evolution-science’ qualified it as only a type of science, and a type of science that is rivaled by another type – namely, creation-science. The language of the act placed creation-science within its rights not only in advancing scientific evidence for acts of creation, but also in attacking the evidence for evolutionary theory. Further, it claimed to disallow the teaching of any religious view and did not require instruction on the origin of the universe and of life at all. It only required that where schools chose to introduce evolutionary theory, they must introduce creation-science as well. As it was structured, Act 590 attempted to avoid violating the Establishment Clause by not explicitly advancing religion in the science classroom.

Act 590 was challenged in the 1982 case, *Bill McLean et al. v. Arkansas Board of Education. McLean*, also supported by the ACLU, was the most significant trial in the larger debate since the Scopes Trial. It not only addressed a violation of the Establishment Clause, but it also entered into academic territory by ruling on the definition of science itself. It brought together scholars and experts in the scientific and religious community and it introduced

arguments from philosophy of science. Of the expert testimony presented at the case, arguments were made that the attacks on evolutionary theory employed by creation-scientist were fallacious and that creation-science was indeed religion, and not science. The testimony that proved most influential to Judge William R. Overton's ruling came from Michael Ruse, a philosopher of science.

In his testimony, Ruse discredited the dual model approach, illustrated that creation-science assumes on the existence of a Creator – even though the language of Act 590 explicitly attempts to avoid this assumption – and defined the standards by which a theory may properly be deemed scientific.¹⁵ Speaking specifically on the matter of the origin of life on this planet, Ruse rejects the dual model approach as a false dilemma because it assumes that the only two options are creation and abiogenesis, which is the view that life arose from inorganic matter through natural processes. As he explains, there are in fact other theories, including that life began on this planet as a result of the actions of intelligent beings elsewhere in the universe and that our planet passed through a cloud of organic matter which took root here. In regards to the necessity of a creator, he explains that 'originally created' must mean something other than 'by natural processes', and that this only makes sense in light of a Creator who does the creating. He adds that the language of the act includes '*kinds* of plants and animals', noting that 'kind' is not a scientific term and appears only in the Bible when used in the relevant context. Finally, in offering the characteristics that a theory must possess in order to count as a scientific theory, Ruse delineates the following:

- 1) It is guided by natural law;
- 2) It has to be explanatory by reference to natural law;
- 3) It is testable against the empirical world;
- 4) Its conclusions are tentative, i.e., are not necessarily the final word; and
- 5) It is falsifiable.¹⁶

In order for a theory to meet Ruse's condition (1), it must be explained wholly in terms of natural forces. The introduction of supernatural forces in any theory places it outside the realm of science and, according to Ruse, in the realm of religion. To meet condition (2), a theory must explain how two phenomena are related by natural law in a way that is immediate and necessary. Condition (3) is met if the theory is supported by empirical evidence and condition (4) means that the theory is not understood as ultimate truth. It must be possible to show that a scientific

theory would be false under certain conditions that could be empirically demonstrated and if this is possible, then the theory meets condition (5).

In his decision in the case, Judge Overton adopted Ruse's conditions near verbatim and set a legal precedent on the meaning of science. He ruled that creation-science does not meet the conditions for a scientific theory because it relies on the assertion that creation was sudden and came from nothing. This notion of creation depends on a supernatural force unguided by natural law, and so inexplicable in terms of natural law. As such, it also fails to be testable or falsifiable. Overton goes further to rule that creation-science does not conform with the standards of science because: (1) it makes reference to terminology such as 'kinds' and 'relatively recent inception' which have no scientific meaning, (2) it attempts to establish limits to changes within species that are not guided by natural law, (3) it simply asserts without evidence that a catastrophic flood occurred, and (4) it fails to fit into what scientists actually think and do.¹⁷ Overton recognizes that the methodology of creation-science is not to use data to infer conclusions, but that "they take the literal wording of the book of Genesis and attempt to find scientific support for it."¹⁸

In addition to ruling that creation-science did not meet the criteria of science, Overton also considered the historical context from which Act 590 arose and the purposes for which it was advanced. In the second section of his ruling, he recounts the history of creationist activism from the days of the fundamentalists to the inception of creation-science and makes note of correspondences revealing that proponents of the act were intentionally promoting a religious crusade. He also appeals to the fact that the state could present no evidence that the act was introduced because it had any particular educational value. For these reasons, he ruled that Act 590 violated the test of secular legislative purpose as set forth in *Lemon v. Kurtzman*.¹⁹ The historical account he provides comprised the bulk of this section and factors significantly into his ruling.

Since *McLean*, the use of the history of creationism and the accepted criteria of a scientific theory to overturn legislation that advances creationists' changing strategy has been a method evoked by judges in landmark cases. For instance, the US Supreme Court overturned a similar balanced-treatment law in Louisiana in the 1987 case, *Edwards v. Aguillard*. In this case, the law in question promoted religion by introducing a theory that depends on a supernatural being.²⁰ Unsurprisingly, the creationist movement shifted strategies again given the necessity of further distancing themselves from religion in the eyes of the court and the need to establish

themselves as promoting legitimate science. Their next, and perhaps most significant strategic shift, was made possible largely due to the efforts of Phillip E. Johnson who was, at the time, a law professor from the University of California at Berkeley.

1.3 Johnson's Shift

In addition to being a legal scholar at the time he entered the debate with the publication of his book, *Darwin on Trial*, Johnson was also a self-professed born-again Christian. Of course, this personal motivation likely influences his interest in challenging evolutionary theory and the arguments he uses to do so, but those who criticize his contributions in the area seem to believe that this is his only claim to be involved. He has been attacked for lacking expertise in science, but I think this is unfair. As the debate has taken place within the legal system since 1925, it seems clear that a legal scholar could have legitimate academic interest in it as well as a significant contribution to make. After all, if the debate were restricted to the community of scientists, there would likely be no debate. This fact might suggest that there is no rightful debate regarding public science education but as public education is ruled by law, it is for the courts to decide what controversies are relevant.

Johnson's contribution that causes him to be celebrated by creationists is that he moves the debate into the realm of philosophy where consensus on scientific data is less relevant. His key argument is that evolutionary theory is advanced within the context of a type of metaphysical commitment that he recognizes goes by many names, but most often calls naturalism. He explains his understanding of naturalism in *Darwin on Trial*. Here, he says:

*Naturalism does not explicitly deny the mere existence of God, but it does deny that a supernatural being could in any way influence natural events, such as evolution, or communicate with natural creatures like ourselves.*²¹

He understands this primarily as a type of philosophical naturalism and claims that it is not necessary to evolutionary theory. In fact, he believes that evolutionary theory does not directly contradict creationism, which is a distinctly new step in the creationist strategy. For Johnson, it is only when evolutionary theory is understood within the context of philosophical naturalism – and he thinks this is the context in which the scientific community at large understands it – that it becomes what he calls *scientific naturalism*:

*Scientific naturalism makes the same point by starting with the assumption that science, which studies only the natural, is our only reliable path to knowledge. A God who can never do anything that makes a difference, and of whom we can have no reliable knowledge, is of no importance to us.*²²

It is the assumption that science is the only reliable path to knowledge that is problematic to Johnson. He thinks this is a type of metaphysical dogma of the same sort that religious commitments are typically accused of being. He calls it *Darwinism* and attributes it to the scientific community as it claims to know how complex organisms came into being in the first place. This, he thinks, is a matter of pure philosophy and is not a conclusion one is entitled to on the basis of empirical data alone.

It is not clear, though, that Johnson is correct in claiming that the scientific community purports to know how complex organisms came into being *in the first place*. If he means that there is general consensus on how organisms have increased in complexity in order to adapt to their changing environments then, yes, Darwinian evolution is a theory of that and there is general consensus about it. However, that he always adds *in the first place* to his charge suggests that perhaps an equivocation is at work here. If what he really means, and I suspect that he does, is that the scientific community has no rightful claim to know the ultimate origins of life, whether complex or otherwise, then he is likely right about that. Yet, it is not clear that this type of belief is in fact advanced by scientists. In his testimony during *McLean*, Ruse explicitly stated that evolutionary theory “attempts to explain how life developed after it was formed. Evolutionary theory does not focus on how life began, but only on what happens to life *after* it began.”²³

Johnson’s emphasis on the word *know* also suggests a problem to me. Ruse testified that “science knows no ultimate truth not subject to revision.”²⁴ However, it is clear that Johnson is arguing that scientists believe that they are possessed of immutable truths. He claims that the most important priority of scientists is to “maintain the naturalistic worldview and with it the prestige of ‘science’ as the source of all important knowledge.”²⁵ To make matters worse, he argues that the community attempts to maintain its prestige by setting up and enforcing the rules of scientific methodology of the sort testified to by Ruse, then accuses him of getting away with a “philosophical snow job.”²⁶ His argument for this is simply his assertions that scientists don’t

take their conclusions to be tentative at all and hold metaphysical commitments that are essentially dogmatic. It seems, though, that the scientific community only advances that *scientific* explanations must appeal to natural causes, not that *meaningful* explanations must appeal to natural causes.

To be fair to Johnson, there are some scientists – he cites Richard Dawkins, in particular – who do advance the view that an understanding of science reveals that religion is fantasy that results from ignorance. Perhaps Dawkins and others like him would readily accept the label of scientific naturalist. But it seems that Johnson’s attempt is to turn the tables on the scientific community at large by suggesting that its underlying motive in advancing evolutionary theory is to attack religion – just as it has been claimed that legislation aimed at challenging evolutionary theory is an attempt to advance religion. My suspicion, though, is that even Dawkins would admit that attacking religion is a side project and not the primary motive of his interest in evolutionary biology. But it appears to be the most important goal of evolutionary biologists in Johnson’s mind. He says:

Another factor that makes evolutionary science seems a lot like religion is the evident zeal of Darwinists to evangelize the world, by insisting that even non-scientists accept the truth of their theory as a matter of moral obligation.²⁷

The claim that scientists are zealots seeking to evangelize the word is puzzling. What I understand as religious zeal is that thing that motivates a person to show up on my doorstep with a book in his hand – and no one has ever knocked on my door with a copy of *The Origin of Species*. In any case, if the discussion is limited to the academic community, then perhaps there are some negative attitudes toward religion in place and perhaps they are advanced with zeal at times. But it does not seem that people who hold these attitudes have just decided to discredit religious sentiments for the sake of doing so. It seems, rather, that they are replying to attacks from the religious community. Here, the historical context is relevant.

In light of Johnson’s arguments, a number of proponents of ‘intelligent design theory’ have fully developed the most recent creationist strategy. Intelligent design theory rests on the assumption that empirical evidence can demonstrate that there is an intelligent cause of certain features of living things. That it is advanced as science is grounded in Johnson’s reasoning. Once the metaphysical dogma that science can only investigate natural causes is cleared away – the

reasoning goes – room for supernatural causes and explanations is made. Two of the most significant proponents of intelligent design are Michael Behe and William Dembski.

1.4 The Case For & Against Intelligent Design

In his book, *Darwin's Black Box*, Michael Behe explains his understanding of intelligent design and argues that a study of several biochemical systems reveals that they are 'irreducibly complex.' This fact, he claims, indicates that they have been designed by an intelligent agent.²⁸ He believes that a system of irreducible complexity cannot arise by chance and must result from an intelligent cause. According to Behe, a system is irreducibly complex if the removal of any of its parts would cause it to cease functioning. He uses a mousetrap to explain this, stating that the removal of any of its parts, the spring, for instance, would mean that it would no longer work. From his observations, Behe argues, biological systems such as the flagella of bacteria demonstrate irreducible complexity and so indicate that they are the result of intelligent design. In fact, he says this revelation should be regarded as "one of the greatest achievements in the history of science" and rivals discoveries of thinkers such as Newton and Einstein.²⁹ He defines 'design' as "the purposeful arrangement of parts" and argues that "the conclusion of intelligent design flows naturally from the data itself – not from sacred books or sectarian beliefs."³⁰ Behe's description of evidence for the design of biochemical systems and the inability of evolutionary theory to account for it has been refuted by scientists. My concern here is his discussion of the detection of design and his claim that science refuses to admit it.

Behe offers a number of examples in order to illustrate his claim that inferences to design play a regular part of our day to day existence. He begins this discussion with the following:

*Imagine a room in which a body lies crushed, flat as a pancake.
A dozen detectives crawl around, examining the floor with
magnifying glasses for any clue to the identity of the perpetrator.
In the middle of the room, next to the body, stands a large, gray
elephant. The detectives carefully avoid bumping into the pachyderm's
legs as they crawl, and never even glance at it. Over time the detectives
get frustrated with their lack of progress but resolutely press on,
looking even more closely at the floor. You see, textbooks say detectives
must "get their man," so they never consider elephants.³¹*

Behe wants us to believe that scientists investigating the development of life are like those detectives and that the elephant represents intelligent design. Yet, his own account states that the detectives ‘never even glance’ at the elephant, which emphasizes that the elephant is there to be seen with the naked eye if only the detectives would look at it. Intelligent design is not this sort of thing. It is not a brute perception, but results from inference. No matter, though, because Behe goes on to describe a number of examples in which the ‘designer’ is not there to be seen, but can clearly be inferred. He asks us to imagine that we are playing a game of Scrabble, we leave the room, return, and the lettered tiles have been arranged to spell out “TAKE US OUT TO DINNER CHEAPSKATES.” Then we are to imagine that we see flowers near the student center spelling out the name of the university, a machine whose gears are set into motion by pulling a lever, and a trap made of vine hanging from a tree branch.³²

In each of these cases, we do not see him, but the designer is clearly inferred. Behe thinks that these examples are analogous to intelligent design, but they are not. At some point we have had a brute experience of persons who might arrange Scrabble tiles to form words, gardeners who might arrange flowers to spell the name of a university, a machinist who might build a machine, and a trapper who might build a trap. Further, we have had some experience of the projects these people are inferred to be engaged in and of the processes they might use to complete them. If we had not had experience of such persons or if we did not have experiential knowledge of the sorts of project Behe describes, then we probably would have no idea that the tiles spelled a sentence, that the flowers spelled the name of a university, that the pile of parts was actually a machine, or that the vine attached to a branch was a trap. Behe’s analogies break down because we have had *experience* of not only what the designers in the cases are – humans – but also of the ways in which humans work to produce designs such as language and technology. We have had no experience of what he takes to be the intelligent cause that created biochemical systems or of the processes by which such a designer might build them.

Behe tries to account for this by attempting to present us with cases in which there is no direct experience of the relevant designer. He asks us to consider how archeologists are able to infer that stones they have found with pictures of camels, cats, griffins and dragons have been designed. But all he has done is made the human designer more remote to us. We are still familiar with humans, and we understand what it means for them to have existed in the past. We are certainly familiar with the images on the stones and the process by which they might be

created as well. His final attempt is a reference to the movie *2001: A Space Odyssey*. In it, he explains, there is a scene in which an astronaut comes across a towering monument. He says that the astronaut knows immediately that it is the work of an alien life form. He also explains that later in the movie it is revealed that there is life on Jupiter, so perhaps attributing a monument on the moon to the work of an alien was not such a leap of imagination for the astronaut. But even if the astronaut had no idea that aliens existed, what more is this than a further inference from what we have experienced? Not only is the monument the sort of thing that we have experienced here on earth, but it also seems clear that the monument would have been built by the same sort of processes that humans engage in to build them. Perhaps not, though. Perhaps in the movie, the alien is able to wave a magic wand and the monument appears. We would only accept that sort of process, and many of us also only accept that aliens exist, insofar as we are watching a movie and that in itself requires that we suspend disbelief. If we weren't engaged in the process of 'movie watching', we would find such representations nonsensical. And even when we are in suspended belief, we still don't fully grasp what kind of process 'waving a magic wand' involves – that's why we call it magic.³³

The point is that in all of these cases the conclusion of design does not simply follow from the data at hand. The inference to design is drawn from the data *and* our background knowledge of human beings, the processes they use to design and, at least in one case, our understanding of what it means to watch a movie. We have no such background knowledge whatsoever, especially no brute experience, of the sort of designer that would be required to build biochemical systems or of the process that such a designer would employ in doing so.³⁴ In fact, the only 'background knowledge' – to use the terminology loosely here – that we could possibly claim toward understanding such a designer or the process of design itself is of the god concept and the miracles he is taken to perform as illustrated in a 'sacred book.' So Behe seems to be fundamentally wrong in claiming that this is not the source of observed intelligent design rather than 'the data itself.' To further demonstrate this, consider the following passage:

*Why does the scientific community not greedily embrace its startling discovery? Why is the observation of design handled with intellectual gloves? The dilemma is that while one side of the elephant is labeled intelligent design, the other side might be labeled God.*³⁵

I don't think it is a question of what the other side 'might' be labeled, as Behe suggests. The only concept we possess that by definition works in such mysterious and magnificent ways is the god concept. Further, Behe is a senior fellow at the Discovery Institute's Center of Science and Culture, whose 'wedge strategy' – developed by Johnson – is to:

*“defeat scientific materialism and its destructive moral, cultural, and political legacies. To replace materialistic explanations with the theistic understanding that nature and human beings are created by God.”*³⁶

Given that this is the case, it is clear that he believes the designer is god as well, despite the fact that he does not go further and directly state this in his book.

Another senior fellow at the Discovery Institute, William Dembski, attempts to explain how intelligent design can be recognized without simply appealing to analogy.³⁷ According to Dembski, intelligent design can be understood as a theory of information where 'complex specified information' is a reliable indicator of design. A system is more or less 'complex' depending upon how many bits of 'information' it involves. For instance, the complexity of a computer program can be measured in terms of how many computational steps it involves, how much memory it occupies, or a combination of the two. Another illustration Dembski uses to explain complexity is that two copies of Hamlet are no more complex than one copy because they contain identical information. No additional information is added by the second copy, the information is only repeated.³⁸ On the other hand, a system is 'specific' to the extent that it 'follows a pattern', or served a purpose which defines its function. For instance, if an archer draws a target on the wall with a circle around it then shoots an arrow and hits the target, the information involved is specified as it reveals the skill of the archer. If the archer had simply shot an arrow at a wall or had shot an arrow at a wall then drew a circle around where it landed, the information would not be specified because it would not reveal the skill of the archer.³⁹ According to Dembski, a system is necessarily the result of intelligent design and could not result from chance if it is comprised of complex specified information.⁴⁰ He calls this the 'Law of Conservation of Energy.' Where we find this in living things, the human immune system, for instance, intelligent design is indicated.

Pennock gives a thorough analysis of arguments offered by Dembski in *Tower of Babel*. In response to this particular argument, he contends that Dembski has not argued for his

conclusion that complex specified information cannot result from chance, but rather that he merely asserts it. Dembski has defined complexity and specificity as independent properties. He explains that complex unspecified information can result from chance and also noncomplex specified information can result from chance. Pennock argues that it is equally possible that chance could conjoin the two properties and produce complex specified information. For instance, Dembski offers a telephone number as an instance of complex specified information. A phone number possesses complexity and specification to the extent that it belongs to a particular individual and when that number is dialed, that individual is reached. In response, Pennock points out that, by chance, wrong numbers do cause the person to be reached, especially in cases where the number is similar to the number of a local pizza parlor. If a phone number is complex and specified to the extent that it reaches you and only you and you can be reached by chance, then chance can produce complex specified information.⁴¹

Pennock also responds to Johnson in *Tower of Babel*, thus striking at the heart of intelligent design theory.⁴² As he understands it, Johnson's effort is to portray evolutionary scientists as blindly clinging to metaphysical dogma because they will not accept the possibility of a Creator and to paint intelligent design proponents as open-minded and the more reasonable of the two. In Johnson's view, the evidence for evolution is weak and creationism would clearly triumph over it if the dogma of naturalism were removed. In reply, Pennock first argues that Johnson's is a version of the dual model argument where he attempts to rule out the other possibilities that make it a false dilemma. Johnson defines creationism broadly and tries to avoid referencing any particular view. However, as Johnson defines Darwinism as a commitment to a specific evolutionary process *and* as the denial of divine intervention then proceeds to attack both, Pennock thinks he reveals his commitment to a particular brand of creationism. As Pennock explains, if he were defending only the broad view of creationism, then he would only need to attack the denial of divine intervention. Since Johnson spends much time attacking particular evolutionary processes, though, Pennock claims that he must have a "specific conflicting Creationist scenario in mind such as the one-week instantaneous creations story."⁴³

In replying to Johnson's key philosophical argument, Pennock explains that there is more than one understanding of the term 'naturalism.' He distinguishes between 'ontological naturalism' and 'methodological naturalism.' While *ontological naturalism* makes the broad claim that what exists in nature is all that exists and is the position that Johnson attacks,

methodological naturalism does not require this strong commitment. Rather, methodological naturalism is a view about what methods are reliable for investigating the world that leaves claims about supernatural entities as open questions.⁴⁴ Pennock argues that evolutionary biologists have no necessary reason to be committed to ontological naturalism, even though methodological naturalism is characteristic of their field. Without methodological naturalism, there is no lawful regularity to constrain scientific research. As such, induction cannot produce reliable results because there is no possibility for controlled experimentation.⁴⁵ In other words, if scientists cannot rely upon set laws of nature, then there is not much they can conclude from their observations. Therefore, far from being a dogmatic metaphysical commitment, methodological naturalism is an indispensable framework for scientific research.

1.5 Miller's Compatibilism

While there are a number of scientists who are methodological naturalists as well as ontological naturalists, there is no necessary connection between the two. For instance, Kenneth Miller is a professor of biology at Brown University and self-professed Catholic who explains the consistency of evolutionary biology and Catholicism in his book, *Finding Darwin's God*.⁴⁶ Miller contends that the findings of science are a testament to the greatness of god and, as such, finds compatibility between faith and reason. As such, he rejects the dual model approach because he finds truth in evolution and truth in religion. He also has an important reason for rejecting the dual model approach that creationists would be wise to accept as their own. He says:

*By arguing, as they have repeatedly, that nature cannot be self-sufficient in the formation of new species, the creationists forge a link between the limits of natural processes to accomplish biological change and the existence of a designer (God). In other words, they show proponents of atheism exactly how to disprove the existence of God – show that evolution works, and it's time to tear down the temple. As we have seen, this is an offer that enemies of religion are all too happy to accept.*⁴⁷

He thinks this strategy works against the creationist because science has adequately explained things that were previously thought to be the work of god and that the evidence suggests natural phenomena will have naturalistic explanations.

Miller's view is that evidence for god should not be sought in science's lack of ability to explain a particular phenomenon, but that god should be understood as using natural processes to create and maintain the universe. He thinks it is a greater conception of god to believe that he created a universe that is self-sufficient than to think that he created a "creaky little machine requiring constant and visible attention."⁴⁸ In his commitment to a self-sufficient universe and so naturalistic explanations for it, he embraces randomness. This is necessary in order for his view to be consistent with accepting the random variation that ultimately results in the exact species that in fact exist. He acknowledges that this is problematic to creationists because it suggests that humans might not have existed and the Bible states that man was created in the image of god. In this sense, it seems that the existence of humans must have been preordained. His reply is this:

*If another group of animals had evolved to self-awareness, if another creature had shown itself worthy of a soul, can we really say for certain that God would have been less than pleased with His new Eve and Adam? I don't think so.*⁴⁹

Here, Miller illustrates his willingness to interpret the Biblical text to account for the actual state of the world and even for any possible world that might have resulted from different contingencies in the history of the universe. This is certainly a strategy that is necessary to achieve compatibility between the findings of science and the Biblical text, but it also introduces what I think is a problem for his view. It seems that no matter how the history of the universe might have gone, Miller would have to concede that the Bible was a metaphor for *that*, even if that history would have precluded the existence of the Bible itself. I do agree with Miller that there can be compatibility between a scientific account of the natural world and a religious worldview, but I am not sure what meaning or significance the Bible can be taken to have as a divinely inspired religious text if one adopts this 'metaphor strategy.' Also, it seems that Ockham's razor might sever Miller's god on this strategy. If naturalistic explanations can be complete, then what value does religion hold?

It is clear that Miller believes in good, evil, and a human soul. He thinks that it is because we are made in the image of god that we have knowledge of good and evil and he also believes

that religion is valuable as a source of morality. But there are other sources of morality that do not require a belief in the transcendental – systems of morality grounded in human rights, a sense of fair play, and even self-interest come to mind. Of course, it is a matter of personal preference that Miller chooses to ground his morality in Biblical teachings, but he seems to suggest that the sole source of value is faith. He might be right if faith is taken to be a mode of understanding the world removed from any particular object of faith. However, he seems to equate ‘faith’ with ‘faith in god.’ At the least, he does not consider any other candidates. To be fair, though, it is not his purpose to engage in debate about morality, he is simply illustrating a view on which his religion is consistent with what he has learned from science. Still, his views are linked to some classic problems in philosophy that he does not adequately address. Namely, the problem of free will and the related problem of evil. He simply assumes a strong version of free will without arguing for it, but he does address the problem of evil directly. He says:

*How can a kind and loving God allow a father to murder his child?
How could He permit the carnage of war, the terror of natural disaster,
the inhuman agony of famine and disease? He allows such things because
He has made us material creatures, dependent upon the physical world
for our existence. In such a world, the destruction of one form of life
comes about as a natural consequence of the existence of another. We are
born in pain, we struggle for our food and drink and shelter, we age, and
eventually we die.⁵⁰*

His reply, that we are material creatures dependent upon the physical world for our existence, is clear enough. And perhaps the death of individuals and the extinction of species is necessary for a variety of life which I suppose could be understood as good in itself. However, the point of the problem of evil is that god, being omniscient, omnipresent, omnipotent, and perfectly good, *could* have made a world in which evils were eliminated, even if we have to be material creatures dependent upon a physical world. For instance, could we not be born without pain? Do we really have to die painfully when we indeed do? What good can there possibly be in a father murdering his child? Miller replies:

*He allows such things as a consequence of the gift of human freedom.
The ability to do good means nothing without the freedom to do evil.
In a world of individuals, some will always choose the latter, and their*

*actions form an unfortunate backdrop to which the moral choices of virtue, charity, and honesty stand in contrast.*⁵¹

Again, the problem of evil is just that god could have created a world in which the ability to do good *did* have meaning without the freedom to do evil. And in fact, any religious view notwithstanding, I suspect that Miller is wrong that the ability to do good is meaningless without the freedom to do evil. He is relying upon a Biblical understanding of good and evil, but if this is removed there is no necessary dependence between the two. For instance, meeting my tax obligation is good, even though I do not have the option to not do so. Of course, I can *not pay* my taxes, but the obligation will still be met insofar as I will be fined if I do not pay, my wages will be garnished, or I could be put in jail. Regardless, the obligation will be met. Also, his assumption of free will plays a significant part in his argument here. He suggests that evil is necessary for humans to be free, but it is mere assertion that humans are free and that free will requires that humans will do evil.

Miller addresses these classic problems in the philosophy of religion because he seeks not only to show that evolutionary theory and a traditional religious faith can be held consistently, but also that it is reasonable to do so. I agree with the former and I do not disagree with the latter. I think, though, that he has failed to argue successfully for it. In any case, his advice to creationists to give up the dual model and so abandon their strategy of attacking evolutionary theory is a needed advancement in the history of this debate. In addition, his willingness to speak openly about his commitment to god as the ultimate cause of the universe is certainly intellectually respectable, especially given the lack of willingness to do so by those who – in closed audiences – claim their pursuits are in the service of their faith.

1.6 The Dover Trial

Despite being the subject of heavy academic scrutiny and despite threats from the ACLU, intelligent design theory did find its way into the academic standards adopted by the school board in Dover, Pennsylvania on October 18, 2004. The school board acted out of evangelical Christian motivations and a desire to return religious faith and traditional morality back to the schools, though not all members of the school board shared these sentiments. The change in standards got underway when the board took issue with their high school biology textbook, *Biology: A Living Science*, which was co-authored by Miller. At an open meeting, a member of

the board criticized the book as being ‘laced with Darwinism,’ then claimed that the separation of church and state was a myth that was not intended by the founding fathers and had been advanced by atheists. The board voted to abandon the book, adopted *Of Pandas and People* – a creationists text – and changed the science standards to require teachers to denounce evolutionary theory and instruct students in intelligent design.

Soon after, on December 14, a group of parents, religious leaders, teachers, and other members of the community filed suit challenging the school board on the new biology curriculum. The case, *Kitzmiller, et al. v. Dover Area School District, et al.*, was followed closely in the town that mixed traditional and modern sensibilities and represented a cultural clash of the sort embodied by the Scopes Trial.⁵² It was also like the Scopes Trial in that one side, this time the proponents of intelligent design, cared less about the outcome of the case and more about having their chance to defend their theories in the public eye. The legal strategy was quite similar to what was seen during *McLean* in that leading experts were brought in on both sides and in the arguments employed by the plaintiffs and the defendants. The plaintiffs set out to show that the school board was motivated by religious concerns and that intelligent design theory was just a contemporary version of creation-science. They also sought to distinguish science from religion and to clarify the meaning of the word ‘theory.’ The defendants set out to prove that the school board only intended to advance science, not religion, and that intelligent design is good science.

Miller was the first witness for the plaintiffs and he combated the notion that evolution requires atheism by identifying as Catholic. In his testimony, he explained evolutionary biology, laid out Ruse’s definition of science, and contended that intelligent design was not science and that its introduction would do a great disservice to the students of Dover. He discredited the key intelligent design arguments by defending the completeness of evolutionary explanations and refuting the notion of design. He presented a step-by-step account of the evolution of the flagellum, which is a structure that intelligent design proponents often appeal to in seeking to illustrate the necessity of design. He also clarified that a ‘theory’ is not a mere guess, but is a “broad, useful, powerful generalization that explains and unites a broad range of facts.”⁵³

While Miller was the plaintiff’s key expert in biology, they also presented a host of other witnesses. Testimony from Barbara Forrest, for instance, who had uncovered the Discovery Institute’s wedge strategy, was essential in identifying the creationist motivations of intelligent

design proponents. Robert Pennock, too, was introduced to refute the testimony of Michael Behe and William Dembski. Importantly, Pennock explained to the court his distinction between ontological naturalism and methodological naturalism (called philosophical materialism and methodological materialism during the trial) and articulated his argument that one does not necessarily imply a commitment to the other. He also showed that methodological naturalism was indispensable to science and explained that it was incompatible with intelligent design as intelligent design introduces supernatural explanations. As such, he argued, its claims are not falsifiable and it cannot be counted as science.

By the time the defendants began arguing their case three weeks into the trial, the plaintiffs' case had been built and it was strong. In the face of the expert testimony the court had just heard, the defendants had to show that intelligent design is, in fact, good science and that it is also not religion. Their hopes were pinned on Michael Behe as he was one of the few biologists in their group of witnesses and he had been a leading founder of intelligent design theory. When Behe took the stand, he identified as Catholic, but explained that he did not have any religious commitment to intelligent design. He also expressed that he was not a creationist of any sort and that his views on intelligent design were motivated purely by his scientific research. He explained his argument from irreducible complexity and offered a definition of science that was a bit broader than the one explained by Miller. According to Behe, science relies completely on empirical facts and logical inferences. Under this definition of science, he explained, intelligent design is indeed a scientific theory. His testimony under questioning from the defense seemed solid, but under cross-examination, Behe suffered some significant blows.

In his deposition and during cross-examination, Behe admitted that his definition of science was not the definition accepted by the National Academy of Sciences. He also admitted that, as such, it included much more as science than the NAS would accept. He stated that his problem with the established definition was that it implied that there would be an agreed upon way to decide if something was well-substantiated. While he believes that intelligent design is well-substantiated, he could not point to many others in his field who agreed. The attorney for the plaintiffs, Eric Rothschild, characterized Behe's definition of science as 'loose', while Behe himself preferred to think of it as 'broad.' Rothschild effectively discredited Behe's definition by asking him if under it, astrology would count as science. Behe replied, "Yes, astrology is in fact

one, and so is the ether theory of the propagation of light, and many other – many other theories.”⁵⁴

The judge in the Kitzmiller case, John E. Jones II, ruled in favor of the plaintiffs. In his opinion, he wrote that an objective observer would know that intelligent design was evolved from earlier forms of creationism and that intelligent design was not science.⁵⁵ In identifying it as a form of creationism, Jones appealed to the history of the creationist movement and to decisions in previous landmark cases. He also recognized the Discovery Institute’s wedge strategy as a specifically religious strategy whose goal was to replace contemporary science with theistic science and noted testimony that intelligent design requires a supernatural designer. The textbook in question in this case, *Of Pandas and People*, also played a significant role in the ruling as it was first written to advance creation-science. After the Supreme Court ruling in the Edwards case and with the inception of intelligent design, the wording throughout the text had simply been changed. Where it initially read ‘creation-science’, ‘intelligent design’ had been substituted and where it read ‘creation’, ‘design’ had been substituted. These considerations and the testimony on whether or not intelligent design is science supported Jones’ decision that the school board violated the Establishment Clause. He addressed the question of science, in his words, “in the hope that it may prevent the obvious waste of judicial and other resources which would be occasioned by a subsequent trial involving precisely the question which is before us.”⁵⁶ Jones ruled that intelligent design was not science because it invoked supernatural explanations, because it employed the same dual model argument that was invoked by creation-science, and because it and its attacks on evolutionary theory were not accepted by the scientific community.

CHAPTER TWO

THE DEMARCATION PROBLEM

The legal battle that began with *Scopes* and has seen its most recent conclusion with *Dover* underscores the significance of key debates in the philosophy of science. I introduced some of these in chapter 1. The purpose of this chapter is to further investigate these debates; particularly the debate over what distinguishes science from nonscience and the debate about the relevance of philosophical assumptions in settling that question. In the context of science education, the relevant question here is whether intelligent design theory is more properly considered science or religion – or perhaps nonscience of some other variety. My aim here will be to show that when due consideration is given to the arguments, the right conclusion to draw is that intelligent design is not science. This is the conclusion that the courts have drawn, but the courts' acceptance of this conclusion has not been sufficient to end the debate surrounding evolution and creationism. It still persists in academia and in society more generally. For this reason, it is important to consider what may be said about intelligent design if its proponents are granted their conclusion that it is, in fact, science. This is a strategy adopted by Phillip Kitcher in his book, *Living with Darwin*. Here, Kitcher explains that even if intelligent design theory is understood to be science – and he thinks it is the right approach to grant this to its proponents – it can only be understood as dead science, or bad science, at best. In this book, Kitcher also suggests that intelligent design theory might simply intend to identify the limits of natural science. He neither believes that this truly is its intention, nor that it succeeds in doing so. Still, this might be an unintended consequence of intelligent design theory that could allow it to be of some value after all, even if it is understood as nonscience or bad science. It could be that important challenges to philosophical naturalism are a worthwhile consequence of intelligent design theory and that these might have far-reaching effects.

2.1 Distinguishing Science from Nonscience

The question of what distinguishes science from nonscience is not a new question in philosophy, but it has held a new and special significance since *McLean*. As Judge Overton relied on the criteria set forth by Ruse in determining that creation-science does not qualify as

science and the same criteria were relevant to testimony in the *Dover* trial, they have been brought under attack in the years since. A full treatment of what has come to be known as ‘the demarcation problem’ is offered by Larry Laudan. According to Laudan, the question of what makes a belief scientific is uninteresting. In his view, we should instead be concerned with what makes a belief well-founded. He goes further to question the criteria offered by Ruse, and contends that the “victory in the Arkansas case was hollow, for it was achieved only at the expense of perpetuating and canonizing a false stereotype of what science is and how it works.”⁵⁷

In *The Demise of the Demarcation Problem*, Laudan addresses the issue of whether there are epistemic features of science that are unique to it and distinguish it from other systems of belief.⁵⁸ Ultimately, Laudan thinks philosophers have failed to answer this question. As he explains, this question has been before the attention of philosophers since Aristotle offered two criteria of demarcation between knowledge and opinion. According to Aristotle, knowledge of a phenomenon requires: 1) certainty, or the infallibilism of its foundations, and 2) comprehension of its first causes. Laudan explains that through the seventeenth and eighteenth centuries, Aristotle’s first criterion, ‘infallibilism’, was embraced, but that the second was rejected. Galileo and Newton, for instance, thought that knowing *how* natural systems functioned was properly considered scientific even without knowing *why* the systems functioned as such. They did, however, regard the certainty of their conclusions as key in qualifying them as fact and distinct from opinion. The preferential status of a functional explanation of a phenomenon even if an ontological explanation is lacking persists in science today, but infallibilism gave way completely to fallibilism in the nineteenth century. Ruse’s falsifiability criterion seems to be a testament to this fact. Laudan represents fallibilism as marking the end of identifying the distinction between science and nonscience as the distinction between knowledge and opinion. He says that “the unambiguous implication of fallibilism is that there is no difference between knowledge and opinion: within a fallibilism framework, scientific belief turns out to be just a species of the genus opinion.”⁵⁹

Given the distinction between knowledge and opinion as proposed by Aristotle, Laudan is certainly correct about this. I think, though, that a separate issue is involved here. The term ‘opinion’ seems to more properly denote claims that are addressed to matters of opinion, which are by definition not subject to independent verification and are not candidates for scientific status for that reason. That a claim is falsifiable does not make it an opinion. The opposite seems

to be true. It seems that opinions are unfalsifiable in virtue of the subject matter to which they are addressed. I suppose this is a question of semantics, but it seems more appropriate to understand 'opinion' in this way. It does seem that the word 'opinion' functions at times to mean one's take on a matter of opinion and at other times to mean one's best guess about a matter of fact. I think the former is the better usage and can help to avoid certain misunderstanding about the status of scientific claims. Scientific claims are certainly falsifiable, but opinions, understood as I am proposing, are not those sorts of claims. If we did qualify the definition of opinion in this way, we could perhaps avoid the sort of mistake made when one says that my belief, for instance, that the earth is more than 4 billion years old is simply my opinion.

With infallibilism abandoned, Laudan explains that the next significant attempt at demarcation was to focus on the methodology of science as distinct from other types of methodologies. This idea, beginning in the nineteenth century, took the scientific method to be the best method available to produce knowledge claims. Even if the claims produced are fallible, the method itself is self-corrective and can eventually correct mistakes. The problem, according to Laudan, is that there was no agreement in the nineteenth century on what the scientific method actually was. Philosophers of science disagreed on exactly what constituted science and worse still, what they offered as criteria for science often did not describe the methods that scientists were actually using. For this reason, Laudan claims that philosophers failed again to distinguish science from nonscience. He goes further to claim that no one had managed to show that the methods proposed as scientific were "epistemically superior to their rivals."⁶⁰

After considering the history of the demarcation effort up to the twentieth century, Laudan raises some questions that he believes should be answered in moving forward. Specifically, he asks:

- 1) What conditions of adequacy should a proposed demarcation criterion satisfy?
- 2) Is the criterion under consideration offering necessary or sufficient conditions?
- 3) What actions or judgments are implied by the claim that a certain belief or activity is "scientific" or "unscientific"?⁶¹

In answering these questions, Laudan contends that 1) a demarcation criterion must adequately explain how we normally distinguish between science and nonscience and it must precisely differentiate between scientific and nonscientific enterprises. In other words, it must account for the epistemic status of scientific claims over nonscientific claims. He also explains that 2) it must

provide the necessary and sufficient conditions of scientific status. Otherwise, it can only tell us what might be science in the event that it only offers necessary conditions; or it is precluded from telling us what is certainly non-science in the event that it only offers sufficient conditions. Both necessary and sufficient conditions are required to tell us what all and only activities or statements count as scientific. Finally, he argues that 3) adequate criteria of demarcation must have ‘judgmental implications,’ insofar as what is called ‘scientific’ is better, or more reliable, knowledge than what is ‘unscientific.’⁶²

Two twentieth century approaches to demarcation that Laudan rejects are *verificationism* and *falsificationism*. ‘Verificationism’ is a theory of meaning proposed by the logical positivists which suggests that meaningful claims are those claims that can be exhaustively verified. Laudan rejects verificationism as demarcation because, as he explains, many scientific statements are not open to exhaustive verification. He cites all universal laws as a case in point. Also, he argues that a statement is verifiable to the extent that we can “specify a class of possible observations which would verify it.”⁶³ Because every belief that has been proposed and rejected as part of science was ‘falsifiable’, it was at least partially verifiable. In order to falsify a claim, we must know conditions under which it would be verified. For this reason, Laudan claims that verificationism has failed as a criterion of demarcation. ‘Falsificationism’, on the other hand, was proposed by Karl Popper and is the view that a claim is scientific to the extent that it can be falsified. Laudan rejects falsificationism as a criterion of demarcation because it could render any statement about what exists as scientific. What is required by falsificationism is that the proponent of a claim can offer some conditions under which that claim might be false. It seems that such conditions could be offered for any claim and so, according to Laudan, Popper has brought us no closer to an acceptable criterion.

Laudan finally considers two other criteria that have been proposed in the twentieth century, the criterion of *well-testedness* and the criterion of *cognitive progress*. He explains that the attempt to qualify claims as scientific to the extent that they are well-tested fails because there are other fields that are not properly considered scientific that advance well-tested claims. He offers, as an example, the claim from football strategy that “offside kicks are not usually fumbled.” He contends that such claims are often better tested than many claims that are properly considered scientific. Also, he argues that claims that have yet to be tested within science would not count as scientific on this criterion. He rejects the criterion of cognitive progress for similar

reasons. There are many disciplines that are not properly considered scientific that have shown considerable cognitive progress and a number of fields in science that, at least in certain periods, have exhibited none.

Laudan concludes this article with the contention that the attempt to distinguish science from nonscience is in vain and that there is nothing interesting to be said toward this effort. He goes as far as to say that we should “drop terms like ‘pseudoscience’ and ‘unscientific’ from our vocabulary; they are just hollow phrases that only do emotive work for us.”⁶⁴ On his view, we should instead be concerned with which claims are well substantiated by evidence and which are not. For this reason, he does believe that some claims have greater epistemic value than others. However, this is not a matter of the types of claims they are but is only a matter of the quality of the evidence that supports them. I think Laudan is correct that scientists are properly focused on investigating evidence for claims that are advanced within their enterprise, but I disagree that philosophers of science have nothing interesting to say about what distinguishes science from nonscience. While a clear line of demarcation has yet to be drawn, there are some claims and methods that seem clearly scientific and some that seem clearly unscientific. What accounts for this? Attempting to determine what accounts for this is an effort that philosophers of science rightly pursue, particularly within the context of the debate about science education. Given the legal context that is relevant to that debate, there is certainly something interesting to say toward distinguishing science from nonscience. Also, I disagree that the failure of philosophers to agree upon a demarcation criterion implies that the effort should be abandoned. There are a number of philosophical debates that have not been resolved to satisfaction but that we still find worthwhile to pursue. And again, the legal context of the debate over science education precludes abandoning the effort altogether. Even if the legal issues at hand are the only reason to pursue the philosophical debate further, we cannot afford to be academic purists when the future of one of academia’s most important disciplines is at stake.

Laudan has also taken aim at the demarcation criteria advanced in *McLean*, where the significance of the legal context clearly cannot be denied. As explained in chapter 1, the criteria adopted by Judge Overton were offered in Ruse’s testimony and are that a theory may properly be counted as scientific if 1) it is guided by natural law, 2) it is necessarily explanatory by reference to natural law, 3) it is testable against the empirical world, 4) its conclusions are tentative, and 5) it is falsifiable. *In Science at the Bar – Cause for Concern*, Laudan admits that

the ruling in McLean is “probably to be commended.” But he goes on to say that “it was reached for all the wrong reasons and by a chain of argument that is hopelessly suspect.”⁶⁵ By applying the arguments discussed above, Laudan contends that creation-scientists make claims that are both testable and falsifiable. For instance, they claim that the Earth is very young and has experience a great flood. In denying that these claims are testable and falsifiable, Laudan thinks that science is deprived of its strongest arguments against creationism. For Laudan, these would be arguments that such claims are not substantiated by evidence and so should be rejected as false. He goes further to argue that the tenants of creation-science only fail to be tentative in the minds of those who advance it and that it is the epistemic status of creationism that is in question, not the particular beliefs of its proponents. Finally, Laudan contends that creation-science cannot be shown to lack the requisite conditions that it is guided by and explanatory by reference to natural law. On his view, the problem might simply be that we have yet to discover the laws that would account for these occurrences. He argues that this is not enough to show that they cannot be explained in terms of natural law.

In *Pro Judice*, Ruse responds to Laudan’s critique of Judge Overton’s ruling in *McLean*.⁶⁶ Given the legal context, Ruse argues that Laudan’s view that creation-science is better understood as weak science than as nonscience is insufficient. As he explains, the US Constitution does not prohibit the teaching of weak science – it only prohibits the teaching of religion. The charge in the case was that Act 590 set out to advance religion in science education. In response, the defendants claimed that creation-science was science, not religion. The plaintiffs, then, set out to show both that creation-science was not properly considered science and that it was properly considered religion. They rejected the dual-model approach, and in doing so advanced independent arguments for both claims.

Ruse grants that a clear line of demarcation has not been drawn, but he argues that his criteria do distinguish what he calls the ‘black and white’ cases. Perhaps his criteria cannot distinguish science from nonscience in the ‘gray areas’, but creation-science does not fall there. As natural law is concerned here, Ruse rejects Laudan’s suggestion that creation-science might depend upon laws that are simply not yet known. Rather, the doctrine of creation-science itself relies upon laws that stand outside of natural law and could never be known. There is no testability or tentativeness in creation-science because, as Ruse explains, one of its central tenants is that it never deviates from the Biblical texts. Finally, he rejects Laudan’s claim that the

claims of creation-science are falsifiable or revisable because there are no conditions under which those who advance them would give them up. Laudan has argued that creation-science should be understood on its own terms and apart from the beliefs of those who advance it. However, Ruse rightly points out that it is not like other enterprises in science that are properly considered within the domain of ‘humanity’s cultural heritage.’ Rather, creation-science exists only in the minds of a small group of people. For this reason, the motivation for Laudan’s suggestion here is indeed unclear.

Laudan has offered a response to Ruse in *More on Creationism*.⁶⁷ His response, however, seems to miss the point of Ruse’s replies. Interestingly, he levies the same charge against Ruse, claiming that he has not properly addressed his arguments that some scientific theories fail to meet the criteria advanced in *McLean* and that some nonscientific theories do. He says, “Ruse fails to see the absolute irrelevance to my argument of his rehearsing examples that ‘fit’ Overton’s analysis.”⁶⁸ I should note, first, that in this article, Laudan fails to consistently employ the quotations he places around “scientific” and “nonscientific” as he does in *The Demise of the Demarcation Problem* and *Science at the Bar – Cause for Concern* that were clearly meant to denote that he was simply mentioning these terms rather than using them. This suggests to me that the ‘black and white’ distinction between the two, which is all that Ruse is arguing for, is necessary even to making his own central argument against it. In any case, what Laudan thinks Ruse fails to see is that if his criteria do not provide a clear line of demarcation then creation-science might indeed be counted as science or, at least, could make some small adjustments to meet the requirements. He seems to think that Ruse is arguing that they in fact do provide a clear line of demarcation, and is only offering one example to support this claim. A better interpretation of Ruse’s reply, though, is that he is not attempting to provide a clear line of demarcation. Rather, he is attempting to distinguish what is clearly scientific from what is clearly nonscientific – the ‘black and white’ cases – *and* he is arguing that creation-science is one of those black and white cases. Laudan has given no reason to think he has failed to do so.

Laudan also seems to miss the point that Ruse makes in stating that creation-science does not exist in the domain of humanity’s cultural heritage, but rather exists in the minds of a small group of people. He stresses again that the beliefs themselves and not the mindset of those who advance them should be evaluated. However, Ruse does seem to be addressing the beliefs themselves. That they issue from a small group that is homogenous in its relevant philosophical

assumptions and do not appeal broadly to humanity suggests that they are more than just weakly supported claims – it suggests that they are religious beliefs. This is relevant in their evaluation, especially in the context of a court that is attempting to determine if they are properly considered scientific claims or religious claims.

I think then, that Ruse has gained his point. First, the legal context gave birth to the creation-science movement so it is relevant in evaluating it. This to not say that Laudan’s larger philosophical point cannot be made. However, it is only within the legal context that this is an important debate, especially since we are considering the beliefs of a small group of people. If not for *McLean*, we would still be debating demarcation criteria, but we would not be debating the scientific status of creation-science. Further, it is not necessary to solve the demarcation problem to show that creation-science is not science. There are clearly cases of science and non-science, even if there are gray areas in between. Creation-science does not fall in the gray area – it is clearly not science. The same hold true, then, for intelligent design theory. As was demonstrated in the *Dover* decision, intelligent design theory has really gone no further than replacing ‘creation’ with ‘design.’ Intelligent design theory could avoid the charge of advancing religion, I suppose, if it were stringent in its adherence to a natural designer, but this is only weakly suggested by Dembski and the most preliminary investigation of his true views and those of other proponents of intelligent design betrays their religious commitments.⁶⁹ Still, rejecting these commitments would only show that intelligent design might not be religion. It would not be enough to show that it is science. Perhaps it could count as science if it proposed a natural design and set about to illustrate the nature of that design and the mechanism by which it designs, but scientists have been engaged in that pursuit for more than a hundred years and the fruit of their efforts is evolutionary theory.

2.2 Philosophical Naturalism & Methodological Naturalism

Despite Laudan’s attempts to divorce the debate over demarcation from philosophical assumptions, the nature of such assumptions has become quite significant to the larger debate about evolutionary theory and intelligent design theory. Specifically, each side charges the other with holding the ‘wrong’ sorts of assumptions for what they advance to properly count as science and not religion. As discussed in chapter 1, the efforts of Phillip Johnson have shifted the debate into this context and provided the theoretical framework for the advancement of intelligent

design to replace creation-science. The effort was to eliminate *prima facie* religious commitments in order to put a new face on creationism that would meet the requirements of the court for entering public education. The effort has failed in the court thus far, but the philosophical debate continues. While I think that Laudan's sincere and charitable – albeit perhaps misguided – effort to evaluate the claims of creation-science in themselves is unproductive, I do think that Johnson's effort to shift the debate into the realm of philosophy is interesting and might yield valuable results. I do not think, though, that the nature of those results would be satisfactory to the proponents of intelligent design.

In his testimony during *Dover*, Robert Pennock argues that intelligent design theory is not merely unscientific, but is essentially religious.⁷⁰ Pennock accepts that science can be understood as a set of methods that require appeal to natural explanations. As he explains, intelligent design theory violates this fundamental tenant of science from the beginning by appealing to explicitly supernatural explanations. He does not believe that science necessarily denies the existence of supernatural entities or causes, but the fact that such things are, by definition, outside of the realm of empirical evidence precludes them from being included in anything that is properly considered scientific. He believes that this alone is enough to count intelligent design theory as religion and not science. To illustrate his claim that intelligent design necessarily appeals to the supernatural, Pennock points to the work of Johnson, who he recognizes has affirmed that “God is objectively real as Creator.”⁷¹ The problem here, according to Pennock, is not that Johnson and other proponents of intelligent design hold an antecedent belief that God exists. The problem is that this belief functions in their explanations, making them fundamentally not naturalistic explanations. They simply reject the methodological naturalism of science.⁷²

Johnson's intellectual honesty, at least, is impressive insofar as he never denies that he has fundamentally different assumptions about the natural world, its causes, and how we should understand them than do those who claim to be doing ‘real science.’ In his book, *Reason in the Balance*, he contends that the demand of science that its explanations be wholly natural assumes that a deeper philosophical commitment, philosophical naturalism, is true. Most of what science tells us about the universe, according to Johnson, is tainted by naturalism and theists should work toward advancing their own theory of knowledge. He does not hide his view that this new theory should be grounded in religious doctrine. He says:

“The most important statement in Scripture about creation is not

contained in Genesis but in the opening verses of the Gospel of John: In the beginning was the Word, and the Word was with God, and the Word was God. He was in the beginning with God. All things came into being through him, and without him not one thing came into being, (John 1:1-3)

This statement plainly says that creation was by a force that was (and is) intelligent and personal. The essential, bedrock position of scientific naturalism is the direct opposite of John 1:1-3. Naturalistic evolutionary theory, as part of the grand metaphysical story of science, says that creation was by impersonal and unintelligent forces. The opposition between the biblical and naturalistic stories is fundamental, and neither side can compromise over it. To compromise is to surrender.”⁷³

He clearly sees science and theism as necessarily opposed to one another, though many, including Ruse, have argued that this is not the case. He continues:

“Because in our universal experience unintelligent material processes do not create life, Christian theists know that Romans 1:20 is also true: ‘Ever since the creation of the world [God’s] eternal power and divine nature, invisible though they are, have been understood and seen through the things he has made.’ In other words, there is absolutely no mystery about why living organisms appear to be the products of intelligent creation, and why scientific naturalists have to work so hard to keep themselves from perceiving the obvious. The reason living things give that appearance is that they are actually what they appear to be, and this fact is evident to all who do not cloud their minds with naturalistic philosophy or some comparable drug.”⁷⁴

Later, in *The Wedge of Truth*, he contends that science as it is currently understood is not a metaphysically innocent empirical enterprise. Rather, he argues that it depends upon philosophical naturalism insofar as it accepts only naturalistic explanations. The assumption of naturalism, Johnson appears to think, opens the door to the broader debate about what metaphysical claims are reasonable to accept. He says:

“By any realistic definition, naturalism is a religion, and an extremely dogmatic one. It rests on a basic conviction about ultimate reality that is

*held by a kind of faith, and it incorporates its own definitions of 'knowledge' and 'reason.' It says that knowledge comes ultimately from our senses and that the more complex forms of knowledge come from scientific investigation. By naturalistic definitions, there can be no such thing as knowledge of the supernatural. Statements about God are either nonrational (if frankly presented as mere subjective belief) or irrational (if they purport to make objective factual claims). This system of categories allows the metaphysical naturalists to mollify the potentially troublesome religious people by assuring them that science does not rule out 'religious belief' (so long as it does not pretend to be knowledge)."*⁷⁵

In these passages, it is clear that Johnson's attempt is to move the problem of demarcation into the realm of philosophical assumptions and it appears that he believes that the nature of these assumptions is that they are either theistic or atheistic. This is a version of the dual-model approach and whether or not he is correct in this approach remains to be seen. Still, he has introduced some philosophical issues of interest that deserve further attention. Namely, he has raised questions about whether science, insofar as it offers only naturalistic explanations, can truly be understood apart from any religious doctrine and what the answer to this question suggests for its fate in the legal context. Interestingly, there is little rejection of Johnson's claim that philosophical naturalism is problematic. Thus far, responses have aimed to move the debate out of the realm of philosophy and back into the realm of practice, or methodology. It seems then, that there might be something significant to address in the larger philosophical context, regardless of whether Johnson's position is correct. To his credit, Johnson appears to concede this point. He says:

*"If Christian theists can summon the courage to argue that preexisting intelligence really was an essential element in biological creation and to insist that the evidence be evaluated by standards that do not assume the point in dispute, then they will make a great contribution to the search for truth, whatever the outcome."*⁷⁶

I will return to these questions and how they have been addressed in recent literature in Chapter 3. For the purposes of this discussion, though, it is important to consider how science was distinguished from intelligent design in the *Dover* case, and *methodological naturalism* was important to achieving this end.

In his testimony, Pennock does address Johnson's concern that science depends upon a type of religious dogma, but he does not argue against him on this point at any length here. Rather, he relies upon the methodological approach to defining science offered by Ruse during *McLean* and claims that "Science does not reject the supernatural dogmatically, but rather because it cannot be tested by empirical evidence."⁷⁷ Clearly this would not count as a satisfactory reply for Johnson because as quoted above, he believes that without a commitment to philosophical naturalism, we are free to see that things are 'actually what they appear to be.' This suggests that for Johnson, the nature of empirical observation itself is determined by one's antecedent philosophical commitments and if this is true, then Pennock is simply begging the question. In any case, later in his testimony, Pennock draws the key distinction between philosophical naturalism and methodological naturalism that keeps the debate in the court centered on practice rather than ideology. He says:

*"As we have seen, the defining element of IDT is its essential reliance upon supernatural beings and powers – entities that are unconstrained by either lawful necessity or chance processes. The ID movement thus rejects a basic element of scientific evidence, namely, that explanations appeal only to natural causal processes. Scientific explanations need not cite a specific law of nature, but they are always understood to be restricted to the physical realm of law-bound cause and effect relations. In science, this is a principle of method, not a metaphysical dogma This is typically spoken of as methodological naturalism in contrast to metaphysical naturalism (also sometimes referred to as ontological or philosophical naturalism)."*⁷⁸

Although Judge Jones accepted the criteria of methodological naturalism in his decision, many are unsatisfied with what it requires. Alvin Plantinga, for instance, advances a number of arguments against it. Plantinga attacks Ruse, in particular, for claiming in *Darwinism Defended* that science – by definition – deals only with the natural.⁷⁹ According to Plantinga, Ruse's explanation of methodological naturalism leaves something to be desired for three reasons. First, he references the demarcation problem and suggests that if Ruse were in fact appealing to a definition, then it should offer necessary and sufficient conditions for what counts as scientific. Second, he thinks the characteristics of science appealed to by Ruse are insufficient. These are that science deals with things that are 1) repeatable, 2) merely natural, and 3) governed by

natural law. Plantinga addresses the first and the third of these. He thinks that the first condition fails to characterize theories like the Big Bang that are clearly scientific. He argues that the Big Bang was unique and possibly unrepeatable, but that this does not prevent us from considering investigation into the Big Bang scientific. In attacking the third, he argues that there is some debate about whether or not natural law even exists. He appeals to the work of Bas van Fraassen who he claims argues for the conclusion that there are no natural laws. Plantinga argues that regularities do exist, but that something further is required of law. Law should explain regularities and should be necessary in some way. He contends that perhaps the requirements for a law to exist may not be met.⁸⁰ Finally, Plantinga argues that regardless of the conditions offered by a definition of science, the debate over demarcation cannot be settled simply by appealing to a definition. He thinks what is at stake is not a question about whether the word 'science' properly denotes a hypothesis that makes reference to god, but rather, it is a question of whether a hypothesis that references god could be part of science.⁸¹

It is curious that Plantinga raises the same objection to Ruse that Laudan raised more than a decade earlier. This is just what his first concern amounts to. Without responding to Ruse's explanation that he is only offering a characterization of the black and white cases of science and non-science, Plantinga raises the demarcation problem as an argument against Ruse's account of methodological naturalism. In *Methodological Naturalism Under Attack*, Ruse replies to Plantinga's concern.⁸² He emphasizes that he is not looking to solve the demarcation problem and that he is not attempting to offer an analytic definition of 'science' in offering criteria for what counts as scientific. For the reasons I discussed in the previous section, I think his replies are sufficient to dismiss this concern.

Ruse also replies to Plantinga's attacks on his characterization of methodological naturalism. According to Ruse, Plantinga's concern over repeatability is misguided because there have been many events that are unique but are still explicable in terms of natural laws. He appeals to the extinction of dinosaurs, in particular, and argues that despite the fact that dinosaurs only existed once and will never reappear, their extinction by way of an asteroid or comet hitting the earth is completely explicable in terms of natural law. It does seem clear that the particular state of affairs upon which natural law operates will determine the uniqueness of the events that result. For this reason, some events are more likely to be repeated and others are less likely. It is not at all clear why Plantinga thinks that this is such a problem for methodological naturalism. It

seems that many examples from natural history can be produced to illustrate this point. What is interesting, and what should be noticed by Plantinga, is that the same natural laws operate in producing unique states of affairs. This suggests that it is indeed a feature of the state of affairs upon which laws operate – and not any problems concerning the repeatability criteria of methodological naturalism – that produce unique events like the Big Bang and the extinction of the dinosaurs.

Plantinga's worry that there might be no natural laws is also addressed by Ruse. He explains that it is legitimate to question the necessity of laws, but that Plantinga has misinterpreted van Fraassen's claims. According to Ruse, laws just are the regularities that are presupposed in science and neither van Fraassen nor any average scientists would deny this. Plantinga has gone further to claim that laws must be more than regularities – they must provide an explanation of the necessity of regularities. It is not clear what Plantinga seeks here, nor is it clear what would satisfy him. It seems that a regularity might be something like the claim that 'an apple falls to the earth when it is dropped.' The law that is invoked to explain this is the law of gravity. Is Plantinga characterizing gravity as regularity rather than a law? And if so, is he further demanding to know what necessitates that gravity exerts its force upon objects? It seems that the regularity of apples falling to the earth as a matter of necessity *is* explained by the law of gravity. It is not clear what further demand Plantinga is making. The only candidate that seems plausible is an explanation of the necessity of the law of gravity itself. But then, if we were to offer such an explanation, what would make *that* the law and not just another regularity to be explained? This suggests to me that if Plantinga is interpreting what most understand as law as mere regularity, then there can be no explanation that will satisfy him.

2.3 Science & Supernaturalism

Thus far, I have focused on the effort made in the demarcation debate to characterize science and to show that intelligent design is not science. This effort points to features of intelligent design that are specifically unscientific – most importantly, that it appeals to supernatural causes. In response, proponents of intelligent design – or at least critical of philosophical and methodological naturalism – have argued that what properly counts as science is not adequately characterized by the criteria that has been offered thus far. There is another strategy in the literature that deserves to be discussed. This is the strategy of showing what

science, properly considered, has in common with intelligent design theory, as opposed to what intelligent design theory has in common with science.

Proponents of this ‘supernatural strategy’ typically focus on supernatural assumptions that have been instrumental in grounding the development of certain theories in the past and contend that we consider those theories to be scientific. So, why should we begrudge intelligent design theory for introducing a supernatural cause? In response to this strategy, Ruse suggests that sometimes science is mingled with nonscience and this fact does not make the nonscience into science. To the extent that one deals with natural law, one is dealing in science. To the extent that one does not, one is dealing in nonscience. He goes further to argue that the scientific enterprise itself has evolved and what might have been considered acceptable in the past is no longer acceptable, nor should it be acceptable.⁸³ I think these are the right sort of replies to the supernatural strategy and that the involvement of supernatural causes precludes a theory from being properly considered scientific.

I also think, though, that there might be a separate issue at hand and I think this issue is suggested by Steve Fuller in his article, *A Step Toward the Legalization of Science Studies*.⁸⁴ Here, Fuller does invoke the supernatural strategy and he in fact served as a rebuttal witness for the defense in the Dover trial specifically to argue against the National Academy of Science’s declaration that science requires methodological naturalism. As he explains, the history of science is full of examples of supernatural hypotheses and explanation. He says:

“Typically, these supernatural hypotheses – expressions of what is less prejudicially called ‘metaphysical realism’ – receive their initial grounding in a mathematically significant pattern that points to a deeper level of explanation. In the case of, say, Newton’s appeal to gravitational attraction or Mendel’s to hereditary factors, these hypotheses have had theistic origins that survive in contemporary IDT –namely, ideas of a divine plan and special creation.”⁸⁵

For this reason, Fuller does not think it is appropriate to characterize science as the absence of any supernatural elements that function in explanation because science has, in fact, done this for centuries. Still, though, he recognizes that the decision in the *Dover* case was the right one and he says that the right precedent was set by Ruse’s testimony in the *McLean* case. Yet, he is not completely satisfied with the *Dover* ruling. He says:

“My own view is that the defense did indeed have the weaker case, but

equally that the judge did an injustice to the relevant philosophy, politics, and ultimately to science. IDT may be inept in its self-understanding and self-presentation, but it did not deserve to be dismissed outright.”⁸⁶

These are the closing remarks of his article, so it is not completely clear what injustice has been done in Fuller’s view. If he thinks that Ruse’s criteria set the right precedent, then it seems that he is not too bothered by counting intelligent design theory as non-science, though he thinks a historical interpretation of the development of science makes this less than a charitable characterization. Also, the ruling was about a proposed educational policy – and he thinks it was the correct ruling – so what is the injustice? Perhaps Fuller thinks that the ruling has ended debate in a significant sense and, in doing so, has deprived us of further and fruitful discussion. I do not think this follows from the ruling at all.

Without question, the debates over demarcation, philosophical naturalism, and methodological naturalism continue and the courtroom can certainly be revisited if the proponents of intelligent design theory are able to get a significant foothold in them. And it is, to be clear, the context of the courtroom that is driving these debates for many involved. Otherwise, why would gaining the status of science be so significant to proponents of intelligent design? Why not just let others think what they may and continue to work on their own projects? The institutes that support them are quite wealthy and, as they like to emphasize, a clear majority of the American public already supports them. To be sure, it is to achieve the goals of the creationist movement in public education that intelligent design advocates continue in their efforts and so the debate will likely continue in a manner similar to the way it has thus far for some time to come. And of course, there will be good scientists and philosophers who will stand every ready to meet the challenge – as they should because the logic is on their side and because there is much at stake.

I believe Ruse’s criteria demonstrate that intelligent design theory is not science and this has proven sufficient to satisfy the courts. As he explains, the courts do not prohibit the teaching of bad science so it is important that it is understood to be a black and white case of non-science. However, as Fuller’s concerns suggest, the debate still exists and indeed continues in other contexts – namely, the academic and social contexts. In his books, *Abusing Science: The Case Against Creationism* and *Living with Darwin: Evolution, Design, and the Future of Faith*, Phillip Kitcher is concerned with these contexts, particularly the social context. As he explains,

the debate over creation and evolution continues to persist in the social context no matter how successfully academics have defended evolution or refuted creationism. For this reason, his aims in these two books are similar. He hopes to provide a guide for people with little training in the subject matter so that they may appreciate the strength of Darwinian evolution, understand the flaws of creationism, and develop a ready response to the defenders of creationism that they encounter.

The first of these books, *Abusing Science*, was published in 1982 and so focuses on creation science.⁸⁷ The second book, *Living with Darwin*, was published in 2007 and deals with the new challenge of intelligent design theory.⁸⁸ While intelligent design theory is properly considered nonscience in the legal context, if it is still insisted to be science in continuing academic and social debates, Kitcher's work is useful in showing that it is bad science. He thinks arguing that intelligent design is bad science rather than nonscience is a more successful approach for two reasons. First, he explains that proponents of intelligent design can simply alter their position so that it does meet the necessary criteria to be counted as science. For instance, he believes it is possible to conceive of intelligence without personifying it. One strategy he suggests is proposing an 'intelligent operation' in the place of an intelligent designer to avoid personification of intelligence.⁸⁹ It seems that we might see such a move from the creationist camp and this is a move that would mirror the transition from creation-science to intelligent design theory. Second, Kitcher advocates the supernatural strategy as effective against attempts at demarcation insofar as he thinks religious hypotheses and theories have functioned throughout the history of scientific inquiry.⁹⁰

Kitcher's own view is that intelligent design theory should be viewed as 'dead science,' or bad science, precisely because of its entanglements with religious sentiments. Similar to Ruse, Kitcher argues that intelligent design might have once been considered science, but it is not properly considered so today. Also similar to Ruse, he recognizes that the legal context requires more than the claim that intelligent design is dead science to keep it out of the classroom. However, he does not believe it is necessary to argue that it is not science in order to satisfy the courts. Rather, his approach is to show that the only motivation for introducing it into the classroom is a religious motivation. For Kitcher, the fact that intelligent design remains silent on the mechanisms of intelligent operation – specifically that would explain when it operates and what it does when it operates – suggests that it is not primarily concerned with doing science.⁹¹ If

it were, and if it were concerned with doing *good* science, then it would seek to offer explanations of its primary mechanisms.

Given the failure of creation science and the subsequent rise of intelligent design theory, Kitcher rightly addresses the puzzling persistence of the creationist movement in *Living with Darwin*. Here, he not only addresses the academic arguments for intelligent design, but also the attitudes that have made its support by average citizens possible. According to Kitcher, a driving force that sends defenders of evolution and creationism to the courts time and again is public sentiment. As he explains, the average person is convinced by creationists that to accept Darwin is to reject god. He notes that this dilemma has been argued against since Darwin's day and that even the eulogies offered at Darwin's funeral in Westminster Abbey show that it is a mistake – one can understand Darwinian evolution as consistent with a divine plan.⁹² Still, the notion that accepting evolution requires atheism persists and is a motivating factor in anti-Darwin sentiments. In addition to addressing the mistaken assumption that evolution is atheism, though, Kitcher also believes it is important to understand how lives can matter in a way that is consistent with evolution. Clearly the average citizen is not convinced, and so he concludes this book with the suggestion that, “We should articulate, as clearly as can be done, the possible routes along which lives can find significance.”⁹³

I think Kitcher is right that views of meaning in life consistent with evolution must be advanced in addition to arguments that evolution is not atheism. I also believe he is correct in his belief that until these issues are adequately addressed, the debate surrounding evolution and creationism will continue to arise. A clear example of this can be found in a paper published in 2008 by Thomas Nagel on intelligent design and public education and in his positive review of a book by Stephen Meyer that advances intelligent design theory. Nagel has extended an olive branch to proponents of intelligent design despite the fact that he does not agree with their religious sentiments. He does, however, agree with their view that accepting evolution requires accepting atheism insofar as he believes that evolutionary theory precludes the possibility of a divine intelligence that intervenes in the natural world. Nagel's arguments have stunned philosophers and scientists, but perhaps may be understood to have been predicted by Kitcher.

One interpretation of intelligent design theory offered by Kitcher suggests that its proponents might simply be attempting to explain the ways in which scientific investigation is limited. He says:

“Perhaps, however, there is an alternative interpretation, one that recognizes the intelligent design-ers as intending only to identify the limits of natural science. On this reading, they would argue only that some evolutionary transitions cannot be understood in terms of the operation of natural selection – or indeed in terms of any other natural process – and they would modestly decline to advance any explanation of why such transitions have occurred.”⁹⁴

Kitcher does not think that this is a proper interpretation of intelligent design theory, and even if it were, it would still have trouble showing the limits of science that its proponents advocate. However, it seems that an effort to explore the limits of science would be useful philosophically, and might provide some catalyst toward scientific inquiry. I am not sure what those limits might be or, more properly, *where* they might be, or even if such limits exist. It seems fair, though, to explore this question. I would not, however, start where intelligent design proponents start. The literature overwhelmingly illustrates how their effort to show the inadequacies of certain scientific explanations has failed miserably. There seems to be another starting place, though, and this one is sketched out by Nagel in his recent paper on intelligent design. Nagel, in fact, seems to represent exactly the approach to this debate that Kitcher briefly describes. In his arguments, Nagel makes a number of the same mistakes that proponents of intelligent design have made. However, his lack of a metaphysical commitment introduces a new approach that might allow for new directions in the larger debate. This will be the subject of the following chapter.

CHAPTER THREE

THOMAS NAGEL & INTELLIGENT DESIGN THEORY: UNLIKELY ALLIES UNITED BY A COMMON FOE

With an academic career spanning nearly 50 years, Thomas Nagel has earned a PhD from Harvard University, taught at University of California at Berkeley, Princeton University, New York University, and produced numerous publications. He is a reputable and esteemed American philosopher and legal scholar best known for his work in ethics and philosophy of mind. Over the last three years, however, his reputation has come under attack. Brian Leiter has gone so far as to blog that Nagel has “made a fool of himself” and that one of his recent publications is “an embarrassment” and “comically bad.” The 2008 publication that Leiter thinks has cost Nagel his reputation, *Public Education and Intelligent Design*, is the first of two recent moves by Nagel that have earned him much criticism from philosophers and scientists alike. His second controversial move came on November 25, 2009, when he recommended Stephen C. Meyer’s book, *Signature in the Cell: DNA and the Evidence for Intelligent Design*, as a book of the year in the Times Literary Supplement. In just over a year, he had shocked the academic community and his views had been “mind-blowing,” to use the words of Stephen Fletcher. In what follows, I will explain Nagel’s views on the status of intelligent design theory and evolutionary theory as science, as well as his policy recommendations for public education. After doing so, I will consider four published responses to Nagel’s assessment of evolutionary theory and intelligent design theory. Finally, I will argue that this recent work is not a particularly surprising move on Nagel’s part and that it is offered not so much to bolster intelligent design theory as to attack the old foe that he labeled ‘scientism’ more than 20 years ago.

3.1 Nagel’s Defense of Intelligent Design

In *Public Education and Intelligent Design*, Nagel argues in a manner that is reminiscent of Phillip Johnson’s views as I discussed in chapters 1 and 2. Here, he makes a number of claims, but the key claims seem to be that (1) intelligent design theory is as much science as evolutionary theory and (2) space should be made in public school curriculum for a frank but noncommittal discussion of the relation of evolutionary theory to religion. These are, at least, the claims that his critics attack. In arguing for these claims, Nagel is responding to Judge John E.

Jones' 2005 decision in *Kitzmiller v. Dover Area School District*, which he says was “celebrated by all red-blooded American liberals as a victory over the forces of darkness.”⁹⁵ In this decision, intelligent design theory was determined not to be science because it invokes supernatural causation, employs a flawed and illogical contrived dualism, and has been adequately refuted by the scientific community to the extent that it is presented as attacks on evolutionary theory. The ruling, Nagel thinks, reveals an “intellectually unhealthy situation” in which religious orthodoxy has given way to a counterorthodoxy supported by bad arguments and an overestimation of the explanatory power of evolutionary theory.

Nagel does not see evolutionary theory as devoid of religious commitments and this idea is central to his arguments. He claims that the religious beliefs associated with evolution must be recognized in order to fully understand the theory and evaluate the evidence for it. This claim seems a bit odd on the face of it, but it is clear that Nagel wants to understand evolutionary theory in the broader social and political context into which it was introduced. He says that evolutionary theory is not just a theory that life evolved, but that its defining element just is its rejection of design. It holds that life arose from random and purposeless mutations and it was presented in the first place as an alternative to design. In being developed as such, Nagel thinks it is clear that advocates of evolutionary theory not only understand the notion of an intelligent designer whose acts and decisions cannot be explained by natural law, but reject the possibility of such a designer as an antecedent religious belief.

By contrast, Nagel defines intelligent design theory as:

*“a claim about what it is reasonable to believe about biological evolution if one independently holds a belief in God that is consistent with both the empirical facts about nature that have been established by observation, and with the acceptance of general standards of scientific evidence.”*⁹⁶

He thinks that its critics exclude it from science because it involves the wrong antecedent belief, namely, that the intervention of an intelligent designer is possible. He does not see intelligent design theory as an argument for god's existence, but rather as a theory about the origins of life that understands the scientific evidence as indicating design. As he defines evolution as a theory about the origins of life that understands the scientific evidence as precluding the intervention of an intelligent designer, he claims that the two theories are theories about the same proposition. That one sees the evidence as being in favor of the proposition that the origin of life involves

intelligent design and the other interprets the evidence as being against this proposition is not enough to count one as science and one as not science.

It is important to Nagel that intelligent design theory does not explicitly address the purposes and intentions of god or the nature of his will, but only suggests that there is evidence of divine intervention. He admits that “divine psychology” is beyond the scope of science, but thinks it is perfectly reasonable for science to make claims that a non-law-governed cause intervened in the natural order and he thinks there can be scientific evidence for this claim. In explaining this, he draws an analogy between intelligent design theory and the idea that ghosts are responsible for certain events. Where ghosts have been attributed responsibility for spooky events, research to show that there is a natural explanation for those events counts as science. However, if the research draws the opposing conclusion – that there can be no natural explanation – then that is not counted as science. Nagel says the reason for this can only be that the proposition that ghosts exist is rejected as obviously false and not something that a reasonable person could accept. He claims that the same thing is happening when intelligent design is rejected as non-science. Its rejection is not because it does not make use of scientific evidence, inference, and explanation. It is rejected because it relies on the antecedent religious belief that god exists.

After arguing that there is not sufficient reason to count intelligent design theory as non-science unless an appeal is made to an antecedent religious belief, Nagel proposes the following dilemma to its opponents: either they admit that the intervention of an intelligent designer is possible or they do not. On the first horn of the dilemma they can show that while the possibility of intervention does exist, the scientific evidence is overwhelmingly against it. However, if this strategy is embraced it cannot be said that a person who appraises the evidence as being in favor of divine intervention is not doing science. On the second horn of the dilemma they can appeal to the belief that intervention is impossible, but as this relies on an antecedent religious belief about the existence of god, namely that god does not exist, this strategy is as much religion as intelligent design theory is claimed to be. The proper conclusion to draw from this dilemma, according to Nagel, is that either both intelligent design theory and evolutionary theory are science or neither of them is.

The conclusion that Nagel draws for educational policy is that both including and excluding intelligent design theory from the science classroom depend upon religious

assumptions. Including it depends upon theistic assumptions while excluding it depends upon atheistic assumptions. As the Establishment Clause prohibits the endorsement of atheism just as much as it prevents the endorsement of theism, Nagel wonders why it is acceptable to teach that design is not possible – which is what he thinks evolutionary theory amounts to – while it is not acceptable to teach that design is possible. On Nagel’s view, the only non-religious approach is to inform students that the evidence may suggest different conclusions depending on what antecedent religious belief one starts with. For this reason, Nagel thinks that discussion of evolutionary theory without elaborating on its religious assumptions is intellectually irresponsible.

Ultimately, Nagel weakens his recommendation for public education. He does think that a frank and noncommittal discussion of the connection between evolutionary theory and religion is called for, but he does not claim that such discussion must take place in biology courses. If biology teachers would be unduly burdened by this, then “room should be found for it elsewhere.” Presumably this discussion could take place in history or perhaps even philosophy courses where the nature of the subject matter would be importantly different. Nagel’s position, then, could be taken as a call to introduce completely new subject areas in public education. However, it is clear that he thinks the discussion he recommends belongs in the science classroom.

3.2 Nagel’s Critics

Soon after the publication of Nagel’s article, a group of critics from Vanderbilt University published a response to his policy proposals in *Spontaneous Generations* that included reference to a forthcoming paper which was later published in the *Journal of Philosophical Research*.⁹⁷ In the first paper, they argue that Nagel’s recommendations for education are not the proper consequence of his philosophical arguments. The second paper is an expansion upon the first, arguing not only that his policy recommendations are misaligned with the conclusions of his philosophical arguments, but that his philosophical arguments fail because they rest on a false dilemma. In what follows, I will consider their criticisms of Nagel’s policy recommendations. After doing so, I will evaluate their argument that Nagel’s dilemma fails and their appeal to what they call *functional nontheism*.

Scott Aikin, Michael Harbour, and Robert B. Talisse, who I will call the Vanderbilt critics, recognize that Nagel’s policy recommendations for education are much weaker than his

arguments would warrant. They first question what Nagel means by a ‘noncommittal discussion’ on the issues given that high school students are not familiar with the details that would allow them to participate in such a discussion. Next, they argue that if Nagel is correct that either both evolutionary theory and intelligent design theory are science or neither of them is, then why not insist that both are taught or demand that neither is? They explain that Nagel attempts to avoid this conclusion by suggesting that intelligent design theory should not be taught in science class because it is bad science, as opposed to non-science. They reply, though, that the distinction between good and bad science is no easier to deal with than the distinction between science and non-science.

It is not clear whether Nagel in fact means to avoid the conclusion that intelligent design theory and evolutionary theory are on equal footing as contenders for biology curriculum. What the Vanderbilt critics seem to be referring to here is Nagel’s claim that he agrees with Philip Kitcher that evolutionists should not argue that intelligent design theory is non-science, but that it must be argued that it is bad science when the attempt is made to exclude it from the classroom. But then he goes on to make a similar point that the critics make. He says that:

“the claim that ID is bad science or dead science may depend, almost as much as the claim that it is not science, on the assumption that divine intervention in the natural order is not a serious possibility.”⁹⁸

So it seems that he thinks arguing that intelligent design theory is bad science is more viable than arguing that it is non-science, but it is not clear at all in this article that he indeed thinks it is bad science. In fact, he contrasts it with Biblical literalism. He says that in order to reject Biblical literalism, no underlying religious belief must be assumed. The scientific evidence shows that the claims of Biblical literalism are impossible and to accept them would defy the standards of scientific rationality. He does not believe that the same is true of intelligent design theory and he makes a concerted effort to show not only that the notion of intelligent intervention in the evolution of life is possible, but also that it is legitimate science to search for clues to such intervention.

The Vanderbilt critics list four possible consequences of Nagel’s arguments, (1) that intelligent design must be included wherever evolution is, (2) that equal time for both views could be insisted upon, (3) that individual school districts could be left to decide, which presumably could result in intelligent design being taught in biology to the exclusion of

evolutionary theory, and (4) that both intelligent design and evolutionary theory might be banned from the classroom.⁹⁹ It seems the first two might be consequences that Nagel would allow, but the third and fourth seem like fundamentally different types of claims. These claims suggest that what clearly counts as science on Nagel's view might be restricted or banned in the classroom. Nagel could reject those two consequences on the criterion that what counts as science must be taught while retaining the first two consequences because they only advocate including more of what he considers science. Nagel does seem to be aware, however, that his arguments might prompt the adoption of the repugnant consequences on the part of some fundamentalists. His article concludes with the following:

*"I understand the attitude that ID is just the latest manifestation of the fundamentalist threat, and that you have to stand and fight them here or you will end up having to fight for the right to teach evolution at all. I believe that both intellectually and constitutionally the line does not have to be drawn at this point, and that a noncommittal discussion of some of the issues would be preferable."*¹⁰⁰

What he seems to be suggesting is that a discussion of intelligent design should be included in the curriculum because it is science, but that prohibiting the teaching of evolution is the proper place to draw the line. And so, it seems that the conclusions to draw from his arguments are just the ones that he intends. It also seems that he can appeal to the criterion that what counts as science must be taught to avoid the repugnant conclusions for education policy.

Nagel's position, then, is that the possibility of divine intervention exists and that those who use data to infer such intervention are in fact doing science just as those who use the data to reject it are doing science. He does not believe that there is a god or that divine intervention is a reality, but he embraces the idea that one can rationally accept the possibility and seek evidence to either confirm or disconfirm it. It is not a conclusion of his arguments that neither intelligent design theory nor evolutionary theory is science. He suggests this only as a *reductio ad absurdum* of the claim that intelligent design theory is not science. Both are science or neither is, and further, evolutionary theory is science, so intelligent design theory must be also. This conclusion, though, relies heavily upon the assumption that what evolutionary theory is doing is in fact using scientific data to infer that there is no designer and as such has as its primary aim to provide an alternative to design.

Nagel does recognize the importance of his assumption that evolutionary theory is offered as an alternative to design and he understands that many who want to exclude intelligent design theory from the classroom would simply reject this by saying that things have changed since 1859. They would admit that in Darwin's day it was reasonable to present evolution as an alternative to design but that today this is as irrelevant as presenting the heliocentric model of the universe as an alternative to the geocentric model. He cites Judge Jones' claim that the court means to express no opinion on the truth of intelligent design as a supernatural theory, but he contends that this is not the case with most evolutionary biologists. For them, he believes that it is part of their basic epistemological and metaphysical framework that god does not exist or that if he does, he exists completely outside the realm of the natural universe.¹⁰¹ Of course, what evolutionary biologists actually believe is a matter of empirical fact. That the foundation of his arguments just is his assumption that they hold one belief rather than another puts those arguments on shaky ground, at best. This is an issue that I will discuss further in chapter 4.

An insightful critique of Nagel's article is offered by Graham Oppy in *Critical Notice: Nagel on Religion, Politics, and Humanity*.¹⁰² Here, Oppy rightly recognizes that Nagel's true battle is with evolutionary reductionism, and indeed, Nagel claims that evolutionary reductionism defies common sense.¹⁰³ I understand evolutionary reductionism to mean that evolution is the whole story of the origins of life and is a deeper metaphysical commitment than evolutionary theory itself seeks to defend. What Nagel seems to be objecting to, really, is the assumption of evolutionary biologists that evolutionary reductionism is true. The extent to which that assumption finds its way into the classroom appears to be the true crux of the matter. In writing about his home state of Victoria, Australia, Oppy contends that controversy does not enter the year 7-12 biology curriculum and that evolutionary reductionism is not favored over any opponent. He goes further to claim that teaching about the known mechanisms of mutation does not assume any antecedent beliefs about the truth or falsity of evolutionary reductionism. On his view, intelligent design theory plays no working role in the biological sciences and he adds that the same is true of evolutionary reductionism. That seems right, and it seems that the two are really beliefs about deeper metaphysical commitments that are perhaps religious, as Nagel claims, or at least philosophical. Nagel is right that the Establishment Clause prevents either of these from entering the classroom. What remains to be shown is whether teaching evolution necessarily brings one in to the exclusion of the other.

The Vanderbilt critics address just this question in their later paper, *Nagel on Public Education and Intelligent Design*. Here, they argue that Nagel's is a false dilemma because the belief that the intervention of an intelligent designer is not possible does not necessarily require the belief that god does not exist. As they explain it, the naturalism that underlies evolutionary theory is not atheistic, but *functionally nontheistic*.¹⁰⁴ When first considering Nagel's dilemma, it did seem to be a false dilemma for the more obvious reason that one might be agnostic on the question of the existence of god. Not having a belief that p does not imply that one has a belief that \sim p. However, the functional nontheism described by the Vanderbilt critics is a more sophisticated notion. It seems to cover the minimally required antecedent belief to overcome Nagel's dilemma and perhaps captures the sentiments of atheists, agnostics, and theists who do not believe that god intervenes. It simply does not speak to the existence of god at all, but is rather the belief that reference to supernatural beings is not necessary to explain biological phenomena. Functional nontheism, then, is the basis of what they call *scientific naturalism*, which is the view that science can proceed on purely natural explanations and does not go further to claim that there are no supernatural explanations. They argue that a scientific naturalist could believe that there are areas in which divine explanations are necessary, such as ethics or aesthetics, but think that they serve no purpose in the sciences.

In fairness to Nagel, he does not state the dilemma as either the admission or rejection of the possibility of god, but as the admission or rejection of the possibility of intervention by a designer.¹⁰⁵ However, he does believe that the antecedent belief which produces the rejection of intervention is most often the belief that god is not possible. This is not necessary though, and he considers the beliefs of Kenneth Miller to illustrate this. Miller would likely count as a theist and a scientific naturalist, according to the definition provided by the Vanderbilt critics. What Nagel says about Miller is that his conception of god as incompatible with intervention in biological evolution is a religious belief – not a scientific belief – that influences his interpretation of scientific evidence.¹⁰⁶ What matters to Nagel is how antecedent beliefs influence one's disposition to believe that scientific explanations will ultimately be complete even if they are not currently complete. Miller's belief is such that he is confident that evolutionary explanations will eventually cover the whole story of the origin of life and this depends on the particular nature of his religious belief. For this reason, functional nontheism appears to count as the sort of religious belief that Nagel characterizes as necessarily problematic

as long as it rests on the rejection of the possibility of god or a concept of god that is incompatible with intervention.

Perhaps, though, functional nontheism motivated by traditional agnosticism does escape Nagel's dilemma. It seems plausible to leave the possibility of divine intervention as an open question and proceed with work in the sciences. I suppose that an agnostic could be more or less committed to agnosticism. Perhaps the lack of belief coupled with the willingness to be moved to one position or the other depending upon future scientific evidence would be sufficiently noncommittal to satisfy Nagel. Another possibility, it seems, might be to defend atheism not as an antecedent religious belief, but as a judgment that follows from the scientific evidence. I see no reason why the religious beliefs in question must be antecedent rather than consequential. One might decide, for instance, that she will only accept propositions that are supported by scientific evidence. This in itself is not a religious belief and it is not a belief about what is reasonable to accept. This disposition, along with a lack of scientific evidence for the existence of god, could produce the judgment that god does not exist. This is a religious belief, but it is consequential rather than antecedent. It is not the sort of belief that is appropriate to advance in the classroom and perhaps it is not even the sort of belief that is properly arrived at on the basis of scientific evidence. However, this example is meant only to illustrate that scientific evidence can be accumulated and evaluated by a person who is, ultimately, an atheist without her atheism informing her research. To return to Nagel's discussion of ghosts, the naturalistic explanation of the spooky events is the science and could produce a judgment about whether or not ghosts are the cause rather than proceeding to prove the hypothesis that ghosts are not the cause. In the former case, the belief about ghosts is arrived at after scientific investigation and explanation and in the latter case; it is assumed in the development of the hypothesis. Still, this line of argument depends upon speculation about what is going on in the mind of the researcher. The fact that Nagel's argument rests on the same sort of speculation is enough to show, I think, that it is deeply problematic.

Yet another attack of Nagel's defense of intelligent design theory comes from Reginald Williams in his article, *Nagel and Intelligent Design*.¹⁰⁷ According to Williams, the problem with intelligent design theory is that it doesn't make sense to attribute a thing to purposeful action when no such purposeful action has ever been known to bring that thing about. As a thought experiment, he asks us to imagine that the assembly of jigsaw puzzles has always been shown to

result from the action of purposeful and creative human beings. Alone, individuals have assembled as many as 100,000 pieces, and many generations working together have assembled puzzles as large as 20 million pieces. Suppose, then, that we discover a puzzle that consists of 10 centillion pieces. It is clear that there have not been enough generations of humans to accomplish such a task. Williams asks what benefit to science would result from postulating that a super-human assembled this jigsaw puzzle. If we cannot understand how the purposeful actions of humans could create it, what does it add to our understanding to suggest that a transcendent super-human created it? The situation is worse, Williams argues, when we postulate a transcendent designer who creates life where our explanations falter because nothing we know about life involves it coming to be through any purposeful action at all. Nagel addresses this concern by claiming that the fact that the internal operations of the designer cannot be discovered does not imply that evidence for a designer cannot be found. However, the point seems to be that we have no idea what such evidence would even look like because we have not seen life arise from purposeful creation in the first place. How would we know what counts as evidence and how would we recognize it when we saw it? Williams argues that if our understanding cannot be furthered by the introduction of a designer, then it has no explanatory value and so does not belong in the science classroom. He concludes that science teachers should be teaching what scientific consensus actually is, and not what it should be or could be in the future.

Williams' argument is strong, I think, against the claim that intelligent design theory should be discussed in public school science curriculum. If we cannot explain what divine intervention means, then what explanatory value can it possibly have? He rightly identifies the issue as a debate about science and so unnecessary to explain scientific consensus. He also rightly points out that science teachers already have more content than they can teach. Ultimately, his position is that teachers should be using their limited time to explain science rather than to introduce debates about it. But this is a practical point, and we can always consider what would be appropriate and constitutional to introduce in the curriculum under ideal circumstances.

Of those who believe that intelligent design theory does not belong in the science classroom, some will admit that it does have a place somewhere in the curriculum. However, where it belongs, the purpose of its introduction, and what should be the nature of the discussion are still open questions. An exception is Oppy, who thinks it does not belong anywhere in the

curriculum as it would necessarily violate the Establishment Clause. Once we remove it from the science classroom, questions about its proper place in the context of evolution and the scientific method become irrelevant. Oppy thinks that any introduction to the issues would violate the establishment clause because the hypothesis of intelligent design theory is not religiously neutral. As he explains, there are other religions that reject both design theory and evolutionary reductionism. Why not discuss these? He also questions why we would introduce this discussion and not comparative religions and philosophy more generally. I agree with this sentiment and also with his observation that proponents of intelligent design stand to gain politically by introducing it into biology, but that it would be a political danger to them if comparative religion and critical analysis were introduced elsewhere. He does say, though, that this should not be a concern to a “self-confessed atheist”, but it seems it shouldn’t matter to anyone who is not motivated by a political agenda.

Oppy is not alone in his conclusions about public school curriculum. Arguments against intelligent design theory in the science classroom do not necessarily preclude suggestions that it be introduced in other areas. Anya Plutynski, for instance, expresses such a sentiment in her article, *Should Intelligent Design be Taught in Public School Science Classrooms?*¹⁰⁸ Here, she suggests that intelligent design might be taught in history, philosophy, or history of science. She argues that such courses would improve student’s critical thinking skills and help them to understand the relevant contexts into which scientific theories have been introduced. I do agree, but I would also add the further reason that the inclusion of such courses would increase jobs for philosophers and the demand for philosophy classes at the college level. In any case, it seems that Nagel would be satisfied with this suggestion as well, at least if he is only held to his weaker claim that room should be made for the discussion *somewhere* in the curriculum. This raises an interesting departure, then, between Nagel and proponents of intelligent design. I think Oppy has rightly pointed out the political motivations that drive the push for intelligent design in science classes but would likely cause the same proponents to reject the introduction of philosophy courses more generally in public education. Nagel does not share the religious commitments of proponents of intelligent design, so he would likely not be opposed to the introduction of a generalized philosophy course. If Nagel is not motivated by political concerns and does not share the antecedent belief that god exists with proponents of intelligent design, then just what prompts

his interest in it? I think consideration of Nagel's second and perhaps more controversial move suggests some answers.

3.3 Nagel Draws Criticism for Endorsing Meyer

Much to the chagrin of philosophers and scientists, Nagel recommended Stephen C. Meyer's book, *Signature in the Cell: DNA and the Evidence for Intelligent Design*, as a 2009 book of the year to the Times Literary Supplement. A key claim that Nagel makes here is that Meyer:

“examines the history and present state of research on non-purposive chemical explanations of the origins of life, and argues that the available evidence offers no prospect of a credible naturalistic alternative to the hypothesis of an intentional cause.”¹⁰⁹

A quick response was issued by a chemist, Stephen Fletcher, from Loughborough University stating that it is “mind-blowing” that Nagel, as a modern university professor, takes Meyer's book seriously. Fletcher goes on to argue that Meyer's book is hopelessly erroneous and suggests that those who want to know more about the subject should save their money “and simply read RNA world on Wikipedia.” He chastises Nagel for recommending the book, saying that it is fine for him to take supernatural beings seriously – and he includes pixies and fairies along with gods and devils in this category – but that he should not promote a book to others that is factually incorrect.

On the same day that Fletcher's letter was published in the Times Literary Supplement, Brian Leiter produced a scathing commentary on Nagel's recommendation on his blog, which is read by a great number of professional philosophers on a regular basis. Leiter criticizes Nagel for having no formal training in biology, evolution, and abiogenesis and he accuses him of giving ammunition to those who seek to undermine biology education in public schools. He claims further that Nagel has invited ridicule to the profession of philosophy and downgrades his status of reputable philosopher to “formerly reputable.” He quotes scientists and philosophers of science who are infuriated by Nagel's action and he provides links not only to their comments, but also to the positive response coming from the Discovery Institute and other creationists. He also mentions Nagel's article defending intelligent design theory as science, and contends that without “*Philosophy & Public Affairs*’ wholly corrupt practice of letting the ‘inside circle’ of

cronies publish without actual editorial oversight, this article could have never appeared in a reputable scholarly journal.” Leiter’s is a commentary on Nagel’s article and nomination of Meyer’s book and not any formal argument against these, but his reaction – which appears to have gone unchallenged by the community of philosophers as of yet – is likely a good indication of a more general attitude of bewilderment, at best, in the philosophical community.

Nagel has not published any public response to Leiter’s comments, but he did offer a reply to Fletcher’s criticisms. In this reply, it seems that Nagel’s true interest in intelligent design theory is evidenced. In a particularly revealing bit, he says:

“The tone of Fletcher’s letter exemplifies the widespread intolerance of any challenge to the dogma that everything in the world must be ultimately explainable by chemistry and physics. There are reasons to doubt this that have nothing to do with theism, beginning with the apparent physical irreducibility of consciousness. Doubts about reductive explanations of the origin of life also do not depend on theism. Since I am not inclined to believe in God, I do not draw Meyer’s conclusions, but the problems he poses lend support to the view that physics is not the theory of everything, and that more attention should be given to the possibility of an expanded conception of the natural order.”¹¹⁰

No response from Fletcher is published, but Leiter did comment on this as well, claiming that it is “revealing.” What Leiter thinks it reveals is that:

“the reason he has given ammunition to ignoramuses and know-nothings in their efforts to mislead schoolchildren is because he thinks Stephen Meyer’s book lends support to a paper that Nagel wrote in 1974!”¹¹¹

The paper that Leiter is referring to is Nagel’s article that argues for an irreducibly subjective element of consciousness, *What Is It Like to Be a Bat?* Leiter is right to draw the connection – especially since Nagel says as much in the letter – but this is not the whole story. Leiter claims that Nagel’s explanation in his reply to Fletcher is “obviously silly and meant to distract attention from the stupid thing he has done.” I think this is wrong.

3.4 Nagel's History of Arguing Against 'Scientism'

In the article, *What Is It Like to Be a Bat?*, Nagel argues for an irreducibly subjective element of consciousness that cannot be explained using terms or concepts that we currently have. In fact, he claims that we have no conception of what a physical explanation of mental phenomenon would be like. It is an interesting note that this seems to be the same sentiment that Williams expresses in raising an objection to intelligent design in his reply to Nagel's 2008 article. It seems, then, that Nagel might agree with Williams on the explanatory limits of intelligent design theory. And indeed, he claims time and again that he is an atheist who is not compelled to believe that divine intervention is involved in the evolution of life. He is clearly not convinced by intelligent design and he is obviously familiar with the literature. It is curious, then, that Nagel is willing to lend support to its proponents despite how this support has been received and could likely have been predicted by Nagel to have been received. There are claims, though, in *What Is It Like to Be a Bat?*, *Public Education & Intelligent Design*, his reply to Fletcher's letter, and his 1986 book, *The View From Nowhere*, that suggest that Nagel comes to the defense of intelligent design theory not because of what it advocates, but because of what it rejects, namely, evolutionary reductionism. And this is not all. It seems clear that evolutionary reductionism is only one part of a larger world view that Nagel labels *scientism* – the view that we have all the necessary concepts and methods by which we will eventually know everything that might ever be known – a world view that he appears to be particularly motivated to lead a charge against.

Nagel has articulated his understanding of scientism and some of his reasons for rejecting it. He has not, however, offered a complete treatment of the subject thus far. His comments about it are offered mostly in passing in the works I will reference here. First, in *What Is It Like to Be a Bat?*, he says the following in a discussion of "Martian or bat phenomenology":

"It would be fine if someone were to develop concepts and a theory that enables us to think about those things; but such an understanding may be permanently denied to us by the limits of our nature. And to deny the reality or logical significance of what we can never describe or understand is the crudest form of cognitive dissonance.

This brings us to the edge of a topic that requires much more discussion than I can give it here: namely, the relation between facts on the one hand and

conceptual schemes or systems of representation on the other. My realism about the subjective domain in all its forms implies a belief in the existence of facts beyond the reach of human concepts. Certainly it is possible for a human being to believe that there are facts which humans never will possess the requisite concepts to represent or comprehend. Indeed it would be foolish to doubt this, given the finiteness of humanity's expectations. After all, there would have been transfinite numbers even if everyone would have been wiped out by the Black Death before Cantor discovered them. But one might also believe that there are facts which could not ever be represented or comprehended by human beings, even if the species lasted forever – simply because our structure does not permit us to operate with concepts of the requisite type.”¹¹²

Presumably, what Nagel is claiming in the 2008 article is that the divine mind – for argument's sake, just as he proposes Martian phenomenology for argument's sake – is just that sort of thing that we are necessarily limited in our understanding of due to our nature as human beings. After claiming that it is the notion of purpose that critics of intelligent design ultimately find problematic, Nagel claims:

“I believe there is a reason for this, and that it depends on a premise that, though completely valid, does not have the consequences that are usually drawn from it. The premise is that the purposes and actions of God, if there is a God, are not themselves, and could not possibly be the object of a scientific theory in the way that the mechanisms of heredity have become the object of scientific theory since Darwin.”¹¹³

A consequence that is usually drawn from this premise – and that Nagel is eluding to here – is that intelligent design is hopelessly flawed. It appears, however, that Nagel thinks that the true consequence to be drawn is that science is limited and, in turn, evolutionary reductionism is hopelessly flawed. He draws a similar conclusion about reductionism in the philosophy of mind and he also eludes to that here. He continues:

“We do not have much scientific understanding of the creative process even when the creator is human; perhaps such creativity too is beyond the reach of science. Leaving that aside: the idea of a divine creator or designer is

clearly the idea of a being whose acts and decisions are not explainable by natural law. There is no divine scientific psychology.”¹¹⁴

It would be a mistake to respond that there is no divine scientific psychology because there is no divine psyche. That would miss the point as much as replying to his 1974 article that we can't have knowledge of Martian phenomenology because there are no Martians.

To return to Nagel's reply to Fletcher, when he says: "The tone of Fletcher's letter exemplifies the widespread intolerance of any challenge to the dogma that everything in the world must be ultimately explainable by chemistry and physics. There are reasons to doubt this that have nothing to do with theism, beginning with the apparent physical irreducibility of consciousness," it is wrong to interpret this as "obviously silly and meant to distract attention from the stupid thing he has done," as Leiter says. His reply is right on target. Further articulation of Nagel's position is found in *A View From Nowhere*:

"Scientism is actually a special form of idealism, for it puts one type of human understanding in charge of the universe and what can be said about it. At its most myopic, it assumes that everything there is must be understandable by the employment of scientific theories like those we have developed to date – physics and evolutionary biology are the current paradigms – as if the present age were not just another in the series.

Precisely because of their dominance, these attitudes are ripe for attack. Of course, some of the opposition is foolish: antiscientism can degenerate into a rejection of science – whereas in reality it is essential to the defense of science against misappropriation. But these excesses shouldn't deter us from an overdue downward revision of the prevailing intellectual self-esteem. Too much time is wasted because of the assumption that methods already in existence will solve problems for which they were not designed; too many hypotheses and systems of thought in philosophy and elsewhere are based on the bizarre view that we, at this point in history, are in possession of the basic forms of understanding needed to comprehend absolutely anything.”¹¹⁵

So, evolutionary biology is not necessarily flawed in Nagel's view, but it is inherently problematic given that it is advanced as if it, along with the other sciences, is the only possible way of understanding the universe. It seems, then, that Nagel is interested in intelligent design

theory because of its rejection of evolutionary theory as the whole story of the origin of life and also because of the way it has been received by the scientific community, including the nature of the arguments against it. These, he appears to think, reveal the commitment to scientism that he thinks is problematic. And this, it seems, is exactly the sentiment he interprets from Fletcher's reply to his recommendation of Meyer's book.

In his comments, Leiter explains that he views Nagel's reply to Fletcher as a distraction because no one is really "committed to thinking physics and chemistry explain everything." As mentioned before, the extent to which Nagel's conclusions depend on speculation about what evolutionary biologists are actually committed to is the extent to which it is problematic. Leiter's explanation here, though, depends upon a misunderstanding of Nagel's view. He does not think that anyone believes that physics and chemistry – or any science for that matter – has explained everything. What he thinks is that most of scientists and philosophers believe that the only type of explanation that will ever explain anything must be a scientific explanation.

The types of explanations Nagel thinks might be worthy to stand along with scientific explanations do not seem to be clear, even to him. In the 2008 article, he says:

*"I do not regard divine intervention as a possibility, even though I admit I have no other candidates."*¹¹⁶

In an attack of evolutionary epistemology in *The View From Nowhere*, he says:

*"I don't know what an explanation might be like either of the possibility of objective theorizing or the actual biological development of creatures capable of it. My sense is that it is antecedently so improbable that the only possible explanation must be that it is in some way necessary. It is not the kind of thing that could be a brute fact or an accident, any more than the identity of inertial and gravitational mass could be; the universe must have fundamental properties that inevitably give rise through physical and biological evolution to complex organism capable of generating theories about themselves and it. This is not itself an explanation; it merely expresses a view about one condition which an acceptable explanation should meet: it should show why this had to happen, given the relatively short time since the Big Bang and not merely that it could have happened – as is attempted by Darwinian proposals."*¹¹⁷

In discussing the irreducibly subjective character of consciousness, he says the following:

“The subjectivity of consciousness is an irreducible feature of reality – without which we couldn’t do physics or anything else – and it must occupy as fundamental a place in any credible world view as matter, energy, space, time, and numbers.”¹¹⁸

This is quite a provocative claim. What Nagel is suggesting is that there are basic elements necessary to understanding ourselves and the universe of which we have no conception. And if what I have referenced in this chapter thus far is taken into full consideration, it is clear that he is saying that perhaps we will never have a conception of these elements. And so, perhaps we will never have a full description of ourselves and the universe. From his work in philosophy of mind, it is apparent that he thinks consciousness involves one of these elements and from his recent work on intelligent design theory, it seems that he believe the origin of life involves another.

A review of Meyer’s book by Glen Davidson can be found online and there, Davidson reveals some things about the book that are informative for this discussion. He says:

“I should note that one reason the activities of the Designer (clearly God) are considered by Meyer to be properly extrapolated from human activity is evidently that Meyer simply considers mind and material to be separate phenomena. If our magical immaterial minds can do things, why won’t science consider that a magical immaterial mind that we don’t know might have made life?”¹¹⁹

If Meyer is really saying things like this, then it is no wonder that Nagel has reviewed him positively. Clearly Meyer embraces what Nagel calls the irreducibly subjective character of consciousness and he goes further to suggest that perhaps the origins of life are to be explained in similar terms, but regarding the workings of some divine mind rather than one like ours. Nagel wouldn’t agree with him, but that is the *right type* of explanation, or at least the right type of curiosity – one from outside the norms of science – that Nagel thinks should be pursued. In asking “why won’t science consider” such an explanation, it seems that Meyer is challenging the scientism that Nagel rejects.

It seems, then, that Nagel relies on a philosophical reading of intelligent design theory. The Vanderbilt critics are correct to evaluate his philosophical arguments and his policy

recommendations for public education separately because these are importantly separate matters. His philosophical arguments, in my view, are much more tenable than any of his critics suggest. It isn't really one's antecedent belief about god's existence that is important to Nagel; it is one's antecedent belief about what types of explanations are reasonable. If one holds the belief that only scientific explanations can be reasonable explanations, then one holds scientism of the type that Nagel describes. This would include someone like Kenneth Miller and causes some trouble for the Vanderbilt critics' arguments. Proposing scientific naturalism doesn't seem to solve the problem because it is exactly that sort of view that Nagel rejects. It still seems to me that the best response to Nagel on this point is to claim some sort of noncommittal agnosticism. Further, that Nagel describes what the proponents of intelligent design are doing as science as much as evolutionary theory is science rests wholly on his speculation that evolutionary biologists hold scientism as their fundamental world view. He could very well be right, but it is important to consider what practicing scientists say about this before making that judgment.

On the philosophical front, it seems that Nagel has recently been concentrating on an idea that he has mentioned in passing for over 20 years now. It is possible that the debate over intelligent design theory in public school curriculum is the only entry that currently exists to the larger debate as he has already entered through the debate over consciousness in the philosophy of mind. His self-admitted – and perhaps unavoidable, even if he is right – inability to articulate exactly what types of explanations he thinks we are fundamentally missing suggests that he would be eager to engage wherever the debate presents itself. I am sympathetic to his project, but I would like to know much more about it. I have an initial grasp of his claim that there are facts that we can never know and that we should believe that these facts exist. However, I am not quite sure what that amounts to. Can I hold a belief if I have no understanding of the content of that belief? On what basis would I hold it? It does seem clear that holding such a belief draws near to holding beliefs based on faith. But at least in the case of religious belief we have some notion of the content of the belief even if we don't think we can understand it fully. What Nagel is suggesting seems quite a bit more abstract than that.

Regarding his recommendation for public school curriculum, what Nagel says here is worth mentioning again:

“This is not itself an explanation; it merely expresses a view about one condition which an acceptable explanation should meet: it should show

why this had to happen, given the relatively short time since the Big Bang and not merely that it could have happened – as is attempted by Darwinian proposals.”¹²⁰

What he is calling for is an acceptable explanation of the nature of the universe. In doing so, he clearly draws a distinction between the question of “why” it happened and the question of “how” it happened. He admits that Darwinian proposals only address the “how” question. It seems then, that as long as science pursues these types of explanations and doesn’t address the “why” question then it can proceed with no difficulty. Oppy, at least, thinks that it already does. The problem for Nagel seems to be that there is more to the story and this is why he is sympathetic to the project of intelligent design insofar as it suggests that current models in science fail to answer the “why” question. However, calling intelligent design science and suggesting that it belongs in science classrooms seems to reaffirm the view that science is the only arena of explanation. We know that is not the case. We do have philosophy in the United States, just not taught as an independent subject in the public schools.

Perhaps it is important to inform students that significant questions exist outside of the sciences. The resolution, I think, is this: by adopting a noncommittal agnosticism in the sciences, it can be argued that what evolutionary theory is doing is science and intelligent design is not, even on Nagel’s view. To introduce students to alternative approaches to understanding the universe and to give them the tools of critical analysis, philosophy should enter the curriculum. An even more complete approach would be to introduce philosophy and comparative religion courses into the curriculum. There are already plenty of degree programs in our colleges and universities to produce teachers in these areas and there are already experts in these areas to develop the curriculum. An additional consequence of this approach might even be the furthering of research in these areas. If there are more jobs for philosophers, then more philosophers will be trained. Further, if real job prospects existed in education, then we might see an unprecedented influx of women, minorities, and people with low-income into philosophy. This could influence philosophical research in important ways.

A key problem that critics of intelligent design articulate is the intellectual dishonesty of pushing intelligent design in the classroom. The goal is not to further knowledge, they say, but to achieve a political agenda. Given the history of the development of intelligent design theory, I think this is correct. I also think it is a mistake to assume that Nagel is unaware of this problem

or that he does not recognize the significance of it. To be fair, it does seem that he believes the arguments exist and are good enough to prevent the repugnant conclusions described by the Vanderbilt critics from affecting public school curriculum. I think Nagel's concern is really to further knowledge in the direction of what are currently unknown possibilities. While he is wrong to claim that intelligent design theory is science and so belongs in the science classroom, it is unfortunate that his larger philosophical project of which this is clearly a part is going unrecognized due to the surrounding political and social issues.

CHAPTER FOUR

WHY NAGEL IS WRONG: SIDING WITH PRACTICING SCIENTISTS ABOUT SCIENCE & SCIENCE EDUCATION

What I have attempted to show thus far is how philosophical issues have been introduced and addressed in the legal context of the battle over evolutionary theory and intelligent design theory in public education. In Chapter 1, I discussed the history of legislative activism surrounding this debate through *Kitzmiller v. Dover Area School District* in which intelligent design theory suffered its most recent courtroom defeat. In Chapter 2, I investigated the philosophical problem of distinguishing science from nonscience and concluded that while intelligent design theory cannot be counted as science, it might be useful in helping to identify the limits of science. In Chapter 3, I considered the recent contribution to this debate made by Thomas Nagel. I argued that Nagel's defense of intelligent design theory in public education should be understood as a further manifestation of his rejection of scientism, or philosophical naturalism, which he has been arguing against for more than 20 years. While his concern about public education is new, the philosophical basis of this concern is not.

As I argued in Chapter 3, the reasoning behind Nagel's recommendation that religion be discussed in connection with science in public education is problematic. It is simply not true that investigating natural causes to the exclusion of supernatural causes necessarily presupposes a religious standpoint. For this reason, Nagel's claim that intelligent design theory is as much science as evolutionary theory is wrong. While I disagree with some of his critics that his philosophical arguments warrant stronger conclusions than he admits, I believe it is worth noting that his weaker conclusion – that a noncommittal discussion of the relationship between evolutionary theory and religion is preferable – is itself misguided. There are two main reasons for believing this. First, intelligent design theory is not science because it assumes supernatural causation – or at least causation that cannot be explained in terms of any natural causes that are known to human beings. Consequently, both it and whatever it may suggest about how philosophical assumptions could potentially inform understandings of evolutionary theory do not belong in science education. Second, if it is insisted that intelligent design theory is science, then it does not belong in the science classroom because it is false or bad science. As I discussed in Chapter 1, proponents of intelligent design such as Behe and Dembski have failed to illustrate an

explanatory need for the intervention of an intelligent designer and they have failed to successfully argue for this sort of intervention in otherwise naturalistic explanations. In Chapter 2, I argued that failed efforts in science might be of some value in identifying the limits of science or in prompting further research. However, this does not mean that failed efforts in science should be understood as being on par with scientific explanations that work. If an understanding of the methods and discoveries of scientific endeavors is the goal of science education, then that is what should be taught in the science classroom – not failed attempts at scientific explanations.

In this chapter, I will discuss another problem with Nagel’s view – namely, his contention that scientists hold philosophical naturalism as a basic epistemological and metaphysical framework. He says, “They do not think, Maybe there are supernatural explanations, but if there are, scientists cannot discover them. Rather, they think, Anybody who is willing to even consider supernatural explanations is living in the past.”¹²¹ His reason for making this claim is puzzling and he appeals to no evidence to support it. Further, a review of literature on the nature of science as informed by practicing science reveals that many scientists in fact do believe that supernatural explanations might exist but that science as it is currently practiced cannot discover them. Clear evidence of this belief can even be found in Florida’s state standards for science. These standards, and more national efforts by scientific groups such as the American Association for the Advancement of Science and the National Research Council, to describe what students should know about science suggest that not only is Nagel wrong about what scientists believe about their work, but he is also wrong about what is happening in science education. There is no evidence that science educators either explicitly or implicitly aim to teach students that naturalistic explanations are the only worthwhile explanations.

4.1 The Nature of Science

To determine whether or not Nagel is correct about what philosophical assumptions are held by scientists, what scientists actually say about the nature of science must be considered. According to William F. McComas – founder of the Program to Advance Science Education and the current Parks Family Endowed Professor in the University of Arkansas College of Education and Health Professionals – confusion about the nature of science can be traced to a number of myths about science. As he explains, these myths can be found in science textbooks and in science classrooms. In *The Principal Elements of the Nature of Science: Dispelling the Myths*, he

discusses several of these.¹²² McComas believes these myths about science likely result from a lack of exposure to philosophy of science in teacher education programs, the lack of research involved in teacher education, and the lack of a full treatment of the nature of science in science classes and textbooks. He further explains that once myths about science make their way into the literature, they are often repeated and are rarely questioned. In what follows, I will discuss some of the myths outlined by McComas insofar as they are relevant to understanding the nature of science in order to evaluate Nagel's claim that science relies on a problematic commitment to philosophical naturalism.

'The problem of induction,' as described by McComas, illustrates that the belief that a preponderance of evidence results in certain knowledge is a myth. The problem of induction is just that inductive reasoning can never guarantee its conclusions. Using inductive reasoning, we can construct generalizations on the basis of our experiences and make predictions about the future. Inductive reasoning can produce conclusions that are warranted and can allow us to construct scientific theories. However, it depends upon observations of states of affairs, and so it could only be by making all relevant observations throughout all time that a conclusion drawn from inductive reasoning could be a final and certain conclusion.¹²³ According to McComas, scientists take a creative leap in drawing their conclusions. The leap, though creative, is toward a conclusion about what is *likely* true or to what conclusion is *most* warranted.

The relevance of McComas' discussion of the problem of induction for considering the claim that philosophical naturalism is problematic is just that such a leap *must* be taken given the nature of inductive reasoning used in science. When only natural causes are considered in scientific reasoning, then the leap being described will be toward a natural explanation of natural phenomena and that seems most prudent given that scientists aim to investigate the natural world. In chapter 3, I discussed Nagel's example of scientific investigation into "spooky" events. My aim there was to illustrate that the conclusion that a supernatural cause is not involved could be a judgment resulting from investigation rather than an antecedent religious belief. The example seems useful here as well. What McComas has explained is that a creative leap *must* be taken to draw a conclusion using inductive reasoning in scientific investigation. Regardless, then, of what antecedent beliefs one actually holds about supernatural causes, when one is investigating the natural world through science the only explanations that are *scientific* explanations are natural explanations. And if McComas is right, then scientists are consciously

making a judgment to accept only scientifically warranted explanations rather than unknowingly relying on an antecedent religious belief.

Because scientific evidence can never result in certain knowledge, it and its methods should not be understood as providing absolute proof. According to McComas, scientific claims are always tentative and this is a hallmark of science that separates it from other forms of knowledge.¹²⁴ He also dismisses as a myth the belief that science can answer all questions. Because of the tentative nature of science, the only questions it can address are those whose answers may be falsified. He considers, for instance, the claim that species were placed on earth fully formed by some supernatural force.¹²⁵ There is no scientific approach that could falsify this claim, so it does not count as a scientific claim. This does not necessarily mean that the claim is meaningless because science does not purport to be the final word on any state of affairs given its tentative or bounded nature. This is what prevents it from being a dogmatic system of belief. According to McComas, there are some questions which simply cannot be asked of scientists. That does not mean that a person could not use their understanding of science to support their belief that such a claim is meaningless, but this is not a belief that results from scientific knowledge alone – it would rest upon some philosophical assumption. Based on their expertise alone, McComas believes it is wise for scientists to avoid answering questions that are of an ethical, social, or metaphysical nature. Whether or not supernatural causes exist is a metaphysical question, not a question of science, and so scientists – in virtue of being scientists – should not address this question. This is not because science is a dogmatic system of belief. Quite the opposite – it results from the tentative nature of science that *prevents* it from being dogmatic. It seems, then, that the sorts of claims made by Johnson and Nagel that science dogmatically dismisses the possibility of a supernatural cause are mistaken.

Two more myths discussed by McComas are the belief that scientists are particularly objective and the belief that science models represent reality. The first seems relevant to Johnson's and Nagel's critiques of philosophical naturalism because it aims to address the relevance of background beliefs to scientific investigation. What McComas explains as 'theory-laden observation' is a psychological notion that refers to preconceptions and biases about the operations of the world that make it impossible to collect and interpret data in a way that is completely objective. The presumption of objectivity in science has fueled critiques of science from multiculturalists that will be discussed later in this chapter. As discussed by McComas, the

research tradition at a given point in scientific investigation, or the paradigm of science at a given time, necessarily limits its objectivity.¹²⁶ Relying on Thomas Kuhn's analysis of the history of science, McComas explains that science does not assume objectivity, but operates within given parameters that limit its considerations. As examples, he mentions the rejection in the history of science of the sun-centered solar system, warm-blooded dinosaurs, the germ theory of disease, and continental drift. Prevailing attitudes in the past precluded accurate descriptions of these phenomena. Eventually, though, explanations were provided that allowed for revolutions in the scientific paradigms and acceptance of these ideas.

The inability of scientists to be completely objective and the notion of scientific paradigms might fuel criticisms against the methodological naturalism assumed by scientists. If methodological naturalism assumes philosophical naturalism and this impedes new directions in scientific investigation, then it is problematic. Could methodological naturalism be understood as an assumption of science that needs to be overturned? It seems that Nagel's critique could be understood in this way. The difference, though, between understanding methodological naturalism as a facet of science as it is currently practiced and understanding the immobility of continents, for instance, as a paradigm of science is that the latter was overturned using the assumption of methodological naturalism. The former, of course, cannot be. By what method could the method of science itself be overturned? Only a shift in the prevailing understanding of the nature of science could achieve such a task. In other words, the assumption that science investigates the natural world using only natural means would need to be abandoned. I do not see any motivation for this because it is not clear what would replace this assumption. I understand that proponents of intelligent design desire the inclusion of supernatural causes in explanations of natural phenomena and that Nagel believes this desire, though not his own, is too hastily dismissed in science as it is currently practiced. However, by what method could this desire be fulfilled? To return to the example of "spooky" events, by what method could one arrive at the conclusion that ghosts are the cause? Even if investigation does not lead to a natural cause of the spooky events, it does not seem that the conclusion that ghosts are the cause is warranted, scientifically at least. To draw such a conclusion through science, positive evidence that ghosts exist and are the cause of the spooky events would be needed. The idea that there might be evidence of ghosts is not conceptually problematic – except that it is not clear what such evidence would look like.¹²⁷

McComas concludes his discussion of scientific paradigms by contending that Kuhn would likely argue that paradigms help keep scientists on track because his review of science suggests that they lead to more explanatory success in science than delays.¹²⁸ So, regardless of what picture of the natural world results from preconceptions and biases, science continues to progress until its own method paints a new picture – so to speak. Science does not have to describe the whole of objective reality to be useful and, in fact, McComas thinks science can make no claims on this front. He explains it is a myth that science models represent reality – though he recognizes that many scientists probably accept this myth as true.¹²⁹ According to McComas, the true nature of reality could only be known if it were possible to ask an omniscient entity and, of course, that is not possible. He identifies two philosophical views that differ on this issue – realism and instrumentalism. ‘Instrumentalism’ is the view that science functions to allow for predictions that work and so it does not matter if its ideas correspond to reality. ‘Realism’ is the view that science works and also is an accurate depiction of reality. It seems that instrumentalism is similar to methodological naturalism removed from any philosophical commitments and realism is methodological naturalism coupled with philosophical naturalism. Although he explains that no survey has been taken on the matter, McComas thinks that many scientists probably are realists. As I explained in chapter 3, this seems correct. What matters, though, is whether methodological naturalism *necessarily* assumes philosophical naturalism. It seems that the coherence of instrumentalism as a working philosophy of science as it is currently practiced is further indication that it does not.

As explained by McComas, science is a creative process whose practitioners are not uniquely objective, whose scope is necessarily limited, and whose conclusions are tentative. Science is one way to learn about the world, but should not be considered the only way or to necessarily produce a true depiction of reality. The National Academy of Sciences takes a similar position on the nature of science, defining science as “the use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process.”¹³⁰ The goal of science as it is practiced in the 21st century is to investigate natural causes of natural phenomena because such explanations can be checked and rely on no prior assumptions to confirm or disconfirm – not because scientists believe that these are the only possible explanations. Further, this allows for science as an activity of a community rather than a private enterprise. The conclusions of scientific research are not held with absolute certainty, but

typically are understood to be unlikely to change due to the extent to which they have been researched and tested by the scientific community.¹³¹ When scientists believe scientific claims with some degree of certainty, it is not necessary that they believe the claims represent the full nature of reality – certainty in science simply amounts to a belief that no further empirical research will falsify a claim. However, it must be understood that falsification is possible in order for it to be a scientific claim. This description of science is compatible with a rejection of philosophical naturalism in cases where it is believed unlikely that empirical evidence will overturn a scientific claim. If a belief is held with that degree of commitment but still must be understood as susceptible to falsification, then under what conditions it could be shown to be false must be left an open question. In other words, philosophical naturalism is in fact precluded if it is believed that no empirical evidence could falsify a claim but that the claim remains falsifiable. I think this is enough to show that Nagel is wrong that scientists hold philosophical naturalism as a basic epistemological and metaphysical framework. While there may be some who do, this is not a stance that scientists assume simply in virtue of being scientists.

4.2 Teaching the Nature of Science

Given that myths about science abound in our society and that they are perpetuated in science textbooks and science classrooms, it is not enough to show that science is not metaphysically dogmatic in order to defend methodological naturalism in the broader legal context. It is also important that an adequate treatment of the nature of science is included in teacher education programs and in fact is implemented in science education. This is necessary to authentic science education and to ensure that the practice of science education is consistent with the nature of science itself. In this section, I will consider the importance of teaching methodological naturalism as an aspect of the nature of science so that the goal of science education is fulfilled and so that science is not mistakenly interpreted as advancing a religious dogma. I will also discuss the framework for implementing teaching the nature of science as adopted in the Florida science standards and strategies aimed at teaching the nature of science.

In their work, *The Bounded Nature of Science: An Effective Tool in an Equitable Approach to the Teaching of Science*, Sherry Southerland, Barry Golden, and Patrick Enderle argue that teaching methodological naturalism is necessary to promoting student learning in the sciences.¹³² Here, they identify factors that are important in a student's ability to gain science literacy, or knowledge of the nature of scientific inquiry and the claims made by science. Given

research in learning theory, Southerland et al. contend that the beliefs students carry into the classroom, their ideas about knowledge itself, and their attitudes towards controversial claims of science affect the degree to which and the level at which they will learn about science. Regarding evolutionary theory in particular – if a student enters the classroom with a deeply held religious commitment that she understands as threatened by evolutionary theory, then she is less likely to engage with and learn about evolution. To remedy this problem and to provide equitable science education to students regardless of their particular backgrounds and beliefs, the authors suggest that the nature of science should be taught as the *bounded nature of science*.

‘The bounded nature of science’ is methodological naturalism removed from philosophical naturalism. As Southerland et al. explain, teaching that science seeks to investigate natural phenomena by natural means should be coupled with the recognition that there are other ways of knowing the world that are importantly different from science and that – in some contexts – may even be preferable. They explain that the following aspects of the nature of science are largely accepted as necessary to emphasize in science instruction:

- 1) *The empirical nature of science (scientific evidence must be physical evidence)*
- 2) *The subjective nature of science (scientists make sense of empirical evidence)*
- 3) *The characteristics and relationships of theories and laws (theories are powerful and useful explanations while laws describe relationships that hold between states of affairs)*
- 4) *The tentative, yet durable nature of science (scientific knowledge can and will change, but experts expect that changes in the most powerful theories will be rare)¹³³*

To this list, they would like to add something like the following:

- 5) Science is bounded in its nature (not all important questions can be answered scientifically)

Science understood as bounded is a view that students with strongly held beliefs and assumptions about science may engage with more easily. The authors argue that science can be seen as one important way of knowing, but not the only important way. Other ways of knowing that are recognized by the authors fall within the arts and within religion and spirituality. These may lead to satisfying explanations that fulfill individuals in terms of meaning and purpose in the world, but they will never be scientific explanations.

Once the bounded nature of science is understood, students can distinguish between science, non-science, and pseudoscience. While science seeks natural explanations for natural

phenomena, non-science might seek supernatural explanations for natural phenomena, as in the case of religious explanations of the natural world. Teaching the nature of science as bounded in this way is a charitable approach to the religious beliefs that may be held by students. Instead of dismissing those beliefs as meaningless, this approach simply places science in a realm apart from enterprises like art and religion. It also teaches that when claims that lie outside the bounded nature of science attempt to be scientific, pseudoscience is the result. Pseudoscience aims to appear scientific by means such as appealing to empirical research and using technical language, but relies on advancing claims that are scientifically untenable insofar as they are untestable or have already been refuted in the scientific community. Examples of pseudoscience offered by the authors are intelligent design and creation science. They contend that it is important to be clear about the distinction between non-science and pseudoscience so that beliefs that are clearly religious – and so clearly non-science – are understood to be under no threat by the claims of science. In this way, they believe that students can feel confident in their religious sensibilities while fully engaging in learning about science.

Southerland et al. mirror some suggestions outlined by Mike U. Smith and Lawrence C. Scharmann¹³⁴ in *Defining Versus Describing the Nature of Science: A Pragmatic Analysis for Classroom Teachers and Science Educators*. According to Smith and Scharmann, the goal of science education is to produce “intelligent consumers of scientific information and effective local and global citizens.”¹³⁵ To achieve this goal, they believe it is sufficient for students to understand what characteristics make something more or less scientific and how to go about judging claims or fields as such.¹³⁶ This approach is consistent with the approach taken by Kitcher insofar as Kitcher wishes to avoid distinguishing science from non-science given the problems with demarcation that were discussed in chapter 2. And in fact, Smith and Lawrence include a section in their article on the demarcation problem. Here, they contend that the demarcation problem should be left to philosophers and that science educators should instead focus on questions about what attributes make a claim more or less scientific. They do give some consideration to the concern that is expressed by Southerland et al insofar as they point out that what makes a field or claim more scientific than another does not make it somehow better.¹³⁷ However, the implications of this concern for student learning and strategies aimed at overcoming problematic consequences of assuming normative judgments about science and non-science are much more fully addressed by Southerland et al.

Smith and Scharmann introduce two classroom activities as strategies for teaching the nature of science that center on students identifying what makes something more or less scientific.¹³⁸ The first that they suggest was introduced by John Somerville in his 1941 article, *Umbrellaology*.¹³⁹ In this article, Somerville describes a hypothetical research activity called ‘umbrellaology.’ This involves a careful research program whereby statistics regarding umbrella ownership are produced after an 18 year door-to-door survey of umbrella owners is conducted. The resulting predictions are those such as ‘women are more likely to carry umbrellas of different colors while men are most likely to carry black umbrellas.’¹⁴⁰ The activity for the classroom is to have students discuss whether or not this research program counts as science. According to Smith and Scharmann, the important outcome of this exercise is that it causes students to actively consider what makes something more or less scientific – not the final determination of whether or not umbrellaology is a science. They value this activity because students are not likely to hold deep convictions about umbrella ownership that would cloud the discussion and result in heated debates.

A second activity suggested by Smith and Scharmann is for students to practice determining what types of questions count as scientific and to what extent.¹⁴¹ Some examples that they offer are ‘Is there a God?’ and ‘How old is the Earth?’ They suggest that teachers may choose questions for discussion that illustrate current controversies and issues. The goal is to keep the discussion focused on the characteristics of science and what makes something more or less scientific. It seems, though, that without the clear emphasis on the bounded nature of science explained by Southerland et al., students may draw normative conclusions about what sorts of explanations are more or less meaningful given what they learn about what sorts of explanations count as more or less scientific. Further, they might assume that a normative value is imposed by the teacher leading such a discussion, particularly if it is a discussion of a controversial issue such as the origin of species. And if the bounded nature of science is not addressed, it could be that this assumption is correct – regardless of whether the teacher is doing so in a manner that understands scientific answers to such questions as the true and final word or as problematic metaphysical dogma. For this reason, it is important to consider teachers’ attitudes towards teaching controversial subjects such as evolution and what approaches they are actually taking in the classroom. It is only by considering what is in fact happening in science classrooms that an appropriate evaluation of science education may be offered.

4.3 The Florida Model

The standards adopted in 2008 as a framework for science education in Florida, the controversy surrounding these new standards, and research on Florida teachers' reactions to them are useful to consider in developing an understanding of what is happening in the broader context of state public education. Because this is the context that is considered by the courts in making decisions that affect science education, I will consider it in this section. The Florida framework offers standards for teaching the nature of science that are appropriate to each grade level and include standards for teaching evolution. Florida teachers' reactions to the standards and what they say about how they teach science in the classroom offer a glimpse into the cumbersome reality of a state public education system. They are also instructive in terms of what is needed if science is to truly remain metaphysically neutral in the eyes of the court.

In February 2008, the Florida Board of Education voted 4-3 to approve new student performance science standards. The new standards replaced the 1996 science standards for which Florida had earned a grade of 'F' from the Thomas B. Fordham Foundation because they offered only vague guidelines for science instruction and omitted evolution altogether.¹⁴² Work on the new standards began in May 2007 by a committee of framers taking into account research in science and science education. Their recommendations were then provided to writers who developed benchmarks and standards. As they were presented to the board for approval, the co-writer of the Fordham report put the new standards in the 'A' range. The board, however, saw fit to add 'the scientific theory of' to 'evolution' as well as to other explanations of scientific phenomena. The resulting grade 9-12 standard regarding life science body of knowledge that mentions evolution reads as follows:

Standard 15: Diversity and Evolution of Living Organisms

- A. *The scientific theory of evolution is the fundamental concept underlying all of biology.*
- B. *The scientific theory of evolution is supported by multiple forms of scientific evidence.*
- C. *Organisms are classified based on their evolutionary history.*
- D. *Natural selection is a primary mechanism leading to evolutionary change.*¹⁴³

This inclusion was not the result of consensus among the writers of the science standards and when consulted, 29 of 38 writers recommended the standards as submitted without the caveat. As reported by Adnaan Wasey, the board's move sparked controversy amongst

proponents of evolutionary theory because ‘theory’ is often understood in non-scientific terms to mean a claim that is speculative and not well supported. Southerland et al. have emphasized that teaching about evolution must include a discussion of the scientific understanding of ‘theory’ as representative of the most powerful and useful of scientific explanations.¹⁴⁴ This is also emphasized by the National Academy of Science in their publication, *Teaching About the Nature of Science*, which aims to serve as a resource for teachers.¹⁴⁵ If this strategy is put into place, and it is included in the 2008 Florida Standards, then public misconceptions about what a theory is in science can be addressed in science classrooms. And, in fact, the framework is in place for doing so in the benchmarks on teaching the nature of science.

The grade 9-12 standards regarding nature of science body of knowledge reflect a number of considerations that have been addressed in this chapter. These considerations have been discussed in relation to the importance of teaching science as one of many ways of knowing the world – namely, by arriving at natural explanations of natural phenomena. They read as follows:

Standard 1: The Practice of Science

- A. *Scientific inquiry is a multifaceted activity; The processes of science include the formulation of scientifically investigable questions, constructions of investigations into those questions, the collection of appropriate data, the evaluation of the meaning of those data, and the communication of this evaluation.*
- B. *The processes of science frequently do not correspond to the traditional portrayal of “the scientific method.”*
- C. *Scientific argumentation is a necessary part of scientific inquiry and plays an important role in the generation and validation of scientific knowledge.*
- D. *Scientific knowledge is based on observation and inference; it is important to recognize that these are very different things. Not only does science require creativity in its methods and processes, but also in its questions and explanations.*

Standard 2: The Characteristics of Scientific Knowledge

- A. *Scientific knowledge is based upon empirical evidence, and is appropriate for understanding the natural world, but it provides only a limited understanding of the supernatural, aesthetic, or other ways of knowing,*

such as art, philosophy, or religion.

B. Scientific knowledge is durable and robust, but open to change.

C. Because science is based on empirical evidence it strives for objectivity, but as it is a human endeavor the processes, methods, and knowledge of science include subjectivity, as well as creativity and discovery.

Standard 3: The Role of Theories, Laws, Hypotheses, and Models

The terms that describe examples of scientific knowledge, for example;

“theory,” “law,” “hypothesis,” and “model” have very specific meanings and functions within science.¹⁴⁶

It seems that many misconceptions that arise about the aims and methods of science, the definition of terms within the enterprise of science, and the status of scientific knowledge are addressed by these standards. It is unclear, then, how claims that science is promoting metaphysical dogma in the classroom such those advanced by Johnson and Nagel can be supported in the context of these standards or in comparable standards of science education. However, this is not to say that such claims are necessarily unfounded. While the framework may be sound, questions arise when considering whether and how these standards are being implemented in the classroom. Here, a consideration of Florida teachers' attitudes toward the new science standards is instructive.

In February 2010, Samantha R. Fowler and Gerry G. Meisels published the results of their survey of Florida science teachers in *Florida Teachers' Attitudes about Teaching Evolution*.¹⁴⁷ Their results reflect the attitudes of 353 research participants, with 28% teaching K-5, 24% teaching 6-8, and 48% teaching 9-12. According to Fowler and Meisels, 20% of the teachers surveyed were uncomfortable with the new science standards and only 62% agreed that they would use the new standards to justify teaching evolution. They further found that only 72% agreed that evolution is a central organizing principle of biology while 17% thought that biology can be understood without learning about evolution. Regarding attitudes about religion and biology, there was no overwhelming consensus that believing in God did not preclude accepting evolution as only 66% agreed with this sentiment. While these results reflect the attitudes of teachers in Florida, the trends described by Fowler and Meisels are seen in many other states.¹⁴⁸

The study also solicited comments from the teachers about criticisms they have faced for teaching evolution. One teacher reported being the only one in the department who teaches

evolution. It was also reported that some have been harassed in the workplace for doing so. Still others report being encouraged by their administrators to teach intelligent design if they taught evolution while others were encouraged not to teach evolution at all. The findings do not come as a surprise to Fowler and Meisels as they expected that the public controversy surrounding evolution was likely to affect teachers and, in turn, the quality of science instruction. Given these findings, Fowler and Meisels call for a united front among teachers and administrators and they believe this can be accomplished by focusing professional development efforts on increasing understanding of evolution and its relevance to biology and on teaching controversial topics while maintaining a positive classroom environment.

The importance of a united front is also emphasized by Lance King and Sherry Southerland in their article, *Where Theory and Law Meet: Trends in Establishment Clause Jurisprudence in the US Federal Courts and Implications for Science Education*.¹⁴⁹ Here, they consider federal court cases dealing with religion in relation to education and more broadly in order to identify current trends in judicial philosophy. They argue that the US Supreme Court is trending toward integration of religion into the public sphere and away from separation of church and state. This trend began with the Rehnquist court and appears likely to continue in the new Roberts court. While they recognize that it is by no means certain, King and Southerland provide evidence that Justices Roberts, Scalia, Thomas, Alito, and possibly Kennedy could tip the balance in producing the nation's first post-separationist court.¹⁵⁰

The implications of a post-separationist Supreme Court are important to consider in light of the push towards national science standards as represented by the Common-Core Standards Initiative. King and Southerland explain that the Obama administration aims to improve the quality of science education in the United States and that as a result, the National Governors Association and the Council of Chief State School Officers are collaborating with Achieve Incorporated to develop common-core standards. The controversy over the new science standards in Florida and the resolution of conflict achieved by introducing a broad treatment of the nature of science suggest to King and Southerland that this model might be instructive in developing common-core standards.¹⁵¹ When common-core standards are introduced, it is likely that they will be met with controversy similar to the Florida controversy. As including a treatment of the nature of science helped to resolve that controversy, it would be useful to have that framework in place at the level of common-core standards as well. King and Southerland

recognize the concern raised by Smith and Scharmann that outlining what is and is not science is not the job of science educators. However, they contend that if science educators do not unite to define their discipline at the level of determining standards of science education, then it is unlikely that they will have much of a say if questions about the nature of science end up before a post-separationist court.

4.4 Nagel's Recommendation Considered

The arguments advanced by Johnson and considered in chapters 1 and 2 are aimed at attitudes held by teachers and advanced in connection with teaching evolution. These concerns seem importantly different from those advanced by Nagel. Specifically, Johnson believes evolutionary theory becomes a metaphysical dogma when it is advanced in the context of philosophical naturalism. His key concern is that evolutionary theory is being taught as a correct philosophical dogma and this could possibly be the case given the number of different attitudes about evolution that make up a cumbersome state public education system. However, this fact also suggests –and it seems that the results of the survey discussed above suggest –that evolution is understood by at least some science teachers as metaphysical dogma even if they are not teaching that it is correct metaphysical dogma. These are genuine concerns that must be addressed by teacher education programs and programs of professional development for teachers and administrators if new standards like those implemented in Florida are to be effective in practice. The point, though, is that the framework for this is in place. It is clear that the standards adequately reflect the bounded nature of science and so do not assume philosophical naturalism. A consequence of this is that a system of public education that is effectively modeled on these standards could avoid criticism by Johnson. Nagel's claims about science and so his recommendation for public education, however, are importantly different. It is necessary, then, to return to his recommendations in light of the work that has been done in Florida towards developing a framework for teaching the nature of science.

Given his history of arguing against scientism, it is clear that Nagel's interjection into the controversy over evolution and intelligent design theory in the classroom is motivated by his belief that science does not – and possibly will never – possess an adequate conceptual framework for answering all questions about the universe and what can be said about it. While he does not advance the view that an intelligent designer is possible, he is sympathetic to the projects of those supporting intelligent design theory in public education because these represent

the sort of revolutionary shift in the sciences that he would like to see. Namely, by suggesting that collecting and interpreting data to support the intervention of a divine cause is science, intelligent design theory challenges the very nature of science itself. This is the sort of challenge Nagel thinks must be taken seriously if progress is to be made in the direction of unknown possibilities. In his article, *Public Education and Intelligent Design*, Nagel offers what may be construed as a reply to appealing to the bounded nature of science. He says:

From the beginning it has been commonplace to present the theory of evolution by random mutation and natural selections as an alternative to intentional design as an explanation of the functional organization of living organisms. The evidence for the theory is supposed to be evidence for the absence of purpose in the causation of the development of life-forms on this planet. It is not just a theory that life evolved over billions of years, and that all species are descended from a common ancestor. Its defining element is the claim that all this happened as the result of the appearance of random and purposeless mutations in the genetic material followed by natural selection due to the resulting heritable variations in reproductive fitness. It displaces design by proposing an alternative.¹⁵²

He also says:

When Darwin proposed the theory of natural selection, neither he nor anyone else had any idea of how heredity worked, or what could cause a mutation that was observable in the phenotype and was heritable. The proposal was simply that something purposeless was going on that had these affects, permitting natural selection to operate. This is no less vague than the hypothesis that the mutations available for selection are influenced by the actions of a designer. So it must be the element of purpose that is the real offender.¹⁵³

Here, Nagel seems to be relying on the fact that evolutionary theory was first offered as an alternative to design in arguing that it necessarily presupposes philosophical naturalism. In chapter 2, I discussed Ruse's contention that science itself has evolved and that what was once considered science is not properly considered so today. I believe this could serve as a reply to Nagel on this front. It could be that evolutionary theory was developed to answer questions that

science today is not understood as equipped to answer. In addition, the accumulation of evidence regarding how heredity works suggests that it is no longer as vague as the hypothesis that the mutations available for selection result from the work of a designer. Nagel understands evolutionary theory as resulting from a religious commitment – namely, that a designer is not possible. He sees its continued advancement today as a service to this worldview. However, when the explanation of the nature of science discussed thus far in this chapter is understood, it is clear that this is not the case. Even if it is part of the legacy of evolutionary theory that it has been represented as a metaphysical worldview by some, evolutionary theory is not inherently a metaphysical worldview.

As I discussed in chapter 3, Nagel thinks that what is understood as science rests on what sorts of explanations are believed possible. He contends that if one holds the belief that a designer is possible, then one will understand intelligent design theory as science inasmuch as evolutionary theory is science. If a designer is possible, then what seems to count as evidence for design can count as scientific evidence for design. It seems that with this concern, Nagel is not attacking philosophical naturalism, but methodological naturalism. Why should science be restricted to investigating natural causes? This does not seem to be the sort of question that appealing to the nature of science alone can overcome because Nagel is attacking the nature of science itself. Science has been adequately explained as a bounded enterprise of investigating natural causes of natural phenomena. Nagel seems to be asking the further question – Why should we understand science as *that*?

In this chapter, a number of benefits that result from understanding the nature of science as bounded and so limited in its scope have been discussed. Such an understanding prevents science from becoming dogmatic, keeps scientists on track, allows for a classroom environment in which students are more readily able to learn, and supports science as a metaphysically neutral enterprise in the eyes of the court. However, Nagel is calling for a broader definition of science. His motivation for this is to allow research into unknown possibilities – and possibilities in directions that science is currently, by definition, unable to investigate. The conceptual frameworks of science, according to Nagel, are unable to provide explanations for everything that we would like to have explained and so he believes that science should allow for the development of new directions of investigation. It is not clear, though, why he believes that science alone should provide explanations for everything that we would like to have explained.

Nagel's views seem closely related to the multiculturalist critique of science and recommendation for science education. The multiculturalist critique is discussed by William B. Stanley and Nancy W. Brickhouse in their article, *Multiculturalism, Universalism, and Science Education*.¹⁵⁴ Here, they contrast *multiculturalism* with *universalism*. 'Multiculturalism' is the view that traditional forms of knowledge as understood in the United States do not adequately represent the perspectives of women, minority races, or marginalized sexualities. On this view, what is assumed to be objective knowledge and passes as common heritage is really the culture of the dominant group that is forced upon and so silences other groups. As a critique of science, multiculturalism raises questions about whose knowledge is being taught as science in the United States and contends that science has historically ignored non-Western approaches.¹⁵⁵ As a common defense of science in response to multiculturalist critiques, 'universalism' is the view that the reality of the natural world is independent of any particular judgments about it. This view suggests that the natural world is the standard by which scientific accounts are judged and it is not affected by factors such as race, class, and gender.

According to Stanley and Brickhouse, the universalist defense of science is flawed. While they acknowledge that the natural world is the final judge of what is a true description of reality, they also recognize that no observation can be made apart from an observer. In other words, the community of scientists decides what to study and what to make of their observations of the natural world. As such, science does not, in fact, produce universal knowledge, but only knowledge that is consistent with the interpretations made by the community of scientists.¹⁵⁶ Stanley and Brickhouse argue that the universalist position in science allows for scientists to pretend that their knowledge is objective and also allows for the destruction of systems of knowledge deemed inferior by the dominant group. The conclusion they draw for science curriculum is that teaching the universalist conception of science is academically irresponsible. A better approach, they believe, is to explain that Western science is but one of many ways of knowing the world. That recommendation is consistent with Florida science standard 2: The Characteristics of Scientific Knowledge. However, Stanley and Brickhouse go further to suggest that it would be responsible science instruction to teach what falls outside the scope of Western science – namely, examples of science from other cultures. In this way, they believe, students can have a more complete understanding of Western science itself.

In his book, *The View From Nowhere*, Nagel advances an epistemological position that is similar to – albeit decidedly more abstract than – the multiculturalist view. The following passage illustrates his view well:

*If we try to understand experience from an objective viewpoint that is distinct from that of the subject of the experience, then even if we continue to credit its perspectival nature, we will not be able to grasp its most specific qualities unless we can imagine them subjectively. We will not know exactly how scrambled eggs taste to a cockroach even if we develop a detailed objective phenomenology of the cockroach sense of taste. When it comes to values, goals, and forms of life, the gulf may be even more profound.*¹⁵⁷

While the multiculturalist argues that a particular perspective – in terms of race, class, gender, and the like – necessarily influences what is said about the nature of reality, Nagel argues in *The View From Nowhere* that the human perspective itself necessarily influences what can be said about the nature of reality. The multiculturalist calls for the inclusion of multiple perspectives to achieve the most adequate depiction of reality. Nagel, on the other hand, goes further to claim that being human necessarily precludes a complete and objective description of reality. On his view, there just are facts about the world that are not accessible to humans. This is a view that has earned him some notoriety in the field of philosophy. And while we may not care what it is like to be a cockroach or what it is like to be a bat – it seems that he is right, at least intuitively, that there is *something* that it is like to be those things. It is not this broader philosophical view, specifically, that Nagel is advancing in *Public Education and Intelligent Design*. What he is doing there, however, does seem closely related. From his understanding of the influence of perspectives on what can be claimed to be known, he believes it is legitimate to claim that scientific investigation yields different results depending on the perspective from which it is approached. This sounds remarkably similar to the multiculturalist view. Also, his recommendation of a discussion on how different antecedent beliefs affect what can be claimed to be known in science is quite similar to the multiculturalist claim that non-Western approaches to understanding the natural world should be discussed. Further, both contend that doing so will advance knowledge about science itself.

In her article, *Epistemic Universalism and the Shortcomings of Curricular Multicultural Science Education*, Southerland offers a reply to the multiculturalist recommendation for science education which can be applied to the recommendation offered by Nagel as well.¹⁵⁸ According to Southerland, by attempting to expand the definition of science so that science education includes a treatment of all ways of interpreting meaning in the world, the multiculturalist recommendation in fact reinforces the mistaken notion that science purports to be the only way of understanding the world. Rather than accomplishing the goals of multiculturalism, Southerland argues that this approach actually devalues other systems of thought as it subsumes them under the heading of 'science.' Further, it expands the definition of science such that it sets no limits on the authority of science.¹⁵⁹ I think this is the right sort of reply to the multiculturalist and to Nagel. However, as discussed above, Nagel's critique depends on a decidedly more abstract concern about the nature of human knowledge, so Southerland's reply applied to Nagel should be discussed specifically in that context.

It is important to remember that Nagel is not interested in intelligent design theory for the same reasons that are important to its proponents. He simply does not share their religious convictions. In suggesting that science education should include a discussion of how the different religious beliefs one may hold affects one's approach to and understanding of the natural world, Nagel is doing something somewhat similar to the multiculturalist. Namely, he is claiming that one's perspective in terms of religious belief has an important effect on what descriptions one will accept, or reject, of the natural world. However, there is an important conceptual difference here that should be considered. Nothing about a person's race, class, or gender dictates that the descriptions of the natural world she will advance will incorporate an account of a supernatural cause. For this reason, the recommendation of the multiculturalist – though appropriately responded to by Southerland – can be satisfied by invoking only natural explanations. And so, considerations of religious beliefs are even further removed from the nature of science than are considerations of differing perspectives resulting from different socioeconomic classes. If it is problematic, as Southerland argues, to include the latter because this reinforces a mistaken understanding of science, then it is even more problematic to include a discussion of the former.

In reality, the sorts of directions that Nagel would like to see investigation towards are completely unknown, even to him. He claims to not know what adequate explanations might look like and what conceptual frameworks would be required to produce them, but on the other

hand, he does not advocate skepticism in science education either.¹⁶⁰ To satisfy Nagel, it might be the best we can do to simply acknowledge the limited nature of human knowledge. However, this is a concern about the nature of knowledge itself – not about the nature of scientific knowledge. Nagel’s concern does not fall within the bounds of a discussion of the nature of science and it is not a concern that is particularly unique to the sciences either. For these reasons, Nagel is wrong to suggest that a discussion of the relationship between evolutionary theory and religion belongs in the science classroom.

While a discussion of the sorts of philosophical concerns that Nagel advances is not appropriate to the science classroom, it could be understood as important to understanding the limited nature of human knowledge. If discussing this is preferable to simply not addressing the issue, then the only proper space that could be made in the curriculum for such concerns would be in a generalized epistemology course. I think an introduction to philosophy by means of a generalized epistemology course would benefit students by allowing them to consider knowledge claims in all fields of study in different lights. As I discussed in chapter 3, I also think that this would be beneficial to the field of philosophy itself as philosophy would find its way into public discourse at all levels and this might advance philosophical research, especially from currently marginalized perspectives. However, the development of a framework for such an introduction would require much effort on the part of philosophers, educators, experts in childhood development, and given the controversial nature of introducing philosophical issues in the classroom – ultimately, legal scholars.

NOTES

¹(Numbers 2009)

²(Pennock 1999)

³(Lawson 1997, p. 23)

⁴(Lawson 1997, p. 24)

⁵(Lawson 1997, pp. 51-58)

⁶(Lawson 1997, p. 71)

⁷Lawson explains that Darrow appealed to the Tennessee state constitution as the US Supreme Court had not yet determined that the establishment clause of the US constitution applied to state laws. Tennessee, though, guaranteed the similar right of citizens to determine their own religious consciences. (Lawson 1997, p. 163)

⁸(Lawson 1997, p. 50)

⁹(Lawson 1997, p. 179)

¹⁰(Numbers 2009, pp. 192-230)

¹¹(Pennock 1999, p. 3)

¹²(Wexler 2006, pp. 83-104)

¹³(Pennock 1999, p. 4)

¹⁴(Pennock 1999, pp. 181-185)

¹⁵(Ruse 2009a)

¹⁶(Overton 1999, p. 294)

¹⁷(Overton 2009, pp. 294-295)

¹⁸(Overton 2009, p. 296)

¹⁹(Overton 2009, pp. 283-290)

²⁰(Pennock 1999, p. 6)

²¹(Johnson 1991, p. 83)

²²(Johnson 1991, p. 83)

²³(Ruse 2009a, p. 264)

²⁴(Ruse 2009a, p. 274)

²⁵(Johnson 1991, p. 84)

²⁶(Johnson 1991, p. 81)

²⁷(Johnson 1991, p. 6)

²⁸(Behe 1996)

²⁹(Behe 1996, p. 233)

³⁰(Behe 1996, p. 193)

³¹(Behe 1996, p. 192)

³²(Behe 1996, pp. 193-195)

³³(Behe 1996, p. 197)

³⁴A related point, I think, is made in (Williams 2010, p. 40), where he says: “The problem is that it makes no sense to infer, from an unlikelihood of something’s existing independently of purposeful action, that it came to exist via such action *when no purposeful action whatever* has been known to engender the relevant sort of thing.”

³⁵(Behe 1996, p. 233)

³⁶(Scott 2006, p. 24)

³⁷(Dembski 2001, pp. 553-572)

³⁸(Dembski 2001, p. 559)

³⁹(Dembski 2001, pp. 560-561)

⁴⁰(Dembski 2001, p. 570)

⁴¹(Pennock 1999, pp. 256-257)

⁴²(Pennock 1999, pp. 185-214)

⁴³(Pennock 1999, p. 201)

⁴⁴(Pennock 1999, pp. 190-191)

⁴⁵(Pennock 1999, pp. 194-195)

⁴⁶(Miller 1999)

⁴⁷(Miller 1999, p. 266)

⁴⁸(Miller 1999, p. 268)

⁴⁹(Miller 1999, p. 274)

⁵⁰(Miller 1999, p. 279)

⁵¹(Miller 1999, p. 279)

⁵²My discussion here is informed by Slack's personal account of the trial and the circumstances surrounding it as represented in (Slack 2007), and also from (Pennock and Ruse 1999, pp. 434-455).

⁵³(Slack 2007, p. 40)

⁵⁴(Pennock and Ruse 2009, p. 455)

⁵⁵(Pennock and Ruse 2009, pp. 506-535)

⁵⁶(Pennock and Ruse 2009, p. 517)

⁵⁷(Laudan 2009b)

⁵⁸(Laudan 2009a)

⁵⁹(Laudan 2009a, p. 316)

⁶⁰(Laudan 2009a, pp. 318-319)

⁶¹(Laudan 2009a, p. 319)

⁶²(Laudan 2009a, pp. 319-322)

⁶³(Laudan 2009a, p. 323)

⁶⁴(Laudan 2009a, p. 328)

⁶⁵(Laudan 2009b, p. 331)

⁶⁶(Ruse 2009b)

⁶⁷(Laudan 2009c, p. 331)

⁶⁸(Laudan 2009c, p. 347)

⁶⁹I think Dembski's concession that the designer might be some alien intelligence is more of an intellectual deception motivated by legal concerns than an honest attempt to characterize intelligent design as science.

⁷⁰(Pennock 2009)

⁷¹(Pennock 2009, p. 459)

⁷²(Pennock 2009, p. 463)

⁷³(Johnson 1995, pp. 107-108)

⁷⁴(Johnson 1995, p. 108)

⁷⁵(Johnson 2000, p. 148)

⁷⁶(Johnson 1995, p. 110)

⁷⁷(Pennock 2009, p. 458)

⁷⁸(Pennock 2009, p. 464)

⁷⁹(Plantinga 2001)

- ⁸⁰(Plantinga 2001, pp. 344-345)
⁸¹(Plantinga 2001, p. 345)
⁸²(Ruse 2001)
⁸³(Ruse 2009b, pp. 339-340)
⁸⁴(Fuller 2009)
⁸⁵(Fuller 2009, p. 488)
⁸⁶(Fuller 2009, p. 489)
⁸⁷(Kitcher 1982)
⁸⁸(Kitcher 2007)
⁸⁹(Kitcher 2007, p. 100)
⁹⁰(Kitcher 2007, pp. 8-9)
⁹¹(Kitcher 2007, pp. 103-106)
⁹²(Kitcher 2007, p. 120)
⁹³(Kitcher 2007, p. 166)
⁹⁴(Kitcher 2007, p. 114)
⁹⁵(Nagel 2008)
⁹⁶(Nagel 2008, p. 188)
⁹⁷(Aikin et. al. 2009)
⁹⁸(Nagel 2008, p. 198)
⁹⁹(Aikin et. al. 2008, p. 38)
¹⁰⁰(Nagel 2008, p. 205)
¹⁰¹(Nagel 2008, p. 205)
¹⁰²(Oppy 2010)
¹⁰³(Nagel 2008, p. 202)
¹⁰⁴(Aikin et. al. 2010, p. 213)
¹⁰⁵(Nagel 2008, p. 195)
¹⁰⁶(Nagel 2008, pp. 197-198)
¹⁰⁷(Williams 2010)
¹⁰⁸(Plutynski 2008)
¹⁰⁹(Nagel 2009a)
¹¹⁰(Nagel 2009b)
¹¹¹(Leiter 2009)
¹¹²(Nagel 1991, p. 424)
¹¹³(Nagel 2008, p. 189)
¹¹⁴(Nagel 2008, p. 189)
¹¹⁵(Nagel 1986, pp. 9-10)
¹¹⁶(Nagel 2008, p. 202)
¹¹⁷(Nagel 1986, p. 81)
¹¹⁸(Nagel 1986, pp. 7-8)
¹¹⁹(Davidson 2010)
¹²⁰(Nagel 1986, p. 81)
¹²¹(Nagel 2008, p. 205)
¹²²(McComas 1998)
¹²³(McComas 1998, p. 6)
¹²⁴(McComas 1998, p. 7)

- ¹²⁵(McComas 1998, p. 9)
- ¹²⁶(McComas 1998, p. 11)
- ¹²⁷This is a point similar to the one made in chapter 3 in the discussion of Williams' reply to Nagel.
- ¹²⁸(McComas 1998, p. 11)
- ¹²⁹(McComas 1998, p. 14)
- ¹³⁰(National Academy of Sciences Institute of Medicine 2008, p. 10)
- ¹³¹(National Academy of Sciences Institute of Medicine 2008, p. 11-12)
- ¹³²(Southerland et. al. 2011)
- ¹³³(Southerland et. al. 2011, p. 87)
- ¹³⁴(Smith and Scharmann 1999)
- ¹³⁵(Smith and Scharmann 1999, p. 493)
- ¹³⁶(Smith and Scharmann 1999, p. 496)
- ¹³⁷(Smith and Scharmann 1999, p. 499)
- ¹³⁸(Smith and Scharmann 1999, pp. 502-504)
- ¹³⁹(Somerville 1941)
- ¹⁴⁰(Smith and Scharmann, pp. 502-503)
- ¹⁴¹(Smith and Scharmann, pp. 503-504)
- ¹⁴²(Wasey 2008)
- ¹⁴³(Florida Board of Education 2008)
- ¹⁴⁴(Southerland et al. 2011)
- ¹⁴⁵(National Academy of Sciences 1998)
- ¹⁴⁶(Florida Board of Education 2008)
- ¹⁴⁷(Fowler and Meisels 2010)
- ¹⁴⁸(Cavanagh 2011)
- ¹⁴⁹(King and Southerland 2011, pp. 1-23)
- ¹⁵⁰(King and Southerland 2011, pp. 7-13)
- ¹⁵¹(King and Southerland 2011, pp. 17-19)
- ¹⁵²(Nagel 2008, p. 188)
- ¹⁵³(Nagel 2008, p. 189)
- ¹⁵⁴(Stanley and Brickhouse 1994)
- ¹⁵⁵(Stanley and Brickhouse 1994, p. 388)
- ¹⁵⁶(Stanley and Brickhouse 1994, pp. 391-392)
- ¹⁵⁷(Nagel 1986, p. 25)
- ¹⁵⁸(Southerland 1997)
- ¹⁵⁹(Southerland 1997, p. 15)
- ¹⁶⁰Though he clearly shows preference for skepticism over reductionism in (Nagel 1986, pp. 67-82)

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BIOGRAPHICAL SKETCH

I am a Florida native, born in Vero Beach on October 4, 1975. Most of my education as a youth was in the Memphis area and I received a Bachelor of Arts in philosophy from the University of Mississippi in 1999. At that time, I was awarded a teaching assistantship to pursue graduate studies in philosophy at Florida State University. I worked as an instructor teaching political philosophy and philosophy of feminism and I also taught special topics courses in women's studies. After completing my PhD coursework, I received a job at Miami Dade College where I am currently an assistant professor of philosophy. In the past two years, I have worked to complete my dissertation and earn my PhD under the direction of Michael Ruse. In addition to my studies and my teaching, I have presented at conferences on topics in philosophy and I regularly serve as an invited speaker and discussion panelists on topics in philosophy and women's studies for the campuses of Miami Dade College.