Some Implications of the Demise of the Demarcation Problem

Tom Hogan*

Abstract

Two court cases, *McLean v. Arkansas* ("*Arkansas*") in 1980 and *Kitzmiller et al. v. Dover Area School District et al.* ("*Dover*") in 2005, showed how decisive philosophy can be when wielding the demarcation argument, as both creation science and intelligent design were denied victories because they were judged to be unscientific based on demarcation arguments. However, since the *Arkansas* decision and before *Dover*, the demarcation problem has generally come to be viewed by philosophers of science as intractable (i.e., "unsolvable"). The corollary of the intractability of the demarcation problem is that anything and everything can claim to be science without fear of being proved otherwise and that, therefore, the term "science" has no meaning. This has some clear implications for the creation project, including the renewed prospect for success in the courts and powerful answers to anti-creationist rhetoric.

Introduction

Reed et al. (2004) noted that forensic arguments alone cannot win the battle against naturalism, and that philosophical arguments are needed as well. Creationists should note that the court cases *Arkansas*, in 1980, and *Dover*, in 2005, showed how decisive philosophy can be when wielding demarcation arguments; the philosophical testimony was more influential in the judicial decisions than the scientific testimony and was quoted verbatim at length in the judicial opinion. Demarcation arguments attempt to distinguish between science and nonscience; demarcation is used by creationists, who argue that the theory of common ancestry is not science because it has not been observed or documented in the fossil record, and by evolutionists, who argue that creation isn't science because only arguments based on methodological or metaphysical naturalism are "science."

The intractability (i.e., "unsolvability") of the demarcation problem was generally accepted by philosophers at the time of *Dover* (Meyer, 1994). The philosophical strategy used by the defense in *Dover* was sound, but the defense made several tactical errors that prevented the court from discerning the status of the demarcation problem. One of the foremost experts on the problem, Larry Laudan, published an article about demarcation (Laudan, 1983) that is widely regarded by philosophers as definitive (Fales, 2005; Koperski, 2008; Meyer, 1994; Monton, 2006). Robert Pennock, a philosopher who was an expert witness for the plaintiffs, testified about Laudan's work on the demarcation problem. Pennock answered the question equivocally, thereby giving two false impressions:

* Tom Hogan, MS, Shawnee, KS, marketstudent@yahoo.com
Accepted for publication September 9, 2009

(1) That demarcation is not intractable and was used by most philosophers to distinguish science from non-science, and
(2) That Larry Laudan would have considered intelligent design to be nonscience because Laudan would have used demarcation to do so, which was contrary to fact, since Laudan had shown the error of that strategy (Laudan is an anti-creationist who thinks that creation science is bad science; cf., Laudan, 1983).

This paper will review and assess Laudan's (1983) paper, "The Demise of the Demarcation Problem," and will discuss some implications that follow from it that may impact future creationist/intelligent design court cases and the creation/evolution debate.

Revisiting Laudan's "The Demise of the Demarcation Problem"

Following the 1980 *Arkansas* case, Laudan reviewed the history of the demarcation problem in 1983. (All references to Laudan in this section refer to his 1983 paper unless otherwise indicated.)

According to Laudan, science was initially defined as those disciplines in which there was apodictic (demonstrable) certainty. It was knowledge, not mere opinion. In contrast, "craft," which seeks methods to accomplish a specific purpose, is also demonstrable, and philosophers of science needed a way to distinguish science from craft. The earliest philosophers (e.g., Aristotle) used *first causes* as their demarcation criteria. *First causes* were thought to be those events that were independent of other causes, such as natural laws. Laudan (1983) used astronomy as an example of something that could be both science and craft, depending on whether it searched for first causes. Seventeenth-century scientists discarded the first causes idea as essential for science when Newton was able to describe the behavior of gravity without finding its cause. Eighteenth-century philosophers of science maintained demonstrability as the essential criterion for defining "science."

Laudan notes that the view that all theories may be fundamentally flawed—a view called *fallibilism*—became prominent in the nineteenth century. Laudan found that foundationally organized progress of scientific theories was no longer a certainty, as many theories were overturned or seriously amended during that period. These theories had been developed gradually and systematically, with newer theories built on the earlier ones. With the rejection of some of the more foundational, earlier theories, the whole progressive view of science was in jeopardy. Science was no longer apodictically certain, but was a work in progress.

Philosophers then began to rely upon methodology—such as methods of reasoning and researching observable entities—for their demarcation criteria. However, this is not what scientists were actually doing. Nevertheless, despite the philosophic failure in demarcation, rhetoric was used against what was perceived as superstition under the pretense that effective demarcation criteria existed.

After examining historical attempts at defining demarcation criteria, Laudan lays out questions that he believes must be considered in demarcation:

1. How shall we determine if the demarcation criteria are adequate?
2. What are the necessary and sufficient conditions for demarcation?
3. What rationale for calling things "scientific" or "unscientific" is precise enough to be useful?
4. What is our motivation for applying demarcation?

Laudan concludes that the question of adequacy must allow for current scientific practice, although I believe he is begging the question. The demarcation plan must identify the methodological or epistemic criteria sufficiently clearly to give the desired result.

In dealing with the second and third questions, Laudan shows that sufficient conditions are used to make sure that things thought to be "scientific" are not excluded by the demarcation criteria and that a failure to meet necessary conditions is used to exclude things that are in fact "scientific." Both types of conditions are essential for any demarcation plan and must be precisely specified in order to be useful.

In answering the last question, Laudan uses historical examples of demarcation attempts. He evaluates the motivations of Aristotle, the logical positivists (e.g., Carnap), and Karl Popper in their efforts to determine demarcation criteria. Laudan states that Aristotle used demarcation to attack the followers of Hippocrates, the logical positivists did the same against the metaphysicians, and Popper aimed at discrediting Marx and Freud through demarcation. Laudan recognizes the power of labeling and categorizing—stressing that philosophers should be careful to do this correctly. Laudan notes that the motives of philosophers should not corrupt their philosophical reasoning when applying demarcation. He might have been thinking of Michael Ruse's testimony in *Arkansas* as an example of motives corrupting correct reasoning.

In the final section of his paper, Laudan turned to modern demarcation attempts, beginning with the logical positivists. Logical positivists insisted that scientific statements must be exhaustively verifiable. However, many scientific conclusions cannot be exhaustively tested (e.g., all universal physical laws), while many other ostensibly nonscientific laws are testable (e.g., the statement that the earth is flat). Popper's sophisticated falsificationism lacks discrimination—many things that are ostensibly "unscientific" (e.g., the flat-

earth hypothesis) are falsifiable, while some scientific propositions (e.g., that atoms exist) are not falsifiable.

Laudan considers whether "scientificity" might have the property of degree and whether theories might be compared based on their testability. He notes that there are technical difficulties with this approach, and only Popper's theory is articulated well enough to evaluate "testability." Furthermore, it can only be used when one theory implies another competing theory and is, therefore, useless for demarcation. Another concern is that Popper sees testability as a semantic notion, while demarcation relies on epistemic principles. Again, if anything is falsifiable, according to Popper, it is scientific, even if it is falsified, including the flat-earth theory or the statement that the moon is made of Limburger cheese.

Next, Laudan looks at some current (as of 1983) candidates for demarcation strategies. These include fruitfulness and progressive development, whether a theory has been well tested, accuracy of predictions, pragmatism, and coherence. He asks (and I paraphrase), "Can ostensibly 'unscientific' things be well tested, including literary theory, carpentry, and football strategy?" (Laudan, 1983, p. 325). Laudan observes that some disciplines that are speculative and investigate first principles may not be well tested when compared with disciplines that are not speculative and are well tested. He also shows that many ostensibly "unscientific" disciplines make cognitive progress and many ostensibly "scientific" disciplines do not make much progress by comparison. The conclusion of Laudan's survey paper is that the current-as-of-1983 status of the demarcation problem in the philosophy of science is that it is intractable (i.e., unsolvable).

Laudan's conclusion is still generally uncontroversial in philosophy of science (Fales, 2005; Koperski, 2008; Meyer, 1994; Monton, 2006). His conclusion means that philosophy *cannot* specify what is not science. This startling development has a number of major implications for creationists and intelligent design (ID) advocates. One of the most important is that the basis for the defeat of ID and creation in *Arkansas* and *Dover* was philosophical malpractice.

Philosophical Malpractice

After Ruse testified against creation science in Arkansas in 1980, Laudan (1982) responded, essentially accusing Ruse of philosophical malpractice. Intelligent design philosopher Stephen Meyer (1994) also found fault with Ruse's work. Ruse (1982) answered Laudan, arguing that the overwhelming need to defeat "creationism" can excuse any philosophical errors. Philip Quinn (1984) responded to Ruse's defense by caustically inquiring whether it was proper behavior for a philosopher to perjure himself in a secular setting as long as he washed his hands in academia.

Robert Pennock likewise committed philosophical malpractice in *Dover* and was taken to task by Fales (2005), Monton (2006), and Koperski (2008). Plantinga (2006) likewise attacked Pennock's idea that methodological naturalism as a shaping principle in science can be used as a demarcation criterion.

In both *Arkansas* and *Dover*, heavy reliance was placed on the categorization of creation and intelligent design as nonscience, based on demarcation criteria. The judicial decisions were based on the philosophical error that valid demarcation criteria have been found and that one of them—methodological naturalism—excludes the supernatural from science.

This makes Laudan's assessment that demarcation is intractable vitally important to both creationists and proponents of intelligent design. If the current inability to define clear demarcation criteria were properly communicated in court, increased prospects of success in obtaining advantageous court decisions for creationists and intelligent design advocates may result. If it can be shown that secularists cannot adequately and conclusively define "science," then their options for prevailing in other cases will rest on naked judicial fiat.

Let us be very clear—as far as philosophy of science is concerned, demarcation is dead and long buried these twenty-odd years since Laudan's 1983 paper was published, notwithstanding the philosophical malpractice by Ruse and Pennock at the bar. No adequate reply to Laudan has been published.

Heterogeneity of Science and Laudan's Proposed Legal Review of Science

As part of his overall argument, Laudan (1983) also made two other important, but ultimately problematic points. First, that science is wildly heterogeneous, and second, that some a posteriori demarcation is possible between good and bad science based on evidential arguments. In the second statement, Laudan implicitly suggested that the courts should judge between good and bad science. His first statement is absurd, and his second statement holds the potential for disastrous consequences.

If the courts were given the power to judge between good and bad science, they would be taking on the responsibility of professional peer review—which is likely to stultify science. Science has thrived for centuries on the principle of peer review. Since law and science are different disciplines, applying different methods, review by lawyer rather than review by peers would eliminate the cooperative and piecemeal nature of scientific discovery that has proven fruitful over many centuries. There is no reason to think that judges would be more competent than scientists in reviewing scientific work. If legal review were to be applied to creation and ID, it could have the effect of stifling open

inquiry; scientists and professors might forever be under the threat of legal action for their communications. Political considerations would drive science, as was seen with the ideas of Lysenko in the Soviet Union (Bergman, 2009; Feyerabend, 1975). This situation would be undesirable for both science and law.

Laudan's acceptance of the heterogeneous status quo in the definition of "science" ignores the damage it does to disciplines that have built their reputations on technological achievements—e.g., physics, chemistry, and biology. When the technological contributions and epistemic credibility of some disciplines are diluted by association with disciplines that have not produced many technological achievements, such as economics, political science, sociology, psychology, meteorology, and paleontology, the reputation of the technologically-prolific disciplines suffers from the association. We see this in the complaints of physicists and chemists when climatologists and experts from the "social sciences" claim to speak for science; physics and chemistry have a cornucopia of technological benefits to their credit, but climatology and the "social sciences" not so much. Conversely, many disciplines have enhanced their reputations simply by claiming to be "science," but without gaining their credibility by making significant technological contributions. Hence the historical increase in "science's" heterogeneity and the accompanying dilution of its reputation.

Asserting that a discipline's reputation can be enhanced by technological fruit does not rely on a claim that demarcation criteria exist. Such claims ignore Laudan (1983). This paper makes no claim that physics, chemistry, and biology are "science" or that technological contributions by a discipline constitute demarcation criteria; this paper merely asserts that there are certain ethical reasons for these disciplines to be jealous of their reputations; those ethical reasons flow from their technological contributions.

In order to show that Laudan's statement, "science is wildly heterogeneous," is absurd, we must revisit the demarcation (of science from nonscience) problem. Laudan (1983) concluded that philosophy of science has so far been unable to define a list of properties that will always separate science and nonscience. This means that philosophy of science cannot clearly distinguish science from nonscience. This vagueness means that philosophy of science will be unable to prevent anything from claiming to be "science" since philosophy of science has shown that demarcation criteria do not exist that can be used to prevent anything from claiming to be "science" (e.g., astrology, carpentry, and art could claim to be "science," which is counterintuitive; we shall examine astrology and art later in this paper). If this is true, then "science" ceases to have a clear or even useful meaning.

If the demarcation problem is intractable, then we must consider whether "science" therefore has *any* meaning. This is a very counterintuitive question, because we think of specific disciplines such as physics, chemistry, etc. as "science." However, philosophy deals with knowledge; our intuition about what is "science" may merely be opinion. Without demarcation criteria, how can philosophy of science rationally support any definition of "science"?

Laudan (1983) has shown that no demarcation criteria exist to prevent any craft, art, or philosophy from claiming to be "science." Suppose that sewing and football coaching wanted to designate themselves as sciences alongside art, astrology, and carpentry. How should we stop them? We have seen that no demarcation criteria exist to do so. What meaning does "science" have if the list of things that are acknowledged as "science" includes diverse human interests that may have no common properties? Aren't we forced to admit that if this were to happen, "science" would have no real meaning? Yet we know that due to our current knowledge about the status of the demarcation problem, we cannot prevent this scenario from occurring. Thus, even without the list of "sciences" being expanded absurdly, we see that the definition of "science" is so vague as to be meaningless.

If "science" cannot be defined in a way to give it meaning, then Laudan's (1983) statement about the "heterogeneity of science" is clearly meaningless, since it relies upon "science" having meaning. In fact, "philosophy of science" and "history of science" also would be meaningless phrases. Hence, Laudan's (1983) statement about the "heterogeneity of science," being meaningless, is absurd.

Why Laudan's Failure to Find Demarcation Criteria Was Predictable

Laudan examined demarcation criteria against examples of science from history. Laudan essentially granted history the privilege of defining "science." This created inevitable problems for philosophy, because the history of science had no governing criteria for demarcation; rather, the reputation of "science" likely led to many disciplines riding the coattails of "science" by claiming to be "sciences." Thus, where originally there were only physics, chemistry, biology, and geology, we see in history that many other disciplines later claimed to be "sciences," including:

- the "social sciences" of psychology, sociology, and political science,
- economics,
- engineering,
- medical science, and, lately,
- history.

This conflation, which occurred historically, was independent of any plan to maintain meaning for "science" through common criteria. Thus, it was

to be expected that Laudan's historical tests of demarcation criteria would be unsuccessful.

Laudan's Implicit Acceptance of Scientism

Since Laudan accepted the heterogeneity of "science," he also necessarily accepted the claims of various disciplines to be "sciences." The aim of such claims is to enhance the disciplines' reputations. We see from the failure of demarcation criteria that there is no necessary reason for such a claim based on a set of common criteria from a definition of "science." Rather, the more likely reason for these claims is due to the reputation enhancements that they gain from the assumption that science has epistemic power; by successfully claiming to be "science," a discipline is able to claim this same epistemic power, and its reputation is enhanced. The original aim of scientism was to rely only on "science" for epistemic truth. A weaker version of scientism claims that "science" produces the strongest claims for epistemic truth, rather than exclusive claims. In practice, this weaker version is almost indistinguishable from the stronger version, since "science" is advancing into many areas of human life, including explanations about religion and sexual attraction. By accepting the historical status quo (heterogeneity) for his definition of "science," Laudan therefore implicitly must accept scientism.

Meaninglessness, Demarcation Criteria, and the Definition of "Science"

Meaninglessness Theorem

1. For any definition of something, we should be able to find at least one thing that does not fit that definition.
2. If a definition cannot find anything that is excluded by the definition, then that definition is meaningless.

Rather than try to prove this theorem at this point, let us assume its validity and use it to prove that the word "science" is meaningless.

Suppose we take a field that intuitively is removed as far as possible from science, such as astrology, and attempt to find actual demarcation criteria to exclude it from science. Laudan (1983) showed that any potential demarcation criteria that we might use to exclude astrology from science will fail, because the same criteria also would eliminate other fields that we would intuitively call "science." Bear in mind that with demarcation, we are applying criteria based on a set of properties in order to dismiss something as nonscience so that empirical tests are unnecessary. If we cannot exclude something like astrology as nonscience, how can we exclude anything? If we cannot exclude anything as nonscience, then the definition of science is meaningless.

What are the potential demarcation criteria that we might apply to astrology? Does astrology make risky predictions? Certainly. Is it falsifiable? Sure. Does it have a specified causal mechanism? No, but neither does gravity. Does its knowledge progress? Astrologers think so. Does it investigate phenomena? Yes, it investigates the relationships between astronomical bodies and their effects on people's lives. Is astrology quantifiable? In some ways. The degrees of angle of the planets and stars from the sun can be measured. Some properties in biology cannot be measured, such as properties like "cat-ness." Are there anomalies in astrology? Sure, but there are also many anomalies in other things we think of as science, including the placebo effect, evidence for variation in the fine-structure constant, and cold fusion, which was recently reproduced by a number of researchers (Brooks, 2007). Thus, we see that no demarcation criteria exist that can be applied to astrology that do not also exclude things that we consider to be scientific.

Let's consider another example. Suppose an artist were to assert that art is science. He might argue that art uses geometry, as does astronomy, because it studies perspective and form. The artist asserts that he is very empirical—he studies his subjects carefully, examining form, shadow, color, and lighting. He says that he performs experiments. He experiments with pen studies before committing to paint and experiments with mixing different colors of paint before committing the paint to the canvas.

It might be asked, "What knowledge is gained from art?" The artist would reply that he investigates human conceptions of beauty, form, nature, and the human experience. His studies sometimes overlap with biology, geology, psychology, and sociology, which intuitively are regarded as sciences. Thus, we see that even art cannot be excluded by demarcation criteria.

We've seen that philosophy has problems trying to define "science." Do nonphilosophers do any better?

Problems with the Definitions of "Science" Outside Philosophy

Let's start our examination of attempts by nonphilosophers to define "science" by considering the idea that "science" might be defined as a list of disciplines: physics, chemistry, biology, etc. Whose list are we to use? The list of the National Academy of Sciences (NAS), which includes economics, sociology, psychology, and engineering? The list of the National Science Foundation? The list that physicists might create? The list that creationists might create? The list that evolutionists might create? What is the rationale for which items to include in the list? Will that list be universally acceptable? Will that list even be useful in the future, when new disciplines arise? What justification can then be given for refusing to accept applications for

entry from current disciplines that are not on the list, seeing as we've just seen philosophy's failure to validate any demarcation strategy? Is the determination to be based simply on ad hoc rationale and brute force?

A couple of textbooks define "science" in terms of the "scientific method." (Dickson, 1995; Thompson and Turk, 1998).

Let's next consider the idea that we can look at definitions from various disciplines for a definition of "science."

> Science is the concerted human effort to understand, or to understand better, the history of the natural world and how the natural world works, with observable physical evidence as the basis of that understanding (Railsback, 2009a).

This definition relies on the claim that one can use "science" to understand "history." This definition forces a conflation of disciplines. Furthermore, it limits the domain of "science" to the natural world, which conflicts with the list from NAS, which includes disciplines that don't primarily study the natural world in whole or in part (e.g., engineering, economics, and much of sociology).

Let's continue looking at various definitions:

> 1. the systematic observation of natural events and conditions in order to discover facts about them and to formulate laws and principles based on these facts. 2. the organized body of knowledge that is derived from such observations and that can be verified or tested by further investigation. 3. any specific branch of this general body of knowledge, such as biology, physics, geology, or astronomy (Morris, 1996).

> Science is an intellectual activity carried on by humans that is designed to discover information about the natural world in which humans live and to discover the ways in which this information can be organized into meaningful patterns. A primary aim of science is to collect facts (data). An ultimate purpose of science is to discern the order that exists between and amongst the various facts (Gottlieb, 1997).

> The investigation of natural phenomena through observation, theoretical explanation, and experimentation, or the knowledge produced by such investigation (Pickett 2005, p. 554).

> Science is a discipline that asks and answers questions about the working of the physical world (Trefil and Hazen, 2004, p. 2).

Notice that these definitions also limit the definition of "science" to nature, which conflicts with the definition implicit from the NAS list. They also conflict with the following, broader definitions:

> Science consists simply of the formulation and testing of hypotheses based on observational evidence; experiments are important where applicable, but their function is merely to simplify observation by imposing controlled conditions (Dott and Batten, as quoted in Railsback, 2009b).

> I stress that my use of the term "science" is not limited to the natural sciences, but includes investigations aimed at acquiring accurate knowledge of factual matters relating to any aspect of the world by using rational empirical methods analogous to those employed in the natural sciences (Sokal, 2008).

The preceding definitions allow for disciplines in the NAS list such as engineering, sociology, psychology, and economics. Sokal actually endorses rationalism and scientism in his definition of "science." The preceding definitions reject the idea that experimental controls are essential to "science." If the epistemic claims resulting from reliance on experimental controls are stronger than those which do not rely on experimental controls, then this definition seems to reduce the strength of the epistemic justification for claims of "science," which necessarily decreases the reputation of "science."

> Science is the pursuit of knowledge and understanding of the natural and social world following a systematic methodology based on evidence (The Science Council, 2009).

The preceding definition conflicts with some definitions since it includes knowledge from the social world and omits engineering.

> Science is the systematic enterprise of gathering knowledge about the universe and organizing and condensing that knowledge into testable laws and theories (American Physical Society Council,1999).

This ambiguous definition lacks any explicit reference to historical study (though the authors may have assumed it) and conflicts with the definition implicit from the NAS list. This definition also assumes the existence of laws, which are absent from most other definitions of "science" that we have considered.

Thus, from the examples above, we see that nonphilosophers are unable to agree about a definition of "science."

Ernst Mayr considers the question, "What is science?" historically, and notes that it cannot be reduced to a precise definition. He even states that science, during one period, was extrapolated from Christian theology (Mayr, 1997).

Richard Feynman was asked to speak about the question "What is science?" Essentially, he stated that the total experience of man (i.e., "science") cannot be reduced to a definition, that we (society) should not be blindly submissive to experts, and that attempts to reduce experience to a definition have resulted in intellectual tyranny (Feynman, 1968). Reducing this further, Feynman is arguing that the term "science" is meaningless except for rhetorical purposes.

The Role of Philosophy in Demarcation

Since many people believe that they can and do define science, even if intuitively,

the question of authority in demarcation will inevitably arise. Who is fit to judge what is "science" and what is not, except scientists—those who actually *do* science?

At least four reasons exist that cause us to question this intuition. First, demarcation is an epistemological question. Epistemological questions are within the domain of philosophy. To deny this is to deny philosophy one of its most basic functions.

Second, the definition of "science" is in question, which is an ontological question, and that is also within the domain of philosophy.

Third, if the definition of "science" is in question, then the definition of "scientist" is equally in question, and who is an authority cannot be established with certainty. The statement that scientists are fit to judge what is "science" is merely begging the question. Are sociologists, political scientists, psychologists, and economists allowed to participate in the definition of "science?" If philosophy cannot show that astrology, art, and carpentry are not science, then why not allow astrologers, artists, and carpenters to determine what is "science?" We can determine who gets to vote on the definition only if we already assume which disciplines are part of "science." Thus, the statement that "scientists" determine what is "science" is really question begging.

Fourth, "science" is composed of many specialties with many methodologies. Do any of the specialists understand enough about the broad scope of "science" to be able to define it? That is where philosophy excels.

An individual scientist is a specialist who knows a particular field. He may be compared to a jockey who rides a thoroughbred, which is a specialized breed of horse. The jockey knows a great deal about how to get the particular horse to perform. The philosopher has at least two roles: he is like an equine veterinarian who knows more generally about all horses as well as more particularly about the horse's anatomy and physiology, and he is like the race judge who can tell the jockey when he has strayed out of bounds during a race.

Epistemological Particularism

It could be asserted that this argument for the meaninglessness of the term "science" might not be valid if one rejects epistemological methodism. Epistemological methodism asks the question, *How do we know?* prior to asking the question, *What do we know?* Epistemological particularism, by contrast, reverses the order of the questions. As an epistemological particularist, Moreland (1994) notes no inconsistency between his assertion that clear cases of science can be recognized and his acceptance of the intractability of the demarcation problem, which would be a problem for the epistemological methodist. However, he has not made it clear what function the word "science" serves in his system of particularism or how that particularism should be distinguished from mere opinion

Conclusion

We are left with the conclusion that the word "science" currently is meaningless in the context of philosophy of science and that its meaning is undetermined due to contradictory opinion in other contexts, with the accompanying confusion and controversy accompanying this vagueness. One of the uses of philosophy is to help define things in order to avoid confusion and controversy; however, it is not currently able to help us by defining the term "science."

Aspects of what we have called "science" were once known as "natural philosophy" and involved a conflation of methods of investigation in certain disciplines (e.g., physics, chemistry, and biology) and knowledge specific to those disciplines. This conflation of method and knowledge resulted in ontological (what exists?) and epistemological (what do we know and how do we know it?) confusion and inevitably led to the current failure of the demarcation project and the confusion of what is meant by "science."

In order to avoid perpetuating this confusion, philosophy must de-conflate "science" and begin the ontological scheme again. There is an opportunity for creationist philosophers to get in on the ground floor of a new ontology project (as some have—e.g., Klevberg, 1999; Kofahl, 2002; Reed and Froede, 1996). The conflation implicit in our conceptions of "science" includes ideas about:

- How to investigate nature
- Testing
- Experimentation
- Theories
- A set of specific disciplines
- A body of knowledge
- Professional societies

The foundational ideas must be defined and organized into a coherent ontological and epistemological scheme. Adler (1965) provides an example of such a project.

With the demise of demarcation, the notion that "the only meaningful statements are scientific statements"—scientism—has received another proverbial "nail in the coffin." Scientism can also be recognized by the claim that "Science has the ultimate say in all questions it addresses, including historical questions." Not only has scientism been shown to be self-refuting, but the "science" edifice it has sought to build also has been shown to be evanescent, if philosophy of science is correct in saying that the term "science" is meaningless. We must be vigilant to the presence of scientism and be diligent to expose it, for it is still a threat to clear thinking.

Scientism often creeps up in unexpected places, such as assertions that science has disproved religion. The proper attitude against scientism is exemplified

by Feyerabend's (1975) applause for the "fundamentalists in California who succeeded in having a dogmatic formulation of the theory of evolution removed from the textbooks and an account of Genesis included." Feyerabend's point is that dogmatic scientism stifles freedom. He also cautions that dogmatic fundamentalism could stifle imagination and that free thought should be heeded by creationists. His ideas highlight for us the need to understand the relationship between science, freedom, and Christian doctrine and theology.

The most critical implication of this paper for creation science is that existing court cases were decided on criteria that have been shown by secular philosophers to be incorrect. Furthermore, the legal strategy of the anti-creationists has been severely undercut. They are left without a definition of "science" and any potential demarcation strategies that might exclude creation. This information must be communicated to creationist attorneys, and we must have creationist philosophers prepared to answer the faulty demarcation-based arguments previously presented in court. Otherwise we shall see more legal setbacks based on the pretense that effective demarcation criteria exist.

It would seem to follow that the science and popular science news media also must be educated that the demarcation criteria that they have assumed to exist are invalid. Biblical and scientific creation science must develop strategies to engage and persuade the media. We must appeal to academic freedom and freedom of investigation. If we are to persuade the media, we must reference sources that the media considers reliable, such as noncreationist philosophers (e.g., Bradley Monton) and evolutionary scientists such as Allen MacNeill. Perhaps we also should engage reporters like Susan Mazur, who has shown that she is sympathetic to fresh, unconventional approaches by her reporting about the Altenberg 16 conference. We must build bridges to the ID community without minimizing our creationist distinctives. Steven Meyer seems to be very approachable and might be persuaded of the appropriateness of skepticism regarding the age of the earth if creationist philosophers can develop an adequate philosophical defense of skepticism about the age of the earth.

As another consequence, creation science will no longer be able to rationally uphold a distinction between "origins science" and "operations science" if the word "science" cannot be defined by philosophy of science, since any such distinction involves philosophy of science. Instead, creationists will need to make epistemic distinctions between different methods of investigation and offer epistemic analysis of and justification for different methods of investigation.

The impact is widespread. How will educators organize their disciplines and curricula, given the problems with the word "science" as discussed above? Surely, they cannot ignore philosophy of science indefinitely. Also, many theologians have built careers by seeking to accommodate "science." If "science" is meaningless, then what is the point of accommodating it? It would seem that they must rethink their work.

Opponents in the creation/evolution debate will no longer be able to rationally use demarcation-based strategies. Rhetoric based on the reputation of "science" will no longer be rational. The opinion of a large group of "scientists" will have no rhetorical force, rationally speaking, if there is no such thing as "science" as commonly defined. Creationists have long sought to have their arguments engaged openly. The anti-creationists have sought to avoid engagement by appealing to demarcation and preventing the publication of articles by creationists in secular journals. With the demise of demarcation, the first objection is removed. Creationists will need to conclusively show systematic prejudice by secular journals against creationist papers in order to overcome the second objection and attain our goal of the open engagement of our ideas. This will likely require the assistance of some sociology of science researchers.

Until the problems with the term "science" are acknowledged by those who rely on ad hoc and vague definitions of "science," there will be conflicts with others who have different definitions of "science"; the term "science" will be a communications obstacle. As ad hoc definitions for "science" collide, people will be forced to accept the conclusion of philosophers of science that "science" has not been adequately defined. Those in academia and nongovernmental organizations who are ideologues and possess power and influence due to the illusion that "science" has useful meaning will not submit easily to the ideas that the common perception of "science" is an illusion and that their ideologies limit human freedom of expression. Many people have gained political power and professional influence due to the conflation of disciplines that are called "science" (e.g., the National Science Foundation and the National Academy of Sciences), and their ideological corruption and tyranny must be exposed in order for people to work in their disciplines and investigate freely without the suppression of the communication of their ideas by the tyranny of ideology.

Acknowledgments. I would like to thank Timothy, a forum participant in The Galilean Library, and Bryan Goodrich for their invaluable questions and discussions concerning the conflated nature of the word "science." I would like to thank Paul Newall, proprietor of The Galilean Library, for introducing me to the works of Paul Feyerabend, whose work was key in my thinking about the demarcation problem. I would also like to thank the anonymous reviewers for their invaluable questions and suggestions.

Glossary

Demarcation: Distinguishing between things in a category and things that are not, for example, between science and nonscience. Often, a list of properties that belong to things in a category are specified, as well as a list of properties that may not belong to things in a category. The category properties must only include items that belong in the category, while they must not include any items that do not belong in the category.

References

CRSQ: Creation Research Society Quarterly

Adler, M. 1965. *The Conditions of Philosophy*. Atheneum, New York, NY.

American Physical Society Council. 1999. Ethics & Values / Education, 99.6, "WHAT IS SCIENCE?" http://www.aps.org/policy/statements/99_6.cfm (as of July 11, 2009).

Bergman, J. 1983. What is science? *CRSQ* 20(1):39–42.

Bergman, J. 2009. Lysenkoism: the tragedy of government-enforced Darwinism: the effect of Darwinism on Soviet Communism. *CRSQ* 44(3):285–290.

Brooks, M. 2007. 13 things that do not make sense. http://www.newscientist.com/article/mg18524911.600-13-things-that-do-not-make-sense.html?page=5 (as of March 7, 2009).

Dickson T. 1995. *Introduction to Chemistry*. John Wiley & Sons, New York, NY.

Dott, R.H. Jr., and H.L. Batten. 1976. *Evolution of the Earth*, 2nd Edition. MacGraw-Hill, New York, NY, as cited by Railsback, 2009b.

Fales, E. 2005. Animadversions on Kitzmiller V. Dover: correct ruling, wrong reasoning. http://www.scottsdalecc.edu/ricker/pests/essays/fales.pdf (as of March 7, 2009).

Feyerabend, P. 1975. How to defend society against science. http://www.galilean-library.org/manuscript.php?postid=43842 (as of March 7, 2009).

Feynman, R. 1968. What is science? http://www.fotuva.org/feynman/what_is_science.html (as of July 11, 2009).

Gottlieb, S. 1997. What is science? Excerpted from an address at the Harbinger symposium, RELIGION & SCIENCE—the Best of Enemies, the Worst of Friends. http://www.theharbinger.org/articles/rel_sci/gottlieb.html (as of July 19, 2009).

Klevberg P. 1999. The philosophy of sequence stratigraphy, part I—philosophic background. *CRSQ* 36(2):72–80.

Kofahl, R. 2002. The crucial importance of epistemology and correctly defining science for the cause of creation and intelligent design. *CRSQ* 38(4):193–198.

Koperski, J. 2008. Two bad ways to attack intelligent design and two good ones. *Zygon* 43(2):433–449. http://www6.svsu.edu/~koperski/Two%20Bad%20Ways%20to%20Attack%20Intelligent%20Design%20and%20Two%20Good%20Ones.pdf (as of March 7, 2009).

Laudan, L. 1982. Science at the bar: causes for concern. *Science, Technology, and Human Values* 7(41):16–19, reprinted in Ruse, M. (editor). 1996. *But Is It Science?* pp. 351–355. Prometheus Books, Buffalo, NY.

Laudan, L. 1983. The demise of the demarcation problem. In Cohen, R.S. and L. Laudan (editors), *Physics, Philosophy, and Psychoanalysis*, Reidel, Dordrecht, Holland. Reprinted in Ruse, M., and R. Pennock (editors). 2009. *But Is It Science?* pp. 312–330. Prometheus Books, New York, NY.

Mayr, E. 1997. *This Is Biology*. The Belknap Press of Harvard University Press, Cambridge, MA.

Meyer, S. 1994. The use and abuse of philosophy of science: a response to Moreland. *Perspectives on Science & Christian Faith* 46:19–21. http://www.asa3.org/ASA/PSCF/1994/PSCF3-94Meyer.html (as of March 7, 2009).

Monton, B. 2006. Is intelligent design science? Dissecting the Dover decision. http://philsci-archive.pitt.edu/archive/00002583/01/Methodological_Naturalism_2.pdf (as of March 7, 2009).

Moreland, J. 1994. Scientific creationism, science, and conceptual problems. *Perspectives on Science & Christian Faith* 46:2–13. http://afterall.net/papers/490578 (as of March 7, 2009).

Morris, C. (editor). 1996. *Academic Press Dictionary of Science Technology*. CD-Rom v. 1.0, Academic Press Inc., New York, NY, as cited in Railsback, 2009b.

Pickett J. (editor). 2005. *The American Heritage Science Dictionary*. Houghton-Mifflin Company, Boston, MA.

Plantinga, A. 2006. Whether ID is science isn't semantics. *Science and Theology News*. http://www.discovery.org/scripts/viewDB/index.php?command=view&id=3331 (as of March 7, 2009).

Quinn, P. 1984. The philosopher of science as expert witness. In Cushing, J., C. Delaney, and G. Gutting (editors), *Science and Reality: Recent Work in the Philosophy of Science*, University of Notre Dame Press, South Bend, IN. Reprinted in Ruse, M. (editor). 1996. *But Is It Science?* pp. 367–385. Prometheus Books, Buffalo, NY.

Railsback, B. 2009a. What is science? http://www.gly.uga.edu/railsback/1122science2.html (as of July 11, 2009).

Railsback, B. 2009b. Some definitions of science. http://www.gly.uga.edu/railsback/1122sciencedefns.html (as of July 11, 2009).

Reed, J.K., and C.R. Froede, Jr. 1996. A Biblical Christian framework for earth history research: introduction to the series. *CRSQ* 32(4):228–229.

Reed, J.K., P. Klevberg, C.B. Bennett, A.J. Akridge, C.R. Froede, Jr., and T.L. Lott. 2004. Beyond scientific creationism. *CRSQ* 41:216–230.

Ruse, M. 1982. Pro Judice. *Science, Technology & Human Values* 7(4):19–23. Reprinted in Ruse, M. (editor). 1996. *But Is It Science?* pp. 356–362. Prometheus Books, Buffalo, NY.

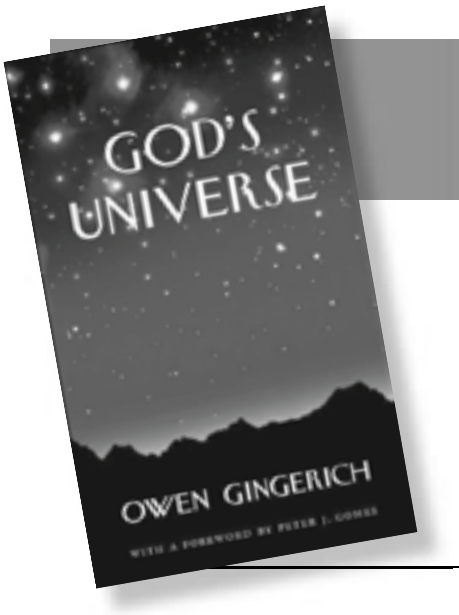
Sokal, A. 2008. What is science and why

should we care? http://www.senseaboutscience.org.uk/PDF/AlanSokalLecture2008.pdf (as of August 8, 2009)

The Science Council [of the United Kingdom] 2009. What is science? http://www.sciencecouncil.org/DefiningScience.php

Thompson G., and J. Turk. 1998. *Introduction to Physical Geology*. Saunders College Publishing, Fort Worth,TX.

Trefil, J., and R. Hazen. 2004. *Physics Matters*. John Wiley & Sons, New York, NY.



Book Review

God's Universe

by Owen Gingerich

Harvard University Press, Cambridge, MA, 2006, 139 pages, $17.00.

Some outspoken testimonies of faith are tolerated in the secular science world. Examples include Francis Collins, John Polkinghorne, and Owen Gingerich. All three promote a theistic evolution worldview. Author Owen Gingerich is a science historian, now retired from a productive career at Harvard University. This book summarizes a series of lectures relating science and faith.

Gingerich is not impressed with the intelligent design (ID) movement, although he is gracious in his critique. He faults ID for not offering a fully comprehensive explanation of nature: ID "does not explain the temporal or geographical distribution of species" (p. 73). He appears to be asking for far more than the ID movement promises. Gingerich accepts intelligent design with "lower case *i* and lower case *d*" but rejects the overall movement (p. 68).

A major topic in the lectures concerns alien life. Gingerich believes that average galaxies are populated by scores of earth-like planets (p. 14). Life probably exists "out there," and if so, God had a hand in it. Regarding fossil extinctions, a process theology or open theology viewpoint is expressed. This is the defective view that God is not omniscient. That is, things are set up in such a way that God does not know the future or how things will turn out. Thus, "fossils of extinct creatures show…a universe that makes itself…the powerful transcendence that brought the universe into being…has self-imposed limitations" (p. 116).

The book includes a sarcastic rewriting of Genesis 1 by astronomer George Gamow (p. 53), and Gingerich rightly challenges such an approach to Scripture. Owen Gingerich does not fit the Creation Research Society young-earth position. However, he has spent several decades on the front lines of Christianity and carries his own share of scars.

Don B. DeYoung
DBDeYoung@Grace.edu