

## **Is it True that ‘Evolution is a Theory, Not a Fact’?**

**1. Introduction.** In recent years the teaching of evolutionary theory in U.S. public school science classes has been called into question by school boards in various parts of the country. Salient results have included public bickering, high-profile court cases, and school board mandated evolution disclaimers, including some pasted on science textbooks.<sup>1</sup> A 2005 court case that garnered a lot of attention occurred in Cobb County, Georgia, where the dispute concerned the legal status of a disclaimer placed, by the local school board, on high school biology textbooks. The disclaimer reads as follows:

This textbook contains material on evolution. Evolution is a theory, not a fact, regarding the origin of living things. This material should be approached with an open mind, studied carefully, and critically considered.<sup>2</sup>

The Cobb County disclaimer is typical of a number of “evolution is a theory, not a fact” type disclaimers, which have appeared in various forms in several states. For instance, in November 2004 the Dover Area School District in Pennsylvania issued a press release indicating that science teachers would be required at the beginning of the evolution unit to say to students the following:

Because Darwin’s Theory is a theory, it is still being tested as new evidence is discovered. The Theory is not a fact. Gaps in the Theory exist for which there is no evidence. A theory is defined as a well-tested explanation that unifies a broad range of observations. Intelligent Design is an explanation of the origin of life that differs from Darwin’s view. The reference book, *Of Pandas and People*, is available for students to see if they would like to explore this view in an effort to gain an understanding of what Intelligent Design actually involves. As is true with any theory, students are encouraged to keep an open mind.<sup>3</sup>

Such disclaimers hearken back at least to 1995, when an evolution disclaimer was pasted on Alabama’s state-approved biology texts. That disclaimer said:

This textbook discusses evolution, a controversial theory some scientists present as a scientific explanation for the origin of living things, such as plants, animals and humans. No one was present when life first appeared on earth. Therefore, any statement about life’s origins should be considered as theory, not fact.<sup>4</sup>

In 1999, the Alabama disclaimer was also voted unanimously by the Oklahoma Textbook Committee to be pasted on all Oklahoma public high school biology textbooks; and, from the mid-1990s to 2005, the Beebe School District in Beebe, Arkansas had pasted on all high school biology textbooks disclaimers

that called evolution “a controversial theory” that many people believe is not adequate to explain origins of life.<sup>5</sup>

As far as I know, there are no official “evolution is a theory, not a fact” disclaimers currently being used on biology textbooks. This is mostly due to two recent high profile court cases (*Selman et al. v Cobb County School District* and *Kitzmiller et al. v Dover Area School District*) in which the disclaimers were ruled illegal due to their violating the First Amendment of the United States Constitution.<sup>6</sup> It is somewhat ironic that some of this legal and legislative maneuvering was prompted, at least indirectly, by President George W. Bush’s No Child Left Behind Act, which mandates that states test students according to various state-adopted standards. Since many states have adopted the 1996 National Science Education Standards—which include the teaching of evolutionary theory—many school districts will teach evolution (some for the first time) in order to meet curriculum standards by the end of 2007.<sup>7</sup> Facing the prospect that evolution will soon be taught in many more public school biology classes than ever before, many opponents of evolutionary theory have sought, and continue to seek, to effect public school policies that discredit the theory in two major ways: (1) by claiming that evolution is a theory but not a fact, and (2) by claiming that evolutionary theory is controversial in science.

Although many people have commented on the legal justification for such policies, my interest here solely concerns whether there is any justification, of the sort that pertains to science, for such policies. Although I cannot respond effectively to every school science policy under consideration, I will respond to both claims I mentioned above by focusing on the Cobb County disclaimer, which succinctly expresses a view I wish to criticize.

My initial reaction to the “evolution is a theory, not a fact” disclaimer was puzzlement about what it says. In this paper I do conceptual analysis on the disclaimer’s key claim in order to discover whether there is any interpretation of it that can reasonably be considered to be scientific advice helpful enough to high school biology students to warrant putting a disclaimer on their biology textbooks.<sup>8</sup> I will argue that the answer is “no”. I will steer clear, for the most part, from considering substantive background assumptions of school board members and political pressures from their constituents. The only crucial

global assumptions that I will make are that the disclaimer's *key claim*, "Evolution is a theory, not a fact", (1) is either true or false, and (2) is to be taken to be the supporting evidence for the advice to students to consider evolution carefully and critically before accepting it as correct.<sup>9</sup>

I take it that there are at least three conditions satisfactions of which are required for a successful interpretation of the key claim. They are what I will refer to as the *no-triviality condition* (i.e., the key claim is not trivially true), the *no-clear-falsehood condition* (i.e., the key claim is not clearly false, given basic knowledge about the nature of science), and the *reasonable-support condition* (i.e., the key claim provides a non-legal rationale, of the sort that pertains to science, that justifies the advice it advocates).<sup>10</sup> Before considering interpretations of the key claim, it may be helpful for me to say a word about the relations among these three conditions.

I assume that any interpretation of the key claim that violates either the no-triviality condition or the no-clear-falsehood condition thereby violates the reasonable-support condition. Hence, I see satisfactions of the no-triviality condition and the no-clear-falsehood condition to be necessary for satisfying the reasonable-support condition. However, satisfying the former conditions is not sufficient for satisfying the latter. An interpretation could satisfy the former but remain not even marginally reasonable as a rationale for placing a disclaimer on a textbook that puts students on their guard about a particular viewpoint at the heart of an entire scientific field of study. The general point I am making here may be appreciated by considering this example: The proposition *human beings exist on planets other than Earth* is neither trivially true nor clearly false, but it would surely not be reasonable, given the evidence we actually do have, to place a disclaimer on a public school textbook that is based on that proposition.

Searching for successful interpretations of the key claim will straightforwardly require considering the use of the words "evolution", "theory", and "fact".

**2. Interpreting "evolution".** Since the disclaimer appears on a biology textbook, surely the term "evolution" is intended to refer to the central concept of evolutionary biology. A good place to start is the definition of "evolution" given in the biology textbook that was the target of the Cobb County court case. According to the textbook, "evolution" is "the process by which modern organisms have descended from

ancient organisms”.<sup>11</sup> Nevertheless, it is worth noting that, in the culture at large, there are a number of different ways that “evolution” is defined or described. Alvin Plantinga has identified five theses that express views people sometimes associate with evolution:<sup>12</sup>

**Ancient Earth Thesis:** The earth is very old (around 4.5 billion years old).

**Progress Thesis:** Life has progressed from relatively simple to relatively complex forms of life (from unicellular life forms to human beings).

**Common Ancestry Thesis:** Life originated at only one place on earth, and all subsequent living things are related by descent to those original living things.

**Darwinism:** Life developed on earth by means of natural mechanisms (commonly expressed by “natural selection operating on random genetic mutation”).<sup>13</sup>

**Naturalistic Origins Thesis:** Life itself originated from non-living matter.

Although many scientists believe all these theses, and although each of them has sometimes been associated with evolution, as Plantinga points out, only the Common Ancestry Thesis and Darwinism are essential to the theory of evolution. Hence, when used in the key claim, some descriptions of “evolution” are bound to fail the reasonable-support condition, because they misrepresent the central concept of evolutionary biology. For instance, it is common for recent evolution disclaimers to say—as all the disclaimers displayed above do say or imply—that evolution is a theory about the origin of living things. Taken at face value, such a disclaimer says that evolution is a theory about how life *originated*; that is, evolution is a theory about how life, any life, began. Let us take this as some evidence for thinking that “evolution” in the disclaimer means the conjunction of the Common Ancestry Thesis, Darwinism, and the Naturalistic Origins Thesis.

Now, although it is true that many scientists are themselves thoroughgoing naturalists—and thus believe the Naturalistic Origins Thesis—it is just not true that what is called “evolution”, as used in biology, purports to tell us how life originated; rather, it purports to explain how life developed. Indeed, the very textbook on which the disclaimer was placed in Cobb County says, “the leap from nonlife to life is the greatest gap in scientific theories of Earth’s early history”.<sup>14</sup> It is remarkable that the biology textbook in question does not say that evolution explains how life originated. Hence, if we take the

disclaimer's use of "evolution" to include "a theory about how life originated", then the result will be a disclaimer that is so misleading that it is surely not going to pass even a weak criterion of reasonable support (since it implies that one of the textbook's claims says something that it does not actually say).<sup>15</sup>

Whether or not those who have supported using the key claim in a disclaimer on biology textbooks have been confused about "evolution" as it is used in biology, it is worth thinking about whether a more accurate description of "evolution" may serve to provide a key claim that meets our three criteria. Toward this end, let us take "evolution" to mean the conjunction of **Darwinism** and the **Common Ancestry Thesis**. A handy way to express the conjunction of these two theses is to use Charles Darwin's phrase, "descent with modification". Accordingly, evolution implies that human beings share their ancestry with other animals. This understanding of "evolution" has three salient merits: it accurately and helpfully identifies what is commonly thought to be the central concept of evolutionary biology, it is consistent with the biology textbook's summary of Darwin's theory, and it is charitable to the disclaimer supporters in that it has a consequence that many of the proponents of the key claim either deny or doubt: namely, that human beings have descended with modifications from non-human species that lived in the past.<sup>16</sup> So, let us now consider the question: Is it true that descent with modification is a theory, not a fact? The answer, of course, depends on what a theory and a fact amount to.

**3. Interpreting "theory".** The word "theory" is used in various ways. I assume that we are looking for a scientific use. Scientists use "theory" in several ways, and things referred to as theories in science take a number of forms. The literature in the philosophy of science is rife with discussions of the variations. We might consider all of them, but I see no need to do so, because there is no reason at all to think that the drafters of the disclaimer intended their warning to students to depend on some narrowly prescribed, highly technical, or highly specialized notion of theory. Surely they intended "theory" to be understood, along the lines of 'that which is, or may be used to provide, a general causal explanation of some widespread domain of physical phenomena'. Indeed, the biology textbook in question defines theory as "a well-supported testable explanation of phenomena that have occurred in the natural world".<sup>17</sup>

Although scientists often use the word “theory” off the record with respect to any old explanation (or, to indicate something more general that may be used to provide some explanation), when scientists are careful, such as when they publish articles in peer-reviewed journals, they usually differentiate what they call *theories* from what they call *hypotheses*. As we were taught in grade-school, a hypothesis is something like a scientist’s educated guess or hunch comprising an explanation of some phenomenon or phenomena, an explanation that has yet to be subjected to the various scientific methods involved in empirical observation, testing, measurement, prediction, and the like. Accordingly, a “theory”, when it is distinguished from a hypothesis, amounts to an explanation of phenomena that has been confirmed by some scientific method(s).

Of course, matters are not so clear-cut in the actual practice of science. For instance, many things that are called “theories”, such as string theory, have not been confirmed by the sorts of observations and tests that are characteristic of science, but they appear plausible to many scientists. And, what is sometimes called a “hypothesis” in science is much more like a prediction concerning some single phenomenon that a scientist hopes will be confirmed by some particular test or observation.<sup>18</sup> We can make use of some of these uses to draft interpretations of “theory” that are very likely to be in the neighborhood of what the disclaimer writers had in mind.

**T is a theory<sub>1</sub>** =df. “T is a general scientific explanation (or T may be used to yield a general scientific explanation) of a widespread domain of physical phenomena that has been confirmed by some widely approved scientific method(s) to be well-supported by the available empirical evidence”.

**T is a theory<sub>2</sub>** =df. “T is a general scientific explanation (or T may be used to yield a general scientific explanation) of a widespread domain of physical phenomena that has not been confirmed by some widely approved scientific method(s) to be well-supported by the available empirical evidence, but which some experts in the relevant scientific field believe will be confirmed by some widely approved scientific method(s) to be well-supported by the available empirical evidence”.

**T is a theory<sub>3</sub>** =df. “T is merely a scientist’s hunch or educated guess that some explanation of physical phenomena will be well-supported by some widely approved scientific method(s).

Here it may be worthwhile to point out the kind of thing that has been said by everyone I have talked to about the meaning of the disclaimer. According to this popular view, as well as by some of the experts involved in the Cobb County trial, the disclaimer was intended to say something along this line:

‘Evolution is an explanation of phenomena that amounts to little more than a hunch or educated guess of

scientists, and, therefore, we should not regard evolution as well-supported by the actual scientific evidence.<sup>19</sup> If this is correct, then the first part of the key claim says this: “Descent with modification is a theory<sub>3</sub>”. The problem with this interpretation is that what it says is clearly false. Indeed, scientific experts have employed numerous scientific tests, measurements, and predictive tools that confirm the explanation involved in the theory of evolution. Even Alvin Plantinga, who is quite skeptical of evolutionary theory, claims that descent with modification is the most probable of all the properly scientific hypotheses, given the evidence and methodological naturalism, which characterizes contemporary science.<sup>20</sup> Thus, it is not true that evolution is a mere educated guess or hunch based on general background information (scientific or otherwise). This is so even if scientists have made some serious mistakes and even if they are wrong about evolution.

The key claim is also clearly false if it uses theory<sub>2</sub>, since evolution has been confirmed by some widely approved scientific methods. Although there are apparently many non-scientists who deny this, it is nevertheless clearly true that there are widely approved scientific methods the use of which provides considerable confirmation for descent with modification. To object to this claim is to reveal ignorance about the nature of scientific confirmation. So, if we are to have any chance of producing an interpretation of the key claim that satisfies our three criteria, then, among the alternatives, we must go with theory<sub>1</sub> as the relevant interpretation of “theory”.

**4. Interpreting “fact”.** The word “fact” is used in various ways. By philosophers, “fact” is often used to mean a *true proposition* or a *state of affairs that obtains*, or the like. Used in this way, “fact” is intended to assert that some feature of the world is a particular way. This meaning of “fact” does not imply anything about epistemic factors; for instance, it does not imply that there is public evidence, logical support, observational confirmation, proof, or anything of the sort, in relation to the claim asserted. Some examples of this use of “fact” include these: “There is a fact about whether God exists”, “There are moral facts”, and “Regardless of which side of the debate one favors, there is a fact about the matter”, etc.<sup>21</sup>

Although there is no single way that “fact” gets used by scientists, a common use of “fact” by scientists means “an experimental observation”. Examples might include “It is a fact that the blue litmus paper turned red when I applied vinegar to it”, and “It is a fact that the most powerful existing telescope revealed no satellite of the moon”. Accordingly, a fact is something along the lines of a single observation.<sup>22</sup>

These uses of “fact” are exemplary in that they imply that the person who asserts that something X is a fact believes that X is *true*. I think that this point generalizes: anytime one asserts that “X is a fact” one expresses one’s belief that the thing asserted is true. Note how odd it would be to hear someone say, “It is a fact that water is H<sub>2</sub>O, but I do not believe that water is H<sub>2</sub>O”, or “It is a fact that I locked the door, but I don’t know whether to believe it or not”. If someone were to say such things, we would wonder whether that person has any idea what a fact is.<sup>23</sup>

However, it does not follow that saying “X is *not* a fact” indicates that one believes that X is false. Although believing that X is true is necessary for thinking that X is a fact, there are uses of “fact” in which it is clear enough that believing that X is true is *not sufficient* for thinking that X is a fact. We can see this clearly enough when we consider uses of “fact” that imply some epistemological status.

At one end of the epistemic spectrum, I suppose one could mean by “fact” something like “conceptual truth”: for example, “It is a fact (or, it is a conceptual fact) that  $2 + 3 = 5$ .” One might use “fact” in such a sentence to indicate that  $2 + 3 = 5$  is *conceptually true* such that anyone who thinks rightly about the concepts involved in the claim can come to know with epistemic certainty that it is true. It would be possible for someone to think that a claim is true but not think that the claim is conceptually true; hence, such a person who uses “fact” to mean “conceptual truth” could consistently believe that a claim is true but not a fact.<sup>24</sup>

More ordinary epistemological uses of “fact” concern empirical claims, such as “It is a fact that the sun is larger than the earth”. I will mention various uses of “fact” that seem to pick out the kinds of things that some actual person might mean by the term. These examples start with a highly restrictive use and become less restrictive. For ease of presentation, I will use *p* to refer to the assertion: *The sun is*

*larger than the earth.* In addition to the uses I have previously mentioned, someone might mean by “It is a fact that *p*” that *p* is true and the actual publicly available evidence *proves* that *p* (i.e., proves in the sense that no new evidence could show that *p* is false). Or, that all the *publicly available evidence strongly supports p* (i.e., that the publicly available evidence makes the claim *beyond a reasonable doubt*), or that *p* is true and that one’s internal evidence supports *p*. Or, one might mean that *p* is true and *all* astronomers (or, scientists) believe on the basis of their expertise that *p*; or, that all educated people (or, people in general) believe that *p*. Or one might mean that the *vast majority* of astronomers (or, scientists, or educated people, or people generally) believe that *p*. Or, one might mean that *p* is true and a *majority* of astronomers (or, scientists, or educated people, or people generally) believe that *p*. Or, one might mean that *p* is true and a *substantial minority* of astronomers (or, scientists, or educated people, or people generally), whose view about the size of the earth and sun one agrees with, believes that *p*. Or, one might mean that *p* is true and a *few* astronomers (or, scientists, or educated people, or people generally), whose view about the size of the earth and sun one agrees with, believe that *p*. Or, one might mean that *p* is true and *some* astronomer (or, scientist, or educated person, or person generally), whose view about the size of the sun and earth one agrees with, believes that *p*. I doubt that there is any epistemological use of “fact” in such a sentence that differs substantially from the ones I have mentioned.<sup>25</sup>

I doubt that “fact” actually gets used in all the ways I have mentioned, and some of those ways are so weak or so wacky that it would be very uncharitable to the disclaimer writers to suggest that they had any of them in mind. For clarity’s sake in what follows, I will list a range of interpretations of “fact” that I take to be in the relevant neighborhood.

**fact<sub>1</sub>:** X is true (or, X indicates a particular state of affairs that obtains in the world).

**fact<sub>2</sub>:** X is true, and X is conceptually true.

**fact<sub>3</sub>:** X is true, and some scientist has observed that X (i.e., it has seemed to some scientist on the basis of some empirical observation that X is true)

**fact<sub>4</sub>:** X is true, and the publicly available evidence supporting X proves that X is true in the sense that no new evidence could show that X is false.

**fact<sub>5</sub>:** X is true, and the publicly available evidence strongly supports X's being true.

**fact<sub>6</sub>:** X is true, and my total internal evidence strongly supports X's being true.

**fact<sub>7</sub>:** X is true, and all the experts in the relevant specific field of inquiry believe on the basis of their expertise that X is true

**fact<sub>8</sub>:** X is true, and all educated people believe that X is true.

**fact<sub>9</sub>:** X is true and all people believe that X is true.

**fact<sub>10</sub>:** X is true, and the vast majority of experts in the relevant general field of study believe on the basis of their expertise that X is true.

**fact<sub>11</sub>:** X is true, and the vast majority of educated people believe that X is true.

**fact<sub>12</sub>:** X is true, and the vast majority of people believe that X is true.

**fact<sub>13</sub>:** X is true, and the majority of experts in the relevant general field of study believe on the basis of their expertise that X is true.

**fact<sub>14</sub>:** X is true, and the majority of educated people believe that X is true.

**fact<sub>15</sub>:** X is true, and it is common sense that X is true (i.e., the majority of people believe that X is true).

**fact<sub>16</sub>:** X is true, and a substantial minority number of experts in the relevant general field of inquiry whose view on the matter I agree with believe on the basis of their expertise that X is true.

**fact<sub>17</sub>:** X is true, and a substantial minority number of educated people whose view on the matter I agree with believe that X is true.

**5. Evaluations of the Key Claim.** Let us pause to consider what we have achieved thus far forth. The key claim, which I will refer to as the *penultimate claim*, means this:

**Penultimate Claim:** Descent with modification (expressed by the conjunction of Darwinism and the Common Ancestry Thesis) is a general scientific explanation (or may be used to yield a general scientific explanation) of a widespread domain of physical phenomena that has been confirmed by some widely approved scientific method(s) to be well-supported by the available empirical evidence, and descent with modification is not a fact.

We now need to consider the various uses of “fact” in order to figure out whether there is any interpretation of the penultimate claim that satisfies our three conditions.

Filling in the penultimate claim with fact<sub>2</sub>, fact<sub>3</sub>, fact<sub>4</sub>, or fact<sub>7</sub> runs afoul of the *no-triviality* condition. Descent with modification is surely not a conceptual truth, but neither is any scientific theory; so, the penultimate claim with fact<sub>2</sub> fails the no-triviality test. Also, descent with modification is not itself an empirical observation but is rather an explanation of empirical observations; and, this is true of any

scientific theory; so, fact<sub>3</sub> is no good. Furthermore, descent with modification would not be a scientific explanation at all if it were not open to revision based on new evidence. But, it is surely a scientific explanation. So, the penultimate claim understood along the lines of fact<sub>4</sub> is trivially true in the sense that it is true of *all* scientific explanations. I can think of no even marginally reasonable scientific rationale for instructing students to be especially careful about accepting one particular scientific theory when that rationale applies equally well to all scientific theories. Hence, a successful key claim is not to be understood along the lines of fact<sub>2</sub>, fact<sub>3</sub>, or fact<sub>4</sub>.

An interpretation using fact<sub>7</sub> has to do with experts (biologists or other scientists) who do not believe that descent with modification is true. This interpretation is true, since there are some biologists or other scientists who deny descent with modification. However, the number is very small and the percentage of biologists and scientists who deny descent with modification is extremely low. According to a 1996 survey, only 5% of American scientists deny descent with modification as the correct explanation for the development of human beings, whereas 95% agree that descent with modification is the correct explanation.<sup>26</sup> That a few American scientists deny descent with modification hardly warrants a disclaimer; for, if it did, then almost every scientific theory would warrant a disclaimer, since almost every scientific theory has a few detractors among scientists. But surely even the drafters of the Cobb County disclaimer do not think that nearly all scientific theories warrant a disclaimer. It seems clear that, even though this use of “fact” in the penultimate claim is not trivial in the sense that it applies to *all* scientific theories, it is nevertheless trivial because it applies to *almost all* scientific theories; but, no reasonable person, I take it, thinks that we are justified in putting disclaimers on science textbooks for almost every scientific theory, just because he or she is aware that some scientists dissent from the prevailing view.

Other interpretations clearly fail to satisfy the *no-clear-falsehood* condition. This is so of those using fact<sub>10</sub>, fact<sub>13</sub>, or fact<sub>16</sub>. As I have mentioned, the vast majority of specialists in the relevant general field of study (biology), as well as the vast majority of scientists generally (95%), believes that descent with modification is a true explanation for the development of human beings (a claim about which many

disclaimer supporters are surely sensitive). Hence, the penultimate claim used with fact<sub>10</sub> is clearly false; and, if the vast majority of biologists and scientists believe this, then so does the majority of biologists and scientists; hence, the penultimate claim used with fact<sub>13</sub> is clearly false. Furthermore, there is no substantial minority percentage of biologists or scientists who believe that descent with modification is false; so, the penultimate claim used with fact<sub>16</sub> is clearly false. To be sure, there is a fairly high percentage of scientists who believe that God exists and that God is the creator of life.<sup>27</sup> But, those views are consistent with descent with modification. Descent with modification, by itself, implies nothing at all either about God's existence or about the origin of life. Perhaps this point has not been appreciated by many parties in the disclaimer disputes.

Other interpretations clearly run afoul of the *reasonable-support* condition. This is so of the penultimate claim used with fact<sub>1</sub>, fact<sub>5</sub>, fact<sub>6</sub>, fact<sub>8</sub>, fact<sub>9</sub>, fact<sub>11</sub>, fact<sub>12</sub>, fact<sub>14</sub>, fact<sub>15</sub>, or fact<sub>17</sub>. Fact<sub>1</sub> used in the penultimate claim says that *descent with modification is false*. However, even if the drafters of the disclaimer believe that descent with modification is false, surely they did not intend for the disclaimer to tell schoolchildren that descent with modification is false. This would be an uncharitable interpretation. To see why, consider that the key claim of the disclaimer is followed by this: "This material should be approached with an open mind, studied carefully, and critically considered". Such an injunction indicates that something along the line of *suspending judgment* on the issue is called for, rather than disbelief.<sup>28</sup>

Fact<sub>8</sub>, fact<sub>9</sub>, fact<sub>11</sub>, fact<sub>12</sub>, fact<sub>14</sub>, fact<sub>15</sub>, and fact<sub>17</sub> also fail the reasonable-support criterion. These uses of "fact" have in common the feature that some group, comprised mostly by non-scientists, believes that descent with modification is false. But, why would the views of people with little or no training in science warrant placing a disclaimer about a scientific theory on a science book? Generally, it is unreasonable to believe the claims of non-experts about a matter when those claims are inconsistent with the claims of the vast majority of experts about that matter. If I want to know something about what it takes to build a car, it would be reasonable for me to rely on the advice of a professional car builder, but it would surely be unreasonable for me to rely on the advice of a non-car builder when I am aware that the non-car builder's advice is inconsistent with the professional's advice. But, since non-scientists do not do

science, they are in no position to have special scientific information about the development of species. They may, and often do, claim to have special information about the matter, but it is not the result of science. And, the issue here is the reasonability of putting a disclaimer on a biology textbook that tells students to be especially on their guard about a particular scientific explanation, which is doubted by some group of non-scientists. Even if it were true that a *very* great majority of non-scientists believed that descent with modification is false, this would be irrelevant: although I have not done a survey, I would bet that a very large percentage of non-scientists do not believe that there is indeterminacy at the sub-atomic level. Suppose that we discovered that a large percentage of them *disbelieved* that there is such indeterminacy: would we thereby be justified in putting a disclaimer on physics textbooks?<sup>29</sup>

Fact<sub>5</sub> and Fact<sub>6</sub> are the most interesting. Used in the penultimate claim, fact<sub>5</sub> says that *it is not the case that the publicly available evidence strongly supports descent with modification's being true*. However, that almost all the biologists and scientists believe that the publicly available evidence strongly supports descent with modification provides considerable reason to think that the penultimate claim using fact<sub>5</sub> is false.<sup>30</sup> Of course, it is *possible* that the biologists and scientists are wrong about the matter. But, the important issue here concerns which scientific theory is probable given the publicly available empirical evidence. As I pointed out earlier, there is no question that there are widely accepted scientific methods that confirm descent modification. No honest person with a basic understanding of the nature of science would dispute this.<sup>31</sup>

One might wonder whether there is some *rival* theory that is confirmed by widely accepted scientific methods. No. There is no rival theory that enjoys even a smidgen of the confirmation by widely approved scientific methods that descent with modification enjoys. Someone might consider the notion of *intelligent design* in this context. Note, however, that extant intelligent design views in *science* are so sketchy and incomplete that they are not so much as testable. To be sure, there are many *philosophical* arguments for intelligent design, and there have been some books and articles published by scientists that have argued for claims that are friendly to an intelligent design position.<sup>32</sup> But, no scientist has told us much of anything about the intelligence, power, goals, or intentions of any intelligent designer necessary

to evaluate an intelligent design hypothesis in light of standard scientific criteria, such as empiricity, observability, falsifiability, testability, controllability, predictability, fruitfulness, and the like. Now, to be sure, there are plenty of people who are happy to place *God* in the role of intelligent designer, but it is remarkable that there is no scientific theory currently being discussed in the science journals that names God as the intelligent designer. My point is that intelligent design explanations in *science* are so sketchy that we just do not have a scientific theory mentioning an intelligent designer that is so much as testable by scientific methods.<sup>33</sup> If we ever get one, we can consider whether the publicly available evidence favors one view over the other, given the employment of widely accepted scientific methods.<sup>34</sup> But, the point to see here is one made by Branden Fitelson and Elliot Sober: whether or not we are justified in thinking that a scientific theory is well supported by the publicly available evidence is, at least in part, a matter of comparison: since there is very little scientific confirmation of any rival to descent with modification, and since descent with modification has been confirmed by widely accepted scientific methods, we have reason to believe that descent with modification is well supported by the publicly available evidence.<sup>35</sup> A recent statement by The Royal Society (the UK national academy of science) acknowledged, in an April 2006 statement, that evolutionary theory is the best explanation for the development of life on Earth:

One of the most important advances in our knowledge has been the development of the theory of evolution by natural selection. Since being proposed by Charles Darwin nearly 150 years ago, the theory of evolution has been supported by a mounting body of scientific evidence. Today it is recognised as the best explanation for the development of life on Earth from its beginnings and for the diversity of species. Evolution is rightly taught as an essential part of biology and science courses in schools, colleges and universities across the world.  
 ... The theory of evolution is supported by the weight of scientific evidence ....<sup>36</sup>

Could it be that the framers of the disclaimer have publicly available evidence that scientists do not have? Have the vast majority of biologists and scientists misidentified the data, or misapplied the data, or failed to recognize what the evidence actually supports, or failed to discern the best explanation of the evidence? If so, then there is a great deal of motivation for some enterprising scientist to argue for such claims in the science journals. But, I take it, the framers of the disclaimers are in no position to argue for

such claims. Hence, the penultimate claim used with fact<sub>5</sub> seems to be false, and, in any case, it runs afoul of the reasonable-support criterion.

Nevertheless, I think that there is an important issue to be discussed with respect to fact<sub>5</sub>. That issue is *methodological naturalism*. According to methodological naturalism, no theory or hypothesis utilizing anything supernatural can count as *scientific*. Apparently, this view is thought by virtually all scientists (and some philosophers of science) to be *essential* to science.<sup>37</sup> However, it is no secret that a large percentage of Americans, as well as a large percentage of the disclaimer supporters, take descent with modification to be inconsistent with some of their religious beliefs, according to which God (a supernatural being) has played a causal role in the origin and development of life. Some such beliefs (but surely not all of them) are almost surely false if descent with modification is true.<sup>38</sup> Nevertheless, if methodological naturalism is essential to science, then descent with modification is without question the most probable theory among any scientific alternatives. Moreover, if methodological naturalism is true, then descent with modification is *extremely probable* on the evidence. Perhaps some rival theory that also enjoys a great deal of scientific confirmation *will* arise in the future, but there is no such rival at present.<sup>39</sup> This explains why most scientists think that disclaimers, political battles, and court cases over the teaching of evolution in public schools are either idiotic or the result of ignorance about the nature of science; for, if methodological naturalism is true, then the matter seems about as settled as scientific theories can be.<sup>40</sup>

Fact<sub>6</sub> used in the penultimate claim also fails to satisfy the reasonable-support test, but for a different reason. It says that *it is not the case that my total internal evidence strongly supports descent with modification's being true*. I think that we should grant that it is possible for someone's total internal evidence to support thinking that descent with modification is false. For all I know, for instance, there is someone who has legitimate evidence (whether or not it would be widely considered to be legitimate), perhaps some form of special religious evidence, which supports thinking that descent with modification is false, even if that person knows that scientists overwhelmingly endorse descent with modification. This would require, I think, some very special evidential circumstance, but it seems to me possible.

Suppose that some framer of the disclaimer managed to get such evidence. Would it thereby be reasonable for that person to put a disclaimer about evolution on the biology textbooks of every student in a public school district? Surely not. It would be reasonable only if that person had good *scientific reasons* to deny descent with modification. But, again, the framers of the disclaimer are not scientists, and they possess no good scientific evidence that descent with modification is false. I conclude that even if the penultimate claim used with fact<sub>6</sub> is true, given some school board member's internal evidence, that claim does not make putting the disclaimers on the textbooks a scientifically justified thing to do.

**6. Conclusion.** Having assessed all the interpretations of the key claim I consider to be in the neighborhood of our target, I conclude that there is no meaning of the key claim that provides even a marginally reasonable ground, of the sort that pertains to science, for a disclaimer of the “evolution is a theory, not a fact” sort to be placed on school textbooks or used in school policies. Is the key claim true? If I am correct, then this is what we should think: On some interpretations, the key claim is true but trivial; hence, those interpretations do not make it reasonable to place a disclaimer on a science textbook. On other interpretations, the key claim is clearly false, given basic knowledge of science and very little thought; hence those interpretations do not make it scientifically reasonable to place a disclaimer on a science textbook. On all the other interpretations, the key claim is true but not even marginally justifiable as a rationale, of the kind pertaining to science, for placing a disclaimer on biology textbooks. Therefore, there is no interpretation of the key claim that scientifically justifies putting the disclaimer on biology textbooks.

**7. Final Thoughts.** What can we learn from all this? Three things come to mind. First, it seems to me that the reasoning involved in developing disclaimers of the “evolution is a theory, not a fact” sort reveals serious misunderstandings or ignorance about science, even if that reasoning is not quite in the neighborhood of what Plantinga has called “stupid reasons” for rejecting evolution.<sup>41</sup> Although those disclaimers do not explicitly reject evolution, they suggest that the scientific status of evolution is considerably worse than it actually is.

Second, I think that the sorts of evolution disputes going on in the culture at large reveal that there is a large percentage of people in general, and a considerable percentage of educated people, including members of school boards, who do not understand the nature or methods of science, or who do not understand the nature of various forms of argumentation. It is a travesty that a course in reason and argument—which teaches basic skills in deductive, inductive, and abductive reasoning—is not required of high school students. If we really care about this stuff, we ought to try to do something about it.

Third, there are reasons to think that the status of methodological naturalism in science is relevant to our assessment of the key claim using fact<sub>5</sub>. Although there is clearly no current scientific rival to descent with modification worth taking seriously, the privileged status of methodological naturalism in science explains, in part, why the key claim using fact<sub>5</sub> fails the reasonable-support condition; for, it effectively prevents the publishing, in mainstream science journals, of peer-reviewed articles that would provide the sort of detail needed to yield a testable rival to current evolutionary theory. However, since powerful arguments from the philosophy of science cast doubt on methodological naturalism, we can expect proponents of the intelligent design movement to use such philosophical arguments in an attempt to diminish evolutionary theory's status in science. Should the strategy succeed, a likely result, given much public sentiment and the strong political will of the anti-evolution movement, would be an escalation of public battles fought over evolution, as well as calls for significant revisions of what seem to be perfectly good science textbooks by those who know little about science. The stakes are high. This might explain why some philosophers of science have argued in high profile court cases that science cannot appeal to the supernatural, even when those philosophers have reason to believe that there is no principled reason that rules out supernatural explanations as being unscientific.<sup>42</sup> Despite my own skepticism about methodological naturalism, I too worry about the likely consequences of a public relaxing of the *de facto* restrictions on what counts as science. From my perspective, methodological naturalism is a vexed, troubling issue, but I predict that it is going to be a hot topic of future public debates over evolution.<sup>43</sup>

Todd R. Long  
California Polytechnic State University

<sup>1</sup> Such results have followed from statements and efforts by Boards of Education in Arkansas, Georgia, Kansas, Ohio, Oklahoma, Pennsylvania, Texas, and others.

<sup>2</sup> The disclaimer was placed on the textbook: Kenneth Miller and Joseph Levine, *Prentice Hall Biology* (Prentice-Hall) 2002.

<sup>3</sup> As reported in Nicholas J. Matzke, “Design on Trial in Dover, Pennsylvania” *Reports of the National Center for Science Education* 24 (5): 4-9.

<sup>4</sup> The anti-evolution message of Alabama’s disclaimer was softened in 2001, and softened further in 2005 (although the most recent version still says that evolution is a controversial theory). All three versions of the disclaimer are available at the following URL: <http://www.alscience.org/disclaimer.html>.

<sup>5</sup> The Beebe School District disclaimer said this: “This textbook discusses evolution, a controversial theory some scientists present as a scientific explanation for the origin of living things, such as plants, animals, and humans. Many people believe that evolution alone is not adequate to explain the origins of life. For these people, the idea of an intelligent designer seems to make sense.”

<sup>6</sup> *Selman v Cobb County School District* decision: <http://alt.cimedia.com/ajc/pdf/evolution.pdf> and *Kitzmiller v Dover Area School District* decision: <http://www.pamd.uscourts.gov/kitzmiller/kitzmiller.htm>. Some of the legal issues have been settled. Although on May 25, 2006 the Eleventh Circuit Court of Appeals vacated the district court’s judgment and remanded the case for further evidential proceedings (see <http://www.ca11.uscourts.gov/opinions/ops/200510341.pdf>), the Cobb County School District decided on December 19, 2006 to accept a settlement (which resulted in a promise not to use evolution disclaimer stickers on school textbooks), rather than fight further in court. But, there are legal issues saliently similar to the Cobb County decision that are still up for grabs. For instance, Liza Gross reports that twelve anti-evolution bills in nine U.S. states were introduced during the first six weeks of 2006. See Liza Gross, “Scientific Illiteracy and the Partisan Takeover of Biology”, *PLoS Biology* 4(5):e167, 2006. Also, for updates on just about all anti-evolution efforts in schools, see the National Center for Science Education’s news archive on evolution in schools: <http://www.ncseweb.org/pressroom.asp?branch=current>.

<sup>7</sup> For more about No Child Left Behind standards as they relate to the teaching of evolution, see the report on Eugenie Scott’s address to scientists and science educators at the 2006 meeting of the American Association for the Advancement of Science, in Liza Gross, “Scientific Illiteracy and the Partisan Takeover of Biology”, *PLoS Biology* 4(5): e167, 2006.

<sup>8</sup> The kind of warrant I have in mind has to do with the sort of epistemic justification that matters in science. I have nothing to say about any legal justification, social justification, or religious justification for the disclaimers.

<sup>9</sup> I take it that these are modest, charitable assumptions about the intentions of the drafters without which the disclaimer becomes absurd.

<sup>10</sup> Although I will not define the reasonable-support condition in a precise way, my commentary will reveal the gist of the condition. My main argument is that there is no interpretation of the key claim that provides even a marginally justifiable rationale, of the sort that matters in science, for the disclaimer.

<sup>11</sup> Kenneth Miller and Joseph Levine, *Prentice Hall Biology* (Prentice Hall) 2002, p. 369.

<sup>12</sup> See Alvin Plantinga, “When Faith and Reason Clash: Evolution and the Bible” in Robert T. Pennock (ed.), *Intelligent Design Creationism and Its Critics* (MIT Press) 2001, pp. 127-128.

<sup>13</sup> I do not mean to limit “natural mechanisms” to natural selection. According to current evolutionary work, relevant natural mechanisms may also include migration, mutation, and recombination. Nothing crucial to my paper turns on these details.

<sup>14</sup> Kenneth Miller and Joseph Levine, *Prentice Hall Biology* (Prentice Hall) 2002, p. 425.

<sup>15</sup> Nevertheless, it may well be that the framers of the Cobb County disclaimer *did* intend “evolution” to mean or imply “a theory about how life originated”. In an *Associated Press* story about the evolution disclaimer trial in Cobb County, it was reported that Marjorie Rogers—who started the drive to put the disclaimers in the school district’s biology textbooks—said that it was only fair to put a small disclaimer in a textbook where religious-based ideas about the origin of life are not mentioned. See Kristen Wyatt, “Trial Begins Over Ga. Evolution Disclaimer”, *Associated Press*, Monday, November 8, 2004.

<sup>16</sup> Here I am, of course, thinking about background assumptions of the drafters of the disclaimers. It is no secret that a salient pressure point for the disclaimer was a shared view among some parents in the community that “descent with modification” is inconsistent with God’s creation of human beings as those parents interpreted the biblical account of creation. And, since “descent with modification” is widely cited as the gist of evolutionary theory by

scientists, I think that it is appropriate, and at the very least, charitable, to take this interpretation to be the one intended.

<sup>17</sup> Kenneth Miller and Joseph Levine, *Prentice Hall Biology* (Prentice Hall), 2002, p. 369.

<sup>18</sup> The word “theory” is used in other ways among the general public. For instance, suppose that, during the intermission of a mystery play, two audience members are discussing who committed the murder. One says to the other, “My theory is that the butler did it; after all, he appeared to be holding a bloody knife when he walked past the window.” The other retorts, “My theory is that the stepmother did it; after all, she hated the boy.” This kind of conversation goes on frequently in ordinary conversations between people. In using the word “theory”, neither audience member implies that he has done anything that constitutes a widely accepted scientific means of confirming an explanation such as what is involved in empirical testing, measurement, or prediction; rather, this use of theory is much more akin to our grade-school understanding of a hypothesis: it is an educated guess or hunch based on the person’s general background information about how murder suspects get treated in plays, or based on more general folk psychology, or the like.

<sup>19</sup> For instance, Kenneth Miller (a biologist at Brown University, the author of the textbook at issue at the Cobb County trial, and an expert witness in that trial) said that the disclaimer used the word “theory” in a colloquial way that suggested that it was “a guess, or little hunch”. See Ellen Barry and Rennie Sloan, “Georgia Evolution Lawsuit is a Fact”, *Los Angeles Times*, November 9, 2004.

<sup>20</sup> See Alvin Plantinga, “When Faith and Reason Clash: Evolution and the Bible” in Robert T. Pennock (ed.), *Intelligent Design Creationism and Its Critics* (MIT Press) 2001, pp. 113-145. I discuss the relevance of methodological naturalism later in the paper.

<sup>21</sup> Closely allied to this meaning of “fact” is a more colloquial use. For example, in writing a letter contesting a parking ticket I recently received, I wrote, “I did, in fact, display a legal parking permit on my windshield”. Interestingly, I did not mean to imply that I had proof or physical evidence that I had displayed the permit. Although I was relying on memorial experiences as a kind of evidence or motivation for making the claim, I did not mean to imply that I had any non-private available evidence for the claim. Indeed, as I pointed out in the letter, there was no way at all for me to provide any non-private evidence. In saying that I did, in fact, display a legal parking permit I merely intended to say that it is *true* that I displayed a legal parking permit. A little observation and reflection reveals that “fact” is used in this way quite often by ordinary people.

<sup>22</sup> Such a view is consistent with theory<sub>1</sub>, according to which a scientific theory is more general than a fact in that a scientific theory is either something that purports to explain a fact or a set of facts, or something that may be used to yield an explanation of a fact or a set of facts. Kenneth Miller, the biologist who wrote the textbook on which the Cobb County disclaimer was placed, said: “Most scientists upon careful reflection would say that evolution is not a fact but a theory. The reason for that is not because they aren’t sure that evolution is true, they are sure that evolution is true, but because a fact is simply an experimental observation. A theory in science is a higher level of understanding because theories explain the facts. Evolutionary theory is considered well supported and reliable, in ordinary language true simply because it explains so many facts from so many observations from so many areas of science”. See Will Femia, “Biologist Ken Miller: Can God and Darwin Coexist?” MSNBC.com Chat Transcript (<http://www.msnbc.msn.com/id/3080890/from/ET/print/1/displaymode/1098/>).

<sup>23</sup> To be sure, one might use the word “fact” in a sentence without implying that one believes that the thing said to be a fact is true; for instance, “Joe Blow believes that X is a fact, but he is wrong.” But, such a statement clearly indicates that one thinks that there is a truth about X, namely, that X is not a fact. It seems to me, then, that a necessary condition on appropriately asserting “X is a fact” is the belief that X is true.

<sup>24</sup> Although it seems that someone *could* use “fact” in something like the way I have identified, I do not know of any actual person who uses the term in that way. I mention it here because it picks out a possible use of “fact” that is radically restrictive.

<sup>25</sup> Reflection on these uses of “fact” reveals the point I made earlier, namely, that for one to say, “X is not a fact”, one does not necessarily indicate that one believes X to be false; indeed, one could believe *p* to be true but think that *p* is not a fact because, for instance, one believes that it is not the case that the vast majority of scientists believe on the basis of scientific work they know about that *p*; that is, one might think that *p*’s being a fact requires a near consensus among scientists, or the like.

<sup>26</sup> According to a random sample of scientists included in the 1995 edition of *American Men and Women of Science*, 95% of scientists said that they believed that human beings evolved over millions of years from less developed forms of life. See L. Witham, “Many scientists see God’s hand in evolution”, *Washington Times*, April 11, 1997: A8. See also the report in *Nature* (April 3, 1997) 386: 435-6.

<sup>27</sup> According to a random sample of scientists included in the 1995 edition of *American Men and Women of Science*, 40% of scientists said that they believed that God guided the evolution of humans. See L. Witham, “Many scientists see God’s hand in evolution”, *Washington Times*, April 11, 1997: A8. See also the report in *Nature* (April 3, 1997) 386: 435-6.

<sup>28</sup> Furthermore, if the drafters of the disclaimer really thought that they had good scientific reason to believe that descent with modification is false, then since it is the guiding, over-arching explanation in biology, with important consequences for almost everything said in the textbook, we would expect them not to put a disclaimer on it but rather to ban the book as an instance of bad science.

<sup>29</sup> It is somewhat ironic that most high school physics textbooks teach Newtonian mechanics, not quantum mechanics, despite the fact that physicists believe that Newtonian mechanics is false. For an excellent discussion of how the Newtonian mechanics-quantum mechanics dispute is crucially different from current evolution-intelligent design disputes, see Branden Fitelson, “Some Remarks on the “Intelligent Design” Controversy”, unpublished manuscript, 2005 (<http://fitelson.org/id.pdf>).

<sup>30</sup> Consider also official statements of 74 scientific and scholarly organizations that endorse evolutionary theory, as compiled by The National Center for Science Education ([http://www.ncseweb.org/resources/articles/8753\\_statements\\_from\\_scientific\\_an\\_12\\_19\\_2002.asp](http://www.ncseweb.org/resources/articles/8753_statements_from_scientific_an_12_19_2002.asp)).

<sup>31</sup> However, some honest, smart people have argued that descent with modification is improbable on the evidence. For instance, Alvin Plantinga has argued that, given theism—which Plantinga says Christians are entitled to assume given all that they know—descent with modification is improbable. See Alvin Plantinga, “When Faith and Reason Clash: Evolution and the Bible” and “Evolution, Neutrality, and Antecedent Probability” in Robert T. Pennock (ed.), *Intelligent Design Creationism and Its Critics* (MIT Press) 2001. I do not know whether Plantinga is correct about this, but I am sure that his claim is relevant to my critique only if there is good scientific evidence that supports theism. Elsewhere Plantinga has, without appealing to theism, argued against the probability of evolution. For instance, he has argued that the probability of the conjunction of *E* (human cognitive faculties arose by evolutionary mechanisms) and *N* (metaphysical naturalism), given *R* (we have generally reliable psychological mechanisms for forming beliefs about the world) is low. See Alvin Plantinga, *Warrant and Proper Function* (Oxford University Press) 1993, ch. 12. However, Branden Fitelson and Elliot Sober have revealed problems with Plantinga’s argument. Furthermore, they point out that, even if Plantinga is correct, it does not follow that (*E* & *N*) is improbable relative to *all* relevant evidence. Moreover, they make the important point that high probability is neither necessary nor sufficient for rational belief. The upshot is that there is considerably more work to do to establish Plantinga’s point. See Branden Fitelson and Elliot Sober, “Plantinga’s Probability Arguments against Evolutionary Naturalism” in Robert T. Pennock (ed.), *Intelligent Design Creationism and Its Critics* (MIT Press) 2001, pp. 411-427.

<sup>32</sup> Design arguments in philosophy go back at least to Plato and include those by Aquinas, William Paley, and a host of twentieth-century and twenty-first century philosophers. For examples of recent pro-intelligent design arguments that are purported to be scientific, see Michael Behe, *Darwin’s Black Box* (The Free Press) 1996 and William Dembski, *The Design Inference* (Cambridge University Press) 1998. See also the list of pro-intelligent design publications accessible on the Discovery Institute’s Center for Science and Culture website: <http://www.discovery.org/csc/>. Also, for useful collections of essays by philosophers and scientists on either side of current debates about intelligent design, see William Dembski and Michael Ruse (eds.) *Debating Design: From Darwin to DNA* (Cambridge University Press) 2004, and Robert T. Pennock (ed.), *Intelligent Design Creationism and Its Critics* (MIT Press) 2001.

<sup>33</sup> This point has been made by a number of commentators. See, for instance, Mark Perakh and Matt Young, “Is Intelligent Design Science?” in Matt Young and Taner Edis (eds.), *Why Intelligent Design Fails* (New Brunswick: Rutgers University Press) 2005, pp. 185-196. See also Matthew J. Brauer, Barbara Forrest, and Steven G. Gey, “Is it Science Yet?: Intelligent Design Creationism and the Constitution”, *Washington University Law Quarterly* 83:1, 2005, 121-124.

<sup>34</sup> A fine argument for this point is made by Elliot Sober, *Philosophy of Biology* (Boulder: Westview Press) 1993, pp. 42-54.

<sup>35</sup> For a helpful discussion and explanation of how evidential support in science depends generally on comparisons of extant scientific theories, as well as an excellent treatment of the scientific status of intelligent design theory in contrast to evolutionary theory, see Branden Fitelson, “Some Remarks on the “Intelligent Design Controversy”, unpublished manuscript, 2005 (<http://fitelson.org/id.pdf>). Elliot Sober also argues that testing a scientific theory is essentially a contrastive activity, in which one specifies a range of alternative theories against which to test the theory at issue. See Elliot Sober, “Testability”, *Proceedings and Addresses of the APA*, 73:2, pp. 47-76. See also

Elliot Sober, "Contrastive Empiricism" in C. Wade Savage (ed.), *Scientific Theories*, vol. 14 (University of Minnesota Press) 1990, pp. 392-410. See also Elliot Sober, *Philosophy of Biology* (Boulder: Westview Press) 1993, pp. 42-46.

<sup>36</sup> Royal Society statement on evolution, creationism, and intelligent design: (<http://www.royalsoc.ac.uk/news.asp?id=4298>).

<sup>37</sup> Basil Whiley seems to speak for a lot of scientists (theists and atheists) in saying: "Science must be provisionally atheistic or cease to be itself". See Basil Whiley, "Darwin's Place in the History of Thought" in M. Banton (ed.), *Darwinism and the Study of Society* (Chicago: Quadrangle Books) 1961. There is a huge body of commentary about the recent evolution disclaimers and court cases that reveals that methodological naturalism continues to prevail as a popular presupposition for science. Methodological naturalism was explicitly discussed in the Kitzmiller v Dover Area School District trial by two philosophers of science, Robert Pennock and Barbara Forrest. Pennock said, "[We scientists] are forced to restrain ourselves to looking for natural regularities. That's part of what it means to be able to give evidence for something. You've undermined that notion of empirical evidence if you start to introduce the supernatural", and Forrest said, "Methodological naturalism is a methodology. It's a way of addressing scientific questions. It reflects the practice of science that has been successfully established over a period of centuries. It's not imposed upon science. It reflects the successful practice of science". A helpful selection of this discussion is provided by Ophelia Benson, "Intelligent Design is Not Science: Official", *The Philosopher's Magazine*, 2006 (<http://www.philosophersnet.com/magazine/article.php?id=1000>).

<sup>38</sup> For instance, the proposition that the Earth is only a few thousand years old is almost surely false, given descent with modification. Note, though, that it does not follow that God did not create the universe or that God did not create life.

<sup>39</sup> A nontheistic rival to evolution is appealed to by The Raelian Movement (<http://www.rael.org>), according to which life on earth was genetically engineered by purposeful, intelligent design: by extraterrestrial humans. However, we have at present almost no evidence for the theory except for the testimony of Rael. See Robert T. Pennock, "Why Creationism Should Not Be Taught in the Public Schools" in Robert T. Pennock (ed.), *Intelligent Design Creationism and Its Critics* (MIT Press) 2001, p. 761.

<sup>40</sup> That is, the matter of which scientific theory is better confirmed by the evidence. Is methodological naturalism true? Although it certainly characterizes an attitude among today's mainstream scientists, some fine work by philosophers of science calls into question the status of methodological naturalism. In addition to the much discussed "demarcation problem", which seems to reveal that there is no necessary and sufficient condition for something to be *science*, the fact that scientists frequently use *inference to the best explanation* (and similar kinds of reasoning) seems to allow for scientific hypotheses and theories that appeal to the supernatural. For an argument that a theory that appeals to the supernatural can satisfy scientific standards, see Del Ratzsch, *Nature, Design and Science* (SUNY Press) 2001. For examples of arguments from philosophers of science (including some who are no friends of intelligent design theory or any view according to which a supernatural being exists) that support the possibility of a properly scientific theory, explanation, or hypothesis that appeals to the supernatural, or that show that there is no necessary and sufficient condition for what counts as scientific that would rule out appeals to the supernatural as being unscientific, see Larry Laudan, "The Demise of the Demarcation Problem" in Michael Ruse (ed.), *But Is It Science? The Philosophical Question in the Creation/Evolution Controversy*, (Buffalo: Prometheus) 1988, 337-350; also see Mark Perakh and Mark Young, "Is Intelligent Design Science?" in Matt Young and Taner Edis (eds.), *Why Intelligent Design Fails* (New Brunswick: Rutgers University Press) 2005, pp. 185-196; also see Elliot Sober, *Philosophy of Biology* (Westview Press) 1993, ch. 2.

If methodological naturalism were to become discredited among *scientists*, then this could, in principle, open the door for a theory that would threaten the scientific status of evolutionary theory. The existence of such a rival could then provide for a key claim using facts that would pass all our tests of a successful interpretation. Will a serious rival emerge in the future? I doubt it, in part because, as I mention in section 7, the near consensus among scientists that methodological naturalism is true practically prevents the publishing, in mainstream science journals, of peer-reviewed articles that would provide enough detail to yield a testable rival to current evolutionary theory. Interestingly, even most philosophers of science who have testified as expert witnesses in evolution-related trials in recent years have joined the chorus of scientists in singing the praises of methodological naturalism as presupposed by science. This chorus has certainly convinced judges that would-be intelligent design theories, for instance, are essentially religious, rather than scientific. For instance, in the Kitzmiller v. Dover Area School District trial, philosophers of science Robert Pennock and Barbara Forrest testified in support of methodological naturalism in science. Forrest was asked by the defense attorney: "Should scientists be allowed to follow the evidence where it

leads or should they be constrained to follow the evidence only where materialism allows?”, to which Forrest replied, “Science by its nature and on the basis of its successful practice cannot address questions of the supernatural, and that’s because the cognitive faculties that humans have will not take us beyond the reach of those faculties. And so science is really an intellectually quite humble process. It does not address supernatural claims. It has no methodology by which to do that”. Quotations provided by Ophelia Benson, “Intelligent Design is Not Science: Official”, *The Philosopher’s Magazine*, 2006 (<http://www.philosophersnet.com/magazine/article.php?id=1000>).

Two thoughts come to mind: first, although I am not sure what was precisely meant by “cognitive faculties that humans have will not take us beyond the reach of those faculties”, I am sure that religious people (including many scientists) for thousands of years have been claiming to have access to the supernatural; and, second, it seems to me that science *does* have methodologies to address supernatural claims: those involved in inference to the best explanation. What prevents us, at least in principle, from comparing, say, evolutionary theory, to some other scientific theory that appeals to a supernatural being, in order to determine which is the best explanation according to the prevailing scientific methods? It is not at all obvious that, merely by mentioning a supernatural being, a theory cannot possess virtues sometimes cited as characteristic of science: empiricity, observability, falsifiability, testability, controllability, predictability, fruitfulness, and the like.

<sup>41</sup> Plantinga directed his own criticism to the early literature from so-called “Creation Science”. See Alvin Plantinga, “When Faith and Reason Clash: Evolution and the Bible” in Robert T. Pennock (ed.), *Intelligent Design Creationism and Its Critics* (MIT Press) 2001, pp. 113-145.

It is worth noting that my central claims in the paper do not imply that those who drafted the disclaimers were themselves stupid, or *believing* irrationally or *acting* irrationally. As for *belief*, I suspect that many disclaimer supporters were either misinformed or ignorant about crucial issues concerning how biology or science in general works, as well as about which theses are crucial to evolutionary theory; accordingly, they might have had reason to believe that evolution is considerably worse as a scientific explanation than are many other scientific explanations. And, given the political pressures placed on them by many of their constituents, it could be that the school board members who were responsible for the actual disclaimers were not *acting* irrationally, either. To find out whether their actions were rational, we would need to know what obligations school board members have to seek out information from the scientific community, what obligations school board members have to satisfy their constituents, and what obligations they have to consider the legal consequences of their behavior. Such issues go beyond the scope of this paper, and, in any case, I do not know how to settle those issues.

<sup>42</sup> A helpful discussion of this general issue occurs in Part Four in Michael Ruse (ed.), *But Is It Science?* (Buffalo: Prometheus) 1988, pp. 335-399, in which philosophers of science Larry Laudan, Michael Ruse, and Philip Quinn discuss Michael Ruse’s expert testimony at the 1981 Arkansas Creationism trial (McLean v. Arkansas). Laudan and Quinn argue separately that the victory for science accomplished by the judge’s ruling was hollow or underhanded, for, as Laudan says, “it was achieved only at the expense of perpetuating and canonizing a false stereotype of what science is and how it works”. See Larry Laudan, “Science at the Bar—Causes for Concern” in Michael Ruse (ed.), *But Is It Science?* (Buffalo: Prometheus) 1988, p. 355. Quinn bemoans the risks and dilemmas that philosophers of science often face when they get involved in policy-making. The risks are that, if philosophers of science seek to express the subtle distinctions and nuances they think are necessary to provide an accurate description of science, they may well fail to communicate or be misunderstood. See Philip Quinn, “The Philosopher of Science as Expert Witness” in Michael Ruse (ed.), *But Is It Science?* (Buffalo: Prometheus) 1988, pp. 367-385. The dilemma is between corruption and ineffectuality. If expert witnesses wish to be understood and efficacious, they may have to dirty their hands by making claims about science that they know to be false; on the other hand, if they wish to avoid corruption, they may have to say things that fail to get the public results that would be good for science. See Philip Quinn, “Creationism, Methodology, and Politics” in Michael Ruse (ed.), *But Is It Science?* (Buffalo: Prometheus) 1988, pp. 395-399.

<sup>43</sup> For helpful comments on earlier versions of this paper, I thank Francisco Flores, Keith Abney, Elliot Cohen, Dwight Yao, and Sam Knowlton, as well as members of the audience at the 2006 Pacific Region meeting of the Society of Christian Philosophers at the University of San Diego, and audience members at the 2006 Cal Poly Spring Philosophy Colloquium at California Polytechnic State University.