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***ON THE ORIGIN OF ACADEMIC FREEDOM BILLS
BY MEANS OF PRECEDENTIAL SELECTION:
AND WHY EFFORTS SHOULD BE TAKEN
TO FACILITATE THEIR EXTINCTION***

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INTRODUCTION

Though courts have uniformly found that legislative efforts to restrict the teaching of the theory of evolution (TE) in public schools violate the Establishment Clause, the tactics of those intent on doing so have consistently adapted to such precedential selection. Most recently, Academic Freedom Bills (AFBs), which permit science teachers to introduce instructional materials that argue against TE, have been proposed in thirteen state legislatures across the United States. Though at present only Louisiana has passed such a bill into law, AFBs are currently pending in Florida, Missouri, South Carolina, Tennessee, and Texas.

State legislators should reject further efforts to enact AFBs into law. AFBs, and the organizations that lobby for them, misrepresent the views of the scientific community regarding the viability of TE. They obfuscate professional and legal protections of teachers' rights to academic freedom, and they propagate inaccurate scientific information. By rejecting AFBs, legislators will avoid wasting tax-payer dollars on inevitable legal challenges. More importantly, they will avoid corrupting students' science education with politics.

• **ORIGINS**

Although most often associated with Charles Darwin and his book *On the Origin of Species by Means of Natural Selection* published in 1859, TE actually existed well beforehand¹. That *traits of a population of organisms change over time*² has long been accepted by scientists, but the mechanism by which this change is brought about was unknown until Darwin posited his Theory of Evolution by Means of Natural Selection (TNS). This theory states that *organisms that possess heritable traits that enable them to better adapt to their environment compared with other members of their species will be more likely to survive, reproduce, and pass on more of*

¹ National Academy of Sciences, "Evolution," 2005.

² *Id.*

*their genes*³ *to the next generation.*⁴ Although TNS was accepted by some in the scientific community during Darwin's lifetime, it was judged unreliable by many others due to alleged methodological flaws and evidentiary deficiencies. Only until the emergence of genetics in the early twentieth century did it find widespread acceptance.

Modern courts are faced with similar challenges when judging the reliability of EWT. In *Daubert v. Merrell Dow Pharmaceuticals*⁵, the Supreme Court held that the trial judge's role with respect to scientific evidence from expert witnesses was that of "gatekeeper." This requires the trial judge only admit expert witness testimony (EWT) that is "*relevant to the task at hand*" and rests "*on a reliable foundation.*" This can be especially difficult in cases involving the forensic sciences where advanced scientific techniques like DNA profiling and serological analysis are at issue. However, when it comes to judging the evidence, science and the law do not have the same objective. One seeks truth; the other seeks proof, as the following analogy demonstrates.

The "*Life/Dinner*" Principle says the pressure of natural selection is greatest on prey species rather than predators. If the fox fails to catch the rabbit, the fox just loses his dinner, but if the rabbit fails to outrun the fox, he loses his life. A similar dichotomy exists between science and the law. If the scientific researcher fails to prove his hypothesis, he simply runs another experiment, but if the judge admits unreliable EWT, personal liberties may be lost. As a normative process, the law has the grave responsibility of making an equitable pronouncement of the truth; whereas science, simply tells it like it is, and can always change its mind later if new evidence comes to light. As a result, courts have carefully governed the admission of EWT. Just like the rabbit must not falter on uneven ground lest it become the fox's dinner, the law must not

³ Gene theory was unknown in Darwin's time.

⁴ National Academy of Sciences: "Creationism and Evolution," 2000.

⁵ 509 U.S. 579, 584-587.

lose its proverbial footing by allowing the trier of fact to hear inaccurate or prejudicial testimony lest it issue an inequitable judgment.

Unfortunately, the law has indeed lost its footing as of late with unreliable and even deceitful EWT in the forensic sciences making its way to the trier of fact. Nonetheless, lawmakers have recognized the problem and sought the aid of science to better understand it. The National Academy of Sciences, at the behest of Congress, has undertaken an extensive review of the forensic sciences, and subsequently issued a report detailing how EWT may be made more reliable. These insights, along with statutory and common-law authorities pertaining to evidentiary standards, may also help resolve the perennial controversy over the teaching of TE in the public classroom.

Like the previous efforts to restrict TE instruction, AFBs, including Louisiana's Science Education Act (LSEA), are on a path that leads inexorably to the courtroom, and because they impermissibly entangle government with religion, courts will almost certainly rule them to be violative of the Establishment Clause. However, we may be able to avoid litigation altogether by preemptively analyzing through the lens of modern evidence law 1.) the history of the TE controversy, 2.) the presuppositions commensurate with AFBs, and 3.) the reasons why the "*Teach the Controversy*" approach advocated by opponents of TE (OTEs) represents poor pedagogy. Plus, by utilizing the practices advocated by the NAS, courts may be better prepared to dispose of the pseudoscientific claims propounded by OTEs...now that the fox has shared his secrets with the rabbit.

John Gould: Darwin's Expert

At the close of the meeting of the Geological Society of London on January 4, 1837, renowned English ornithologist, John Gould, was given the monumental task of illustrating and

documenting over four hundred and fifty bird specimens previously unknown to science. Though he had no formal training, Gould had served as staff taxidermist and lithographer for the Zoological Society of London for the previous ten years, and he had published several collections of his ornithological work, including *The Birds of Europe*, a five-volume set, and *A Century of Birds from the Himalaya Mountains*, which documented many previously unknown specimens. Consequently, the Geological Society deemed Gould well-qualified for the task.

The four hundred and fifty bird specimens had been brought back from South America by a twenty-seven year old, largely self-taught naturalist named Charles Darwin, who had recently completed a five-year surveying expedition aboard the HMS *Beagle*. Darwin had labeled and memorialized the acquisition of many of the birds, but the sheer volume made Gould's preliminary work of organizing and categorizing the specimens challenging. Gould eventually came upon an especially puzzling set of birds that Darwin had obtained from an isolated group of islands known as the Galapagos, five-hundred miles west of continental Ecuador. Darwin had classified the birds as blackbirds, grosbeaks, and finches. However, Gould concluded that Darwin was mistaken.

Though the specimens had distinctive bills that made them appear to be separate species, all of their other characteristics were essentially identical. Gould made detailed observations of the birds, noting that they were all dull brown to black in color and had similar plumage with short tails. They shared a common body type, weighed 8-38 grams, and measured 8-20 cm. Consequently, Gould opined that instead of three separate species, they were actually all finches simply with different bill shapes.⁶

That Darwin would have relied on Gould's opinion is not surprising. Gould possessed a wealth of experience in the relevant fields of taxidermy and anatomy, and his personal

⁶ See cover page.

examination of the finch specimens made him more than capable of offering a reliable expert opinion, despite his lack of formal training. As a loose analogy, Gould would have likely qualified to offer EWT in a modern court because under *Daubert*, he would have met the minimum experiential requirements, and his opinion about the relatedness of the finches was well within the scope of his expertise.

In 2000, Federal Rule of Evidence (“FRE”) 702 was amended to codify *Daubert*, and two other contemporaneous cases that impacted EWT: *Kumho Tire Co. v. Carmichael* (“*Kumho*”) and *General Electric Co. v. Joiner* (“*Joiner*”). Now, FRE 702 is the primary statutory authority for EWT. It reads:

“If scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training, or education, may testify thereto in the form of an opinion or otherwise.”

Authority from the common law for experts like Gould who offer technical, rather than scientific, EWT comes from *Kumho*.⁷ Here, the Supreme Court held that the trial judge’s gate-keeping function applies to all expert testimony, including non-scientific testimony. Had Gould passed the threshold tests for qualifications, ultimately, whether a court would have admitted his opinion would have been based on his methodology. Scientific EWT must be derived from the scientific method, described as the process of formulating hypotheses and conducting experiments to prove their truth or falsity. In the context of *technical* knowledge, the court may look to other factors relevant to admissibility including refutability, subjection to peer review, presence of a known or potential error rate, presence of established standards or controls, and acceptance by the scientific community. However, this list is non-dispositive and courts may look to other relevant factors to determine methodological validity.

⁷ 526 U.S. 137 (1999).

The method of direct visual inspection of the sort performed by Gould is not always admissible. In fact, in *Kuhmo*, the EWT was provided by a well-qualified expert testifying within the scope of his expertise. However, in reversing the decision of the 11th Circuit, the Supreme Court ultimately affirmed the trial court's decision to preclude the expert's opinion that a manufacturer defect caused a tire on Plaintiff's van to explode. The Supreme Court held that although the expert's method of visual inspection was generally reliable, it had not been applied reliably to *this specific tire*. The expert had merely ruled out causes for the tire to explode other than a defect. But he could not reliably conclude that the defect was indeed the cause of the explosion because there was credible evidence that other causes, like improper inflation, could have brought about the explosion. *"Nothing in either Daubert or the Federal Rules of Evidence requires a district court to admit opinion evidence that is connected to existing data only by the ipse dixit [unsupported statement] of the expert."*

Thus, had there been evidence of other viable explanations for the common morphologies of these specific finches, Darwin may have been wise to reject Gould's opinion. However, *"the decision to admit expert testimony is committed to the broad discretion of the trial court, and its determination will be affirmed unless it is 'manifestly erroneous'."* Gould presented his measurements and observations in support of his opinion at the next meeting of the Geological Society on January 10, and the story was carried by the newspapers. Moreover, the following year, Gould's findings were published in *Zoology of the Voyage of H.M.S. Beagle*, a nineteen part chronicle of Darwin's specimens from South America. Consequently, as an expert witness with sufficient technical experience, whose testimony was within the scope of his expertise, whose methodology was well accepted and peer reviewed, and whose basis for his conclusion

was sound, Gould's opinion that Darwin's specimens were in fact all finches would likely be admissible in a modern court, and Darwin was well justified in relying on it.

After receiving news of his misclassification of the finch specimens, Darwin began to ruminate on Gould's insight. He reasoned that their unique bills were the result of the different sizes of seeds and insects on the distinct environments of the Galapagos. Those finches with bills best adapted to the available food resources on a particular island survived, passing on the beneficial bill shape to their offspring. Those that did not died, allowing the new bill shape to propagate throughout the population. Thus, over time, Darwin rationalized, it might be possible for new species to arise entirely as a result of cumulative adaptations by successive generations as a result of naturally-occurring selection pressures, like food supply.⁸ Given millions or even billions of years, perhaps this process had even produced all of the orders of life on earth from a single common ancestor.

Courts are often leery of this type of extrapolation. For instance, in *Joiner*, Plaintiff's expert used a "*weight-of-the-evidence methodology*" to argue that a chemical could cause cancer. However, the expert pooled the results of multiple epidemiological studies in order to draw this conclusion. The Supreme Court noted that "*Trained experts commonly extrapolate from existing data.*" However, in ultimately rejecting the expert's opinion, the Court held "*A court may conclude that there is simply too great an analytical gap between the data and the opinion.*"

Nonetheless, over the next twenty years, Darwin continued to grow the data and develop his theory. From his home in Down, England, he studied the dramatic traits that could arise in pigeons and barnacles as a result of selective breeding. He theorized that similar results could be

⁸ This process known as speciation or macroevolution, and is a primary point of contention by OTEs, who argue that only microevolution (minor morphological changes not resulting in new species) can be produced by TNS.

achieved solely by natural forces. He corresponded extensively with Gould and other colleagues in the natural sciences about his research, and by 1859, when he published his seminal work, *On the Origin of Species by Means of Natural Selection*, his theory was fully formed. In the years since, all credible scientists recognize Darwin's genius. In many ways, however, it was Darwin's expert, John Gould, and his learned opinion regarding the relatedness of the Galapagos finches that served as a basis for Darwin's revolutionary insight.

Darwin's Methods Under Attack

Darwin was all too aware that *Origin* would likely antagonize the religious community. By dispensing with a supernatural explanation for the vast array of life on earth, TNS contradicted biblical creationism and implicitly provided a framework through which existence could be understood in entirely natural terms. However, as Secretary of the prestigious Geological Society of London and an experienced researcher renowned for the trove of over 6,000 specimens he brought back from South America, Darwin was surprised by methodological criticisms from his fellow scientists. His detractors argued that his theory that different life forms evolved from a common ancestor was primarily conjectural, and his evidence for the mechanism by which this process occurred, TNS, was entirely circumstantial.

In the mid-19th century, there was much controversy among scientists regarding the scientific method. Matters of causation, semantics, and the role of theoretical entities were fiercely debated. Two of the most significant treatises on the scientific method were English mathematician John Herschel's *Preliminary Discourse on the Study of Natural Philosophy* (1830) and John Stuart Mill's *A System of Logic* (1843). In his last year at Cambridge, Darwin read Herschel's treatise which advocated a method called induction, often associated with one of the founding fathers of modern science, Francis Bacon.

Unlike the modern empirical method, where a hypothesis is formed first and then facts are gathered, the inductive method calls for *facts* to be collected first, and only later, are conclusions drawn based solely based on those facts. Many scientists of Darwin's day, felt methodologies based on the use of hypotheses were unreliable due to the possibility of confirmation bias. This is the idea that preconceived ideas can lead a researcher to favor only those facts that support his preconceptions. According to Herschel, "*to explain something is to give its antecedent cause; if that is unknown, we subsume the fact to be explained with other, similar phenomena under a general law until we discover the cause.*" Mill's philosophy was much more empirical, but like Herschel, he believed that laws were to be discovered in the facts, not imposed on the facts.

As with most scientists of the day, Darwin was an advocate of the inductive method, and at the time he wrote *Origin*, claimed to have employed "*true Baconian principles*" when developing his theory. However he would later concede that employing such an entirely inductive methodology was impossible with TNS due to its cumulative nature and extremely large time scale. As a result, TNS was ill received by many in the scientific community.

One of the harshest critics of Darwin's methodology was Adam Sedgwick, his geology professor at Cambridge. Sedgwick asserted that Darwin, "*deserted the inductive track, the only track that leads to physical truth.*" According to Sedgwick, "*Darwin's theory is not inductive because it is not based on a series of acknowledged facts pointing to a general conclusion.*" He then argued, "*Many of your wide conclusions are based upon assumptions which can neither be proved nor disproved. Why then express them in the language & arrangements of philosophical induction?*" Richard Owen, the leading comparative anatomist of his day said he himself had

entertained the idea of natural selection, but refrained from putting it forth as it lacked any inductive foundation.

Nonetheless, Darwin felt he was following the canons of good science as spelled out Herschel by showing how his theory could explain a variety of facts. Darwin was pleased to learn that Mill found *Origin* methodologically sound. Darwin was especially anxious to learn of Herschel's reaction but was discouraged to learn he described it as the "*law of higgledy-piggledy*."

Survival of the Fittest

One of the failings of modern forensics found in the NAS report, was a lack of "*Lack of Peer Reviewed, Published Studies*." It went on to explain that "*To answer questions regarding the reliability and accuracy of a forensic analysis, the research needs to distinguish between average performance (achieved across individual practitioners and laboratories) and individual performance (achieved by the specific practitioner and laboratory). Whether a forensic procedure is sufficient under the rules of evidence governing criminal and civil litigation raises difficult legal issues that are outside the realm of scientific inquiry.*" To wit, the *Daubert* Court, in explaining this evidentiary standard, pointed to several factors that might be considered by a trial judge, including whether the theory or technique has been subjected to peer review and publication. As such, the NAS recommended a "*new federal entity [that] should competitively fund peer-reviewed research on the accuracy, reliability and validity of forensic science disciplines and quantify the uncertainty of disciplines.*"

Peer review has been a part of modern scientific method only since the middle of the 20th century, the only exception being medicine. Before then, its application was lax in other scientific fields. The first recorded editorial prepublication peer-review process was at The

Royal Society in 1665 by the founding editor of *Philosophical Transactions of the Royal Society*, Henry Oldenburg. Another early, peer-reviewed publication was *Medical Essays and Observations* published by the Royal Society of Edinburgh in 1731, from which the present-day peer-review system evolved.

Darwin did not consider *Origin* a scholarly work; indeed he considered it an abstract of his intended manuscript. However, he was eager to get the input of his peers on his theory of natural selection and corresponded frequently with others in the scientific community, both before and after it was published. In Darwin's time many writings were reviewed anonymously in journals and newspapers. As such, the Rudiments of modern scholarly peer review, may be seen in Darwin's work.

In *Origin*, to support his theory, Darwin offered detailed descriptions of his experiments in selective breeding and volumes of notes and correspondence with colleagues, as well as the specimens from South America. However, even to this day his critics allege that there is insufficient proof to support his theory. His own confidence about the strength of his methods notwithstanding, Darwin recognized the validity of many these arguments. *Origin* had not posited a precise mechanism by which favorable traits were passed from parent to offspring, and the fossil record at the time lacked the sort of transitional species needed to confirm his theory.

Rather than avoid these criticisms, however, Darwin encouraged them. For example, In *Origin*, he provided specific ways in which his theory might be disproven. He wrote, "*If it could be demonstrated that any complex organ existed, which could not possibly have been formed by numerous, successive, slight modifications, my theory would absolutely break down.*" Moreover, his eagerness to have his peers review his work is reflected in the titles of two of the chapters

from *Origin*: Chapter 6: "*Difficulties on Theory*", and Chapter 9: "*On the Imperfection of the Geological Record*".

Of the initial 1250 copies of *Origin* made available for sale in November of 1859, nearly half were purchased by lending libraries, a primary resource for scientific literature at the time. Another 3,000 were published within the next few weeks, and by January of the following year, a publisher in Boston offered the first 2,500 copies for sale in the U.S. Thus, Darwin relied on the power of criticism to strengthen his theory.

By 1864, *Origin* had been translated into multiple languages, and thousands of copies had been sold throughout the world. As a result of its widespread dissemination and revelatory nature, *Origin* was indeed subject to intense criticism. Before his death in 1882, Darwin revised it six times, releasing subsequent editions with modified arguments and additional chapters to respond to critiques from the scientific community. However, his theory of natural selection as the primary mechanism for evolution was not widely accepted in his lifetime. In fact, the period after his death until the early part of the 20th century would come to be known as "*the Eclipse of Darwin*," as it was later described by evolutionary biologist, Julian Huxley. During this time, other theories of speciation predominated. Saltationism, for instance, held that new species arose all at once as a result of large mutations, and Neo-Lamarckism held that heritable traits could be acquired. This led botanist, Eberhardt Dennart, to declare in 1903, "*We are now standing at the death bed of Darwinism*," and in 1907, entomologist Vernon Lyman Kellogg wrote, "*...the fair truth is that the Darwinian selection theory...stands today seriously discredited in the biological world.*"

Adaptation

Yet, Darwin's encouragement of scientific criticism would ultimately confirm the strength of his methodology and the resilience of his theory. For instance, today we know his so-called "*Tree of Life*," a hand-drawn diagram in *Origin* used to represent the relationships between different life forms, was too simplistic. Rather than distinct limbs on a tree, these relationships are better represented by the intertwined branches of a shrub due to the effects of crossbreeding. But instead of refuting Darwin's core principles, this actually supports them. Scientists have found that individuals with the widest mix of genes have less congenital disorders and are generally healthier than their purebred counterparts. Therefore, natural selection actually predicts crossbreeding because the resultant progeny will be more likely to pass on their genes.

Likewise, Darwin's hypothetical mechanism for heredity, which he called *pangenesis*, had to be abandoned once Czech monk and university-trained physicist Gregor Mendel demonstrated through his work with pea plants that traits were passed from parent to offspring in accordance with specific laws. These laws would later form the foundation of the scientific study of heredity, now known as genetics. As a result of further development of Mendel's ideas and technological innovation far beyond that of the 19th century, genetic analysis now serves as the strongest affirmation of Darwin's theories by allowing scientists to identify specific biological entities, known as genes, shared by all life. Additionally, the number of transitional fossils has increased enormously since Darwin's day, and this problem of stasis has been largely resolved with the advent of the theory of punctuated equilibrium, which predicts a primarily stable fossil record broken up by occasional major speciations.

Just as the pressure to find food selected only the most robust and adaptable of Darwin's Galapagos finches, intellectual pressure from the scientific community has had a comparable

effect on his ideas in *Origin*. Today, as a result decades of refinement by scientific criticism, the core principles of evolution and natural selection are among the most well supported in all of science, along with atomic theory, germ theory, and heliocentrism. It is unfortunate, therefore, that similar methods have not been employed by legislators in the U.S. when proposing measures pertaining to the theory of evolution, where students' educations and personal liberties are at stake.

**COMMON DESCENT:
THE PHYLOGENY OF ACADEMIC FREEDOM BILLS**

*"If we lose, it won't matter that much. If the law is unconstitutional, it'll be because of something in the language that's wrong.... So we'll just change the wording and try again with another bill.... We got a lot of time. Eventually we'll get one that is constitutional."*⁹

In an uncanny resemblance¹⁰ to the very phenomenon it decries, the antievolution movement has evolved yet again. Louisiana's Senate Bill 733, signed into law by Governor Bobby Jindal on June 25, 2008 (Louisiana Science Education Act [LSEA]), is the latest mutation in a long-running war to challenge the validity of the theory of evolution (TE) in American classrooms. After *Kitzmiller v. Dover* in 2005, in which intelligent design (ID) was found unconstitutional, OTEs adapted to the precedential selection pressure. The strategy now being employed in Louisiana and elsewhere through Academic Freedom Bills (AFBs) by opponents of the theory of evolution (OTEs)—including the Seattle-based conservative think tank, the Discovery Institute (DI)—is more subtle and potentially more difficult to challenge. Instead of trying to prove that ID is science, OTEs have now sought to bestow on teachers the right to introduce non-scientific alternatives to TE under the auspices of academic freedom.

⁹ Senator James Hoisted, Washington Post, December 7, 1981.

¹⁰ See Addendum

Proponents are actively lobbying for bills similar to the LSEA be introduced in state legislatures throughout the country. Currently, national and state statutes prescribe content standards for science curriculums in public schools. Any educational materials used in public classrooms must meet these standards. The State Department of Education through the State Board of Elementary and Secondary Education implements these standards. AFBs allow individual school boards and teachers to make additions to the science curriculum without clearance from these authorities. Thus, a teacher could use instructional materials in a public classroom that put forth entirely unsubstantiated claims. The law expressly permits the use of 'supplemental' classroom materials in addition to state-approved textbooks.

Santorum Amendment

The U.S. Congress passed the No Child Left Behind Act of 2001 (NCLB) in order to improve outcomes for students in public schools. The Act induces states to implement standards-based educational models by conditioning federal funds on the development of measurable goals and periodic assessments in basic skills. The bill was coauthored by John Boehner (R-OH), George Miller (D-CA), and Judd Gregg (R-NH), and was proposed by president George W. Bush on January 23, 2001. With relatively little debate, it passed the House of Representatives on May 23, 2001 with a vote of 384–45, and passed the Senate on June 14, 2001, with a vote of 91–8. It was signed into law on January 8, 2002.

There was one amendment, however, a seemingly innocuous “*Sense of the Senate*” amendment that carried no weight of law, but would indeed generate debate. On June 13, 2001, Rick Santorum (R-PA) proposed Amendment No. 799, which dealt with the ostensibly noble subject of “*intellectual freedom*” in the public classroom. Santorum read the Amendment into the record:

"It is the sense of the Senate that—

(1) good science education should prepare students to distinguish the data or testable theories of science from philosophical or religious claims that are made in the name of science; and

(2) where biological evolution is taught, the curriculum should help students to understand why this subject generates so much continuing controversy, and should prepare the students to be informed participants in public discussions regarding the subject."

Santorum explained his rationale for the Amendment:

"It simply says there are disagreements in scientific theories out there..." "I frankly don't see any down side to this discussion—that we are standing here as the Senate in favor of intellectual freedom and open and fair discussion of using science—not philosophy and religion...but science—as the basis for this determination."

The Amendment was met with bipartisan support. The late Ted Kennedy (D-MA) affirmed the amendment's rationale: *"We want children to be able to speak and examine various scientific theories on the basis of all of the information that is available to them...."* Likewise, the congressional record shows the late Robert Byrd (D-WV) affirmed the educational benefits of the Amendment. Kansas governor, Sam Brownback (R-KS), a Senator at the time, also expressed his support for the Amendment, and did so in the context of his experience with the Kansas School Board's controversial vote in 1999 to omit questions from state assessment tests regarding the ability of natural selection to produce new species. With such magnanimous endorsements, the Amendment passed with nearly a unanimous vote. However, since the House of Representatives had already voted on the NCLA the previous month, the Amendment had to go to a bicameral conference committee before it could be voted into law.

In the meantime, when news of the Amendment reached the scientific community, signatories on behalf of ninety-six scientific and educational organizations sent a letter to the Committee's joint chairmen Boehner and Kennedy urging that the Amendment be stricken from the final bill. The organizations included the National Association of Biology Teachers, the

American Institute of Biological Sciences, the American Society for Biochemistry and Molecular Biology, the Assn. of College & University Biology Educators, the Kansas Association of Biology Teachers, the Paleontological Society, Society of Protozoologists, and the Society of Toxicology.

The letter read in part,

The undersigned...urge the Conference Committee to remove Section 1022 from the Senate-passed version of H.R.1. As written,...this resolution mask[s] an anti-evolution agenda that repeatedly has been rejected by the courts. Evolutionary theory ranks with Einstein's theory of relativity as one of modern science's most robust, generally accepted, thoroughly tested, and broadly applicable concepts. From the standpoint of science, there is no controversy. If the point of the resolution is to encourage teaching about political controversy surrounding scientific topics, then evolution is just one of a legion of issues that are the subject of political debate. Confusing political with scientific controversy on the topic of biological evolution will weaken science education.

The Committee eventually voted not to approve Santorum's Amendment. However, a modified version was appended to the Committee's December, 2001 Conference Report. It reads,

"The Conferees recognize that a quality science education should prepare students to distinguish the data and testable theories of science from religious or philosophical claims that are made in the name of science. Where topics are taught that may generate controversy (such as biological evolution), the curriculum should help students to understand the full range of scientific views that exist, why such topics may generate controversy, and how scientific discoveries can profoundly affect society."

Though the Report lacks the force of law, courts may use it as explanatory text regarding the purpose and legislative history of the bill should its intent ever be at issue.

In the coming months, OTEs declared victory. In a press release dated December 21, 2001, with the headline, "Congress gives victory to scientific critics of Darwin," Bruce Chapman, president of the DI announced, "The education bill just passed by Congress...[will] change the face of the debate over the theories of evolution and ID in America." He opined that "the Darwinian monopoly on public science education, and perhaps on the biological sciences

in general, is ending.” However, as Eric Meikle, of NCSE explained, “the fact that evolution is singled out as uniquely controversial amply indicates the amendment’s anti-evolutionary intention. In proposing the amendment, Senator Santorum cited a law review article coauthored by ‘intelligent design’ proponent David K DeWolf, professor of law at Gonzaga University and Senior Fellow at the Discovery Institute’s Center for the Renewal of Science and Culture. And the godfather of the ‘intelligent design’ movement, Phillip Johnson, was quoted in the June 18 Washington Times as having “helped frame the language” of the amendment.”

Moreover, the force of the Report language was misrepresented. In an op-ed piece for the March 14, 2002 issue of the *Washington Times*, Santorum claimed that the language was a “provision” of the bill:

At the beginning of the year, President Bush signed into law the “No Child Left Behind” bill. The new law includes a science education provision where Congress states that “where topics are taught that may generate controversy (such as biological evolution), the curriculum should help students to understand the full range of scientific views that exist.” If the Education Board of Ohio does not include intelligent design in the new teaching standards, many students will be denied a first-rate science education.”

Ohio Representatives Boehner and Steve Chabot repeated this claim. A March 20, 2002 story also in the *Washington Times*, quoted the Congressmen as writing: “The Santorum language is now part of the law.” This of course, is misleading because the Santorum language does not have the force of law, despite the Congressmen’s claims.

Louisiana Science Education Act of 2008

§285.1. Science education; development of critical thinking skills

B.(1) The State Board of Elementary and Secondary Education, upon request of a...local public school board, shall allow and assist teachers...and school administrators to create...an environment within public elementary and secondary schools that promotes critical thinking skills...[regarding] scientific theories...including, but not limited to, evolution, the origins of life, global warming, and human cloning.

(2) Such assistance shall include...effective ways to help students...critique...scientific theories...including those...in Paragraph (1)....

C. A teacher...may use supplemental textbooks and other instructional materials to help students...critique...scientific theories...as permitted by the...local public school board...

D. This Section shall not be construed to promote any religious doctrine, promote discrimination for or against a particular set of religious beliefs, or promote discrimination for or against religion or nonreligion.

Anti-Evolution Educational Materials

*"The LSEA is already producing its intended result. Livingston Parish School Board in Louisiana has begun exploring the teaching of creationism in the public school system's science classes."*¹¹ The director of curriculum for the district reportedly told the Board that, under the LSEA, schools are allowed to present *"critical thinking and creationism"* in science classes, creationism, of course, being deemed unconstitutional as non-science by the Supreme Court in *McLean*. Yet, the response from the Board was practically jubilant, with one member proposing the formation of a committee to study the hiring a pro-creationist science teacher. Another member, in a remarkable disregard for the law and his fiduciary duties to the taxpayers of Livingston Parrish, stated *"We don't want litigation, but why not take a stand for Jesus and risk litigation."*

Unfortunately, such statements bring to mind *Kitzmiller*, where efforts to promote ID by members of the Dover School Board wound up costing nearly two million dollars in legal fees. Worse still, in its opinion, the Court recounted the testimony of expert witness, Dr. Kenneth Miller, regarding the impact on students of the introduction of creation science, like ID, into the science classroom: *"Dr. Miller testified that a false duality is produced.... Introducing such a religious conflict into the classroom is 'very dangerous' because it forces students to 'choose*

¹¹ As reported by the Baton Rouge *Advocate* (July 24, 2010).

between God and science,’ not a choice that schools should be forcing on them.”¹²

Notwithstanding, this indeed the predicament students are placed in under the LSEA and similar AFBs. As such, a review of some of the instructional materials that these measures will allow into the classroom is prudent.

Anti-Evolution Instructional Materials

Anti-Evolution Textbooks

Of Pandas and People: The Central Question of Biological Origins (“*Pandas*”) was the biology textbook at issue in *Kitzmiller*, and is widely espoused among OTEs. As the Court noted, “*Pandas* was written by Dean Kenyon and Percival Davis, both acknowledged creationists.” Plaintiffs’ experts testified that “*Pandas* presents discredited science” and “*biochemical similarities between organisms [that are] inaccurate and downright false.*” Kevin Padian, a biologist and professor at University of California, Berkeley reviewed the book and called it “*a wholesale distortion of modern biology.*” Moreover, Michael Ruse, a professor of philosophy and biology at Florida State University, said, “*this book is worthless and dishonest.*”

Explore Evolution: The Arguments For and Against Neo-Darwinism is a supplementary biology textbook published in 2007 and co-authored by three DI members: Stephen Meyer, Scott Minnich, and Paul Nelson.¹³ It is described as aimed at helping educators and students to discuss “*the controversial aspects of evolutionary theory that...are not widely reported in textbooks.*” The book elicited a strong response from the British Centre for Science Education, which, in January of 2010, issued “*An Open Letter To All School Librarians.*” The letter reads in part, [*Explore Evolution*] “*manipulates a mixture of half-truths and outright errors.*”¹⁴ Biologist and associate professor at the University of Minnesota, Morris, PZ Myers wrote, “*The book is*

¹² Id. at 55.

¹³ Myer and Minnich served as expert witnesses for Defendant in *Kitzmiller*.

¹⁴ <http://bcseweb.blogspot.com/p/open-letter-to-school-librarians.html>

entirely about finding fault with evolution, under the pretext of presenting the position of evolutionary biology (sort of) together with a critique. The biology part is shallow, useless, and often wrong, and the critiques are basically just warmed over creationist arguments.”¹⁵

Anti-Evolution Text Addendums

*“EVOLUTION ADDENDUM” is a type of supplemental material referred to as an “Add On”, that consists of pages to be inserted into mainstream science textbooks with critiques of passages referring to evolution. “Add Ons” are available, often for free, on apologist web sites. One particular “Add On” is keyed to the textbook, *Biology*, authored by Kenneth Miller, Plaintiffs’ expert in *Kitzmiller*. The “Add On” was written by creationist, Charles H. Voss, Jr. Ph.D., a retired professor of electrical and computer engineering who has written addenda for multiple well known biology textbooks and posted them in pdf. format for download by teachers, students, and parents. Voss’s education is in electrical engineering, obviously not directly relevant to evolutionary biology. The author of the textbook, however, Allan J. Tobin, Ph.D., is Professor Emeritus at UCLA. He received his S.B. from MIT, in Humanities and Science, and his Ph.D. from Harvard, in Biophysics. The remainder of Dr. Tobin’s credentials are too long to post here.*

Nonetheless, Voss feels qualified to critique Dr. Tobin’s scholarship. The *“Add On”* reads, *“Studying Evolution Since Darwin, Page 410. Add this to the last [sentence] in the first paragraph. The authors state, ‘Scientific evidence supports the theory that living species descended with modification from common ancestors that lived in the ancient past.’ Think Critically: Are you an exact copy of your parents or are you different? If you are different does this agree with the theory proposed?”* Voss is obviously attempting to cast doubt on the theory of common descent with the specious argument that progeny would have to be exact replicas of

¹⁵ http://scienceblogs.com/pharyngula/2007/06/explore_evolutiondisplacing_go.php

their parents for the theory to hold true. Another “*Add On*” uses a similarly vapid argument: “*It should be remembered that biology is the study of living things. It is not necessary to know about an organism’s origin or past to determine...how it functions internally and externally....*” Another “*Add On*” entitled, “*Evolution Exposed*” from the organization, Answers in Genesis, asserts, “*Using basic genetic principles and operational science, we can understand how the great diversity seen in the dogs of the present world could have come from one pair of dogs on Noah’s Ark.*” Clearly, this sort of material is entirely inappropriate for a public school.

Anti-Evolution Model Curriculum

Ohio’s “*Critical Analysis of Evolution*” lesson plan, excerpted below, is based on a model curriculum promoted by the DI. It has been adopted into bill form in several states. It was at issue in Ohio and Kansas, and led to prolonged school-board hearings in both states. Eugenie Scott, Ph.D., head of the National Center for Science Education, describes it as “*riddled with scientific inaccuracies,*” and explained that “*it was widely feared that it would provide a pretext for the introduction of creationist misrepresentations of evolution. The lesson plan proved these fears to be justified.*”

“Critical Analysis of Evolution – Grade 10 Ohio (Proposed, not adopted)

6. Allow the groups to pick (or assign) one of the five aspects of evolutionary theory. Assign two groups to research each aspect. The aspects are:

Aspect 1: Homology (anatomical and molecular)

Aspect 2: Fossil Record

Aspect 3: Anti-Biotic Resistance

Aspect 4: Peppered Moths

Aspect 5: Endosymbiosis”

This sampling of anti-evolutionist materials likely to make their way into the public schools demonstrates the clear potential for harm from AFBs. The information asserted is largely erroneous and entirely inappropriate for use in the public schools. The Court in *Kitzmiller* highlighted the unsuitability of similar instructional materials promoting ID:

“Accepting for the sake of argument...that to introduce ID to students will encourage critical thinking, it still has utterly no place in a science curriculum. This tactic is at best disingenuous, and at worst a canard. The goal of the IDM is not to encourage critical thought, but to foment a revolution which would supplant evolutionary theory with ID.”

***THE STRUGGLE FOR PROOF:
INVESTIGATING THE CLAIMS OF ACADEMIC FREEDOM BILLS***

To adequately demonstrate the folly of AFBs, their implicit claims must be investigated. In a propitious turn of events, the National Academy of Sciences (NAS) has recently bolstered the ability of evidence law to investigate specious claims and “junk science” of the sort propounded by OTEs. In *Strengthening Forensic Science In the United States: A Path Forward*, the Academy recommends concrete ways in which the forensic sciences may be improved to ensure reliability and accuracy in an evidentiary context. By employing the recommendations of the NAS and using statutory and common law authorities from the law of evidence, the following pages will examine three faulty presuppositions implicit in AFBs.

Faulty Presupposition One:

*There is Substantial Conflict Among Qualified Experts
Regarding the Viability of the Theory of Evolution,*

Faulty Presupposition Two:

*Educators’ Rights to Academic Freedom Have Been Violated
For Challenging the Viability of the Theory of Evolution*

Faulty Presupposition Three:

*There Exists Scientifically Valid Evidence
That Challenges the Viability of the Theory of Evolution*

By showing that these basic assumptions underlying AFBs are flawed, that lawmakers will be even more apparent.

Faulty Presupposition One:
There is Substantial Conflict Among Qualified Experts
Regarding the Viability of the Theory of Evolution

That individuals who provide expert witness testimony (EWT) should be qualified to do so has been axiomatic for over two-hundred years. In *Folkes v. Chadd* (1782), the case generally regarded as the first to feature expert testimony from the witness stand, Plaintiff called civil engineer Thomas Smeaton to opine whether the recent demolition of a retaining wall contributed to the erosion of a local harbor. In overruling Defendant's objection, the esteemed English justice, Lord Mansfield, offered the court's reasoning:

"It is objected that Mr. Smeaton is going to speak, not to facts, but as to opinion. That opinion, however, is deduced from facts which are not disputed. Mr Smeaton understands the construction of harbours, the causes of their destruction and how remedied.... Of this, such men as Mr. Smeaton alone can judge. Therefore, we are of the opinion that his judgment, formed on facts, was proper evidence. The opinion of scientific men upon proven facts may be given by men of science within their own science" (emphasis added).

Here, Lord Mansfield articulates the same basic standard federal courts use today¹⁶ (arguably, more clearly). Yet in their report, the NAS found such practice was rampant. For example, individuals who provide EWT regarding digital evidence, are rarely certified by any sort of governing body, and there is "*wide variability in, and uncertainty about, the education, experience, and training of those practicing this discipline.*" Thus, to use the language of Lord Mansfield, there is no way to determine if they are indeed "*scientific men.*" As a result, accreditation and oversight of a unifying agency were key recommendations in the NAS report.

Biology, genetics, chemistry, and paleontology are just a few of the relevant disciplines touched by TE. Yet, as molecular biologist Jacques Monod wrote, "*everybody thinks he understands it.*"¹⁷ On February 11, 2009, "*the eve of the 200th anniversary of Charles Darwin's*

¹⁶ FRE 702, discussed *infra*.

¹⁷ On the Molecular Theory of Evolution (1974).

birth, a new poll showed that only 39% of Americans say they 'believe in the theory of evolution,' while 25% say they do not believe in the theory."¹⁸ Moreover, "there is a strong relationship between education and belief...: 21% of those with high-school educations or less [do not accept TE, whereas] 74% of those with postgraduate degrees [do accept TE]." Insight into this phenomenon may be found in the infamous *Scopes* case, where the Prosecution implored judge John T. Raulston to exclude certain EWT:

"Now, if your honor please, when the experts come in they have to qualify...as expert upon the Bible and experts upon a particular branch of science.... Now, why should these experts know anything more about the Bible than some of the jurors? There is one on there I will match against any of the theologians they will bring down...; he knows more of the Bible than all of them do."

Could it be that the majority of the population, likewise, does not think it needs the input of experts to determine the validity of TE? This is a good possibility because there can be confusion about when expertise is needed.

In addition to meeting basic qualifications, an expert must be able to help the trier understand facts relevant to the case. If the scope of the expert's testimony is with respect to subject matter that a reasonable juror would be able to comprehend without the aid of EWT, then the expert will be inadmissible. An interesting case that dealt with just this matter was *Carroll v. Otis Elevator Co.*,¹⁹ where a child pushed the emergency stop button on an escalator on which Plaintiff was riding, causing Plaintiff to fall, and injure her knee. Plaintiff sued Otis, the manufacturer, alleging that the escalator's "*emergency stop button was unguarded and unreasonably attractive and operable by children.*" Defendant's sole complaint on appeal was

¹⁸ Gallup; Results are based on telephone interviews with 1,018 national adults, aged 18 and older, conducted Feb. 6-7, 2009, as part of Gallup Poll Daily tracking. For results based on the total sample of national adults, one can say with 95% confidence that the maximum margin of sampling error is ± 3 percentage points. Interviews are conducted with respondents on land-line telephones (for respondents with a land-line telephone) and cellular phones (for respondents who are cell-phone only). In addition to sampling error, question wording and practical difficulties in conducting surveys can introduce error or bias into the findings of public opinion polls.

¹⁹ 896 F.2d 210, 214-15 (7th Cir. 1990).

that the trial court abused its discretion by permitting Plaintiff's witness to testify as an expert on the subject of escalator design. Defendant argued that the expert's testimony should not have been admitted because the subject thereof was not "*beyond the ken of the average juror.*" Generally, "*When [expert] opinions are excluded, it is because they are unhelpful and therefore superfluous and a waste of time.*"²⁰ In affirming the lower court's decision to admit the testimony, the Court of Appeals for the Seventh Circuit wryfully held, "*While it is true that one needn't be B.F. Skinner to know that brightly colored objects are attractive to small children...given our liberal federal standard, the trial court was not 'manifestly erroneous' in admitting this testimony....*" Thus, even in ostensibly banal matters courts recognize the utility of expert opinion. Perhaps, with regard to TE, the public should do in kind.

Yet, a critical question in determining the admissibility of EWT is always whether the "*area in which the witness has superior knowledge, skill, experience, or education [comports] with the subject matter of the witness's testimony.*"²¹ In *Carroll*, the expert's area of expertise was "*experimental psychology*". Consequently, the court limited his testimony "*to whether the design features of this allegedly defective escalator stop button would cause young children to push it more than the stop buttons of other escalators.*" The Court found that the expert "*was qualified to opine on this subject because his area of expertise involve[d] human behavior and perception, and his testimony related solely to the attractiveness and accessibility of the stop button to children.*" Accordingly, the expert testified that "*red buttons attract small children, this button was unreasonably easy for a child to push, and that a covered stop button is less accessible to children than an uncovered stop button.*" Scope, therefore, is the defining character of admissible EWT.

²⁰ Fed.R.Evid. 702 advisory committee's note citing 7 Wigmore Sec. 1918. 9.

²¹ *Gladhill v. General Motors Corp.*, 743 F.2d 1049, 1052 (4th Cir.1984).

In the case of *Kitzmiller v. Dover*, Plaintiffs' biology expert, Kenneth Miller, "*a widely-recognized biology professor at Brown University who has written university-level and high-school biology textbooks used prominently throughout the nation,*" testified that TE is "*overwhelmingly accepted*" by the scientific community along with every major scientific association.²² Yet, the proponents of AFBs, such as the Discovery Institute (DI), assert that there is widespread controversy about the validity of evolution and that educators should "*teach the controversy.*" In support of this claim, the DI offers "*A Scientific Dissent from Darwinism,*" a statement that expresses doubt regarding the validity of TE. It reads, "*We are skeptical of claims for the ability of random mutation and natural selection to account for the complexity of life. Careful examination of the evidence for Darwinian theory should be encouraged.*" The DI advertised the statement in periodicals such as "*The New York Review of Books, The New Republic, and The Weekly Standard in October and November of 2001.*" It sought to gain sufficient signatories from individuals in the U.S. with advanced degrees in fields relevant to TE, to bolster their assertion that there was a genuine controversy over its validity. The DI even submitted the list as part of an amicus brief in *Kitzmiller*. However, the "*Scientific Dissent from Darwin*" did not turn out to be as robust as the DI had hoped.

By 2007, after six years, the DI had only managed to recruit 600 signatories. According to the National Science Foundation (NSF), "*in 1999, there were 955,300 biological scientists in the U.S. (about 1/3 of who[m] hold graduate degrees). There were also 152,800 earth scientists in the U.S. as well. Therefore, the 600 [signatories] represent[ed] about 0.054% of the estimated 1,108,100 biological and geological scientists in the US in 1999. In addition, a large fraction of the [signatories] have specialties unrelated to...evolution.*" In fact, 75% "*are not biologists.*" Thus, those on the list who actually qualify to opine on TE, "*roughly 150, represent*

²² 1:94-100 (Miller).

about 0.0157% of the U.S. biologists that existed in 1999.” However, “approximately 40% of the [signatories]” do not even live in the U.S., further depreciating the numbers. Today, the number of signatories hovers around 760.

Yet, it has been asserted that because the language of the statement is so vague and noncommittal, many of the signatories were unclear as to what they were signing. For instance, *“Southeastern Louisiana University philosophy professor Barbara Forrest and deputy director of the National Center for Science Education Glenn Branch comment[ed] on the ambiguity...: ‘Such a statement could easily be agreed to by scientists who have no doubts about evolution itself, but dispute the exclusiveness of...natural selection, when other mechanisms, such as genetic drift and gene flow, are being actively debated.’”* Moreover, *“Skip Evans, also of the [NCSE], suggest[ed] that this confusion has in fact been carefully engineered.”* At least one of the signatories, Robert C. Davidson, a professor at the University of Washington medical school said *“he was shocked”* at the suggestion that there was dissent among qualified scientists over TE. *“It’s laughable,”* he said. *“There have been millions of experiments over more than a century that support evolution. There’s always questions being asked about parts of the theory, as there are with any theory, but there’s no real scientific controversy.... When I joined I didn’t think they were about bashing evolution. What they’re doing is instigating a conflict between science and religion.”*

In response to the DI’s submission of the list as part of their amicus brief in *Kitzmiller*, a petition entitled, *“A Scientific Support for Darwin”* was created in 2005. It generated nearly 8,000 signatures *in 4 days*. Additionally, *“a tongue-in-cheek response known as Project Steve, a list of [only] scientists named Steve²³ who agree that evolution is ‘a vital, well-supported, unifying principle of the biological sciences,’”* was begun in 2003. As of July 12, 2011, the

²³ “People named Steve make up approximately 1% of the total U.S. population.”

“Steve-o-Meter” had 1,168 ‘Steves,’ 51% of whom were biologists. This also included Nobel Prize-winning physicists, Steven Weinberg and Steven Chu.

Although the DI has instigated other lists, most notably “*Physicians and Surgeons who Dissent from Darwinism*” (approximately .02% of U.S. physicians), the overwhelming conclusion is that the “*Scientific Dissent from Darwinism*” is wholly underwhelming. Thus, the first presupposition associated with AFBs—*There is Substantial Conflict Among Qualified Experts Regarding the Viability of the Theory of Evolution*—is clearly unfounded. Nonetheless, it is this type of misleading propaganda that results in erroneous statements going into the Congressional Record like the following from 2001 by the late Senator Robert Byrd (D-WV): “*It is important that students be exposed not only to the theory of evolution, but also to the context in which it is viewed by many in our society.*” “*I, personally, have been greatly impressed by the many scientists who have...concluded that some Divine force had to have played a role in the birth of our magnificent universe.*” Just as unqualified and unreliable EWT can improperly influence a trier of fact, the legislators who support AFBs are influenced by unqualified and unreliable evidence of the scientific community’s position on the validity of TE. Thus, it too should stricken from the record.

Faulty Presupposition Two:
Educators’ Rights to Academic Freedom Have Been Violated
For Challenging the Validity of the Theory of Evolution

The second presupposition requisite with AFBs is essentially that there is a lack of protection for educators’ academic freedom. Otherwise, language like the following from the DI’s Model Academic Freedom Bill would be redundant: “*SYNOPSIS: Existing law does not expressly provide a right...for a public school teacher or [a] teacher at an institution of higher education for presenting scientific information pertaining to the full range of scientific views*

regarding biological and chemical evolution.” In fact, this type of language is indeed redundant because teachers’ rights to academic freedom are thoroughly protected under the law.

Academic Freedom refers primarily to a teacher’s right of *“freedom in the classroom in discussing their subject.”* This is the professional standard defined by the American Association of University Professors (AAUP) in its *“Statement of Principles on Academic Freedom and Tenure,”* and *“endorsed by more than 185 scholarly and professional organizations and incorporated into hundreds of college and university faculty handbooks.”* The AAUP *“is the largest professional organization for higher education in the United States.”*²⁴ Members of *“professors and other academics total nearly 47,000, with over 500 local campus chapters and 39 state organizations.”* The AAUP’s stated mission is to *“advance academic freedom and...to define fundamental professional values and standards for higher education.”* Accordingly, the Supreme Court, in *Keyishian v. The Board of Regents*, established the legal basis for the AAUP’s *“Statement of Principles on Academic Freedom and Tenure.”* Noting that the parties were signatories to the statement, the Court asserted that *“[o]ur nation is deeply committed to safeguarding academic freedom, which is of transcendent value to all of us and not merely to the teachers concerned. That freedom is therefore a special concern of the First Amendment, which does not tolerate laws that cast a pall of orthodoxy over the classroom.”* Clearly, the Court is fierce defender of academic freedom and there professional and legal safeguards that make AFBs superfluous.

Notwithstanding, courts have held that academic freedom is a protected right only as long as the speech is *“advances an academic message.”* In *Bonnell v. Lorenzo*, the Court held, *“while a professor’s right to academic freedom and freedom of expression are paramount in the*

²⁴ Public Services Quarterly Volume 7, Issue 1-2, 2011, Special Issue: Rethinking Reference, Intellectual Freedom DOI:10.1080/15228959.2010.520593 Emily Knoxa* pages 49-55

academic setting, they are not absolute.” The speech must be “*germane to the subject matter.*” Moreover, the scope of teachers’ academic freedoms have been further refined by the concept of “*institutional academic freedom.*” In *University of California v. Baake*, the Supreme Court noted a supervening right to academic freedom held by academic institutions. “*Academic freedom means that the university can determine for itself on academic grounds: 1. who may teach, 2. what may be taught, 3. how it shall be taught, and 4. who may be admitted to study.*” Thus, while academic freedom is undoubtedly a high priority in the U.S., it must always be tempered by relevance to the topic at hand.

Nonetheless, there are still those who feel that academic freedom is being curtailed of those who challenge TNS. In fact, a recent movie entitled *Expelled: No Intelligence Allowed*, starring talk-show host, Ben Stein, was released in theaters nationwide in 2008 and featured this very premise. The movie would otherwise be a forgetful propaganda piece were it not for the fact that it was used by members of the DI along with Stein to lobby state legislators to promote AFBs. In fact, on March 12, 2008, Florida Rep. Alan Hays, sent “*An exclusive invitation to members of the Florida Legislature...to attend an exclusive pre-screening...[of Expelled, which] follows Ben Stein on his journey...where he discovers that scientists, educators and philosophers are being persecuted because they dare to go against the theory of evolution.*” Moreover, anti-evolutionist instructional materials were sent to private schools across the country by the movie’s promoters in order to garner support, and even encouraged students to “*TAKE THE EXPELLED CHALLENGE: The school that brings the most people to see EXPELLED wins \$10,000!*”

Thankfully, the movie was met with limited success due to reviews like that of the *New York Times*, which described it as “*a conspiracy-theory rant masquerading as investigative inquiry.*” Yet, the film’s technique—arguing for conclusions drawn from unrepresentative

samples—highlights serious flaws with such inductive methodologies and the movement to oppose TE at large. Availability bias occurs when an individual draws conclusions about a set of data from only the subsets most accessible to him. A good example is the distorted risk of crime of some viewers of local news due to its disproportionate coverage of high-profile crimes. Additionally, selection bias can also skew conclusions drawn from inductive methodologies, as control groups comprised of confounded data serve as an unreliable comparison. Accordingly, courts have always been leery of relying too heavily on conclusions drawn from studies of individuals, known as case reports, without a controlled assessment. In *Hall v. Baxter Healthcare Corp.*,²⁵ the court noted that case reports “cannot be the basis of an opinion based on scientific knowledge.” Nonetheless, in an interview in the April 14, 2008 issue of *Newsweek*, Stein confidently asserted, “There are a number of scientists and academics who’ve been fired, denied tenure, lost tenure, or lost grants because they even suggested the possibility of intelligent design. The most egregious is Richard Sternberg at the Smithsonian, the editor of a magazine that published a peer-reviewed paper about ID. He lost his job.” Stein would be wise to take a lesson from the *Hall* Court, however, because the case of Richard Sternberg is a perfect example of why conclusions drawn from case reports are so inherently unreliable.

Sternberg is a scientist who completed a BS degree from University of South Carolina and has two PhDs: one, in molecular evolution from Florida International University, and the other, in systems science from Binghamton University. He was the editor of the scientific journal *Proceedings of the Biological Society of Washington* from 2004-2007. He is also an advocate of ID, and believes it deserves to be part of the discussion about evolution and the origin of life on Earth. Sternberg has been openly critical of the mainstream in evolutionary biology for refusing to even consider alternatives or challenges to strict neo-Darwinism.

²⁵ 947 F. Supp. 1387, 1411 (D. Or. 1996).

On December 11, 2006, the U.S. House of Representatives Subcommittee on Criminal Justice, Drug, Policy, and Human Resources ostensibly issued a report entitled, *“Intolerance and the Politicization of Science at the Smithsonian: Smithsonian’s Top Officials Permit the Demotion and Harassment of Scientist Skeptical of Darwinian Evolution.”* The report was commissioned by Mark Souder (R-IN) as subcommittee chairman. In August of 2005, subcommittee staff initiated their own investigation into the possible mistreatment of Sternberg at the hands of officials at the Smithsonian’s National Museum of Natural History (NMNH). The investigation concluded that *“[it] is...clear that a hostile work environment was created with the ultimate goal of forcing Dr. Sternberg out of the Smithsonian.”* Despite this finding, the OSC was unable to pursue its investigation *“due to a question of jurisdiction.”* Nonetheless, the report notes that the investigation by subcommittee staff made the following findings:

- *Substantial, credible evidence of efforts to abuse and harass Dr. Sternberg because of his role in the publication of a paper on “the theory of intelligent design” and his views on evolution.*
- *Scientists who are known to be skeptical of Darwinian theory cannot expect to receive equal treatment or consideration by NMNH officials.*
- *NMNH officials have made clear their intent to prevent any scientist publicly skeptical of Darwinian theory from ever being appointed as a Research Associate, no matter how sterling his or her professional credentials or research.*
- *Since the treatment of Dr. Sternberg came to light in early 2005, evidence has accumulated of widespread invidious discrimination against other qualified scientists who dissent from Darwinian theory and/or who are supportive of intelligent design.*

The Report recommends the following actions be taken:

“Congress should consider statutory language that would protect the free speech rights regarding evolution of scientists in the Smithsonian and other federally-funded institutions.”

Though on its face Sternberg’s case, as characterized by Souder’s Report, seems like a genuine example of discrimination, like the anti-evolution movement at large, there is little truth by the claims.

The Report is actually not an official document of the Committee; it was published by Souder as an individual representative without it gaining any official standing by the Committee, which never formally accepted it. This is contrary to claims by the DI and OTEs that have asserted that the report represents an official position by the Committee supporting Sternberg's claims of discrimination. Moreover, in 2001, Sternberg became the unpaid managing editor of *Proceedings of the Biological Society of Washington* (PBSW), a taxonomic journal which usually publishes descriptions of newly-identified species. In June 2004, Sternberg circumvented normal editorial policies of the Journal and published a paper by Stephen Meyer advocating ID: "*The origin of biological information and the higher taxonomic categories.*"²⁶ Though his superiors were justifiably critical of Sternberg's actions for violating the Journal's editorial policies, they by no means forced Sternberg to quit. He had already issued his resignation in October of the previous year. Moreover, the appendix to Souder's Report contains a letter from the director of the Smithsonian in which it is revealed that the inaction on the part of the Smithsonian officials to which the report refers is regarding Sternberg's demand that they give him a \$300,000 grant to make up for his allegedly lost research time. Plus, in 2004 he was given another three-year appointment as an unpaid research associate. And in November of 2006, he received still another three-year appointment at the NMNH.

Moreover, there is substantial evidence that Sternberg was biased in the matter. He had close connections to Meyer, which suggest at least the appearance of a conflict of interest. For instance, in 2002, Sternberg presented a lecture on ID at the Research And Progress in Intelligent Design (RAPID) conference where Meyer was also a presenter. The explicit purpose of the conference was to "*form new collaborations among scientists seeking to do research on the interface between science and faith, particularly within the context of ID.*" Only ID advocates

²⁶ Vol. 117, no. 2, pp. 213-239.

spoke at the conference, and it was organized and hosted by the International Society for Complexity, Information and Design (ISCID), a group dedicated to promoting ID, of which Sternberg is a Fellow. ISCID is directly affiliated with the DI, where Meyer serves as the Program Director of the Center for Science and Culture. Critics also note that Sternberg sat on the editorial board of the Baraminology Study Group, which studies “*creation biology*” and whose website is hosted by Bryan College, a conservative Christian school named after anti-Darwin lawyer William Jennings Bryan, made famous in *Scopes*.

The American Association for the Advancement of Science (AAAS), in a position statement describing the events around the controversy, said “*Given these associations, Dr. Sternberg would appear to be, at very least, an advocate for 'intelligent design' and critical of standard peer review processes as they bear on the scientific assessment of the 'intelligent design' hypothesis.*” Critics describe Sternberg's explanation of events, that a pro-ID paper *just happened* to find its way to a publication with a sympathetic editor responsible for ensuring proper peer review as improbable and that “*people who want us to believe that the publication process outlined [by Sternberg and DI] was transparent and only had to do with science*” [are] “*disingenuous.*”

Moreover, there is strong suggestion of bias behind the Report itself. Souder has longstanding connections to the DI. On May 10, 2000, Souder and then representative, Charles Canady (R-FL) hosted a congressional briefing on behalf of the DI. This did not sit well with certain biology professors at Baylor University as the congressional record demonstrates:

Mr. SOUDER. Mr. Speaker, on June 1, [2000] I received a letter that was written by seven members of the biology department...from Baylor University in response to my co-hosting a recent conference on intelligent design, the theory that an intelligent agency can be detected in nature, sponsored by the Discovery Institute. The professors denounced intelligent design as pseudo science. Nevertheless, many of us continue to be concerned about the unreasoning

viewpoint discrimination in science. As the Congress, it might be wise for us to question whether the legitimate authority of science over scientific matters is being misused by persons who wish to identify science with a philosophy they prefer. I want to thank Philip Johnson of the University of California at Berkeley...and others in drafting this response.

Faulty Presupposition Three:
There Exists Scientifically Valid Evidence
That Challenges the Viability of the Theory of Evolution

The third and most important faulty presupposition inherent with AFBs is whether there are indeed valid criticisms of TE which students and teachers in public schools should be free to discuss. If there are no valid criticisms of course, the legislation is moot because educators are obliged to restrict their in-class speech to that which conveys a valid “*academic message*.” In its “*Statement on Academic Freedom*,” the AAUP explained: “[I]t is highly needful, in the interest of society at large, that what purport to be the conclusions of men trained for, and dedicated to, the quest for truth, shall in fact be the conclusions of such men.” By allowing local teachers and school boards to circumvent state curriculums, AFBs present an opportunity for unwary or even unscrupulous educators to introduce speech in the public classroom that falls below this standard, to wit, the following.

The Claim: ‘*Science textbooks propound misinformation about the scientific validity of commonly cited examples of evolution.*’

Expert: Jonathan Wells

Current Position: Senior Fellow, Discovery Institute

Advanced Degrees: Ph.D. Molecular and Cell Biology, University of California at Berkeley; Ph.D. Religious Studies, Yale University.

Publications: *Icons of Evolution: Science or Myth? Why Much of What We Teach About Evolution Is Wrong*, 2002.

Potential Conflicts: Religiously motivated to discredit evolution.²⁷

Along the spectrum from specious to valid among scientific theories purporting to discredit TE, Jonathon Wells’ *Icons of Evolution: Science or Myth? Why Much of What We*

²⁷ "Father's [Sun Myung Moon's] words, my studies, and my prayers convinced me that I should devote my life to destroying Darwinism.... When Father chose me...to enter a Ph.D. program in 1978, I welcomed the opportunity to prepare myself for battle." --Jonathan Wells, Darwinism: Why I Went for a Second Ph.D.

Teach About Evolution Is Wrong (Icons) would undoubtedly lie at the periphery of the former. In it, he discusses ten examples of TE, which he alleges are invalid or fraudulent, that have historically been used, primarily for illustrative purposes, in high-school textbooks. Although the book was lambasted by critics in the scientific community, it is still promoted as a credible source of scientific information by OTEs, and was even listed among the as supplemental reading materials in Ohio's proposed Grade 10 model lesson plan on TE. Jerry Coyne, Ph.D., a biology professor at the University of Chicago, has been an outspoken critic of the book and authored a review that appeared in the journal, *Nature*.²⁸ He wrote, "*Jonathan Wells' book rests entirely on a flawed syllogism: ...textbooks illustrate evolution with examples; these examples are sometimes presented in incorrect or misleading ways; therefore evolution is a fiction.*" Additionally, the journal *Quarterly Review of Biology* published a review entitled "*The Talented Mr. Wells*" by Kevin Padian, Ph.D., professor of Integrative Biology at the University of California, Berkeley, and Alan Gishlick, Ph.D., professor of geology at Gustavus Adolphus College. In their review, professors Padian and Gishlick compare Wells's book to the type of manipulation artfully employed by the protagonist in the movie, *The Talented Mr. Ripley*. "*This kind of distortion,*" they write, "*misleading by the omission of important information, is the basis of Icons of Evolution.*" The authors also note that Wells,

"appears not to know the difference between direct and collateral ancestry. He completely mistakes scales of time in Darwin's finches and other natural examples of selection rates. He rails against artists' drawings of ape-like humans that, in his view, 'justify materialistic claims that we are just animals,' as if the drawings were evidence. In discussing mutant fruit flies, he argues that changes in DNA have nothing to do with the expression of new features—which should surprise the professors in the department that gave him his PhD."

²⁸ Review of : Jonathan Wells - Icons of Evolution: Science or Myth? in *Nature*, 410, (2001) 745-46.

They conclude by noting that *Icons* “can scarcely be considered a work of scholarly integrity.”

Yet, *Icons* is one of the texts that will likely be used as supplemental information under the LSEA or other similar AFBs. As researcher Bruce Grant noted, “*unfortunately [Wells] is probably pretty convincing to people who really don’t know the primary literature in this field.*”

The last chapter of *Icons* urges readers to lobby Congress to eliminate research funding for evolutionary biology. Perhaps most disturbingly, in the book’s appendix, and on Wells’ website, www.iconsofevolution.com, he offers templates of stickers that he encourages students to paste into textbooks over passages that he disclaims, essentially encouraging students to deface educational materials paid for by taxpayers. Wells is more concerned with politics than science. AFBs that clear a path for the introduction of this type of publication into the public classroom would not only harm students’ scientific education, it would deepen social and political divisions.

The Claim: The Theory of Natural Selection (TNS) is refuted by biological structures that are “*irreducibly complex*,” meaning they could not have arisen incrementally.

Expert: Michael Behe

Current Position: Senior Fellow, Discovery Institute; professor of biological sciences at Lehigh University

Advanced Degrees: Ph.D. biochemistry, University of Pennsylvania

Associations: Center for the Science and Culture, Senior Fellow

Publications: *Darwin’s Black Box: The Biochemical Challenge to Evolution*, 1996.

Potential Conflicts: Affiliated with political and religious organizations opposed to evolution.

The origin of the Intelligent Design (ID) movement has been dated to 1996 with the publication of professor, Michael Behe’s book, *Darwin’s Black Box: The Biochemical Challenge to Evolution*. It was in this same year that the Discovery Institute (DI) received a three-year grant from religious benefactors in the amount of \$750,000 to fund the Center for Science and Culture, the primary lobbying arm for ID. Thereafter, Behe’s theory of irreducible complexity

(IC) served as the primary evidence against TNS. IC states that TNS fails because certain biological systems are too complex to have arisen incrementally. As Behe puts it,

"By irreducibly complex, I mean a single system which is necessarily composed of several well-matched, interacting parts that contribute to the basic function, wherein the removal of any one of the parts causes the system to effectively cease functioning."

Interestingly, this echoes Darwin's own sentiment in *Origin* where he noted, *"If it could be demonstrated that any complex organ existed, which could not possibly have been formed by numerous, successive, slight modifications, my theory would absolutely break down."* Behe claims to have found just such complex organs in the bacterial flagellum, the blood clotting system, the visual cascade, and vesicular transport. The reader should be mindful that the following pages detail the strongest arguments OTEs and proponents of ID have asserted, and these are the theories that may wind up in public science classes if AFBs are not resoundingly rejected.

From the outset there were problems with IC. When *Darwin's Black Box* was first published, several commentators noticed a flaw in Behe's reasoning. IC claims to demonstrate the failure of TNS to incrementally lead to a complex organ, but the scenario in which Behe purports to demonstrate this inability is one that involves the removal of a part from an already fully-formed organ. Behe acknowledged this in an article entitled, *"A Reply to My Critics,"* published in 2001 in the journal *Biology and Philosophy*. He wrote, *"The difficult task facing Darwinian evolution...would not be to remove parts from sophisticated pre-existing systems, it would be to bring together components to make a new system in the first place. Thus, there is an asymmetry between my current definition of irreducible complexity and the task facing natural selection. I hope to repair this defect in future work."* Four years later, however, during cross examination in *Kitzmiller*, the attorney for Plaintiffs asked,

Q. "You haven't repaired that defect, have you, Professor Behe?"

A. "No, I did not judge it serious enough to do so yet. I thought that was an interesting philosophical turn on my discussion,...but that is not -- that is not -- I did not consider that to be relevant to biology."

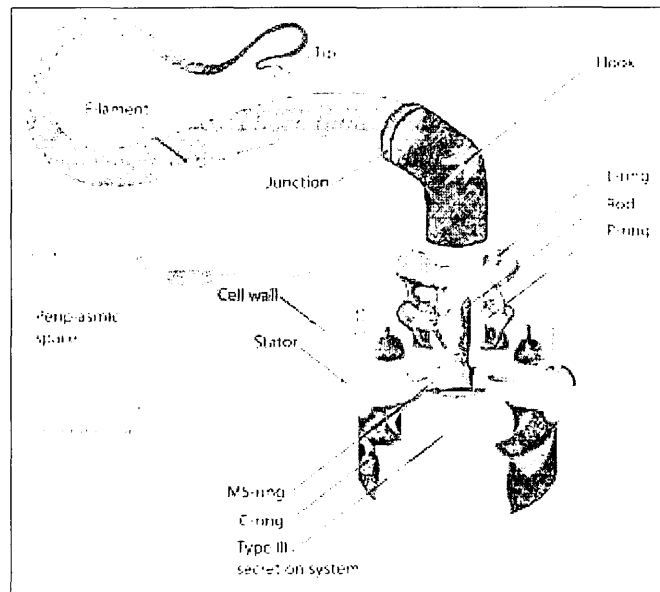
Q. Okay. The task facing natural selection, that's not relevant to biology?

A. No...I don't think is really relevant to biology."

In the Court's opinion, however, it was quite *"relevant to biology,"* noting, "[Behe failed] to properly address the very phenomenon that irreducible complexity purports to place at issue, natural selection."

Beyond the definitional stage, the problems for IC only get worse. The bacterial flagellum has been described as the *"poster child"* for IC. A bacteria, of course, is a single-celled microorganism; the flagellum *"is a tail-like projection that protrudes from the cell body"*

that aids in locomotion. (One thinks of the oft seen image of sperm cells *"swimming"* towards an egg by using their tails for propulsion.) Flagella are made of biochemical compounds, proteins, found within the cell, and each flagellum employs approximately 30 different proteins to function as a locomotive device. According to IC, the



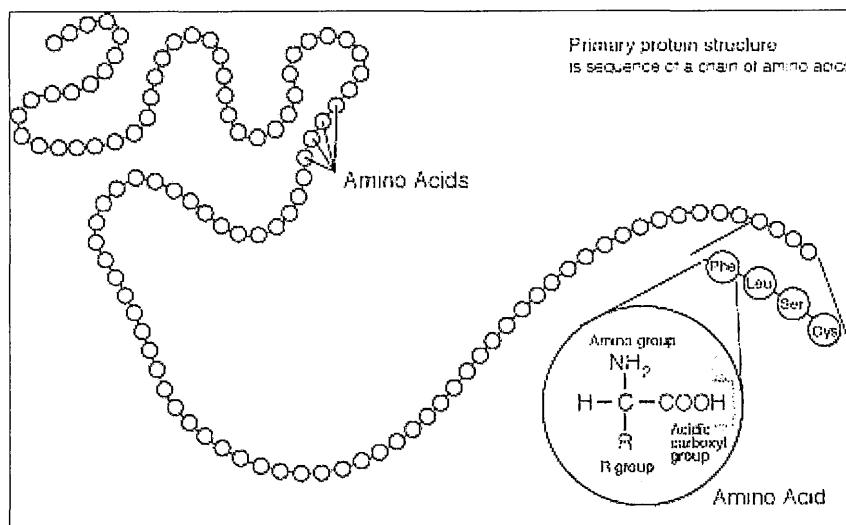
removal of any one of these proteins should result in the cessation of function, and since a non-functioning flagellum would be maladaptive, natural selection would select against organisms that had anything less than a fully-functioning flagellum. In other words, the flagellum, *"would have to arise as an integrated unit in one fell swoop for natural selection to have anything to act on"* according to Behe.

To illustrate the concept of IC, Behe often analogizes to a mousetrap. In order to trap a mouse he states, each component of the mousetrap is needed: the wooden platform, the spring, the hold-down bar, the hammer that catches the mouse, and the catch that holds the bait. *'What good is a mouse trap without a platform to hold the parts in place, or the spring to provide the energy to release the hammer,'* Behe asks? Plaintiff's expert Kenneth Miller answered this question by showing up at the courthouse one day wearing part of a mousetrap as a tie clip. Miller's point was that *functionality can shift* through the evolution of a trait, a concept known as "*exaptation*." Thus, a trait can evolve because it served one particular function at one time, and then later, came to serve another. And this is precisely what Miller would demonstrate occurred in Behe's so-called irreducibly complex bacterial flagellum.

In Miller's expert report, he described a precursory function of the flagellum called the Type III Secretory System (TTSS), which utilizes only ten proteins instead of thirty. *"Certain pathogenic bacteria attack human cells by means of a specialized protein secretory system that injects protein toxins into the cells of their host. Molecular studies of the proteins in the TTSS have revealed [that] the proteins of the TTSS are directly homologous to the proteins in the...bacterial flagellum."* What Miller means here is that the proteins in the flagellum and the proteins in the TTSS have a common evolutionary origin, and thus the bacterial flagellum did not have to arise "*in one fell swoop*" as Behe suggests; instead, it evolved from the TTSS.

Molecular biologists reach this conclusion by employing a well-established technique called homology modeling of proteins. Proteins are biochemical compounds comprised of amino acids in a single chain called a polypeptide. Amino acids are molecules containing groups of elements, one of which is called the amino group, and one is called the carboxylic acid group. A third variable group distinguishes the different types of amino acids. A chemical reaction

between amino groups and carboxyl groups causes the release of a single molecule of water, which bonds the amino acids together. The chain may then fold in on itself taking a variety of shapes



which facilitate certain biological function, e.g. the parts of the bacterial flagellum.

The specific sequence of amino acids in any protein is genetically determined; thus, by sequencing the genetic information of proteins, scientists are able to infer the sequences of amino acids in proteins. Homology modeling uses known sequences to which an unknown sequence can be compared. The closer the two samples map each other in the sequence of amino acids, the more closely they are evolutionarily related. A simpler, but less reliable technique involves looping a shorter sequence for use as the comparison model. Of course, because less of the actual sequence of amino acids is known, the potential for error is higher with this technique. Nonetheless, shortly after *Darwin's Black Box* was published, biologist Jerry A. Coyne wrote a review of the book for the journal *Nature*, in which he described homology modeling techniques using complete genetic sequencing of proteins. This conclusively demonstrated the evolutionary link between the TTSS and the bacterial flagellum, essentially debunking Behe's theory of IC.²⁹

However, after these criticism came to light, Behe revised his definition of IC, as the following exchange between him and Plaintiff's attorney in *Kitzmiller* demonstrates.

²⁹ Nature 383, 227-228 (19 September 1996) | doi:10.1038/383227a0, Jerry A. Coyne, God in the details.

Q. And as you testified, I believe, on Monday, a scientist named Alan Orr noted an ambiguity in your definition?

A. Yes.

Q. And you tweaked that definition?

A. Right.

Q. I'm going to read [the tweaking you described you did in response to Alan Orr]. And I've called it here the modified definition of irreducible complexity from Darwin's Black Box. What it says is, 'By irreducibly complex, I mean a single system which is necessarily composed of several well-matched, interacting parts that contribute to the basic function, wherein the removal of any one of the parts causes the system to effectively cease functioning. An irreducibly complex system cannot be produced directly, that is by continuously improving the initial function which continues to work the same mechanisms by slight successive modifications of a pre-cursor system, because any pre-cursor to an irreducibly complex system that is missing a part is, by definition, non-functional.'"

However, as Plaintiff's expert Miller noted, this qualification—that only the current function of a biological mechanism may be considered when assessing IC—renders it meaningless as a criticism of the theory of natural selection (TNS), because TNS *"proffers exaptation as a well-recognized, well-documented explanation for how systems with multiple parts could have evolved through natural means."* IC does nothing; plus, Behe testified that there are no *"peer reviewed articles by anyone advocating for intelligent design supported by pertinent experiments or calculations which provide detailed rigorous accounts of how intelligent design of any biological system occurred,"* nor did he *"report any new data or original research in Darwin's Black Box."*

Miller writes that this lack of empirical support fatally undermines IC. *"The assertion that cellular machines [such as bacterial flagella] are irreducibly complex, and therefore provide proof of design, has not gone unnoticed by the scientific community. A number of detailed rebuttals have appeared in the literature, and many have pointed out the poor reasoning of recasting the classic argument from design in the modern language of biochemistry (Coyne 1996; Miller 1996; Depew 1998; Thornhill and Ussery 2000)."* Biologist Jerry Coyne criticized

Behe for leaving out relevant information contradictory to IC, writing, Behe “*fail[ed] to deal honestly with the evidence for evolution.*” Moreover, in his review for the journal, *The Quarterly Review of Biology*, professor of ecology, Neil Blackstone³⁰ wrote, “*Behe...has indulged in some very poor scholarship. He has oversimplified evolutionary theory, made implausible assumptions, committed errors in logic, ignored the relevant literature, and neglected the proper methodology.*”

Behe also seems to have a conflicted regard for the importance of peer review. In *Darwin's Black Box*, he includes a chapter entitled, “*Publish or Perish,*” and writes, “*the theory of Darwinian molecular evolution has not published, and so it should perish.*” Aside from being a blatant misstatement of fact, as would be demonstrated in *Kitzmiller*, Behe acknowledges that there are no articles in peer-reviewed scientific journals arguing for the irreducible complexity of complex molecular systems, and yet he obviously still holds to his convictions about the validity of IC notwithstanding. He also touts the fact that *Darwin's Black Box* was peer reviewed as one of the strengths behind his claims. When asked if he “*would agree that peer review for a book published in the Trade Press is not as rigorous as the peer review process for the leading scientific journals,*” Behe vehemently disagreed, stating,

“No, I would not agree with that. The review process that the book went through is analogous to peer review in the literature, because the manuscript was sent out to scientists for their careful reading. Furthermore, they read it more carefully than most scientists read typical manuscripts that they get to review because they realized that this was a controversial topic. So I think, in fact, my book received much more scrutiny and much more review before publication than the great majority of scientific journal articles.”

³⁰ Ph.D., 1985, Yale University; B.A.

Articles in scientific journals are usually submitted to two or three scientists for review. While *Darwin's Black Box* ostensibly had more than that, it was certainly not the case that it was subjected to "*careful reading*" or even well received.

Four of the five reviewers that Behe cites were Michael Atchison, Robert Shapiro, K. John Morrow, and Russell Doolittle, all of whom have made statements that contradict or do not support Behe's claim of the book passing a rigorous peer review. Under cross examination, Behe was forced to acknowledge that one of the reviewers, a biochemist at the Veterinary School at the University of Pennsylvania, by the name of Michael Atchison, did not, in fact, perform a review of the book at all. In an article for a Christian website, Atchison recounts being contacted by the publisher of *Darwin's Black Box* for a recommendation as to whether it sounded like a good book to publish: "*I received a phone call from the publisher in New York. We spent approximately ten minutes on the phone. After hearing a description of the work, I suggested that the editor should seriously consider publishing the manuscript. We hung up, and I never thought about it again.*" When asked if that was his "*understanding of the kind of peer review Dr. Atchison did of [his] book,*" Behe replied, "*No, it wasn't. I thought he had received a copy of the manuscript and went through it. So -- but -- so, yes, I was under a different impression.*" Reviewer Robert Shapiro confirmed that he at least reviewed the book, but thought its conclusions were false. Had the book been submitted to a peer-reviewed journal and this comment appeared, Shapiro's review would have forced the removal, or at least reformulation, of the theory of IC. Reviewer K. John Morrow described the book as "*appalling*" and "*unsupported.*" Russell Doolittle, upon whom Behe based much of his discussion of blood clotting, described it as "*misrepresenting many important points*" and

"disingenuous." On the other hand, when it comes to evidence that refutes IC, Behe's standards are unreasonably stringent and his methods of verification incompetent.

The vertebrate immune system is another of the biological systems Behe argues is irreducibly complex. He states that the complex proteins that *"initiate a cascade of enzymatic reactions"* to ward off invading microorganisms would not function if any of the component proteins were missing. Moreover, he testified that there was no peer-reviewed literature documenting a *"rigorous"* analysis of the possible evolutionary pathways of the vertebrate immune system. He came to this conclusion by performing *"a literature search"* on a popular database called Pubmed, which archives peer-reviewed journal articles and is maintained by the National Institutes of Health. Behe entered the search terms *"vertebrate immune system"* and *"random mutation"* into the database and then reviewed the articles produced by this search, which totaled less than ten. However, he did not search a closely related term for random mutation, *"transposition,"* which has been well-established as a genetic phenomenon upon which TNS acts to produce morphologic changes. In fact, in 1983, the Nobel Prize was awarded to the scientist who discovered these *"jumping genes,"* as they were described due to their seemingly haphazard disappearance and reappearance throughout the genome. Moreover, the term *"transposition"* actually appeared in several of the titles of the ten or so articles that Behe did review. Thus, his review of the literature seems to be either biased or inept.

When Plaintiff's counsel performed a similar literature search using the term *"transposition"* it produced fifty articles, ranging in dates from 1973-2005, the same year as the trial. When presented with these articles and the assertion that they rebutted his suggestion that the scientific literature contains no rigorous explanation for how the vertebrate immune system arose, Behe disagreed saying, *"They're wonderful articles. They're very interesting. They simply*

just don't address the question that I pose". Behe explained that in order to affirm the evolutionary origins of the vertebrate immune system, he would need, "a step-by-step, mutation by mutation analysis, I would also want to see relevant information such as what is the population size of the organism in which these mutations are occurring, what is the selective value for the mutation, are there any detrimental effects of the mutation, and many other such questions." "But," as was noted in The Quarterly Review of Biology, "this is an absurd demand, which is never met in any other scientific domain, and is certainly not met by ID creationists themselves when they propose "design" as an alternative explanation."³¹ Moreover, when asked if he had actually "undertaken to try and figure out those [questions]," Behe merely replied, "I am not confident that the immune system arose through Darwinian processes, and so I do not think that such a study would be fruitful," an utterly unsatisfactory answer for a scientist with any integrity.

Plaintiff's counsel further proceeded to provide Behe with multiple treatises on the evolutionary origins of the vertebrate immune system, stacking them on the witness stand in front of Behe while reading titles such as, Evolution of Immune Reactions, Origin and Evolution of the Vertebrate Immune System, Evolution and Vertebrate Immunity, Evolution of Vertebrate Immunity, the Phylogenesis of Immune Functions, the Evolutionary Mechanisms of Defense Reactions, and Immunity and Evolution. Although Behe responded that he had not read any of these books, he held fast to the position that they did not provide the sort of "rigorous" analysis that he would need to conclude that the vertebrate immune system arose incrementally. Plaintiff's counsel queried, *"all of these materials I gave you and, none of them in your view meet the standard you set for literature on the evolution of the immune system?"* Behe replied,

³¹ "Irreducible Incoherence and Intelligent Design: A Look into the Conceptual Toolbox of a Pseudoscience," Vol. 85, No. 4; December 2010.

"yes, in my, in the reading I have done I have not found any such studies." Behe then asked Counsel, "would you like your books back? They're heavy."

In his review³² of Behe's analysis of the vertebrate immune system in *Darwin's Black Box*, Robert L. Dorit, Ph.D.,³³ a professor and researcher of "experimental...approaches to molecular evolution," quoted none other than Charles Darwin. Dorit wrote that shortly after *Origin* was released, Darwin sent a letter to friend and colleague Charles Lyell imploring, "Will you honestly tell me (and I should be really much obliged) whether you believe that the shape of my nose was ordained and 'guided by an intelligent cause?'" In a similar bout of exasperation, Dorit goes on to write, "as a practicing biologist..., I cannot but find the premise of this book—that 'molecular discoveries have plunged a wooden stake through the heart of Darwinian logic'—ludicrous." He then proceeded to detail six "fallacies" in *Darwin's Black Box*:

- *Fallacy one*: There is a boundary between the molecular world and other levels of biological organization.
- *Fallacy two*: The current utility of a given feature (molecular or otherwise) explains "why" the feature originally evolved.
- *Fallacy three*: Unless we can identify advantages for each imaginary gradual step leading to a contemporary bit of biochemistry, we cannot invoke a Darwinian explanation.
- *Fallacy four*: Molecular evolution: "a lot of sequences, some math, and no answers."
- *Fallacy five*: There is a conspiracy of silence among scientists concerning the failure of Darwinian explanation.
- *Fallacy six*: The evolution of complexity is unaddressed and unexplained.

Dorit concludes by writing, "Although I do not doubt the sincerity of the author..., the case...put forth in *Darwin's Black Box* is built on some deep misunderstandings about evolution, molecular organization and, ultimately, about the nature of scientific inquiry."

³² "American Scientist"

³³ Harvard University

Though Behe may have coined the term “*Irreducible Complexity*,” the idea has been around for centuries, if not longer. In fact, in *Origin*, Darwin wrote, “*To suppose that the eye with all its inimitable contrivances for adjusting the focus...could have been formed by natural selection, seems, I freely confess, absurd in the highest degree.*” The cognitive dissonance associated with complexity is a result of the fact that in their daily lives, humans never directly experience natural forces that could create complexity on this order, nor will they ever directly experience these types of forces because of the geologic time scales upon which they act. Nonetheless, science has shown repeatedly that given enough time, even organs as complex as the eye, or the vertebrate immune system, or the bacterial flagellum, can be explained through the gradual, incremental changes through TNS. Consequently, to introduce such unsupported theories into the public schools, even if they *seem* plausible to the non-expert, would jeopardize the integrity of students’ science education.

Alternative Theories to Evolution

If the most common criticisms of TNS are specious and the best argument propounded by OTEs is flawed and unsupported, are there any positive arguments that provide an alternative theory as to how life on earth arose?

Biblical Creationism

Biblical creationists, of course, promote the idea that the origins of man may be found in the Book of Genesis, and that scientific data, “*creation science*”, bares this out. In fact, on March 19, 1981, the Governor of Arkansas signed into law Act 590 of 1981, entitled “*Balanced Treatment for Creation-Science and Evolution-Science Act*,” which mandated that “*Public schools within this State shall give balanced treatment to creation-science and to evolution-science.*” The Act set forth the specific theories that “*creation science*” entailed:

(a) Creation-science includes the scientific evidences and related inferences that indicate: (1) Sudden creation of the universe, energy, and life from nothing; (2) The insufficiency of mutation and natural selection in bringing about development of all living kinds from a single organism; (3) Changes only within fixed limits of originally created kinds of plants and animals; (4) Separate ancestry for man and apes; (5) Explanation of the earth's geology by catastrophism, including the occurrence of a worldwide flood; and (6) A relatively recent inception of the earth and living kinds.

Act 590 was it issue in *McLean v. Arkansas*, in which a group of local ministers and educators sued the State Board of Education contending that the Act constituted an establishment of religion, violated their right to academic freedom, and was unconstitutionally vague.

In support of these ideas, the defense submitted the testimonies of Norman Geisler, Ph.D., a philosopher, Hilton Fay Hinderliter, Ph.D., a nuclear physicist, and Robert V. Gentry, M.S., also a nuclear physicist. However, the experts all relied on and propounded the views that the idea of creation described in the Act—*creatio ex nihilo*—sudden creation from nothing, is the concept of creation by God, an inherently religious concept and an clear violation of the First Amendment's Establishment clause. Dr. Geisler, however, argued that “*teaching the existence of God is not religious unless the teaching [sought] a commitment to God*” from the student. The Court held that this was “*contrary to common understanding and contradict[ed] settled case law.*” Moreover, the Court held that without the “*unifying idea of supernatural creation by God...the remaining parts of the [Act] explain nothing and are meaningless assertions.*” For example, the “*separate ancestry of man and apes*” was simply a bald assertion, explaining “*nothing and refer[ing] to no scientific fact or theory.*” Consequently, the Court ruled that “*the State failed to produce any evidence...[that] anyone considered the legitimate educational value of the Act. It was simply and purely an effort to introduce the Biblical version of creation into the public school curricula.*” Beyond being scientifically indefensible and unconstitutional, Biblical Creationism is pedagogically unsound, and is therefore unavailing as an alternative to TE.

Specified Complexity

In the years since *McLean*, OTEs evolved a more nuanced positive argument beyond creationism, in order to circumvent Establishment clause problems encountered by supernatural theories. Rather than the Judeo-Christian God, OTEs posit a nondescript “*intelligent designer*” as an alternative to TE, and at least on its face, the theory that life on earth³⁴ was designed does not necessitate supernatural causation.

Michael Dembski, Ph.D. is a proponent of the idea that intelligent design (ID) is not necessarily religious in nature. As one of Defendant’s experts in *Kitzmiller*, Dembski noted the definition of ID in his expert report: “*Intelligent design is the field of study that investigates signs of intelligence. It identifies those features of objects that reliably signal the action of an intelligent cause.*” He goes on to describe a theory called “*Specified Complexity*” (SC) that allegedly supports ID. SC was first introduced in his book, *The Design Inference* and further developed the follow up, *No Free Lunch*. Dembski cites Carl Sagan’s novel, *Contact*, as illustrative of the principles of SC: “*In that novel, radio astronomers discover a long sequence of prime numbers from outer space. Because the sequence is long, it is complex. Because the sequence is mathematically significant...it is also specified. Thus,...the radio astronomers...observe specified complexity in this sequence of numbers [and]...have convincing evidence of extraterrestrial intelligence.*” Dembski goes on to cite real-world examples of scientific disciplines that supposedly employ a similar search for design. “*Many special sciences already employ specified complexity as a sign of intelligence—notably forensic science, archeology, and the search for extraterrestrial intelligence (SETI). Accordingly, design in*

³⁴ A designer of the universe necessitates supernatural causation as this requires any entity to work outside the laws of nature.

cosmology and biology is scientifically detectable, and intelligent design constitutes a legitimate scientific theory.”

Indeed, the mere search for design is a key element in the forensic sciences and the legal system, and by no means necessitates the supernatural. In fact, in a recent interview, evolutionary biologist, author, and noted atheist, Richard Dawkins stated, “*It is even possible the whole of life on this planet has been intelligently designed by some vastly superior alien from outer space.*”³⁵ To wit, the Raelian Movement is a “*scientific religion*” that teaches that life on Earth was created by a race of space aliens. Raelians reject evolution and creationism, and in 2002, officially endorsed the Dembski and other OTEs’ efforts to teach ID in public schools³⁶. Moreover, Plaintiff’s expert in *Kitzmiller*, John Haught, Ph.D., noted that proponents of ID have even suggested that the designer could be time-traveling cell biologist whose time machine has broken prohibiting him from returning to the present to inspect his handiwork. However, no serious alternatives to the Judeo-Christian God have been proposed by members of ID.³⁷

Notwithstanding, the search for design is indeed a legitimate scientific endeavor that plays an integral part in the legal system. Forensic anthropology, for example, is the application of the science of physical anthropology and human osteology (the study of the human skeleton) in the search for non-natural causation. It is used most often in the context of murder investigations, where victims’ remains are in the advanced stages of decomposition. Forensic anthropology is one of the divisions of the American Academy of Forensic Sciences, and an integral part of the Joint POW/MIA Accounting Command Central Identification Laboratory, which bills itself as the largest forensic anthropology laboratory in the world. Forensic anthropologists employ well-established techniques of pathology, odontology, and anatomy to

³⁵ Richard Dawkins, PhD, *Evolutionary Biologist, author*. *FFRF*, 31:02-31:26.

³⁶ There was a conspicuous absence of publicity from OTEs about this, however.

³⁷ 20:102-03 (Behe).

assist in the recovery of remains, assess age, sex, stature, and ancestry, as well as analyzing causes of trauma and disease. This is accomplished through careful comparison of remains found at a crime scene with known skeletal models. By maintaining rigorously measured models as controls, forensic anthropologists can provide statistical analyses necessary to make estimates and predictions from found remains. And although some of the techniques used in forensic anthropology, such as facial reconstruction, are inadmissible in court, forensic anthropologists frequently testify as expert witnesses, due to the fact that the underlying data upon which expert's base their opinion does not necessarily have to be admissible, per FRE 703.

Computer fraud is another legitimate scientific endeavor in which scientists search for evidence of design. Forensic data analysts scour vast quantities of information, usually business records, for anomalies that suggest fraudulent activity. They typically do this by importing potentially fraudulent data into a relational (comparative) database and then comparing the two. Any irregularities receive further investigation. Forensic data analysts typically have a background in law, accounting, finance, or law-enforcement, and often provide EWT in cases involving regulatory actions and embezzlement.

However, both forensic anthropology and forensic data analysis can be distinguished from the search for design under SC. These disciplines draw their inferences of design through the use of *known samples*, e.g. previously measured skeletal models or relational databases as in the examples above. SC, on the other hand, searches for design with no known sample, e.g. science has no idea what would even constitute evidence for intelligent biological design. It would be like the forensic anthropologist attempting to rearrange decomposed skeletal remains without ever having seen a human skeleton or even a human. With no known sample as a control, there is no reliable way to judge the accuracy of data. Moreover, without a frame of

reference, ID proponents are simply imputing their own conceptions of design, when they have no support that suggestion that the evidence for biological design would in any way resemble any of the known examples of non-biological design. The following exchange during cross between Behe and Plaintiff's counsel in *Kitzmiller* illustrates this point.

Q. So we can recognize that my keys, they look designed right?

A. Yes, they do.

Q. Therefore we can infer that my hand, which is holding them, is also designed?

A. I'm not quite sure why you say therefore.

Q. Well, you said the inference, the inductive reasoning is that we see systems in our everyday experience we recognize as designed, and....so from that we can infer to biological life that my hand, also pretty intricate, is also designed?

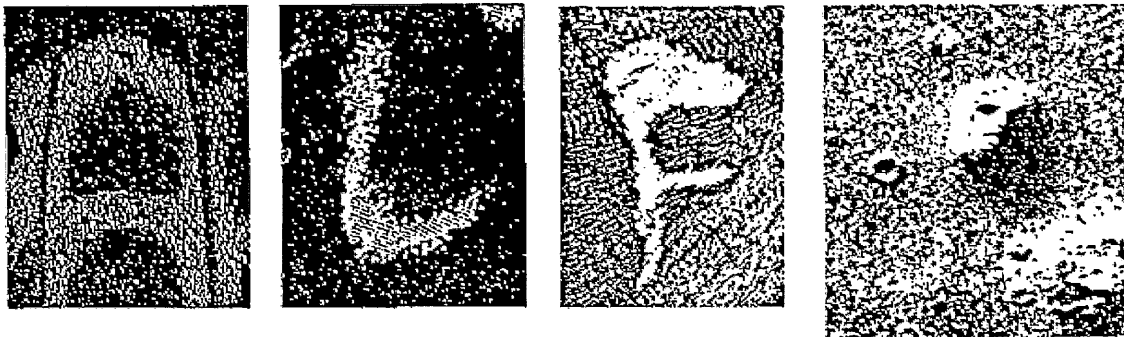
A. That's not quite the way I would say it. I would say I would look at all those mechanical things like the watch, like even the keys and so on, and say that all those in our experience required intelligence in their production, and therefore when we come to biological objects we can use similar reasoning for those.

Clearly, ID proponents provide no support for the inference that since man-made things that look designed *were* designed, then biological things that look designed must have been designed too. This is simply a bald assertion, akin to a concept in cosmology and physics known as the Anthropic Principle. The idea is that if extraterrestrial life is to be found, it will necessarily have many of the same traits as humans because any form of life will have basic requirements like a need for food and water. And while there is support for this idea because every example of life we have encountered has had certain basic requirements, there are *no* known examples of biological design to use as a comparison, so we would not necessarily know evidence for biological design even if we saw it.

Accordingly, Dembski's subsequent analogy to the efforts of the SETI Institute (SETI) are also inapt. SETI is a non-profit organization that searches for extraterrestrial life, is also inapt. SETI uses radio and optical telescopes to search for deliberate signals from extraterrestrial intelligence, much like the sequence of prime numbers in the novel *Contact* that Dembski

described. However, again, the researchers at SETI have a reference model—life on earth—with which to compare the readings produced by their telescopes. Since ID has no such reference model for biological design its methods are inherently unsound.

Moreover, without a comparison, data can easily be confused for design when in fact none exists. For example, Dembski, as one of the authors of *Pandas*, the textbook at issue in *Kitzmiller*, writes that because we observe natural and manmade objects, there are necessarily two fundamental forms of causation: natural and intelligent. He uses then uses Mount Rushmore and Thomas Paley’s famous “*watchmaker analogy*” as examples of obvious design. However, this argument fails as well because it does not account for the vast array of “*naturally designed*” objects, such as beaver dams, bird nests, or the honeycombs of bees. And while Mount Rushmore is obviously of human design, what about the “*stone face*” on Mars photographed by the NASA Viking spacecraft or the letters of the alphabet that appear in the wing patterns of certain butterflies?³⁸ Without controls, science is confined to perception and intuition.



Essentially, Dembski’s SC suffers from bias, a common flaw with arguments constructed by inductive methodologies. In fact, this was one of the key recommendations by the NAS to improve problems in the forensic sciences. The NAS report noted,

³⁸ From *Smithsonian* 5(10): 28-29. January 1975). See also Amato, I. 1990. Insect Inscriptions. *Science News* 137(24): 376-377 (June 16).

“The new federal entity should support research programs on human observer bias and sources of human error in forensic examinations. Such programs might include studies to determine the effects of contextual bias in forensic practice (e.g., studies to determine whether and to what extent the results of forensic analyses are influenced by knowledge regarding the background of the suspect and the investigator’s theory of the case).”

Just like any other scientist, the findings of forensic science experts are vulnerable to cognitive and contextual bias.³⁹ Likewise, SC suffers from a form of bias called confirmation bias. This theory holds that researchers place more emphasis on evidence that supports their hypothesis and less emphasis on evidence that refutes it. A good demonstration of this, specifically in the scientific context, was featured in the *Quarterly Journal of Experimental Psychology*. In a study entitled, “*Confirmation Bias in a Simulated Research Environment: An Experimental Study of Scientific Inference*,” subjects formulated hypotheses about the laws governing events in a computer-simulated environment. They then chose between pairs of environments in which they could either 1.) make observations which would probably confirm their hypotheses, or 2.) test alternative hypotheses. Researchers found that the subjects routinely chose the observations that would probably confirm their hypotheses rather than testing alternative hypotheses. Yet when information that falsified their chosen hypothesis was found, they used this information to reject other hypotheses, showing a double standard. Consequently, researchers concluded there was evidence for confirmation bias.⁴⁰ Likewise, Dembski, and other ID proponents, are susceptible to unreliable conclusions by searching for evidence that confirms SC rather than refutes it.

While most scientific endeavors face a risk of bias to some degree, the risk is especially egregious in the case of ID because researchers have shown that *the very nature* of the debate

³⁹ See, e.g., I.E. Dror, D. Charlton, and A.E. Péron. 2006. *Contextual information renders experts vulnerable to making erroneous identifications*. Forensic Science International 156:74, 77. (“Our study shows that it is possible to alter identification decisions on the same fingerprint, solely by presenting it in a different context.”).

⁴⁰ Volume 29, Issue 1, 1977

between evolution and ID can lead to unintended bias.⁴¹ The online peer-reviewed journal, *PLoS One*, featured a 2011 study by researchers who were interested in examining the psychological motives underlying the widespread support for ID despite the lack of scientific evidence, and the widespread animosity toward evolution which has an abundance of scientific evidence. The researchers “*tested whether these attitudes [were] influenced by [ID’s] provision of an explanation of life’s origins that better addresses ‘existential concerns’ than [does evolution].*” They subjected participants to “*existential threat*” by reading passages that reminded them of their own mortality, and then reading passages written by (none other than) ID proponent, Michael Behe, and evolutionary biologist and atheistic author, Richard Dawkins. Participants then completed questionnaires that rated their acceptance or denial of ID or evolution.

The researchers found that regardless of participants’ religiosity, educational background, or preexisting attitude toward evolution, they were more likely to show support for ID when they had been subjected to the “*existential threat*” beforehand. The authors concluded that the effect of heightened mortality awareness on attitudes toward ID and evolution was “*due to a desire to find greater meaning...when existential threats are activated.*” Thus, if there is *any* scientific endeavor that demands rigorous controls and comparative models to counter the potential for bias it is the search for ID. Because these are lacking, ID is unreliable and should not be presented to students as scientific knowledge.

ID proponents have never genuinely entertained the proposition that the designer was not supernatural. In fact, Dembski, himself, has been quoted as saying of the designer, “*It could be space aliens. There are many possibilities*” but has also written “*The conceptual soundings of the [intelligent design] theory can in the end only be located in Christ.*” In December 2007,

⁴¹ Tracy JL, Hart J, Martens JP (2011) Death and Science: The Existential Underpinnings of Belief in Intelligent Design and Discomfort with Evolution. *PLoS ONE* 6(3): e17349. doi:10.1371/journal.pone.0017349

Christian organization, Focus on the Family, quoted Dembski as saying “*The Designer of intelligent design is, ultimately, the Christian God.*” Likewise, Defendants’ expert in Kitzmiller, Scott Minnich, confirmed that the existence of a supernatural designer is a “*hallmark of ID,*” while Behe has written that it is “*implausible that the designer is a natural entity.*” Since a deity is by definition outside the laws of nature, the supernatural theory of ID is not falsifiable, not scientific, and not appropriate for science education in the public schools.

However, never let it be said that OTEs are anything but tenacious. Though ID may have failed as a methodologically naturalistic argument, proponents now seek to change the very definition of science to incorporate their theory of intelligent design.

Science and Supernatural Causation

Courts have periodically been faced with the difficult proposition of defining science when assessing the admissibility of scientific EWT. FRE 702 uses the term “*scientific*” to describe one of the three fields of inquiry to which experts may testify. However, the *McLean* Court noted that even the testifying experts had difficulty in providing a satisfactory definition, offering such ephemeral answers as “*science is what is accepted by the scientific community*” or even, science is “*what scientists do.*” The court in *Daubert* held that “*for purposes of Rule 702, ‘scientific’ implies a grounding in the methods and procedure of science.*” It went on to specifically define science in terms of methodology: “*Science is not an encyclopedic body of knowledge about the universe. Instead, it represents a process for proposing and refining theoretical explanations about the world that are subject to further testing and refinement*”⁴² (emphasis in original). Thus, tentativeness seems to be a central component of that which is “*scientific.*”

⁴² 509 U.S. 579, 590 (1993)

Yet, in order for a proposition to be tentative it must necessarily be falsifiable and therefore testable. This is key distinction noted by the NAS, which has stated, “[one of the] *basic requirements of science* [is] *that hypotheses must be restricted to testable natural explanations. Since* [creationist theories] *are neither testable nor tentative...[they] are out of the question.*” However, there are plenty of accepted scientific theories that are not falsifiable, nor testable. For over twenty years, scientists have been debating string theory as a unified theory of the cosmos, but it has never been tested; it is only mathematically feasible. Likewise, scientists since the Renaissance have been operating on the un-testable assumption that the laws of the universe are, in fact, comprehensible; yet, this assumption could also never be tested. On the other hand, astrology and numerology are at least testable, but few scientists would characterize them as “*scientific.*”

Moreover, intuition, or “*the ability to acquire knowledge without inference or the use of reason,*”⁴³ plays a central part in the scientific process but is by definition not testable. An article in the journal *Science*⁴⁴ noted that “*by provid[ing] a conceptual foundation that suggests the directions which new research should take, ‘Intuition,’ as used by the modern mathematician,...plays a major role in the evolution of mathematical concepts.*” In a similar vein, an article in the *Journal of Advanced Nursing* entitled, “*Informational Basis for Expert Intuition,*” noted that “*Intuition has been cited as an integral part of nursing clinical expertise.*” However, it also noted methodological disputes “*over the status of nursing intuition as ‘art’ or ‘science’.*” ID is highly intuitive, but its methods are suspect. Evolution, on the other hand, is highly *unintuitive* but its methods can be studied in detail. Yet, if an unverifiable method like

⁴³ Oxford English Dictionary

⁴⁴ Effken JA. *Science*. 1967 May 5;156(3775):605-10. The role of intuition. Wilder RL.

intuition plays “a major role” in the scientific process, testability, and by extension, tentativeness, fails as the defining characteristic of science.

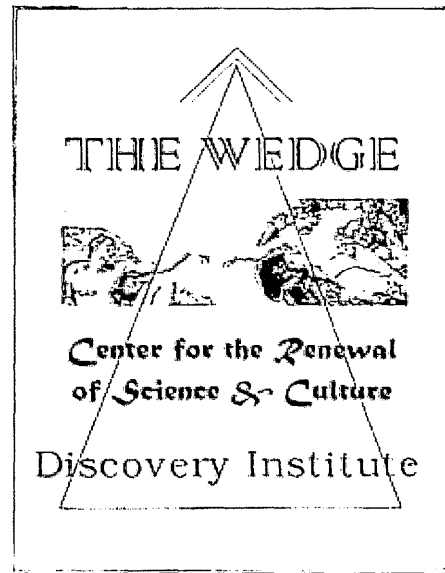
The *McLean* Court imposed the requirement that “*science is guided by natural law*” and must be “*explanatory by reference to natural law.*” This is also not always the case, however, because besides intuition, which is by definition devoid of any law, scientists often proceed without reference to natural law. Newton, for example, felt confident to posit physical laws of nature while having no conception of the true causal nature of the law of gravity. For that matter, much about gravity is still unknown today, and yet science has proceeded to send humans into outer space and satellites into orbit based merely on the observable effects of gravity. Likewise, Darwin generated his theory of natural selection (TNS) without an established mechanism of heritability, which wasn’t established until the early part of the 20th century with the emergence of gene theory. Thus, the notion that science is always guided by natural law is also unavailing.

What the *McLean* Court more likely meant is that science may not invoke supernatural causation for its explanatory power. In fact, the Court went on to conclude that “*creation science...is simply not science*” because it depends upon “*supernatural intervention,*” which cannot be explained by natural causes.⁴⁵ The court in *Kitzmiller* likewise noted that “*While supernatural explanations may be important and have merit, they are not part of science. This self-imposed convention of science, which limits inquiry to testable, natural explanations about the natural world, is referred to by philosophers as “methodological naturalism” and is sometimes known as the scientific method. Methodological naturalism is a “ground rule” of science today which requires scientists to seek explanations in the world around us based upon*

⁴⁵ Kitzmiller citing *McLean*

what we can observe, test, replicate, and verify.” Thus, if there is any unifying character of science it must be methodological naturalism.

However, *“ID aspires to change the ground rules of science”* in order to accommodate supernatural causation, *“which the Supreme Court in Edwards and the court in McLean correctly recognized as an inherently religious concept.”* ID’s intent to foment a scientific methodological revolution first came to light in the now infamous, “Wedge Strategy”. This was an internal Discovery Institute (DI) action plan written by the “father” of ID, Phillip Johnson, that was somehow leaked to the public. Though at the time DI maintained a secular façade, the Wedge Strategy spelled out DI’s ultimate goal of instituting *“a theistic understanding that nature and human beings are created by God.”* It would accomplish this by *“defeat[ing] scientific materialism [a.k.a.*



methodological naturalism] represented by evolution.” Accordingly, the overthrow of methodological naturalism is precisely the scientific revolution for which Defendant’s experts in *Kitzmiller* advocated. In his expert report, Dembski, argued that methodological naturalism must be overturned if ID is to prosper, and he justified this by stating that *“intelligent causation is perfectly natural provided that nature is understood aright.”* Defense expert Stephen Meyer used the justification that methodological naturalism *“lacks justification as a normative definition of science”* due to its lack of precise demarcations. Yet, while there are clear difficulties in identifying precise demarcations for the definition of science, ID proponents run

into their own problems when forced to proffer a precise definition of science that accommodates ID.

Under ID's proposed definition of science, nearly any hypothesis could count as scientific. Behe testified that *"a scientific theory is a proposed explanation which focuses or points to physical, observable data and logical inferences."* However, the following excerpt from his cross examination demonstrates that this leads to absurd conclusions.

Q And using your definition, intelligent design is a scientific theory, correct?

A Yes.

Q Under that same definition astrology is a scientific theory under your definition, correct?

A Yes, that's correct. And let me explain, under my definition of the word "theory,"...does not include the theory being true.... There have been many theories throughout the history of science which looked good at the time which further progress has shown to be incorrect.

Q Has there ever been a time when astrology has been accepted as a correct or valid scientific theory, Professor Behe?

A Well, I am not a historian of science. And certainly nobody -- well, not nobody, but certainly the educated community has not accepted astrology as a science

Aside from absurd conclusions, the change to the definition of science as proposed by ID proponents, would require *"entire fields of inquiry, including especially in the human sciences... to be rethought from the ground up in terms of intelligent design."* This also would mean a complete overhaul of the legal principles of causation. Under this definition of science, the four basic factors to which courts may look for assessing EWT would be utterly irrelevant: 1.) supernatural causation is untestable and therefore not able to be falsifiable; 2.) Peer review would be useless because experimentation employing supernatural causation could never be regularly replicated; 3.) Rate of error could never be determined since verification tests could not be run; and 4.) Although, the scientific community could hypothetically accept the theory, it would have no basis for doing so, rendering such acceptance meaningless. As one legal commentator put it, *"the willingness to entertain the idea of [super]natural causation as part of*

one's scientific research program would mean throwing in the towel on the possibility of doing science at all: Because one can never prove or disprove supernatural explanations—'God did it,' explains everything and nothing—one can never reach conclusions about when, where, how, or even whether a [super]natural cause will next occur." Thus, ID's definition of science incorporating supernatural causation is untenable.

If the only truism that can be discerned about what constitutes science is that it rejects supernatural causation, and if many of the most commonly proffered demarcations are unreliable, how then are courts supposed to determine when EWT is "*scientific*" under FRE 702? In the author's view, this assessment may most closely be accorded with philosopher and historian, Thomas Kuhn's conception of the scientific paradigm. "*A paradigm, for Kuhn, is a sort of consensual world view within which scientists work. It comprises an agreed upon set of assumptions, methods, language, and everything else needed to do science. Within a given paradigm, scientists make steady, incremental progress....*" However, new discoveries result in inevitably contradictions and implausible conclusions, inexorably leading to a point of revolution when the entire set of "*assumptions, methods, language, and everything else needed to do science*" is no longer relevant. This is called the "*paradigm shift*" and marks a new definitional stage of science. Kuhn cited the work of Copernicus, Newton, and Einstein as examples of such paradigm shifts; no doubt Darwin's would qualify as well.

What courts may take away from this is that there will never be a point in which scientific inquiry is defined by a single demarcation. Not only will science not be amenable to such deconstructionist efforts, it will also be inherently contradictory at any given point in time, leading up to a point when the entire existing regime is overthrown (the paradigm shift). There very well may be a time when scientists discover that the universe was *creatio ex nihilo* by a

supernatural flying spaghetti monster. However, until that time, scientists must work under the paradigm *du jour*, which is presently methodological naturalism, and for our courts or our classrooms to permit anything else is to subvert the paradigm. Rather than bright-line rules, courts must continue to employ a factors test, which begins and ends with methodological naturalism.

Writing for the Palaeontological Association's online newsletter, Ronald Jenner, professor of evolution and ecology at the University of California, Davis, issued a review of ID proponent, Stephen Meyer's article in the journal *Proceedings of the Biological Society of Washington*—the very same article discussed earlier that was eventually withdrawn by the journal after it was shoehorned in by fellow ID proponent and editor at the time, Richard Sternberg. Nonetheless, Jenner detailed Meyer's basic arguments: "*Meyer provides a selective critique of the ability of current neo-Darwinian evolutionary theory fully to explain the origin of evolutionary novelties in general, and the evolution of the major animal body plans in particular. Meyer argues that it is highly improbable that 'random' variation and natural selection can lead to the evolution and functional divergence of genes and proteins.*" Consequently, because science's understanding of these processes is currently incomplete, Meyer concludes that the major animal body plans must have been intelligently designed. However, Jenner identifies the fatal flaw with such a methodology. "*I am the first to admit that we haven't solved the problem of the origin of animal body plans yet. We're not even close. But, there is undeniable progress. Rather than continuing to trust in the ability of science to make progress, as it always has, Meyer is willing to throw up his hands in bewilderment, and exclaim miraculous intervention of an intelligent designer. That's not the spirit of science.*" Likewise, the NAS has stated, "*Forensic science examiners need to understand the principles, practices, and contexts of scientific*

methodology” and must be educated in “scientifically valid principles.” Thus, if we are to have any hope of order and justice in our courts and society at large, supernatural causation and theories like irreducible complexity and specified complex that necessitate it, must be rejected. As Robert Dorit wrote in reviewing ID proponent Michael Behe's book, Darwin's Black Box, “The hand of God may well be all around us, but it is not, nor can it be, the task of science to dust for fingerprints.”

WHICH CONTROVERSIES SHOULD BE TAUGHT?

The most common and the most challenging arguments against the theory of evolution (TE) have been more than adequately rebutted. However, Plaintiffs' expert in *Kitzmiller*, Kenneth Miller, was unequivocal in his view on the current status of evolutionary knowledge: *“One of the things that I think is important to make clear to the Court is that it is absolutely true that there are many, many structures in the living cell...for which we don't have a detailed... evolutionary explanation. That is a point that all scientists will concede. We have enormous arguments in the field of cell biology as to the exact mechanism” [of TE].... There are many, many...unsolved problems in biology.*” Does this mean we should entertain other theories, even weak ones, nonetheless? The Court noted, *“the fact that a scientific theory cannot yet render an explanation on every point should not be used as a pretext to thrust an un-testable alternative hypothesis grounded in religion into the science classroom....”* Perhaps not, but should the unanswered questions about TE be taught in the public classroom? Advocates of AFBs certainly think so. Here are a few questions for which evolutionary science has less than a complete understanding, and that, according to the Institute for Creation Research, *“would make for good classroom discussion:”*

- 1. Microsoft programmers utilized complex codes to create the Windows software. The genetic code, which is more sophisticated, controls the physical processes of*

life and is accompanied by elaborate transmission and duplication systems. How does evolution, using natural processes and chance, solve the problem of complex information sequencing without intelligence?

2. Evolutionists believe the Cambrian explosion of new life began about 525–550 million years ago. What is the approximate number of beneficial mutations which must have occurred per year during this 5-million-year period, given that billions x billions of information bits would have to be encoded? What percentage of mutations in multicellular organisms have been recognized as beneficial? List any you find.

3. Evolution teaches that mammals evolved from reptiles. All mammals have three bones in the ear (and the Organ of Corti) and a single bone on each side of the lower jaw. All reptiles have a single bone in the ear and on average six bones on each side of the lower jaw. Speculate how intermediate forms could have managed to hear and chew, while the necessary restructuring was taking place and the Organ of Corti was being developed.

Clearly, there is a good deal of wisdom to British chemist, Leslie Orgel’s infamous “*Second Rule*” of Biology: “*Evolution is cleverer than you are.*” Notwithstanding, these questions pertain to advanced topics that are inappropriate for students in primary or secondary education. However, opponents of the Theory of Evolution (OTEs) argue that the unanswered questions pertaining to TE should be discussed with students nonetheless.

In many ways AFBs may trace their origins to a 2002 article in the *Cincinnati Enquirer* written by the head of the Discovery Institute’s (DI) Center for Science and Culture, Stephen Meyer. Here, he introduces the now ubiquitous “*Teach the Controversy*” approach, the rallying cry for many AFB lobbyists. Meyer asserts in the article, “*When two groups of experts disagree about a controversial subject that intersects the public school curriculum students should learn about both perspectives.*” He goes on to ask “*whether students will learn both sides of the real and growing scientific controversy about Darwinism, and whether a 19th century theory will be taught dogmatically to 21st century students.*” Similar language found its way into the LSEA and served as a central premise in the movie *Expelled*, discussed earlier. Meyer divides the “*Teach the Controversy*” approach into five basic arguments, and asserts that together, they

establish why the so-called evidence against TE should be taught in public schools. The following will show that, in fact, each of these arguments fail, establishing only that the “*Teach the Controversy*” approach, at least with respect to TE, should not be taught anywhere.

“First, honest science education requires it.”

Meyer begins by imploring readers, “*If students are to be required to master the case for Darwinian evolution (as we think they should), shouldn't they also know some of the difficulties described in such scientific literature?*” In what is no doubt a zenith of irony, he goes on to recount that in 1999, the Ohio State Board of Education was debating whether to include arguments against TE in the state curriculum. In support thereof, Meyer and co-fellow at the Discovery Institute (DI), Jonathan Wells, the author of *Icons of Evolution*, testified before the Board and “*submitted an annotated bibliography of over 40 peer-reviewed scientific articles that raise significant challenges to key tenets of Darwinian evolution.*” However, at the same hearings, Lawrence Krauss biologist and professor at Case Western Reserve University testified that there were no articles in peer-reviewed scientific literature that raised doubt about the validity of TE. This caused Eugenie Scott, director of the National Center for Science Education (NCSE), to look into Meyer’s and Wells’ bibliography a bit more closely.

As their website notes, “*NCSE sent a questionnaire to the authors of every publication listed in the Bibliography,*” asking them whether they considered their work to provide scientific evidence against evolution. “*None of the 26 respondents (representing 34 of the 44 publications in the Bibliography)*” answered in the affirmative. David M. Williams (coauthor of article 18 of the Bibliography) remarked, “*No, certainly not. How could it possibly?*” Kenneth Weiss (author of article 21), remarked, “*I state clearly that evolution is beyond dispute based on all the evidence I am aware of.*” The NCSE also asked the authors in the Bibliography whether their

articles provided support for intelligent design (ID). NCSE notes, *"Many were indignant at the suggestion."* Douglas H. Erwin (author of article 8) answered, *"Of course not — [ID] is a non sequitur, nothing but a fundamentally flawed attempt to promote creationism under a different guise. Nothing in this paper or any of my other work provides the slightest scintilla of support for 'intelligent design'. To argue that it does requires a deliberate and pernicious misreading of the papers."* Several respondents even went so far as to say that their work constituted scientific evidence against "intelligent design." Shortly thereafter, the DI added the following disclaimer to the Bibliography when it posted it on its web site:

"The publications are not presented either as support for the theory of intelligent design, or as indicating that the authors cited doubt evolution. Discovery Institute has made every effort to ensure that the annotated summaries accurately reflect the central arguments of the publications."

There is more that makes Meyer's plea for "scientific honesty" ironic. Besides Behe's misleading testimony about the extent to which his book, *Darwin's Black Box*, was peer reviewed, and besides Meyer's own collusion with Richard Sternberg to publish an ID journal article that would later have to be recalled, Meyer and other members of the DI have found a wily means of avoiding the criticism that their theories have not been published in peer-reviewed journals: they started their own "peer-reviewed" journal. *Bio-Complexity* is the flagship publication of the ID movement, started just within the last two years. However, nearly all of the reviewers are associated with the DI or the ID movement, and all operate under the journal's mission of *"developing and testing the scientific case for intelligent design."* This, of course, presents a risk of bias that no reputable journal would tolerate, and makes any suggestion of scientific integrity through peer review within the ID movement preposterous.

Meyer's first argument fails because honest science education holds no place for the controversy referenced by Meyer, as it is political and religious in nature, not scientific. Perhaps

the only one in the ID movement who has been honest was founder, Phillip Johnson, who, while speaking at a conference at Biola University said, “[t]his isn’t really, and never has been, a debate about science. It’s about religion....”

***“Second, constitutional law permits ‘Teaching the Controversy’
about scientific theories of origins.”***

Meyer at least correctly notes that the Supreme Court held in *Edwards v. Aguillard* that state legislatures (and by extension state boards) have the right to mandate teaching scientific critiques of prevailing theories. However, he incorrectly asserts that “*the court also made clear that teachers have the right to teach students about ‘a variety of scientific theories about origins...with the clear secular intent of enhancing science education.’*” The remainder of the passage from *Edwards* makes this obfuscation clear: “*We do not imply that a legislature could never require that scientific critiques of prevailing scientific theories be taught. Indeed, the Court acknowledged in *Stone* that its decision forbidding the posting of the Ten Commandments did not mean that no use could ever be made of the Ten Commandments.... In a similar way, teaching a variety of scientific theories about the origins of humankind to schoolchildren might be validly done with the clear secular intent of enhancing the effectiveness of science instruction*” (emphasis added). The court here is referring to the legislature’s right to mandate teaching scientific critiques of prevailing theories, not the teachers’. This is a key distinction and a critical flaw with AFBs.

Unlike professors, teachers at the primary or secondary levels are restricted with respect to academic freedom, more so than those at the university level. In most states (not including Louisiana, of course), teachers are required to teach from instructional materials adopted by state or local boards of education and designed by publishers pursuant to pedagogical and state curriculum standards. Twenty-two U.S. states have “*state adoptions*” administered and

implemented by the state board of education and the state department of education. As part of the adoption process in “*state adoptions*,” instructional materials are designed and developed in accordance with very specific state criteria. The other twenty-eight states are “*non-adoption states*,” meaning that adoption of instructional materials is carried out by local school districts, although the materials must generally reflect state standards nonetheless. According to the Association of American Publishers, the national trade association of the American book publishing industry, instructional materials are developed by publishers who “*rely on the expertise of authors, scholars, and writers to conceive the idea for a textbook, frame a scholarly approach, and write the manuscript. Publishers then direct a team of editors, content experts, and reviewers who evaluate the manuscript for accuracy of content, appropriateness of writing style for grade level, adherence to state curriculum guidelines, and effectiveness of the pedagogy.*” Thus, the opinions of qualified experts are a key part of the textbook adoption process, at least ostensibly.

Expert opinion is not indispensable. Each publisher determines the approach it believes will be most effective in the marketplace, as well as the classroom. Competitiveness is significant because publishers have financial incentives to cater to the curricula of states with large textbook markets like Texas and California. Thus, when these states adopt instructional materials based on hollow science of the sort promoted by Meyer and the DI, publishers often attempt to persuade other states to adopt the same textbooks in order to minimize production costs. This exact scenario occurred only recently.

On March 27, 2009, when the Texas Board of Education enacted new standards requiring all textbooks used in public schools to teach ID alongside evolution and question the validity of

the fossil record. According to the NCSE, “Don McLeroy,⁴⁶ a dentist and [ex]chair of the board, said, ‘I think the new standards are wonderful...dogmatism about evolution has sapped ‘America’s scientific soul.’” The influence of the DI’s model high-school science lesson plan, “*Critical Analysis of Evolution*” in Texas, has impacted the purchasing habits of the respective authorities in the following states: Arkansas, Florida, Georgia, Louisiana, Kansas, Michigan, Missouri, Mississippi, Montana, Ohio, Pennsylvania, West Virginia. In fact, in 2005, Kansas actually adopted the DI’s supernatural definition of science. It read, “*Science is a systematic method of continuing investigation that uses observations, hypothesis testing, measurement, experimentation, logical argument and theory building, to lead to more adequate explanations of natural phenomena.*” Thus, significant numbers of textbooks had to be catered specifically for this definition. In 2007, when the political affiliations of the state board of education changed, the definition was changed back to rely solely on natural causation, undoubtedly at the exasperation of a publisher somewhere who was stuck with an entire state’s worth of second-rate science books.

In 2010, subsequent to the passage of the LSEA, the Louisiana Board of Elementary and Secondary Education (BESE) faced a similar predicament when adopting new science textbooks under an AFB. And although the BESE ultimately voted to adopt textbooks that included only natural causation and did not mention intelligent design, many commentators thought the setting was ripe for them to do so. For instance, in a cover story, the Louisiana newspaper, *Independent Weekly*⁴⁷ quoted Board president Dale Bayard as saying, “*I am an open-minded person, and I challenge anybody to come and tell me — and I’ve asked a couple of educators that are friends of mine — can you swear on a stack of Bibles there’s no other refutable data that provides an*

⁴⁶ McLeroy, after a BOE hearing at which several evolutionary biologists testified as to the overwhelming acceptance of TE by scientists, infamously exclaimed, “Somebody’s gotta stand up to experts!”

⁴⁷ December 8, 2010

objective other approach to Darwin's theory?" However, this statement completely misses the mark because refutable data for objectives other than TNS can be provided for nearly anything, including space aliens, time-traveling cell biologists, or even your author. Accordingly, Joe Neigel, a professor of biology at the University of Louisiana, Lafayette, stated, *"To suggest we need to teach both sides is like saying we should be teaching the opinion that the earth is flat because there are some people who believe the earth is flat and they claim they have evidence the earth is flat, so we should give equal time to these people. It's an attempt to make it seem like there are two sides that have similar weight when in fact that isn't the case at all."* The could not have been framed more insightfully than it was by local biology teacher, Patsy Peebles, who was quoted in *The Shreveport Times*⁴⁸ as saying, *"The opponents to these [pro-evolution] biology books have an unfortunate misunderstanding of what is and isn't in the realm of science. By opening the door for their 'both sides' of any issue, you allow non-science and pseudo-science into the science classroom."* AFBs make this risk especially egregious because they take the adoption of instructional materials out of the hands of state and local boards of education, where at least there is oversight and available expertise, and places it in the hands of individual teachers, who may be unduly influenced by the fallacious claims of organizations like the DI.

Notwithstanding, Eugenie Scott and Glenn Branch of the NCSE have authored multiple works on how teachers should decide which controversies to teach. Scott has a Ph.D. in anthropology and taught at the University of Colorado and at California State University, Hayward before being appointed as head of the NCSE. Branch, also with the NCSE, is Deputy Director and possess a Masters of Arts in Philosophy from the University of California, Los Angeles. In 2006, the two co-edited, *Not in Our Classrooms: Why Intelligent Design is Wrong*

⁴⁸ December 9, 2010

for *Our Schools*. Additionally, Scott and Branch co-authored a journal article entitled, “*Evolution: what’s wrong with ‘teaching the controversy’*” for *TRENDS in Ecology and Evolution*.⁴⁹ In it, they provide “*five criteria for determining whether a controversy is appropriate to teach in a public school science class.*”

1.) “*The controversy ought to be of interest to students*”

For example, they describe “*a raging scientific controversy over whether maximum likelihood or parsimony ought to dominate in phylogenetic interpretation.*” Not without a little humor, they intend to make the point that most of the genuine debates regarding TE deal with extremely specific and advanced topics that would likely not appeal to students with only limited understanding of the field.

2.) “*The controversy ought to be primarily scientific, rather than primarily moral, social or religious*”

With their second criterion, Scott and Branch explain that “*Questions about the morality of such research are...important, but they are not suitable for a science class.*” As an example, they point to the “*controversy over stem-cell research*” but note that the controversy is not scientific; rather, it is about whether it is morally permissible to manipulate embryos to produce stem cells.

3.) “*The resources for each side of the controversy ought to be comparable in availability*” and 4.) “*The resources for each side of the controversy ought to be comparable in quality*”

Here, they highlight pragmatic concerns regarding the availability and quality of instructional materials regarding a particular controversy, and went on to note that “*the scientific quality of the antievolutionist resources is exceedingly poor.*” The text “*Add Ons*” discussed previously are a good example. They are only available online, and due to Voss’s background in electrical engineering rather than a field relevant to TE, they represent dubious scholarship.

⁴⁹ Vol.18 No.10 October 2003

5.) *"The controversy ought to be understandable by the students"*

This last criterion demonstrates why the previous discussion questions suggested by the Institute for Creation Research are inappropriate. As Scott and Glenn note, *"The evidence for evolution is easy to understand, at least on a basic level. But the antievolutionist critique of evolution ranges freely and opportunistically through the scientific literature, from astronomy to zymurgy."* *"Most of the fascinating controversies [in evolution] require a great deal more developmental, morphological, and genetic training than a high school student can be expected to master in the time available."* *"Faced with the ICR's...eclectic list of questions...even a working research scientist would have a difficult time sorting through the quagmire of misleading and mistaken claims. It is unreasonable to expect... students to do so."*

Scott and Glenn conclude by observing that under these criteria, *"the antievolutionists' controversy about evolution...is [not one] worth teaching,"* because it *"fails significantly to satisfy"* the second, fourth, and fifth criteria: it is religious or moral in nature (criterion 2); the quality of instructional materials is poor (criterion 4); and most students below the university level would be ill equipped to understand the genuine, but highly-complicated, controversies in evolutionary biology.

Thus, just because the Supreme Court ruled in *Edwards* that students could be taught differing theories, this does not mean that *all* controversies should be taught. Meyer's second argument for why public school teachers should *"Teach the Controversy"* surrounding TE fails because public school teachers are *"expected to [present only] legitimate scientific views..., reliable information, and describe scientific concepts and theories accurately and correctly."* The scientific evidence presented by OTEs falls well short of these standards.

“Third, federal education policy calls for precisely this kind of approach.”

As with the preceding point, Meyer misleads the reader by implying that the No Child Left Behind Act allows *teachers*, rather than *legislators* or *state boards of education*, to unilaterally append the curriculum with instruction on the controversy surrounding evolution. As established, curricula and instructional materials in primary and secondary education are not the province of teacher.⁵⁰ The reason is that pedagogically, students at this level need a standardized, foundational approach to learning that will prepare them for more advanced studies at the university level, where professors have more freedom to challenge students with controversial topics. This approach is codified in NCLB which puts forth standards to ensure students have the basic skills they will need to progress as students and citizens upon graduation from high school. Moreover, while Meyer correctly states that the report language accompanying the No Child Left Behind Act reads, “*where topics are taught that may generate controversy (such as biological evolution), the curriculum should help students to understand the full range of views that exist [and] why such topics may generate controversy,*” he misleadingly implies that this language carries the weight of law. If anything, this language would merely serve to aid a Court in interpreting the language of the Act. However, just as a Court may look to report language to help frame the intentions of the legislators, a Court may also look to the legislative history of the report itself in order to frame the context in which it arose.

As such, it would be evident to a Court that this language was initially submitted by Rick Santorum (R-PA), who is on record advocating for ID, as a “*Sense of the Senate*” amendment, but was met with resistance by members of the Conference Committee. It was then subsequently heavily modified and relegated to the report language. A Court would also no doubt be aware that the language was proposed by Senator Rick Santorum, who advocated for schools to

⁵⁰ Except in Louisiana, of course

embrace the theory of intelligent design in the Senate record. And most certainly a Court would be aware of Committee co-Chairman, Ted Kennedy's public rebuke of Senator Santorum's suggestion that Kennedy supported the teaching ID, when Kennedy, writing to the editor of the *Washington Times*, noted, "*Unlike biological evolution, 'intelligent design' is not a genuine scientific theory and, therefore, has no place in the curriculum of our nation's public school science classes.*" Thus, contrary to Meyer's implication, the NCLB Act does not "*call*" for the teaching of controversies pursuant to the Conference Committee's report language. This language has no impact on the allocation of responsibility for the adoption of science curricula, and has no impact on teachers' obligations to construct lesson plans and use instructional materials pursuant to state and local requirements. Plus, given the contentious nature of the context in which the report language came to be, a court would almost certainly accord it little weight in interpreting the provisions of the Act. Consequently, Meyer's third argument fails as well.

"Fourth, voters overwhelmingly favor this approach."

Meyer's fourth argument—that voters favor the "*teach the controversy*" approach—is also unavailing, and typifies an alarming disdain for the opinions of experts rampant among OTEs. Meyer sites polling data that 71% of voters expressed their support for teaching evidence both for and against evolution. However, "*99.9 percent of scientists accept evolution*" according to Brian J. Alters (B.Sc., Ph.D. USC), Associate Professor of Education at McGill University, where he holds the Tomlinson Chair in Science Education and has taught science education at both Harvard and McGill Universities. Alters, quoting the American Association for the Advancement of Science, stated that TE, "*like the phenomenon of gravity...is an accepted fact.*" For the author's money, Alters seems more convincing than the court of public opinion.

Catchphrases like “*academic freedom*” or “*intellectual freedom*” may garner support for OTEs by appealing to voters’ sympathies, but if we are to ensure that students in public schools receive an accurate science education, we must imbue the responsibility of educational policy on qualified individuals, like Brian Alters, who are well-qualified and have solid bases for their opinions.

Courts have long recognized the dangers of unqualified and unfounded opinions. In *Thomas J. Kline, Inc. v. Lorillard, Inc.*, the Fourth Circuit found that the trial court abused its discretion by allowing “*testimony about credit discrimination by [a] witness who was not an economist and whose general business education did not indicate ‘any training in the area of anti-trust or credit’ and who admitted ‘that she lacked any other experience in such matters.’*”⁵¹ Meyer advocates making a similar mistake by suggesting that our state and local school boards should defer to popular opinion regarding science curricula. Certainly some of the same 71% of voters Meyer cites probably elected, either directly or indirectly, judges like Kenneth L. Ryskamp, Senior Justice in the U.S. District Court for the Southern District of Florida, who, in *Chikovsky v. Ortho Pharmaceutical Corp.*⁵², held as inadmissible the opinions of a doctor who testified that an acne medicine could cause birth defects when the sole basis of his opinion was “*common sense*”. Citing *Daubert*, Judge Ryskamp further ruled that, “‘*knowledge*’ connotes more than a subjective belief or unsupported speculation,” and that “*This is precisely the kind of evidence that the trial judge must exclude in performing the gatekeeper function.*”

Meyer’ fourth argument ultimately fails because he has juxtaposed his priorities. Rather than deferring to popular interests, we should instead defer to the interests of the children in our public schools. With this in mind, it is evident that the decisions about science curricula should

⁵¹ 878 F.2d 791, 800 (4th Cir. 1989)

⁵² 832 F. Supp. 341, 344–46 (S.D. Fla. 1993)

be left to qualified individuals with a sound bases for their decisions. Meyer could take a lesson from Galileo Galilei who said, *“In questions of science, the authority of a thousand is not worth the humble reasoning of a single individual.”*⁵³

“Finally, good pedagogy commends this approach.”

Despite, Meyer’s claim that *“teaching the controversy”* serves as good pedagogy, educators seem to hold a different opinion. The Educational Resources Information Center (ERIC), *“is the largest educational database in the world, indexing over a million journal articles, research reports, curriculum and teaching guides, conference papers and books. If teaching the controversy were a genuine pedagogical [concept], it would be prominently reflected in ERIC.”* However, on July 28, 2011, a search of the phrase, *“teach the controversy”* produced two hits, both of which were articles criticizing the DI’s efforts to promote the campaign. Moreover, introducing supernatural causation into the science classroom as the DI advocates is utterly devoid of pedagogical benefits. The student’s next logical question—*“Who or what designed the designer?”*— leads to an infinite regression of more questions. Mathematician, Richard Wein, noted that *“the unanswered questions an explanation creates ‘must be balanced against the improvements in our understanding which the explanation provides.’”* Thus, in Meyer’s *“Teach the Controversy”* approach, where the answer is ID, *“The new question raised by the explanation is as problematic as the question which the explanation purports to answer.”*

While the *“Teach the Controversy”* approach may ostensibly seem fair, the true inequity rests with OTEs’ efforts to mislead students about the true nature of the scientific controversy surrounding TE. As it has often been said, *“Science is not a democracy.”*⁵⁴ The simple fact is

⁵³ 1632

⁵⁴ Earl Geddes, Ph.D.

that there is no *valid* science disputing the *validity* of TE and so there is no *valid* controversy, despite what OTEs attempt to conjure up. Using fairness as the standard by which we determine which topics to introduce into the science classroom as Meyer would have us do, would lead to a curriculum determined solely by political currency. The only standard for science, and thus the only standard for the science classroom, must always be the evidence. Lawrence Krauss, a physicist at Case Western Reserve University, who testified at the 2002 hearings regarding Ohio's state science standards noted OTEs "*use language that sounds sensible*" and state '*We just want an equal playing field for our ideas.*'" However, "*they already have an equal playing field—the field of science. They can submit their ideas to journals, and get peer reviewed, and if their ideas are any good they'll make it into the scientific canon, and make it down into the high schools.*" Like the machinations of natural selection, intellectual honesty in the realm of science is ruthless and permits no weakness. Thus far, OTEs ideas simply have not been up to the challenge.

Nonetheless, fostering critical thinking skills in students, especially science students, is without question of vital importance. As Michigan State physiology professor Robert S. Root-Bernstein wrote, "*Questions are what drives science, not answers.... Take nothing for granted, I counsel my students: that is what makes a scientist.*" But just as educators' academic freedom is limited to speech that is "*germane to the subject matter,*" students' critiques must be limited by observation and reasonable inference. Otherwise, students will be unable to distinguish between valid and fallacious criticism. The "*Teach the Controversy*" approach provides no guidance in this regard. For instance, Senate Bill 1854 introduced in March of this year and currently pending in the Florida legislature, merely states that it is "*An act relating to required instruction in the public schools...requiring that the instructional staff of a public school teach a thorough*

presentation and critical analysis of the scientific theory of evolution.” With such vague language, students will be unable to discern genuine science from pseudoscience. As professor Root-Bernstein also noted, “*I encourage [students] to be skeptical—as long as their skepticism is based on logic and evidence.*”⁵⁵ The absence of this type of logical caveat is what is missing from AFBs, why the “*Teach the Controversy*” approach is not good pedagogy, and why, ultimately, Meyer’ fifth and final argument fails, just like the preceding four.

“*Presenting all sides of a controversial issue appeals to popular values of fairness, openness, and equality of opportunity,*” but OTEs’ intent is not to foster genuine debate about the *mechanics* of evolution; it is to create doubt within students about whether evolution actually occurred. Biologist Jerry Coyne framed the situation well in his review of Jonathon Wells’ *Icons of Evolution*. Coyne said, the “*Teach the Controversy*” approach is about as “*intellectually honest as one would expect from someone whose ‘prayers convinced me that I should devote my life to destroying Darwinism.’*” The calculating zealotry of OTEs has no place in the science classroom, and no place in a modern, democratic society. Legislators should reject AFBs because they propagate dangerous ideology and cloak students’ futures in a veil of myth and superstition.

On June 30, 1860, less than a year after Darwin’s *Origin* was first published, a now legendary debate occurred between biologist, Thomas Huxley, an ardent defender of TNS, and bishop of Oxford, Samuel Wilberforce, a staunch critic. Though the details of exactly *how* the events unfolded have been lost with time, as with TE, the important thing is we know *that* it happened. Thus, allegedly, after Huxley had just finished lecturing on *Origin* to an audience of scientists and lay people at the Oxford University Museum, Wilberforce stepped from the crowd and asked,

⁵⁵ “Darwin’s Rib,” in *Discover*, September 1995, pp. 38–41.

'Tell me, Mr. Huxley, is it through your grandfather or your grandmother that you claim descent from a monkey?'

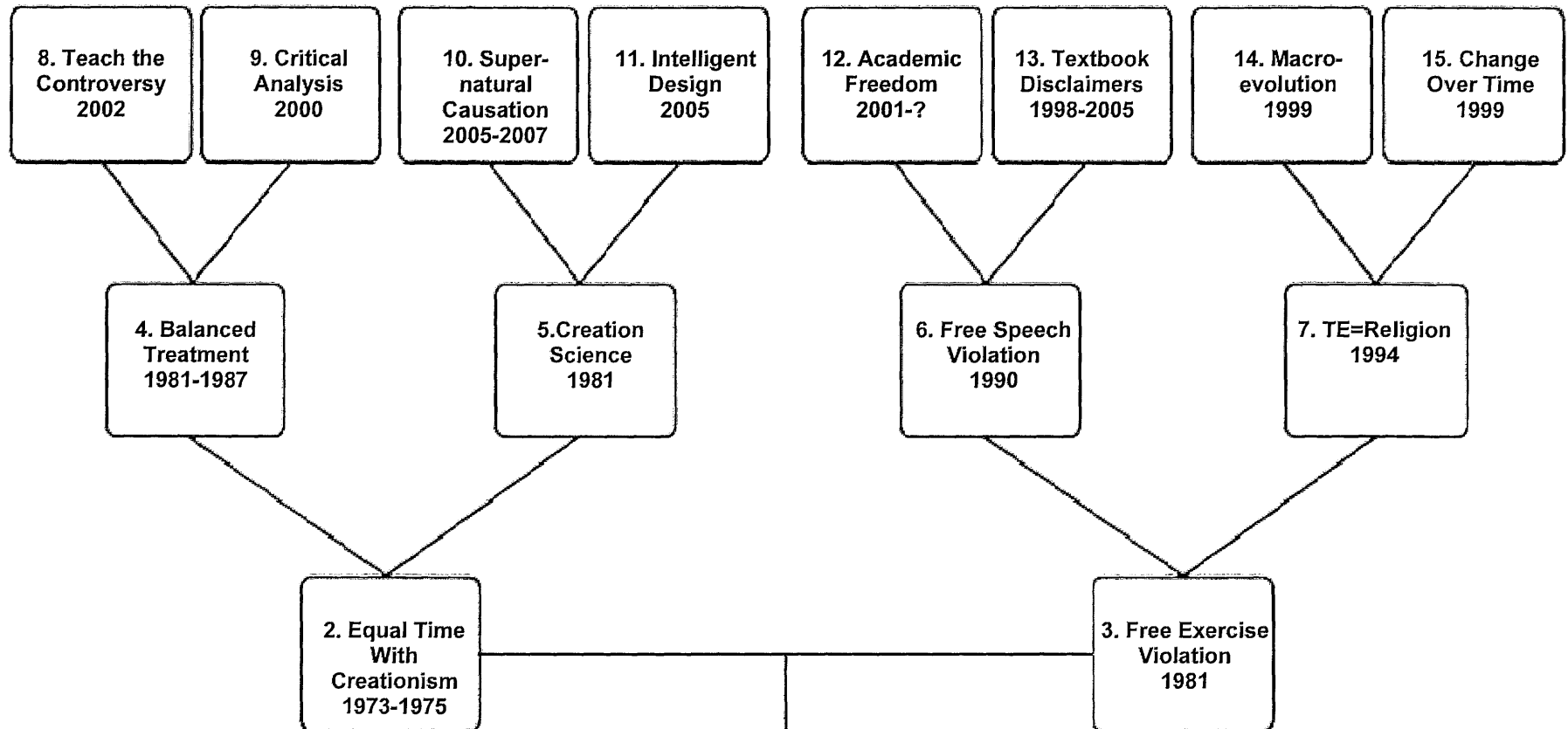
To which Huxley replied,

'I would not be ashamed to have a monkey for my ancestor, Bishop Wilberforce, but I would be ashamed to be connected to a man who used his great gifts to obscure the truth.'

CONCLUSION

In sum, state legislators should reject proposals for Academic Freedom Bills, and the Louisiana state legislature should repeal the LSEA. This type of legislation misrepresents the level of dissent among qualified experts regarding the viability of the theory of evolution, obfuscates the professional and legal protections of teachers' rights to academic freedom, and introduces invalid scientific information into the public classroom. By rejecting Academic Freedom Bills, law makers will avoid wasting tax-payer dollars in inevitable legal challenges, and more importantly, they will avoid corrupting students' science education with divisive politics.

ADDENDUM: PHYLOGENY OF ACADEMIC FREEDOM BILLS



1. TN Butler Act; Scopes v. State (upheld)
AR Initiated Act 1; Epperson v. AR
(overturned; no secular purpose to prohibition)
2. Public Acts of TN; Daniel v. Waters
(required teaching of creationism = preferential treatment)
3. Segraves v. CA (required teaching of TE not violative of Fr. Ex. cl.)
4. MS Balanced Treatment Bill. LA Balanced Treatment Bill;
Edwards v. Aguillard (unconst.; no secular purpose)
5. AR Act 590; McLean v. AR BOE ('creation science' not science)
6. Webster v. New Lenox Sch. Distr.
(denied; teaching TE not violative of Fr. Sp. cl.)
7. Peloza v. Capistrano Sch. Distr.
(teaching TE not an establ. of secular humanism)

1. Teaching Prohibitions 1925-1968

8. DI introduces "Teach the Controversy" campaign
9. DI promotes "Critical Analysis" of TE
10. KS Dept. of Ed. changes definition of 'science' to include
supernatural causation; reverses 2 yrs. later
11. Kitzmiller v. Dover BOE (policy to make aware of ID text and gaps
in TE violates Lemon test)
12. Santorum Amendment to NCLB Act. LSEA passed into law
13. AL and WA state require disclaimers on science textbooks
Freiler v. Tangipahoa BOE
(stated intent, 'critical thinking', a sham)
14. KS removes all references to "macroevolution" from science stds
15. KY Dept. of Ed. replaces TE with "change over time"
in science stds