



# Florida Science Matters

Florida Citizens for Science

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## Welcome!

by Joe Wolf

Welcome to “Florida Science Matters,” produced by Florida Citizens for Science. We are a volunteer, not-for-profit organization incorporated here in the state of Florida. We are teachers, scientists, retired folks, printers, designers, gardeners, office workers and others from all walks of life. We all share an interest in education and science and believe these are important for Florida’s future. We accept people of all races, genders, political beliefs, and religions from throughout Florida. We are non-political – we do not support political candidates – but we do support and promote ideas. Our mission is to promote high quality science education here in Florida, including teaching evolution, the foundational concept of modern biology.

Science is under attack. Science is critically important to us as individuals, to the economy of Florida, our country and to the world. Without it we would not have the standard of living we enjoy today: the TVs we watch, our computers, the internet, our cell phones, the food we eat, the cars we drive, or the fuel to drive them. Many of us would not be alive today without medical science. But still: science is under attack.

The attack on science includes, but is not limited to, attacks on evolution and the teaching of evolution. The teaching of evolution has been attacked since the days of William Jennings Bryan in the 1920s and increased after the passage of the Next Generation Sunshine State Science Standards in 2008. Since 2008, bills have been introduced in the legislature every year to allow teachers to teach creationism, “alternate theories” to evolution, strengths and weakness of evolution, intelligent design, or one of the other

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## Toward Better Science Literacy for All: Florida’s New Science Standards

by Debra Walker, Ph.D.

Exactly how do we improve science literacy in Florida? Higher standards are a start. Toward that goal, the Florida Department of Education recently convened a committee of volunteer framers and writers to redesign the state’s science standards.

The committee began work in May 2007. The process ended when the Florida Board of Education (BOE) approved new standards on February 19, 2008. Most committee members were teachers and professors. I was one of two elected officials who took part; we are both school board members with science credentials. It was exhilarating to collaborate with consummate professionals working out what kids should know about science when they graduate high school.

The new science standards cover major concepts at greater depth than before and encourage hands-on laboratory experiences for all kids, beginning in kindergarten. Benchmarks were aligned by grade level and organized into 18 Big Ideas that spanned the K-12 sequence. These organizing principles are drawn from science frameworks used in the National Assessment of Educational Progress, a standardized test used to sample districts each year to determine relative success.

Three major content strands run through the K-12 sequence: physical science, earth/space science and life science. A fourth strand, the nature of science, covers scientific thinking across the discipline. Florida’s nature of science benchmarks are unique in the US. Teachers can use them to demonstrate the difference between scientific ways of knowing and other ways of knowing. Scientific thinking is not innate; it must be explicitly taught. The nature of

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euphemisms for religion-inspired pseudoscience. Sometimes this masquerades under the heading of “Academic Freedom”. While the backers of this legislation are careful never to say what these alternate theories are, it is well known that they mean “Creation Science” and/or “Intelligent Design Creationism”. Around the country similar legislation has been introduced in many states, and passed in Louisiana. The Texas State School Board is allowing and even encouraging teachers to teach these concepts—based on belief, not scientific evidence—in the science classrooms. The recent movie *Expelled: No Intelligence Allowed* repeated old, tired, and proven false objections to evolution and in doing so called science itself into question. A few years ago the State Board of Education of Kansas tried to change the definition of science. They wanted to leave out the fact that science explains the natural world in terms of the natural world. The Kansas Board wanted to allow non-natural or super-natural explanations in science. As the author Kenneth Miller says, “This is a science stopper.” As soon as something becomes hard to understand a student or researcher could just say “a supernatural being did it:” end of inquiry, end of discussion, no more scientific advancements. We strongly object to the introduction of non-science and anti-science into our children’s science curriculum.

This newsletter and following newsletters will explore the vital issues that concern us. They will be published throughout the year but not on a definite schedule. We seek to educate our readers about evolution, science and why science is important to the lives of everyone here in Florida.

*(Joe Wolf is president of Florida Citizens for Science.)*

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## Intelligent Design Creationism: Not Science but Nonsense

by David L. Wilson, Ph.D.

The intelligent design (ID) argument, as put forward by William Paley in 1802, is a simple one. Paley said that if one were to find a watch on the ground, one would conclude that such a complex instrument required a designer—so why shouldn’t the same hold true for living organisms, which are even more complex than watches? This was a version of the even older teleological argument for the existence of a god.

Half a century after the ID argument of Paley, Darwin showed that, for living organisms, natural selection can substitute for a designer, eliminating the need for assuming that each species on Earth required a separate creation. Nevertheless, some not only cling to ID but argue that it deserves equal time with evolution in public school science classrooms. It is on this political, rather than scientific, level that the argument continues. Many individuals in both religious and scientific communities oppose such “equal time” proposals because, among other reasons, ID proved to be unneeded. Below, I briefly examine the ID argument and some reasons why it does not belong in science classes, except as an example of a hypothesis that is not supported by evidence and is not scientific, and therefore is not an appropriate classroom alternative to the theory of evolution by natural selection.

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science benchmarks help students find structure in the great diversity of scientific content they must internalize.

Life science saw a major overhaul in terms of evolution. The basic concept is first introduced in the primary grades. Human evolution is considered in middle school. Evolutionary processes are important components of the high school curriculum. In fact, evolution appears 16 times in the new standards: a dramatic contrast to the prior standards, which omitted evolution entirely.

As the new standards are dramatically different in all strands, textbooks are now being substantially revised to correlate with them. Florida has appointed Science Textbook Committees that adopted appropriate texts in the fall of 2010. These texts are available for districts to purchase for the 2011-2012 school year. Judging by recent events in Texas, the textbook selection process is rife with opportunities for politics to infringe on curriculum. Be prepared to speak out if all goes awry. Florida Citizens for Science will be keeping an eye on the process for you—but please contact us immediately if you see a problem in your local district..

Over the past year, officials across the nation have developed a set of national standards referred to as the Common Core. The Florida BOE is now preparing to adopt these standards, which will eventually replace our Florida standards. For science, this is scheduled to occur in 2014. We must remain vigilant throughout the process to ensure that Florida’s new standards are not watered down for the sake of a Common Core.

*(Debra Walker, Ph.D., is Courtesy Assistant Curator, Florida Museum of Natural History, University of Florida.)*

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The recent rebirth of the idea of ID is linked to young-Earth creationism—the view that the universe and all in it was created by a god, or gods, a few thousand years ago. That view began to fall apart during the early-to-mid 1800s as scientific evidence showed a much older age for our universe, now estimated to be about 14 billion years. Attempts to place the creationist view into science classes peaked with the Scopes trial in 1925, which actually concerned whether evolution could be taught in public schools. Though creationists won that trial, they lost the political argument from that point, and it was downhill from there. Evolution was not only allowed in science classes, but attempts to teach creationism were blocked by courts, culminating in a U. S. Supreme Court decision in 1987 (*Edwards v. Aguillard*) that prohibited the teaching of “scientific creationism” in public schools as a violation of the separation of church and state. Creationism was legally recognized as a religious view, not a scientific one.

Creationism was quickly repackaged into ID by individuals and groups such as the Discovery Institute, whose stated goal was to promote their particular religious world-view in public schools. ID is a reworking and adjustment of creationism, and those supporting it have hopes of getting their ideas into classrooms. To achieve their goal, they have supporters of their views on school boards and state textbook committees, pressing for ID to be taught alongside evolution in science classes. They had a major setback in Pennsylvania in 2005, when a conservative federal court judge appointed by George W. Bush, John E. Jones III, ejected ID from

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classrooms, identifying it as just creationism warmed over (*Kitzmiller, et al v. Dover Area School District, et al.*): “We find that ID is not science and cannot be adjudged a valid, accepted scientific theory.” Judge Jones declared that ID “is grounded in theology, not science.”

One interesting side point of discovery at that trial concerned a book, *Of Pandas and People*, which ID proponents present as a preferred textbook. The book was being written at the time of the *Aguillard* decision in 1987. Early drafts of the book spoke of creationism. After the Supreme Court decision, each mention of “creation science” was simply replaced by “intelligent design” before the final version of the book went to press, showing the concepts were nearly synonymous.

Nevertheless, ID supporters continue to press for their views, which are based on opinion and without scientific foundation. There are several parts to the ID argument, as it currently is being presented. One part attempts to challenge evolution by natural selection by questioning how complex, multi-part mechanisms in living organisms could have evolved when a single part would not have functioned alone, and so could not have been selected for during evolution. Those arguing for ID seem to be saying that they can’t figure out how multi-part mechanisms could have evolved naturally, so ID must be required. I would suggest that this is more a limit in their imaginations than in the natural world. Currently, scientists are elegantly delineating the ways many particular mechanisms did evolve. Combining evidence from gene sequencing, comparative morphology, and the timeline of fossils allows them to illustrate that the various parts of a particular, current mechanism evolved at earlier times for other, different functions, and so were available for a new use. The evidence indicates that it is quite possible for complex mechanisms to evolve naturally.

Basically, the ID argument boils down to “I can’t figure out how this happened naturally, so it must not have.” ID views were found to be unnecessary during the 1800s, as natural mechanisms were discovered, developed, and supported by evidence. ID views did not die in the public arena because some religious extremists do not want to recognize that natural selection can act as the equivalent of a designer, replacing the need for a supernatural explanation.

Another frequently heard statement from ID supporters is that one should “teach the controversy” in science classrooms—that teaching ID is a matter of academic freedom, and that it is important for students to hear all sides of the argument and be allowed to make up their own minds. Such an argument is misguided because it is a false dichotomy. There is no controversy between ID and evolutionary views within science today. There are no striking data anomalies in evolutionary theory. Evolution, the idea that life has evolved and is evolving on Earth, is one of the most strongly supported theories in science today, with growing evidence from a variety of scientific disciplines. It might be easier to challenge Newton’s law of gravity than evolution, but that theory is not as much of a source of distress to some as evolution is.

So, if there is a controversy to teach here, it is not a scientific one, but a political, philosophical, or religious one. The whole history of ID-creationism might make an interesting topic for a history class or a law school class, but to insert it into a science class, to be taught as a viable alternative to evolution, would be like inserting flat earth views into a geology class or astrology into an astronomy class. Teaching what some people think or believe, rather than what the data and evidence show, is not teaching science.

Science must always remain open to new ideas, new data, and tests of hypotheses and theories. However, there are no data that support ID, and no test has been done to support ID. That is why ID is just masquerading as a science—it is a pseudoscience at best. There is no way to falsify an ID hypothesis. It basically is a criticism of the gaps. It can be used to attack a not-yet-solved or understood aspect of science, and merely says that we won’t ever have a natural explanation. That is not evidence, but just an assertion. What has been happening, first with creationism, and now with ID, is that as science advances, the supporters have to retreat and continue to “explain” the remaining gaps. We saw that happen with the idea of “missing links” in the fossil record in Darwin’s time. Creationists argued that there were gaps in the fossil record. Of course, such gaps are exactly what are expected, as fossils do not form for every living organism. Since Darwin’s time, as more evidence has been gathered, many links have been found, and so are no longer “missing.” Indeed, in the case of human evolution from earlier primate forms, there now is a deep richness of hominid fossils—distant and close “cousins” to our own species of *Homo sapiens*. To the ID proponent, every time a missing link is identified, one missing link becomes two—one on each side of the new link.

There is a much larger concern about attempts to introduce ID as a part of science. ID proponents have declared a “wedge strategy” of pushing more generally for inclusion of supernatural explanations within science. Amusingly, some are now attacking neuroscience, and calling for a return to earlier views of the relationship between mind and brain that have mind as a supernatural entity. This attempt, ironically, occurs just as science is finding ever-stronger evidence that mental activities arise from the functioning of the brain. Supernatural explanations do not withstand tests of scientific rigor. It is difficult to imagine the look of science if supernatural explanations are allowed a role, since science would just stop wherever a supernatural explanation is accepted. In the case of ID, there is no useful explanatory role that it adds. Accept ID and the next question is: who or what designed the designer? Invoking an unexplained designer does not explain anything. Meanwhile, ID inclusion expands causes beyond those needed—it is not parsimonious. Science attempts to find natural explanations for how our universe works, and scientists seem to be doing a pretty good job of it. ID is not necessary, useful, or testable.

(David L. Wilson is Professor of Biology at the University of Miami.)

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Keep Up  
with Florida science education:

Read the



# The Precise Language of Science

by Kevin M. Folta, Ph.D.

One of the challenges of communicating scientific principles is that scientists are committed to speak and write within a framework of strict rules. These rules require the use of conservative statements, discrete meanings and soft language that reflect the ever-changing face of science. Scientists' statements are bound to precise experimental design, generation of reproducible evidence, and evaluation of data and interpretation by rigorous peer review.

Those who espouse less-than-scientific viewpoints do not strive to meet these same criteria. They do not need to, as their views come from a place other than evidence-based, unbiased scientific inquiry.

Herein lies the central problem with communicating science today, especially in a climate where political or ideological positions are frequently incompatible with hard scientific findings. Scientists maintain adherence to the rules of science, yet those we try to share our results with do not necessarily possess the tools, training or desire to understand precisely what is being said. This disparity is the foundation of misunderstanding and mistrust, as the words we use in science are readily misinterpreted (if not manipulated) by those who preach anti-scientific agendas.

While it may be attractive (and easy) to fight nonsense with nonsense, it is critical that proponents of scientific principles maintain strict adherence to the rules of scientific communication. One of the most important facets of this approach is to understand the frequently misused terminology associated with scientific inquiry. By self-policing our language we can better engage those who tout anti-scientific principles and more clearly present truly scientific findings or positions. Here are some good examples. To illustrate the point, fill in the blank with the words "evolution", "climate change", "vaccination safety", or "we landed on the moon".

1. It is common to hear scientific proponents say, "I believe in \_\_\_\_\_." What we really mean is, "I accept the evidence supporting \_\_\_\_\_." There is no "belief" in science, yet we hear such statements frequently in scientific discourse. The precise attitude is not one of belief, but one that understands, trusts, and acknowledges empirical scientific data.
2. It is also common to hear someone say, "I have a theory about \_\_\_\_\_." What they really mean is, "I have a hypothesis regarding \_\_\_\_\_." This example is an important one because it plays into the "only a theory" concept promoted by

those who do not understand science. In popular parlance a theory is a guess, whereas in the scientific context it is a hard synthesis of substantial evidence that provides a currently irrefutable basis for further inquiry. A hypothesis is a testable notion. Precise use of "hypothesis" instead of "theory" clears confusion.

3. I can't tell you how many times I've heard science proponents say, "It is part of the \_\_\_\_\_ debate," when in reality there is no basis to infer two opposing scientific positions. It is important for us as stewards of science to denounce the false dichotomy and maintain a position that there is science, and there is everything else. Until opposing positions present compelling data in suitable forums, they are not science and there is no debate.
4. "\_\_\_\_\_ has been proven." This is a tough one, as the clear scientific consensus tells us that beyond the shadow of a doubt that there is undeniable evidence supporting \_\_\_\_\_. We see this massive data set as proof. But should we remain open as scientists? What we really should say is that "There is massive and thus far incontrovertible evidence supporting \_\_\_\_\_ that defines a scientific consensus." This leaves the door open for new findings and interpretations that could potentially reshape scientific interpretations if they are found through hypothesis testing.
5. "The claims for/against \_\_\_\_\_ have been published." Again, this is a flimsy and perhaps dangerous statement, as "published" can mean a note in a book, an opinion in a newspaper article or even a note on a website. What we need to say is that "The evidence for \_\_\_\_\_ has been presented in the peer-reviewed literature in a high-impact journal." Peer-review is a rigorous editorial process where those who may agree, or frequently disagree, with your viewpoint critique your work. In legitimate journals, review is rarely a rubber stamp, and is frequently an evidence-based persuasive battle among author, editor, and referee. New "journals" claim peer review, especially in complementary and alternative medicine, and now "creation science". These are not high impact (frequently cited) journals, and therefore are not considered equivalent with actual published evidence.

Ultimately the words we use have meaning and the words we use to communicate science must be precise to limit innocent misinterpretation or malicious manipulation. It is important to remember to use precise language, especially when discussing flashpoint topics with students, opposition groups, or the media.

(Kevin M. Folta, Ph.D., is Assistant Professor, Horticultural Sciences Department, University of Florida.)

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