# Why We *Should* Teach About Creationism in Science Classes*

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October 19, 2005

In recent years, the proponents of teaching "Intelligent Design" and its precursor "Scientific Creationism" have redoubled their efforts to impose their pseudo-science in the classrooms of our public schools.

Yet, in all the turmoil created by these battles in the school boards and courts, there is one solution that has been overlooked, or perhaps avoided. In the true spirit of turning a problem into an opportunity, if we wish to improve the critical thinking skills of our students, "Scientific Creationism" provides many examples of a pseudo-science that can be analyzed in detail to teach students why it just doesn't work.

My field is astrophysics, and over the past ten years I've examined a number of claims by the "Young Earth Creationists" (YEC) who object to modern cosmology's evidence that the universe is on the order of 14 billion years old. I have discovered that creationist theories, such as claims that the speed of light was significantly higher in the recent past[1], (to solve the light-travel time of seeing galaxies billions of light-years away in a Universe less than ten-thousand years old) have errors so obvious that they can be addressed by students with a high school (or advanced middle school) understanding of physics or mathematics[2]. YEC claims using general relativity[3, 4] might have to be dealt with in undergraduate to graduate-level physics classes[5, 6]. These debunking exercises will better prepare future scientists for dealing with these issues.

Many amateur and professional scientists have analyzed creationist claims and the results are available through a number of resources such as the *Talk.Origins* newsgroup and website[7]. In college level physics and astronomy classes, many Creationist claims can be examined directly. Gigabytes

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of astrophysical data are already freely available online to support such a project. Curriculum developers need to be able to convert the analyses of pseudo-science claims into workable lesson plans and then deliver the resources and necessary training to the schools and teachers. This is not an easy task, but the price of *not* doing it risks crippling American leadership in science and engineering. Myself and others have done some work from the astrophysical side of the problem, as have some geologists and biologists, but these efforts need to be expanded.

Advocates of "Creation Science"[8, 9] and "Intelligent Design"[10] fear such an approach. While it's not received much attention, some have publicly admitted that their theory (actually a hypothesis) has had no success in the laboratory[11]. Creationist cosmologies rely on experimentally unsupported analysis techniques, in such basic areas as computing signal travel time or gravitational forces, that are of no value for designing a radar system or a satellite trajectory. That's why they fall back to "teaching the controversy" as it is an easy way to avoid this problem, while they try to maneuver other components of their agenda into the classroom (this is what the Discovery Institute describes as the "Wedge Strategy")[12]. "Intelligent Design", as a real scientific theory, failed a century ago, and belongs in the dustbin of failed theories with the luminiferous aether and the plum-pudding model of the atom.

The "Teaching the Controversy" approach advocated by IDers focuses on the "problems" in the theory of Evolution - while conveniently ignoring two basic facts: one, that their own theories (when they're actually bold enough to state one) have far more serious failures and problems; and two, that every established modern physical theory grew from a difficult problem, some aspects of which persist even today. It took thirty years of failures to develop a usable theory of atomic structure. The development of quantum theory not only moved atomic structure and chemistry into a realm understandable via mathematics, but it also opened the door to developing semiconductor electronics and understanding the mystery of low-temperature superconductivity. Yet a successful understanding of high-temperature superconductivity still eludes us. Every major scientific discovery has a similar history. Science is *about* solving problems, a task which can sometimes take years, even decades.

Creationist statements that "Evolution is a theory, not a fact" or that a scientific "theory" is weaker than a "law", are just playing games with words. Maxwell's electromagnetism is a theory - yet it has a far wider range of applicability than Gauss's Law, the Biot and Savart Law, and Faraday's Law which are contained within it. The kinetic theory of gases

has far more predictive power than the Gas Laws. Quantum mechanics is a theory. Even gravity is a theory. I've yet to see anyone demonstrate a useful better antenna design, a better semiconductor component design, or develop a trajectory to send a spacecraft through the Solar System without using these theories. We've sent spacecraft to distant regions of our own Solar System, but I've yet to see a Biblical geocentrist[13, 14] apply their theories to solving a practical problem such as computing the trajectory to send a spacecraft to a Sun-Earth Lagrange point, or to the Moon, Mars, or beyond. We already do this with robotic spacecraft and this might be an important issue for human crews in the not-to-distant future.

Another popular creationist claim is that we can't know what happened in distant regions of the cosmos or far back in time, yet physicists have done this from the time of Galileo with great success. Newton's theory of gravity was explaining how planets and stars move in empty space nearly three centuries before machines and humans could travel in space to test it. Einstein's revision to that theory was explaining observations in the distant cosmos years before some of the predictions could be tested in Earth-based experiments[15] and decades before its effects were incorporated into the Global Positioning System (GPS)[16, 17]. Quantum theory was explaining atomic behavior in rarified regions of distant space[18, 19] and the incredible high-density structure of stellar remnants such as white dwarf[20] and neutron stars decades before the conditions could be even partially reproduced in the laboratory[21, 22], even before it became a key component in the development of microelectronics. When astrophysicists discovered a deficit in the number of neutrinos emitted from the Sun in the late 1960s, called the Solar Neutrino Problem[23], Creationists touted this as evidence that the Sun was not powered by nuclear reactions and the 4.5 billion year age of the Sun was not possible[24]. Scientists checked their calculations and concluded that a neutrino mass (up to that time, calculations were done assuming neutrinos were massless), far smaller than was possible to measure at the time, could explain the deficit[23]. In recent years, we've been able to confirm this effect in Earth-based experiments[25]. We've even discovered properties in the atomic nucleus based on cosmological constraints[26, 27]. Cosmology isn't just something that happens 'out there' – it has often provided guidance on physical phenomena years before controlled laboratory experiments were possible. There have been no similar successes or utility from Creation "science" or "Intelligent Design". Cosmology has real practical applications for our technology and quality of life on Earth. Yet few of our science courses cover the history of the connections between discoveries and applications. This is material could easily be covered in introductory

and general education science classes.

Since the dawn of the atomic age in WWII, the scientific community has enjoyed the generosity of taxpaying public. Scientists have used this generosity to unlock mysteries from deep within the atom to the most distant regions of the cosmos and have generated useful products and methodologies in the process. These developments helped make the United States a world leader technologically as well as economically.

In spite of all this advancement, the American scientific community has left behind an intellectual vacuum in the education system that crackpots and con-artists have been all too willing to fill. The American scientific community has ignored this growing problem and now it threatens to undermine the knowledge engine that makes this nation a viable competitor in the global technology market. Those who doubt this should examine the history of this century more closely.

Stalin dismissed Darwinian selection in favor of Lysenko's theories on adaptation, allowing the political process, instead of the scientific process, to define the science. When the Soviets applied Lysenko's ideas to Soviet agriculture, crop failures ensued[28]. This was the reason for the U.S. grain sales to the Soviet Union in the 1970s. The Soviets' resulting inability to feed their own people was a contributor to their collapse.

The Nazis combined their anti-semitism and distain for the philosophical implications of the Theory of Relativity under the term "Jewish Physics", while touting their own experimentally-based "Aryan Physics"[29]. The famous "Einstein Letter", advocating the development of the atomic bomb, was sent to FDR in August of 1939. At that time, nuclear energy research was limited to tabletop experiments[30, 31]. The only indication that the energy release would extrapolate to levels necessary for an atomic bomb explosion were the successes of the same theory in calculating the energy production in the Sun and other stars[32, 33]. "Aryan Physics" had touted the superiority of experimentalists over the speculations of theorists[34], and (thankfully) may have hindered their ability to create such a weapon.

In working with students, we don't need to limit the debunking exercises to creationism. The popular media: movies, television, and even the news have contributed a lot of bad science to the public sphere. Phil Plait's *Bad Astronomy* website was started to address this issue[35]. There are also a plethora of pseudo-science claims with their adherents, many who post their ramblings on the World Wide Web. The late Carl Sagan addressed many of the flawed arguments in Velikovsky's *Worlds in Collision*[36] in Sagan's *Cosmos* series and book[37, pp. 90-91]. A perusal of the website *Crank dot Net*[38] yields a cornucopia of pseudoscientific claims with a broad

range of sophistication, such as: the Moon landing hoax, free-energy scams, and "proofs" that relativity is wrong. A surprisingly large number of these can be addressed at a high-school classroom level. Teaching students how to analyze these types of claims with real science gives them a valuable tool not only for their professional future, where they will be competing economically with scientifically literate citizens of other countries, but also for their role as citizens in a technologically-advanced society.

I've raised this issue with scientists and teachers, many of whom express reluctance to address debunking pseudo-science in the classroom, for reasons ranging from time constraints to limitations of science teacher competence. However, the scientific community can no longer afford the luxury of letting this battle play out in the courts and hoping for the best. Over the past five years, this problem has grown from isolated challenges in individual states to challenges all over the United States. The approach I propose gives the scientific community the chance to take control of the issue rather than continuing to dodge this guerilla war strategy of the Creationists.

The scientific community holds all the cards in this debate, it's time we play them.

**Acknowledgements:** The author would like to express appreciation to all those who reviewed drafts of this document and provided helpful corrections and comments.

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