Peter H. Garland, Executive Director
State Board of Education
333 Market Street
Harrisburg, PA 17126-0333

Dear Mr. Garland:

We are very concerned about sections of the Board’s proposed Academic Standards for Science and Technology that appear to permit local school districts to teach creationism. By including language that questions the scientifically based theory of evolution in sections 3.3.10.D and 3.3.12.D, the proposed standards assure that some of our 501 school districts will attempt to inject creation theory into their science classrooms. It is our understanding that at least one representative of the Department of Education has acknowledged that these standards do open the door to such teachings.

The Anti-Defamation League (ADL), an 88 year old civil rights and human relations organization, fights anti-Semitism, racism, prejudice, and bigotry of all kinds. ADL has been a leading force in maintaining the wall between church and state in the nation’s public schools. We regard a strong division between church and state as essential to preserve and promote religious rights and liberties in our increasingly pluralistic society. You can understand, therefore, why the ADL opposes the proposed language in sections 3.310.D and 3.3.12.D.

While the role of evolution in shaping the biological world is accepted as fact in the scientific community, some religious people—from a variety of faiths—reject its veracity because they believe it is irreconcilable with the Biblical story of creation. Many opponents of the teaching of evolution argue that evolution remains unproven, and that schools should give equal time to “creationism,” the belief that humankind was created by a divine being according to a literal interpretation of the Book of Genesis. This idea is clearly a religious doctrine and should not be taught as fact in the public schools.

The Establishment Clause of the First Amendment of the U.S. Constitution prohibits the government from endorsing any particular religious belief. This prohibition ensures that our public schools remain places in which students of all faiths may learn in an atmosphere free from divisive theological debates and sectarianism. Public schools must fulfill the First Amendment’s mandate of separation of church and state and remain free from the influence of religious dogma in order for students of all faiths to attend school without fear of coercion.

The U.S. Supreme Court has unambiguously held that it is unconstitutional to restrict a public school teacher’s right to teach evolution, as well as to require
educators who teach evolution to also teach "creationism." To counter these decisions, creationists have developed new tactics to promote their way of undermining the way biology is taught in public schools, such as the language proposed in sections 3.3.10.D and 3.3.12.D of the proposed standards.

Creationism is a collection of religious ideas based on varying interpretations of the Bible. Consequently, any attempt to supplant or supplement the teaching of evolution in order to promote creationism would have a religious purpose. This effort to introduce a theological doctrine into the public school curricula would inevitably offend many teachers and students. Different religions interpret the Bible differently. Whose religious interpretation would be taught? Further, what about students who come from religious traditions where their sacred texts differ with the Bible? Both public school educators and religious leaders should be concerned about the prospect of biology classes degenerating into debates on Biblical interpretation.

While the Biblical story of creation may constitutionally be taught as part of a class on religion or religious literature, in science classes teachers must present only scientific explanations for life on earth. Further, science teachers may not teach as fact the theory that humankind was created by a divine being or that the Book of Genesis presents an accurate version of the world's creation. The Supreme Court's approach is beneficial not only to science teaching, but also to an atmosphere which allows diverse religious beliefs to co-exist in the classroom. Our history has largely been free of the kind of sectarian discord that has plagued other countries precisely because we have kept government out of religion and religion free from government control.

We urge that the words "or do not support" in the first paragraph of section 3.3.10.D, and the entire first paragraph of section 3.3.12.D be deleted from the proposal. The lack of such language in at least one section of the standards that concern the theory of evolution highlights the fact that these words are unnecessary. Section 3.5.12.A in the section paragraph reads "Interpret geological evidence supporting evolution".

By protecting the right of students to learn science uninfluenced by religious doctrine, we best fulfill the purpose and the promise of the First Amendment. Any religious body has the constitutional right and protection to teach creationism as a part of its doctrine. At the same time, there must be no doubt that creationism may not be taught in the science classes of our public schools.

Sincerely,

Ginnie S. Greene
Associate Director
May 14, 2001

Peter H. Garland, Executive Director
State Board of Education
333 Market St.
Harrisburg, PA 17126-0333

Dear Mr. Garland:

I have been aware of the proposed section of the State Board’s proposed Academic Standards for Science and Technology that could permit the teaching of creationism in the science curriculum of local school districts. This is something that has been of concern to me.

Our church acknowledges the crucial importance of the state in the realization of religious and other liberties and declares its support of the proper exercise of governmental power to that end. In determining academic standards for public schools, the State Board has an obligation to give equal protection to all religious views. Since creationism is believed by many, but not all, as a matter of faith, opening the door to its teaching in public school classrooms, in our view, violates the equal protection standard.

Specifically, I would recommend that the words “or do not support” in the first paragraph of section 3.3.10.D, and the entire first paragraph of section 3.3.12.D be deleted from the proposed language.

The Evangelical Lutheran Church in America strongly supports the right of any religious body to teach creationism as part of its doctrine. This is clearly the responsibility of the church, synagogue, mosque or other places of worship.

I urge you to retain the traditional neutrality of public education in matters of religion by removing the above-cited language.

Thank you for your consideration.

Sincerely,

[Signature]

The Rev. Donald J. McCoid, D.D.
Bishop, Southwestern Pennsylvania Synod
Evangelical Lutheran Church in America
Dear Dr. Garland,

I am writing with regard to the proposed amendments to the state academic standards in science, technology, the environment, and ecology. The proposed amendments were advertised in the April 21, 2001 edition of the Pennsylvania Bulletin.

A working knowledge of science is of great importance to the high school student in the understanding of issues which may come up in everyday life as well as in competing with their peers for higher academic and career positions. The earlier the student is exposed to quality science education, the better his or her foundation in the sciences would be for later coursework. This is why it is of such great importance to ensure that our Commonwealth present the best information it possibly can. As such, I am providing my comments to the proposed standards to assist you in their finalization. Additionally, I should note that my background includes an undergraduate and graduate degree in biology, past positions as an environmental chemist, and a current position as an environmental biologist with the Federal government. As my background is primarily general science, biology, and environmental studies, I will only comment on those related standards.

**Proposed Standards for Science and Technology**

A. Inquiry and Design

Standard A. First, contrasts should be clearly presented between the scientific and everyday usage of the terms law, fact, theory, and hypothesis. Due to a lack of understanding of such terms, today, much information presented to the public today results in either confusion or mis-understanding of the information. Second, this standard should specify the meaning of “new information”. If new information is used to change or modify a scientific theory or practice, it must be acquired through the scientific method and then evaluated by the peer review process. “New information” presented should not
come by non-scientific conjecture, hunches, emotion, un-substantiated information, or hypotheses. If the standard is to involve this kind of review of scientific information, the curriculum designer(s) must be very well versed in the issues and what is and is not based in science. This holds similarly for the involvement of skepticism about scientific explanations and critical evaluations of scientific theories. Of course skepticism is very important in the promotion of critical thinking. Therefore, curricula may include discussion or debate of how a specific theory was actually modified by healthy scientific skepticism to form an existing scientific theory. I question, though, at what level these determinations (e.g. identification of specific "new information") would be made and by what person or persons. Finally, for this standard, it is mentioned that science is limited to the observable aspects of the world and the universe. I agree, to an extent, with this point. However, the standard should identify that the observable may include observable indicators of un-observable phenomena (e.g. the change in color of a solution to indicate pH change or the deflection of a meter to indicate electron flow). It may be better to say that science is limit to the concrete.

Standard B. Within this section, the standard seems to elude to the scientific method at various points (..raising questions, formulating hypotheses...). The scientific method is the basis by which all scientific endeavors are measured. The method should not be eluded to, it should be out-and-out stated as part of the standard. As well, it seems that there is a dis-joint between the elusion of the scientific method and the final step - the theory (i.e. the method is described in 3.2.7B but the theory is described in 3.2.7A). This term too should be defined in the standards and described as an extremely important part of the method. Third, the standard should include, at least at the upper levels, a description of peer review and its importance to the scientific process.

Biological Sciences:

Standard A. This standard stresses the similarities and differences between living organisms and the reasons for similarities and differences as related to environmental circumstances. This is only partly accurate as genetic relationships (both existing and ancestral) between living organisms play key roles in many similarities and differences. Continuing, later grades are to learn the phylogenetic scale only up to the level of the order. Why do they not include family, genus, and species as they too are very important stages of biological classification? The jump from 3.3.7A to 3.3.10A seems dis-joint as the standard involves the usage of dichotomous keys in grade 7 but the phylogenetic scale is not mentioned until grade 10. It is my experience that dichotomous keys work by the phylogenetic scale and usually to the species level. How is the 7th grader to understand the usage of such a dichotomous key when he is not to learn the levels of classification for 3 or so more years?

Standard D. The standard should mention at an upper grade level that extinction, while largely natural, may be brought about by man's impacts.
It is un-clear as to the wisdom or validity of mentioning studies that do not support evolution theory. First, why must evolution be singled out among all the numerous theories upon which the rest of the biology standards (and science in general) are based? Recall my comments from Standard A of “Inquiry and Design” regarding new information (including new scientific facts). Any new information typically added to the curriculum would have gone through the rigors of the scientific process (including a thorough peer review). To date, I am not aware of any scientific studies that refute evolution in general although I have seen valid refutations of case specific research. However, at that point, the scientific process would not be considered complete. I am also aware of a great deal of conjectural information not based on science or not reviewed by the peer review process and not found to be acceptable to the science at large of which is typically leveled at case-specific studies as a refutation of evolution in general. Furthermore, the text book is to be used to disseminate the most accepted information on the general level (although case-specific studies may be used to describe a concept). Involving “new facts” would be highly confusing to the student who is not totally cognizant of the scientific process. As I am sure you are aware, evolution is the key unifying theory to which biology is based. It may be beneficial in the spirit of skepticism and critical thinking, however, to review some case-specific controversies between lower-level studies to show that argument is part of the process of scientific theory refinement. But to derive an argument against a well-developed, wide-ranging theory such as evolution on the basis of questionable refutations of a few case-specific studies does not make much sense to me.

Glossary. The glossary should include the follow terms and concepts: theory (scientific), hypothesis (scientific), law (scientific), fact (scientific).

**Environment and Ecology Standards**

Watersheds and Wetlands:

The standards should mention that the study of the environment is based upon the basic sciences (i.e. biology, chemistry, and physics) and so the scientific process including the scientific method and the peer review process. In upper levels, it may be a good idea to compare and contrast actual scientific finds versus media interpretation.

Standard C - The standard mentions the importance of diversity of organisms in a stream as a reflection of quality. It should go further to mention that specific groups of organisms are often equated with the quality of the waterbody. As well, the standard should incorporate mention of the biological, chemical, and physical testing procedures typically used to identify water quality.

Standard D - The standard should emphasize the role the various forms of hydrology (e.g. sheet flow from precipitation, groundwater, surface water, tidal flux, and perched water tables) play in wetland development and characterization.
Standard E. - Under cost-benefit analysis, the standard mentions the impact of man on wetland and watershed conservation. The standard should also include the impact of conservation on human activities.

Renewable and Non-Renewable Resources

Standard A - The standard should include the explanation of environmental effects on usage of renewable resources as well as non-renewable resources.

Environmental Health

Standard A. The standard recognizes pollution reduction by cost-benefit analysis and risk management. However, if you are to include risk management, you must include assessment of risk to identify risk to be managed.

Standard B. The standard should include the impacts of point source pollutants on water supply as well as non-point sources. In the mention of environmental regulations, Federal ones should be stressed (those in addition to non-point and point source regulations) as well as local and state regulations.

Standard C. The standard should mention the impact of a healthy environment on the human ecosystem as well as other ecosystems.

Agriculture and Society

The Standards should include a study of agricultural impacts on the environment (e.g. forest clear-cutting and soil erosion, livestock feedlots and water quality, or farming and wetlands) and methods of minimizing such impacts.

Threatened and Endangered Species - First, Standards A and B seem to either duplicate information from Ecosystems and Their Interaction or reflect information that would best go in to Ecosystems and Their Interactions. Second, the standard should include A) the importance of preserving/conserving threatened and endangered (T&E) species; B) the impacts T&E species regulations have on development (e.g. commercial, residential, or infrastructure) and natural resource usage, and C) how impacts can be minimized to T&E species in development and natural resource usage.

Environmental Laws and Regulations

Standard A. The standard should mention at the lower levels that there are federal as well as state and local regulations. All key laws and regulations should be mentioned, at least to the federal level, of which regard the subjects already covered in the Environmental and Ecological Standards (e.g. the Clean Water Act for sewage/stormwater discharges and
wetland/waterway filling or the Resource Conservation and Recovery Act for solid waste management). This should be as most students would probably stay in the U.S. and be subject to those laws, but may not stay in Pennsylvania their whole life. In discussing conflicting rights and environmental regulations, the standard should mention that regulations assist in balancing the rights of those whom would utilize the resource versus those of whom would benefit from non-use of the resource (e.g. balancing the needs of a property owner of whom wishes to fill a wetland versus the needs of a neighbor of whom may be adversely affected by the filling of that wetland). I do not understand the need for singling out the Endangered Species Act for special consideration of positive and negative impacts. When teaching such material, it is often very hard to filter out what is science and what is pure conjecture. Those in position to make curriculum decisions need to be very well-rounded and highly knowledgeable about such issues if you plan to include that kind of review of any environmental regulations in the standards. It is important for the student to understand that the regulations are there for their health, safety, and well-being.

Glossary - The glossary should utilize accepted definitions of terms pertinent to their usage in the environmental sciences.

Regarding the term “wetland”, the definition should be “an area inundated or saturated with surface or groundwater at a frequency or duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions”.

The term “mitigation” should be defined as an activity initiated to minimize the loss or impact to a resource (e.g. shallow water habitat, desert, old growth forest, ocean, tall grass prairie, wetland, endangered species, etc.). Typically, mitigation is done sequentially in the environmental realm. First, the resource should be avoided if at all possible. Then, if it must be impacted, the activity must minimize resource loss. For the loss of the resource that has been determined to be absolutely necessary, there should be compensation. Compensation may involve such activities as construction of a similar resource at a different location, restoration of temporary impacts or losses, enhancement of an existing resource, perpetual preservation of similar resources, or even monetary donations to an organization of whom would voluntarily do the those compensation activities mentioned. Construction of man-made habitats such as wetlands is only one type of compensation and is the last step in mitigation.

Regarding the term “pest”, it should include that it could be an organism in direct as well as indirect competition with humans for a resource. For example, it could be an organism such as a parasite that impacts the blood of an animal of whom we use for meat or clothing or an insect that affects an ornamental plant.

As well, the glossary should include all terms utilized in the standards. Similarly, such terms in the glossary should be used in the standards.
The Glossary should also include the following terms: hydric soils, risk assessment (as well as risk management), pollution, headwater, wildlife, erosion, sedimentation, consumer, producer, shredder, decomposer, predator, cost/benefit analysis, commodity, environment, toxic waste, hazardous waste, habitat, threatened species, endangered species, extinct species, law, and regulation.

Thank you for your time and consideration. As a former student within the Pennsylvania public educational system, I feel this Commonwealth should be commended for its past efforts to maintain the highest caliber of science, technology, and environmental education standards. I trust that you will ensure that all the science standards are kept to an equal, if not higher, level of academic competency to allow our students to reach their own level of competency. I thank you for your consideration.

Yours truly,

David J. Caplan
215-656-6731 (work)
610-887-8832 (home)
djcaplan@erols.com (e-mail)

Copy Furnished:

Representative Connie Williams
May 14, 2001

Peter H. Garland,
Executive Director of
State Board of Education
333 Market Street,
Harrisburg, PA. 17126-0333

Dear Mr. Garland,

I write to express my concern over the inclusion in the State Board's Proposed Academic Standards for Science and Technology of the provision: "that support or do not support the theory of evolution". My fears were further confirmed when a representative of PA Department of Education admitted last November that that language would allow the teaching of creationism in PA's public schools.

Creationism is not based on a scientifically arrived at theory, but rather on a religious basis arising from the first book of the Old Testament. The Courts of this country have repeatedly and consistently held that religious doctrines, like creationism, can not be taught as science.

I therefore urge you to take immediate action which would eliminate that provision from the proposed regulations. This undoubtedly will save the taxpayers considerable funds in legal fees and court costs defending this proposed academic standard.

Respectfully Yours,

Darlington Hoopes, Jr. Esq.

DHJr/fh
copies: The Honorable Jess M. Stairs
      The Honorable Nicholas A. Colafella
      The Honorable James J. Rhoades
      The Honorable Allyson Y. Schwartz
Peter H. Garland  
Executive Director of the State Board of Education  
333 Market Street  
Harrisburg, PA 17126-0333

Re: Pennsylvania Science and Technology Standards

Dear Mr. Garland,

I have just reviewed the latest draft of the Pennsylvania Science and Technology Standards. There are a few areas that are of great concern and disappointment to me. The structure of 3.3 biological sciences suggests a deliberate attempt to teach as little human evolution as possible. From grades 4-10 it seems human evolution is not addressed at all. Teaching these students only evolution pertaining to other animals. Finally by 12th grade human evolution is mentioned. However, by this time religionists have had many years to sow their seed of deception and little attention is paid to the very limited discussion of human evolution. The price of not offending a few religious fundamentalists is high. It is graduates who do not have a proper understanding of human evolution. It is graduates who equate murder with natural selection or claim Darwin and his theory as racist. Of course this is absolute rubbish. It is the children who will suffer from this incomplete education. Lacking accepted scientific knowledge that is fact, not theory as laymen understand the word.

There may be nothing more important than a proper understanding of human evolution. After all, it is the answer to the most asked question of all time. Who are we and where did we come from? Taught properly and thoroughly it is a beautiful process.

I also have specific objections to sections 3.3.10.D, "Analyze evidence ... that support or do not support the theory of evolution." And section 3.3.12.D, "Analyze the impact of new scientific facts on the theory of evolution." These phases seem to invite any number of creation myths to be presented as viable scientific alternatives worthy of classroom discussion. I certainly hope this was not your intention. Regardless of how it was intended, one must only look to previous religious attacks on learning (1968-Orange County California sexual education attack, 1974-Conold County West Virginia textbook war) to realize these are exactly the kind of vague phrases ruthless religious warriors will interpret and use to their benefit.

In addition, asking the classroom for possible evidence that does not support evolution would deliberately undermine its validity. I would suspect this technique is not applied to other accepted sciences. As with all accepted sciences, experts weigh all the evidence and draw conclusions from them. Indeed much of their time is spent trying to disprove what are referred to as theories. They have concluded that all evidence supports evolution. The only proof against mainstream human evolution would not be scientific but would originate from the myths of creationists. The truth does matter. Certainly we should be teaching what we know to be true. Even in the presence of angry creationists. Please instill a proper and thorough understanding of human evolution in our children.

Sincerely,

Bradley E. Paxson  
1118 Elm Street  
York, PA 17403
Dear Mr. Pierce:

Thank you for your e-mail of May 11, 2001 on proposed 22 Pa. Statutory Code, Chapter 4, Appendix B (academic standards for Science and Technology).

Your e-mail is considered as official public comment and is being shared with all members of the Board. Pursuant to the provisions of the Regulatory Review Act, copies of your comments are also being provided to the Independent Regulatory Review Commission (IRRC) and the Chairmen of the House and Senate Education Committees.

Be assured that your comments will be considered carefully in the development of the final-form of these regulations.

The Regulatory Review Act provides that information on the final-form of regulations be mailed to public commentators at their request. If you would like to receive the final-form of these academic standards when they are submitted to the Education Committees and IRRC, please make your request in writing to the State Board of Education, First Floor, 333 Market Street, Harrisburg, PA 17126-0333.

Sincerely yours,

Peter H. Garland
Executive Director

cc: Members of the State Board
    Senator Rhoades
    Senator Schwartz
    Representative Stairs
    Representative Colafella
    IRRC

-----Original Message-----
From: Timothy Pierce [mailto:tlpst48+@pitt.edu]
Sent: Friday, May 11, 2001 5:59 PM
To: O0statbd@psupen.psu.edu
Subject: Comments re: Standards

Dear Sir or Madam:

I wish to protest the approval of any language in Pennsylvania's science and technology education standards that will allow the teaching or introduction of creationist views in science curricula. Please edit the standards so that they DO NOT contain any of the state Board of Education's revisions from last July that would allow the teaching of creationism in science curricula. As a graduate student in the Department of Geology and Planetary Science at the University of Pittsburgh and as a member of several professional societies for earth
scientists. I feel that I must concur with the majority of my peers in stating that faith-based doctrine has no suitable place in science curricula. Particularly, I agree with the specifics regarding this matter that have been outlined in official statements by the American Geophysical Union (AGU) and the Geological Society of America (GSA). Thank you for listening to my concerns as well as those of other members of the scientific community.

Sincerely,

Timothy L. Pierce
Graduate Student Researcher
Department of Geology and Planetary Science
University of Pittsburgh
May 10, 2001

Peter H. Garland, Executive Director
State Board of Education
333 Market Street
Harrisburg, PA 17126-0333

Dear Mr. Garland:

As representatives of a number of faith based organizations we are very concerned about sections of the Board’s proposed Academic Standards for Science and Technology that appear to permit local school districts to teach creationism. By including language that questions the scientifically based theory of evolution in sections 3.3.10.D and 3.3.12.D, the proposed standards assure that some of our 501 school districts will attempt to inject creation theory into their science classrooms. It is our understanding that at least one representative of the Department of Education has acknowledged that these standards do open the door to such teachings.

Although creationism is believed by many as a matter of faith, it is a religious doctrine that should not be taught in our public school classrooms as science. Religion has an important place in our lives. It should be practiced in our churches, synagogues, mosques and other places of worship. Our United States and State Constitutions demand, and common sense dictates, however, that religious doctrine has no place in our public institutions.

We urge that the words “or do not support” in the first paragraph of section 3.3.10.D, and the entire first paragraph of section 3.3.12.D be deleted from the proposal. The lack of such language in at least one section of the standards that concern the theory of evolution, highlights the fact that these words are unnecessary. Section 3.5.12.A in the section paragraph reads “Interpret geological evidence supporting evolution”.

We strongly support the right of any religious body to teach creationism as fact as a part of its doctrine. At the same time, there must be no doubt that it may not be taught in the science classes of our public schools.

Sincerely,

[Signature]

Penny Staver
A United Methodist Witness

[Signature]

Rev. Lynn P. Lampman
Episcopal Public Policy Network

[Signature]

Rev. K. Joy Kaufmann
Pennsylvania Council of Churches

[Signature]

Joel Weisberg
Pennsylvania Jewish Coalition

222 Pine Street, Harrisburg, PA 17101
tele: (717)233-1110 fax: (717)233-3182
E-mail: PaJwshClnn@aol.com
Webpage: http://www.pjc.org
Dr. Peter Garland, Executive Director
State Board of Education
333 Market Street
Harrisburg, PA 17126-0333

Dear Dr. Garland:

I wish to comment on the draft academic standards dealing with science and technology. My particular concern is with those changes made in Section 3.3: Biological Sciences that relate to the teaching of evolution. I believe that adding the phrase "or do not support" to proposed standard 3.3.10.D.1, and adding a new standard 3.3.12.D.1 to "analyze the impact of new scientific facts on the theory of evolution" will confuse students about science and biology, reduce the quality and quantity of biology they will learn, and undermine their preparation for further study and careers.

From my training as a scientist at top American universities and my teaching of paleontology over a 35-year career at Bucknell University, it is clear that the theory of evolution is the most fundamental underpinning of our understanding of life and its history. In science, the word "theory" is reserved for important, well-understood, synthesizing concepts, such as the theory of gravity, or the theory of relativity. That is the status of ideas on the evolution of life. Some special-interest groups misuse this word "theory" to assert that evolution is "not proven"; nothing could be farther from the truth.

You may ask what could be the harm of introducing evidence and studies from the fossil record, body structures, embryology, or DNA that do not support the theory of evolution. First of all, there is NO such scientific evidence and studies that do not support the theory of evolution. Yes, there are other viewpoints on the evolution of life, but there are no other scientific viewpoints.

We face in this country a sophisticated attack by some special-interest groups on the teaching of evolution. While these groups have been largely unsuccessful in their more direct challenges, they have become more subtle and are now proposing to be allowed equal time in science classes for ideas that they claim to be alternative scientific views on life and its history. But those ideas have been shown time and again to have no scientific basis and to be merely a masquerade for introducing particular religious viewpoints into science classes.

While superficially one might argue that introducing opposing viewpoints in science classes is only a matter of fairness or balance, further thought shows that the consequences of this can be quite negative. No one would argue that anything positive would be achieved by introducing flat earth ideas into earth science classes, or astrology into astronomy classes, even though many people believe in the value of astrology. Some things just are not science and have no place in science classes. And be assured that it is nonscience ideas that these special interest groups want to have introduced into school biology classes.

Other states have experienced this same attack on the teaching evolution, and we can see what negative consequences ensue for the teaching and learning of biology. Students become confused about what science is and about what its principal foundations are. It is already next to impossible to find time to teach what is needed in biology classes, but with extraneous matters introduced, less real biology is taught. But even more worrying is that in many cases, teachers and school systems decide to avoid the controversy and remove all consideration of evolution from their programs. That then deprives all students of the most important concept in biology. At a
time when Governor Ridge appears in television commercials touting Pennsylvania's success in producing top-quality graduates in science and engineering, is it not a mistake to introduce something into education standards that will weaken the preparation of future graduates.

I urge you to revert to the previous wording of standard 3.3.10.D.1 and to exclude proposed standard 3.3.12.D.1

Yours sincerely,

Edward Cotter
Professor Emeritus of Geology
May 10, 2001

Peter H. Garland  
Executive Director  
State Board of Education  
333 Market Street  
Harrisburg, PA  17126-0333

Re:  A Response to the Proposed Academic Standards for Science and Technology and a recommendation for a new curriculum, ORIGINS.

Dear Mr. Garland:

No scientific theory of evolution exists. All references to "a theory of evolution" or "evolution theory" must be deleted from the Proposed Academic Standards of Science and Technology.

Naturalistic macroevolution is an irrational scientific theory. All references to a naturalistic "progression from an early hominid to a modern human," whether stated or implied, must be deleted from the Proposed Academic Standards of Science and Technology.

The evolution of the first cell and macroevolution are concepts that should be taught in public schools. A class on ORIGINS, which is separate from the science curriculum, needs to be developed to present, discuss, and debate the conflicting concepts and philosophies.

Sincerely yours,

Fredric P. Nelson, MD

Enclosure
A Response To The

Proposed

Academic Standards for

Science and Technology

By: Fredric P. Nelson, MD
A Response To The

Proposed Academic Standards for Science and Technology

I. No scientific theory of evolution exists. All references to a "theory of evolution" and "evolution theory" must be deleted.

A. The Proposed Academic Standards for Science and Technology states:

   As a result of repeated, rigorous testing over time and applying multiple perspectives to a problem, consistent information emerges. A theory describes this verifiable event or phenomena. [P. 3]

B. From this statement, a scientific theory can be defined as a concise description of consistent information that has been rigorously tested and verified.

C. Evolution can be divided into 4 distinct categories. They are:

   1. The naturalistic biochemical evolution of the first cell, which is a scientific hypothesis.
   2. Microevolution, which is a scientific theory.
   3. Naturalistic macroevolution, which is a scientific hypothesis.
   4. Evolution by intelligent design, which is a scientific hypothesis.
The naturalistic biochemical evolution of the first cell does not meet the definitional requirements of a scientific theory. It is a hypothesis.

1. The mechanisms responsible for the naturalistic biochemical evolution of the first cell have never been described, rigorously tested or verified.
   a.) The mechanisms for producing all of the necessary simple organic compounds are unknown.
   b.) The mechanisms for producing the necessary, functional proteins are unknown.
   c.) The mechanisms for producing the necessary, functional RNA are unknown.
   d.) The mechanisms for producing DNA with coherent and comprehensive information are unknown.
   e.) The mechanisms for producing a functional cell membrane are unknown.
   f.) The mechanisms for assembling all components at the right location and at the right time are unknown.
   g.) The mechanisms for initiating metabolism within the first cell are unknown.
   h.) The mechanisms for circumventing the laws of probability are unknown.

[See: THE NATURALISTIC BIOCHEMICAL EVOLUTION OF THE FIRST CELL: AN IRRATIONAL SCIENTIFIC HYPOTHESIS, Attached]

2. The naturalistic biochemical evolution of the first cell does not meet the definition of a scientific theory.

3. The naturalistic biochemical evolution of the first cell is a scientific hypothesis.

4. The Academic Standards for Science and Technology may refer to a hypothesis of the naturalistic biochemical evolution of the first cell.
E. Naturalistic Macroevolution does not meet the definitional requirements of a scientific theory. It is a hypothesis.

1. The mechanisms responsible for naturalistic macroevolution have never been described, rigorously tested or verified.

   a.) The mechanisms for producing a voluminous expansion of new DNA are unknown.

   b.) The mechanisms for producing DNA with coherent information are unknown. Coherent DNA in an insect might code for a wing structure that could generate lift.

   c.) The mechanisms for producing DNA with comprehensive information are unknown. Comprehensive DNA in an insect with wings must code for the physiology needed to power the wings and for the neurology needed for a functional flight program.

   d.) The mechanisms for producing irreducibly complex biochemical systems are unknown.

   e.) The mechanisms for circumventing the maximum number of tries available for naturalistic macroevolution, which is less than $10^{50}$ tries, are unknown. [See: NATURALISTIC MACROEVOLUTION- AN IRRATIONAL SCIENTIFIC HYPOTHESIS, attached]

   f.) The Mechanisms for circumventing the laws of probability are unknown.

2. Naturalistic macroevolution does not meet the definition of a scientific theory.

3. Naturalistic macroevolution is a scientific hypothesis.

4. The Academic Standards for Science and Technology may refer to a hypothesis of naturalistic macroevolution.
F. Microevolution fulfills the definitional requirements of a scientific theory.

   1. Many mechanisms responsible for microevolution have been defined, rigorously tested and verified.

   2. Microevolution meets the definition of a theory, and a theory of microevolution exists.

   3. The Academic Standards for Science and Technology may refer to a theory of microevolution.

G. Since the naturalistic biochemical evolution of the first cell and naturalistic macroevolution are scientific hypotheses, no theory of evolution exists.

H. Since no theory of evolution exists, the five (5) references to the “theory of evolution” or “evolution theory,” as found in The Proposed Academic Standards for Science and Technology, must be deleted.

   1. Two references are found under 3.3.10.D, Grade 10.

   2. Three references are found under 3.3.12.D, Grade 12.

II. The naturalistic macroevolution of modern humans from an early hominid is an irrational scientific theory. The naturalistic “progression from early hominids to modern humans,” as found under 3.3.12.D, Grade 12, must be neither stated nor inferred.

A. Time, matter, bodies of water, food supply, and good luck are all insufficient to bring about one step in the naturalistic macroevolution of a single-celled organism. [See: THE NATURALISTIC MACROEVOLUTION OF A λ REPRESSOR FOLD: AN IRRATIONAL SCIENTIFIC HYPOTHESIS, attached]

B. Time, matter, landmass, food supply, and good luck are all insufficient to bring about a single step in the naturalistic macroevolution of a large animal. [See: THE EVOLUTION OF THE GREATER CUMETERSAUR, attached]

C. The naturalistic macroevolution of an early hominid to a modern human is an irrational scientific hypothesis.

   1. The probability of DNA coding for a necessary, functional protein made up of only 100 amino acids is 1 chance in $10^{65}$ per try.

   2. One offspring of an early hominid is equal to 1 try in naturalistic macroevolution.
3. If an early hominid were given 1 chance in a 100 million trillion trillion trillion to complete the first step in naturalistic macroevolution toward a modern human within a time period of 1 million years, he would need to produce 6.7 offspring for every square meter of the landmass of Planet Earth each year for each of the 1 million years.

4. Each of the 6.7 offspring per square meter would need to reproduce for naturalistic selection to begin to select the 1 offspring with the advantageous trait provided by the new protein.

5. Time, matter, landmass, food supply and good luck are all insufficient to bring about the first step in the naturalistic macroevolution of an early hominid to a modern human.

D. Since naturalistic macroevolution does not and cannot explain just one step in macroevolution in a single-celled organism, in a large animal, or in an early hominid, it does not and cannot explain all steps in macroevolution.

E. Since the naturalistic macroevolution of modern humans from an early hominid is an irrational scientific hypothesis, it should not be taught in a science course.

F. All references and/or inferences to the naturalistic macroevolution of modern humans from an early hominid as found in The Proposed Academic Standards for Science and Technology must be deleted. [See: 3.3.12.D. Grade 12]

III. A Recommendation

Scientists state that evolution by intelligent design and special creation are not scientific and should not be taught in a science classroom. This is true. They are not scientific and should not be taught in a science classroom. However, the naturalistic biochemical evolution of the first cell and naturalistic macroevolution are highly irrational scientific hypotheses. They, too, should not be taught in a science classroom.

Since the evolution of the first cell and macroevolution are concepts that should be taught, a class on ORIGINS, which is separate from the science curriculum, needs to be developed to present, discuss, and debate the conflicting concepts and philosophies.

Fredric P. Nelson, MD
May 10, 2001
THE NATURALISTIC BIOCHEMICAL EVOLUTION
OF THE FIRST CELL –
AN IRRATIONAL SCIENTIFIC HYPOTHESIS

The National Aeronautic and Space Administration (NASA) has stated that the simplest living organization would have at least 124 different proteins and a functioning genetic code. Each of the proteins would contain 400 amino acid residues.

The universe has existed for $<10^{18}$ seconds and contains $<10^{80}$ hydrogen atoms.

The universe contains about $5 \times 10^5$ carbon atoms for every $10^5$ hydrogen atoms, and the large majority of carbon atoms remain within stars. There are $5 \times 10^5$ carbon atoms per $10^5$ hydrogen atoms $< 10^{80}$ hydrogen atoms or $<5 \times 10^{76}$ carbon atoms in the universe.

Proteins composed of 400 amino acid residues have a carbon skeleton composed of more than $1.6 \times 10^3$ carbon atoms. The maximum number of such proteins that can exist at any one time in the universe is $<5 \times 10^{76}$ carbon atoms / $>1.6 \times 10^3$ carbon atoms per protein or $<3.1 \times 10^{73}$ proteins.

Proteins must exist for more than 1 second to possibly contribute to the biochemical evolution of the first cell. There have been $<3.1 \times 10^{73}$ proteins per second $<10^{18}$ seconds or $<3.1 \times 10^{91}$ proteins [rounded up to $10^{92}$ proteins] possibly contributing to the biochemical evolution of the first cell during the entire existence of the universe.

The number of variations in a protein composed of 400 amino acid residues is $>10^{520}$.

The probability of producing a specific protein composed of 400 amino acid residues on the first attempt to arrange naturalistically (i.e., blindly or randomly) the amino acids is $<1/10^{520}$. The probability of producing a functional protein containing 400 amino acid residues on the first attempt to arrange naturalistically (i.e., blindly or randomly) the amino acids is $\sim 1/10^{260}$.

The probability of naturally producing a necessary, functional protein composed of 400 amino acid residues with only $10^{92}$ tries or attempts is:

A probability of $\sim 1/10^{260}$ per try x $10^{92}$ tries which equals a probability of $\sim 1/10^{168}$

A probability of $1/10^{168}$ is the same probability as consecutively drawing two preselected atoms from the universe followed by drawing a red marble from a container holding 100 million green marbles while blindfolded.
The DNA molecules of the birds provide no clue as to their various origins whether by naturalistic macroevolution; by evolution according to the intelligent design of very smart scientists; by evolution according to the intelligent design of God; or by the special creation of God from the dust of the ground. Since DNA does not manifest the biochemical mechanisms of its origin, it provides no scientific evidence to favor naturalistic macroevolution over evolution by intelligent design or over special creation.

As noted, the nucleic acid sequence in DNA specifies the nucleic acid sequence in RNA, which, in turn, specifies the amino acid sequence in proteins. Proteins are two steps removed from DNA. Since DNA and RNA do not reveal the biochemical mechanisms responsible for the nucleic acid sequence of DNA, proteins do not provide such information. Although proteins reveal a relationship between species, they provide no scientific evidence to favor naturalistic macroevolution over evolution by intelligent design or over special creation.

Homologous structures are three steps removed from DNA. DNA codes for RNA, which codes for proteins, which are the building blocks of homologous structures. Since DNA, RNA, and proteins fail to reveal the biochemical mechanisms responsible for the nucleic acid sequence of DNA, homologous structures fail to provide such information. Although homologous structures reveal a relationship between species, they provide no scientific evidence to favor naturalistic macroevolution over evolution by intelligent design or over special creation.

Fossils are homologous structures turned into stone. They are four steps removed from DNA, which codes for RNA, which codes for proteins, which form the building blocks of homologous structures, which turn to stone. Since DNA, RNA, proteins, and homologous structures fail to reveal the biochemical mechanisms responsible for the nucleic acid sequence of DNA, fossils fail to provide such information. Although fossils reveal a relationship between species, they, too, provide no physical evidence to favor naturalistic macroevolution over evolution by intelligent design or over special creation.

The relationships between species are frequently expressed visually through the use of branching diagrams called phylogenetic trees. A phylogenetic tree is used to depict relationships between various species by arranging DNA, proteins, homologous structures, fossils and/or representative pictures of the various species on the branching diagram. Not one of these phylogenetic trees is able to reveal the biochemical mechanisms responsible for the nucleic acid sequence of DNA. Phylogenetic trees provide no scientific evidence to favor naturalistic macroevolution over evolution by intelligent design or over special creation.

DNA, proteins, homologous structures, fossils, and phylogenetic trees do not, and cannot, provide any scientific evidence to favor naturalistic macroevolution over evolution by intelligent design or over special creation.
NATURALISTIC MACROEVOLUTION—
AN IRRATIONAL SCIENTIFIC HYPOTHESIS

Less than $10^{50}$ proteins have existed on planet earth. If $10^{50}$ proteins were swept together into one pile, there would be enough protein to cover the entire surface of Planet Earth to a depth of 3 feet every year for over 3.5 billion years. A little math is in order:

An average protein is composed of 200 amino acids and has a mass exceeding $2 \times 10^4$ daltons, where one dalton equals the mass of one hydrogen atom.

The mass of $10^{50}$ average proteins can be calculated by multiplying $>2 \times 10^4$ daltons per average protein times $10^{50}$ proteins. This equals a mass of more than $2 \times 10^{54}$ daltons or hydrogen atoms. Since $6.0225 \times 10^{23}$ hydrogen atoms are present in 1 gram of hydrogen, the mass of $10^{50}$ average proteins exceeds $3.32 \times 10^{30}$ grams.

$$>2 \times 10^{54} \text{ hydrogen atoms} / 6.0225 \times 10^{23} \text{ hydrogen atoms/gram} = >3.32 \times 10^{30} \text{ grams}$$

Planet Earth has a mass of $5.976 \times 10^{27}$ grams. The mass of $10^{50}$ average proteins would be more than 555 times the mass of Planet Earth.

$$>3.32 \times 10^{30} \text{ grams} / 5.976 \times 10^{27} \text{ grams} = \text{A relative mass} >555$$

Planet Earth has a mean density of $5.517 \text{ grams/cubic centimeter}$. Protein has a density less than 1.8 grams/cubic centimeter. If their masses were equal, the volume of protein would be more than 3 times the volume of Planet Earth.

$$5.517 \text{ grams/cubic centimeter} / <1.8 \text{ grams/cubic centimeter} = \text{A relative volume} >3$$

The volume of $10^{50}$ proteins would be more than 1665 times the volume of Planet Earth.

A relative mass $>555 \times \text{A relative density} >3 = \text{A relative volume} >1665$

Planet Earth has a volume of $1.083 \times 10^{21}$ cubic meters (cu. m.).

The volume of $10^{50}$ average proteins would be more than $1.803 \times 10^{24}$ cu. m.

$$>1665 \times 1.083 \times 10^{21} \text{ cu. m.} = >1.803 \times 10^{24} \text{ cu. m.}$$

Planet Earth has a total surface area of $5.096 \times 10^{14}$ square meters (sq. m.).

The depth of $10^{50}$ proteins on $5.096 \times 10^{14}$ sq. m. would be:

$$>1.803 \times 10^{24} \text{ cu. m.} = >3.538 \times 10^9 \text{ meters}$$

$$5.096 \times 10^{14} \text{ sq. m.}$$
Cumetersaur immediately realized that he had to take a much greater gamble. He speculated that a probability of 1 chance in a trillion trillion trillion for setting off on the first step of his evolutionary scheme would be much more reasonable. He redid his calculations and found that he would need $10^{21}$ offspring each year for 100 million years. He knew that that $10^{21}$ offspring would fill a volume of $10^{21}$ cubic meters, the volume of Planet Earth. "It can't be. It is!," he cried out to no one in particular.

Cumetersaur took up his pencil one last time. He wrote down the very unlikely probability of 1 chance in 100 million trillion trillion trillion. He desperately hoped that a mere $10^{13}$ offspring per year for 100 million years would prove reasonable. Why, his offspring would cover only 6.7% of Earth's landmass after the first year. At first he thought it just might work. But quickly he realized that after 5 more years 40% of the ground would be covered, and that natural selection requires his offspring to reproduce, and that the food supply would quickly vanish. "What good is a competitive advantage if it takes you longer to starve to death?," he mumbled to himself.

Cumetersaur let out a deep sigh. He laid down his pencil. A tear filled his right eye and splashed onto his penciled equations. Then heartbroken and weeping, he flung himself to the earth realizing that he, the Greater Cumetersaur, would never be the naturalistic progenitor of the great dinosaurs.

OBVIOUS CONCLUSIONS: Time, matter, landmass, food supply and good luck are all insufficient to account for naturalistic macroevolution. Naturalistic macroevolution is a highly irrational scientific hypothesis.
THE NATURALISTIC MACROEVOLUTION OF
A $\lambda$ REPRESSOR FOLD-
AN IRRATIONAL SCIENTIFIC HYPOTHESIS

Reidaar-Olson and Sauer determined that the probability of randomly assembling a $\lambda$ repressor fold by naturalistic macroevolution in the bacterium, Escherichia coli [E. coli], is about one chance in $10^{63}$ for each new protein segment made up of 92 amino acids. [See reverse side]

An E. coli with the $\lambda$ repressor fold would have greater reproductive success and would displace E. coli without the $\lambda$ repressor fold through natural selection.

A collection of $10^{50}$ E. coli, each with a new protein segment made up of 92 amino acids, would have one chance in 10 trillion of containing a $\lambda$ repressor fold.

E. coli are about 4 micrometers in length and 2 micrometers in diameter. They have a volume greater than 10 cubic micrometers.

A cubic meter contains $10^{18}$ cubic micrometers. One cubic meter would hold less than $10^{17}$ E. coli. A collection of $10^{50}$ E. coli would fill a volume greater than $10^{33}$ cubic meters.

A volume of $10^{33}$ cubic meters is more than the volume of a sphere whose radius extends from the center of the sun to the orbit of the planet Mercury. It would fill a volume 263 times the volume of Planet Earth each year for 3.5 billion years.

The expectation that naturalistic macroevolution would produce an E. coli with a $\lambda$ repressor fold is highly irrational. Time, matter, a suitable environment, food supply and good luck are all insufficient for accomplishing just this one step in naturalistic macroevolution. Naturalistic macroevolution does not—and cannot—account for all steps in macroevolution.
Functionally Acceptable Substitutions in Two α-Helical Regions of λ Repressor

John F. Reidhaar-Olson and Robert T. Sauer
Department of Biology, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139

"Extrapolation to the rest of the protein indicates that there should be about $10^{57}$ different allowed sequences for the entire 92-residue domain." Page 315

"Nevertheless, the estimated number of sequences capable of adopting the λ repressor fold is still an exceedingly small fraction, about one in $10^{63}$, of the total number of possible 92-residue sequences." Page 315

THE EVOLUTION OF
THE GREATER CUMETERSAUR

The Greater Cumetersaur was a most remarkable dinosaur. Not only was he a mathematical genius, he had evolved into a most peculiar shape. He measured exactly 1 meter in height, 1 meter in width, and 1 meter in length. Of all his dreams, Cumetersaur desperately wanted, more than anything else, to be the progenitor of all the great dinosaurs—the triceratops, the diplodocus, and even tyrannosaurus rex.

Cumetersaur believed he could succeed where lesser dinosaurs failed. He devised a way to naturalistically produce a new segment of DNA for each one of his offspring, and each new segment of DNA would code for a unique protein made up of only 100 amino acids. Each of his offspring would be another try in his quest to be the progenitor of history.

He had calculated that the probability of naturalistically coding for an average size protein, a protein made up of 200 amino acids, was 1 chance in $10^{260}$ per try, while the probability of naturalistically coding for a small protein, one made up of 100 amino acids, was greatly improved to only 1 chance in $10^{130}$ per try. He would, therefore, get his DNA to code just for the smaller proteins. His brilliance further shown forth as he was the first dinosaur to conceptualize that he did not need to code for a specific protein, only a functional protein. His experiments clearly revealed that the probability of a new segment of DNA coding for a needed functional protein made up of 100 amino acids was merely 1 chance in $10^{65}$ per try.

While Cumetersaur was brilliant, he was also a bit lazy. He believed that he had all the time in the world to undergo evolution. Well, while not having all the time in the world, he did feel that he could take up to 100 million years to accomplish the first step in his great evolutionary adventure. That he was a gambler worthy of his noble heritage became apparent when he initially decided to introduce a probability of 1 in 10 million into his calculations for naturalistically evolving the first functional protein. He picked up a pencil and a piece of bark, and he scribbled down his calculations.

The number of tries/year x a probability of $1/10^{65}$ per try x $10^8$ years = $1/10^7$ odds

Then he transposed the numbers and solved for the unknown.

The number of tries per year = $10^{65}$ tries x $1/10^8$ years x $1/10^7$ = $10^{50}$ tries per year

Cumetersaur understood that 1 try meant 1 offspring and that $10^{50}$ tries required $10^{50}$ offspring. He calculated that $10^{50}$ Cumetersaurs would fill a volume of $10^{50}$ cubic meters or about 118 cubic light years. "Yikes!" he shouted. His self-confidence drained away.
The depth of $10^{50}$ proteins on $5.096 \times 10^{14}$ sq. m. per year for 3.5 billion years would be:

$$>3.538 \times 10^9 \text{ meters} = >1 \text{ meter per year or 3 feet per year for over 3.5 billion years.}$$

$$3.5 \times 10^9 \text{ years}$$

......

The water of hydration for protein is 10% to 20% of the mass of the protein. Since the mass of $10^{50}$ average proteins is more than $3.32 \times 10^{30}$ grams, the mass of the water of hydration would be more than $3.32 \times 10^{29}$ grams. Planet Earth contains $1.4 \times 10^9$ cubic kilometers of water. A cubic kilometer of water was a mass of $10^{15}$ grams. $1.4 \times 10^9$ cubic kilometers of water has a mass of $1.4 \times 10^{24}$ grams. The water of hydration for $10^{50}$ average proteins would be more than $2.37 \times 10^5$ times the volume of water found on Planet Earth or more than 300 times the volume of Planet Earth itself.

......

Each new protein produced by a random alteration in DNA is one try or one attempt to bring about naturalistic macroevolution. The probability of randomly assembling a functional protein of 100 amino acids is about 1 chance in $10^{65}$ per try. The best probability of completing just one step in naturalistic macroevolution with less than $10^{50}$ tries is:

A probability of $1/10^{65}$ per try $\times <10^{50}$ tries $= Less than 1 \text{ chance in } 10^{15}$

OR LESS THAN ONE CHANCE IN A MILLION BILLION.

It is highly unlikely that naturalistic macroevolution completed just one step in macroevolution. It is highly irrational to believe that naturalistic macroevolution could account for every step in macroevolution.

Since less than $10^{50}$ proteins must account for each and every step of macroevolution, naturalistic macroevolution is a highly irrational scientific hypothesis.

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RETHINKING EVOLUTION
P.O. Box 1145
Lansdowne, PA 19050
www.erols.com/rethinkingevolution
DNA, proteins, homologous structures, and fossils provide no scientific evidence to favor naturalistic macroevolution over evolution by intelligent design or over special creation.

The nucleic acid sequence in DNA specifies the nucleic acid sequence in RNA, which, in turn, specifies the amino acid sequence in proteins. However, DNA does not, and cannot, reveal the biochemical mechanisms responsible for an alteration in its nucleic acid sequence. This is a basic concept. DNA just does not reveal its biochemical mechanisms of origin. As such, DNA, proteins, homologous structures, and fossils provide no scientific evidence to favor naturalistic macroevolution over evolution by intelligent design or over special creation.

The following word picture demonstrates that DNA does not reveal its biochemical mechanisms of origin:

Presume the existence of a species of bird named "U." In the distant past, various members of the species were carried by trade winds from the mainland to four separate islands. None of the members ever returned to the mainland, and the birds never flew between the islands. Four isolated populations of "U" live on the four Islands—#1, #2, #3, and #4.

On Island #1, naturalistic macroevolution occurs within members of species "U," and a new species of bird evolves, "W."

A group of very smart scientists are aware of "U" and "W" on Island #1, when they discover Island #2 with only "U." The scientists gather "U" eggs from Island #2 and bring them back to their laboratory. They remove the DNA from the eggs and redesign the DNA to be identical to the DNA of species "W." The redesigned DNA is reinserted into the eggs, which are returned to Island #2. Revisiting Island #2 several years later, they find offspring of the two species, "U" and "W."

On Island #3, God remodels the DNA in several "U" eggs, making the DNA identical to the DNA of species "W" on Island #1.

On Island #4, God creates species "W" from the dust of the earth, making the DNA identical to the DNA of species "W" on Island #1.

Now four islands each have two species of birds, "U" and "W." In time, scientists discover all four islands. Members of species "W" are removed from each island and taken to the science laboratory. There the DNA molecules from species "W" from Islands #1, #2, #3, and #4 are subjected to a multitude of tests and found to be identical.
The probability of naturally producing all of the 124 necessary, functional proteins would be far less than the probability of consecutively drawing 250 preselected atoms from the universe while blindfolded.

A probability of $\frac{1}{10^{168}}$ ignores the fact that 19 of the 20 biological proteins have two isomers, D- and L-, and only L- isomers are found in biological proteins. It also ignores the fact that more than 25 non-biological proteins are produced by the same means that produce biological proteins. In sparking simulations, the relative yield of the non-biological amino acid α-amino-n-butyric acid is 170 times that of proline and 340 times that of threonine.

If a mere $10^{50}$ proteins composed of 400 amino acid residues were swept together into one pile, a pile unlikely to contain even 1 functional protein for naturalistic biochemical evolution, the mass would be greater than $4\times10^{54}$ daltons, where 1 dalton equals the mass of 1 hydrogen atom. Since there are $6.0225\times10^{23}$ hydrogen atoms per gram of hydrogen, the mass of $10^{50}$ proteins would be $6.6\times10^{30}$ grams. Planet earth has a mass of $5.97\times10^{27}$ grams. The pile of $10^{50}$ proteins is $>1,000$ times the mass of planet earth and $>3,000$ times the volume of planet earth. How do necessary, functional proteins ever find one another?

The water of hydration for a protein is 10% to 20% of the mass of the protein. The mass of the water of hydration for $10^{50}$ proteins composed of 400 amino acid residues would be $>6.6\times10^{29}$ grams. Planet earth contains $1.4\times10^{9}$ cubic kilometers of water, which equals $1.4\times10^{24}$ grams of water. The water of hydration for $10^{50}$ such proteins is $>4.7\times10^{5}$ times the volume of water found on planet earth or more than 600 times the volume of planet earth. The little warm pond of naturalistic biochemical evolution is a vast, waterless, lifeless desert.

The naturalistic biochemical evolution of the first cell is a highly irrational scientific hypothesis. The biochemical evolution of the first cell did not, and could not, occur naturally.
ORIGINS: A NEW CURRICULUM

The debate over the proposed science standards in the Commonwealth of Pennsylvania is severely hampered by bad definitions and bad logic.

The most vague definition of all is applied to the word "evolution." Many scientists claim that "evolution" is one of the most intensely studied areas in science and prove their statement by referring to a vast amount of data pertaining to microevolution. Many non-scientists claim that they do not believe in "evolution" but are referring to the evolution of the first cell and to macroevolution.

"Evolution" is composed of four distinct categories. Meaningful discussion can occur only when each category is kept distinct and when the same category is being referred to by all parties.

The first category of "evolution" is the naturalistic biochemical evolution of the first cell, which uses naturalistic processes to assemble the original cell and to initiate metabolism. It ends with the replication of the first cell.

The second category is microevolution, which involves rearrangements of, and substitutions in, already existent, functional DNA molecules.

The third category is naturalistic macroevolution, which uses naturalistic processes to expand the DNA to code for new systems and new structures that are coherent and comprehensive.

The fourth category is evolution by intelligent design, in which an intelligent designer assembles the first living and replicating cell and produces new species by expanding and altering the initial DNA to code for new systems and new structures that are coherent and comprehensive. This could be accomplished through ongoing intelligent intervention or through the intelligent alignment of all physical entities at the time of the Big Bang.

Special creation, where species are instantaneously produced, is not a category of "evolution" but needs to be compared to the above four categories of "evolution," because it could produce everything that naturalistic evolution is claimed to produce.

The naturalistic biochemical evolution of the first cell and naturalistic macroevolution occur as natural biochemicals are arranged and combined by natural biochemical mechanisms. Alterations in DNA are random. Organisms with beneficial alterations in DNA prosper through natural selection. Naturalistic evolution is scientifically permissible and is experimentally reproducible or "scientific."
The intelligent design of the first cell and the intelligent design of macroevolution occur as natural biochemicals are arranged and combined by intelligent manipulation. Alterations in DNA are intelligently designed. Both intelligent selection and natural selection of new species can occur. Evolution by intelligent design is scientifically permissible, but it is not experimentally reproducible. It is "not scientific."

Though evolution by intelligent design is "not scientific," it may be a mode or the mode of macroevolution. By analogy, a big yellow school bus is real, even though it is intelligently designed and manufactured. The big yellow school bus is real, but it is not experimentally reproducible. It, too, is "not scientific."

Many scientists have made the "philosophical" assumption that the biochemical evolution of the first cell occurred naturalistically. They have also made the assumption that all macroevolution occurred, and occurs, naturalistically. If these assumptions are correct, evolution by intelligent design and special creation did not occur. However, these assumptions need not be correct, and they do not rule out evolution by intelligent design or special creation. Evolution by intelligent design and special creation are both scientifically permissible.

An abundant amount of scientific and mathematical data shows that the naturalistic biochemical evolution of the first cell and naturalistic macroevolution are irrational scientific hypotheses. This is made obvious by the following two examples.

NASA has stated that the simplest living organism would have at least 124 different proteins, each protein being made up of 400 amino acids. Since each amino acid site could be filled by any one of 20 different amino acids, a protein made up of 400 amino acids could be arranged into more than $10^{520}$ different variations. The probability of randomly assembling a specific protein made up of 400 amino acids, given one try, would be one chance in $10^{520}$.

The 124 proteins of the first cell do not need to be specific; they need to be functional. The probability of producing a functional protein made up of 400 amino acids would be on the order of one chance in $10^{650}$. The probability that a pile of $10^{50}$ proteins, each protein made up of 400 amino acids, would contain one functional protein for the first cell is almost nil. This pile of $10^{50}$ proteins would have a mass more than 1,000 times the mass of Planet Earth and would require 5,000 times the volume of water on Planet Earth to hydrate the protein.

The little warm pond of naturalistic biochemical evolution is a vast, waterless desert in which just two of the functional proteins would probably never meet.

Scientific research has determined that the probability of randomly assembling a λ repressor fold by naturalistic macroevolution in the bacterium, Escherichia coli [E. coli], is about one chance in $10^{63}$ for each new protein made up of 92 amino acids. An E. coli with the λ repressor fold would have greater reproductive success and would displace E. coli without the λ repressor fold through natural selection. A collection of $10^{50}$ E. coli,
each with a new protein made up of 92 amino acids, would have one chance in 10 trillion of containing a λ repressor fold.

This collection of $10^{50}$ E. coli would fill a volume greater than the volume of a sphere whose radius extends from the center of the sun to the orbit of the planet Mercury. It could fill a volume 263 times the volume of Planet Earth each year for 3.5 billion years. Since naturalistic macroevolution is most unlikely to produce this one step in macroevolution, it does not—and cannot—account for all steps in macroevolution.

Scientists state that evolution by intelligent design and special creation are not scientific and should not be taught in a science classroom. This is true. They are not scientific and should not be taught in a science classroom. However, as the above examples reveal, the naturalistic biochemical evolution of the first cell and naturalistic macroevolution are highly irrational scientific hypotheses. They, too, should not be taught in a science classroom.

Since the evolution of the first cell and macroevolution are concepts that should be taught, a class on ORIGINS, which is separate from the science curriculum, needs to be developed to present, discuss, and debate the conflicting concepts and philosophies.

Fredric P. Nelson, MD
Rethinking Evolution
P.O. 1145
Lansdowne, PA 19050
May 5, 2001
Commonwealth of Pennsylvania
STATE BOARD OF EDUCATION

May 9, 2001

Ms. Janice Wagner
1250 West Valley Road
Loganton, PA 17747

Dear Ms. Wagner:

Thank you for your letter dated May 8, 2001 on proposed 22 Pa. Code, Chapter 4, Appendix B (academic standards for Science and Technology).

Your letter is considered as official public comment and is being shared with all members of the Board. Pursuant to the provisions of the Regulatory Review Act, copies of your comments are also being provided to the Independent Regulatory Review Commission (IRRC) and the Chairmen of the House and Senate Education Committees.

Be assured that your comments will be considered carefully in the development of the final-form of these regulations.

The Regulatory Review Act provides that information on the final-form of regulations be mailed to public commentators at their request. If you would like to receive the final-form of these academic standards when they are submitted to the Education Committees and IRRC, please make your request to me in writing at the address printed below.

Sincerely yours,

[Signature]
Peter H. Garland
Executive Director

CC: Members of the State Board
Senator Rhoades
Senator Schwartz
Representative Stairs
Representative Colafella
IRRC
Peter H. Garland  
Executive Director, State Board of Education  
333 Market Street  
Harrisburg, PA 17126-0333  

Dear Mr. Garland,

I recently became aware of proposed changes in language used in our State’s Science and Technology Standards. As a taxpaying citizen of PA, a trained theologian, and a father of two children in the public school system, I must object to and protest these proposed changes.

I speak specifically of suggested language in paragraphs 3.3.10.D.1 and 3.3.12.D.1. My information leads me to believe that these changes are fueled by religious fundamentalists seeking to disparage the teaching of evolution as a way to buttress their claims for creationism. As a taxpayer supporting our public schools, I resent any move to bring “creationism” into the science curriculum. My hard-earned money should not be used to support such endeavors.

Secondly, as one who has spent many years studying theology and scripture, I find no basis for the claims made by those who would have us believe that the story of creation in the Bible is literal fact. No matter how hard one wishes to make it so, the Bible is not a science book. Any attempt to make it one only serves to cheapen both the Bible and science.

Lastly, I have two children who are in the midst of their public school careers. I in no way want any science teacher — skilled as they may be in their discipline — attempting to instruct my children on matters religious. I dare say that most teachers are ill-prepared for such a task. I do not presume to teach my children the intricacies of the DNA molecule and I insist that a science teacher not delve into my children’s spiritual beliefs.

Make no mistake, I welcome the study of religion in public schools. Our children need to be exposed to the myriad of faiths and cultures present in our world. Only then can they be truly well-rounded and informed. For too long schools have been afraid of religion. Hire qualified teachers to teach about the religions of the world. Do not “backdoor” an out-dated, misinformed notion such as creationism into our schools under the guise of science.

Thank you for your consideration.

Sincerely,

[Signature]

Rev. J. Rodger Clark, Jr.
Commonwealth of Pennsylvania
STATE BOARD OF EDUCATION
May 9, 2001

Dr. Fredric P. Nelson
Eastwick Pediatrics
Suite Two
2801 Island Avenue
Philadelphia, PA 19153

Dear Dr. Nelson:

Thank you for your letter dated May 5, 2001 on proposed 22 Pa. Code, Chapter 4, Appendix B (academic standards for Science and Technology).

Your letter is considered as official public comment and is being shared with all members of the Board. Pursuant to the provisions of the Regulatory Review Act, copies of your comments are also being provided to the Independent Regulatory Review Commission (IRRC) and the Chairmen of the House and Senate Education Committees.

Be assured that your comments will be considered carefully in the development of the final-form of these regulations.

The Regulatory Review Act provides that information on the final-form of regulations be mailed to public commentators at their request. If you would like to receive the final-form of these academic standards when they are submitted to the Education Committees and IRRC, please make your request to me in writing at the address printed below.

Sincerely yours,

[Signature]
Peter H. Garland
Executive Director

CC: Members of the State Board
Senator Rhoades
Senator Schwartz
Representative Stairs
Representative Colafella
IRRC

First Floor, 333 Market Street, Harrisburg, PA 17126-0333
Telephone (717) 787-3787 • TDD (717) 783-8445 • FAX (717) 787-7306
Commonwealth of Pennsylvania
STATE BOARD OF EDUCATION

May 9, 2001

Mr. Scott M. Oser
250 E. Wynnewood Road
Apartment #13
Wynnewood, PA 19096

Dear Mr. Oser:

Thank you for your letter dated May 5, 2001 on proposed 22 Pa. Code, Chapter 4, Appendix B (academic standards for Science and Technology).

Your letter is considered as official public comment and is being shared with all members of the Board. Pursuant to the provisions of the Regulatory Review Act, copies of your comments are also being provided to the Independent Regulatory Review Commission (IRRC) and the Chairman of the House and Senate Education Committees.

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Sincerely yours,

[Signature]
Peter H. Garland
Executive Director

CC: Members of the State Board
Senator Rhoades
Senator Schwartz
Representative Stairs
Representative Colafella
IRRC
Dear Mr. Garland:

The State Board of Education's Proposed Rule Making on Academic Standards was published in the Pa Bulletin this past Saturday. The provisions that everyone has been waiting to see concern the teaching of the theory of evolution. The proposal authorizes the teaching of "studies that support or do not support the theory of evolution." The obvious fear is that this language, and other language, in the proposal would support the teaching of creationism in our schools.

All scientific theories including those that are the foundation of thermodynamics, nuclear physics, astronomy, and number theory are subject to reevaluation based on new scientific findings. To dismiss evolution, as some do, because it is referred to as the "theory of evolution" is to misunderstand what the term "theory" means in science and further to assume the phrase "theory" of evolution implies less confidence in the science of evolution than scientists have in the "law" of thermodynamics. It does not. In these contexts, the usages of "theory" and "law" are merely linguistic habits.

It is true that there are important questions remaining to be resolved in various sciences such as the apparent inconsistencies between Newtonian and quantum mechanics, did or how did the universe begin, what is gravity, or did life originate on earth or were its "seeds" transported from outer space. Nevertheless, the theories that define these sciences are so well established that they are the foundation of commercial industries such as the nuclear energy, satellite development, e-commerce, as well as the pharmaceutical industry.

It is for all these reasons that we strongly recommend that the wording of the new educational standards be changed to eliminate any possibility that creationism would be allowed to be taught in Pennsylvania schools as a science subject. Creationism is a religious concept and should only be taught in churches and synagogues where they rightly belong.

Sincerely,

Morton L. Medinsky, PhD
<table>
<thead>
<tr>
<th>NAME</th>
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Commonwealth of Pennsylvania
STATE BOARD OF EDUCATION

May 9, 2001

Dr. Morton Metersky
725 Cheryl Drive
Warminster, PA 18974

Dear Dr. Metersky:

Thank you for your letter dated May 7, 2001 on proposed 22 Pa. Code, Chapter 4, Appendix B (academic standards for Science and Technology).

Your letter is considered as official public comment and is being shared with all members of the Board. Pursuant to the provisions of the Regulatory Review Act, copies of your comments are also being provided to the Independent Regulatory Review Commission (IRRC) and the Chairmen of the House and Senate Education Committees.

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Sincerely yours,

Peter H. Garland
Executive Director

CC: Members of the State Board
Senator Rhoades
Senator Schwartz
Representative Stairs
Representative Colafella
IRRC
Dear Mr. Wehmeyer:

Thank you for your e-mail of May 9, 2001 on proposed 22 Pa. Code, Chapter 4, Appendix B (academic standards for Science and Technology).

Your e-mail is considered as official public comment and is being shared with all members of the Board. Pursuant to the provisions of the Regulatory Review Act, copies of your comments are also being provided to the Independent Regulatory Review Commission (IRRC) and the Chairmen of the House and Senate Education Committees.

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Sincerely yours,

H. Garland
Executive Director

cc: Members of the State Board
    Senator Rhoades
    Senator Schwartz
    Representative Stairs
    Representative Colafella
    IRRC

-----Original Message-----
From: FWehmeyer@rohmhaas.com [mailto:FWehmeyer@rohmhaas.com]
Sent: Wednesday, May 09, 2001 1:56 PM
To: 00statbd@psupen.psu.edu
Subject: Fwd: [PCRSNEWSLETTER] Alert: PA Dept of Education Conside...

(Forwarded Information Moved to File: ~FWRD_1.txt)

I understand that the PA Dept of Education has announced its intention to finalize the science and technology education standards. I was given this e-mail address as a contact. I applaud the effort to improve science education. I have been employed as a chemist by Rohm and Haas for nearly 20 years working in Spring House PA.
Forwarded with Changes

From: <JamesSClovis@aol.com> at ROH
Date: 5/8/01 9:39AM
To: Allen F Dr. Marks at CCMSPH14
*To: Alexandra Samuels at CCMH008
*To: Charles E Dr. Jones at CCMSPH05
*To: Henry P Jr Stoebenau at CCMH009
*To: George S Mack at CCMH007
*To: Charles T Williams at CCMPHL02
*To: Rita W Dr Stevens at CCSPH17
*To: Paul H Dr. Reibach at CCMSPH18
*To: Christine M Miller at CCMSPH15
*To: Cheryl A Martin at CCMSH013
*To: Ann Hecht Dr Beaulieu at CCMSPH06
*To: collette@esvax.email.dupont.com at ROH
*To: JCrawford@ato.com at ROH
*To: EDavis@pgcorp.com at ROH
*To: T Dent@pgcorp.com at ROH
*To: RDirkx@ato.com at ROH
*To: Durandr@sunchem.com at ROH
*To: DA. HSUAN.FENG@cmx.sai.com at ROH
*To: DAVID KEIFER@fmc.com at ROH
*To: ron.l. koontz@lmco.com at ROH
*To: SKOONTZ@cpcus.jnj.com at ROH
*To: scott@lockledge.com at ROH
*To: JOHN. LYGA@fmc.com at ROH
*To: joseph maqlaty@merck.com at ROH
*To: wransom@fi.edu at ROH
*To: KATHRYN.SCHWENZER@roche.com at ROH
*To: Smiththom@saic.com at ROH
*To: WALLERFU@apci.com at ROH
*To: connie.wickersham@atofina.com at ROH
*To: kershner@rbs.org at ROH
*To: Phyllis.S.Buchanan@usa.dupont.com at ROH
*To: Toh.kelinich@fi.edu at ROH
*To: marquie.e.vavalla@usa.dupont.com at ROH
*To: raymond.jeffries@widener.edu at ROH
*To: rbandlow@email.msn.com at ROH
*To: chearns@ti.com at ROH
*To: schroeder@rbs.org at ROH
*To: p johnston100@hotmail.com at ROH
*To: jgould@mv.org at ROH
*To: Admin@tabernacle.k12.nj.us at ROH
*To: altalj@abington.k12.pa.us at ROH
*To: acola@nasd.k12.pa.us at ROH
*To: mlong@nasd.k12.pa.us at ROH
*To: anders.hedberg@bms.com at ROH
*To: carlo.parravano@merck.com at ROH
*To: johnniemw@chemheritage.org at ROH
*To: markm@chemheritage.org at ROH
*To: DCragin@ato.com at ROH
*To: rahkab@polymer.br.roehmhaas.com at ROH
*To: td@qfdi.gov at ROH
*To: FRIEDRG@war.wyeth.com at ROH
*To: ejpsb@worldnet.att.net at ROH
*To: nhiller@phila.k12.pa.us at ROH
*To: kenschroeder@netcarrier.com at ROH
*To: ehouston@ti.com at ROH
*To: Robert_C_Lausch@armstrong.com at ROH
*To: jpcurtin@interboro.k12.pa.us at ROH
*To: snyder1@interboro.k12.pa.us at ROH
*To: lefkow@interboro.k12.pa.us at ROH
*To: Schmuckl@vm.temple.edu at ROH
*To: Jim Low@fmc.com at ROH
*To: randolph.guschl@usa.dupont.com at ROH
To: rtempest@rcn.com at ROH
To: jeannev@gse.upenn.edu at ROH
To: suzannem@chemheritage.org at ROH
To: margaretk@chemheritage.org at ROH
To: davidb@chemheritage.org at ROH
To: mvorna@chemheritage.org at ROH
To: stepheng@chemheritage.org at ROH
Subject: Fwd: [PCRSNEWSLETTER] Alert: PA Dept of Education Consid...

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Commonwealth of Pennsylvania
STATE BOARD OF EDUCATION
May 9, 2001

Mr. Larry Frankel
Executive Director
ACLU of Pennsylvania
125 South 9th Street
P.O. Box 1161
Philadelphia, PA 19105-1161

Dear Mr. Frankel:

Thank you for your letter dated May 4, 2001 on proposed 22 Pa. Code, Chapter 4, Appendix B (academic standards for Science and Technology).

Your letter is considered as official public comment and is being shared with all members of the Board. Pursuant to the provisions of the Regulatory Review Act, copies of your comments are also being provided to the Independent Regulatory Review Commission (IRRC) and the Chairmen of the House and Senate Education Committees.

Be assured that your comments will be considered carefully in the development of the final-form of these regulations.

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Sincerely yours,

[Signature]
Peter H. Garland
Executive Director

CC: Members of the State Board
Senator Rhoades
Senator Schwartz
Representative Stairs
Representative Colafella
IRRC

First Floor, 333 Market Street, Harrisburg, PA 17126-0333
Telephone (717) 787-3787 • TDD (717) 783-8445 • FAX (717) 787-7306
May 8, 2001

Dr. Peter Garland  
Executive Director of the PA State Board of Education  
333 Market Street  
Harrisburg, PA 17126-0333

Dear Dr. Garland

I am writing to comment on the Proposed Pennsylvania Science Standards.

I agree with the Revised Version which requires students to “analyze the theory of evolution”.
I also agree with the part of the Revised Version which adds a standard requiring students to “compare and contrast scientific theories and beliefs”.
I am thankful that you have included a section which requires students to “analyze evidence of fossil records, similarities in body structures, embryological studies and DNA studies that support or do not support the theory of evolution”.

However I would ask you to change Section 3.3.12D to include a standard with the following language:
“Critically evaluate the validity of the hominids that evolutionists claim to be ancestral to modern man”.

I am a parent of a 10th grade student and I would like to thank you for all of the time and effort that you have dedicated to the education of the children of Pennsylvania.

May God bless you and your family.

Yours Truly,

Janice I. Wagner  
1250 West Valley Road  
Loganton, PA 17747
To: gstrait@mail.clpd.k12.pa.us
RE: Science Standards

Dear Mr. Strait:

Thank you for your e-mail of May 8, 2001 on proposed 22 Pa.
Code, Chapter 4, Appendix B (academic standards for Science and
Technology).

Your e-mail is considered as official public comment and is
being shared with all members of the Board. Pursuant to the provisions
of the Regulatory Review Act, copies of your comments are also being
provided to the Independent Regulatory Review Commission (IRRC) and the
Chairmen of the House and Senate Education Committees.

Be assured that your comments will be considered carefully in
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standards when they are submitted to the Education Committees and IRRC,
please make your request in writing to the State Board of Education,
First Floor, 333 Market Street, Harrisburg, PA 17126-0333.

Sincerely yours,

Peter H. Garland
Executive Director

cc: Members of the State Board
    Senator Rhoades
    Senator Schwartz
    Representative Stairs
    Representative Colafella
    IRRC

-----Original Message-----
From: Gene Strait [mailto:gstrait@mail.clpd.k12.pa.us]
Sent: Tuesday, May 08, 2001 3:44 PM
To: State Board of Education
Subject: Science Standards

To the PA State Board of Education
I am writing to express my appreciation for the excellent job you have
done in revising the science standards to include language that makes
the evolution section sound less like indoctrination and more like the
pursuit of critical thinking. My name is Gene Strait and I am a biology
teacher in a high school in Lebanon, PA. I participated in a round
table discussion on the science standards over a year ago. Since then
you have addressed the concerns of thousands of people in PA. We do not
want our children indoctrinated in evolution, rather we want them to
critically think through these important issues as they would any other
scientific theory. I commend you for the adjustments you have made and
encourage you to not cave into the liberal backlash that you undoubtedly
have received. This is not about the liberals versus the conservatives.
This is about teaching our precious children honest science that looks at ALL the facts and not just the ones that fit the theory of evolution.

Sincerely,
Gene M. Strait
1304 Old Line Rd
Manheim, PA 17545
gkstrait@hotmail.com
Dear Dr. Garland:

Proposed revisions of Pennsylvania's Academic Standards for Science and Technology contain troubling language that would weaken the teaching of evolution in Pennsylvania public schools. These revised standards are being reviewed for final approval. I urge that these standards be rejected, and that state academic standards recognize the status of evolution as a proven theory that is fundamental to all life sciences.

The 1998 version of the Pennsylvania science standards has been considered an ideal model of how public schools should approach the teaching of evolution. The 1998 standards reflect the centrality of the theory of evolution to modern science, and recognize that evolution is an established fact of science, supported by overwhelming evidence. No alternate scientific theory exists.

The new standards are a gigantic step backwards in many ways. For instance, the revised standards now suggest that students learn to analyze scientific evidence and facts which “support or do not support the theory of evolution” (Section 3.3.10.D.1). This language is troubling for the simple reason that such scientific evidence simply does not exist. It cannot be found in the scientific literature of any field, or in any peer-reviewed scientific journals. Creationist opponents of evolution will claim that there does exist evidence against evolution, and yet they have failed to publish any such evidence in any reputable scientific journal, and the scientific community is unanimous in rejecting creationist claims. Thus, the revised science standards can only have the effect of injecting non-scientific evidence into the science curriculum. The motives behind this language are in fact sectarian, and not scientific.

In another instance, the 1998 standards mandated that students “know that present earth features and organisms arose from materials and life forms of the past.” The revised standards eliminate this mandate, replacing it by ambiguous statements that students should “analyze the theory of evolution” and “analyze the impact of new scientific facts on the theory of evolution” (Section 3.3.12.D). Once again, the revised language weakens a scientifically correct statement, and implies doubt about evolution that simply is not based in science.
It is a general feature, in fact, of the new proposed standards that they single out evolution in a way which other scientific theories are not singled out. The standards repeatedly give the impression that evolution is unproven or doubtful, when in fact the opposite is true. Fulfilling the mandate that students analyze "evidence" against evolution would in fact require that schools purchase and use sectarian religious curriculum materials that have already been ruled unconstitutional. School science textbooks should in fact reflect the accepted understanding of contemporary scientists. Creationist materials do not satisfy this requirement.

Weakening the teaching of evolution in Pennsylvania schools would have a disastrous effect upon the biological and medical sciences, which play such an important role in our economy and our society. Evolution is fundamental to biology and indeed all the natural sciences, and has been used to understand and solve many problems in agriculture, medicine, ecology, and public health. Understanding the biological sciences without evolution would be like trying to do physics without Newton’s laws of motion. At a time when our students need a better grounding in basic science, and stronger academic standards, we should not be watering down curricula to satisfy a sectarian agenda utterly unsupported by the scientific evidence. I urge that the proposed standards be rejected, and that they be replaced by standards that recognize the centrality of evolution to science and evolution’s near-universal acceptance within the scientific community.

Sincerely,

Scott M. Oser

Scott M. Oser
250 E. Wynnewood Rd
Apartment E-13
Wynnewood, PA 19096
May 5, 2001

Peter H. Garland
Executive Director
State Board of Education
333 Market Street
Harrisburg, PA 17126-0333

Re: Science and Technology Standards as Proposed by the Pennsylvania Board of Education and a recommendation for a new curriculum, ORIGINS.

Dear Mr. Garland:

Scientists state that evolution by intelligent design and special creation are not scientific and should not be taught in a science classroom. This is true. Though evolution by intelligent design and special creation may be the means by which most evolution occurred, they are not scientific and, therefore, should not be taught as science.

However, the naturalistic biochemical evolution of the first cell and naturalistic macroevolution are highly irrational scientific hypotheses. They, too, should not be taught as science.

Since the evolution of the first cell and macroevolution are concepts that should be taught, a class on ORIGINS, which is separate from the science curriculum, needs to be developed to present, discuss, and debate the conflicting concepts and philosophies.

Sincerely yours,

Fredric P. Nelson, MD

Enclosure
ORIGINS: A NEW CURRICULUM

The debate over the proposed science standards in the Commonwealth of Pennsylvania is severely hampered by bad definitions and bad logic.

The most vague definition of all is applied to the word “evolution.” Many scientists claim that “evolution” is one of the most intensely studied areas in science and prove their statement by referring to a vast amount of data pertaining to microevolution. Many non-scientists claim that they do not believe in “evolution” but are referring to the evolution of the first cell and to macroevolution.

“Evolution” is composed of four distinct categories. Meaningful discussion can occur only when each category is kept distinct and when the same category is being referred to by all parties.

The first category of “evolution” is the naturalistic biochemical evolution of the first cell, which uses naturalistic processes to assemble the original cell and to initiate metabolism. It ends with the replication of the first cell.

The second category is microevolution, which involves rearrangements of, and substitutions in, already existent, functional DNA molecules.

The third category is naturalistic macroevolution, which uses naturalistic processes to expand the DNA to code for new systems and new structures that are coherent and comprehensive.

The fourth category is evolution by intelligent design, in which an intelligent designer assembles the first living and replicating cell and produces new species by expanding and altering the initial DNA to code for new systems and new structures that are coherent and comprehensive. This could be accomplished through ongoing intelligent intervention or through the intelligent alignment of all physical entities at the time of the Big Bang.

Special creation, where species are instantaneously produced, is not a category of “evolution” but needs to be compared to the above four categories of “evolution,” because it could produce everything that naturalistic evolution is claimed to produce.

The naturalistic biochemical evolution of the first cell and naturalistic macroevolution occur as natural biochemicals are arranged and combined by natural biochemical mechanisms. Alterations in DNA are random. Organisms with beneficial alterations in DNA prosper through natural selection. Naturalistic evolution is scientifically permissible and is experimentally reproducible or “scientific.”
The intelligent design of the first cell and the intelligent design of macroevolution occur as natural biochemicals are arranged and combined by intelligent manipulation. Alterations in DNA are intelligently designed. Both intelligent selection and natural selection of new species can occur. Evolution by intelligent design is scientifically permissible, but it is not experimentally reproducible. It is "not scientific."

Though evolution by intelligent design is "not scientific," it may be a mode or the mode of macroevolution. By analogy, a big yellow school bus is real, even though it is intelligently designed and manufactured. The big yellow school bus is real, but it is not experimentally reproducible. It, too, is "not scientific."

Many scientists have made the "philosophical" assumption that the biochemical evolution of the first cell occurred naturalistically. They have also made the assumption that all macroevolution occurred, and occurs, naturalistically. If these assumptions are correct, evolution by intelligent design and special creation did not occur. However, these assumptions need not be correct, and they do not rule out evolution by intelligent design or special creation. Evolution by intelligent design and special creation are both scientifically permissible.

An abundant amount of scientific and mathematical data shows that the naturalistic biochemical evolution of the first cell and naturalistic macroevolution are irrational scientific hypotheses. This is made obvious by the following two examples.

NASA has stated that the simplest living organism would have at least 124 different proteins, each protein being made up of 400 amino acids. Since each amino acid site could be filled by any one of 20 different amino acids, a protein made up of 400 amino acids could be arranged into more than $10^{520}$ different variations. The probability of randomly assembling a specific protein made up of 400 amino acids, given one try, would be one chance in $10^{520}$.

The 124 proteins of the first cell do not need to be specific; they need to be functional. The probability of producing a functional protein made up of 400 amino acids would be on the order of one chance in $10^{260}$. The probability that a pile of $10^{50}$ proteins, each protein made up of 400 amino acids, would contain one functional protein for the first cell is almost nil. This pile of $10^{50}$ proteins would have a mass more than 1,000 times the mass of Planet Earth and would require 5,000 times the volume of water on Planet Earth to hydrate the protein.

The little warm pond of naturalistic biochemical evolution is a vast, waterless desert in which just two of the functional proteins would probably never meet.

Scientific research has determined that the probability of randomly assembling a λ repressor fold by naturalistic macroevolution in the bacterium, Escherichia coli [E. coli], is about one chance in $10^{53}$ for each new protein made up of 92 amino acids. An E. coli with the λ repressor fold would have greater reproductive success and would displace E. coli without the λ repressor fold through natural selection. A collection of $10^{50}$ E. coli,
each with a new protein made up of 92 amino acids, would have one chance in 10 trillion of containing a λ repressor fold.

This collection of 10^{50} E. coli would fill a volume greater than the volume of a sphere whose radius extends from the center of the sun to the orbit of the planet Mercury. It could fill a volume 263 times the volume of Planet Earth each year for 3.5 billion years. Since naturalistic macroevolution is most unlikely to produce this one step in macroevolution, it does not—and cannot—account for all steps in macroevolution.

Scientists state that evolution by intelligent design and special creation are not scientific and should not be taught in a science classroom. This is true. They are not scientific and should not be taught in a science classroom. However, as the above examples reveal, the naturalistic biochemical evolution of the first cell and naturalistic macroevolution are highly irrational scientific hypotheses. They, too, should not be taught in a science classroom.

Since the evolution of the first cell and macroevolution are concepts that should be taught, a class on ORIGINS, which is separate from the science curriculum, needs to be developed to present, discuss, and debate the conflicting concepts and philosophies.

Fredric P. Nelson, MD
Rethinking Evolution
P.O. 1145
Lansdowne, PA 19050
May 5, 2001
May 4, 2001

Dr. James Gallagher
State Board of Education
Commonwealth of Pennsylvania
333 Market Street
Harrisburg, PA 17126-0333

RE: Proposed Changes to Science Standards

Dear Dr. Gallagher:

The American Civil Liberties Union of Pennsylvania continues to strongly oppose the proposed Academic Standards for Science and Technology that appears to permit local schools to attempt to teach creationism. We have reviewed the proposed standards and are deeply troubled by the prospect that they could undermine the teaching of evolution. We are even more concerned because Dan Langan, a spokesman for the Department of Education, has openly admitted that these standards will allow the teaching of creation theory in public school science classes. (Pittsburgh Post-Gazette, November 29, 2000) As of this date, we have seen no disavowal of that disturbing statement by Mr. Langan.

The ACLU has considerable experience in the fight over teaching creationism. Back in 1925, the ACLU represented John Scopes in the landmark case that established that evolution could be taught in the nation’s public schools. Since then, all across the country, the ACLU has been frequently assisted parents and children who oppose public schools injecting religion into the curriculum through the teaching of creationism.

Courts have consistently decided that religious doctrines cannot be taught as science. The United States Supreme Court has specifically found that the teaching of creationism violates the First Amendment. Edwards v. Aguillard, 482 U.S. 578 (1987) and Epperson v. Arkansas, 393 U.S. 97 (1968). In 1999, the Fifth Circuit Court of Appeals ruled against a Louisiana school board’s policy that required that the teaching of evolution be accompanied by a disclaimer that mentioned the biblical version of creation. Frieler v. Tangipahoa Parish Board of Education, 185 F.3d 337 (5th Cir. 1999).

We have no doubt that some school districts will attempt to inject creationism into the science classrooms of Pennsylvania if the proposed regulations are adopted as
currently written. We are confident that any court would agree with us and find that any attempt to teach creationism is unconstitutional. We hope that the State Board of Education will revise these standards and not knowingly invite controversial litigation over well-settled matters of constitutional law.

While the ACLU is primarily concerned with the constitutional implications of these standards, we are also concerned about the impact they will have on Pennsylvania’s public school students. In order to be competitive in the economy of the 21st century, our students need to receive a comprehensive education, one that includes an accurate teaching of the theory of evolution. Employers will be looking to hire individuals who have a solid understanding of science. High-tech businesses and companies that manufacture health related products will expect prospective employees to be conversant with modern scientific theories. Pennsylvania would do a grave disservice to its public school students and to the economy of this state if it did not establish rigorous standards for the teaching of science.

The ACLU urges the State Board of Education to revise the proposed standards for the teaching of science. We think that it should be absolutely clear that evolution is to be taught as scientific theory and that creationism is not to be taught in science classes. The ACLU would recommend the following two changes:

3.3.10 D. – In the first paragraph, delete the words “or do not support”

3.3.12 D. – Delete the entire first paragraph: “Analyze the impact of new scientific facts on the theory of evolution.”

We believe that these deletions will improve the standards. Students will be required to explain and analyze the theory of evolution as well as the scientific evidence that supports that theory. Students will learn to think critically about the theory of evolution. Students will learn how scientific evidence explains the existence of surviving species and the extinction of other species. Students will understand the concept of natural selection. Most importantly, students will not be confused into believing that religious doctrine is science or a scientific theory.
By speaking with greater clarity, you will be complying with the United States Constitution, promoting the best interests of Pennsylvania’s public school students, and saving the taxpayers the expense of funding unnecessary litigation. We urge you to make changes to the proposed standards so that all school districts in Pennsylvania will understand that creationism is not part of the scientific curriculum.

Very truly yours,

Larry Frankel
Executive Director

Cc: The Members of the Pennsylvania Senate and House Education Committees
May 4, 2001

Dr. James Gallagher
State Board of Education
Commonwealth of Pennsylvania
333 Market Street
Harrisburg, PA 17126-0333

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Very truly yours,

[Signature]

Larry Frankel
Executive Director

Cc: The Members of the Pennsylvania Senate and House Education Committees
We, the biology faculty of Bloomsburg University, are gravely concerned about the inclusion of anti-evolution language in the proposed Academic Standards for Science and Technology. Evolution is arguably the most important unifying theory of biology, on par with the Theory of the Atom. There is no sound scientific or pedagogical reason to misrepresent evolution and its central role in biology to the students of Pennsylvania’s public schools.

Evolution is the scientific theory that explains the pattern of similarities and differences among organisms on earth throughout the earth’s history and across its many environments. The essence of this theory is descent with modification - that all living things are members of a large family tree and that their similarities and differences reflect their relatedness through common ancestors. There are several mechanisms and models that we recognize as responsible for evolution, including the slow, gradual accumulation of stepwise structural change (Darwinian evolution) and other models based on alterations of regulatory processes, developmental processes, silent or “neutral” mutations, and more. While the latter are non-Darwinian, they are still evolutionary.

It is an egregious misrepresentation of modern biology to imply that evolution is an idea with little scientific support, as some anti-evolution critics claim. There are many rejected ideas in the history of science that we no longer take seriously—for example, that the Earth is flat or at the center of the universe—which some people continue to proclaim. These are simply not a part of the scientific debate and therefore have no place in the science curriculum. The so-called evidence against evolutionary theory (included in section 3.3.10.D.1 of the proposed standards) is one of these rejected ideas.

Evolution provides the basis for scientific research in medicine, agriculture, biotechnology, pharmacology, and dozens of related fields. To downplay the importance of evolution (as is done in section 3.3.10.A of the proposed standards) is to deny Pennsylvania’s students a framework to understand both basic and applied research. Similarly, a definition of science as the study of directly observable phenomena only (as is stated in section 3.2.10.A.2 of the proposed standards) excludes much of chemistry, physics, and astronomy along with evolution. Using such a restrictive and incorrect definition of science would reduce the science curriculum to a jumble of disjointed and incomplete ideas.

We hope that you and the other members of the Board of Education will review the proposed standards and remove the anti-evolution language. The standards should reflect current scientific thought and practice; the students of our public schools deserve nothing less.

Sincerely,

[Signatures]

125 Hartline Science Center • Bloomsburg University • 400 East Second Street • Bloomsburg, PA 17815-1301
570-389-4400 • FAX: 570-389-3628
A Member of Pennsylvania’s State System of Higher Education
3 May, 2001

Peter H. Garland
Executive Director of the State Board of Education
333 Market Street
Harrisburg, PA 17126-0333

Re. Pennsylvania Science and Technology Standards

Dear Mr. Garland,

While the latest draft of the Pennsylvania Science and Technology Standards are quite good overall, there are a couple of areas where the most recent version is worse than the earlier draft. These concern the standards for biology and evolution where they now allow the introduction of creationist teachings in Pennsylvania classrooms.

In section 3.3.10.D, the paragraph one has been modified to "Analyze evidence ... that support or do not support the theory of evolution." And in section 3.3.12.D, the phrase "Analyze the impact of new scientific facts on the theory of evolution." has been introduced. Evolution has been singled out for treatment different from that of any other science in a number of ways.

First, no other science is asked to analyze evidence that does not support it. Imagine the uproar if the standards required analysis of evidence that "do or do not support the theory of heliocentricity". Imagine the dismay if the standards required "analysis of the impact of new facts on the theory of plate tectonics". Note that some religious zealots have attacked both of these theories, but the Science Standards do not compromise with these people and allow inclusion of their arguments. The Science Standards also should not compromise with creationists who object to evolution.

Second, if a school district did attempt to follow the proposed standard to analyze evidence that do not support evolution, they would find that the only materials they could use would be from creationist organizations. Legitimate biology study materials do not have the distortions and misrepresentations that characterize creationist writings and their "evidences against evolution".

Finally, in the biology section all five appearances of "evolution" are either "theory of evolution" or "evolution theory", as if evolution is more speculative than other sciences. This is simply not the case. Evolution is no more speculative than plate tectonics (3.5.10.A) or stellar life cycles (3.4.10.D). Also there is inconsistency even within the standards themselves, as section 3.5.12.A has "Interpret geological evidence supporting evolution.", without the "theory" disclaimer, as if geologists can say the "e" word without tiptoeing around political sensibilities.

The previous draft science standards received an "A" in the Fordham Foundation's study evaluating each state's treatment of evolution. The current proposed standards would receive a rating of "C" from the report's author, Dr. Lawrence Lerner. I believe that Pennsylvania should strive for an "A". While I recognize that there must be tremendous political pressure to weaken the teaching of evolution, I hope that you will uphold strong science standards.

Yours sincerely,

H. Czigler

Martin Czigler
67 Spencer Ave.
Lancaster, PA 17603
Subject: Proposed Changes in Science Education Standards

Dear Mr. Garland:

I am a registered Republican resident of Montgomery county who strongly objects to the proposed changes in education standards. I am a scientist and parent with an intense interest in education. Although many people are concerned that evolutionary biology is singled out, I could justify targeted changes in general because no subject in science is more thoroughly misunderstood by nonscientists. The wording of the proposed new standards leaves no doubt, however, that the motivation for the changes is not to improve the understanding of the subject, or of the scientific method in general. In particular the part about "evidence that does not support" raises a red flag. Does the "support" pertain to a particular evolutionary mechanism or to the general conclusion of common descent? Are there valid testable hypotheses that this evidence does support? As you surely know, several organizations, such as CRSC and ICR exist for the sole purpose of misrepresenting the science. Members and supporters of these organizations are notorious for discussing only the evidence that appears to refute some aspect of evolution. When placed in proper context, however, such counterintuitive observations as the Cambrian explosion, are not only consistent with, but supportive of mainstream theories. Whether they endorse traditional creationism, or the newer "intelligent design" variant, there are many teachers who are prepared to exploit the proposed changes to the fullest extent.

I would certainly support the teaching of a more critical approach to all science, not just biology, but I am convinced that the net effect of the proposed changes would be to encourage an extremely uncritical acceptance of pseudoscientific methods and explanations. Most parents are ill-equipped to set the record straight if their child is taught, for example, that "irreducibly complex" biological systems cannot arise by evolutionary mechanisms. Most parents do not know that the promoters of "alternative" biology rarely, if ever participate in the research community, but instead use pseudoscientific tactics, not the least of which is the blatantly false claim that their non-participation is due to a "conspiracy." I am fully aware of the real research, particularly in molecular biology, that will surely revise our understanding of the origin and development of life. Results of this research are earning their right to be taught in science class. The pseudoscientific arguments and obscure semantics of the anti-evolutionists are not. I am also aware that many people will oppose the changes out of fear of encroachment of religion in public education. Let me emphasize that I do not represent them, but rather the "silent majority" of religious conservatives. Within this group, those who have followed the science and the controversy as I have for years overwhelmingly agree that creationism is both bad science and bad religion. The current standards may not be not perfectly worded, but they are far superior to the proposed ones for protecting the student's right to a proper science education, and the taxpayer's right to a good investment in America's future.

Sincerely,

Frank J. Iaconianni, Ph.D.
Peter H. Garland,
Executive Director of the State Board of Education,
333 Market Street
Harrisburg, PA 17126-0333

Dear Mr. Garland,

I would like to protest the change in language proposed in paragraphs, 3.3.10.D.1 and 3.3.12.D.1 of the Science and Technology Standards. Although at first glance, the language seems fairly innocuous, when comparing it to the old paragraphs, it is obvious that creationists have gotten their foot in the door. Why not demand teaching of evidence against the "theory" of gravity or the "theory" of relativity, or myriad other well-accepted "theories" that are not explained in the Bible?

In addition, in both old and new paragraphs 3.2.10.A.2 "concrete" and "observable" miss the mark. Science is about "testable" aspects of the world. Many aspects of science, e.g. relativity, energy, radiation, etc. are neither concrete nor directly observable. And one more quibble: paragraph 3.5.12.A.3 erroneously links evolution and astronomical changes.

Evolution is not a religion, and creationism is NOT science. Keep religious dogma out of our public schools! There is no evidence not supporting evolution unless creationists fabricate it. The new language requires that such "evidence" will need to be obtained from those same creationists. Is the worship of a book going to be taught as science?

Keep in mind the fiasco that Kansas went through in the past year. Do not make Pennsylvania a similar laughing stock, with research organizations threatening a boycott. If you persist in keeping this language, I predict you will need to spend money on litigation. I myself would rather support litigation than see my taxes used to teach our kids medieval stupidity.

Very truly,

John Wolff
Garland, Peter

To: Pottagea@aol.com
Subject: RE: Pennsylvania Teaching Standards

Dear Ms. Pottage:

Thank you for your e-mail of May 3, 2001 on proposed 22 Pa. Code, Chapter 4, Appendix B (academic standards for Science and Technology).

Your e-mail is considered as official public comment and is being shared with all members of the Board. Pursuant to the provisions of the Regulatory Review Act, copies of your comments are also being provided to the Independent Regulatory Review Commission (IRRC) and the Chairmen of the House and Senate Education Committees.

Be assured that your comments will be considered carefully in the development of the final-form of these regulations.

The Regulatory Review Act provides that information on the final-form of regulations be mailed to public commentators at their request. If you would like to receive the final-form of these academic standards when they are submitted to the Education Committees and IRRC, please make your request in writing to the State Board of Education, First Floor, 333 Market Street, Harrisburg, PA 17126-0333.

Sincerely yours,

Peter H. Garland

Executive Director

cc: Members of the State Board

Senator Rhoades

Senator Schwartz

Representative Stairs

Representative Colafella

IRRC

--Original Message-----
From: Pottagea@aol.com [mailto:Pottagea@aol.com]
Sent: Wednesday, May 02, 2001 9:57 PM
To: 00statbd@email.cas.psu.edu; Mdwood@bloomu.edu
Subject: Pennsylvania Teaching Standards

Dear Dr Peter H. Garland,

I am appalled that this state is even considering to include arguments against the theory of evolution, never mind the consider of how teachers are supposed to achieve the impossible and actually find scientifically verified and acceptable theories which oppose this theory. Evolution is simple a biological process which explains and underpins all biological mechanisms. Why are people so concerned by this implication? The theory of cellular

5/3/2001
organization...atom structure...Quantum theory, none of which have been 'observable,' causes such controversy. If you wish Pennsylvanian students to join the ranks of well-educated, knowledgeable and thoughtful students, in aversion to becoming another laughing stock I hope you will reconsider this amendment. Creationist arguments are based upon faith, not fact and facts alone are what should be taught in a science classroom.

Regards,
Alison Pottage
To: Donna Cleland
Subject: RE: ARIES

>Dear Ms. Cleland:

Please be advised that we will consider the additional information sent to me on May and included below as an addendum to you previous letter of public comment.

Thank you for your interest in this issue.

Sincerely yours,

Garland

Executive Director

cc: Board members
    Senator Rhoades
    Senator Schwartz
    Representative Stairs
    Representative Colafella
    IRRC

> -----Original Message-----
> From: Donna Cleland [mailto:donnacleland@earthlink.net]
> Sent: Tuesday, May 01, 2001 4:53 PM
> To: Garland, Peter; schwartz@dem.pasen.gov
> Cc: David A. Bauman; Reeny Davison; Marlene A Hilkowitz; Bruce Ward
> Subject: Fw: ARIES
>
> Dear Mr. Garland,
> Please find Dr. Ward's response to my original email of concern about the
> inclusion of Science Standard 3.4.4D concerning the lunar phases, eclipses
> and the seasons. There are lots more of us who deal with planetariums in
> this area (the Franklin Institute's, the planetarium at Ridley School
> District, etc. ) and at planetariums and universities elsewhere in this
> country who believe that mastery of this material is developmentally
> inappropriate to expect of 4th grade students.
> Please take the time to read Dr. Ward's response. It is eloquent and
> 500%
> correct. He speaks for so many of us who aren't associated with
> prestigious
> institutions like Harvard but deal with children daily as professionals
> trying to convey these concepts and know deeply that these are concepts
> which are far too abstract for very young children. Most adults do NOT
> understand the true "reasons for the seasons" and if your committee has an
> hour to spare, we will prove that to you.
> Donna Cleland
> SEPARSI
> ----- Original Message -----
From: "Bruce Ward" <bward@cfa.harvard.edu>
To: "Donna Cleland" <donnacleland@earthlink.net>
Cc: <JMars509954@cs.com>
Sent: Sunday, April 15, 2001 3:37 PM
Subject: Re: ARIES

Donna,
Apologies for just now getting back to you - our days are just too short!

I will copy this note to John and some other people at Charlesbridge. You are certainly welcome to share the substance of it as you wish. Since this is just going to come off the top of my head as I go along, though, don't take it as a "publishable document!!!"

Your note raised many critical issues and reflects the difficult position our nation's educators now face - unwilling to short change the children by not doing everything possible for them to take the tests (driven by the standards), and yet knowing that the children are in fact being short changed (not by the teachers, but mostly by political forces) since what is being passed off for learning (reflected in better test scores) for the most part becomes, at best, inert knowledge.

So, let me make some general comments first, and at points I will use our elementary and middle school program (ARIES) for context. We are known for our work looking at science misconceptions. I will limit my ideas here to the physical and space sciences, although much of it cuts across all fields. You mentioned A Private Universe - note the title of the video - every person has her or his own private universe. What we find is that many of the misconceptions are quite commonsense - no surprise. But if you want students to move beyond their misconceptions, the students must first commit - in writing we say - to their own models or ideas. Only when they make this commitment, and then later discover their model will not work, will they be in a position to let go of their misconception (and even then there is no guarantee). All this means the students must reconstruct a new
model based on personal discoveries - if science is presented to them as
received truth (which is pretty much what happens at all levels and in
parts of the country), their misconceptions will persist. We like to say
that beliefs are much more powerful than evidence - we all reject
evidence presented by others about all sorts of things - but when we begin to
accumulate evidence of our own we may then be a little more able to change
our thinking.
Both the Standards and Benchmarks emphasize the need for students to
do science, but then turn around and fall into the age-old trap. If you look
at the NRC Standards you will see the as you move from themes for
elementary kids through to those for the high school, the need for the
teacher to dispense the science grows incrementally. The Benchmarks are
not much different. If you look at The Physical Setting (beginning on p. 62)
you see that the things for children in K-2 are pretty much observable.
But already in grades 3-5 things change. How are kids ever going to see planet
motion against the stellar background? My adult students don't get it.
And the orbit of the Earth? And the Sun is a star, or that stars are distant
suns? More on all this below.
In ARIES we have worked very hard to avoid having the science be received
truth. I can think of only a few times in our modules (there are 8 modules)
where we have to tell the children some fact (we need to tell them that
the Earth as seen from the Moon would have a two degree angular size -
there's no way yet we have found for them to discover this on their own!!). We
only deal with things the kids can actually observe and on which they
can collect data. You note we don't do the planets. Right. Few adults get it -
why would the kids? Your point about the age appropriateness is on the
mark. And what are they supposed to get? That the planets orbit the Sun?
How? There is no way for them to even discover that the Earth orbits the
Sun. Try this - ask your colleagues how they know the Earth orbits the
Sun?
And what evidence do they have for their thinking? I will be surprised if
more than a few (if any) can give you a definitive answer. And the idea
the Sun is a star is just as remote - stars are small white lights in
the night - not a seemingly larger yellow object in the daytime. The bottom
line is that what will pass for science is really received truth - and the kids
are not then doing science.
What can be done? I wish I had an answer. We were a review site for both
the Standards and Benchmarks. We sent back harsh reviews, and in return,
received bland form letters saying our comments had arrived. If the PA
astronomy standards are still in flux maybe the following will help you.
Here are some ideas about specific topics.
Moon. Most adults will never get it - the Moon may be the hardest thing
up there to understand. We have seen modest success at grades 6-8, but that
is because we have spent years trying to figure out the best way for people
to construct understanding. (I assume you see how we tackle the subject in
Moon and Stars.) Everyone wants to do the Moon in the 4th grade. Question:
How can you understand phases if you do not know the Moon is spherical,
not a disk as it is always seen and drawn? We find - in spite of what
people's perceptions are - that 4th graders have a hard time internalizing
the notion of a spherical Earth, let alone a spherical Moon. So at 4th grade the kids can observe and look for a pattern, but the evidence is overwhelming that they really cannot get the phases (i.e., the fact the apparent change of the Moon's shape is really a result of our viewing a changing portion of the illuminated half). Motions of the Moon also includes its true orbital motion (easterly) and its spin (why we always see the same portion of the surface). We take these on in Moon and Stars (they are generally never addressed by others). But for kids in grades 6-8, not 4th. Our sense is that kids at this age can begin to internalize some of these ideas, especially if they invest time for observations and then model these movements in class. Kids of this age (grades 6-8) are a little
more
>> prepared to make the conceptual leaps from their observations to a
>> three-dimensional sense of the Earth, Moon, Sun relationship,
>> although
>> it
>> is very difficult. I can tell you most adults never get this stuff.
>>
>> Seasons. Again, we do this with kids in grades 6-8, and it is
>> probably
>> at
>> the cusp. Most sources say seasons are due to the tilt of the
>> Earth's
>> spin
>> axis. Technically, it is the twofold effect of this tilt that leads
>> to
>> seasons - changing hours of daylight and darkness, and diminishing
>> obliqueness of the sunlight striking the Earth (increasing as a
>> result
>> the
>> amount of sunlight striking a given unit area). In ARIES the kids
>> collect
>> data to support the first reason, and measure the changing angular
>> height
>> of the Sun over time and then model the heating effect of that
>> change to
>> support the second reason. As you know from A Private Universe, the
>> reasons
>> for seasons is a generally misunderstood topic for a large
>> proportion of
>> our population. We field tested the seasons material in 5th grade
>> and
>> found
>> in some - but not all - settings it can be used with 5th-graders
>> (late).
>>
>> Forget it for 4th graders.
>>
>> Earth's Place in the Solar System. How can anyone think 4th graders
>> can
>> discover this? In our Earth in Motion module we address the issue of
>> night
>> and day, and the apparent motion of the Sun. Can the kids determine
>> if
>> the
>> Earth is spinning? Not really. When they observe the Sun move
>> (apparently)
>> across the sky, it could be the result of the Earth's spin, but it
>> could
>> also be the Sun moving - or both. I would be delighted if the
>> children
>> said
>> it could be either or both. We have the kids model night and day in
>> their
>> astronomy labs. We even have them determine which way the Earth
>> spins
>> (if
>> it does) by referring back to earlier shadow trackings. And it is
>> even
>> possible for them to see that the shadow pattern supports a
>> spherical
>> Earth
>> model. So at least the kids can discover these things. Again, ask
>> colleagues what definitive evidence they have for the spin of the
>> Earth?
>> I
>> bet most will give responses that could be understood as just the
>> opposite
>> (i.e., Sun, Moon, and stars all move westerly around the Earth). And
understanding the Earth's place in the solar system? As I said above, how
could they ever discover that the Earth orbits the Sun? And that the
Earth
is the third planet from the Sun? The reason the Ptolemaic world
view
ever
existed was because for a long time it made sense — and few people
today
know why it is not the best model.
Eclipses. If you want to explain a solar eclipse you have to start
with
the
fact that the Sun and Moon have approximately the same angular size.
Not a
4th grade topic. Lunar eclipses? Of course it ultimately depends
upon
knowing the Earth is larger than the Moon (and therefore the Earth
has a
long shadow!). Kids say the Moon is smaller because it looks
smaller.
But
then how does one account for the Sun's apparent size compared to its
actual size? Like so many other things, here again you have to
resort to
providing fact-based information, and not discovery. (You can use a
lunar
eclipse as one bit of evidence the Moon is smaller than the Earth —
the
early astronomers did — but I'd want the kids to actually view that
event.)

Basically all the things the PA Standards call for in the 4th grade hold
a
vision of science as received truth. We know this: we can transport
information around the Earth and even far into space. But that is not
learning or understanding. Ultimately the model of instruction
called for
with these standards depends more upon the dispensation of
information
and
less with constructing understanding. We feel that all learning is
idiosyncratic, and it is constructed between the ears of each learner.
Seeing science as received truth fails our kids — the empirical
evidence
for this is well documented in the literature. If you want I will see if
I
can put together a brief reading list. There is a collection of short
essays in book — I think the title is Relevant Research — put out about
5-6
years ago by NSTA. (I don't have my copy in front of me at the
moment.)

Some of the articles provide a good place to start. I also think the book
by Rosalind Driver (just before she died) is very good. I will get
that
> > reference to you.
> > Regards.
> > Bruce.
> >
> >
1 May, 2001

Dr. Peter H. Garland, Executive Director
State Board of Education
333 Market Street
Harrisburg, PA 17126-0333

Dear Dr. Garland:

It has recently come to my attention that the Pennsylvania Board of Education is currently reviewing a proposal that would limit teaching of Evolution Science and substitute Creationism ideas. This is a grave concern for scientists as it violates intellectual standards and forces religion into the state-run school system.

First, Evolution is a science, not a belief system. One does not "believe in Evolution". There is empirical evidence to support the tenants of Evolution. Evolution is a Theory in the scientific meaning of the word, not, as the lay usage dictates, a light-weight idea with little support. The statement that evolution is "only a theory" is incorrect since in the scientific meaning of a theory the empirical evidence overwhelmingly supports it. Without the unifying tenants of Evolution, life sciences become a disorganized group of unconnected facts. Evolutionary Science gives us predictability in our scientific endeavors. Without it we can't make accurate predictions.

Creationism, however, is a Christianity-based belief system, not a science based system. Creationism doesn't have empirical evidence to support it. In fact, there is no science-based body of evidence supporting Creationism. To add Creationism to a science-based course makes as much sense as requiring that all mathematics classes also teach Christian biblical knowledge. Creationism relies on the Christian bible as its source of knowledge. There is no science used. It also attempts to destroy Evolution, however, offers no science-based body of knowledge to replace it. If it truly is science then it will offer alternative science-based solutions with empirical evidence to replace the concepts addressed by Evolution. It will also create hypotheses and theories which can be tested using the Scientific Method. Since it does not do these things, Creationism is not a science.

The function of the State Board of Education should be to lead, not to give in to special interest groups which have their own agenda. Please don't make the mistake of requiring that public school teachers substitute religion for science. Our students need to know science. They get their religion at home. Teach science in the classroom! Teach religion in the church and in the home. Don't mix them.

Sincerely yours,

[Signature]

Dr. Frederick C. Hill, Professor
Dr. Peter H. Garland, Executive Director
State Board of Education
333 Market Street
Harrisburg PA 17126-0333

Dear Dr. Garland:

In my opinion the proposed revision to the standards for science education is unwise. The revision is clearly based on religious objections to teaching evolution in the schools. This is not a debate over scientific merit, as if the Pennsylvania Board of Education has some insight that is lacking at our nation’s centers for science. I think it is both dishonest and harmful to pretend otherwise.

Public opinion and politics is essential when formulating public policy, and the curriculum of our public schools is certainly public policy. There is little doubt that a plurality of voters in some school districts want the curriculum to be consistent with their religious beliefs, and those same beliefs are held by many voters in every school district.

These supporters of the proposed revisions clearly intend the standard to “analyze...studies that do not support evolution” to either weaken student confidence in evolution and/or support to the plausibility of “Intelligent Design” (or equivalent theories which are consistent with the role of God as Our Creator).

Yet in any school district there will be different understandings of science and religion in the community. Can you imagine the uproar over the student or teacher who openly challenges the validity of “Intelligent Design”? Will there be guidelines on how students and teachers are to “analyze” these studies without offending religious sensibilities? Will flaws in the theory of “Intelligent Design” be the subject of classroom discussion and homework assignments? I only hope that the Board of Education appreciates that injecting religious values into science classes will promote religion in the hands of some, and subject it to ridicule in the hands of others.

Sincerely,

Stephen Katz, M.D.
Commonwealth of Pennsylvania
STATE BOARD OF EDUCATION
April 30, 2001

Ms. Liz Hrenda
Executive Director
PA Alliance for Democracy
300 North Second Street
Suite 906
Harrisburg, PA 17101

Dear Ms. Hrenda:

Thank you for your letter dated April 26, 2001 on proposed 22 Pa. Code, Chapter 4, Appendix B (academic standards for Science and Technology).

Your letter is considered as official public comment and is being shared with all members of the Board. Pursuant to the provisions of the Regulatory Review Act, copies of your comments are also being provided to the Independent Regulatory Review Commission (IRRC) and the Chairmen of the House and Senate Education Committees.

Be assured that your comments will be considered carefully in the development of the final-form of these regulations.

The Regulatory Review Act provides that information on the final-form of regulations be mailed to public commentators at their request. If you would like to receive the final-form of these academic standards when they are submitted to the Education Committees and IRRC, please make your request to me in writing at the address printed below.

Sincerely yours,

Peter H. Garland
Executive Director

CC: Members of the State Board
Senator Rhoades
Senator Schwartz
Representative Stairs
Representative Colafella
IRRC

First Floor, 333 Market Street, Harrisburg, PA 17126-0333
Telephone (717) 787-3787  •  TDD (717) 783-8445  •  FAX (717) 787-7306
April 26, 2001

Dr. James Gallagher
State Board of Education
333 Market Street
Harrisburg PA 17126-0333

RE: Recommendations on the Department’s draft “Standards for Teaching Science”

Dear Dr. Gallagher:

Following are the comments of the Pennsylvania Alliance for Democracy (PAD) concerning the Department of Education’s proposed Standards for Teaching Science. We applaud the effort and overall results achieved by the State Board of Education in this large and very important undertaking.

Summary: We have two specific suggestions which we believe will make these standards even better. We recommend below that the first bulleted items under 3.3.10D and 3.3.12D be deleted. These paragraphs make inappropriate reference to evolution in a way that is not applied to the other sciences. Our reasons follow.

1. In section 3.3.12 D of the proposed Standards, the following language is found, “analyze the impact of new scientific facts on the theory of evolution.”

Comment: In section 3.2.12A of the draft Standards it suggests all scientific theories are to be evaluated. We agree. However, why is only the theory of evolution targeted in 3.3.12.D, first paragraph, and the other sciences are not treated the same way? The language in 3.3.12D suggests that somehow the theory of evolution is less well established as a science than the theories governing other sciences. This is not true according to more than 35 scientific associations such as the American Association for the Advancement of Science which have adopted resolutions that support the theory of evolution. In fact, many scientists hold that evolution is one of the most powerful explanatory tools in science today and its influence is reaching far beyond explaining the origins of humans. Evolutionary theory is now influencing scientific thinking in the fields of psychology, language, cultural anthropology, and cosmology to name a few. (1. Voices For Evolution, The National Center for Scientific Education, Inc., Berkeley, CA 1995)

All scientific theories including those that are the foundation of thermodynamics, nuclear physics, astronomy, and number theory are subject to reevaluation based on new scientific findings. To dismiss evolution, as some do, because it is referred to as the “theory of evolution” is to misunderstand what the term “theory” means in science and further to
assume the phrase “theory” of evolution implies less confidence in the science of evolution than scientists have in the “law” of thermodynamics. It does not. In these contexts, the usages of “theory” and “law” are merely linguistic habits.

It is mistakenly claimed by some that the theory of evolution as it applies to human evolution has not been and can not be “proved” in the rigorous controls of laboratory experiments and research. In fact, important research that is producing life saving drugs for humans now is being developed in pharmaceutical laboratories which depend on the theory of evolution for their laboratory research and test controls. To paraphrase a genetic researcher in one pharmaceutical company interviewed by Dr. Andrew Petto, National Center for Science Education, “genetics control how people respond to different medications. SNPs (Single Nucleotide Polymorphisms) are used to build associations, called HAPs, with different genes. Evolution predicts how the frequencies of SNPs will vary among human populations, based on the relatedness of the different populations. Better, higher-quality, and more effective drugs can be produced more quickly and efficiently when they are pretested using models based on evolutionary predictions.”

Another example is instructive. According to Dr. Andrew Petto, “the human genome sequencing company, Celera - made a big splash earlier in the year when they announced the complete sequencing of the human genome - was able to make so much progress so quickly because they used evolutionary models to predict the contents of the parts of the human genome that had not yet been sequenced. Their next step is to use these algorithms to identify the role of the genes being sequenced - regulatory and structural genes, as well as chromosomal organization and structure.”

It is true that there are important questions remaining to be resolved in various sciences such as the apparent inconsistencies between Newtonian & quantum mechanics, did or how did the universe begin, what is gravity, or did life originate on earth or were its “seeds” transported from outer space. Nevertheless, the theories that define these sciences are so well established that they are the foundation of commercial industries such as the nuclear energy, satellite development, e-commerce, as well as the pharmaceutical industry.

Recommendation: Drop the reference to evolution in 3.3.12D because it serves no useful purpose in these standards, and more importantly, undermines the science of evolution.

2. In section 3.3.10 D of the proposed Standards, the following language is found, “Analyze evidence of fossil records, similarities in body structures, embryological studies and DNA studies that do or do not support the theory of evolution.”

Comment: First, the comments made for #1 also apply here. Second, the language “that do or do not support the theory of evolution” seems to suggest that the Department of Education is taking the position that all theories may be of equal usefulness for understanding the world regardless of how poorly conceived or imperfectly grounded in reality these may be. We believe the Department has the responsibility to support scientific standards that are consistent with the best scientific thinking of today.
Furthermore, the proposed language will open the door to allow creationism or so-called “creation-science” to be taught as sciences which these are not. We believe teaching creationism as a science in public schools violates the church-state separation of the Pennsylvania and United States Constitutions.

The Pennsylvania Alliance for Democracy supports each person’s right to religious belief, but we do not confuse religion with science. These serve very different needs in the lives of individuals and our society, and they depend on different concepts of the “truth.”

**Recommendation:** We suggest that the language “that do or do not support the theory of evolution” in 3.3.10D is inappropriate to Standards for Teaching Science and recommend it be deleted from the Standards.

With those comments and recommendations made, we wish to thank you for your significant contributions in the important work of educating our children.

Respectfully submitted,

Liz Hrenga
Executive Director
Commonwealth of Pennsylvania

STATE BOARD OF EDUCATION

April 30, 2001

Dr. James H. Marden
Associate Professor of Biology
Pennsylvania State University
208 Mueller Laboratory
University Park, PA 16802-5301

Dear Dr. Marden:

Thank you for your letter dated April 26, 2001 on proposed 22 Pa. Code, Chapter 4, Appendix B (academic standards for Science and Technology).

Your letter is considered as official public comment and is being shared with all members of the Board. Pursuant to the provisions of the Regulatory Review Act, copies of your comments are also being provided to the Independent Regulatory Review Commission (IRRC) and the Chairmen of the House and Senate Education Committees.

Be assured that your comments will be considered carefully in the development of the final form of these regulations.

The Regulatory Review Act provides that information on the final-form of regulations be mailed to public commentators at their request. If you would like to receive the final-form of these academic standards when they are submitted to the Education Committees and IRRC, please make your request to me in writing at the address printed below.

Sincerely yours,

Peter H. Garland
Executive Director

CC: Members of the State Board
Senator Rhoades
Senator Schwartz
Representative Stairs
Representative Colafella
IRRC
April 26, 2001

Dr. Peter H. Garland, Executive Director
State Board of Education
333 Market Street
Harrisburg PA 17126-0333

Dear Dr. Garland,

It has come to my attention that the Pennsylvania Board of Education is considering finalizing new science and technology education standards that include presentation of the 'evidence against' evolution.

It is a mystery to me that you can consider dumbing down the teaching of evolution when national magazines like Time and Newsweek have recently run cover stories about the ongoing problem of rapid evolution of antibiotic resistance in bacteria and viruses. In many cases, drugs that wiped out certain strains of bacteria two decades ago now have no effect. The drug and insecticide companies are spending hundreds of millions of dollars on research to find new antibiotics and pesticides because they know that the ones on the market now become less effective every year. They certainly are not spending this kind of money because evolution is a "theory". These are hard-nosed business people who know fully well that the "fact" of evolution will put them out of business if they don't evolve their products to keep pace.

The National Institutes of Health (NIH), which fund the research that constitutes the backbone of medical advances in this country spend hundreds of millions of dollars every year on research that addresses evolution. Why? Because biology is an evolutionary process, and you cannot understand very much about anything in biology if you do not look at it from an evolutionary perspective. I suggest that you have a look for yourself. Go to the webpage that provides a search engine for NIH research grant awards (http://commons.cit.nih.gov/crisp/CRISP.Generate_Ticket), and type the word "evolution" into the "enter search terms" box at the top of the page. Then, press the "submit query" button and see what happens (you need not fill in any of the additional information in the other boxes). You will receive a listing of the first 250 of the 976 active NIH grants that address evolution. This is the nationwide list. Perhaps you are wondering how much of this research occurs in Pennsylvania. OK, just go back to the initial search engine page, make sure "evolution" still appears in the "enter search terms" box, and select "Pennsylvania" in the state window near the bottom of the page. You will now see 55 active research grants in PA. Scroll down through the list a bit; maybe even click on some project titles and read the abstracts. The funding amounts are not shown, but a reasonable estimate is that each of these projects are funded at a level of about $200,000 per year, which means that NIH is spending about 11 million dollars per year on
evolution research in the state in which you are charged with formulating educational policy (note that I haven’t even mentioned research funded by the National Science Foundation, which spends even more on evolution research, including my own). Hmmm. Maybe you need to think again about the scientific standing of the dozens of MD’s who like to write letters to newspapers, school boards, and politicians proclaiming that they are enlightened people of science who have gone to college and seen that evolution is a sham. These people are doing the equivalent of proclaiming that the earth is flat. “You can’t see evolution happening” they loudly proclaim, although they would probably also concede that your cannot stand on the earth’s surface and observe that it is spherical. The only way to observe slow, gradual change is to use methods that change one’s everyday perspective of time and space. If you look at the earth from a perspective that greatly expands your view of space (i.e. go up in a rocket), it becomes obvious that the earth is spherical. If you look at life forms from a perspective that greatly expands your view of time, evolution is equally obvious. We have known this for decades from fossil data; modern DNA and protein sequence data simply refines our knowledge and clinches the case. University curricula in biology, geology, and astronomy are dominated by the study of gradual change and non-biblical ideas about the origin of the cosmos and life on earth. Students who enter college after studying the high school curriculum you now propose will be poorly prepared to understand and keep pace in these fields.

The people who have already succeeded in largely removing evolution from school textbooks want to finish the job by inserting language that creates the entirely false notion that there is legitimate scientific debate about the factuality of evolution. These are the same people who, if allowed free reign, would ban books from libraries and persecute the heretics who do not share their views. It is your job to stand up to their dogma, regardless of the political consequences!!!! Anything less is a betrayal of hard-earned human knowledge and the trust and responsibility of your position. Today’s students will need solid scientific training to deal with an ever changing (i.e. evolving) biological world.

Sincerely,

James H. Marden, Ph.D.
Associate Professor of Biology
Pennsylvania State University
University Park, PA

P.S. - Please distribute this letter to all members of your committee.
Dear Ms. Cleland:

Thank you for your e-mail of April 29, 2001 on proposed 22 Pa. Code, Chapter 4, Appendix B (academic standards for Science and Technology).

Your e-mail is considered as official public comment and is being shared with all members of the Board. Pursuant to the provisions of the Regulatory Review Act, copies of your comments are also being provided to the Independent Regulatory Review Commission (IRRC) and the Chairmen of the House and Senate Education Committees.

Be assured that your comments will be considered carefully in the development of the final-form of these regulations.

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Sincerely yours,

Peter H. Garland
Executive Director

cc: Members of the State Board
    Senator Rhoades
    Senator Schwartz
    Representative Stairs
    Representative Colafella
    IRRC

-----Original Message-----
From: Donna Cleland [mailto:donnacleland@earthlink.net]
Sent: Monday, April 30, 2001 7:46 AM
To: pgarland@state.pa.us
Cc: Bollinger, G
Subject: Pa Science Standards

Dear Mr. Garland,
I represent a Consortium of school districts in southeast Pennsylvania. We have concerns about the proposed standards especially the inclusion of 3.4.4D which states that children by 4th grade should know about the moon phases, the seasons and eclipses. In our experience, children of that age are not capable of mastering those concepts. We would like to present to you the research and the opinions of experts in this field which support our view. Please let us know how that could be accomplished.

Thank you.

Donna Cleland
Dear Dr. Sturm:

Thank you for your e-mail of April 30, 2001 on proposed 22 Pa. Code, Chapter 4, Appendix B (academic standards for Science and Technology).

Your e-mail is considered as official public comment and is being shared with all members of the Board. Pursuant to the provisions of the Regulatory Review Act, copies of your comments are also being provided to the Independent Regulatory Review Commission (IRRC) and the Chairmen of the House and Senate Education Committees.

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Sincerely yours,

Peter H. Garland
Executive Director

cc: Members of the State Board
Senator Rhoades
Senator Schwartz
Representative Stairs
Representative Colafella
IRRC

-----Original Message-----
From: Charles Sturm [mailto:cssturnrjr@pitt.edu]
Sent: Monday, April 30, 2001 8:49 PM
To: 00statbd@psupen.psu.edu
Subject: Academic Standards

Dr. Peter Garland
333 Market Street
Harrisburg, PA 17126-0333

30 April 2001

Dear Dr. Garland,

I am writing to express my concern about several sections of the Proposed
Academic Standards for Science and Technology. I am concerned that the
rewording of these sections will weaken the educational opportunities of our students. Specifically, I find that they weaken the findings that evolution is the best explanation for the changes that we see among living organisms, and of evolutions' role as one of the unifying themes in biology. Additionally, I find that these reworded standards provide an opportunity to teach creationism, intelligent design or whatever fancy name one wishes to give to this alternative, unfounded idea.

I strongly urge that the following standards be returned to their original wording:
3.2.7.A.4
3.2.10.A.2, 4
3.3.10.A
3.3.10.D.1

I also find that the following sections are reworded in a way that singles evolution out for special treatment. Since no other biological theory is so treated, I do not see why we should do this with evolution. I recommend that they too be returned to their original wording.
3.3.12.A.3
3.3.12.D.1

As a physician, scientist and Christian, I strongly urge that the Pennsylvania State Board of Education rethink the standards and return them to their original wording.

Charles F. Sturm, Jr. M.D., M.S.

Director, Forbes Regional Family Health Center
Research Associate, Carnegie Museum of Natural History

Institutional affiliations are for identification only. My views are not to be construed as representing an official statement of these organizations.
Benkovic, Susan

To: ibss1@aol.com
Subject: RE: New Standards

Dear Mr. Meyers:

Thank you for your e-mail of April 28, 2001 on proposed 22 Pa. Code, Chapter, Appendix B (academic standards for Science and Technology).

Your e-mail is considered as official public comment and is being shared with all members of the Board. Pursuant to the provisions of the Regulatory Review Act, copies of your comments are also being provided to the Independent Regulatory Review Commission (IRRC) and the Chairmen of the House and Senate Education Committees.

Be assured that your comments will be considered carefully in the development of the final-form of these regulations.

The Regulatory Review Act provides that information on the final-form of regulations be mailed to public commentators at their request. If you would like to receive the final-form of these academic standards when they are submitted to the Education Committees and IRRC, please make your request in writing to the State Board of Education, First Floor, 333 Market Street, Harrisburg, PA 17126-0333.

Sincerely yours,

Peter H. Garland
Executive Director

-----Original Message-----
From: ibss1@aol.com [mailto:ibss1@aol.com]
Sent: Saturday, April 28, 2001 2:07 PM
To: oostatbd@email.cas.psu.edu
Subject: New Standards

Hello!

I am concerned about the new changes in the Standards for science especially 3.3.10.D.1 - "analyze evidence of fossil records, similarities in body structures, embryological studies and DNA studies that support or do not support the theory of evolution." This will allow all sorts of questionable theories into the science classroom. It will also open the door for more law suits if "a certain theory like creation is not discussed. Creation should be discussed in a religion class, not in a science class.

Sincerely,
Stephen C. Meyers, Th.D.
Vice-president,
Institute for Biblical & Scientific Studies
http://bibleandscience.com

4/30/2001
Dear Mr. Garland,

I am writing to comment on the content of the proposed Pennsylvania Academic Standards. For the most part they are insightful and appropriate and your office should be commended. However, as a scientist (and one from a Catholic Institution) I am very concerned at the wording used regarding the topic of evolution. It is not a question as to whether evolution occurs but rather how. In fact, there are several different mechanisms that have been proposed including "gradualism", "punctuated equilibrium", "lateral gene transfer", and "symbiogenesis". But that is not the point of my letter. The way the standards are currently written opens the door wide open for the introduction of creation science (a.k.a. intelligent design) into the biology curriculum. The Supreme Court has been very clear on this matter (teaching of creation science in public schools is against federal law) and the ACLU does not take this issue lightly (both Moon and Seneca Valley have been sued). The mixed signals area biology teachers have received have resulted in them not teaching evolution (I recently spoke with two teachers from Alderdice High School here in Pittsburgh). Evolution is a cornerstone of modern biology and we will do a great disservice to our children's education by allowing a religious belief masquerading as science to be taught as science. Kansas learned its lesson. Thus I strongly urge you to change the wording of two of the standards and suggest the following changes:

Grade 10: "Analyze evidence of fossil records, similarities in body structures, embryological studies and DNA studies that support or do not support the theory of evolution."

Grade 12: "Analyze the mechanisms through which evolution occurs."

Thank you for your consideration in the matter. And feel free to contact me.

Sincerely,

John F. Stolz
Professor of Biology
Stolz@duq.edu
Education for the Mind, the Heart, and the Soul
26 April 2001

Dr. Peter H. Garland
Executive Director
State Board of Education
333 Market Street
Harrisburg PA 17126-0333

Dear Dr. Garland:

It is my understanding that Pennsylvania's draft academic standards on science and technology are in the final approval process. As a research scientist and a science educator, I am writing to urge the State Board of Education to resist all efforts to water down the teaching of evolution, and to reject the efforts of religious special interest groups to incorporate so-called "evidence" against evolution in the science curriculum. To do otherwise would be a profound disservice to the citizens of the Commonwealth.

It is clearer than ever that if the United States is to maintain its position as a world leader in this new century, its citizens must be well educated, particularly in science and technology. Biology and biomedical technology are currently two of the most rapidly growing areas of research and development. We are therefore obligated to teach our students biology, and to teach it well; unfortunately, any student who leaves school believing that creationist ideas have any factual validity has gotten a big red "F" insofar as understanding biology is concerned. We mustn't allow this to happen to an entire generation of students.

Thank you for your attention.

Sincerely,

Patrick J. Loll, Ph. D.
Assistant Professor

(215) 898-1294
(215) 573-2236 FAX
loll@pharm.med.upenn.edu
Commonwealth of Pennsylvania
STATE BOARD OF EDUCATION

April 30, 2001

Mr. John Lennox
Professor of Microbiology
Penn State/Altoona College
3000 Ivyside Park
Altoona, PA 16601-3760

Dear Professor Lennox:

Thank you for your letter dated April 26, 2001 on proposed 22 Pa. Code, Chapter 4, Appendix B (academic standards for Science and Technology).

Your letter is considered as official public comment and is being shared with all members of the Board. Pursuant to the provisions of the Regulatory Review Act, copies of your comments are also being provided to the Independent Regulatory Review Commission (IRRC) and the Chairmen of the House and Senate Education Committees.

Be assured that your comments will be considered carefully in the development of the final-form of these regulations.

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Sincerely yours,

[Signature]

Peter H. Garland
Executive Director

CC: Members of the State Board
Senator Rhoades
Senator Schwartz
Representative Stairs
Representative Colafella
IRRC

First Floor, 333 Market Street, Harrisburg, PA 17126-0333
Telephone (717) 787-3787 • TDD (717) 783-8445 • FAX (717) 787-7306
April 26, 2001

Dr. Peter H. Garland, Executive Director  
State Board of Education  
333 Market Street  
Harrisburg PA 17126-0333

Dear Dr. Garland

I have read with dismay the wording of the proposed guidelines for science education as they relate to the teaching of evolution. As a parent, a Pennsylvania citizen (Blair Co.) and a University teacher of Life Science I would like to express my reasons for opposing this religiously motivated insertion of "pseudoscience" into the guidelines.

1. Science and religion in science classes.

My primary objection to the proposed 2000 standards for science teaching is that they seriously blur the distinction between science and religion in a way that does injury to both. The Christian religion is a system of understanding the world based upon faith and authority, the authority of the bible. For those who adhere to its tenets it provides guidance in life and a moral foundation for behavior and decision making. It describes the conditions under which a Christian may seek salvation. Its written text, the Bible, is a volume of moral philosophy, as many believe, the recorded word of God. It is not, and should not be considered a science treatise. Flat earth geography was a biblically based belief until advances in science and technology showed that the belief was untenable. To ground ones faith on biblical interpretation of the universe risks having that faith shaken by new discoveries.

Science on the other hand is a system of understanding the universe based upon observation and testing. It admits of no ultimate authority. All conclusions are tentative, even evolution. Nothing is accepted as true unless experimental evidence exists that supports the concept. Even then, true is a relative term. All statements in science have associated with them a probability term indicating the degree of confidence one holds in an idea. Despite suggestions to the contrary from members of the creationist movement, acceptance of evolution is not a dogmatic decision. In fact most of the "data" creationists advance to support their position is gleaned from the scientific literature, from scientists debating the probability of different modes by which evolution may proceed.
Any effort to insert religious creed into science education threatens religion by subjecting elements of the believer's faith to the constant testing of the scientific method. If you are going to call religion science then it must be subject to the same rules and potential refutation that scientific hypotheses must meet and withstand. Is this something you really want to do? Inserting religion into science classes also subverts science by insinuating an inadmissible ultimate authority, the Bible. Remember science is based upon observation and testing and is subject to refutation. Under these conditions, science and religion are threatened, and both are diminished in the process.

Many supporters would argue that, this is neither the intent nor the effect of the 2000 guidelines. The intent, in their mind is a balanced treatment and a democratic fairness in providing "both" sides of the issue and permitting the student to decide. If critical thinking is a goal of education, they argue, what could be more appropriate? But here we are attempting to equate incommensurables. The rules that govern science and religion are different as explained above. Trying to decide between them is like trying to decide if you would rather be a Republican or a Presbyterian, they are not mutually exclusive. To introduce religion into a science class is to change the rules of science so drastically that a student can hardly come away with his or her concept of science intact. The function of a high school level biology class is, in my opinion, to bring students to an understanding of how science works and to relate to them the best understanding of the current understanding of science. Certainly, critical thinking should be a component of such a class. But when learned scientists and creationists cannot reach common ground based upon the evidence what is the hope that students in high school can to so? Even so, were there a body of data suggesting that creation science is as good an explanation of the natural world as evolution, I would argue for its inclusion. Unfortunately, this is not the case. Whereas new data supporting the evolutionary hypothesis are reported almost daily in the scientific journals and public press, the arguments of the creationists are static. Most of the arguments are decades old, some as old as the concept of evolution itself and have changed not a wit in all that time.

2. History and objectives of the movement.

The recent trend to insert "waffle" wording into the educational guidelines by which school districts and teachers design curricula is the latest in a lengthy running conflict between educators and creationists over the introduction of religion into science classes. The 1920's saw the passage of the Butler act in Tennessee and similar acts in other states mostly in the southern U.S. The Scopes trial was an early battlefield in which this dispute was contested. Though Scopes was convicted he got off with only a fine (later rescinded by a higher court). A victory for the evolution side? Not really. The effect of these laws intimidated text book publishers from the mid 1920's right up to the launching of Sputnik by the Soviet Union in 1957. Examination of biology texts from that time reveals a conspicuous absence of evolutionary theory. The implication of these laws was, if you wish to sell books in our state, abandon evolution and the textbook publishers rolled over. The 1968 Supreme court decision in the case of Susanne Epperson v. Arkansas finally resulted in the declaration that all of the so called "Monkey Laws" proscribing the teaching of evolution were unconstitutional. This legislative defeat was
followed by a series of see-saw battles in which proponents of creationism introduced laws supporting, concepts such as "equal emphasis", "balanced treatment", and "creation science", as if calling something science is sufficient to make it so. Each of these concepts has been tested in the nations' courts and found wanting. In his opinion in McLean v Arkansas, 1981, for example, Judge Overton ruled that Act 590, the Balanced Treatment Act, was "a religious crusade, coupled with a desire to conceal this fact". Furthermore, Overton declared "The evidence is overwhelming that both the purpose and the effect of Act 590 is the advancement of religion in the public schools."

The latest prongs in the attack use words with supposedly non-religious connotations such as "intelligent design" and "irreducible complexity". If these are intended to be non-religious, then just what intelligence is implied and who designed the complex systems referred to?

The use of phrases in the proposed guidelines such as teachers may present facts "that do or do not support the theory of evolution" can only be construed as encouraging the introduction of creationist rhetoric. What other than creationism can proponents of the bill mean by "Under the proposed standards, there's room for science teachers to expose students to other theories"? Interestingly enough, this phrase is applied only to the guidelines as they deal with evolution, presumably theories contrary to atomic theory, thermodynamics and Mendel's laws are not to be considered. Evolution is being specifically targeted in a way that leaves no doubt as to the religious intent of the proponents of these guidelines.

3. The Kansas Experience.

In 1999, the State Board of Education of Kansas passed a resolution removing mention of Evolution, the age of the Earth, the big bang and other generally accepted "facts" of science from the testing guidelines of the state examinations. True, they did not try to prohibit the teaching of evolution, but their clear intent was, "Remove these topics from the test and teachers will not emphasize them". This shows an appalling lack of respect for the integrity of the teachers of the state who, bye and large, have continued to teach science as it is generally accepted by the community of scientists. More to the point, the decision by the Kansas Board has made the State a laughing stock. The scientific community and the religious community united in decrying the decision as being not only bad science but bad religion as well. In this, as in so many other instances our founding fathers had it right. There is a genuine rationale for separating state and religion and this unwise decision in Kansas draws pointed attention to the wisdom of those who built this caveat into our nations founding documents. On a more practical level, many industries, particularly those of a biotechnological bent, are seriously revising their estimate of Kansas as a fertile field for investment and development. Several years later and the situation in Kansas has now been redressed. New elections have turned many of the creationists out of office and the Board of Education of Kansas has recently restored the original intent of the testing guidelines.
Granted, the wording of the Pennsylvania science education guidelines is not so restrictive as that in the Kansas guidelines, but the implication is clear. These recommendations admit the possibility of interposing religious doctrine into the science classes of our state. The result may well be the diminution of the quality of our children's education, the reprobation of the business community and the further weakening of the constitutional foundation of our educational system. I implore you to bend every effort to have this waffle wording removed from the state guidelines before Pennsylvania follows Kansas into the educational dark ages.

Sincerely,

John Lennox
Professor of Microbiology
Penn State Altoona College
Altoona PA 16603
Garland, Peter

To: reedfam@3rdm.net
Subject: RE: Science Standards

Dear Ms. Reed:

Thank you for your e-mail of April 26, 2001 on proposed 22 Pa. Code, Chapter 4, Appendix B (academic standards for Science and Technology).

Your e-mail is considered as official public comment and is being shared with all members of the Board. Pursuant to the provisions of the Regulatory Review Act, copies of your comments are also being provided to the Independent Regulatory Review Commission (IRRC) and the Chairmen of the House and Senate Education Committees.

Be assured that your comments will be considered carefully in the development of the final-form of these regulations.

The Regulatory Review Act provides that information on the final-form of regulations be mailed to public commentators at their request. If you would like to receive the final-form of these academic standards when they are submitted to the Education Committees and IRRC, please make your request in writing to the State Board of Education, First Floor, 333 Market Street, Harrisburg, PA 17126-0333.

Sincerely yours,

Peter H. Garland
Executive Director

cc: Members of the State Board

Senator Rhoades
Senator Schwartz
Representative Stairs
Representative Colafella
IRRC

-----Original Message-----
From: Marilyn Reed [mailto:reedfam@3rdm.net]
Sent: Thursday, April 26, 2001 9:58 AM
To: 00statbd@psupen.psu.edu
Subject: Science Standards

To the State Board of Education:
I am supportive of the majority of changes that were made in the science standards for our state. As a school director, I hear a lot about "critical thinking skills" and "higher order thinking", but I see very little follow through on this when it comes to the topic of evolution. I believe that it is important to treat evolution like the theory that it is and teach students to critically analyze it for its positive and negative aspects. We need to instruct students on how to do a good job of sorting through what is fact and what isn't fact when it comes to science. There are things that have been taught to our students as fact

4/30/2001
which I have learned were actually lies and this is a travesty. Please support these changes. The only item that still concerns me is Section 3.3.12.D. I would support changing this to read: "Critically evaluate the validity of the hominids that evolutionists claim to be ancestral to modern man." This would be much more acceptable to me and would show a higher degree of critical thinking on the part of students.
Sincerely,
Marilyn Reed
April 26, 2001

Peter H. Garland
Executive Director
State Board of Education
333 Market Street
Harrisburg, PA 17126-0333

Re: Scientific theories, historical technologies, and the Proposed Academic Standards for Science and Technology.

Dear Mr. Garland:

Professor Ernst Mayr, Alexander Agassiz Professor of Zoology, Emeritus, Harvard University, wrote in the July 2000 issue to Scientific American that the “theory of evolutionary biology” is a concept based on observation, comparison, and classification. He noted that scientific experimentation is an inappropriate technique in evolutionary biology because history is not open to experimentation. [See enclosure, page 1]

The National Association of Biology Teachers stated that a scientific theory requires reproducible sets of experimentally-derived data from natural processes. The “theory of evolutionary biology” is not a scientific theory but a mere conjecture. All references to a scientific theory of evolution in the Proposed Academic Standards for Science and Technology must be deleted.

Professor Mayr labels evolutionary biology a historical science. It would be more accurate to label evolutionary biology a historical technology. Where “science” excludes intelligent input, “technology” implies intelligent input. A technology is scientifically permissible, though not scientific. In the Proposed Academic Standards, relabeling evolutionary biology a historical technology produces no violence to the historical record, yet it permits, though it does not require, supernatural causation. [See enclosure, pages 2 & 3]

Sincerely yours,

Fredric P. Nelson, MD

Fredric P. Nelson, MD
RETHINKING DARWINIAN EVOLUTION

On September 23, 1999, Professor Ernst Mayr\textsuperscript{1} received the Crafoord Prize from the Royal Swedish Academy of Science. Upon receiving this award, Professor Mayr delivered an address, which was subsequently published as “Darwin’s Influence on Modern Thought” in the July 2000 issue of the Scientific American.\textsuperscript{2} In the article, Professor Mayr presents the fundamental ideas of Darwinian evolution.

The fundamental ideas of Darwinian evolution need to be rethought, and this treatise attempts to do just that. To avoid misrepresenting the ideas, this treatise selects quotes from Professor Mayr’s article. The quotes are followed by reasoned objections or differing interpretations.

1. “[…] theories in evolutionary biology are based on concepts rather than laws.”\textsuperscript{3}

The National Association of Biology Teachers defines a scientific theory as follows:

In science, a theory is not a guess or an approximation but an extensive explanation developed from well-documented, reproducible sets of experimentally-derived data from repeated observations of natural processes.\textsuperscript{4}

Professor Mayr stated that evolutionary biology is a historical science based on observation, comparison, and classification.\textsuperscript{5} He noted that experimentation is inappropriate for understanding the historical progression of evolution.\textsuperscript{6} Evolutionary biology does not use experimentally-derived data. The historical data are not reproducible.

Rather, Darwin’s theory of evolutionary biology is based on concepts. A concept is a thought, a generalizing idea, a philosophy, or even a religion. Evolutionary biology does not meet the established criteria of a scientific theory, which requires reproducible sets of experimentally-derived data of natural processes. Therefore, no scientific theory of evolution exists.

\textsuperscript{1} Alexander Agassiz Professor of Zoology, Emeritus, Harvard University
\textsuperscript{3} Ibid. p. 83
\textsuperscript{5} Mayr. P. 81
\textsuperscript{6} Ibid. p. 80
2. "First, Darwinism rejects all supernatural phenomena and causations."\(^7\)

Darwin's rejection of all supernatural phenomena and all supernatural causations is a presupposition made without proof or supporting evidence. In logic, that which is freely asserted can be freely denied. Darwin's free assertion that there is no supernatural causation in evolution can be freely rejected.

Supernatural causation in the biochemical evolution of the first cell and in macroevolution is scientifically permissible. It will be shown that supernatural causation is rationally necessary.

3. "Finally, [Darwin] reasoned that the mechanism of evolution was natural selection."\(^8\)

Professor Mayr stated that natural selection should be considered a two-step process. The first step is the production of abundant variation. The second step is the elimination of inferior individuals.\(^9\)

Actually, natural selection has absolutely nothing to do with the production of abundant variation. The abundant variations are due to biochemical mechanisms, which produce variations in the nucleic acid sequence present in DNA. These variations consist of substitutions, additions and/or deletions. The biochemical mechanisms of DNA variation, which led to the first cell and to macroevolution, are unknown and are totally independent of natural selection.

The use of the adjective, "natural," prejudges the unknown biochemical mechanisms, which produce variations in the nucleic acid sequence present in DNA. Scientifically, unknown mechanisms must not be declared "natural" until they have been shown to be "natural." Certainly, if there were no supernatural causation, the biochemical mechanisms would be, of necessity, "natural." However, if supernatural causation does occur, at least some biochemical mechanisms of DNA variation would not be "natural." Predetermined criteria often lead to bad science and to erroneous conclusions.

4. "Evolutionary biology [...] is a historical science."\(^10\)

Since evolutionary biology is historical, the methods of evolutionary biology are observation, comparison and classification.\(^11\) Experimentation is irrelevant, because the enterprise is to recreate a complete record of actual past events.

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\(^{7}\) Ibid. p. 81  
\(^{8}\) Ibid. p. 80  
\(^{9}\) Ibid.  
\(^{10}\) Ibid.  
\(^{11}\) Ibid. p. 81
In evolutionary biology, a comparison is made between the DNA, proteins, homologous structures, and fossils of various organisms. Evolutionary biology does not—and cannot—reveal the biochemical mechanisms that produced the variations in the nucleic acid sequence present in the DNA molecules being compared. Evolutionary biology may be able to explain the "why" of natural selection, but it cannot explain the "how" of DNA variation.

Evolutionary biology is labeled a "historical science." This label is loaded with secondary meanings. "Science" is the study of the physical world. Scientists attempt to explain physical events by natural causes. The claim that evolutionary biology is a "historical science" strongly infers that evolutionary biology only has naturalistic or materialistic causes.

It would be more accurate to label evolutionary biology a historical technology. A technology is scientifically permissible, though not scientific. Where "science" excludes intelligent input, "technology" implies intelligent input. "Historical science" creates a false mental barrier, which is removed by reference to historical technology. In a technology, supernatural causation would at least be permitted, though not required. Relabeling evolutionary biology as a historical technology produces no violence to the historical facts. No unnecessary presuppositions need be made.

Evolutionary biology is currently a historical technology. Scientists have taken human DNA and inserted it into a bacterium, which now produces human insulin. Similar technology has been used to produce human growth hormone. If scientists can generate evolution by intelligent design, why not God? It is reasonable to speculate that God, and possibly His angels, used proprietary information to conduct genetic engineering.

5. "Philosopher of science Karl Popper's famous test of falsification therefore cannot be applied to [the so-called laws of biology]." 12

Karl Popper's test of falsification is not applicable to evolutionary biology. The true historical record is 100% accurate, though not 100% complete. A true and faithful record of actual events is a true and faithful record of actual events. It is obvious that the interpretation of the historical record might be false, but the true record is not false.

On the other hand, the historical record does not—and cannot—reveal the biochemical mechanisms that brought about the variations in the nucleic acid sequence present in the DNA, which led to the biochemical evolution of the first cell. The historical record does not—and cannot—reveal the biochemical mechanisms that brought about the variations in the nucleic acid sequence present

12 Ibid. p. 82
in the DNA of various organisms, which lead to macroevolution. The biochemical mechanisms are unknown.

Experiments devised to determine the biochemical mechanisms of DNA variation can be falsified. In fact, setting unnecessary restrictions on the biochemical mechanisms, such as eliminating supernatural causation, is the first step to falsification. Scientists must demonstrate that naturalistic biochemical mechanisms of DNA variation are both capable and adequate to explain the biochemical evolution of the first cell and the macroevolution of all living entities, past and present. Supernatural causation might not have occurred, but that is to be determined by experimentation, not by presupposition. Here, Karl Popper’s test of falsification does apply.

6. “[…] Humans and living apes clearly had common ancestry, an assessment that has never again been seriously questioned in science.”

Use of terminology such as common ancestry implies naturalistic macroevolution from a common ancestor. Commonality could have occurred through several other means. There is no infraction of either logic or the data to consider commonality brought about through macroevolution by intelligent design. Also, special creation may produce commonality if organisms are linked by common ideas.

The known data do create immense problems with naturalistic macroevolution. Less than $10^{50}$ proteins have ever existed on planet earth. If $10^{50}$ average-sized proteins were swept together into one pile, there would be enough protein to cover the entire surface of Planet Earth to a depth of 3 feet every year for over 3.5 billion years.

Each new protein produced by a random variation in DNA is one try or one attempt to bring about naturalistic macroevolution. The probability of 100 DNA triplets randomly coding for a needed, functional protein composed of 100 amino acid residues is about 1 chance in $10^{65}$ per try. The overall probability that naturalistic macroevolution would ever produce just one such protein with less than $10^{50}$ tries is less than one chance in a million billion.

The naturalistic macroevolution of apes or modern man from a common ancestor is an irrational scientific hypothesis. The reasoning follows. One offspring of a common ancestor is equal to 1 try in naturalistic macroevolution. If the common ancestor were given 1 chance in 100 million trillion trillion to complete just the first step and if the first step consisted of producing a necessary,

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13 Ibid.
functional protein of only 100 amino acid residues within a time frame of 1 million years, the common ancestor would need to produce 6.7 offspring for every square meter of the landmass of Planet Earth each year for each of the 1 million years.

In turn, the 6.7 offspring per square meter would need to reproduce for natural selection to select the 1 offspring with the advantageous trait provided by the new, functional protein.

Time, the number of offspring, landmass, food supply and good luck are each insufficient to bring about the first step in the naturalistic macroevolution of a common ancestor to an ape or a modern human.

Since naturalistic macroevolution does not—and cannot—explain this one step in macroevolution, it does not—and cannot—explain all steps in macroevolution. It is highly irrational to believe that naturalistic macroevolution is the mode of macroevolution. Supernatural causation is not just permitted; it is rationally necessary.

7. "The second [contribution by Darwin] is the notion of branching evolution, implying the common descent of all species of living things on earth from a single unique origin."\(^{15}\)

Not only is the naturalistic macroevolution of humans a highly irrational scientific hypothesis, the naturalistic macroevolution of a single-celled organism is a highly irrational scientific hypothesis.

Reidaar-Olson and Sauer determined that the probability of randomly assembling a \(\lambda\) repressor fold by naturalistic macroevolution in the bacterium E. coli is about one chance in \(10^{63}\) for each new protein segment made up of 92 amino acid residues.\(^{16}\) A collection of \(10^{50}\) E. coli, each with a new protein segment made up of 92 amino acid residues, would have one chance in 10 trillion of containing a \(\lambda\) repressor fold. A collection of \(10^{50}\) E. coli could fill a volume greater than 263 times the volume of Planet Earth each year for 3.5 billion years.

The expectation that naturalistic macroevolution would produce an E. coli with a \(\lambda\) repressor fold is highly irrational. Time, matter, a suitable environment, food supply and good luck are each insufficient for accomplishing this one step in naturalistic macroevolution. The idea that naturalistic macroevolution occurred in even one single-celled organism is an irrational scientific hypothesis. The idea that naturalistic macroevolution is the basis for all steps in macroevolution is a

\(^{15}\) Mayr. p. 80

highly irrational scientific hypothesis. Here again, supernatural causation is not just permitted; it is rationally necessary.

In summary:

1. No scientific theory of evolution exists.
2. The presupposition that no supernatural causation exists is freely asserted and can be freely rejected.
3. Natural selection is totally unrelated to the biochemical mechanisms that produce variations in the nucleic acid sequence occurring in DNA.
4. Experiments devised to determine the biochemical mechanisms, which produced variations in the nucleic acid sequence in DNA, can be falsified.
5. Evolutionary biology is a historical technology.
6. Naturalistic macroevolution is a highly irrational scientific hypothesis.
7. Macroevolution requires supernatural causation.
8. The commonality that exists between humans and living apes is due to macroevolution by intelligent design and/or common ideas in special creation.

Fredric P. Nelson, MD
Rethinking Evolution
P.O. Box 1145
Lansdowne, PA 19050
April 14, 2001
-----Original Message-----

To: kmw4@psu.edu
Subject: RE: Science Standards

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Dear:

Thank you for your e-mail of April 26, 2001 on proposed 22 Pa. Code, Chapter 4, Appendix B (academic standards for Science and Technology).

Your e-mail is considered as official public comment and is being shared with all members of the Board. Pursuant to the provisions of the Regulatory Review Act, copies of your comments are also being provided to the Independent Regulatory Review Commission (IRRC) and the Chairmen of the House and Senate Education Committees.

Be assured that your comments will be considered carefully in the development of the final-form of these regulations.

The Regulatory Review Act provides that information on the final-form of regulations be mailed to public commentators at their request. If you would like to receive the final-form of these academic standards when they are submitted to the Education Committees and IRRC, please make your request in writing to the State Board of Education, First Floor, 333 Market Street, Harrisburg, PA 17126-0333.

Sincerely yours,

Peter H. Garland
Executive Director

cc: Members of the State Board
Senator Rhoades
Senator Schwartz
Representative Stairs
Representative Colafella
IRRC

-----Original Message-----

From: Ken Weiss [mailto:kmw4@psu.edu]
Sent: Thursday, April 26, 2001 9:52 AM
To: 00statbd@psupen.psu.edu
Subject:

Dr. Peter H. Garland, Executive Director
State Board of Education
333 Market Street
Harrisburg PA 17126-0333

My understanding is that there is a pending action on public education that would allow, permit, or mandate specific qualifiers in the teaching of biology that relate to the possibility of non-evolutionary explanations. There are many things not known about how living forms arise.
and diversify. However, the facts of shared origin among species, of the processes by which inherited variation is transmitted and spread over time, and that this is affected by the success of organisms are as well established as the existence of gravity and atoms are in physics and chemistry, and this needs to be clearly taught.

Other explanations, such as for the age of the earth or the origins of all life, are held by many people. While some of these are in fact demonstrably false, many are unrelated to and do not change the facts of how life and inheritance vary over time. Explanations for ultimate origins are matters of personal faith that are outside the realm of science. Science is a way of knowing about the material world, not the non-material one.

To specify that these non-science explanations be added as alternatives specifically to biological explanations is a way to use governmental resources to establish support for one particular religious view. That's not only illegal but is wrong -- not everyone shares any particular explanation for the origins of existence and no such explanation has been demonstrated by science. The story of the creation of our universe as presented in Genesis, for example, is not accepted by all voting, taxpaying US citizens -- not even as their religion, much less as their understanding of the world. Science classes need to teach science, and only science.

Further, the same caveats would then have to be added to chemistry, physics, geology, astronomy, and all other science classes because they deal with things whose existence, and behavior, ultimately have to do with the nature of the universe. Biology is no different in that respect.

The people who came to our shores to build a new country were trying to escape the dictatorship of one religious view over others, and the founders of our Constitution knew the dangers of allowing even a hint of religious advocacy into the power structure of government. Whatever peoples' religious faith, history shows the awful dangers of allowing that to mix with the power of public institutions. Even if there is a majority, at present, who hold a particular religious view, the wisdom of the Constitution is that it protects the minority from any such majority, when it comes to civil rights, personal beliefs and practices, and the like.

Science is not religion, and science should be taught on its own terms. Scientists may or may not be religious, but science is no threat to religion. On the other hand, religion is certainly a threat to a sound knowledge of the world, when it is treated as a dogmatic alternative to science. Religion is something else, is personal, and should not in any way be taught in some governmentally specified way or with the support of common, public resources.

Kenneth M Weiss, PhD
Evan Pugh Professor of Anthropology and Genetics
Dear Mr. Garland:

We are facing the threat of a serious intrusion by fundamentalist religious influences in the proposed new standards for science education in Pennsylvania. As a scientist and educator all of my life, I see the relentless efforts of the religious right to introduce their dogmas into public education in the guise of creation "science" as dangerous attempts to propagandize our young people and deprive them of the understanding of real science and technology that they need in modern society.

The following was written by the Northwest PA Chapter of Americans United. It accurately reflects my views.

The Pennsylvania Board of Education's proposed Academic Standards for Science and Technology raise grave constitutional and public policy concerns. We urge you to revise these new standards to reflect sound constitutional law and appropriate science education.

The new standards state that teachers may present "studies that support or do not support the theory of evolution" (grade 10, see 3.3.10.D) and that schools may also "analyze the impact of new scientific facts on the theory of evolution" (grade 12, see 3.3.12.D). We believe these words have been carefully chosen to allow the promotion of religious concepts in public school science classes (see Elaboration, below).

Fundamentalist Christian groups and their Religious Right allies are pressing for the inclusion of creationism in the public school curriculum under the guise of science. In reality, creationism is not science, but rather a religious concept drawn from a literal interpretation of the Book of Genesis. That work is a theological document, not a science book. The U.S. Supreme Court and lower federal courts have been diligent in requiring that public education remain neutral on religious matters and ensuring that our schools do not get into the business of preaching instead of teaching. In 1968 the Supreme Court struck down a religiously motivated Arkansas law prohibiting the teaching of evolution in public schools. In 1987 the Supreme Court ruled that a Louisiana law requiring "balanced
treatment" between evolution and creationism was unconstitutional. Because the courts have erected barriers to prevent fundamentalist theology from being taught as science in public schools, advocates of creationism have moved to a new strategy. They now are focused on teaching the "flaws" in evolutionary science, while offering "intelligent design" as an alternative "scientific" theory. In fact, "intelligent design" is merely a new version of creationism, a religious concept cloaked in a transparently thin veneer of science.

The proposed science standards under consideration by the Board clearly open the door to religious intrusion into the public school science curriculum. If local school districts follow these standards -- and alter their curricula to conform to religious tenets -- lawsuits are certain to result. We strongly urge you not to give bad advice to school administrators and science teachers through poorly worded science standards. This issue can also have important non-legal ramifications. You will recall the controversy that erupted in Kansas in the summer of 1999 when the state board of education there voted to downplay evolution in the state science standards. It engendered divisiveness and a pitched political battle that resulted in Kansas voters rejecting several creationist board members in favor of moderates who had vowed to restore evolution to the standards. We strongly believe that Pennsylvania does not need a divisive controversy of this type and certainly does not need a costly, drawn-out legal battle -- which could easily be the result if these standards are adopted. Instead, Pennsylvania needs science and technology standards that are free from sectarian dogma, that instruct its children in the fundamental principles of modern biology and that spur all of the state's public school children to aspire to excellence.

I urge you to reject the new proposed standards that contained the thinly disguised creationist language. This letter reflects my own views, and should not be taken as the policy or views of my employer.

Sincerely,

Roger F. Knacke, Ph.D.
(Director, School of Science, Penn State Erie)
To: R. Argot  
Subject: RE: Science, Technology, Environment, and Ecology

Dear:

Thank you for your e-mail of April 24, 2001 on proposed 22 Pa. Code, Chapter 4, Appendix B (academic standards for Science and Technology).

Your e-mail is considered as official public comment and is being shared with all members of the Board. Pursuant to the provisions of the Regulatory Review Act, copies of your comments are also being provided to the Independent Regulatory Review Commission (IRRC) and the Chairman of the House and Senate Education Committees.

Be assured that your comments will be considered carefully in the development of the final-form of these regulations.

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Sincerely yours,

Peter H. Garland
Executive Director

cc: Members of the State Board  
Senator Rhoades  
Senator Schwartz  
Representative Stairs  
Representative Colafella  
IRRC

-----Original Message-----
From: R. Argot [mailto:gocrash@hotmail.com]  
Sent: Tuesday, April 24, 2001 9:12 PM  
To: pgarland@state.pa.us  
Cc: reargot.SR.High.WestYork@wyasd.k12.pa.us  
Subject: Science, Technology, Environment, and Ecology

Mr. Garland,
Good evening. I write to you tonight own my behalf, speaking as an individual teacher, about my reflections on standards for Science, Technology, Environment, and Ecology. Let me first say, they are impressive. It would be phenomenal if all students were at this level when they graduated from high school. However, I believe that as written the standards are too high.

We are a country that believes students have a right to a quality education. But we are also a country that expects our students to do more than come home from school and study. If parents were truly aware of what
is being proposed, I think they would have similar concerns. As I read
the
online version of the PA Bulletin, "The purpose of adding these
requirements
is to specify academic standards to be achieved by students enrolled in
the
public schools [including public charter schools] of this Commonwealth."
Again, later on, "Proposed amendments to Chapter 4 define the standards
in
science and technology and environment and ecology to be achieved by
students in the public schools."
Maybe I am reading it wrong, but this is saying that all regular
students are expected to meet all of these standards. The standards do
say
that students should be able to meet some of these specific items when
they
are done, they are supposed to meet all them. Is the Department of
Education suggesting that students should not be permitted to graduate
if
they cannot meet these standards?
Finally, I want to briefly touch on a point that I have addressed
several times with Dr. Kip Bollinger. I do not feel that the science
and
technology standards address the issue of ethics strongly enough. I
know
that the issue of ethics can be addressed when completing tasks that
will
help students explore 3.1 and 3.2, but I have not actually found the
issue
of ethics in the standards. I think that is wrong. Far too many scientists
have done things for advancement of knowledge without regard for the
consequences. If we as a state are going to set standards for our
students
(even at a lower level than currently proposed) we need to instill a
sense
of value in the way that they (and our society) pursues knowledge.
Thank you for your time and consideration. Please let me know if I
can be of further assistance. Sincerely, Ryan Argot (717)792-9062

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