

reports

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Dear NCSE members,

I'm not going to lie. The problems NCSE exists to solve are not small. Ensuring that evolution and climate change are taught accurately and effectively at all grade levels, in all schools, even where the risk of conflict is high and even when the resources are lacking, might seem like an unattainable goal. Especially when there are people out there actively working to block it!

But do not despair, dear reader, for in these pages you will find example after example of practical, concrete, tangible examples of progress. What NCSE is doing is manifestly making a difference in improving how these critical topics are taught in schools and discussed in communities.

Our feature article (“Yes, Elementary School Teachers Also Need to Know Evolution,” p. 3) describes an interesting research project that examines why preservice elementary school teachers might support the teaching of creationism (including “intelligent design”) along with evolution. The answer—which points the way towards a practical solution—is an inadequate understanding of the nature of science. Look for future NCSE collaborations with those working to make sure that future teachers are confident in their ability to convey the nature of science to their students.

The NCSEteach program is in the midst of an ambitious experiment: can we bring together a dream team of experts to develop a series of climate change lessons that can be adapted to work at any grade level, customized to include local evidence, and effective in correcting the misconceptions students are likely to bring to class? All indications are that the answer is going to be yes, as you’ll read in “A Talker, a Teacher, a Scientist, and a Fed Walk into a Bar...” (p. 10).

You’ve already learned how NCSE Science Booster Clubs are giving tens of thousands of people the opportunity to interact with the evidence for climate change and evolution for themselves. In this issue, we offer a glimpse of the process we use to develop new activities so that they are scientifically accurate, engaging, cheap, quick, and emotionally resonant. “Turtles, Ticks, and Mosquitoes,” (p. 12) anyone?

Don’t get me wrong. The problems are still out there, which is why NCSE continues to monitor state and local legislatures, boards, and agencies for signs of trouble—you can see some highlights (lowlights?) on pages 8 and 9—and to provide organizational help to oppose problematic policies and practices. As the calls we receive from everyone from local parents to reporters from *The New York Times* attest, NCSE is the acknowledged expert on identifying and blocking efforts to miseducate our children about science.

We can only do that with your help. Thanks for your continued support!

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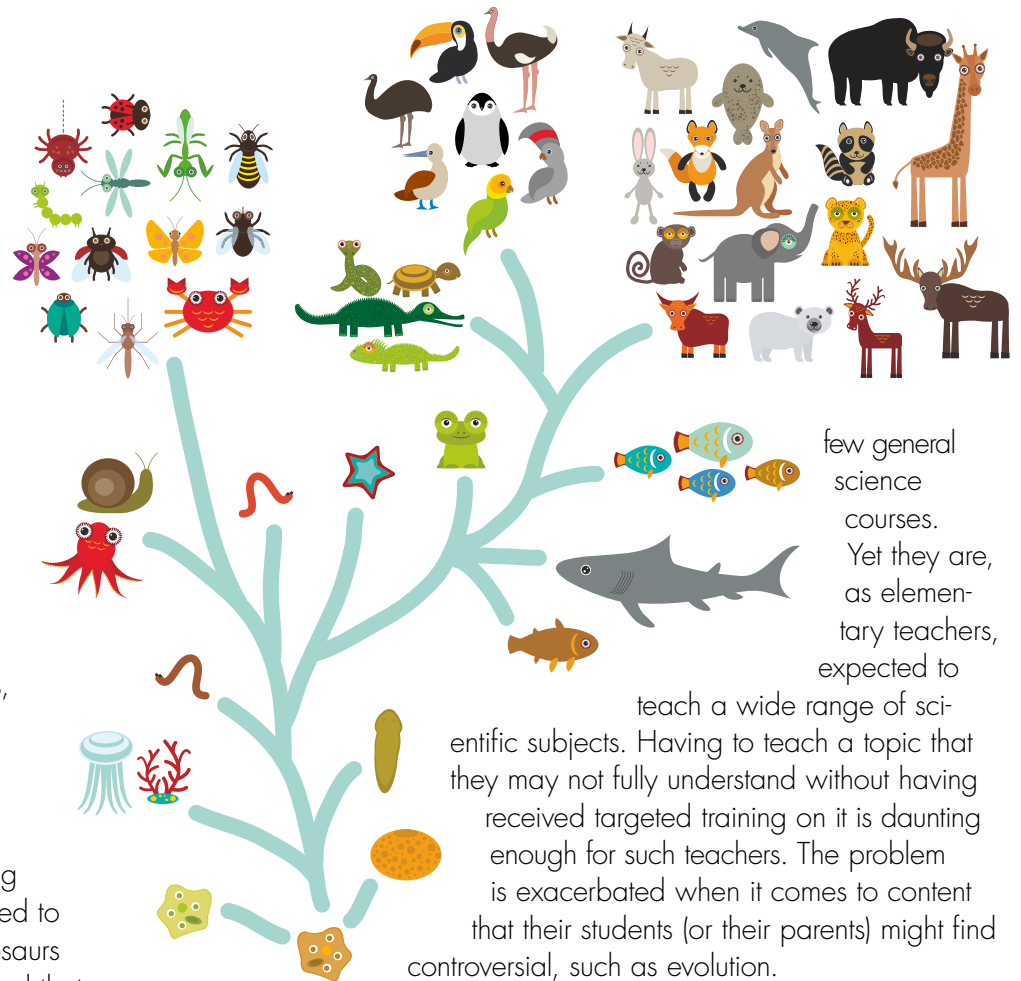


Yes, Elementary School Teachers Also Need to Know Evolution

At a recent science education convention, during a discussion about the need to assemble an evolution resource book for K–12 teachers, a fellow science educator objected, “But evolution isn’t really taught in elementary grades, is it?” You bet it is. While the phrase “natural selection” might not be included at the elementary school level of the Next Generation Science Standards, concepts foundational to evolution—such as the ways organisms respond to changing environmental conditions, evidence of common ancestry, and adaptations—are present. Every student taught in accordance with NGSS or a similar set of standards should leave fifth grade understanding many basic facts and principles related to evolution, such as that (non-bird) dinosaurs went extinct before humans existed and that organisms have variations that make them more or less likely to survive in their environments.

If we want elementary students to get the gist of evolution, we need their teachers to understand it, and our colleague’s objection that there isn’t any evolution in the K–5 classroom suggests that at least some don’t. While there is ample research at the middle school, high school, and university levels regarding evolution acceptance, understanding, and teaching, there is little focused on elementary grades. As a step toward filling this gap in the literature, we conducted a study involving university students enrolled in an elementary teacher preparation program (hereafter referred to as the “participants”).

In many teacher preparation programs, students pursuing elementary teacher licensure are required to take only a



few general science courses. Yet they are, as elementary teachers, expected to teach a wide range of scientific subjects. Having to teach a topic that they may not fully understand without having received targeted training on it is daunting enough for such teachers. The problem is exacerbated when it comes to content that their students (or their parents) might find controversial, such as evolution.

In a [2007 survey](#) of high school biology teachers, 22% reported pressure to downplay or skip evolution or to include non-scientific “alternatives” in the curriculum as advocated by many anti-evolution groups. Because of these challenges, it is critical that teachers discern science from non-science and that they know to use this distinction as the determining factor of what should be taught in their classrooms.

Accordingly, we sought to determine participants’ conceptions of science and how these conceptions were used to distinguish between scientific and non-scientific explanations of the origin of species. Our research questions were as follows:

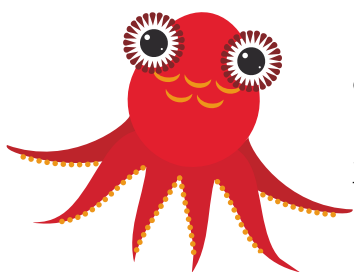
- What views do elementary preservice teachers hold on the possible inclusion of creationism and/or “intelligent design” in the K–12 science curriculum?

- How do elementary preservice teachers justify including or excluding creationism and/or “intelligent design”?

(While we agree that “intelligent design” is merely a new strategy of presenting creationism, our research has shown that often teachers consider it to be separate, so we distinguished creationism and “intelligent design” in the study.)

Elementary Preservice Teachers’ Perspectives on Creationism and “Intelligent Design”

Our study took place at a public university in the American South. It included seventy-six participants enrolled in a science pedagogy course. The course emphasized a hands-on, inquiry-based approach to teaching, and included topics such as asking higher-order questions, integrating science and English language arts, and the nature of science and scientific inquiry. There was no instruction related to evolution, creationism, or “intelligent design.”



To ascertain the participants’ perspectives, we created and conducted an activity called the “Science in the Public Schools—School Board Scenario” (see box). The first step in the activity was to read the scenario, in which the local school board was consid-

ering adding creationism and/or “intelligent design” to the science curriculum. The participants were instructed to provide a definition of science before reading short descriptions of evolution, creationism, and “intelligent design.” Then they were asked to use their definition of science in composing a written recommendation to the

school board about the proposed curriculum change: should the school add creationism, add “intelligent design,” add both, or add neither?

Findings

Initial analysis of the data involved simply recording how many participants recommended each possible response (add creationism, add “intelligent design,” add both, add neither). While tallying the responses, a fifth category emerged: some participants recommended “mentioning” creationism and/or “intelligent design” in the curriculum, but not actually teaching it. This category was designated as “just mention.” The proportions of participants falling into each category are summarized in the graph shown at right.

After the participant responses were tallied, the data was qualitatively analyzed, revealing informed and naive conceptions of science that led to differing views on creationism and “intelligent design.”

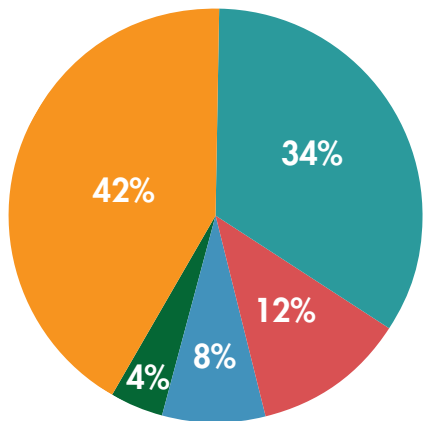
The good news is that of the 76 participants, 32 (42.1%) recommended adding neither creationism nor “intelligent design”—the largest single response category. More importantly, through their reasoning, these participants demonstrated more informed views of science than those who agreed with adding creationism, “intelligent design,” or both. These participants accurately recognized the importance of scientific evidence and communicated that evolution meets, and the supposed alternatives fail to meet, this standard. They further indicated that scientific claims are based on empirical evidence. This is unlike both creationism and “intelligent design,” which are based on faith, making them non-scientific topics not suitable for the science curriculum.

Science in the Public Schools—School Board Scenario

You have been elected to your local school board. There is currently a motion to alter the science curriculum in the local schools regarding their presentation of evolution. Currently, evolution is the only scientific explanation provided for the diversity of life on Earth. A growing population of concerned parents are advocating for introducing intelligent design and/or creationism into the unit on evolu-

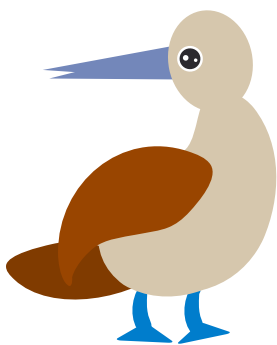
tion. Your opinion on this matter should be based upon your understanding of what is or is not scientific, so begin by defining the word “Science.” Then, read the description of each position and, based upon your understanding of science, decide whether or not you would choose to include creationism and/or intelligent design in the science curriculum. Be sure to justify your decision.

Proportion of survey respondents who would...



- Add neither
- Add creationism and "intelligent design"
- Add creationism only
- Add "intelligent design" only
- Only mention either or both

Participants' recommendations in the School Board Scenario (n=76).



That was the good news.

Worryingly, the majority of participants (53.9%, $n = 43$) agreed with adding creationism, "intelligent design," or both to the science curriculum. The participants offered several explanations as to why they would support allowing these

supposed "alternatives" to be inserted into their science classrooms.

Some described evolution as "just a theory" and used this description to justify the inclusion of "other theories." This perspective demonstrates a common misconception: the failure to understand that a scientific theory is not a mere speculation or conjecture.

Others referred to evidence to support creationism or "intelligent design" that, in their opinion, provided enough reason to include them alongside evolution. However, in most of these cases, the participant failed to provide any examples of the evidence to which they had alluded or offered examples that revealed their lack of understanding of what constitutes scientific evidence. For example, one participant referred to the idea that the great flood of

Genesis could have formed the Grand Canyon. This participant failed to recognize that a biblical reference is not empirical evidence (and that geological evidence directly contradicts the idea of a worldwide flood).

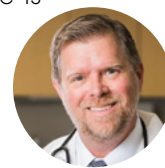
Some participants doubted evolutionary theory because evolution, as they understood it, is a completely random process; they therefore regarded evolution as lacking the credibility necessary to be favored over competing explanations. Such participants revealed another very common misconception: failure to recognize the role of natural selection, which is non-random, in driving evolutionary change.

The last justification for including creationism and/or "intelligent design" was perhaps the most worrisome for science education. A number of the participants expressed their desire to "teach all sides" of an issue, arguing that doing so would create a more democratic classroom that would promote more critical thinking skills. While a democratic classroom might be a worthy goal and critical thinking is always desirable, these participants were not recognizing that they were in effect advocating for the inclusion of non-science in the science curriculum. Would they teach all sides of the issue of the shape of Earth?

Recommendations

Clearly, more emphasis needs to be given in preservice teacher training to the presence of foundational evolution concepts that are taught in the K–5 grades. Preservice teachers in teacher education programs should clearly understand their roles in preparing students to understand complex evolution concepts in middle school and high school. More importantly, these future teachers need to be taught to discern between science and non-science, and most importantly, to value the role of this distinction in determining what material should be taught in their science classrooms. Teacher education programs (for preservice teachers) and professional development opportunities (for inservice teachers) should emphasize the nature of science so that teachers can discern science from non-science and keep their science curriculum focused on science. There is much work to be done.

Mark Bloom is a professor of biology and science education at Dallas Baptist University. The opinions he expressed in this piece are his own and do not represent those of his institution. markb@dbu.edu



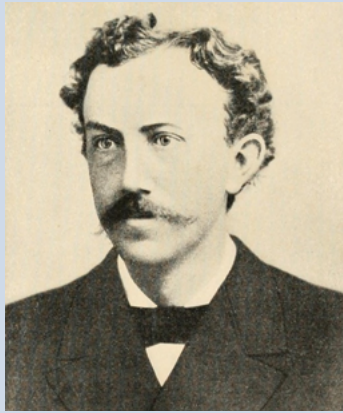
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PLACE & TIME

David Starr Jordan (1851–1931)

David Starr Jordan was born on January 19, 1851, in Gainesville, New York. In 1869, he enrolled in the newly established Cornell University, where in 1872 he received an M.S. (he never received a bachelor's degree). After teaching science in Indiana, he received an M.D. from Indiana Medical College. In 1875, Jordan became a professor of natural history at Butler University (from which he would receive a Ph.D. in 1878), after which he taught at—and in 1884 became president of—the University of Indiana. There he wrote *Darwinism* (1888), and later, *Footnotes to Evolution* (1898). In 1891, Jordan became the first president of Leland Stanford Junior University (which later became Stanford University), and while in that position coauthored with Vernon Kellogg *Evolution and Animal Life* (1907).



David Starr Jordan was an ichthyologist who claimed to have taught the first evolution course offered anywhere in the world. This public domain photo from Jordan's memoir *The Days of a Man* (1922) shows Jordan in 1880.

Jordan, an ichthyologist, was influenced by famed biologist Louis Agassiz, but was never converted to Agassiz's antievolutionary views. Throughout his life, Jordan was distant from religion, often claiming that much of what we have called religion is “the debris of previous generations,” and regarded the

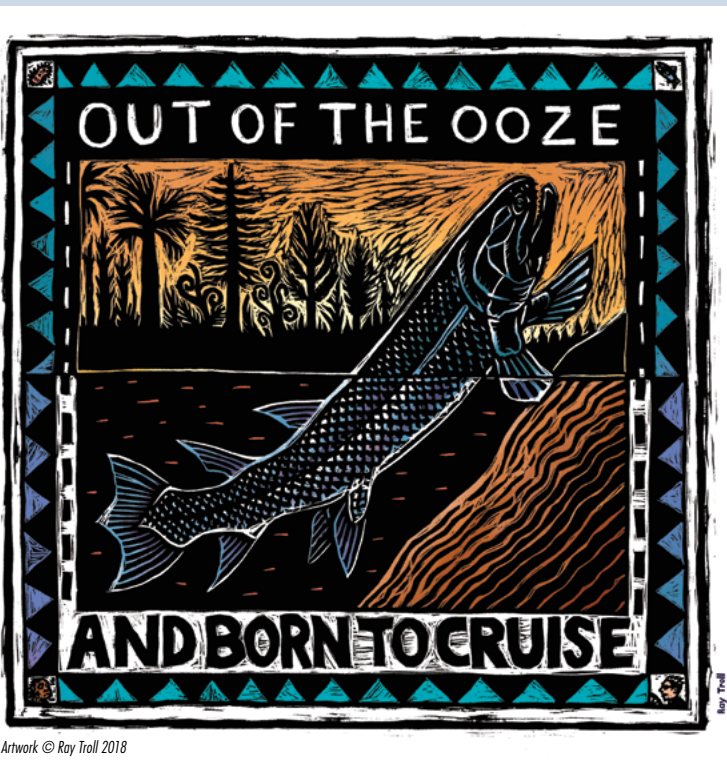
Protestant revivalism of the 1920s as “simply a form of drunkenness no more worthy of respect than the drunkenness that lies in the gutter.” Jordan was also a staunch eugenicist, as were many supporters of evolution at the time.

Outside of academia, Jordan held many prestigious leadership positions during his career. He was a founding

member of the Sierra Club, serving as its Director from 1892 to 1903, and was president of the American Association for the Advancement of Science from 1909 to 1910. Jordan served as president of the National Education Association in 1915, and from 1906 to 1916 was on the first board of trustees of the Carnegie Foundation for the Improvement of Teaching. Jordan directed the World Peace Foundation from 1910 to 1914, where he approached war and peace from a biological perspective, noting that war was detrimental to the health of species because it removed the strongest individuals from the gene pool. In 1925, Jordan chaired the Tennessee Evolution Case Defense Fund Committee for the ACLU. He raised more than \$11,000 for the fund, some of which was given to John Scopes to subsidize his attending graduate school at the University of Chicago.

Jordan died on September 19, 1931, in his home in Palo Alto, California. The *David Starr Jordan*, named in his honor, was a US government research ship from 1966 to 2010, when it was decommissioned. Cornell University, Indiana University, and Stanford University jointly sponsor the David Starr Jordan Prize, an international award given every three years to honor a young scientist's innovations in evolution, ecology, and population biology.

Randy Moore is the H. T. Morse–Alumni Professor of Biology at the University of Minnesota, Twin Cities. His most recent book is *A Field Guide to the Scopes Trial* (Rhea County Historical and Genealogical Society, 2016). Rmoore@umn.edu



Artwork © Ray Troll 2018



NCSE is delighted to congratulate **Michael E. Mann** on receiving the James Shea Award for 2017. Presented by the National Association of Geoscience Teachers, the award honors “exceptional contributions in the form of writing and/or editing of Earth science materials (broadly construed) that are of interest to the general public and/or teachers of Earth science.” Announcing the award, NAGT described Mann’s “contributions to the earth sciences as a researcher, author, lecturer, and advocate” as “legendary,” adding, “He is one of a few courageous climate scientists who continue to play a leading role in calling the attention of the public and policy makers to the overriding environmental challenge of the twenty-first century: anthropogenic climate change.” Mann is Distinguished Professor of Atmospheric Science at Penn

State University, with joint appointments in the Department of Geosciences and the Earth and Environmental Systems Institute. He is also director of the Penn State Earth System Science Center. His latest book, coauthored with Tom Toles, is *The Madhouse Effect* (Columbia University Press, 2016). A member of NCSE’s Advisory Council, he received NCSE’s Friend of the Planet Award in 2014.

Bob Melton received the Jack Renner Distinguished Service to Oklahoma Science Education Award from the Oklahoma Science Teachers Association. The award is presented annually to “individuals and organizations who have made significant contributions to the advancement of science education in Oklahoma,” according to the National Association of Biology Teachers. A

long-time member of NCSE, Melton is the STEM Facilitator and Assessment Coordinator for the Putnam City School District. He served as the president of the National Association of Biology Teachers in 2016.

NCSE is pleased to congratulate **Elliott Sober**, the Hans Reichenbach and William F. Vilas Research Professor of Philosophy at the University of Wisconsin, Madison, and a member of NCSE’s Advisory Council, on receiving, along with Nancy Cartwright, the 2017 Dr. Martin R. Lebowitz and Eve Lewellis Lebowitz Prize for Philosophical Achievement and Contribution, awarded by the Phi Beta Kappa Society in conjunction with the American Philosophical Association.

—GLENN BRANCH

DINNER PARTY 101: What to Do When Friends Don't Fret the Flu



“How have you been lately?” I asked over dinner. “Ah, well, you know, I’m just getting over that horrible flu that’s going around,” my friend replied. No surprise there: the flu has “gone viral” this year (pun intended), frequently in the news and on people’s minds—and for good reason. This flu season has been alarming, breaking records in terms of rate of infections, hospitalizations, and fatalities.

There are many different misconceptions about the flu that can make their way into the conversation, and as an NCSE staffer, I think that I’m pretty good at spotting them. Especially troublesome is the misconception that getting the vaccine actually causes illness. This misconception has been particularly popular this year because the vaccine was not a very good match for one of the circulating strains (H3N2), and so many people who receive the vaccine are still getting sick. The imperfection of the vaccine also feeds the perception that scientists really don’t know what’s going on with the flu at all since they can’t seem to stop it. My personal least favorite flu-related misconception is, “Well, my body is pretty strong as it is. I don’t need to get the flu shot.”

When I hear any of these troubling ideas, at dinner or otherwise, it is tempting to rattle off all of the reasons

why they are so flawed. But I know that doing so would not help my friends understand the importance of the flu vaccine. So instead I put the science facts on hold and remember the no-conflict approach from the booster club program. Instead of screaming when my least favorite misconception appears, for example, I remind my friends that getting the flu shot isn’t just about them: it helps protect those people who cannot receive the vaccine for themselves (often because they have weak immune systems). Getting the flu shot is important because it helps us to protect the most vulnerable among us, including infants and the elderly. That often opens up the door to conversation, so I can go on to explain the mechanics of the vaccine and how it helps even if you do still get the flu. And—I’ll admit it—I might direct my friends to the CDC website (www.cdc.gov/flu). After all, facts, data, and evidence matter a lot. They just don’t always make the best opening salvo.

Just like climate change, influenza affects all of us. And here at NCSE, one of our core missions is to get people to engage with the evidence, understand how science works, and to make it clear that we are all in this together.

—CLAIRE ADRIAN-TUCCI

UPDATES

ncse.com/updates

CALIFORNIA, ANGELS CAMP

A creationist student at Bret Harte High School is challenging a district policy that “religious theories ... shall not be discussed in science classes.” According to the *Sonora Union Democrat*, the district’s policy derives from the California School Boards Association and is believed to comply with applicable law. But a local attorney representing the student and his family told the newspaper, “if the board clings to this unconstitutional policy, then my clients are prepared to litigate.” The board is considering the issue.

CONNECTICUT, WILTON

While visiting a local coffeehouse to defend controversial comments about American history and politics she posted to Facebook, Andrea Preston, a Republican candidate for the Wilton Board of Education, reportedly offered the view that textbooks should be “balanced” on topics such as creationism and evolution and climate change as part of “a well-rounded curriculum,” according to the *Wilton Bulletin* (November 5, 2017). Subsequently, Preston placed a distant fourth in the November 7, 2017, election for three seats on the board.

FLORIDA

House Bill 827 and Senate Bill 1644 would, if enacted, revise the procedures for adopting instructional materials to permit members of the public to recommend instructional materials for consideration by the state or their district school board, which would then be required to get in touch with the publisher of those materials and allow it to submit a bid for evaluation. Creationist and climate change denial materials are likely to be recommended if these bills pass.

FLORIDA

House Bill 825 and Senate Bill 966 would, if enacted, require “[c]ontroversial theories and concepts ... [to] be taught in a factual, objective, and balanced manner,” while allowing local school districts to use either the state science standards or alternatives “equivalent to or more rigorous than” them. There is no indication in the bills about which “theories and concepts” are “controversial,” but it is suggestive that SB 966’s sole sponsor, Dennis Baxley (R–District 12), has a history of antievolution advocacy.

Are there threats to effective science education near you? Or do you have any cause for celebration to share? E-mail any member of staff or info@ncse.com.

FLORIDA

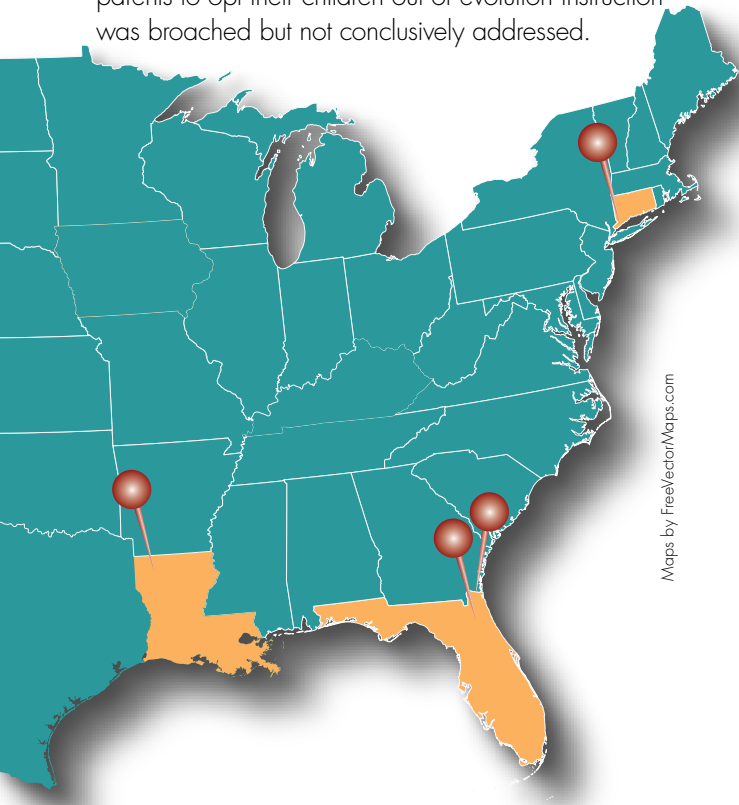
The effects of a new law in Florida, which permits any county resident to question specific instructional material and receive an official hearing, are already manifesting, according to the Associated Press. Since the law’s passage, no fewer than seven districts reported receiving at least one complaint, including one in Brevard County that elementary school social studies textbooks are engaged in “blatant indoctrination” by asserting that global warming is caused by human activity, and one in Nassau County challenging the teaching of evolution (see next page).

FLORIDA, CLAY COUNTY

At the January 4, 2018, meeting of the Clay County School Board, board member Ashley Gilhousen suggested changing the way in which evolution is taught in the county’s public schools, complaining that “the only theory mentioned is evolution and all that is expected for students to know is its supporting evidence and none of its flaws.” Her suggestion was offered informally during a discussion of K–12 science textbook adoption; it was not greeted enthusiastically and no vote on it was taken.

FLORIDA, NASSAU COUNTY

At its December 14, 2017, meeting, the Nassau County School Board unanimously voted against local retired teacher Jay Shutt's proposal to "stop the teaching of Darwinian evolution as fact" by inserting a disclaimer promoting creation science in textbooks that discuss evolution. The district's chief of legal services and superintendent, while opposing the proposal, expressed sympathy for the religious concerns underlying Shutt's proposal. The possibility of allowing parents to opt their children out of evolution instruction was broached but not conclusively addressed.



LOUISIANA, WEBSTER PARISH

Cole v. Webster Parish School Board, a lawsuit filed in the United States District Court for the Western District of Louisiana on December 18, 2018, alleges that the Webster Parish School District "has a longstanding custom, policy, and practice of promoting and inculcating Christian religious beliefs." Included in the complaint is the claim that at least three science teachers told their students that evolution is not real, one describing it as a "fairytale." The plaintiffs are represented by the ACLU.

NATIONAL

Textbooks that miseducate students about science may be in wide use in private schools receiving public funding through voucher or tax-credit schemes, according to the Huffington Post (December 7, 2017). Focusing on the 42 percent of the 8000-odd such schools that identify as Christian but not Catholic, Rebecca Klein and her colleagues ascertained that 32 percent of these schools were using textbooks from publishers Abeka, Bob Jones University Press, or Accelerated Christian Education, which are likely to misrepresent evolution and climate change.

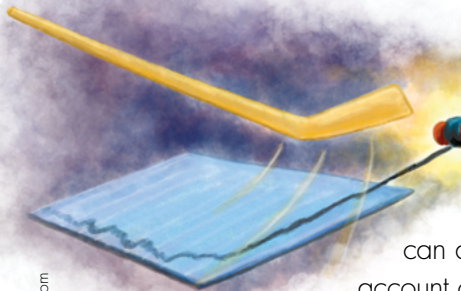


SOUTH AFRICA

In a June 2017 decision, the Johannesburg High Court ruled that public schools in South Africa may not promote one religion over another. The ruling came in response to a lawsuit brought by the *Organisasie vir Godsdienste-Onderrig en Demokrasie* (OGOD: the Organization for Religious Education and Democracy) in May 2017 seeking action against six Afrikaans state schools for their unconstitutional practices promoting Christian beliefs, including presenting creationist teachings, although the court did not grant the restraining order that OGOD sought.

A Talker, a Teacher, a Scientist, and a Fed Walk into a Bar...

...or at least, a conference room.



If you were expecting a punch line, I'm afraid you'll be disappointed. What I can deliver, however, is an account of a meeting between

John Cook and Nabanita Borah from George Mason University's Center for Climate Change Communication, Frank Niepold from the National Oceanic and Atmospheric Administration (NOAA) Climate Program Office, and me. We met at George Mason University in December 2017 to plan strategy and begin lesson development for the Turning Misconceptions into Educational Opportunities (TMEO) workshop, our new project aimed at improving climate change education.

Forming Our Team

What do you need to build an effective lesson about climate change? You need the science, of course. But that's not enough. Unlike other topics such as photosynthesis in biology or forces in physics, climate change presents two serious challenges. First, it's a rapidly changing field that most current educators were never themselves taught. And second, there is a whole propaganda apparatus out there determined to cloud and tarnish the science by misrepresenting it as controversial. Students coming into the classroom have probably internalized such misinformation, which can reinforce their pre-existing misconceptions.

To overcome these challenges, we needed experts in science communication and pedagogy, and we needed someone to help us get the attention of teachers. And so we formed our dream team: Cook and Borah have the science and the communication skills but not the pedagogy or audience; Niepold has the pedagogy and audience, but not the science or communication expertise—and me? I have a little of everything, but my real contribution is bringing everyone together.

A Misconceptions-Based Approach

I worked with Cook, Borah, and Niepold to develop a set of five lessons to teach climate science and solutions, each based on a commonly held misconception. The first lesson is centered on the misconception that scientists are not settled about the causes of our present period of climate change. In fact, the scientific consensus is firm. Multiple studies conducted in multiple ways have shown that [97% of scientists](#) understand climate change to be occurring and that human activity is the cause. Thanks to a concerted propaganda campaign, however, many people suffer from the false impression that the science is still unsettled. The challenge of this lesson, therefore, is to guide the students through a hands-on experience where they discover the consensus for themselves. It is not effective to challenge the misconception simply by presenting alternative arguments, a common communication strategy; and it isn't sufficient simply to lead the students through the evidence for consensus, a common pedagogical strategy. Instead, the students need to grapple with the data themselves, construct their own understanding of the evidence, and recognize the validity through their own discovery.

Most students can't do entirely independent research at even the high school level—a teacher must guide them through this process. But this is a unique challenge for two further reasons. First, these are large datasets, and it is impossible to do a hands-on lesson that generates the data directly. Second, the learning objective is the recognition of the validity of the scientific consensus, not an evidence-backed hypothesis. So how do we do it?

Our plan is to have the students work in teams on separate lines of evidence that point to the conclusion that humans are the primary force behind climate change. These datasets will be comprised of real data generated by climate scientists. One team may focus on the comparison of warming in the troposphere with cooling in the

stratosphere, for example. These concurrent trends can only occur if the cause is human activity, not natural—but of course, students wouldn't know that yet. Other groups could look at trends from land surface or ocean records, others at ice-core data. Students will be guided through an analysis of the data and will share their discoveries with the rest of the class. In this way, the students will come to realize that all lines of evidence point to the same conclusion. The teacher will close the lesson by discussing the 97% consensus of climate scientists and the misconception that this consensus doesn't exist.

The next four lessons will give students more practice with the process of exploring data and recognizing where they might have had misconceptions. One will look more closely at models, another will look at the geologic record, a third will explore local extreme weather events, and a fourth will focus on locally implemented solutions to climate-driven problems.

You may be concerned that the students will not reach the conclusion that their line of evidence points to human impacts on climate change. Rest assured: the data are compelling. Students will be working with real data made available through the resources provided by NOAA. Our team is confident that if the students really dig into this evidence, guided by skilled inquiry teaching, they will conclude, correctly, that climate is changing due to human activity. It's no different from a good physics lesson. In the same way that students might roll balls down ramps and calcu-

late acceleration, they will explore real data that exposes reliable outcomes. A big difference, though, is that no one comes into a physics classroom having been subjected to a propaganda campaign designed to sell the idea that gravity is a lie! So, importantly, the teachers will be trained on how to guide discovery without challenging the students' prior beliefs. Cook and NCSE have developed effective strategies for addressing misinformation through no-conflict approaches. Combining respectful communication with the pedagogical approach of discovery learning makes this lesson a double whammy. Ultimately, however, it is the science that wins the day.

Next Steps

The next step for these lessons is for classroom teachers to get their hands on them and make them their own. By the time you read this, eight master teachers from places where climate change is societally controversial will have come together to adapt these lessons to their grade levels and local ecosystems. Then they'll take the lessons back to their communities, test them in their classrooms, and then train local teachers in how to use them in their classrooms.

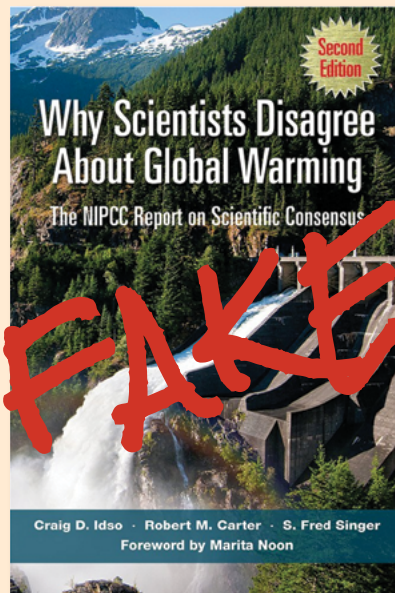
I hope to report on that workshop in the next issue of *RNCSE*. In the meantime, if you happen to run into me at a conference or local bar, I'll eagerly share how well this process is working. You can join me in a toast to its success.

Brad Hoge is NCSE's Director of Teacher Support. hoge@ncse.com



WHAT WE'RE UP AGAINST Propaganda Accepted as Unbiased

When InsideClimate News surveyed science teachers in the winter of 2017 to ascertain their reactions to the spring mailing from the Heartland Institute containing its climate change-denial brochure *Why Scientists Disagree About Global Warming*, it was a relief (and not a surprise) to learn that a vast majority of them regarded it as propaganda and pseudoscience. But it was dismaying to find a teacher in Pendleton, South Carolina, commenting, "For the most part, yes [I find the materials accurate]. Most information out



there has bias one way or another. I teach my students how to discern fact from spin. Climate change is real. Human actions and activities have an impact on climate. Natural forces are dominant, however. The true impacts of climate change need to be presented in an even manner. There should be no bias in science." It was especially dismaying that the teacher's assessment of the science disagrees with that of [97 percent](#) of climate scientists.

—GLENN BRANCH



news from the science booster clubs

Turtles, Ticks, and Mosquitoes (Oh My!)

In previous issues of *RNCSE*, I've shared information with you on many aspects of the Science Booster Club program, such as stories of audience interactions, profiles of graduate students and volunteers, maps of our expansion, and updates on our science literacy research and community impacts. In this issue, I'd like to discuss the content we're using to engage the public, in terms of both the topics we're teaching and our strategies for crafting engaging public exhibitions.

New for 2018: Combo Kits

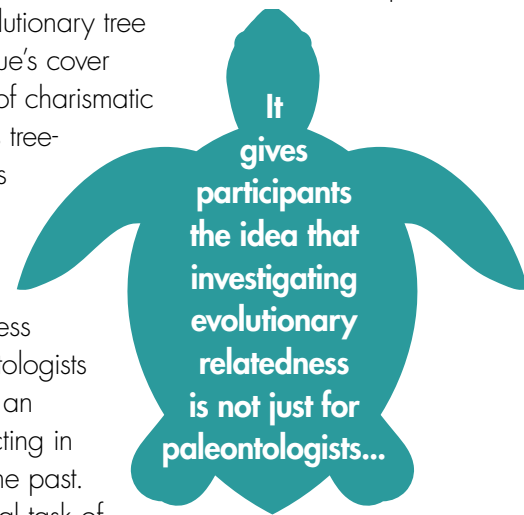
As our national expansion clubs and our pilot sites in Iowa continue to mature and expand, we have a pressing need for unique, high-quality content that we can access and share freely. We are meeting that need with new exhibition kits that combine information on evolution and climate

change through engaging, hands-on activities. We are currently piloting the first of these "combo kits" in Iowa, with an activity called "Turtle Time."

In this activity, participants study small model sea turtles and with the help of an exhibitor, use their observations to place the turtles on an evolutionary tree diagram (see this issue's cover image). The choice of charismatic living animals for this tree-

thinking exercise was deliberate. It gives participants the idea that investigating evolutionary relatedness is not just for paleontologists and that evolution is an ongoing process, acting in the present not just the past. Since the fundamental task of the activity is looking for similarities and differences, the activity is accessible to even very young children, who can help other audience members identify colors, shapes, and other visible traits that do indeed convey evolutionary relatedness.

Once participants complete the tree exercise, depending on contact time and format, exhibitors can use the recent interaction with model turtles to explore sea turtle biology and vulnerability to climate change. This type of linked activity accomplishes two goals. First, it reveals connections between big ideas in science. Second, it takes advantage of the emotional and intellectual connection participants have just developed working with the turtle models. Participants are primed to feel empathy and to be eager for action when they get the facts about the threats sea turtles are experiencing because of climate change. For example, exhibitors use visuals to explain the life cycle of sea turtles, especially the interesting fact that their offspring become male or female based on the incubation temperatures of



Turtle Time! Photo: Emily Schoernig

their eggs, and to connect that to climate change, adaptive behaviors in sea turtles, and ways people can help sea turtles thrive in the future.

Summer Combo Kit: Protecting Public Health

Our next combo kit in development, scheduled to pilot in late spring 2018 with national rollout in early summer, will provide a valuable public health perspective on our issues. This activity, tentatively called “Ticked Off,” is a game that lets participants model the spread of disease-causing insects as the climate changes. Using maps from public health publications, we are creating two game boards. One shows the spread of ticks that carry Lyme disease; the other the spread of the mosquito *Aedes albopictus*, which can carry a variety of dangerous viral diseases, such as Dengue fever. Participants will see how the map changes as events related to climate change and human action change the range of the disease-carrying insects. After playing the game, participants will have the opportunity to learn about pathogen evolution, and get crucial public health information as they learn to identify disease vectors and disease symptoms that may be new to their area.

Using this strategy, we can again link climate change and evolution, and make it clear how these big ideas are not abstract. They are ideas that are relevant and have practical impacts and applications to community life. With “Ticked Off,” we are hoping that the immediacy of these practical applications will help inspire peoples’ capacity for change.

The themes for these combo kits were carefully chosen. Both deal with examples where human action has played a crucial role in the past and can play a major role in the future. Sea turtles were critically endangered only a few decades ago. Human interventions have had a major impact on species recovery. Vector-borne diseases were a major public health menace in the US a hundred years ago, but human action tremendously reduced these threats. With climate change, the threat of both sea turtle extinction and the spread of vector-borne diseases will only increase, but these are problems people can work creatively to solve. We just need to see the potential for change and begin to work on creating paths for change.

Measuring Change

We are hoping that our new combo kits won’t only teach about evolution and climate change, but will also help our

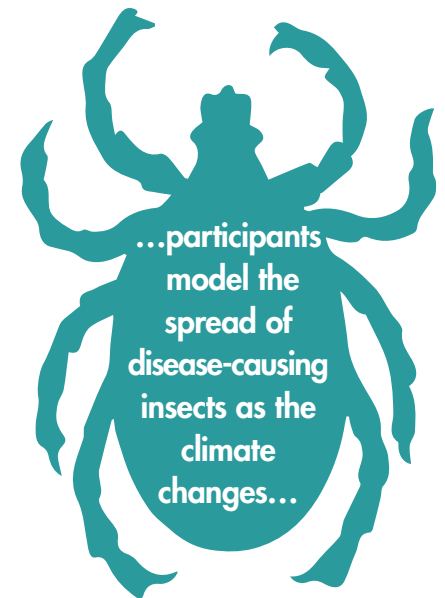
participants care more about climate change and feel more empowered to act. Accordingly, with these new kits, we are planning to roll out some new research surveys in the second half of 2018. We will be asking questions that look at how people feel about climate change, how much they think climate change will impact their communities, and how much they think they can do anything about climate change in their communities. This will complement our earlier science literacy work, which we also hope to continue with new, stripped-down surveys that will take participants less time to complete.

These new research tools should be ready to help us collect data in the fall of 2018. And we’re going to need them! I am happy to announce that a grant proposal submitted by University of Iowa professor Maurine Neiman (see [RNCSE 2017: 37\(4\):3–5](#)) and me recently secured over \$270,000 from the Ron J. Carver Charitable Trust to fund the graduate students who work on the SBC program over the next three years. Until 2021, four graduate students will have year-round support based on their research contributions to the SBC program. This will enable us to expand our footprint in Iowa to new communities, and to increase the quantity and quality of our data collection.

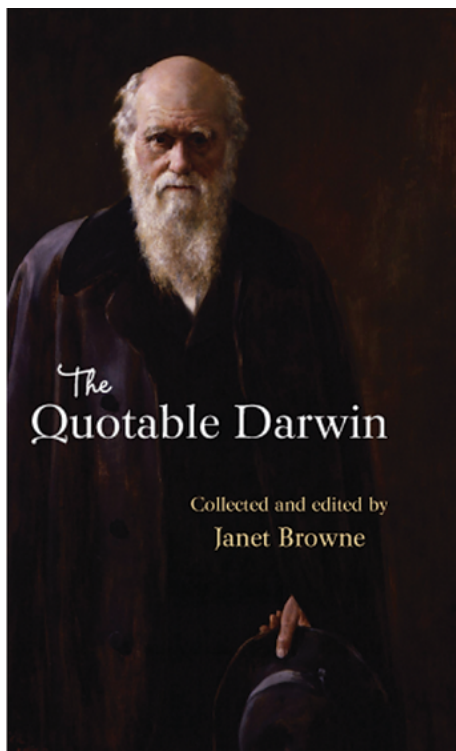
Eyes on Quality

As the SBC program continues to expand, we are constantly working to increase not just quantity measures, such as the number of clubs and participants, but also quality measures. We are crafting new content that engages with people on multiple levels, developing research instruments that allow us to study the impact of our programs in new ways, and working to secure new lines of funding to support quality program growth and development. We look forward to a great year in 2018.

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THE RNCSE REVIEW



The Quotable Darwin

editor: Janet Browne

publisher: Princeton University Press, 2018

reviewed by: Glenn Branch

When I experimented, trying to jot down as many passages from Darwin as I could remember coming across in my day-to-day reading, the result was a dozen phrases, including “There is grandeur in this view of life” (from the final paragraph of the *Origin*); “furnished with a tail and pointed ears” (the *Descent’s* description of a human ancestor); and “What a book a Devil’s chaplain might write” (from Darwin’s 1856 letter to J. D. Hooker)—hardly enough to justify such a book.

With *The Quotable Darwin*, the hypothesis is put to the test. Janet Browne—the author of the magisterial *Charles Darwin: Voyaging* (1995) and *Charles Darwin: The Power of Place* (2002)—offers six chapters of quotations from Darwin: “Early Life and Voyage of the Beagle”; “Marriage and Scientific Work”; “Origin of Species”; “Mankind” (a surprisingly gendered title); “On Himself”; and “Friends and Family.” Each is subdivided into topics: thus “Friends and Family” contains “Friends and Contemporaries”; “Reflections on Darwin by His Contemporaries”;

“Recollections by His Family”; “Tributes”; and “Varia.”

The treatment appears to be conscientious, despite Browne’s declaration, “Very occasionally, I have silently made minor changes to help to clarify his meaning” (p. xvii), which is not a good editorial practice. But references are provided throughout (although “quoted in Marxist Internet Archive” is not adequate as a reference to Engels’s eulogy for Marx) and editorial clarifications appear where needed (although not always: it would have been helpful to note that the “Sir W. Thompson” of Darwin’s 1869 letter to James Croll was William Thomson, with no *p*, later elevated to the peerage as Lord Kelvin).

Darwin
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but is he
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And *The Quotable Darwin* is compendious. Few of Darwin’s quotable passages are missing, although I do regret the absence of

In 2015, Michael Barton, who writes about the history of science on his blog *The Dispersal of Darwin*, saved me a bit of time. I had been considering requesting a review copy of *Darwin on Evolution: Words of Wisdom from the Father of Evolution*, but Barton reported that the book was shoddy and slapdash. True, you usually can’t judge a book by its cover, but when the cover of a book of quotations from Darwin attributes to him the incoherent and ungrammatical “Intelligence is based on how efficient a species became at doing the things they need to survive,” perhaps you can. Certainly I did.

At the time, Barton lamented the absence of a competent book of quotations from Darwin. I was skeptical. Darwin is highly readable, but is he really all that quotable?

a complaint from his 1861 letter to Charles Lyell: “I am very poorly today & very stupid & hate everybody & everything.” There is also a judicious selection of quotations from Darwin’s contemporaries included, among them the bogus “It is not the strongest of the species that survives ...” quotation. It is duly marked as bogus, but there is no mention of Nick Matzke’s discovery of the original in Leon Megginson. As a collection of contemporary quotations about Darwin, this book is no substitute for Thomas F. Glick’s *What About Darwin?* (2010).

As for the passages from Darwin himself, most of them are not especially quotable. Few would merit inclusion in a general book of quotations—and indeed, only two appear in *The Concise Oxford Dictionary of Quotations* (1991): “furnished with a tail and pointed ears” and “a Devil’s chaplain.” (Also appearing is a definition of natural selection not in Browne.) And with the on-line availability of resources such as John van Wyhe’s Darwin Online and the Darwin Correspondence Project at Cambridge University, it’s hard to see the advantage of having a special compilation of passages from Darwin between the covers of a book.

That’s not true of all scientists. Consider Einstein, like Darwin a celebrity scientist in a time of mass media. But unlike Darwin, he was not shy of publicity; he was eager to offer his opinions on matters outside his professional specialty; Einstein often intentionally couched his thoughts aphoristically. Einstein, in short, tended to be quotable. Moreover, his views were

advanced and reported in a vast array of outlets, not all of which are now easily accessible. So the need for a book such as *The Ultimate Quotable Einstein* (2010), the first in the Princeton University Press series including *The Quotable Darwin*, is clear.

But Darwin? Acknowledging that “Darwin was not much given to aphoristic turns of phrase,” Browne suggests that the “Quotable” format “allows a fresh sort of insight ... by revealing people fully in the round” (p. xv). Thus perhaps *The Quotable*

Darwin is best understood not as a compilation of noteworthy passages from Darwin but as a biography of Darwin in his own words. But there already is a biography of Darwin in his own words, of course—his autobiography (which should be read in Nora Barlow’s unexpurgated edition of 1958). For all its virtues, then, *The Quotable Darwin* strikes me as inessential.



Glenn Branch is deputy director of NCSE. branch@ncse.com



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