

# reports

OF THE NATIONAL CENTER FOR SCIENCE EDUCATION | WINTER 2019 | VOLUME 39 | NO 1

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# Dear NCSE members,

As I write this, the deadliest and most destructive fire in California's history is raging to the north, part of what has turned out to be the worst season for wildfires in the state's history. For NCSE's home state, figuring out how to make fires less likely to start, slower to spread, and more quickly contained, and making it easier and faster for endangered residents to be notified and evacuated, will be major public policy challenges of the next decade. And pertinent to our work at NCSE, the urgency of accomplishing each of these goals is increasing because of a changing climate, which heavily favors the fires and makes prevention and response much harder.

There is a term we use among NCSE staff—"flare-up"—to refer to situations in which an individual or a group is trying to limit or distort what students learn in their science classrooms. While our kind of flare-ups do not directly threaten property or lives, there is still a parallel to the fires that are currently raging. What does NCSE staff do when there is a flare-up, such as a proposal to take climate change or evolution out of state science standards? We fight it, mustering community support to contain and eventually eliminate it. Why? So that the effort to undermine science education doesn't gain momentum and spread through the community and beyond.

At NCSE, we are working hard to make sure that conditions in communities across the country are unfavorable to flare-ups, so that fewer arise and those that do arise are quickly extinguished. Together, our programs help local communities and teachers ensure that distrust and opposition to good science teaching doesn't gain a foothold or spread. Evolution and climate change, because they are so frequently subject to such misrepresentation, are ideal for teaching students to see through misleading tactics. When students are confident about their ability to think like scientists, they can fight back by recognizing faulty reasoning, false equivalence, cherry-picking of evidence, and other tricks aimed at distorting scientific evidence. These skills will be vital in solving problems, from fires to sea level rise to infectious diseases, which demand a scientifically empowered citizenry.

Finally, I want to let you know that this issue of *RNCSE* will be the last edited by Stephanie Keep. I wish each and every one of you could meet her. She is brilliant and funny and fiercely devoted to good science and good writing. In her four years with us, she has transformed this publication into a vivid quarterly portrait of how NCSE is working to defend and transform evolution and climate change education. Paul Oh, our new communications director, will be taking over the editorial reins at *RNCSE*, but fortunately Stephanie has agreed to continue to contribute.

As always, thank you for your support of NCSE.



Ann Reid is the executive director of NCSE. [reid@ncse.com](mailto:reid@ncse.com)





**MEMBERSHIP & STAFF**

**602**  
sustaining  
members

**3,079**  
members  
representing  
50 states and  
5 countries

**3**  
awesome  
new full-time  
staff  
members

**SUPPORTING TEACHERS**

**21**  
local  
workshops  
in  
development

**5**  
webinars  
conducted with  
198 live  
participants

**10**  
misconception-  
busting lessons  
created

**18**  
teacher  
ambassadors  
representing  
14 states

**RALLYING THE TROOPS**

**9**  
anti-science bills  
defeated with NCSE'S  
help (Alabama,  
Florida [3], Iowa, Idaho [2],  
Wisconsin [2])

**6**  
states in which NCSE  
mustered support for quality  
state science standards  
(Arizona, Colorado, Idaho,  
Maine, Virginia, Wisconsin)

# ncse

**8**  
new videos  
featuring our  
Teacher  
Ambassadors



**74,142**  
YouTube Channel  
video views totaling  
963,320 minutes

**0**  
videos featuring  
our camera-shy  
new Director of  
Communications

**932**  
visitors to our  
booth at the  
Iowa State Fair

**11**  
activities  
developed

**45**  
times DNA  
was compared  
to boogers

**5**  
new clubs  
in 2018

**2,000+**  
messes  
made

**SPREADING THE WORD**

**BUILDING COMMUNITY  
ENGAGEMENT**

# BY THE NUMB3RS

# Got Climate Change Misconceptions? John Cook Can Help.

“The climate is always changing.”

“Scientists disagree about the causes.”

“Animals and plants can just adapt.”

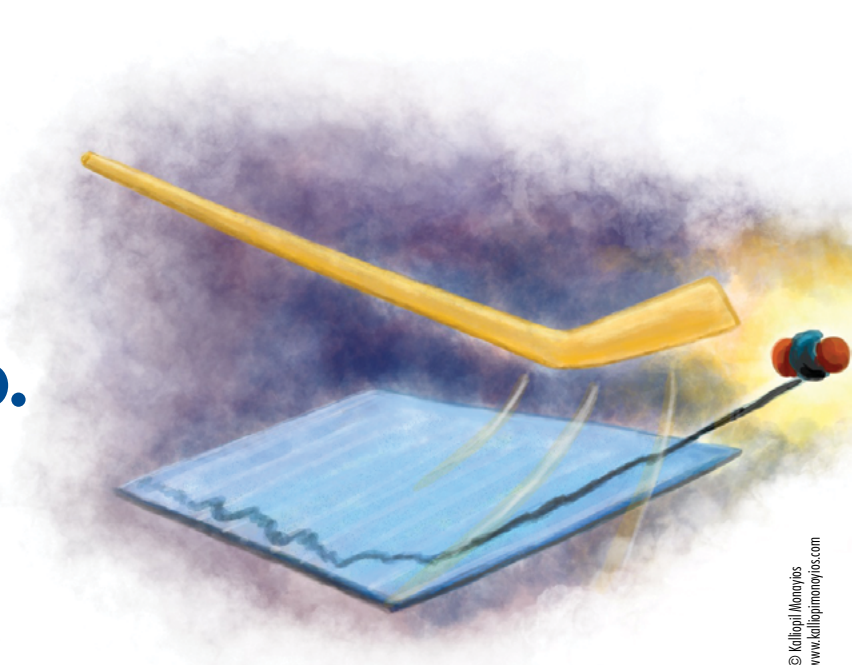
**T**he three false statements above are just a few of the biggest misconceptions about climate change that afflict many individuals—including students. How should educators combat these misconceptions? According to John Cook, Research Assistant Professor at the [Center for Climate Change Communication](#) at George Mason University, the best approach is to tackle them head-on and leverage the misconceptions into learning opportunities. The creator of the website [Skeptical Science](#) and co-author of several books on climate change denial, Cook works closely with NCSE’s Turning Misconceptions into Educa-



tional Opportunities (TMEO) Teacher Ambassadors in developing misconception-based lessons and related professional development for science educators.

In an era when misinformation is prevalent, and easily disseminated, John Cook’s approach

helps students (and non-students) separate fact from fiction, guiding them on a path of scientific understanding about climate change. We decided to interview Cook about his misconceptions work to gain insight into what has been recognized as an extremely powerful way to help young people construct their own understanding of climate change. Our exchange has been edited for sense and length.



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www.kalliojimonoyios.com

**Paul Oh:** My first question is pretty basic: Why misconceptions?

**John Cook:** To quote that famous educator Yoda, “You must unlearn what you have learned.” Misconceptions interfere with new learning. They can give students false confidence that they understand a phenomenon when their understanding is actually faulty. And in the worst case, misinformation can stop people from acknowledging facts. For example, studies have shown that when people are presented with facts and corresponding misinformation that distorts those facts, if they don’t have a way of resolving the conflict between the two, there’s a danger that they’ll disengage and not even accept the facts. Misinformation can cancel out factual information.

**PO:** I know that you recognize the importance of misconception-based teaching in general, but you also have a particular interest in misconceptions about climate change. Of all the climate misconceptions, which do you most wish you could bust permanently?

**JC:** The most damaging climate misconception is that climate scientists disagree on human-caused global warming. Only around 10 percent of Americans are aware that over 95 percent of climate scientists agree that humans are causing global warming. The reason this is so important is because perceived lack of consensus is a gateway misconception—it not only affects views on whether climate change is happening and whether it’s human-caused, but also colors willingness to support climate action. Fortunately, it’s one of the easier misconceptions to dispel, as it just requires communicating a single number: [97 percent](#) of climate scientists agree on human-caused global warming.



**PO:** So if a teacher has just one lesson to cover climate change, I assume that mentioning the 97 percent consensus would be important? Anything else?

**JC:** Yes, absolutely you need to bring up the consensus—that is critical, and as I said, it doesn't take up much time. In fact, a complete explanation of climate change can be compressed to just ten words: "It's real. It's us. It's bad. Experts agree. There's hope." In other words, climate change is happening; human activity is causing it; the impacts are serious and already happening; there's scientific consensus (97 percent!) on the first three points; but we have all the technology we need to avoid the worst impacts of climate change.

**PO:** Okay, that's what educators should do. How about what they should definitely *not* do?

**JC:** There are two aspects to climate change: the problem and the solutions. What we should avoid is only giving half the picture. If we only communicate the problem, it ends up being a doom-and-gloom message that can actually paralyze people and cause them to disengage from the issue. While if we only communicate the solutions, that's a positive message, but it lacks the urgency that the dire situation of climate change dictates. We need to communicate both—climate change is a dire, immediate problem, but we can solve it if we act with urgency.

## Random Samples

with Richard Katskee



Since its formation, NCSE has had many extraordinary people serve on its board of directors, including

leaders in science education, research, activism, and law. This year, one such extraordinary board member is leaving after six years of service. Richard Katskee is an accomplished lawyer and currently the Legal Director at Americans United for Separation of Church and State. At Americans United, Katskee has used his legal knowledge to litigate cases under the First Amendment all over the country, including [Kitzmiller v. Dover Area School District](#) in 2005. He has taught law and ethics at several prestigious institutions, is well-known for his incisive legal briefs, and is so busy that I'm amazed he had time to do this. Let's pick his brain!

*First, quick word associations. What's your immediate reaction to the following?*

- **NCSE:** The most creative proponent and most important defender of sound science education.
- **Separation of church and state:** The essential guarantee of religious freedom that allows us to live together in relative harmony despite our different beliefs.
- **"The full Kitzmiller":** The perfect blend of expertise, intensity, and approachability in presenting science, science education, history, theology, and law to protect the rights of children.
- **Education:** The best hope for our children and our future, but only if we protect, defend, and encourage it.

*What moment stands out to you as the most significant in Kitzmiller v. Dover?*

There were so many moments—serious, funny, emotional. But perhaps the most significant moment for me came during testimony by plaintiff Fred Callahan, who said, "[T]here have been letters written about the plaintiffs ... We're said to be intolerant of other views. Well, what am I supposed to tolerate? A small encroachment on my First Amendment rights? Well, I'm not going to. I think this is clear what these people have done. And it outrages me."

*What's currently the biggest threat to First Amendment rights today?*

Parents, teachers, school administrators, and members of state boards of education argue that their religious liberty means that they can prevent the rest of us from learning anything that conflicts with their particular beliefs. The fundamental right to religious freedom—the right to believe, or not, to practice your faith, or not, according to the dictates of your conscience—isn't the power to impose your beliefs on others. It isn't the power to deprive others of a quality education. It isn't a license to discriminate. Sadly, the high ideal of religious freedom is being twisted and misused, today more than ever. That's a danger to us all.

*Finally, is it true that the Discovery Institute accused the judge in the Kitzmiller case of plagiarizing your legal briefs? I guess that's a compliment?*

I'm proud of our legal briefs. But their force, like that of Judge Jones's decision, was a product of the power of the science and the law. As for the eloquence of the judicial opinion, that was the judge's own. In the academy, false accusations of plagiarism are a high crime. In the law, though, we have an old saying: "When the facts are on your side, pound the facts. When the law is on your side, pound the law. When neither is on your side, pound the table." The Discovery Institute pounded the table.

—STEPHANIE KEEP

**PO: Speaking of communication, what would you change about how the popular news media covers climate change?**

**JC:** The media does a lot of damage through false balance—by giving deniers equal weight with climate scientists. Research ([including my own](#)) has shown that this conveys the impression of a 50–50 scientific debate, lowers public perception of scientific consensus, and reduces acceptance of climate change. But the news media could cover climate change accurately, while fulfilling the journalistic norm of balance, by communicating the weight of evidence or the weight of experts. For example, they can acknowledge the existence of contrarian voices while also pointing out that they are a vanishingly small minority.

**PO: What I notice about the way the media covers climate change, besides the false balance you mention, is that it is often so bleak. I usually feel a certain amount of despair as I get more informed. Do you feel that, too? How do you fight despair?**

**JC:** I remind myself that climate change is not a binary proposition. It's not a case of suffering climate impacts or avoiding climate impacts. Climate change is a matter of degrees (literally). Every scrap of action now means some amount of avoided climate impacts down the track. So I continue to fight, and communicate the reality

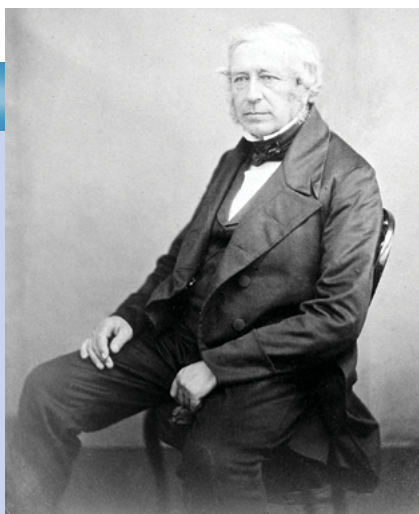
of climate change, so we will take actions now that will reap dividends well into the future.

**PO: That helps, thanks. I'm going to try and internalize that message, and I hope our readers do, too. Is there anything else you'd like to share about your misconceptions work?**

**JC:** Misconceptions are an unfortunate reality, but they're also an opportunity. Misconception-based learning is one of the most powerful ways of teaching science. Not only do students achieve stronger learning gains (compared to straight teaching of the science), but also the learning gains last longer. The students develop critical thinking skills that they can apply to all different forms of misconceptions and misinformation. They come away empowered to talk about the issue, which is crucially important with climate change, since climate silence is an impediment to meaningful societal progress. So I suggest that rather than running from misinformation and denial, we use its presence as a powerful educational opportunity.

**PO: Thank you so much for all of your work. Our Teacher Ambassadors have embraced your approach in the lessons they've developed—and continue to develop—and I really look forward to spreading the word about the power of misconception-based teaching with your continued help.**

**Paul Oh** is NCSE's director of communications.



Wellcome Library, London

*John Stevens Henslow was one of Charles Darwin's most influential mentors.*

John Stevens Henslow was born February 6, 1796, in Rochester, England. Despite being most interested in natural history, Henslow studied mathematics at Cambridge University. Natural history shaped

## PLACE & TIME

### John Stevens Henslow (1796–1861)

his post-graduate life, however. After graduating in 1818, Henslow became a fellow of the Linnean Society and founded the Cambridge Philosophical Society with geologist Adam Sedgwick and others. The Society's mission was (and still is) to promote science at Cambridge. Henslow's influence at Cambridge increased when he was made chair of mineralogy in 1822, and then chair of botany in 1825, despite admitting that he knew little about plants. He married Harriet Jenyns in 1823, with whom he had three daughters (the oldest of whom married botanist Joseph Hooker) and three sons.

Henslow, who became an ordained minister in 1824, believed in the fixity of species but acknowledged that there is enormous variation within species. He required his students to collect and examine plants rather than simply examine herbarium specimens. His excellent teaching caught the attention of Prince Albert, who had Henslow teach his children. Another of Henslow's famous students was Charles Darwin, who noted Henslow's "power of making the young feel completely at ease." The Henslows frequently hosted students and faculty at their home, and Darwin often took





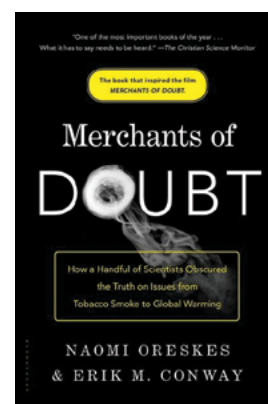
**Judith Eisen** of the University of Oregon was elected to the American Academy of Arts and Sciences in 2018. “Judith Eisen’s contributions to science and society’s understanding of science have been tremendous and nonstop,” said the University of Oregon’s president in a press release. “She is such a positive force, from her research in developmental biology and neuroscience, to her training of scientists and mentoring of undergraduates, to her campuswide impact on [how] science is taught and communicated.”

**Philip Kitcher** of Columbia University and **Richard Lenski** of Michigan State University were elected to the American Philosophical Society, the oldest learned society in the United States, in 2018. Both are recipients of NCSE’s Friend of Darwin award, and Kitcher is also a member of NCSE’s Advisory Council.

NCSE is delighted to congratulate **Michael E. Mann** on his selection to receive the 2018 Climate Communication Prize from the American Geological Union. The prize is conferred annually in recognition for communication of climate science. 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 was among the first recipients of NCSE’s Friend of the Planet Award in 2014.

NCSE is pleased to congratulate **Naomi Oreskes**, Professor of the History of Science at Harvard University and a member of NCSE’s board of directors, on receiving

a fellowship from the John Simon Guggenheim Memorial Foundation. The fellowships are “intended for individuals who have already demonstrated exceptional capacity for productive scholarship or exceptional creative ability in the arts,” and the foundation notes of Oreskes that “[s]ince the early 2000s, she has been a leading public voice on the issue of anthropogenic climate change.” Also receiving a Guggenheim Fellowship was Erik M. Conway, with whom Oreskes coauthored *Merchants of*



*Doubt: How a Handful of Scientists Obscured the Truth on Issues from Tobacco to Global Warming* (2010).

—GLENN BRANCH

long walks with Henslow to discuss natural theology. Darwin became so close to his botany professor that he became known as “the man who walks with Henslow.”

In August 1831, Henslow learned of an opening for a ship’s naturalist on the upcoming voyage of HMS *Beagle* to South America and beyond. After considering the offer himself, Henslow approached his brother-in-law, Leonard Jenyns, but Jenyns declined the offer. Henslow then contacted Darwin, who accepted the invitation. Before Darwin left, Henslow encouraged him to read Charles Lyell’s *Principles of*

*Geology*, but included the admonition to not “believe any of the wild theories.” During the *Beagle*’s voyage, Darwin sent specimens to Henslow, who forwarded them to appropriate experts.

In 1837, Henslow moved to a new congregation in Suffolk. Although he officially maintained his position at Cambridge for several more years, he concentrated his efforts on his new parish. In 1860, Henslow chaired the meeting of the British Association for the Advancement of Science at which Bishop Samuel Wilberforce and Thomas Henry Huxley met in their

famous “debate.” When Henslow died a year later, he was buried near his wife in his parish cemetery at Hitcham in Suffolk. Upon learning of Henslow’s death, Darwin—who named Anne, George, and Leonard Darwin after Henslow’s children—remarked that “a better man never walked this Earth.” Henslow never accepted Darwin’s conclusions about evolution.

**Randy Moore** is the H. T. Morse–Alumni Professor of Biology at the University of Minnesota, Twin Cities. His most recent book, coauthored with Kara Felicia Witt, is *The Grand Canyon: An Encyclopedia of Geography, History, and Culture*, (ABC-CLIO, 2018). [Rmoore@umn.edu](mailto:Rmoore@umn.edu)



# UPDATES

ncse.com/updates

Are there threats to effective science education near you? Do you have a story of success or cause for celebration to share?

E-mail any member of staff or [info@ncse.com](mailto:info@ncse.com).

## COLORADO

The Colorado state board of education voted to adopt a new set of state science standards on June 13, 2018, despite opposition from members of the board who “disliked the way the standards treated climate change as a real phenomenon,” according to Chalkbeat. The new standards received “overwhelming support ... from science teachers” in Colorado. Voting to accept the new standards were Val Flores, Jane Goff, Rebecca McClellan, and Angelika Schroeder; voting against were Steve Durham, Joyce Rankin, and Debora Scheffel.

## FLORIDA

About forty percent of private schools newly approved to receive public funds use textbooks from Abeka, Bob Jones University Press, or Advanced Christian Education, according to a survey by the *Orlando Sentinel*.

“The most striking feature of the biology books is their focused argument against evolution, a fundamental building block of modern biology.” Despite the public funding of these schools, the *Sentinel* noted, “Florida law prohibits the department [of education] from asking about or regulating academics at these schools.”

## FLORIDA, COLLIER COUNTY

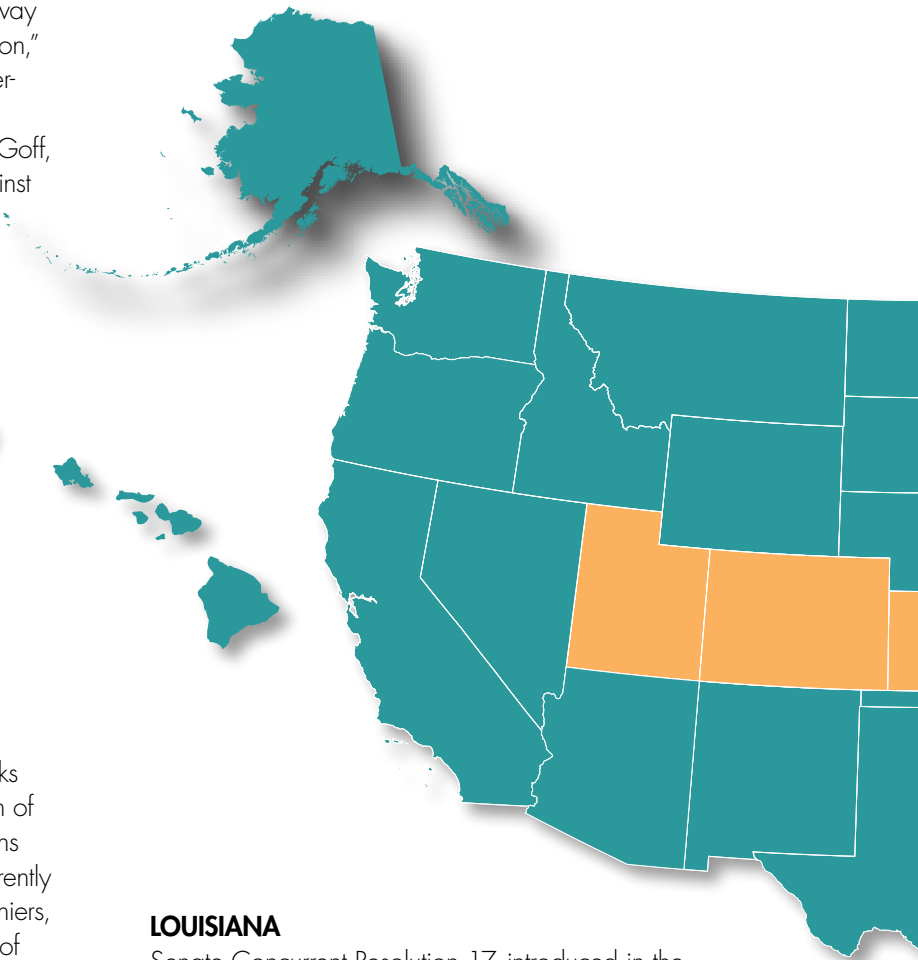
“The Collier County School Board voted 3–2 on Monday [June 18, 2018] to adopt a new batch of science textbooks [even] after residents filed objections to more than a dozen of them,” according to the *Naples Daily News*. The objections were filed pursuant to a new law, enacted in 2017, apparently aimed at empowering creationists and climate change deniers, and indeed the target of the objections was the treatment of evolution and climate change in the textbooks.

## KANSAS, SABETHA

The inclusion of evolution in a Miller and Levine high school biology textbook proposed for adoption alarmed Jim Scoby, a member of the board of education for Prairie Hills USD No. 113. Scoby’s complaint was that “[The book] taught evolution as fact. Macroevolution is not universally accepted, and that is what this book teaches, and I don’t like it,” according to the *Sabetha Herald*. Despite the objection, the book was adopted on a 6–1 vote on May 14, 2018, with Scoby the sole holdout.

## LOUISIANA

Senate Concurrent Resolution 17, introduced in the Secondary Extraordinary Session for 2018 of the Louisiana Senate on May 29, 2018, would have commended a former state senator, Bill Keith, “on his support and endorsement of teaching creationism in public schools.” Keith sponsored the Balanced Treatment for Creation-Science and Evolution-Science Act in 1981. SCR 17’s sponsor, John Milkovich (D–District 38), previously introduced a similar measure, Senate Resolution 33, in the Regular Session for 2018. SCR 17 died when the legislature adjourned.





## LOUISIANA, WEBSTER PARISH

A settlement was reached on May 11, 2018, in *Cole v. Webster Parish School Board*, a lawsuit filed in the United States District Court for the Western District of Louisiana alleging that the Webster Parish School District “has a longstanding custom, policy, and practice of promoting and inculcating Christian religious beliefs.” Included in the complaint was the claim that at least three science teachers told their students that evolution is not real, one describing it as a “fairytale.”

## UTAH

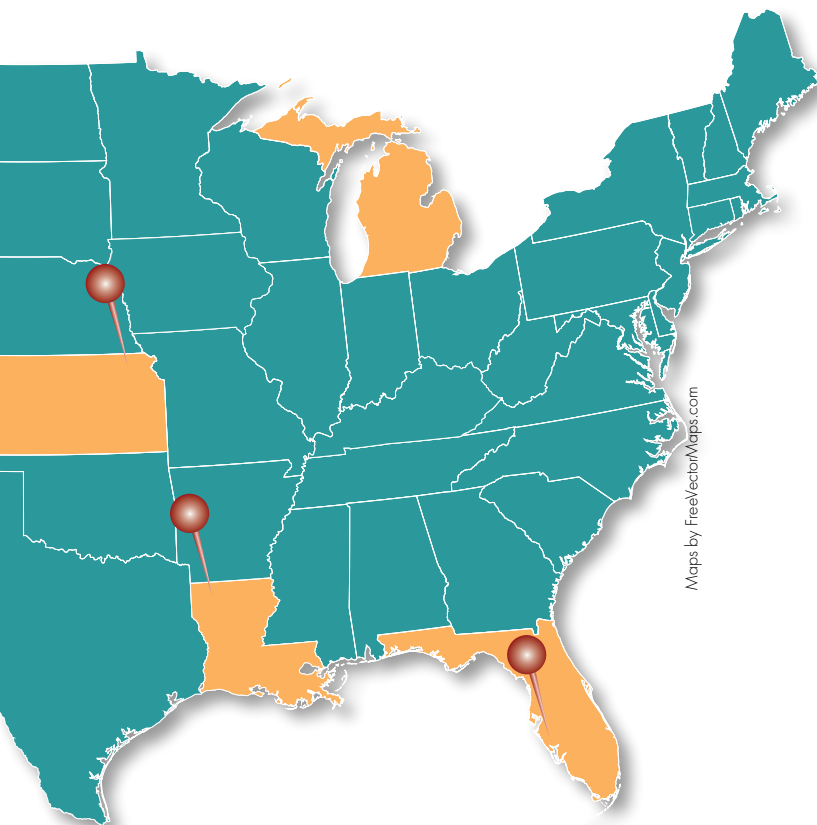
“The Utah State Board of Education greenlit plans Thursday [April 12, 2018] to begin drafting new school science standards, a process likely to touch on divisive issues like climate change and evolution,” according to the *Salt Lake Tribune*. A single, unidentified, member of the committee that formulated the plans recommended including “a statement to encourage student inquiry by exploring scientific literature that challenges standard theories” in the introduction to the revised standards—presumably targeting evolution and/or climate change.

## NATIONAL

A pair of bills introduced in Congress in April 2018—S. 2740 in the Senate; H.R. 5606 in the House of Representatives—would authorize the National Oceanic and Atmospheric Administration to institute a competitive grant program aimed in part at developing and improving educational material and teacher training on the topic of climate change. NCSE is among the organizations endorsing the bills, and NCSE’s executive director Ann Reid applauded them, commenting, “The Climate Change Education Act addresses a critically important need.”

## JERUSALEM

“The Natural History Museum in Jerusalem has been keeping an exhibit on human evolution covered under a sheet to avoid offending ultra-Orthodox visitors, and a staff member ... asked a customer to leave when she inquired why the museum was censoring the display,” the *Times of Israel* reported in April 2018. The museum acknowledged that it covered the display, on request, during visits from ultra-Orthodox schools, and indicated that it would continue to do so, but denied expelling any visitors.



## MICHIGAN

References to climate change, among other topics, were removed from Michigan’s proposed social studies standards by “a cadre of conservatives,” according to a June 2018 report from *Bridge* magazine. The revisions that affect the treatment of climate change are primarily at the grade 6 level, where a reference to global climate change was removed, and at the grade 7 level, where a section on geography was largely deleted. The final decision will be made by the state board of education.



# A Hop, a Skip, and a Jump: NCSE's Teacher Ambassador Program



*Evolution teacher ambassadors (left to right) Joe Evans, Milan Neely, and Lyle Carbutt at the 2018 workshop at Georgia Southern University. Photo: Cecily Tye*

**W**e hopped into our first teacher ambassador workshop back in February 2018 with our climate change educators. We skipped right on to our second workshop in July 2018 with our evolution educators. Now we're ready to jump into the next phase of the NCSE Teacher Ambassador Program (TAP), in which we reach out to teachers who might otherwise avoid professional development on evolution and/or climate change.

## Putting the "A" in TAP

Reaching this group of teachers has always been our ultimate goal. That's why we call the enlisted educators *teacher ambassadors* rather than master teachers or mentor teachers. Sure, they are masters of their craft and mentors to their colleagues, but, crucially, they are also active in the recruitment of teachers we want to reach. Our teachers are ambassadors to peers who are reticent about participating in professional development on "controversial" topics. They are ambassadors to teachers who are unaware of the need for teaching these topics thoroughly and who are often unprepared to do so effectively. And they are ambassadors to teachers who have their own doubts about these topics and may even share some of the misconceptions our lessons are designed to overcome.

Our ambassador teachers are currently working on developing professional development opportunities in their own communities all across America (see the back cover for evidence!). They are reaching out to their schools and/or district administrators to organize workshops and recruit hesitant teachers. Some are also enlisting informal science

centers, university scientists, and other community members and organizations in their local areas. And of course, they are collaborating with us, NCSE, every step of the way.

I'd like to give you some updates on what our teachers are doing. I'll break it down into the two current groups of ambassador teachers, our climate change ambassadors and our evolution ambassadors.

## Ambassadors for Climate Change Education

To remind you, these climate change teacher ambassadors participated in our [Turning Misconceptions into Educational Opportunities \(TMEO\) workshop](#) held at George Mason University back in winter 2018. At the workshop, they helped to develop and refine a unit of five climate change lessons and then field-tested them in their own classrooms during the spring semester. To probe the lessons' efficacy, the teachers administered pre- and post-tests. Preliminary results show that student understanding of the material had improved and that the targeted misconception had been corrected.

Five 90-minute webinars were then produced in the summer with our partner organization the Alliance for Climate Education (ACE). The webinar format, we hope, will enable us to expand the reach of the program. In each live webinar, ambassador teachers presented the lessons to more than 300 total registrants. Participant feedback was positive and the webinars are currently available for anyone to watch through ACE's Vimeo site.

That's all impressive, but as I said, we are now in the midst of the ambassador work. Here's what each of our ambassadors are up to:

- Nina Corley of Galveston, Texas, plans to propose a workshop for the Space Exploration Educators Conference in February 2019, and is working with the University of Texas Medical Branch and Texas A&M University-Galveston to develop a workshop for March 2019.
- Al Dorsch of New Castle, Pennsylvania, is the lone elementary grade teacher among the eighteen teacher ambassadors. A past middle school teacher and high





*Climate teacher ambassador Erin Stutzman mapping out interconnected effects of climate change at the winter 2018 workshop.*

Photo: Jennifer Gonzalez

# is Up and Running

school assistant principal, he now teaches fifth-grade science and social studies. He is working on ideas for integrating the two content areas for elementary and middle school teachers.

- Kim Parfitt of Cheyenne, Wyoming, is working on a proposal for the Wyoming STEM Conference in August 2019 and the Wyoming Science and Math Science Teaching Conference in October 2019. She is also reaching out to the University of Wyoming to provide pre-service teacher training opportunities.
- Kelly Pipes of Wilkesboro, North Carolina, is working with her district administration to generate a schoolwide program focused on information/misinformation with different elements addressing different disciplines and grade levels. She also presented at the NSTA Regional Conference in National Harbor, Maryland, in November 2018.
- Erin Stutzman of Boise City, Idaho, is working with numerous colleagues in Boise State University's Department of Earth Sciences and Department of Education to create professional development workshops for Idaho's regional i-STEM workshops, which will occur throughout the summer of 2019. She is also planning to present at the NSTA regional conference in Seattle.

## Ambassadors for Evolution Education

Our [evolution ambassador teachers](#) attended (in person or virtually) a workshop at Georgia Southern University in summer 2018. They were each provided an outline of a five-lesson unit, which they are currently field-testing in their classrooms. Amanda Glaze is developing pre- and post-tests for assessment.

Not to be outdone by the climate change education team, all ten of our evolution ambassadors are also currently planning workshops in their areas for 2019:

- Lyle Carbutt of La Jara, Colorado, is planning a workshop for the spring or summer of 2019 at a local community college.
- Joe Evans of Worton, Maryland, is working with the Maryland State Department of Education Supervisors to develop workshops for the spring or summer of 2019.

- Tom Freeman of Anaheim, California, will develop workshops for the summer of 2019. I also met with Freeman at NABT in November to discuss developing workshops for future NABT meetings.
- Turtle Haste of Albuquerque, New Mexico, is planning to present at the New Mexico STEM conference in June 2019 and the regional NSTA meeting in Salt Lake City, Utah, in 2019. She is also participating in a Howard Hughes Medical Institute-supported evolution workshop at the New Mexico Museum of Natural History & Science and has already talked to the director about doing a workshop.
- Jamie Kay of Cerritos, California, is working on workshop ideas for summer of 2019.
- John Mead of Dallas, Texas, and Dean Mohlman of Austin, Texas, are working together to develop workshops for the Dallas and Austin areas, particularly through the Perot Museum of Nature and Science. Mohlman is also using evolution to frame the curriculum for his biology courses using our unit plan as a guide.
- Milan Neely of Philadelphia, Pennsylvania, is adopting the workshop lessons for her environmental science classes and is working with her supervisor to develop professional development activities for spring 2019.
- Colleen Swihart of Beaver Creek, Oregon, is working with a local university colleague to develop a two-day workshop for the summer of 2019. She also plans to develop a series of workshops for early release days in her district.
- Blake Touchet of Lafayette, Louisiana, has moved into a dual position as teacher and coordinator of training for south central Louisiana. He will incorporate the workshop lessons into his "buffet" of lessons for regional training. He plans to develop a workshop for the Science Museum in Lafayette for 2019.

## What Comes Next?

Our work will not end once this first round of local professional development workshops is completed. We have already announced our second TMEO workshop for the spring of 2019 and are actively recruiting new climate change educators for this cohort. In addition, we are working with colleagues at Clemson University to recruit and train a cohort of teachers focused on the nature of science. And we will begin recruiting a second cohort of evolution ambassador teachers in the spring of 2019.

A hop, a skip, and a jump, but never stopping to take a breath.

**Brad Hoge** is NCSE's Director of Teacher Support.  
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## news from the science booster clubs

# Making Flu Shots Less Scary for Both Children and Their Parents

Every quarter, NCSE unveils a new activity for Science Booster Clubs to use at events across the country. After prototyping in Oakland and beta-testing in several key locations, our winter activity about the flu vaccine is ready for national distribution. In it, younger visitors and those dropping by for just a few minutes build the components of a flu shot out of beads. The goal here is to demystify the annual ritual and perhaps also take some of the scariness out of it, too. Visitors looking for a challenge can extend the activity by travelling the globe in a race against time to solve an epidemiological mystery and build the optimal vaccine.

### Why flu shots?


Whichever version of the activity visitors do, they will learn important concepts about mutation rates, herd immunity, and viral evolution in an accessible way that emphasizes

personal connections to the science—part of the central mission of the Science Booster Club Program. Moreover, through these conversations, we also hope to address misconceptions about the flu vaccine and vaccines in general. According to research, misinformation about vaccines is abundant and skepticism about vaccine effectiveness is rising. While the SBCs don't aspire to be public health organizations, the activity is a great way to offset what has become a growing campaign of misinformation, and is fully consistent with the core SBC mission of encouraging people to engage with scientific evidence and ask questions.

Public reactions to the new activity have varied. In our beta-testing, we've watched countless kids—who only minutes before had approached with wariness—giggle at the pig and egg beads (to represent a gelatin and egg-yolk medium) they place inside the shot before practicing administering the shot to themselves, their parents, and their siblings. It is pretty easy to tell when children aren't scared of talking about flu shots, but it can be a little harder when it comes to their parents. With some parents, you can hear the intake of breath when we ask the child to put a preservative in the flu shot. You can also sometimes see the relief cross a parent's face when a child says they have never gotten a shot before and the volunteer doesn't launch into a reproachful lecture.

### Understanding the issue is key to this activity's success

Part of the training for this particular activity will involve preparation to engage with families that are unsure about or even against vaccinations. While we will implement our signature no-conflict approach as always, we realize the importance of tailoring our strategies to address the concerns of the vaccine-hesitant. When activities involve climate change and evolution, we know that a fear of appearing foolish tends to drive hesitancy of engagement among our audiences. With vaccinations, however, there is an added challenge of overcoming parental doubt or denial. Parents who hold anti-vaccination views frequently believe that scientists are at best misinformed and at worst actively working to spread lies. The personal stakes are also higher in comparison with evolution and climate change discussions because they feel decisions about vaccination have immediate and important implications for the health of their children.



*After building and administering toy flu shots themselves, kids find the real shot less scary. Photo: Paul Oh*





Our flu shot mystery invites whole families to get involved in building the best flu shot for the 2018 season. Photo: Paul Oh

Understanding values is the key strategy for finding common ground. Almost everyone who expresses hesitation about vaccinations does so because they value the health

of their children. Conversations that don't recognize this value or, worse, deny it, have little chance of progressing beyond conflict. It is only by giving adults the space to hold their beliefs without judgment that we can create a venue in which they feel comfortable asking the questions that may help them start to question those beliefs. I hope that a well-trained volunteer corps armed with accurate information can work to address this growing issue. Through the wonderful work of all our volunteers, we can have the difficult conversations to make vaccination against the flu less scary for everyone!

**Kate Carter** is NCSE's Director of Community Science Education. [carter@ncse.com](mailto:carter@ncse.com)



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Dear NCSE,  
I read your article in the [Fall 2018 Reports of the NCSE](#) and was curious exactly how “dish soap, table salt, and rubbing alcohol” can be used to “pull out DNA from fruit.” You gave the ingredients in the recipe, but not the instructions! Is there any chance you can share them?

Sincerely,  
Desiring New Activities



That's DNA!  
Strawberry DNA to be exact.  
Photo: Ashley Collins

Dear DNA,

That's an awesome question, and the answer is “Absolutely!” We are always excited to share our activities. Here's how to get your very own sample of fruit DNA with some commentary on why certain steps are included:

### Supplies Needed

- Applesauce or mashed-up strawberries, about  $\frac{1}{3}$  cup
- Table salt
- Dish soap
- Rubbing alcohol
- 2 cups or containers
- Coffee filter
- Measuring cups and spoons
- Chopstick or other tool good for fishing out the DNA

### Directions

1. Make the extraction solution by mixing a cup of water,  $\frac{1}{2}$  teaspoon of salt and 2 teaspoons of dish soap. Why are you doing this? Cells, and their nuclei, are surrounded by fatty membranes. The detergent breaks down the membranes so you can get to the DNA inside. The salt helps to get rid of the proteins that package the DNA tightly inside the nucleus.
2. Add about  $\frac{1}{8}$  cup of the extraction solution that you made to the applesauce.
3. Put a coffee filter over a cup or container and gently pour the fruit mush into the coffee filter. Why are you doing this? This step gets rid of the fruit pulp and seeds and should leave a pure solution of DNA.

4. Once your solution has finished dripping through the coffee filter, tilt the cup containing your DNA and carefully pour  $\frac{1}{4}$  cup of alcohol down the side of the container. Why are you doing this? DNA is insoluble in alcohol, so it precipitates (that is, comes out of the solution as a solid).

That's it! After about five minutes, you should be able to see a mass of white stringy stuff right where the alcohol and DNA solution meet. *That's DNA!* You can fish this out using a chopstick or spoon.

I hope that you'll try this and report back to let us know how it went. We also have training videos for this and other SBC activities available online, so make sure to check out our Youtube channel: <https://www.youtube.com/user/NatCen4ScienceEd>. If you find these activities are so much fun that you want to start your very own Science Booster Club, let us know!

On behalf of all the Science Booster Club volunteers, we hope you have a great time bringing science into your home!

—KATE CARTER



# THE RNCSE REVIEW

Even before, and certainly since, atmospheric chemist Paul Crutzen stated, “We are in the Anthropocene!” at a professional conference in Mexico in 2000, many scientists, economists, sociologists, historians, and even politicians have spent an enormous amount of time pondering and debating the term. Should the Anthropocene be considered a formal component of the scientifically established and accepted record of Earth time, of “deep time,” that is summarized as the Geologic Time Scale? As a co-author of the Geological Society of America’s Geologic Time Scale (now in version 5), I personally have followed this discussion, in its many forms, with great interest. Although we cannot make the decision (that responsibility lies with the International Commission on Stratigraphy), my co-authors and I have, with the last two versions of GSA’s Geologic Time Scale, discussed the issue vigorously and ourselves considered whether a formal time unit needs to at last be accepted as part of our home’s history.

Erle C. Ellis’s *Anthropocene: A Very Short Introduction* provides an exceptionally well-organized, sufficiently detailed, and encompassing overview of why the Anthropocene should be clearly recognized, in some form, as an unprecedented time in Earth history. Amazingly, the essence of the most

## Anthropocene: A Very Short Introduction

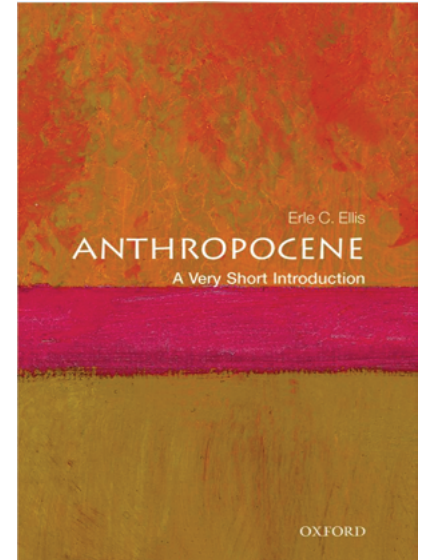
*author* Erle C. Ellis

*publisher:* Oxford University Press,  
2018

*reviewed by:* John Geissman

important subject in Earth history of our day is encapsulated within less than 200 pages of text augmented with a rich array of choice illustrations. My initial reaction after reading Ellis’s contribution was to think about just how enlightened our world would be if everyone would read this book.

*Anthropocene* consists of eight chapters. Chapter 1 (“Origins”) provides an orderly synopsis of just how we humans have adjusted our thinking about our place in the universe over time and how we have now recognized just how powerful a force we have become in quite a short period of time—hence the introduction of the term “Anthropocene.” In chapter 2 (“Earth System”), Ellis explains the immense complexity of how natural processes are linked together in a series of cycles, and how human activity can perturb and has perturbed the global natural system. If you ever wanted a concise yet sufficiently detailed discussion of Earth time, then chapter 3 (“Geologic Time”) is strongly recommended. This chapter presents the essential background on the origin of the Geologic Time Scale and the global effort to “nail down” key time points in Earth history as Global



My initial reaction after reading Ellis’s contribution was to think about just how enlightened our world would be if everyone would read this book.

Boundary Stratotype Sections and Points (GSSPs). Much of the chapter is devoted to the Quaternary, the most recent formal period of Earth time, and concludes with the initiation of the Anthropocene Working Group, charged with, among other things, deciding when the Anthropocene should formally begin.



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The following four chapters concentrate on more of the details of past human activity, current human social and socioeconomic change, and what the present and near future portend. Chapter 4 (“The Great Acceleration”) provides a rich discussion of the link between the rapid increase of human activity and changes in Earth’s systems over the past 50 to 100 years. The chapter ends with a succinct discussion of key markers of anthropogenic change (such as concrete, plastics, global black carbon, and plutonium fallout). Chapter 5 (“Anthropos”) concentrates on the history of human activity transforming Earth, and ends with discussion of early thoughts on where the GSSP for the Anthropocene should be placed.

The title of chapter 6, “Oikos,” alludes to how humans have altered ecological

conditions at all scales, from very local to fully global. Included in this chapter is a discussion of the possibility that we are at the beginning of a bona fide sixth mass extinction.

The final two chapters urge us humans to acknowledge our role in climate change and ask what we are going to do about it. Ellis concludes chapter 7 (“Politikos”) by describing “the Anthropocene as [a] crisis ... above all, a crisis of action” and begins chapter 8 (“Prometheus”) by posing a question, “If humans are indeed transforming Earth, what is to be done? Or more humbly—what can be done?” (p. 144). He then convincingly argues that we cannot just stand by and maintain the current trajectory; the chance remains for us to effect major, global, changes toward a better outcome.

Unfortunately, the International Commis-

sion on Stratigraphy decided last spring (2018) to “kick the can down the road” with regards to the Anthropocene. According to their judgement, we are presently living in the Meghalayan, the youngest of three newly identified divisions of the Holocene, beginning circa 4200 BCE and lasting to the present. Regardless of these facts, I am of the opinion that the Anthropocene will certainly not disappear in the minds of those concerned with Earth’s future, as we all should very much be. *Anthropocene* is very well worth the price, and is certainly the kind of book that you should be proud of loaning to your friends, even those who do not necessarily think the way you do!

**John Geissman** is Professor Emeritus of Earth and Planetary Sciences, University of New Mexico, and Professor of Geosciences and Department Head, University of Texas at Dallas. [jwgeiss@protonmail.com](mailto:jwgeiss@protonmail.com)



## WHAT WE'RE UP AGAINST

### Blaming Evolution for School Shootings

Mike Cochran, running for re-election to the McMinn County (Tennessee) School Board, responded to a local newspaper’s question about school safety by decrying the teaching of evolution. “You can’t teach a student that life is a random accident, that they just come from animals, and that the driving force behind evolution is that the strong survive and the weak die. Then, when a few of them blow up and hurt or kill others, we are wringing our hands and asking why are we



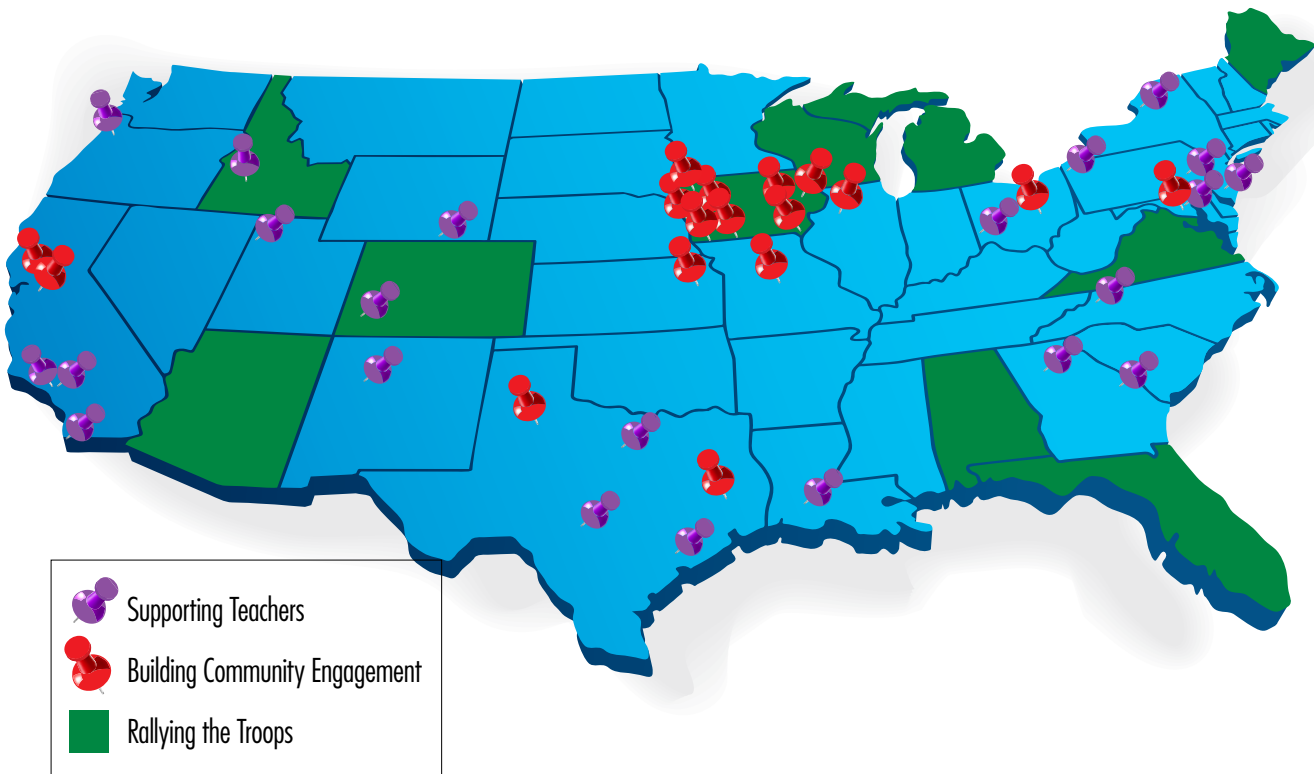
The McMinn County Courthouse in Athens, Tennessee. Photo: Brent Moore, 2010. Used under Creative Commons Attribution-NonCommercial 2.0 Generic (CC BY-NC 2.0) license.

behaving like animals,” he explained. Adding, “I don’t mean, and I don’t want anybody getting me wrong, that we shouldn’t teach the Theory of Evolution. However, I am against teaching it as a fact. It’s called a theory for a reason. If we are going to teach kids the evidence that supports evolution, we should also show them the scientific evidence that debunks it.” In the August 2, 2018, election, Cochran was re-elected.

—GLENN BRANCH

**CHANGE SERVICE REQUESTED**

# In 2018 NCSE was on the ground in communities across the country.



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