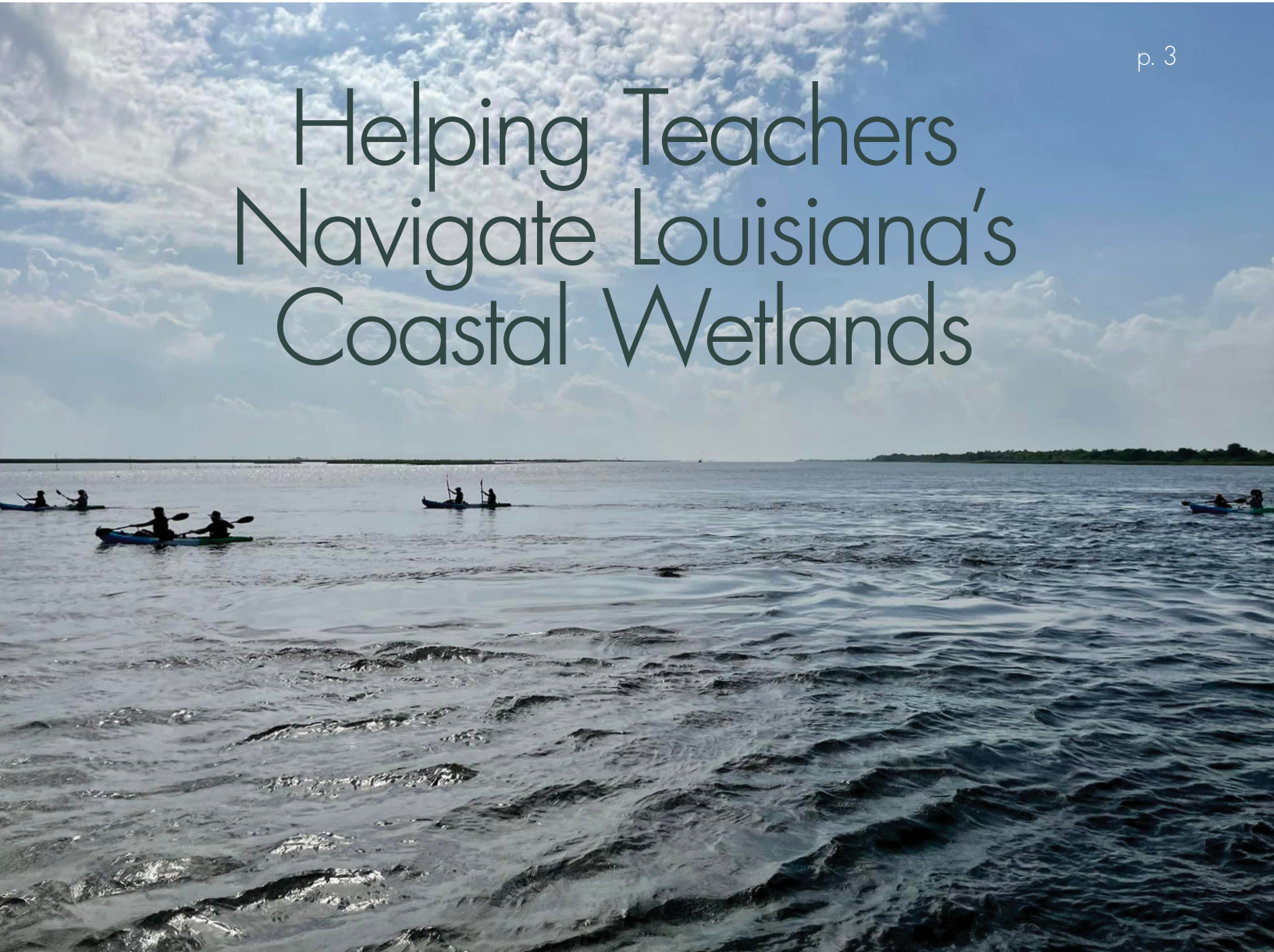


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Dear NCSE Supporters,

It has been a busy summer at NCSE. Teachers have gathered, awardees have been chosen, new staff are settling in, and, sadly, one staff member—whom we came to appreciate enormously during her brief time at NCSE—has accepted a very exciting new position at Colorado State University (see p. 5).

If you've been following along at home, you know that NCSE recruited teachers from across the country to test our new [evolution](#), [climate change](#), and [nature of science](#) lessons in their classrooms during the 2021–2022 school year. Despite recurrent waves of COVID-19, which made it hard to predict whether students would be learning in the classroom or from home, these teachers put our lessons through their paces and provided feedback throughout the year. And in July 2022, almost all of them came to Fort Collins, Colorado, to meet each other in person, learn about changes that have been made in the lessons in response to their feedback, and get pumped up for testing the revised lessons in the upcoming school year. I was fortunate to get to spend a day with these amazing teachers. They are so dedicated and so enthusiastic. All of us at NCSE are so fortunate to have them on our team—almost as fortunate as their students.

Summer is also when NCSE staff pores over candidates for our Friend of Darwin and Friend of the Planet awards, which recognize individuals or organizations that have made outstanding contributions to our mission of safeguarding effective and accurate science education. It's never easy to choose, but we have yet another stellar group this year; through their scholarship, teaching, activism, and communications, these individuals have made NCSE's work easier in a multitude of ways (see p. 10).

There is a persistent misconception out there that most science teachers focus on filling their students' heads with facts, discouraging the next generation from pursuing or even being interested in science. Well, that's a pretty old stereotype that is mercifully less and less accurate. It's certainly not true of the teachers we work with, and with your support, we're working hard to spread state-of-the-art pedagogical practices far and wide. If you'd like to learn more about a program that exposes science teachers to locally relevant field research, check out the story about our own Blake Touchet (p. 3). He's been supporting a group of Louisiana science teachers as they embark on field experiences to better understand—and incorporate into their teaching—the changing nature of their state's coastal watershed.

Big challenges; high stakes. That's what we're all about here at NCSE. We couldn't do it without your support. Thanks for walking alongside us.



Ann Reid is executive director of
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Helping Teachers Navigate Louisiana's Coastal Wetlands

Fort Proctor was built in 1856, about 70 kilometers southeast of New Orleans. At the time of its construction, it sat about 500 meters inland, next to a railroad line. Intended to protect water routes to New Orleans, it was never garrisoned because the progress of modern warfare made the fortress obsolete even as it was completed. Though it has fallen into disrepair, it is listed on the National Register of Historic Places.

It is also now completely surrounded by water.

A combination of erosion, subsidence, riverine mismanagement, hurricanes, and sea level rise means that the only way to visit Fort Proctor is by boat. During a recent summer morning, NCSE's Blake Touchet and 20 intrepid elementary, middle, and high school science teachers, along with researchers on a [Louisiana Sea Grant](#)-led project, paddled kayaks out to the fort as part of a professional development experience. The trip allowed the teachers, who came from across the state, to see firsthand the coastal changes affecting Louisiana.

"People used to walk to this place where they're now kayaking," explains Dani Dilullo, Director of Education and Engagement for Louisiana Sea Grant and the principal investigator of the National Oceanic and Atmospheric Administration grant that is funding the teachers' professional development experience, called [B-WET](#) (Bay Watershed Education and Training). "You're like, 'Oh my goodness!' It wasn't an easy kayak trip, either, because it was kind of windy that day, and they're kayaking this long distance."

The trip allowed the teachers, who came from across the state, to see firsthand the coastal changes affecting Louisiana.

In addition to the trip to Fort Proctor, the teachers took part in other place-based learning experiences during the summer of 2022, with excursions to a wetland that the state of Louisiana is restoring, a coastal forest to take core samples from trees, and the Bonnet Carré spillway, a critical flood control on the lower Mississippi.

Aimee Hollander, co-principal investigator on the B-WET grant and director of Nicholls State University's Center for Teaching Excellence, says that a majority of science

taught in Louisiana public schools is prescribed. As a result, science teachers don't have the opportunity to create lessons and activities that focus on aspects of the world with which their students are familiar. "With the grant," she continues, "we can bring certain scientific phenomena into the classroom that these students see every single day or read about in their local newspapers—land laws, diversions, climate change, sea level rise, extreme weather. These are things students know about

firsthand but are not necessarily taught in our prescribed curriculum."

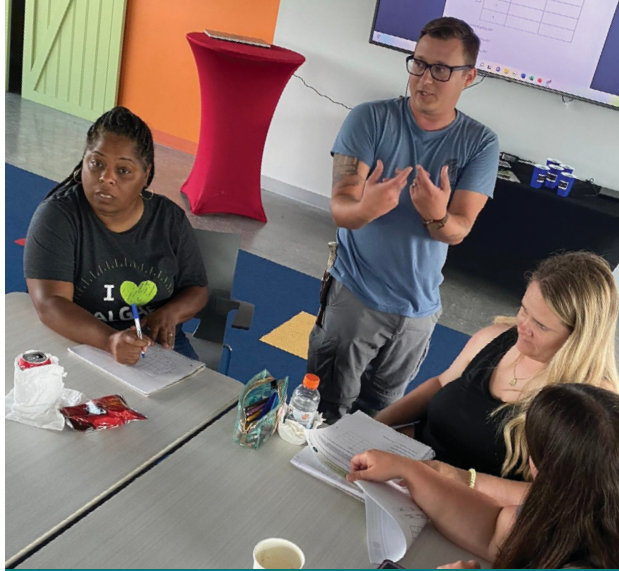
The 20 participating teachers have signed on for two years as part of the grant. In summer 2022, they met for one week to engage with researchers in the field at places like Fort Proctor and then in a seminar room to develop ideas for how they would incorporate their experiences in their own classrooms. Along with the excursions, the teachers had the opportunity to interact with subject-area experts who answered questions, demonstrated research techniques, and,

in the case of Touchet, provided teaching resources.

Touchet introduced the teachers to NCSE's [climate change lesson sets](#), in particular a hindcasting interactive that helps students better understand climate modeling, a tree core activity, and a hurricane simulation. Afterward, Touchet helped them align the phenomena they chose to focus on based on their field experiences with their specific grade-level standards, and also brainstormed activities with them.

"The teachers particularly appreciated the misconception-based approach in NCSE's activities that addresses the common misconceptions that students have surrounding these issues," Touchet recalls. During the 2022–2023 school year, Touchet will continue working with the B-WET teachers to guide them as they create climate lessons.

Hollander points out that the teachers engaged not only with "phenomenal subject-matter experts" like Touchet and scientists from Nicholls State, Louisiana State University, and the University of New Orleans but also, perhaps just as importantly, with local community members. "They got to interact with people who have been living in these parts of Louisiana for much of their lives and who told personal stories of their experiences living through major



...the beneficiaries of the effort put in by B-WET teachers—whether physical, as in kayaking to Fort Proctor, or mental, as in crafting engaging, hands-on lessons—are Louisiana's students.

storms, seeing the changes in wetlands, seeing the changes in the fish populations. That really humanizes this work and helps the teachers when they're developing their lessons around these scientific phenomena to bring those voices into their classrooms."

Ultimately, the beneficiaries of the effort put in by B-WET teachers—whether physical, as in kayaking to Fort Proctor, or mental, as in crafting engaging, hands-on lessons—are Louisiana's students.

"Over 50 percent of Louisiana is in a floodplain," Dilullo observes. "So everybody has to have a relationship with water, whether it's the Mississippi River, whether it's the Gulf of Mexico, whether it's a really rainy

season. We all are connected to water here in some way, shape, or form. And if we want our students to grow up and be part of the cohort that has to protect and restore or maintain the coast, we need to show them the problems, we need to show them the solutions in place now, and we also need to show them possible future innovations."

And NCSE's Touchet will be there to help make that happen.

Paul Oh is NCSE's Director of Communications. oh@ncse.ngo



Dendroclimatologist Clay Tucker instructing Louisiana science teachers in how to sample and interpret tree cores, an extension of an NCSE lesson set.

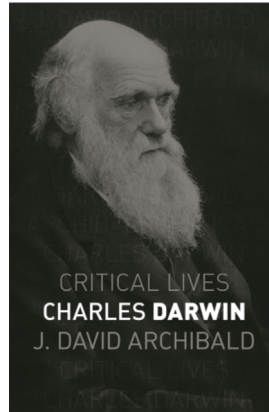
Photos by Blake Touchet



Supporters in the SPOTLIGHT

J. David Archibald's *Charles Darwin* (Reaktion Books, 2021) was published. The publisher writes, "In this new biography, J. David Archibald describes and analyzes Darwin's prodigious body of work and complex relationships with colleagues, as well as his equally productive home life ...

This is a fresh, up-to-date account of the life and work of a most remarkable man." Archibald is Professor Emeritus of Biology at San Diego State University.



Nigel Hughes of the University of California, Riverside, received the 2021 Raymond C. Moore Paleontology Medal in recognition of "Excellence in Paleontology" from the Society for Sedimentary Geology. The medal is conferred to "persons who have a significant record of outstanding contributions in paleontology, especially those aspects of paleontology that bear on a major objective of this Society which Professor Moore helped to establish, that is, to promote the science of stratigraphy through research in paleontology and evolution, and the use of fossils for interpretations of paleoecology."



NCSE is pleased to congratulate **Blaire Van Valkenburgh**, the Donald R. Dickey Chair in Vertebrate Biology in the Department of Ecology and Evolutionary Biology at the University of California, Los Angeles, on receiving the 2021 Romer–Simpson Medal from the Society of Vertebrate Paleontology for "sustained and outstanding scholarly excellence." The Romer–Simpson Medal is the society's highest award.



Jason R. Wiles, Associate Professor of Biology at Syracuse University and a recent recipient of NCSE's Friend of Darwin award, was honored with the Technology Alliance of Central New York's College Educator of the Year award for 2020, election to the Linnean Society of London in 2021, and the Four-Year College & University Section Research in Biology Education Award from the National Association of Biology Teachers for 2021. Wiles commented, "It is an honor to be in the company of colleagues who have been among my heroes in science and science education. Appreciation for the work we're doing in my lab is an indicator that we're having the impact we want to make, and an encouragement to continue doing all that we can toward the public understanding of science and toward a more diverse and inclusive scientific community."



Farewell to DeeDee Wright



NCSE bids farewell to DeeDee Wright, NCSE's Assistant Director of Teacher Support and Science Education Research Specialist. Wright joined NCSE in early 2021 as a Postdoctoral Fellow in Science Education Research and Evaluation. She worked with the Supporting Teachers program and the now-discontinued Breaking Down Barriers program by developing and

conducting research and evaluation related to climate change and evolution education. Her last project for NCSE was co-coordinating and co-leading NCSE's first Leadership Academy and Professional Learning Conference, recently held in Fort Collins, Colorado. Wright will become Assistant Professor of Experiential Education in the Biology Department at Colorado State University. She will continue to consult on an NCSE program's curriculum study until its completion in 2023. NCSE wishes her all the best in her future endeavors.

One Hundred Years of Anti-Evolution Legislation Are More Than Enough

In a famous 1958 address commemorating the hundredth anniversary of the publication of Charles Darwin's and Alfred Russel Wallace's [essays](#) on evolution by natural selection, the distinguished geneticist Hermann J. Muller lamented the neglect of evolution in American education.

"It ill befits our great people," he [observed](#), "to turn our backs on it, to pretend that it is unimportant or uncertain, to adopt euphemistic expressions to hide and soften its impact, to teach it only as one alternative theory, to leave it for advanced courses where the multitudes cannot encounter it, or, if it is dealt with at all in a school or a high school biology course, to present it as unobtrusively and near the end of the course as possible."

Muller's address was entitled "One Hundred Years without Darwinism Are Enough." Now is a good opportunity to add that one hundred years of anti-evolution education legislation are enough.

That's because 2022 marks a centenary which, although obscure, is worth celebrating: the defeat of Kentucky's [House Bill 191](#). Introduced in the Kentucky General Assembly on January 23, 1922, the bill would

have prohibited "the teaching in public schools and other public institutions of learning, Darwinism, atheism, agnosticism or evolution as it pertains to the origin of man."

Offending instructors would have faced the prospect of a fine of between \$50 and \$5000—between \$825 and \$82,500 in today's money—and/or confinement in the county jail for between ten days and a year, while institutions that willfully allowed the teaching of the offending doctrines would have lost their charters and been subject to a fine of up to \$5000. The bill languished in committee until March 5, 1922, when, after a day of intense debate in the House, it was finally defeated on a narrow vote of 42 to 41.

House Bill 191 was the very first in a series of bills over the next century that variously sought to ban the teaching of evolution; balance the teaching of evolution with supposed alternatives such as "biblical creationism," "creation science," and "intelligent design"; and blunt the teaching of evolution by mischaracterizing it as scientifically controversial. The majority of these bills attempted, like House Bill 191, to impose requirements on teachers—



and they sometimes similarly provided for punishments.

Oklahoma's recently introduced [Senate Bill 1470](#) would allow parents to sue schools that allow teachers to present "positions in opposition to closely held religious beliefs" of their students; offending teachers could be held personally liable for at least \$10,000 per incident. Although evolution is not explicitly mentioned in the bill, its sponsor [supported](#) previous anti-evolution education legislation in Oklahoma.

But laws that require teachers to miseducate their students about evolution have not fared well in the courts, including the Supreme Court, which in 1987 [ruled](#) that a 1981 Louisiana law requiring equal time for "creation science" alongside evolution violated the First Amendment. Unsurprisingly, the handful of anti-evolution education laws that remain on the books took a different approach, allowing (rather than requir-



From *Literary Digest*, July 25, 1925

ing) teachers to miseducate their students.

[Kentucky's 1976 law](#) is the most blatant, licensing teachers to present "the theory of creation as presented in the Bible." [Mississippi's](#), [Louisiana's](#), and [Tennessee's](#) laws are circumspect in comparison, not mentioning any supposed alternatives to evolution. Tennessee's law omits the e-word altogether, although its target was sufficiently clear that it won the nickname "[the monkey bill](#)" when it was under consideration in the legislature.

Misguided legislators continue to propose such laws today. Arkansas's [House Bill 1701](#), introduced less than a year ago, would have allowed teachers in the state's public and open-enrollment charter schools to "teach creationism as a theory of how the earth came to exist." The bill's description of creationism wouldn't be accepted even by creationists, and Arkansas's previous flirtation with creationism, a 1981

law requiring "creation science" to be taught in the state's public schools alongside evolution, was thwarted by a federal district court in [McLean v. Arkansas](#) in 1982.

Nevertheless, House Bill 1701 easily passed the House Education Committee and then the House of Representatives. It was only because a legislator regarded as sympathetic to creationism was absent from the Senate Education Committee's meeting that the bill was ultimately [defeated](#) there on a vote of 3 to 3.

Fortunately, it's rare these days for anti-evolution education bills to come so close to passing. That's in part thanks to the dedicated advocacy of the supporters of evolution education, such as the National Association of Biology Teachers, which [recognizes](#) that "Evolution is a necessary part of teaching biology in an effective, detailed, and scientifically and pedagogically authentic manner and should be a major theme throughout the life science curriculum."

But it's also because there's little appetite for legislative micromanagement of the public school science classroom. Only 11 percent of Americans would grant state legislatures (and governors) a great deal of influence in deciding how teachers in the public schools teach about human evolution, [according](#) to a recent national poll from Penn State's McCourtney Institute for Democracy, as opposed to 36 percent who would do so for science teachers.

Yet owing to a persistent though [dwindling](#) minority

of the American public that rejects evolution, science teachers are often subjected to explicit or implicit demands to downplay evolution in their classrooms: in a [survey](#) nationally representative of public high school biology teachers conducted in 2019, more than one in six reported experiencing such pressure.

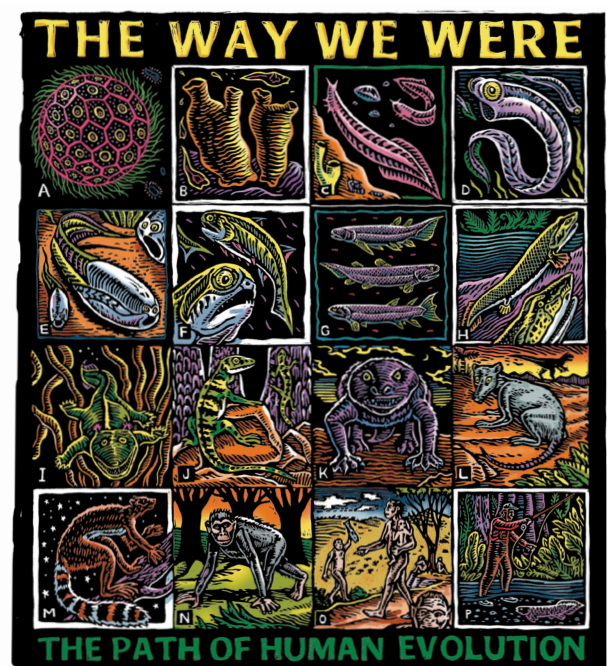
But the bulk of them persevere. In the same [survey](#) about 67 percent of these teachers reported emphasizing the broad scientific consensus on evolution while not giving any credence to creationism—encouragingly, up from 51 percent in 2007.

When it comes to evolution education, the very last thing American science teachers need from their state legislatures is interference motivated by fundamentalist antipathy to evolution. One hundred years of anti-evolution education legislation are, if anything, more than enough.

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Glenn Branch is NCSE's Deputy Director. branch@ncse.org



Artwork by Ray Troll © 2017 www.trollart.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.ngo.

MASSACHUSETTS, SOMERVILLE

After the Vida Real church submitted a proposal to start a private Christian school to the Somerville School Committee in September 2021, a subcommittee's report expressed concern about the school's position on a number of issues, including creationism. The school would reportedly use the controversial Accelerated Christian Education curriculum, which emphasizes rote learning and embraces young-earth creationism. In March 2022, attorneys from religious right organizations representing the church complained of both the committee's delay in considering the proposal and what they described as its "hostility towards Vida Real's religious beliefs." In any event, the committee approved the proposal in the following month. At the same meeting, however, the committee also considered a resolution to ask the state to revisit the process whereby local school committees are expected to approve new private schools in their jurisdiction, describing the statutory criteria as "both vague and highly limiting."



WISCONSIN

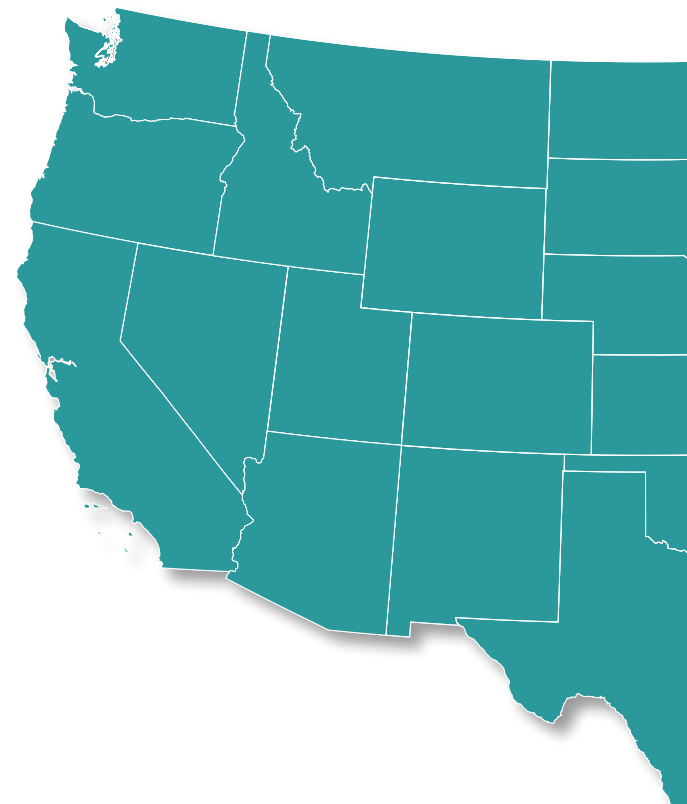
Wisconsin's Senate Bill 761 and the identical Assembly Bill 783 would have, if enacted, authorized the state superintendent of public instruction to adopt model academic standards related to climate change that "incorporate an understanding of climate, the interconnected nature of climate change, the potential local and global impacts of climate change, and individual and societal actions that may mitigate the harmful effects of climate change."

Although Wisconsin's current state science standards are based on the same framework on which the Next Generation Science Standards are based, their treatment of climate change is substantially worse, receiving the grade of C- in "Making the Grade?"—the 2020 report from NCSE and the Texas Freedom Network Education Fund—as compared to the NGSS's grade of B+.

The bills would also have authorized the superintendent to provide grants to or contract with state agencies or non-profit organizations to develop climate change curriculum resources and to assist local school boards in developing

PENNSYLVANIA, PERKASIE

A parent who asked a tutoring program about assistance for her daughter in learning about evolution for her Advanced Placement biology examination was surprised to be told that a tutor would teach through "a biblical worldview ... meaning we believe that God created the world in six literal days," according to a February 27, 2022, report from WHYY. The tutoring program, Re:ivals Resource Center, is sponsored by the First Baptist Church of Perkasie, and listed on the Penridge school district's website on a "Community Flyers" page, presumably with no intention of endorsement. But the superintendent told the parent he had discussed and visited the tutoring program, and Alex Luchenitser of Americans United for Separation of Church and State told WHYY that "if the superintendent or other school officials are taking actions that communicate to parents or students that the school district does endorse or promote or approve the content of this particular religious program, then there would still be a violation of the U.S. Constitution and the separation of church and state."



climate change curriculum and curriculum resources. All these resources would have been required to align with any model standards related to climate change adopted by the superintendent. The bills also would have provided \$500,000 over two fiscal years to fund the grants and a new position in the department of public instruction.

Introduced in December 2021 and January 2022 by Chris Larson (D–District 7) with six of his colleagues in the Senate and Sondy Pope (D–District 80) with twenty of her colleagues in the House of Representatives, the bills were referred to the Senate Committee on Education and the House Committee on Colleges and Universities, where they died when the legislature adjourned in March 2022.

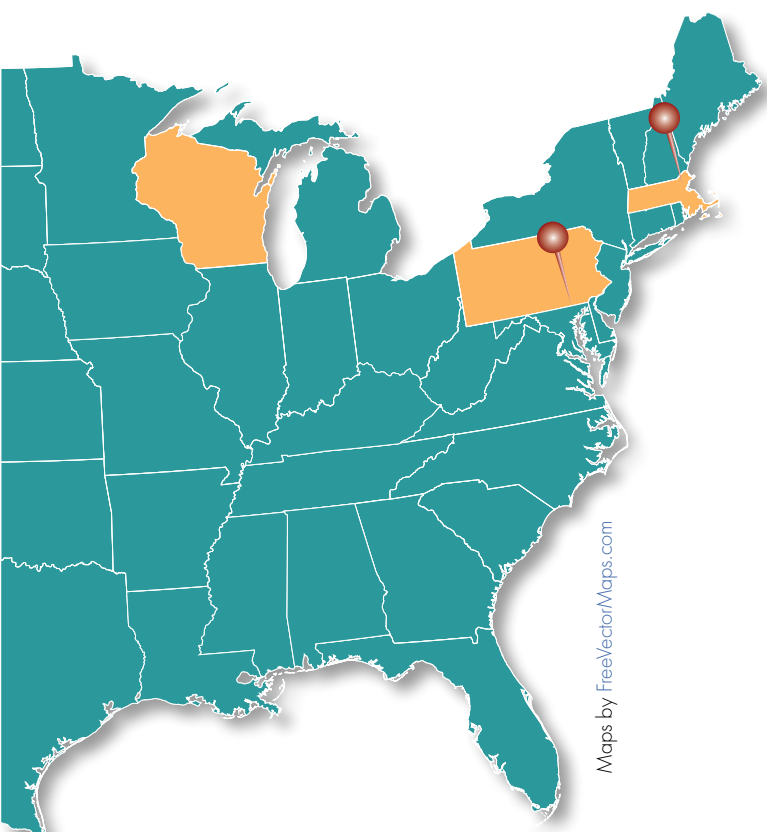
WISCONSIN

Wisconsin’s Senate Bill 763 and the identical Assembly Bill 785 would have, if enacted, created a program to award “scholarships to students who are enrolled in an institution of higher education [in Wisconsin] and who are engaged in studies directly related to programs preparing the students for careers in occupational areas addressing

or responding to climate change.” The bills would have provided \$5 million biennially to fund the scholarships. The scholarships would have been capped at \$5000 per student per year; half of the scholarships would have been awarded on the basis of academic merit and half on the basis of financial need. Introduced in December 2021 and January 2022 by Jeff Smith (D–District 31) with five of his colleagues in the Senate and by Jill Billings (D–District 95) with 21 of her colleagues in the House of Representatives, the bills were referred to the Senate Committee on Universities and Technical Colleges and the House Committee on Education, where they died when the legislature adjourned in March 2022.

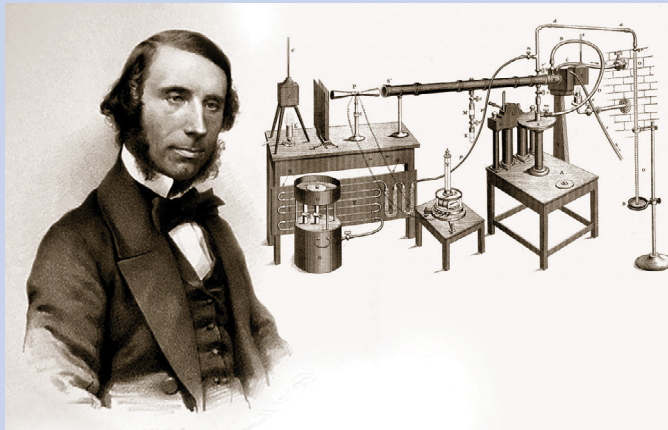
SWEDEN, RIMBO

In March 2022, a Swedish court of appeal ruled that evolution was not taught in accordance with the national curriculum at Ekebyholmsskolan, a primary and secondary school run by the Adventist Church in Sweden in Rimbo, a small town 50 kilometers north of Stockholm. Ekebyholmsskolan is a “free school,” privately operated but receiving government funding and required to follow Sweden’s national curriculum. In 2018, a complaint about the teaching of evolution at the school prompted a governmental investigation that found shortcomings and mandated corrections. Of particular concern was a presentation that cited the Discovery Institute’s “Dissent from Darwinism” statement as evidence that a growing number of scientists are dubious about evolution. (In a commentary in the Christian newspaper *Dagen*, Patrik Lindenfors, a zoologist at the University of Uppsala, cited NCSE’s Project Steve by way of refutation.) The school then chose to appeal the investigation’s mandate, but the court ultimately ruled that the school should not present scientifically unwarranted critiques of evolution. [Thanks to Dan Larhammar and Patrik Lindenfors for providing articles from *Dagen*.]



John Tyndall was interested in ice. That was not surprising for an Anglo-Irish scientist who spent his summers as an ardent pioneer Alpinist. After risking his life traversing glacier crevasses in pursuit of a first ascent, Tyndall took up the study of glacier dynamics. He found that the subject had a wider significance, for there was growing evidence that masses of ice ten thousand times bigger than anything in the Alps had once covered northern Europe and America. An Ice Age—the first scientific demonstration that our planet’s climate can change profoundly, even catastrophically.

Various speculations circulated about what could cause such a change, and Tyndall realized he could test one of them. In the 1820s Joseph Fourier in France had guessed that Earth’s atmosphere, which allows visible sunlight to reach the surface and warm it, blocks outgoing heat (infrared) radiation. Fourier said the air acts



like a pane of glass to retain the heat; others would call this a “greenhouse effect,” although actually the main job of the glass in a greenhouse is to hold the warm air inside.

Could a change in the composition of the atmosphere affect Earth’s climate? The idea got little traction, for most scientists thought the atmosphere was transparent to all radiation. In 1859 Tyndall decided to check that. In his laboratory in England he built a clever apparatus, centered on a tube that could contain a gas. At one end of the tube he put a box with boiling water as

a source of heat radiation; at the other end he put a thermocouple, in which heat could induce a tiny flow of electricity. To measure the current, Tyndall bought a “first-class galvanometer” from a craftsman in Berlin. But he found the instrument was unreliable. Painstaking investigation over many frustrating days traced the

problem to the green silk insulation covering the galvanometer’s wires. New silk fixed that. There was an even worse problem with putting windows at each end of the tube: glass would not do, for glass was known to block heat radiation. Rock salt would transmit the rays, but the task of finding crystal-clear slabs, Tyndall wrote, seemed “insuperable.” He turned to acquaintances, British gentlemen with an interest in science, who pitched in and tracked down a few usable pieces.

Finally everything was ready. Tyndall quickly found that the main atmospheric gases, oxygen

Friend of Darwin and Friend of the Planet Awards for 2022



Tim Berra

NCSE is pleased to announce the winners of the Friend of Darwin award for 2022: **Tim M. Berra**, Academy Professor Emeritus of Evolution, Ecology, and Organismal Biology at The Ohio State University, Professorial Fellow at Charles Darwin University, and the author of *Evolution and the Myth of Creationism* (1990); **Adam Laats**, Professor of Education and History at Binghamton University (SUNY) and the author of *Creationism USA* (2020); and **Lisa D. White**, Director of Education and Outreach at the University of California Museum of Paleontology.



Adam Laats

NCSE’s executive director Ann Reid extolled the winners, explaining, “Tim



Lisa D. White

Berra has helped to expose the flaws of creationism going back to the days of creation science, while Adam Laats has helped to chart the contours of the controversies over evolution education going back to before the Scopes trial.” She added, “And the importance of Lisa White’s efforts to help science educators teach evolution effectively can’t be overstated,” citing in particular her leadership on the Understanding Evolution website.



Andrew Dressler

NCSE is also pleased to announce the winners of the Friend of the Planet award for 2022: **Andrew Dressler**, Professor of Atmospheric Sciences at Texas A&M University and the author of *Introduction*

and nitrogen, were indeed transparent to heat radiation, just as everyone had supposed. Hydrogen was easy to generate, so he checked that too; it was transparent. He was ready to quit.

Then Tyndall thought of another gas that happened to be right at hand in his laboratory: coal-gas. This was a fuel used for lighting and Bunsen burners, produced industrially by heating coal. It consisted of carbon monoxide mixed with methane and other hydrocarbon gases. Tyndall put some in his tube, and found the gas was as opaque to heat radiation as a plank of wood. Thus the Industrial Revolution, intruding into

Tyndall's laboratory in the form of a gas-jet, declared its significance for the planet's heat balance.

Reinvigorated, Tyndall went on to try other gases and found that carbon dioxide (CO₂), water vapor, and some hydrocarbons like methane also blocked heat radiation. He concentrated on water, which is thousands of times more abundant in the atmosphere than the others. "This aqueous vapour," he realized, "is a blanket more necessary to the vegetable life of England than clothing is to man. Remove for a single summer-night the aqueous vapour from the air ... and the sun would rise upon an island held fast in the

iron grip of frost." True, but as later scientists pointed out, water moves in and out of the atmosphere in a matter of weeks—Earth is a rainy planet—whereas CO₂ lingers for centuries. And as Tyndall had discovered, it takes very little CO₂ to block heat radiation. So the amount of CO₂ in the air makes a big difference for the climate.

Tyndall did understand the fundamental mechanism—and he could explain it. Later, after he became famous as a science teacher and popularizer, he described the greenhouse effect with a concision and accuracy that has never been surpassed: "As a dam built across a river causes a local deepening of the stream, so our atmosphere, thrown as a barrier across the terrestrial rays, produces a local heightening of the temperature at the Earth's surface."

Spencer Weart was Director of the Center for History of Physics at the American Institute of Physics from 1974 to 2009; he is the author of *The Discovery of Global Warming* (second edition, 2008) and maintains a website of the same name: <https://history.aip.org/climate/index.htm>. swear1@gmail.com



THE END OF PLACE & TIME

Randy Moore and Spencer Weart, the authors of *RNCSE*'s regular Place and Time column—which describes episodes alternately from the history of the creationism/evolution controversy and the history of climate science—have, coincidentally, both decided to retire from the column. Consequently, the Place and Time column in *RNCSE* 42:4, Weart's discussion of the pioneering climate scientist John Tyndall, is the last in the series. We are grateful to both Weart (a recipient of NCSE's Friend of the Planet award) and Moore (a recipient of NCSE's Friend of Darwin award) for their contributions to *RNCSE* and their support of NCSE.



Kelley T. Lê

to *Modern Climate Change* (third edition, 2021); **Kelley T. Lê**, Director of the Science Project at the University of California, Irvine, and the author of *Teaching Climate Change for Grades 6–2* (2021); and **Climate One**, the weekly podcast and public radio program from the Commonwealth Club of California.



Climate One's Greg Dalton

"The Friends of the Planet for 2022 have tirelessly promoted the cause of climate change education," Reid observed. "For Andrew Dessler, through his authoritative college textbooks as well as through his commentary in the popular media. For Kelley Lê, through her important guide aimed at helping middle and high school

teachers teach climate change effectively and her related outreach activities. And for Climate One, through its commitment to empowering public conversations that connect all aspects of the climate emergency."

The Friend of Darwin and Friend of the Planet awards are presented annually to a select few whose efforts to support NCSE and advance its goal of defending and supporting the teaching of evolution and climate science have been truly outstanding. Previous recipients of the Friend of Darwin award include Niles Eldredge, Richard B. Katskee, Judy Scotchmoor, Carl Zimmer, and the plaintiffs in *Kitzmiller v. Dover*. Previous recipients of the Friend of the Planet Award include Richard Alley, Ayana Elizabeth Johnson, and the Paleontological Research Institution.



Meeting of the Minds

What do you get when you bring together 42 NCSE-affiliated science teachers from around the country? Collaboration, camaraderie, and constant learning.

Twelve of NCSE's teacher ambassadors and several members of NCSE's staff met on the campus of Colorado State University July 9–12, 2022, to take a deep dive into NCSE's recently completed lesson sets on evolution, climate change, and the nature of science. These teachers are planning to teach some or all of the lessons in the upcoming school year—and support colleagues in teaching them, too.

Additionally, NCSE's teacher ambassadors developed skills they need to begin leading professional learning opportunities in school districts across the nation.

Before the teacher ambassadors departed, they were joined by 30 curriculum field testers—science teachers who have been trying out parts of the lesson sets and reporting the results back to NCSE staff.



Above NCSE Teacher Ambassadors discuss ways to implement NCSE lesson sets in diverse classrooms. Right: Getting hands-on practice analyzing simulated ice core isotopes, part of an activity from one of NCSE's climate change lesson sets. Photos by NCSE

Participants are beginning the second year of the curriculum study in the fall of 2022. NCSE will use feedback from the field testers gathered throughout the first year and during the summer to revise and improve the lessons in an effort to make them even more teacher-friendly and easily integrated into any state's curriculum requirements.

The full days included the teachers trying out activities that they'll be asking their



students to engage in, interacting with guest presenters, and enjoying field experiences that highlighted the rich possibilities of place-based science learning. Here are just a few photos from the event.

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Below: Teacher Ambassador Rebecca Brewer shows off her protein model, part of an activity from one of NCSE's nature of science lesson sets.



Right: NCSE's Blake Touchet discussing science education leadership with Teacher Ambassadors and Curriculum Field Testers.

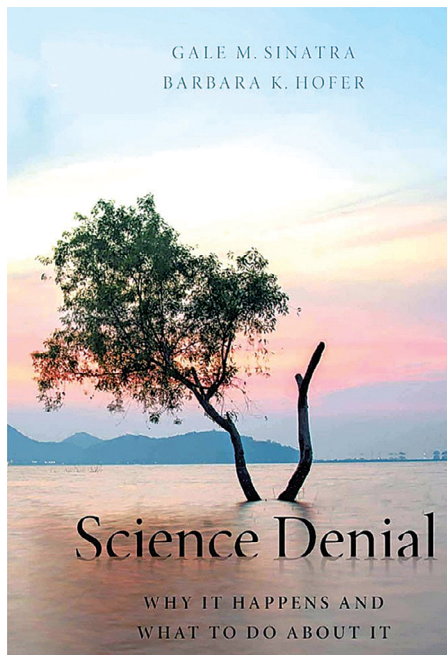


Science Denial: Why It Happens and What to Do About It

author: Gale M. Sinatra and
Barbara K. Hofer

publisher: Oxford University Press

reviewed by: Craig A. Foster



People seem to gravitate towards a deficit-model approach to science education; that is, they think the cure for science denial is to add more traditional science education. But research shows that just doing more is unlikely to provide the best return on investment. In fact, it might not provide any return at all. The public has unprecedented access to science information; that isn't stopping people from choosing ivermectin over vaccination.

Science Denial is basically the game plan for doing better than blithely hoping that a one-size-fits-all set of scientific explanations will cause people to jettison scientific flim-flam. It's painful to admit, but addressing science denial is far more challenging than that. Those who are interested in addressing science denial effectively should definitely read this book.

Sinatra and Hofer's book addresses a crucial social problem. People maintain various forms of science denial—about vaccination, genetically

modified organisms, climate change, evolution, and the shape of the earth, to name a few of the examples discussed in the book—because they seek and process information in flawed ways. Science denial is a public problem because it wastes resources (e.g., your tax dollars) and compromises individuals' emotional and physical health.

Being a psychology professor, like *Science Denial's* authors, I understand the necessity of this wonderful book.

Science Denial covers all the major social science factors that prevent people from developing scientific literacy. These include the proliferation of misinformation, shortcomings in traditional science education, misguided attitudes about science, challenges in evaluating online information, errors and biases in processing information, motivational factors, social influence, and social identity.

It's regrettably ironic when people use only their intuitions to promote

critical thinking. Thankfully, Sinatra and Hofer's suggestions for addressing science denial are evidence-based. *Science Denial* draws from well-established social science principles without letting the underlying research compromise readability. *Science Denial* uses anecdotes, but does so to illustrate concepts, not as evidence.

The writing is consistently oriented to the everyday person who is genuinely interested in amending scientific misconceptions. Most chapters begin with a personal vignette for context and end with sensible goals tailored to educators, science communicators, policymakers, and the general public.

I particularly appreciated the "Why Science is Not Infallible" section (pp. 6–7). Science communicators might be tempted to portray scientists as stainless paladins selflessly fighting those who are greedy or willfully ignorant. I don't believe in that approach. The authors maintain credibility by acknowledging science's mistakes, even while promoting science's considerable value more generally.

Understanding the sources of science denial is important, but it isn't a panacea. Consider that those who believe scientific nonsense can be remarkably adept at generating ad hoc explanations to parry legitimate science. These explanations are objectively unrealistic, but they feel realistic to those who really want to believe. Flat-earthers, for example, believe that globers are the ones misinterpreting evidence due to confirmation bias. Accordingly, science deniers

who read *Science Denial* might agree with the book generally while still holding onto their pet beliefs. They might even thereby become better equipped to deflect criticism!

In any case, the task of improving critical thinking broadly is daunting. The deliberate cognitive strategies offered by Sinatra and Hofer—such as “Practice slowing down and allowing for a more thoughtful, informed response” (p. 90)—are entirely justifiable. At the same time, mental habits are slow to change; deliberate thought takes effort and bias rarely makes itself self-evident. Even so, I share Sinatra and Hofer’s hope that individuals will try to put their good advice into practice. Even small gains across many people could make a difference.

Those who are interested in addressing science denial effectively should definitely read this book.

Personally, I would have preferred a little more emphasis on altering one’s social environment as a method for addressing science denial. *Science Denial* definitely encourages this strategy by covering topics such as social identity, social persuasion, and echo chambers, and by suggesting additional science education. Nevertheless, I believe the authors could have encouraged more strongly the benefits of joining organizations that offer

sustained lessons in scientific literacy like the Committee for Skeptical Inquiry and, of course, the National Center for Science Education.

But that’s a mere quibble coming from a social psychologist about a treatment that was fittingly rooted in educational psychology. I tip my hat to Sinatra and Hofer for a superb book devoted to a superb cause. I encourage everybody to consider the preventable harm caused by science denial, and to pick up *Science Denial*, the book, to help us find a solution.

Craig A. Foster is Professor and Chair of Psychology at SUNY Cortland, where he studies the development of scientifically unrealistic beliefs (i.e., pseudoscience). He is a Fellow of the Committee for Skeptical Inquiry. craig.foster@cortland.edu



WHAT WE’RE UP AGAINST

Apples, Oranges, and Climate Change Denial

A laudatory review of a booklet from the climate-change-denying Heartland Institute published in the conservative *Washington Times* argued against the “oft-cited, but quite distorted, claim that 97% of climate scientists are true believers in anthropogenic global warming” by invoking the results of a 2016 survey of members of the Ameri-

can Meteorological Society. The reviewer, himself a meteorologist, correctly reported that only about two thirds of the respondents to the survey agreed that human activity is responsible for a majority of the changes in the climate over the past 50 years. But he overlooked—or deliberately omitted—the fact that less than two in five of the

respondents to the survey considered themselves “expert” in climate science. In contrast, the studies that underlie the 97 percent estimate typically assess expert opinion by examining either the peer-reviewed scientific research literature in climate science or the views of the scientists who have contributed to it. —GLENN BRANCH

CHANGE SERVICE REQUESTED

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while they learn accurate science.**

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