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Dear NCSE Members,

One of the joys of working at home for the last two years has been having a hummingbird feeder just a few feet outside my home office window. I live right in the middle of San Francisco and have barely a postage stamp of a backyard, so you'd think there wouldn't be a whole lot of opportunities to engage with nature. But the climate is such that hummingbirds live here year-round and it's a rare day that I don't spot several of them tanking up. They're feisty little creatures—it's not uncommon to see two of them buzzing each other like tiny World War I flying aces to control access to the feeder, and I once saw several of them work together to chase off a crow during nesting season.

What's my point? I'm not sure—it just seems important after these two years of disruption and anxiety to take a moment to appreciate any small pluses when it seems like the minuses are so much more obvious.

There are plenty of pluses to report on at NCSE. In this issue of *RNCSE*, you'll read about some of our amazing teacher partners who continue to be recognized for their dedication throughout the pandemic. You'll also find an interview with one of the two researchers who won the National Association of Biology Teachers 2021 Evolution Education award (now sponsored by NCSE) for their work studying how teachers can help their students resolve perceived tension between their religious beliefs and the science of evolution. The book under review in this issue—*Why Are There Still Creationists?*—also explores the question of how to better understand what makes creationists tick. And we also celebrate NCSE's 40th anniversary with a look back at the organization's founding penned by our first executive director and my predecessor, Eugenie C. Scott.

It's not all rainbows and kittens. We're carefully tracking the burgeoning phenomenon of local activists pressuring school boards to limit what is taught in public schools. So far, evolution and climate change have not become targets for parents who seem determined to prevent their children from learning anything they disagree with, but we are watching closely. We are also concerned about reports that teachers are leaving the profession in higher than usual numbers—neither science nor any other discipline can afford to lose a generation of skilled teachers. The overall state of public education right now falls somewhere between challenging and besieged, and we are doing what we can to support science teachers in their crucial work.

Like the hummingbirds outside my window, sometimes it feels that we are each so individually tiny and fragile that we can't possibly solve all the problems faced by science education these days. But working together, tiny hummingbirds can chase away birds over 100 times their weight, and they don't even have smartphones or opposable thumbs. Working with you, our generous supporters, and taking advantage of every tool at our disposal, we can continue to make sure that students everywhere get an accurate and effective education about evolution, climate change, and the nature of science. Thank you for flying with us.



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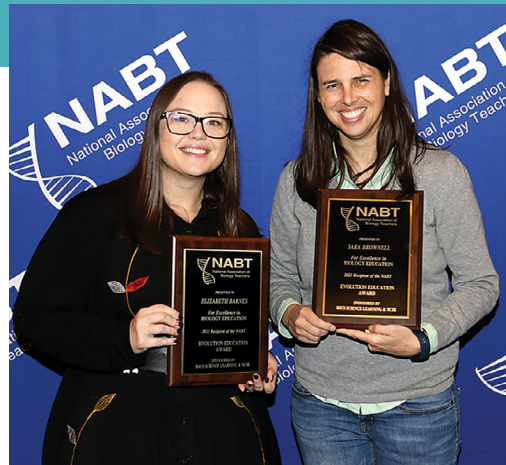


Teaching Evolution to Students of Faith

Liz Barnes grew up “a stereotypical secular science-minded person” who thought evolution and religion had to be in conflict. And she noticed that her science teachers, particularly at the higher education level, often manifested this same mindset. Her classmates who were religious noticed too—one of them decided to drop a biology class as a result. That troubled and intrigued Barnes.

She knew that about half the U.S. population didn’t accept evolution, despite it being foundational to the biological sciences. It gnawed at her that the teaching approach she experienced could be contributing to that lack of acceptance, and may have even been hardening it. “It was important to me to study this disconnect in the classroom that I had witnessed,” Barnes recently told *RNCSE*, “between the college instructors, who most of the time were secular, compared to their students, who were mostly religiously affiliated.”

Barnes, a National Science Foundation Graduate Research Fellow at Arizona State University at the time, talked with her advisor, Sara Brownell, and they decided to dig into the literature. They discovered that there was very little research



Liz Barnes and Sara Brownell with the National Association of Biology Teachers 2021 Evolution Education Award, the first sponsored by NCSE.

on the relationship between science faculty communicating about evolution and the religious backgrounds of the students in their classes. But what they did find seemed to suggest that higher education faculty weren’t interested in tackling the cultural disconnect between scientists communicating about evolution and the often more religious students with whom they were communicating. So they went ahead and conducted their own studies. The

outcome was the development and publication of an instructional framework called [Religious Cultural Competence in Evolution Education](#) intended to help college-level biology instructors become more sensitive to the perspectives of students who are religious, and by doing so, help those students not just understand but also accept evolution.

Cultural competence, Barnes explained, refers to the ability of people of one culture to understand and relate to the people of another culture. The idea of cultural competence first arose in the medical profession as a means for physicians to better communicate with patients and has since been adopted for use by K–12 educators. Barnes and Brownell applied their understanding of cultural competence to evolution education, viewing religious belief as an identity type (see the table below).

ReCCEE Practices and Citations Supporting Them

ReCCEE practice	Description	Empirical support
Acknowledge	Acknowledge that some students may see a conflict between evolution and their religious beliefs.	Jackson et al., 1995; Dagher and Boujaoude, 1997; Brickhouse et al., 2000; Donnelly et al., 2008
Explore	Discuss and encourage the exploration of students’ personal views on evolution and religion.	Scharmman, 1993, 1994; Ingram and Nelson, 2006; Wiles and Alters, 2011; Winslow et al., 2011; Manwaring et al., 2015; Scharmman and Butler, 2015
Teach the nature of science	Explain to students the bounded nature of science and different ways of knowing.	Rutledge and Warden, 2000; Scharmman et al., 2005; Ingram and Nelson, 2006; Martin-Hansen, 2006; Nehm and Schonfeld, 2007; Ladine, 2009; Cavallo et al., 2011; Carter and Wiles, 2014
Outline the spectrum of viewpoints	Explain that there are diverse viewpoints on evolution and religion and that viewpoints are not restricted to atheistic evolution and special creationism. Discuss the possibility of theistic evolution.	Verhey, 2005; Ingram and Nelson, 2006; Martin-Hansen, 2006; Donnelly et al., 2008; Wiles and Alters, 2011; Barnes et al., 2017a
Provide role models	Highlight religious leaders and biologists who accept evolution.	Winslow et al., 2011; Barnes et al., 2017a
Highlight potential compatibility	Explicitly discuss the potential compatibility between evolution and religion.	Martin-Hansen, 2006; Robbins and Roy, 2007; Wiles and Alters, 2011; Scharmman and Butler, 2015

It's this work that led to Barnes, now an assistant professor at Middle Tennessee State University, and Brownell, a neuroscientist and education researcher, receiving the National Association of Biology Teachers Evolution Education Award for 2021, the first sponsored by NCSE. The annual award (which NCSE's Deputy Director Glenn Branch received in 2020) was presented to Barnes and Brownell at NABT's conference in November 2021 by NCSE Director of Teacher Support Lin Andrews.

"As someone raised in Tennessee and now living in an extremely conservative state, Kansas, I know from personal experience that ignoring cultural competence in the classroom is a surefire way to alienate your students," Andrews said. "While my first encounter with Liz and her advisor, Sara, was at the 2021 NABT Honors Banquet, I was immediately impressed by their fresh take on this research. I felt like they had eloquently verbalized what many biology teachers were trying to do every day—to recognize a student's belief system in an appropriate fashion to provide a safe space for greater scientific understanding. Having encountered the array of variations in approaches to dealing with religious students they described during my own schooling, I can say with confidence that their findings are essential tools teachers at any educational level should consider using when discussing societally controversial topics like evolution with their students."

The research that led Barnes and Brownell toward the Religious Cultural Competence in Evolution Education framework involved conducting a series of studies with professors and students at public higher education institutions. They interviewed professors who were mostly secular about how they were teaching evolution and how they were addressing the perceived conflict between evolution and religion. "The instructors at secular institutions were mostly completely avoiding the topic," Barnes said. "A small subset of those instructors were being actively hostile to religion. They weren't really thinking about how their students' religious backgrounds might be influencing how they were receiving their instruction."

The two then interviewed religious students from these professors' classrooms. "Students were already coming in with this misconception that their religion had to be in

conflict with evolution," Barnes said. "Instructors not addressing that only allowed that misconception to remain."

Barnes has heard the refrain that it's not a professor's job to convince her students to accept evolution but rather simply to

teach the concepts. She counters by saying that if an instructor doesn't address what Barnes described as the single most predictive factor—namely religiosity—for rejection of evolution, then that is an oversight. "Instructors say it's not my job to teach students to accept evolution," Barnes said. "It's so interesting that they say that about evolution. Because I don't think we'd say that about other topics, like photosynthesis. If

I were teaching photosynthesis and the whole class got an A on the test but 30 percent of students left the class thinking photosynthesis wasn't real, as they do evolution, for me personally I wouldn't see myself as a successful instructor." Barnes added that helping students grasp the

nature of science is critical if they are to develop greater acceptance of evolution. For instance, distinguishing between methodological and philosophical naturalism in science and describing evolution more accurately as agnostic rather than atheistic improves religious students' comfort learning and accepting evolution. As it stands now, Barnes and Brownell's research shows that almost half of college biology students enter their classes thinking one has to be an atheist to accept evolution.

Barnes and Brownell are currently doing additional research on the Religious Cultural Competence in Evolution Education framework as part of a National Science Foundation grant. They're attempting to determine the role the framework plays in improving acceptance of evolution by students who are religious. "What we're seeing so far is that when instructors bring forth examples of religious scientists who accept evolution, students are more accepting of evolution by the end of the class. Conversely, if instructors are more negative about religion, we see lower acceptance of evolution at the end of instruction."

Such negativity, Barnes added, does not have to be overt. She and Brownell observed instructors who students rated as more negative about religion than other instructors. The forms of negativity about religion were not explicit. In one instance, a professor projected a comic that poked fun at a theistic version of evolution at the beginning of class.

What we're seeing so far is that when instructors bring forth examples of religious scientists who accept evolution, students are more accepting of evolution by the end of the class.



Members in the SPOTLIGHT



John Henry Beyer, a geophysicist now retired from Lawrence Berkeley National Laboratory, contributed a column about climate change to the *Sierra Sun* (serving the Truckee, California, area). “To varying degrees, we have been warned about global warming for about 30 years,” he wrote. “But until recently it seemed to be in a time and place far, far away. Now people are realizing that the consequences of a warming planet are happening here and now. ... Among climate scientists, consensus has reached 97% that 1) climate change is real, 2) it’s happening now, and 3) we are the primary cause. Most of the remaining 3% earn a living, directly or indirectly, from the fossil fuel industry. Global warming is not a hoax.” His column was published on March 26, 2021.



Karen Mesmer received the Ron Gibbs Award, conferred annually by the Wisconsin Society of Science Teachers to a person who “has made outstanding contributions in science education over a long and distinguished career in Wisconsin,” for 2020. A former colleague told the *Baraboo News Republic*, “She teaches the kids to love science, so it’s not just about

teaching them the science content ... but she teaches them to love science, to think like a scientist, to ask questions and then search out the answers to those questions.” A long-time member of NCSE, Mesmer taught for 26 years in the Baraboo School District, mostly at the middle school level, before retiring in 2015.



Marvalee Wake of the University of California, Berkeley, was interviewed for *BioScience’s* “In Their Own Words” series, which focuses on “scientists who have made great contributions to their fields.” “I’m an evolutionary morphologist with two primary interests,” Wake told *BioScience*. “One is the biology of an order of amphibians that is not frogs and toads or salamanders and newts [i.e., Apoda, the caecilians]. The other is the evolution of derived modes of reproduction and the developmental and physiological biology involved in that evolution, all in a phylogenetic context.” Wake also discussed her career, her service to the profession, and changes in the academy. She ended by advising aspiring scientists, “It’s important to be present, ask questions, and look around you.” The interview appeared in the October 2020 issue of *BioScience*; audio is available online at <https://bioscience-talks.aibs.org/episodes/in-their-own-words-marvalee-wake>.

According to their analysis, subtle negativity such as this can lead to lower evolution acceptance among students.

Are there implications in Barnes and Brownell’s research for K–12 education?

Barnes and Brownell are admittedly not K–12 education experts and their work focuses on college-level evolution education, Barnes noted. However, she observed that most public school biology teachers take college-level biology and are likely influenced by the biology instruction they receive in college. If college instructors are not culturally competent when teaching pre-service teachers, this could lead to those teachers being ineffective themselves. For instance, religious teachers may avoid teaching evolution due to unresolved personal conflict or secular teachers may themselves teach evolution in a way that is not culturally competent. “College instructors are the ones modeling evolution instruction for pre-service K–12 teachers. It’s all connected,” she said.

...to figure out ways to reduce perceived conflict between political identity and acceptance of climate change

Barnes noted there is no shortage these days of science communication that involves cultural dissonance between groups. She has decided to turn her research lens toward climate change and students’ and professors’ political identities. “Here at Middle Tennessee State University, for instance, the majority of my students are politically conservative. So how are instructors, who are mostly politically liberal, taking this into account when they’re teaching about climate change?” Her hope, as with evolution education, is to figure out ways to reduce perceived conflict between political identity and acceptance of climate change, with the aim of creating more inclusive climate change education for students from

different political leanings while also increasing those students’ comfort with accepting climate change themselves.



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

PLACE & TIME

Boulder 1965: Is the Climate Unstable?

Photo by Canby Galini, Creative Commons License (CC BY-NC 4.0) via OpenSky.



The National Center for Atmospheric Research Mesa Laboratory in Boulder, CO. Copyright University Corporation for Atmospheric Research.

Boulder, Colorado, is a university town with majestic views of a sandstone scarp to the west and summer thunderstorms stalking the plains to the east. It is a premier center for the study of climate (although I admit I went there because it is also a center for mountaineering and skiing). Alongside the university science departments there is the High Altitude Observatory, studying the sun since 1940, and the gorgeous laboratories of the National Center for Atmospheric Research designed by master architect I. M. Pei. The buildings were under construction in August 1965 when a small conference on “Causes of Climate Change” convened in Boulder. Scarcely noticed at the time, in retrospect the meeting marked a revolution in climate science.

The organizers deliberately brought together scientists from a fantastic diversity of fields, experts in everything from sunspots to volcanoes. Presiding over the meeting was an oceanographer, Roger Revelle. Lectures and roundtable discussions boiled with spirited debate as rival theories clashed; Revelle needed all his exceptional leadership skills to keep the meeting on track. Convened mainly to discuss explanations of the ice ages, the conference featured a burst of new ideas about physical mechanisms that could bring something few had thought possible: abrupt climate change.

Invited to give the opening address was a pioneer of computer meteorology, Edward Lorenz. It would not be until 1979 that he asked, “Does the flap of a butterfly’s wings in Brazil set off a tornado in Texas?” But already in 1961 a lucky accident had pointed Lorenz to the effect. His computer model was producing impressive simulacra of evolving weather patterns, worked out to six decimal places. One day he needed to repeat a calculation and for convenience entered only the first three digits of the initial conditions. He was shocked to see that over a few simulated weeks the weather pattern diverged radically from his original result. In Boulder, Lorenz reported that the slightest change of conditions could produce a massive transformation in an atmospheric system.

A geochemist brought related evidence. Wallace Broecker told how he used radioactive isotopes to date fossil coral reefs perched at various elevations, getting a timetable for how the sea level had changed as continental ice sheets built up and melted away. His dating of ice ages, to almost everyone’s surprise, neatly matched a timetable proposed decades earlier in astronomical calculations by a Serbian mathematician, Milutin Milanković. The subtle changes in sunlight calculated from periodic shifts in Earth’s orbit seemed insignificant. Yet somehow the tiny shifts governed ice ages.

“The Milanković hypothesis,” Broecker now declared, “can no longer be considered just an interesting curiosity.” As others brought up additional observations and theories, the conference members began to speculate how the climate system could be so delicately balanced that a small push could “trigger” a switch between altogether different states.

By the end of the conference the experts had reached consensus on some points. In a summary, the respected climatologist Murray Mitchell reported that minor changes in the past “may have sufficed to ‘flip’ the atmospheric circulation from one state to another.” Our “comparatively amicable interlude” of warmth could give way to another ice age, he warned, and perhaps faster than had been supposed. It was a natural concern when for millions of years Earth’s climate had oscillated between moderate warmth and glacial cold. Scientists were only beginning to think about the rise of human greenhouse gas emissions. Nobody had yet imagined a mechanism that might push the planet abruptly into a state geologists had seen farther in the past, when palm trees flourished on the coasts of Antarctica.

Today the IPCC’s scientists warn that unless we stop pushing global temperature higher with our emissions, an onset of unstoppable feedbacks that force the temperature to an intolerable height “cannot be ruled out.” But already in 1965 climate experts had walked away from the traditional and comfortable belief that climate could change only slowly over many centuries. The system is not so stable.

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>. sweart1@gmail.com



Founding Board Member Appreciates NCSE's Enduring Impact



In 1982, Kenneth Saladin and a handful of others met in a Washington D.C. hotel to plot ways to keep creationism out of science classes in public schools. Perhaps, they ventured during their brainstorming session, they should unite their state-by-state efforts

through a nonprofit group to address the issue on a national scale. Never could they have imagined that the seed of their idea would blossom into an organization still very active [40 years later](#).

The NCSE founding board member explained, “when we conceived of NCSE in 1982, we thought it would function for two or three years just to beat down the wave of state-by-state creationist legislative initiatives. We figured we would slay the dragon and then disband.”

Now retired after 40 years of teaching biology at Georgia College & State University, Saladin marvels at NCSE's longevity and impact.

“Back then, we scraped together enough small grants to hire Genie Scott as the first executive director,” Saladin remembered. “So much is owed to Genie's amazing energy, eloquence, and organizational skills. She got us national recognition. When a state bill would crop up or the fundamentalists would move to censor high school textbooks, we became the group the media went to for information. It was very gratifying.” (For more, read Eugenie C. Scott's “NCSE: The First 1.26 Gigaseconds” on page 10.)

Saladin financially supports NCSE's work with royalties from his three human anatomy and physiology college textbooks, one of which has become McGraw Hill's best seller in its category. He continues his support because he

appreciates how the organization has stayed relevant. “Not only creationism and climate change denial, but also the current wave of science denial surrounding COVID-19 are reminders of the continuing importance of NCSE.”

NCSE's move to address climate change education in 2012, followed by its development of model lesson plans to enable educators to teach climate change in the face of climate denial, was a “brilliant” move in Saladin's view. “There are a lot of common elements in our playbooks to fight pseudoscience and misinformation in all these areas,” he said, comparing climate change deniers to creationists.

Saladin, who fell in love with science as a kid while “roaming around fields, forests, and creeks in undeveloped areas near my home,” devoted his career to helping young people engage with science. He's taught widely diverse branches of biology, including human anatomy and physiology, histology, animal behavior, sociobiology, zoology, and honors seminars and colloquia on the creationism controversy. He greatly appreciates that partly due to NCSE's persistent efforts, the tide is turning and “advocacy of creationism in the classroom is declining markedly and evolution is getting more class time,” he said.

At 72, Saladin hasn't slowed down in his quest to ensure young people learn accurate science—he's currently writing the tenth edition of his lead textbook. Nor has NCSE slowed down – it's still strong four decades after a few concerned educators met in a hotel in Washington D.C. “Since NCSE doesn't rely on grants as much as it did in the early years, it's crucial that we continue to generously support this work at the grassroots level of we individual members and donors.”

Deb Jones is NCSE's Director of Development.



WHAT WE'RE UP AGAINST Random Cranks on Facebook

As part of a fundraising campaign in the winter of 2021, NCSE ran a number of advertisements on [Facebook](#) focusing on climate change education. Among the friendly and supportive responses were a handful that were less so. A variety of common misconceptions were on display: for example, “I'm old enough to remember when all you brainiacs wanted to spread suit [*sic*: presum-

ably soot] over the poles because you were afraid of the next Ice Age,” “All climate models are wrong,” “Lol talk about ‘gas lighting.’ Climate change is a hoax,” and “The climate has been changing since the ICE AGE with no cars, planes, or humans” (emphasis in original). But vulgar



abuse was abundant too: “Leftists pigs the lot of y'all,” for instance. Fortunately, not only did the Facebook campaign more than pay for itself, but even the crankery was grist for the present What We're Up Against column!

—GLENN BRANCH

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.

ARKANSAS, BATESVILLE

In August 2021, during a Senate Education Committee hearing on House Bill 1701, which would have allowed the teaching of creationism in the state's public schools, a state senator who is himself a teacher at Southside Charter High School commented that a biology teacher colleague of his "teaches both the creationism [sic] theory and the evolution theory, one right after the other. He treats them both equally." The Freedom from Religion Foundation then sent letters to the district supervisor and the senator to educate them on the constitutional law that prohibits teachers in the public schools from presenting creationism as scientifically credible, although no response from either recipient was reported. House Bill 1701 died in committee on the narrowest possible vote, 3–3.



bill cited the threat of other types of "science denialism" as reasons to pass the bill. The bill was later referred for further study.

MICHIGAN

Michigan's House Bill 5283 would, if enacted, establish a temporary environmental literacy task force, charged with developing a model curriculum aimed, in part, at preparing students for understanding and addressing environmental challenges, including climate change. The task force would also assess the degree to which existing resources, including the state science standards, address environmental literacy. The task force would submit a report to the legislature including the model curriculum and any recommendations for legislation. House Bill 5283 was introduced by Julie Rogers (D–District 60) along with twenty-five cosponsors, on August 18, 2021, and referred to the House Committee

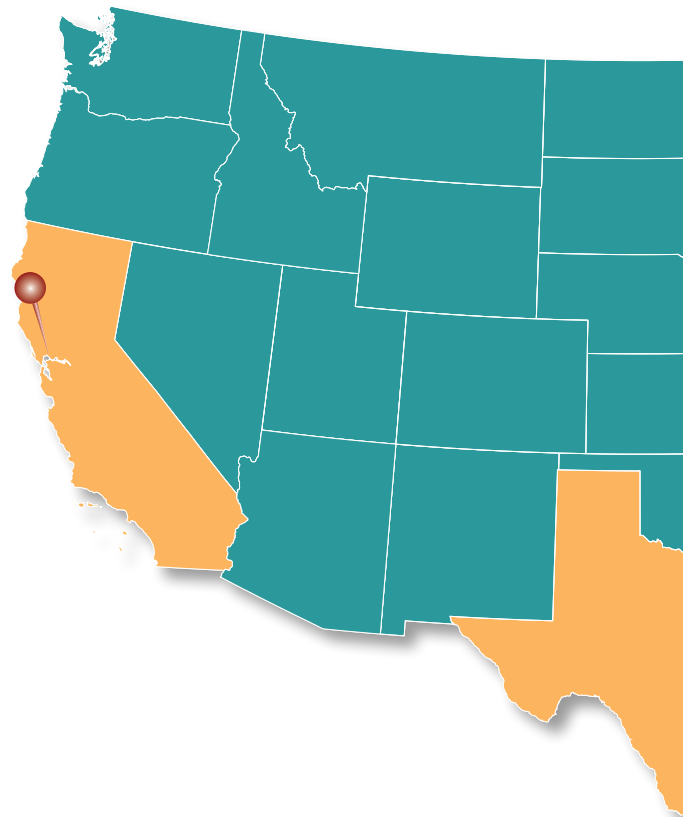
CALIFORNIA, BERKELEY

The Berkeley Unified School District Board of Education voted in November 2021 to "develop and implement a framework for teaching human-induced climate change, including its causes and solutions, and who will feel its effects the hardest," according to *Berkeleyside*. The vote reportedly represents the first climate change education school board resolution in the nation with funding—\$65,000—attached. "The money will be used to pay teachers as part of a climate literacy working group to develop curriculum and model lessons by June 2023."



MASSACHUSETTS

Massachusetts's House Bill 607, sponsored by Kenneth I. Gordon (D–District 21), would, if enacted, require that the state's science standards "include only peer-reviewed and age-appropriate subject matter," where "peer-reviewed subject matter" is defined as "conducted in compliance with accepted scientific methods." Introduced on May 29, 2021, the bill was heard in the Joint Committee on Education on September 13, 2021. In 2019, Gordon introduced the identical House Bill 471. During a July 9, 2019, hearing in the Joint Committee on Education, as NCSE previously reported, Gordon explained that HB 471 would keep climate change denial out of the science classroom, and a science journalist testifying in favor of the



on Education. It is unclear whether the committee will consider the bill. Michigan adopted the Next Generation Science Standards in 2015; the NGSS received the grade of B+ in “Making the Grade? How State Public School Science Standards Address Climate Change,” a 2020 report from NCSE and the Texas Freedom Network Education Fund.

TEXAS

A controversial revision to the state’s education code is confusing teachers and administrators in Texas’s public schools—and science education is not immune. In June 2021, the code was revised (by the enactment of House Bill 3979) to provide in part, “For any social studies course in the required curriculum: (1) a teacher may not be compelled to discuss a particular current event or widely debated and currently controversial issue of public policy or social affairs; (2) a teacher who chooses to discuss a topic described by Subdivision (1) shall, to the best of the teacher’s ability, strive to explore the topic from diverse and contending perspectives without giving

deference to any one perspective.” In October 2021, the Texas Tribune reported that the Association of Texas Professional Educators was receiving questions from teachers about the meaning of the bill: “A biology teacher asked if they should give equal time to creationism and evolution.”

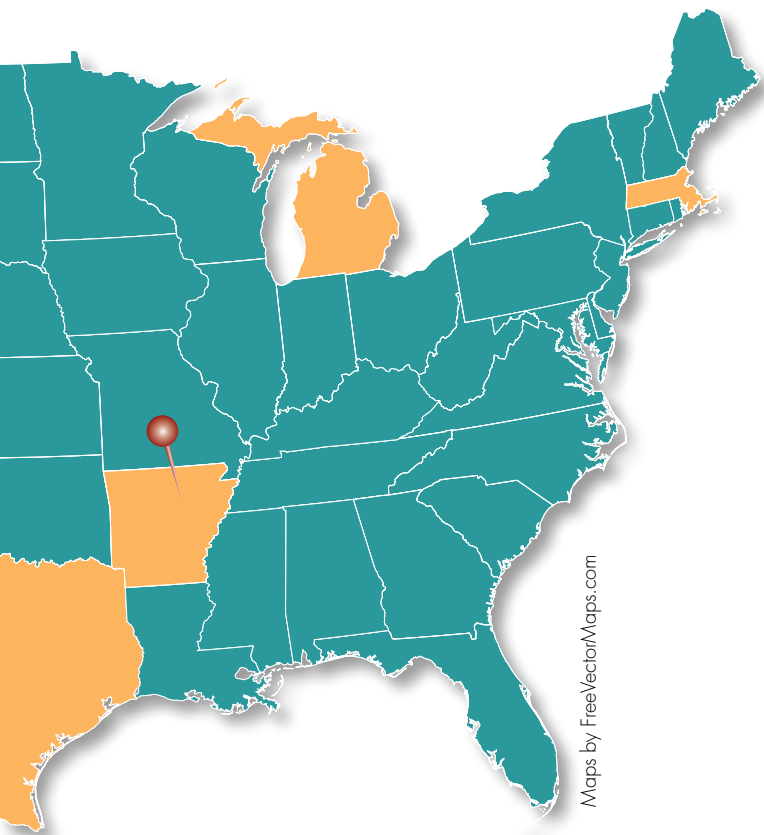
TEXAS

The Texas state board of education voted on December 1, 2021, to adopt revised state science standards for kindergarten through the eighth grade that include climate change at the eighth-grade level—but not as accurately and thoroughly as was hoped. The revised standards are not expected to be implemented until the 2024–2025 school year.

Although the revised standards recognize that climate is influenced by greenhouse gas emissions, they fail to convey forthrightly the fact that human activity is definitely responsible for recent climate change, owing to the board’s insistence on including the word “can” and excluding the phrase “over the last 150 years” in the relevant contexts. A proposed requirement that students learn about efforts to mitigate climate change, including by reducing greenhouse gas emissions, was previously removed at the suggestion of board member Will Hickman, a lawyer employed by Shell Oil.

Earlier in 2021 and in 2020, the board agreed to slight improvements in the treatment of climate change in the state science standards at the high school level for both required and elective courses, as NCSE previously reported. But there was a lot of room for improvement. In “Making the Grade?”—a 2020 report from NCSE and the Texas Freedom Network Education Fund—Texas was one of only six states to receive the grade of F for the treatment of climate change in its state science standards. In November 2021, dozens of Texas climate scientists called for improvements to the K–8 standards.

Reacting to the board’s vote on the K–8 standards, Val Benavidez of the Texas Freedom Network commented, “The progress we made on getting the state board to ensure that Texas schools teach students the full truth about climate change has been important, but that progress is uneven, not nearly enough.”



NCSE: The First 1.26 Gigaseconds



Photo by Wesley Esberry

Nick Matzke, left, and Eugenie Scott prepare for the *Kitzmiller v. Dover* federal trial.

If you were a high school biology teacher or a scientist and you learned that your state was starting to consider a law requiring teachers to teach something called creation science, what would you do? In the early 1980s, this was a pressing question for many. By 1981, 15 states had considered “equal time” for creation and evolution laws. Before long, the number rose to 26.

Stan Weinberg and Jack Friedman, former colleagues at the Bronx High School of Science, stepped up to the plate. In 1980, they enlisted scientists like Stephen Jay Gould, Niles Eldredge, and Isaac Asimov to join a scientist/teacher organization on the East Coast, and later recruited more teachers at the [National Science Teachers \(now Teaching\) Association](#) annual meeting to try to stem the tide by forming similar groups around the country. These were dubbed the Committees of Correspondence, a term borrowed from the Revolutionary War, by Wayne Moyer, the executive director of the [National Association of Biology Teachers](#), who was central to all of these efforts.

By 1981, 15 states had considered “equal time” for creation and evolution laws. Before long, the number rose to 26.

Weinberg continued building up the network across the country, with the help of NABT, the NSTA, and the [National Association of Geology Teachers](#), as well as scientific societies such as the [American Institute for Biological Sciences](#), the [American Association of Physical \(now Biological\) Anthropologists](#), and the [American Geophysical Union](#), which helped publicize the Committees of Correspondence to their members. When scientists would ask Weinberg, “Where is my group?” he often replied, “Congratulations. You’re in charge of forming it!”

In October 1981, two important meetings to organize resistance to the creationist onslaught were held back-to-back. [The National Academy of Sciences](#) hosted a meeting of representatives of scientific organizations and eminent scientists, and the next day NABT held a broader meeting, including educators, scientists, members of the clergy, and representatives of the legal community. Everyone was eagerly awaiting a decision from the first trial over the constitutionality of teaching creation science in the public schools, [McLean v. Arkansas](#). Whatever the outcome, it was assumed that more trials would follow.

At both of those meetings, Weinberg argued that the decentralized nature of American education required a grass-roots approach such as the Committees of Correspondence. But, Weinberg and Moyer contended, they would need not only expansion but also coordination beyond what NABT and Weinberg himself could provide. Thus it was agreed to found a national organization. A pivotal meeting was held at the AAAS meeting in January 1982 to discuss the

structure of such an organization. Work began immediately to draw up documents and form a board for what would be called the National Center for Science Education. NCSE was incorporated and attained status as a 501(c)3 nonprofit in 1983; Weinberg set about raising money; and finally, in November 1986, there was enough money to hire the first executive director of NCSE.

That would be me.

Almost immediately, in 1987, NCSE became involved, albeit in a minor way, in a federal district court case, [Webster v. New Lenox School District](#). NCSE would later play a role in a number of court cases involving evolution education: [Peloza v. Capistrano USD](#), [LeVake v. ISD 656](#), [Selman v. Cobb County](#), [Hurst v. Newman](#), and, of course, [Kitzmiller v. Dover](#), in which NCSE advised the plaintiffs' legal team and recruited its expert witnesses.

Perhaps NCSE's most important role during the early decades was advising parents, teachers, and other citizens trying to oppose policies that compromised the integrity of science education in their local schools. Most of the help was behind the scenes. Probably the first major "flare-up" (as they are known in-house) was the controversy over a creationism policy in Vista, California. But the longest-lasting flare-up, from 1998 to 2005, was the Kansas "evolution wars," during which NCSE worked closely with Kansas Citizens for Science—a descendent of a Committee of Correspondence—to reverse a series of creationist-friendly revisions to the state science standards.

NCSE was—and remains—the clearinghouse for information on the creationism/evolution controversy. Teachers struggling against pressure to include creationism or exclude evolution, parents concerned

about efforts to compromise the teaching of science, reporters trying to write stories on a hot subject they knew little about—all have learned that at NCSE they could find information on all aspects of the issue: scientific, pedagogical, religious, and legal. NCSE worked closely with teachers to help them teach evolution more effectively.

NCSE was—and remains—the clearinghouse for information on the creationism/evolution controversy.

But although resisting the creationist threat was the impetus for NCSE, the organization was intended from the beginning to be more than—as one of our opponents snidely suggested—"the National Center for Selling Evolution." The name was chosen because it would allow the opportunity to address other science education issues after the creationism issue dissipated. Well, that didn't happen, but nevertheless NCSE branched out to helping teachers and other citizens resist not only anti-evolutionism but also efforts to compromise the teaching of climate change, and science denial in general. From the beginning, NCSE sought to educate the public through improving the teaching of science and of science as a way of knowing.

That history reverberates today through NCSE. As the website proclaims:

- [We support teachers](#)

- [We block threats to science education](#)
- [We investigate science education](#)

I have been delighted to see how NCSE has thrived and expanded since I retired in 2014. The Supporting Teachers program has blossomed through the [Teacher Ambassador initiative](#), the production of [high-quality classroom materials](#), and other efforts that improve the teaching of science. Recently, with so much misinformation on COVID-19 circulating, it was good to see [NCSE's series](#) explaining the relevant science—it helps that executive director Ann Reid spent a decade studying the 1918 influenza pandemic! The [monitoring](#) of anti-science efforts continues, and NCSE remains ready to advise and provide accurate information about the various forms of science denialism that continue to swirl around us. And I have been excited to see NCSE conducting its own [research](#) in the last few years: helping us understand what teachers know, what they're doing, and what they need to do better.

Forty years from now, what will NCSE be doing? I used to joke with staff that all nonprofits are attempting to work themselves out of existence: if the nonprofit succeeds, the problem is solved—the naked are clothed, the hungry are fed, peace and justice are proclaimed, or (in NCSE's case) science education is perfect. And then I'd joke that they shouldn't worry. So keep on [supporting NCSE](#) for the next 40 years as this fine organization continues to work hard to improve science education—because everyone deserves to engage with the evidence.

I'm very proud to have worked there.

Eugenie C. Scott was the executive director of NCSE from 1986 to 2014.



Kudos to NCSE's Teacher Ambassadors for Their Recent Accomplishments

Our teacher ambassadors are a stellar bunch, constantly going above and beyond to support student and teacher learning when it comes to evolution, climate change, and the nature of science. Their résumés overflow with teaching experience, leadership positions, and conference presentations. Not even a global pandemic could stop them from continuing to gain accolades. Here are some of their achievements over the past 12 months, along with projects they're currently involved with. I'm certain you'll be as impressed as I am.



Dave Amidon, LaFayette Junior-Senior High School, LaFayette, New York: Amidon attained National Board

Certification. His teaching was also the subject of a National Oceanographic and Atmospheric Administration article, and he was featured recently in *Reports of the National Center for Science Education* about NCSE's work collaborating to develop climate change visualizations.



Rebecca Brewer, Troy High School, Troy, Michigan: Brewer co-authored the 3rd high school edition of the textbook *Biology*

Now and the educator guide for the graphic novel *The Curie Society*. She was awarded the 2021 Science Teacher of the Year Award from the Detroit Science Fair and was recently selected as a BSCS teacher co-designer for the Climate Education Pathways curriculum. Brewer is also the author of an NCSE evolution lesson set, "The Origin of a Species: A Snake in the Grass," which will be released soon.



Jennifer Broo, Mariemont High School, Cincinnati, Ohio: Broo is writing guides for Advanced Placement biology units for a

textbook to be published titled *Biology for the AP Course*. She is also developing lessons in collaboration with the Florida Museum of Natural History at the University of Florida: "The Origin and Diversity of Armor in Girdled Lizards: A Case Study in Convergent Evolution" and (for AP environmental science) "Fishing in the Tropic."



Jason Carter, The Science House, Asheville, North Carolina: This past year, Carter has transitioned from classroom

teaching to serving as the assistant director for North Carolina State University's The Science House, Mountain Satellite Office. He was also named the North Carolina Science Teachers Association Region 8 Middle School Science Teacher of the Year, and he was chosen to be part of the first

cohort for North Carolina SEED (STEM Educators to Equity and Diversity) Fellows.



Andy Epton, Henry Ford Academy, Dearborn, Michigan: Epton led a presentation titled "Vulcan: Mercury's Contender for

First from the Sun" at the first Friday lecture series at his local planetarium. Epton is also developing an exhibit about geology and moon rocks at the Henry Ford Museum, which is attached to his school. And he was named a National Aeronautics and Space Administration Solar System Ambassador.



Tom Freeman, Esperanza High School, Anaheim, California: Since 2020, Freeman has been a member of the National Association of Biology Teachers' Board of Directors.

He was also a table leader at the 2021 AP Biology Exam Reading of student responses on the Advanced Placement Biology Exam; as table leader, Freeman answered questions from his group of teacher readers and helped settle discrepancies in scoring.



Jeff Grant, Downers Grove North High School, Downers Grove, Illinois: Grant received the National Association of Biology

Teachers Outstanding Biology Teacher for Illinois award for 2021. He is also currently developing with his class an experimental prairie, a project funded by the Illinois Department of Natural Resources. And he is putting his great artistic talents to use for NCSE by creating a collection of animal drawings for one of our evolution lesson sets.



Melissa Lau, Piedmont High School, Piedmont, Oklahoma: Lau was named to Oklahoma's State Department of Education Standards Review and Revision

Writing committee, working specifically on the high school physical science standards. She and her students were also featured in the recently published book *Miseducation: How Climate Change is Taught in America*. A veteran middle school science teacher,

Lau also recently survived her first semester teaching chemistry.



John Mead, St. Mark's School, Dallas, Texas: Mead became president of the Texas Association of Biology Teachers. He has also

been nominated for the Presidential Awards for Excellence in Math and Science Teaching for the state of Texas. Mead was also one of a handful of teachers who authored a chapter in the new Teacher Institute for Evolutionary Science book *On Teaching Evolution*.



Erica Thornhill, Southern Boone High School, Ashland, Missouri: Thornhill wrote a section for the *Biology Now* teacher resource

guide on best practices for teaching socially controversial topics in the classroom. The guide is expected to be published in June 2022. She is also joining the Missouri Scholars Academy as a faculty member leading a summer program for gifted rising juniors whom she will be teaching about the nature of science. Thornhill also received funding to take environmental science students on a trip down the Missouri River.



Blake Touchet, Lafayette Parish School District, Louisiana: Touchet transferred into the role of Science Master Teacher,

overseeing science curriculum and instruction for two high schools and two middle schools in his district. He is presenting a paper titled "Administrators' Perceptions of and Roles in Teaching Socially Controversial Science Topics" at the American Educational Research Association conference in April 2022 (and he plans to finish his doctoral dissertation by summer 2022). Touchet was also one of a handful of teachers who authored a chapter in the new Teacher Institute for Evolutionary Science book *On Teaching Evolution*.

Lin Andrews is NCSE's Director of Teacher Support. andrews@ncse.ngo





Bruce S. Grant, a long-time member of NCSE, is Emeritus Professor of Biology at the College

of William and Mary, where his research focused on evolutionary genetics. His book *Observing Evolution: Peppered Moths and the Discovery of Parallel Melanism* was published by the Johns Hopkins University Press in 2021. The interview has been edited for length and clarity.

Glenn Branch: You began your career as a geneticist working on fruit flies in the laboratory. How did you become interested in fieldwork on peppered moths?

Bruce S. Grant: My teaching assignments included evolution. Each year I explained natural selection with the example of industrial melanism: differential predation by insectivorous birds on moths having different degrees of dark pigmentation in environments affected by industrial atmospheric pollution resulted in darker moths; when the pollution was abated, the result was lighter moths. Yet there remained unresolved questions about the daytime settling behavior of moths. The published experiment to settle a long-standing controversy on this was flawed. Each year, when I covered this topic, I grew ever more impatient that the crucial experiment was still

not done, and I complained insistently about this to a distinguished visitor to our campus. His response: “Why don’t you do it?” He had me there.

GB: Can you sketch your contribution to the controversy about the mechanism by which peppered moths choose their daytime hiding places?

BSG: Research with various moth species demonstrated that light reflectance from surfaces of potential resting sites is a factor in the choices they make. In general, dark species show a statistical bias for settling on dark backgrounds, whereas pale species tend to hide on lighter backgrounds. Peppered moths, at some locations, are polymorphic, with some individuals pale (speckled), and some solid black (melanic). What do they do when offered light and dark places to hide? Preliminary experiments reported morph-specific rest-site selection in which the melanic moths tended to settle on dark backgrounds, and the speckled moths tended to choose pale rest sites. Individuals in polymorphic populations must figuratively ask themselves, “Which color am I?” H. B. D. Kettlewell, a pioneer in this field, suggested that individual moths answer that question by self-inspection, comparing what they see to the reflectance of the substrate they have landed on. If they match well enough, the moth settles there, but if they don’t match the substrate, they move on, in search of a more suitable surface. He called this mecha-

nism “contrast/conflict.” But he never tested it. It remained pure speculation. Years later, T. D. Sargent attempted to test Kettlewell’s hypothesis. He concluded that the moths did not use contrast/conflict, and suggested that background choices by moths reflected genetic differences. Unfortunately, his experiment was fundamentally flawed. It was my intention to resolve the controversy by doing the crucial experiments. I have described this work in considerable detail—but rather than issue a spoiler alert, I invite readers of this interview to become readers of my book.

GB: What is the “parallel melanism” of your book’s subtitle, and what does it add to the significance of the peppered moth story?

BSG: “The parallel evolution of melanism” was shortened for the subtitle to “parallel melanism.” The emphasis should be on *parallel evolution*, and its significance to the peppered moth story is replication. The value of *replication* in experimental work is well-understood. Laboratory experiments in any scientific discipline require replications to demonstrate that a particular outcome was not simply a fluke or a chance occurrence. “Can you do it again?” one might ask. So lab scientists repeat their experiments multiple times. Replications producing the same results lend confidence to conclusions. But what about observations in nature? How does one replicate the conditions? The real world is not easy to control, as you might imagine. Our

discovery of the parallel rise and fall of melanism in peppered moth populations on separate continents under similar environmental circumstances serves as nature’s replicate experiment. What happened in Britain was not unique. It happened independently in North America, too.

GB: *To what extent would you say that industrial melanism in the peppered moth remains a useful illustration of evolution in action?*

BSG: Although there are numerous examples of natural selection from the wild in addition to the melanic evolution in peppered moths, few can be observed so directly as they happen, and of these, none are as thoroughly documented or as well-understood, including the genetic analysis of the character, the documented repeated occurrences, and the painstaking identification of the proximal agent. Industrial melanism is also easy to comprehend, whether presented in outline



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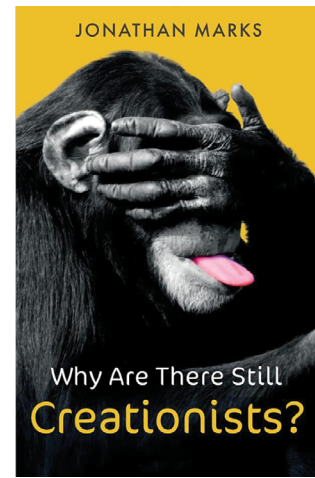
or in extensive detail. With the inclusion of more recent work since its first introduction as the classic “textbook” example of natural selection, the evolution of melanism in peppered moths is an even better example today.

GB: *Although you’re aware of dishonest criticisms of scientific work on the peppered moths, you decline to address them in your book. Could you say a bit about that decision?*

BSG: Debating people who make arguments not based on demonstrable evidence, or who intentionally distort evidence, was not the purpose of this book. I’ve engaged in those battles elsewhere, and provided references in *Observing Evolution*. I would also recommend a very thorough treatment by Barbara Forrest and Paul R. Gross in their book *Creationism’s Trojan Horse: The Wedge of Intelligent Design* (Oxford University Press, 2004). But let me add that it is an essential component of science that all claims are subject to intense scrutiny. Industrial melanism is no exception. Every conclusion must be supported by evidence, and we must be prepared to amend our conclusions in light of new evidence. Our conclusions are always conditional and subject to change. This is not a weakness of science; it is its strength. But we don’t settle issues through endless debate, or worse, by deliberately misrepresenting evidence.



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



Anthropologist Jonathan Marks has written extensively about science, considering in his work mainly the social and political issues related to human origins, human diversity, the construction of race as a biological category, and evolutionary theories. In this book, Marks continues in this trajectory by juxtaposing the stories of ancestry in science and religion and the myths of both.

In the debate between Darwinism and creationism (the view that the first book of the Bible—Genesis—is a literal book of facts regarding the origin of the universe), Marks is very clear about where he stands. He is not in the business of dismissing creationism as an anti-science movement, the product of archaic ignorance. Yet he makes it clear that neither does he belong to the party of Richard Dawkins, which passionately defends the notion that science is inherently atheistic, the answer for every mystery. Rather, he positions himself as an agnostic, who capitalizes “Him” in reference to God, as he explains, “out of politeness and custom” (page xi). In fact, Marks thinks that the question of God’s existence has no relevance for the debate over origins. He finds it difficult to believe that supernatural beings exist, but he would not mind if they did. “The only beings that I am aware of interacting

THE RNCSE REVIEW

Why Are There Still Creationists?

author: **Jonathan Marks**

publisher: **Polity Press**

reviewed by: **Larissa Carneiro**

with are the ones inhabiting the natural realm, not the supernatural" (page xi). But he does not appreciate the narrow view of creationists who endorse the idea that evolutionary biology and geology are systematically wrong, that humans were specially created by God, and that the bulk of the geological formations we see today are the product of either the divine six-day creation or Noah's mythical flood, as briefly and contradictorily described in the Bible.

Although a book about theories of ancestry, [*Why Are There Still Creationists?*](#) is also a book about contemporary America. First, because the type of creationism that Marks describes (young-earth creationism) exists almost only among fundamentalist Protestant Christians in the United States. As reflected in Pope John Paul II's 1996 address to the Pontifical Academy of Science, "Truth Cannot Contradict Truth," Roman Catholicism is officially at peace with the theory of evolution. In this address, the Pope formally acknowledged the idea that evolution and the divine were complementary realities, allowing that evolution can coexist with Catholic doctrine. Second, when discussing evolution and creationism, Marks writes about the situation of America today: an age when the American public witnessed

the Capitol being invaded by what looked like a horde of barbarians; when scientific knowledge about a deadly global pandemic, the efficacy of vaccines, and global warming have been bluntly rejected in favor of patently ludicrous beliefs and conspiracy theories; and when white evangelicals avow racist rhetoric and policies that seem incompatible with the vaunt-

Although a
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*Why Are There
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ed values of Christianity. Against this complex backdrop, rife with the distrust of science, Marks aims to answer the question posed in the title of his book.

In order to do so, Marks divides his book into six chapters: "Introducing the Ancestors," "Scientific Stories of Our Ancestors," "Attacking Evolution," "Biblical Literalism and Rationalism," "Myths of Science and Religion," and "Sacred Ancestry." Throughout the book, Marks does not promote the belief that science is the promised and enlightened ultimate stage of human civilization. In fact, consistent with his body of work, he acknowledges the historical misuse of Darwinism: the supposed scientific rationale for eugenics,

race and gender superiority, and, consequently, colonialism. Marks shields neither science nor religion from their own missteps. He writes, "Not taking evolution seriously is bad, but taking evolution too seriously is also bad" (page 88).

Marks does not think that more science is the antidote for creationism. Creationism is not the opposite of evolution. It is more properly understood as a theological stance on how to interpret the Bible than as a strictly anti-science discourse. Creationists, according to Marks, "are reactionary, not primitive. They have adopted an extreme theology in face of rationalist narratives about who we are and where we came from. Their theology is consequently what defines them, not their approach to science" (page 93).

Such a book about young-earth creationism, its beliefs, and its social and political implications in American life is both welcome and relevant today. This book deserves attention from anyone who wants to understand better what is going on in the United States. The prose is very accessible and clearly written, and permeated with Marks's characteristic sardonic wit. *Why Are There Still Creationists?* will appeal to a large audience beyond the academy but may also be used to good effect in undergraduate and graduate classrooms.

Larissa Carneiro is an instructor in the Department of Religious Studies at Duke University. Her scholarship focuses on the intersection of religion, technology, and science, exploring how scientific and technological progress have affected religious practices, discourses, and beliefs and vice versa. larissa.carneiro@duke.edu



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