

reports

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NCSE goes to Washington...

and RNCSE goes fully digital



NCSE GOES TO WASHINGTON

p. 3

THE GROWTH AND DEVELOPMENT OF RNCSE

p. 5

RANDOM SAMPLES ... WITH NEILL W. POGUE

p. 10

RNCSE REVIEW: THE FAILURES OF MATHEMATICAL ANTI-EVOLUTIONISM

p. 13

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Dear NCSE Supporters,

As 2022 comes to an end, I feel so grateful that you have walked alongside NCSE through the long years of the COVID-19 pandemic. You've been with us as we reimagined our teacher support program despite closed schools and remote learning, developed a set of lessons to address the nature of science as the public struggled with making sense of breaking science news, and found ways to support evolution and climate change education at a time when political polarization, disruption to our educational system, and uncertainty about the future were at all-time highs.

We made it! And we did it together. All of us at NCSE are so very thankful for your ongoing support of our mission.

Our plans for 2023 are ambitious. We have created and tested a spectacular set of lessons on evolution, climate change, and the nature of science, with the help of a formidable team of teachers across the country, supported by a committed staff that will now be working to introduce our resources to teachers everywhere. For years, we've been building a program that will help teachers who currently lack the confidence or content knowledge to teach evolution and climate change with confidence, and now all the pieces are in place.

We also intend to continue our unique research into what is actually going on in America's classrooms, this time with a survey aimed at discovering what teachers tell their students about the nature of science. As with our surveys on evolution and climate change, the results will be of wide general interest, helping NCSE continue to be the go-to source on how teachers navigate challenging topics, as well as informing to our own programs.

And, of course, we will continue our 40-year commitment to ensuring that no effort to interfere with the integrity of the science classroom goes unnoticed or unchallenged. The last year has seen numerous misguided efforts across the country to ban books and constrain how teachers talk about certain topics. If evolution and climate change begin to come under fire, as they have in previous similar campaigns, NCSE will be there to help local science advocates take action.

There is one thing, however, that we have decided to stop doing: printing NCSE's quarterly publication *Reports of the National Center for Science Education (RNCSE)*. We will continue to produce *RNCSE* and post it on our website, but we will no longer be mailing physical copies. I know that this decision may come as a disappointment to some, but the economic and environmental costs have simply increased to the point that a print publication can no longer be justified. As Andrew J. Petto (a long-time editor of *RNCSE*) observes in his history on p. 5, *RNCSE* has undergone many changes over the years as the challenges NCSE faces, and the technologies available to address them, have evolved. This is one more chapter in that story.

We plan to notify all our supporters by email each quarter when the new issue of *RNCSE* is posted. If we do not have your email address, and you'd like to be notified, please send your email address to media@ncse.ngo, with "Email me about *RNCSE*" in the subject line. And you can always find every issue of *RNCSE* at <https://ncse.ngo/rncse>.

Thanks again for helping NCSE thrive during a tough time. We appreciate each of you and wish you the very best in 2023.



Ann Reid is executive director of NCSE. reid@ncse.ngo





K-12 Science Education: Is it the best or the worst of times?

Ann Reid

NCSE GOES TO WASHINGTON

Despite the prominence of the word “National” in NCSE’s name, we spend relatively little time in our nation’s capital. After all, K–12 science education is not only delivered, but also largely managed and regulated, at the local level, so we focus on teachers, districts, and states, not national policymakers.

But there are exceptions!

I have served for the last five years on the American Association for the Advancement of Science (AAAS) Committee on Science, Engineering and Public Policy (COSEPP). (It wouldn’t be Washington if there weren’t lots of acronyms!) COSEPP is composed of experts on topics ranging from the national security implications of scientific and technological research, through how research funding can be more efficiently and equitably distributed, to the potential ethical and privacy impacts of new technologies. The overall role of the committee is to advise the AAAS—the nation’s largest scientific professional society, with over 120,000 members—on policy issues. To that end, it has organized an annual forum on science and technology policy for the last 47 years. The forum is attended by hundreds of science policymakers, representing federal agencies, congressional offices, think tanks, media organizations, and advocacy groups, in Washington DC and beyond.

While my COSEPP colleagues all understand the importance of K–12 science education, and appreciate NCSE’s long-time role in defending the integrity of the science classroom, K–12 science education never seemed like a great fit for the national-policy-focused Science and Technology Policy Forum.

Nevertheless, for the past several years, I consistently urged to my COSEPP colleagues that the issue of K–12

science education deserved more attention. (It’s possible that I was just the teensiest bit obsessive about the subject.) Finally, COSEPP this year invited me to put my money where my mouth is and take responsibility for organizing a half-day session at the 2022 forum. Furthermore, they invited me to give the keynote address.

I really had one big idea in mind. I wanted to push back on the suggestion you are most likely to hear from virtually any scientist or policymaker when asked how to improve K–12 science education, which is: “Science teachers should do a better job teaching science.” (There are a number of variations on this theme: teachers should avoid

assignments that involve rote memorization, they shouldn’t just teach to the test, they should provide more hands-on activities, etc. You get the idea.) The implication is that the problem is with science teachers and that the solution is to tell them what to do.

Well, at NCSE, we know that just telling teachers to do better is not a solution. Teachers are embedded within complex systems of state policies, standards, and testing systems that greatly constrain their

options. The complexity of the systems in which teachers are embedded is the main theme I wanted to convey during our session.

When I first started at NCSE, I labored under the same misconception that the solution is to tell science teachers to do better. What I realized is that if we really want teachers to cover evolution and climate change better, they need support: support both to gain mastery of the content and to learn how to address misconceptions that students bring into the classroom. That’s why we now provide professional development that gives teachers not only a solid grounding in the science of evolution and

The complexity of the systems in which teachers are embedded is the main theme I wanted to convey during our session.

climate change but also sets of lessons they can use in their classrooms that allow students to overcome their misconceptions about the topics. So I decided to share NCSE's approach with the forum audience of policymakers. But rather than simply delivering a talk about it, I took the opportunity to use the same methods we recommend for teachers with the audience. Which is to say that I, along with NCSE's amazing teacher support staff and teacher ambassadors, sought to engage the audience with the evidence about K–12 science teaching in order to dismantle their misconceptions about it, especially the idea that the solution is just to tell science teachers to do better

We tackled this misconception in three steps.

First, in my keynote address, I invited the audience to consider the ample evidence that the science teaching research community has amassed about the best way to teach science. Effective science teaching should help students acquire content knowledge not through memorization and lecture, but by asking questions, gathering evidence using the techniques scientists use, discussing their findings, and asking more questions. Furthermore, students should be encouraged to recognize concepts that recur in science such as patterns, cause and effect, and the interrelationship of structure and function.

The science education research community has not only demonstrated the effectiveness of this approach, it has succeeded in enshrining these principles in a model set of science standards—the Next Generation Science Standards—that have been adopted by 20 states (plus the District of Columbia). (A further 25 states have adopted state science standards that are based on the same fundamental pedagogical practices.)

That's the good news. We know how to do science education right, and the standards are in place to support it.

Sadly, I then had to share the bad news. Powerful as it is, teaching in accordance with the NGSS framework is hard! It requires most teachers to radically rethink how they teach and totally overhaul their beloved lesson plans.

It should be clear that teachers simply cannot be expected to make all those changes without significant profes-

sional development, extra preparation time, a robust supply budget, and ongoing mentorship. At present, few states provide the resources to make that happen. Even more discouragingly, this approach to teaching science is not consistently being taught to pre-service science teachers.

Resources are lacking, but so are incentives. Once teachers have mastered the new approach, they are not paid more or promoted more quickly. By the same token, teachers who stick to the old ways face no consequences so long as their students continue to do well on standardized tests, which generally reward rote learning.

In my keynote address, I did my best to describe what great science teaching looks like, but we all know that the best way to learn is to experience, so after my presentation, we prepared to knock the audience off their feet.

In the second step, we split the audience into three groups, dispatched them to separate makeshift classrooms, and allowed them to experience great science teaching there and then. Two of our staff members, Lin Andrews and Blake Touchet, paired up with four [NCSE Teacher Ambassadors](#)—David Amidon, Jennifer Broo, Jeff Grant, and Melissa Lau—to guide these national policymakers through an evolution, climate change, or nature of science lesson,

each designed to correct a common misconception. With hands-on activities—rolling dice, measuring skulls, or comparing DNA sequences—the participants learned a lot of science while having a lot of fun.

As a result, there was quite a buzz when the audience reconvened in the auditorium for the third step in our program: a panel discussion of the obstacles facing science teachers. Both Lin Andrews and Melissa Lau participated in the panel, and I think that by the end of the conversation, everyone in the room had a much more nuanced understanding of how dedicated science teachers are and how simply being told to do better doesn't begin to address the obstacles that stand in the way of great K–12 science education.

I hope that NCSE's moment in the sun in the nation's capital helped these policymakers understand what we need to do to help teachers do better. The extreme

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...

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A panel to discuss the challenges science teachers face.
Photo courtesy of the American Association for the Advancement of Science

decentralization of our education system forestalls any simple national fix, but we offered some examples of programs that could be enacted at the federal level that might help. Funding of professional development to help current teachers improve their classroom techniques could be considerably expanded, for example. Similarly, it would be great for there to be more funding of scholarships for college students willing to double-major in a science discipline and education, and also provide these students with the opportunity to be mentored by a master

teacher during their first few years of teaching—a practice that has been demonstrated to improve both teaching skill and retention in the field.

While organizing this session, I was vividly reminded of how rarely teachers are actually at the table when decisions about education are being made. It's not hard to understand why—they're busy teaching! (Taking time away from the classroom is challenging: there's a lot of material to cover in a school year and it's a lot of extra work to prepare a substitute so that the students don't fall behind. But I hope that by bringing such a stellar group of teachers (not to mention our own staff members, who only recently left the classroom) to Washington DC, NCSE will have convinced a lot of national policymakers that it's time to move beyond the idea that the problem with science education is the teachers and instead embrace the notion that teachers are a big part of the solution.

Ann Reid is executive director of NCSE. reid@ncse.ngo



The Growth and Development of Reports of the National Center for Science Education

Editor's Note: This issue represents the last print version of *RNCSE*, though it will continue to be available online at ncse.ngo/rnsce. With that in mind, we asked Andrew J. Petto, *RNCSE*'s longest-serving editor, to reflect on the history of the publication.

NCSE BEGINNINGS

NCSE has always relied on local activists for information, action, and insights, so maintaining strong communications among all those who share the same goals for promoting, preserving, and defending the integrity of science education has always been an essential function of the organization. Assisting local activists in their encounters with opposition to evolution education required state-of-the-art two-way communications. NCSE needed to hear from activists and others with an interest in science education (such as teachers, administrators, legislators, parents, and students), and also needed to be able to share with them important information.

When NCSE began operations in the early 1980s, the state of the art for rapid communication was the telephone, though the fax machine had recently achieved technical standardization. Internet communications were just becoming

available in some locations, particularly universities and government agencies. So the new organization needed a print organ, disseminated by mail, to reach most of its members and fellow travelers with essential information, strategies, and contacts for defending and promoting evolution education.

NCSE Reports served these needs with a quarterly summary of news about evolution education in the U.S. (including so-called flare-ups), common creationist arguments and strategies for diluting evolution education and/or inserting creationism into the curriculum, reports from local activists, and encouragement from the (small) staff at NCSE. One of the most popular items was the Updates feature, in which NCSE staff reported on actions and initiatives at the local, state, and national level that aimed either to defeat or promote evolution education.

NCSE Reports served as a way to connect the staff to members all around the country. At the same time, there was a need for people to understand and analyze the arguments that creationists promoted, often as "scientific" alternatives to evolution. From 1980 to 1997, these arguments were discussed—sometimes by creationists themselves—in *Creation/Evolution Journal*, which also carried reviews of books by creationists and evolutionists writing about the creationism/evolution struggle (mostly) in the USA.

Insightful readers will have noticed that *CEJ* first appeared two years before the founding of NCSE. Indeed, it was originally published by the American Humanist Association in support of the work of the Committees of Correspondence and others opposing creationism in public school curricula. NCSE acquired *CEJ* and maintained it as a separate semiannual publication through 1996. *CEJ* was

where the technical and scientific details of models, arguments, and educational materials were detailed, while *NCSE Reports* continued its focus on news (legislation, curriculum proposals, court cases, successes—and failures—in defending and promoting evolution education in communities around the country.

During this time, email was becoming more widely available. Almost all colleges and universities had their own email domains by 1980 and commercial email providers emerged a few years later. By the early 1990s, many public school districts also had their own email services. Email provided new ways to send and receive information—asynchronously, so time zones and schedules did not matter. NCSE established its first email account in 1994 as another way to connect with its members and to provide resources, advice, and local allies quickly.

In 1996, NCSE launched its own website, where a lot of the information that used to be available only quarterly could now be disseminated rapidly and retained indefinitely. This was the beginning of a transition in which people could access essential information in real time rather than waiting for a quarterly publication to arrive in the mail.

Information provided to or from some of these contacts in email exchanges became the basis for articles in *NCSE Reports* on flare-ups and similar challenges to evolution education. Additionally, *NCSE Reports* still provided information about programs, resources, and personnel that were the core service of NCSE to its members and their communities.

By the early 1990s, the World Wide Web was born and became more

widely accessible. In 1996, NCSE launched its own website, where a lot of the information that used to be available only quarterly could now be disseminated rapidly and retained indefinitely. This was the beginning of a transition in which people could access essential information in real time rather than waiting for a quarterly publication to arrive in the mail.

RNCSE BEGINS

These changes in the ways that people communicated were a part of the foundation for the transition from *CEJ* and *NCSE Reports* as separate publications to the unified *Reports of the National Center for Science Education (RNCSE)*. The new bimonthly publication still contained the news items found in *NCSE Reports*—information about staff, programs, and resources provided by NCSE. It also published peer-reviewed articles and book reviews that examined specifics of creationist—including, later, “intelligent design”—models and claims.

The new format of *RNCSE* also allowed a different type of writing—reflections, commentaries, essays—that were not available to readers in the previous formats. These included the “members pages”: a four-page centerfold beginning with a one-page tear-off with useful information for members (for example, Randy Olson’s [“Ten \(eleven\) things evolutionists can do to improve communication”](#)). The new format also carried a regular series—People and Places by Randy Moore (for example, “Mary Anning: Fossil Hunter”)—that provided historical insights about the social history of evolution and evolution education. There were scholarly essays providing background on issues relevant to understanding science and how evolution integrated with research in other fields (for example, David Morrison’s “An astrobiological perspective on life’s origin”). There even were first-person essays about encounters with creationism in places like [Dinosaur Adventure Land](#) and the [Creation Museum](#).

In 2012, *RNCSE* began also carrying regular articles, news, and features

related to climate change. Although these seemed to some like a departure from NCSE’s traditional mission, it soon became clear that the need to support education and outreach in climate education was almost identical in many ways to the need in evolution education. NCSE applied its skills, resources, and experience to climate education, and *RNCSE* reflected those efforts in its pages.

CONTINUING EVOLUTION

NCSE Reports began accepting electronic submissions in 1995. As these became more common, *RNCSE* began using an electronic journal management system in 2011 to track submissions, revisions, and acceptances. This system also served as a platform for electronic publication through 2015. This is why certain issues of *RNCSE* appear as static PDFs of the journal instead of the individual articles retrievable from earlier and later volumes.

Beginning in 2016, *RNCSE* began publication in color and returned to a quarterly publication schedule. In addition, the journal went through a refocusing of its scope and breadth, essentially returning to the emphasis that began it all: news, resources, information about programs and staff, and other material focused on the organization and its work. By this time, the number of outlets and opportunities for critical examination of “scientific” claims and objections to evolution and climate science had grown, and become more accessible to the general public. *RNCSE* accordingly returned to its roots as a source of information about NCSE and its work.

Acknowledgments: Thanks to the NCSE staff (past and present)—and especially to Glenn Branch and Eugenie C. Scott—for providing information about events, dates, and programs at NCSE.

Andrew Petto is Distinguished Lecturer Emeritus at the University of Wisconsin–Milwaukee. He served as editor for *NCSE Reports*, *Creation/Evolution Journal*, and *Reports of the National Center for Science Education* from 1995 to 2014. He is the co-author with Alice Kehoe of a forthcoming book, *Humans: An Introduction to Four-Field Anthropology* (NY: Routledge, 2023).





Supporters in the SPOTLIGHT



Michael Beidler joined the Executive Council of the American Scientific Affiliation, a long-standing international network of Christians in the sciences, in April 2022; he will serve a three-year term. A retired officer in the U.S. Navy, Beidler is also president of the Washington DC chapter of the ASA.



NCSE's deputy director **Glenn Branch** and **Taner Edis** of Truman State University were among fourteen new Fellows of the Committee

for Skeptical Inquiry chosen for their outstanding contributions to science and skepticism, according to a February 1, 2022, announcement. They join former NCSE executive director **Eugenie C. Scott**, NCSE board members **Michael E. Mann**, **Kenneth R. Miller**, and **Naomi Oreskes**, and former NCSE board member **Barbara Forrest**.



Leslea Hlusko of the University of California, Berkeley, received the Gabriel W. Lasker Service Award for 2022 from the American Association of Biological Anthropologists. The award recognizes and honors individuals who have demonstrated a history of excellence in service to the association, its members, and/or the

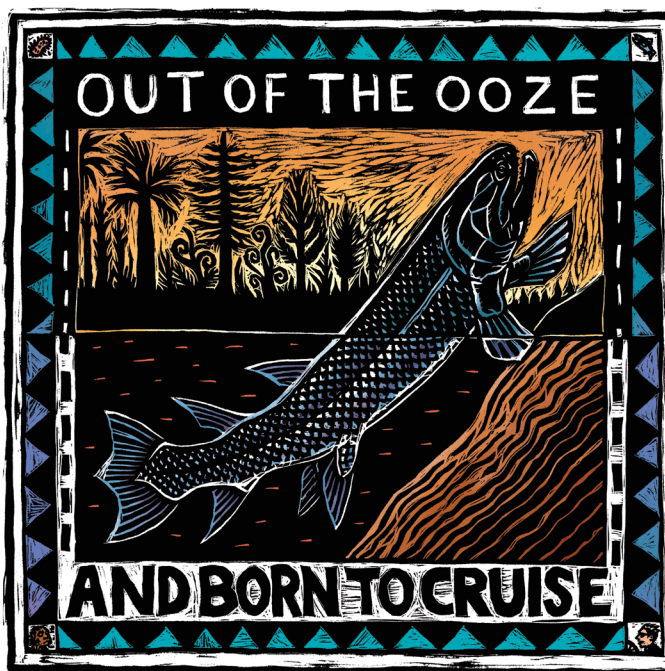
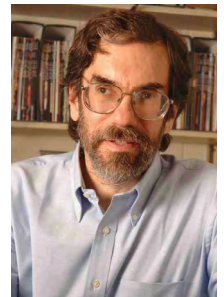
field of biological anthropology. NCSE's former executive director **Eugenie C. Scott** received the award in 2012.



NCSE is pleased to congratulate **Robert D. Holt**, Eminent Scholar and Arthur R. Marshall Jr. Chair in Ecological Studies in the Department of Biology, University of Florida, Gainesville, on his election to the National Academy of Sciences.

David Jablonski of the University of Chicago was awarded the Darwin–Wallace Medal for 2022 by the Linnean Society of London. According to the citation:

David Jablonski has been one of the most influential and innovative palaeobiologists: a leader in the use of large-scale data sets to investigate macroevolutionary pattern over diverse temporal scales and levels in taxonomic hierarchy. His contributions cover topics as diverse as the effect of larval ecology on evolution, causes of the latitudinal diversity gradient, determinants and consequences of geographic range size, the origin and fate of evolutionary novelties, species selection, and, of pressing relevance, the biology and evolutionary impact of mass extinctions. Working with organisms from molluscs to mammals he has demonstrated that morphologically defined genera are largely concordant with clades present in molecular phylogenies, with coherent macroecological properties (like geographic range and body size), and therefore valid and meaningful evolutionary units for analyses of both fossil and living organisms. He is a tireless advocate for palaeobiology, and, more broadly, evolutionary biology.



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.

CONNECTICUT

Connecticut's public schools are now legally mandated to include the teaching of climate change consistent with the Next Generation Science Standards. Although the latest bill to include such a mandate, House Bill 5285, died when the Connecticut legislature adjourned sine die on May 4, 2022, the relevant provision of the bill was included in the state budget, which was passed by both houses on May 3, 2022, and then signed by Governor Ned Lamont. Connecticut adopted the Next Generation Science Standards in 2015, but there were repeated attempts (including Senate Bill 345 and House Bill 5360 in 2018) to include climate change as a statutorily required topic of instruction. House Bill 5285 was introduced by the Committee on Education, with Bobby Gibson (D–District 15) listed as a cosponsor.



FLORIDA

In April 2022, the Florida state department of education rejected 54 of 132 mathematics textbooks under consideration for state adoption because they contained “prohibited topics” such as “references to Critical Race Theory (CRT), inclusions of Common Core, and the unsolicited addition of Social Emotional Learning (SEL) in mathematics.” Examining the reviews of the textbooks, the *Tampa Bay Times* observed that climate change was targeted too: the reviewer of a rejected high-school-level textbook complained that it had “multiple exercises regarding an argument between Al Gore and Rush Limbaugh. Within the text and questions, you can tell the author favors Al Gore and dislikes Rush Limbaugh based on questions.”



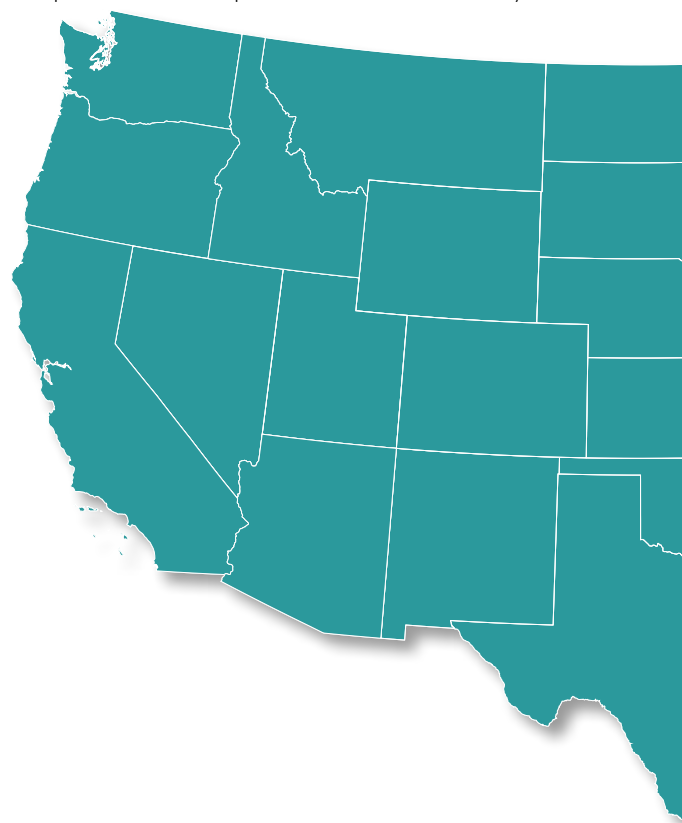
INDIANA

“The Indiana State Board of Education (SBOE) today approved new K–12 Indiana Academic Standards in science,” according to a June 8, 2022, press release from the Indiana Department of Education. The new standards “reflect similar content areas as Indiana’s previous 2016 standards, with an increased focus on supporting active student engagement in science learning.” There was visible improvement

with regard both to evolution and climate change. The old standards, adopted in 2016, received the grade of F for their treatment of evolution at the middle school level in a 2017 study by Bertha Vazquez published in *Evolution: Education and Outreach* and the grade of D for their treatment of climate change at the middle and high school level in “Making the Grade?”—the 2020 study by NCSE and the Texas Freedom Network Education Fund. In contrast, the treatment of evolution and climate change in the new standards is similar to the treatment of those topics in the Next Generation Science Standards, which have been adopted so far by twenty states (and the District of Columbia). The new standards moreover include two further Earth and Space Science standards relevant to climate change as well as a set of standards for high school environmental science.

RHODE ISLAND

Senate Bill 2039 and the identical House Bill 7275, introduced on January and February 2022, would have, if enacted, required the state department of education “to develop a set of key environmental, climate, and sustainability principles and concepts” and to take a variety of



steps to ensure that they are reflected in Rhode Island’s public schools. Of particular note, the bills called for the revision of the state science standards for science and social studies where appropriate, for guidance to be given of how to incorporate climate change into mathematics and English language arts, and for teacher professional development in science, civics, and social science to include the key principles and concepts. They died when the legislature adjourned in June 2022, having previously been “held for further study” in their respective committees. The bills were substantially similar to Senate Bill 464 and House Bill 5625 from 2021, both of which died in committee. Non-binding resolutions expressing the legislature’s support for increased climate education were introduced in 2019 and 2020 but died in committee.

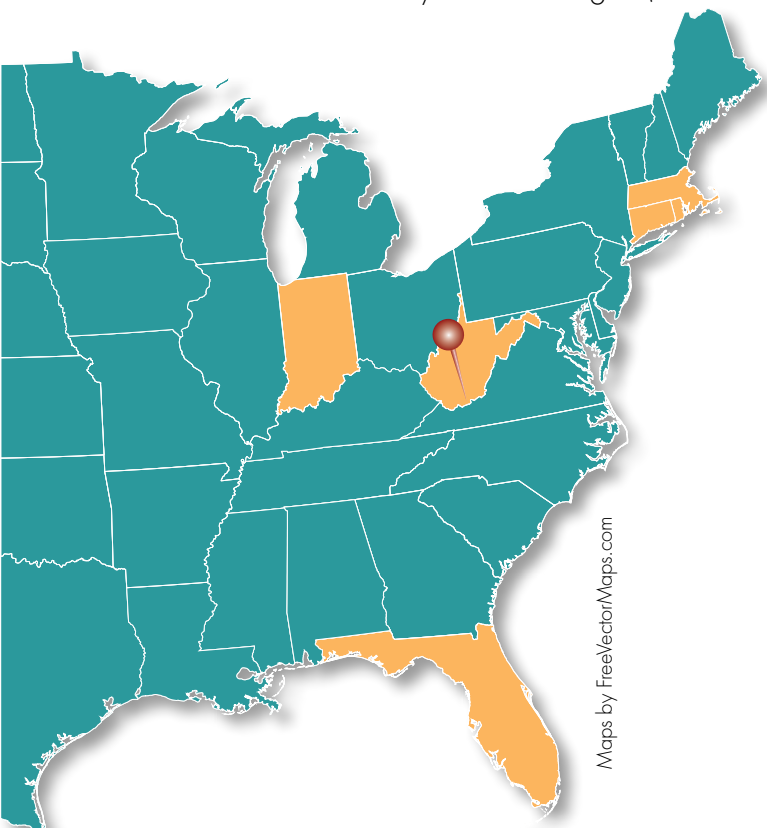
RHODE ISLAND

House Bill 7539, which contained a provision requiring that “History, literature, social science, and natural science topics shall be subject to critical analysis that requires all sides of the topic to be presented and explored,” died when the legislature adjourned in June 2022, having previously been “held for further study” in committee. Introduced by Patricia Morgan (R-District

26), House Bill 7539 was aimed primarily at preventing the teaching of what its sponsor described as “critical race theory”; it is unclear what, if any, “natural science topics” were contemplated.

WEST VIRGINIA, MERCER COUNTY

A settlement was reached in *Freedom from Religion Foundation and Doe v. Mercer County Board of Education et al.*, originally filed in 2017. The plaintiffs challenged the constitutionality of the Mercer County school system’s “Bible in the Schools” program, which, according to their complaint, included a lesson that “advocates for creationism and a belief that animals were created as stated in the bible rather than by natural processes.” The trial court granted the defendants’ motion to dismiss the case in 2017, but the decision was reversed on appeal and remanded back to the trial court. The school board then voted to end the program permanently. In the settlement, dated May 16, 2022, the school board agreed to pay \$225,000 to cover the plaintiffs’ costs and fees.



TURKEY

Adnan Oktar, the controversial Islamic creationist who publishes under the name Harun Yahya, was sentenced to serve a staggering 8568 years in prison for a long list of offenses on November 16, 2022. Oktar was previously convicted on a similar host of criminal charges in 2020 and sentenced to over 1075 years in prison, but in early 2022, a higher court ordered the retrial owing to procedural deficiencies in the original trial. Through his so-called Scientific Research Foundation (Bilim Araştırma Vakfı, or BAV), Oktar and his followers produced a steady stream of publications and audiovisual material aimed at dismissing evolution as baseless and pernicious.





Neill W. Pogue is Assistant Professor of Instruction at the University of Texas,

Dallas. His book [*The Nature of the Religious Right: The Struggle Between Conservative Evangelicals and the Environmental Movement*](#) (reviewed on p. 15) was published by Cornell University Press in 2022. The interview has been edited for length and clarity.

*Glenn Branch: How did you become interested in the struggle that you explore in *The Nature of the Religious Right*?*

Neill W. Pogue: As a new graduate student specializing in environmental history in 2009, I wanted to find an interesting thesis paper topic. As I read through the literature, it became apparent that quite a lot had been written about religious faith and the environment, but scant scholarship was dedicated to the relationship between the environment and white conservative evangelicals of the religious right. Prevalent scholarly thought was that religious right supporters either always opposed environmental efforts or ignored them—

until around the year 2000, when their leaders released official anti-environmental statements. As I started exploring the topic, I discovered that the community actually espoused environmentally friendly views even before the first Earth Day observance in 1970. This discovery led me to continue research, which ultimately led to the publication of this book.

GB: There was, you argue, a major shift among conservative evangelical attitudes toward the environment circa 1992. What was the shift, and what produced it?

NWP: Among the wider American populace, the environmental movement enjoyed a heightened level of attention in response to the 20th anniversary of Earth Day in 1990. Not to be left out, segments of the religious right movement wanted to energize others in their community to turn environmentally friendly philosophies into action. To counteract their efforts, secular conservative think tanks and special advocacy groups such as the John Birch Society produced anti-environmental information that specifically targeted human-caused global warming. They marshaled a host of arguments ranging from simple denial to conspiracy

theories that accused environmentalists of wanting to destroy the U.S. and start a one-world government. Such views gained a foothold among some in the religious right's leadership, who systematically stamped out the pro-environmental supporters using a strategy of misinformation and public ridicule.

*GB: To what extent would you agree with Robin Globus Veldman's thesis (in *The Gospel of Climate Skepticism*, reviewed in RNCSE 2020; 40(3):14–15) that theology is not the main factor driving the attitude of religious conservatives to environmental issues?*

NWP: Theology indeed only plays a contextual role in the religious right's anti-environmental views. This very point is underscored in my book's final chapters, which explore the experience of the Evangelical Environmental Network (EEN). This eco-friendly evangelical organization, which began in 1993, continues to encourage all Bible-believing evangelicals to save God's earth for explicitly theological reasons. The larger religious right community ignores this theology and clings to conspiracy theories connected to identity politics. There was a time, however, when even the wider

religious right community espoused views similar to what the EEN supports today.

GB: You document that the shift was visible also in the textbooks used in conservative evangelical K–12 education. Can you give a few examples?

NWP: From the 1970s until the late 1980s, home and Christian school textbooks promoted environmentally friendly views. As late as 1989, for example, one economics textbook warned that humanity should not abuse and destroy the earth in exchange for material wealth. In 1993, the same publisher released a science textbook that rejected virtually any popular eco-friendly effort, whether to counter pesticides, ozone depletion, acid rain, or global warming. At the top of the section on global warming, a poem read, “Roses are red, violets are blue / They both grow better with more CO₂.” In other words, more pollution in the form of carbon dioxide will be great plant food. This perspective was a direct repeat of what conservative think tanks were arguing at the time. Although the textbook arguments have changed over the years, their publishers continue to maintain that human-caused climate change is not happening. It needs to be realized that this misinformation is taught in

home and Christian school classrooms that serve over a million students a year.

GB: In your book, you seem to be a bit pessimistic about a conservative evangelical return to environmentalism. Does the National Evangelical Association’s recent “Loving the Least of These” report help to allay your gloom?

NWP: In previous drafts, I was even more pessimistic, but I gradually incorporated some positive elements in the final manuscript. After all, since the religious right’s environmental views transitioned from support to opposition due to non-theological reasons, they could change back again. For this to happen, however, the community would need to stop demonizing eco-friendly views. I speculate that this will be difficult owing to the current importance of identity politics. Nevertheless, I believe that even the most ardent religious right supporters would have a hard time justifying environmental opposition if they were aware that respected leaders in their very own community were serious about supporting eco-friendly initiatives until the early 1990s.

GB: What advice would you offer to people hoping to engage

constructively with conservative evangelicals on environmental issues, especially regarding climate change education?

NWP: I would advise them to read my book! *The Nature of the Religious Right* is not a hit piece vilifying conservative evangelicals. Instead, it offers a nuanced understanding of exactly how the views of their community evolved from the late 1960s to the present. Using the evidence offered in the book, a reader could constructively engage in conversation with religious right supporters to talk about the theological arguments for caring for God’s earth. Both conservative evangelicals and environmentalists can point to highly respected religious right leaders and followers who worked to motivate the wider community into environmental action in the early 1990s. If such information is communicated with honesty, empathy, respect, and understanding, perhaps bridges of communication can be built even in today’s highly polarized society to reach mutually beneficial solutions. This is why I dedicated the book to “conservative evangelicals and environmentalists.”

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TEACHER AMBASSADOR SPOTLIGHT:



Ericca Thornhill

At the National Center for Science Education, the Supporting Teachers team has the opportunity to work with amazing teachers across the United States who represent a wealth of knowledge and experience.

Among them are the NCSE Teacher Ambassadors, who go above and beyond what is required to teach science in today's educational system. In this issue, we're highlighting the work of Ericca Thornhill, a high school science teacher from Columbia, Missouri.

Thornhill has taught high school science for twenty-five years and is currently an instructor and science division chair at Mizzou Academy, an online/blended school embedded within the University of Missouri's College of Education and Human Development research program. Her work with NCSE began when she joined the Nature of Science teacher cohort assembled at Clemson University in the summer of 2019.

In the summer of 2022, Thornhill was a teacher at the Missouri Scholars Academy, a three-week student program offered at the University of Missouri for gifted students from across the state. The enrichment course she developed and taught there was based on the resources and pedagogy she helped NCSE develop while working with the Supporting Teachers program. Specifically, her course focused on helping stu-

dents overcome common misconceptions about science by engaging in evidence-based learning and reasoning, with three major areas of focus: (1) what is science, (2) what is pseudoscience, and (3) how to talk to science deniers that are often family or friends. As this was not a formal classroom situation, but more like a summer camp for dedicated students, there were plenty of field trips and special guest speakers as well!

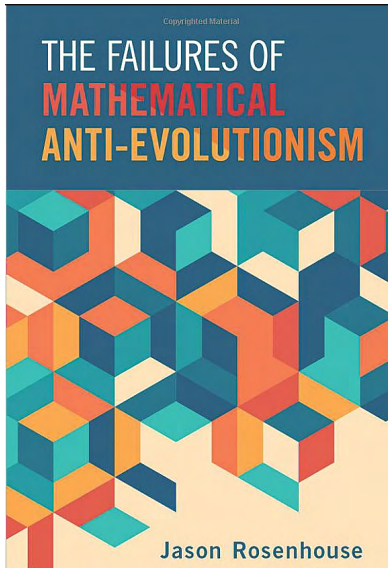
Recently, Thornhill shared many insights about her experience in teaching this new course. She pointed out that the opportunity to delve into the process of science helped to strengthen her students' critical thinking skills and ability to identify misinformation and pseudoscience readily. In fact, she was surprised at how excited her students became at analyzing logical fallacies, identifying cherry-picked data, and debunking conspiracy theories.

Thornhill was particularly impressed when her students had the opportunity to meet with a local meteorologist who they knew was a vocal and prolific climate change denier. The students adeptly used their new knowledge to challenge his arguments with evidence. They were surprised at the effectiveness of their efforts: he even went as far as to acknowledge that climate change was "probably" caused by human activity, although he quickly used

irrelevant data to change the subject. After the conversation ended, the students were eager to compare notes about every logical fallacy he used. They even spotted the irony that he invoked climate models to support his perspective despite having previously claimed that the unreliability of climate models means that anthropogenic climate change can't be definitively proved.

As part of the course, Thornhill invited NCSE Executive Director Ann Reid to speak with the students about engaging with science deniers through no-conflict approaches. "When I met with these students, I was struck by the quality of their questions and, perhaps even more importantly, their follow-up questions," Reid recalled. "Many of them wanted to know how to talk to friends or family members who reject well-established scientific conclusions. While they might have been hoping for a one-line zinger, I suggested that they needed to think about how to win those people's trust and respect before they could change their minds. The students immediately began strategizing about how to do that. It's a sign of a good teacher that the students have learned how to hear and test new ideas."

Through these kinds of experiences, Thornhill's students' critical thinking skills steadily progressed. Whenever possible, she included a variety of



THE *RNCSE* REVIEW

The Failures of Mathematical Anti-Evolutionism

author: Jason Rosenhouse
publisher: Cambridge University Press
reviewed by: David H. Bailey

Although modern science has uncovered a universe that is far vaster and more awe-inspiring than ever imagined before, some writers, mostly of the “creation science” and “intelligent design” schools, prefer instead to combat science, particularly on topics such as evolution that they regard as undermining traditional religious beliefs. One common line of argumentation is that certain biological structures are so unlikely, according to simple back-of-the-envelope reckonings based on probability or information theory, that they could never have been produced by a purely natural evolutionary process, even assuming millions or billions of years of

geologic time. Thus evolutionary theory must be false.

Biologists have never taken these writings seriously, mainly because the empirical evidence for evolution is so overwhelming. Mathematicians and statisticians have never taken these writings seriously, mainly because they have deemed them unworthy of detailed refutation. As a result, there has been a dearth of reliable, readable information on the topic.

Mathematician Jason Rosenhouse’s new book [The Failures of Mathematical Anti-Evolutionism](#) addresses this specific topic. Rosenhouse is very well qualified for the task. He has previ-

ously published *Among the Creationists: Dispatches from the Anti-Evolutionist Front Line* (2012), describing his experiences attending numerous creationist and intelligent design conferences. He has also published several books explaining various mathematical subjects, including the probability paradoxes surrounding the so-called Monty Hall problem, to a mainstream audience. His books clearly demonstrate a talent for science writing.

His new book respectfully but firmly explains why various anti-evolution arguments based on probability and information theory are without merit. Many of these are some variation of what Rosenhouse terms the “Basic Argument from Improbability”: (a) identify a complex biological structure; (b) model its evolution as a random selection from a large space of equally probable outcomes; (c) use elementary combinatorics to enumerate this space; and then assert that the resulting “probability” is too remote for the structure to have evolved.

As Rosenhouse observes, such arguments fall victim to several well-known fallacies. First of all, they presume that

the resources she helped develop, including several activities found in NCSE’s [Nature of Science lesson set plans](#). She reports that her students most enjoyed debunking pseudoscience examples, as seen in [“Science Can Make You Strong,”](#) and using the [FLICC](#) heuristic that helps to reveal the workings of science denial arguments, found in [“Science Is a Way of Knowing.”](#)

Asked why she felt a course like the one she developed for the Missouri Scholars Academy was so crucial in this current climate, Thornhill responded: “When you make decisions on anecdotal evidence instead of empirical evidence, it can do real harm. Critical decisions can be affected by bad data. It can harm our local communities and our nation as a whole.”

Ericca Thornhill embodies the type of teacher any parent would hope their students will encounter in a high school science classroom. NCSE is delighted to have the chance to shine a spotlight on the amazing work she is doing, both for NCSE and her students, every day.

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all outcomes are equally probable, which is utterly false in real-world biology: some structures are very likely to appear, while vast numbers of others are not biologically possible at all. Further, these arguments presume that the structure must have appeared via a single-shot “random” selection among all combinatorial possibilities, whereas real biological structures typically arise from a long string of earlier steps over the eons, each useful in an earlier context. Finally, these arguments ignore the crucial role of natural selection in efficiently finding a “path” through biological space.

In general, such arguments are dead ringers for the post-hoc probability fallacy, reckoning a probability after the fact and then claiming that the event could not have happened naturally. As Rosenhouse explains, we should not be surprised at a seemingly improbable outcome, because some outcome had to happen.

Rosenhouse illustrates this type of fallacious reasoning with the following story:

Suppose you and a friend are in the downtown area of a major American city, and you both decide you want a slice of pizza. You pick a direction and start walking. Within just two blocks you find a pizza parlor. Your friend now says, “Incredible! The surface of the Earth is

His new book respectfully but firmly explains why various anti-evolution arguments based on probability and information theory are without merit.

enormous, and almost none of it is covered with pizza parlors. Yet somehow we were able to find one of the few places on Earth that has a pizza parlor. How can you explain something so remarkable? (pp. 128–129)

As he explains, the surface area of the Earth is irrelevant because it was only necessary to search the tiny portion near their location, which, because it is in a major city, has numerous pizza parlors. Rosenhouse then points out that the Basic Argument from Improbability “is guilty of precisely the same oversights, except applied to protein space rather than to the surface of the Earth.” He adds that “the mathematical model on which the argument relies is far too unrealistic to produce meaningful results.”

Rosenhouse also addresses arguments based on information theory, entropy

and the Second Law of Thermodynamics. Although such arguments are superficially more sophisticated than probability arguments, in the end he finds them equally dubious—either they rely on intuitive lines of thinking that do not stand up to rigorous analysis, or else they feature profound-looking mathematical analyses, which, because they are based on deeply flawed idealistic models, are irrelevant.

Rosenhouse’s book is a major step forward, and will be greatly appreciated in the anticreationist community. But as Rosenhouse himself acknowledges, much remains to be done. For example, I would like to see even more exposition explaining to nonexpert readers why a remote probability figure, reckoned after-the-fact using a dubious model, is both unreliable and misleading. And it would be nice to see analysis of the sort offered in Rosenhouse’s book extended to even more specific examples that appear in the ever-expanding “creation science” and “intelligent design” literature. Hopefully his nicely crafted book will serve as a template for additional contributions in this arena.

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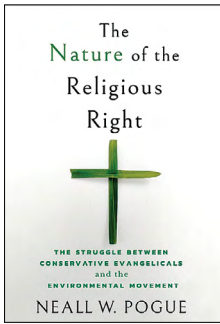


In a memoir posted on the Discovery Institute’s “Evolution News & Science Today” blog in

WHAT WE’RE UP AGAINST The Old Origin-of-Life Switcheroo

August 2022, Stephen C. Meyer recalled that “I had never really thought about where DNA—or the information it contained—came from in the first place,” adding, “On February 10, 1985,

I learned I wasn’t the only one. On that day I found myself sitting in front of eight world-class scientists, who were discussing the vexing scientific and philosophical question: How did the



The Nature of the Religious Right: The Struggle Between Conservative Evangelicals and the Environmental Movement

author: Neall W. Pogue

publisher: Cornell University Press

reviewed by: Glenn Branch

Around 1970, the year of the first Earth Day, conservative evangelicals in the United States were in general favorably disposed toward environmentalism, which they understood in terms of responsible human stewardship for God's creation. But then, alienated by a perceived hostility to Christianity in the environmentalist movement and preoccupied by different social issues, they tended to neglect the environmental cause. And after 1992, the year of Al Gore's *Earth in the Balance* and the United Nations Framework Convention on Climate Change, they were largely recruited to the cause of doubt and denial. Today less than a quarter of white evangelicals accept anthropogenic climate change. Neall W. Pogue's *The Nature of the Religious Right* is a valuable chronicle of the evangelical U-turn.

Of particular interest is Pogue's focus on the content of textbooks

aimed at students in conservative evangelical classrooms, especially those published by Bob Jones University Press and A Beka (later Abeka) Book. These were designed, he plausibly argues, to relay "common accepted truths" rather than "unsettled and contro-

Today less than a quarter of white evangelicals accept anthropogenic climate change.

versial debates among conservative evangelicals" (p. 63). Accordingly, science as well as history and social studies textbooks from these publishers shifted from reflecting a modicum of concern for the environment to disseminating doubt or even denial about the relevant sci-

ence. A case in point is the doggerel to be found in A Beka's 1993 high school textbook *Science: Order & Reality*: "Roses are red, violets are blue / They both grow better with more CO₂" (quoted on p. 129).

The Nature of the Religious Right also provides a helpful reminder that (in the words of chapter 7's title) "it could have taken a very different path." As Robin Globus Veldman emphasized in her *The Gospel of Climate Skepticism* (2019), it is not theology alone that drives evangelical anti-environmentalism. Pogue's examination of the relatively environment-friendly views of such figures of the evangelical establishment as Francis Schaefer, Pat Robertson, and Richard Land provides ample confirmation. Similarly, Pogue highlights the ongoing work of Katharine Hayhoe (a recipient of NCSE's Friend of the Planet award), Richard Cizik, and the Evangelical Environmental Network to counteract anti-environmentalism among evangelicals, but not with any great degree of optimism. Here's hoping that he's wrong!



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first life on earth arise?" As the biologist Joe Felsenstein observed on The Panda's Thumb blog, these are different questions: "there are well-known evolutionary processes that are capable

of putting adaptive information into the molecule by choosing particular bases at each site. They continue to happen long after the origin of life." If Meyer did not deliberately change the

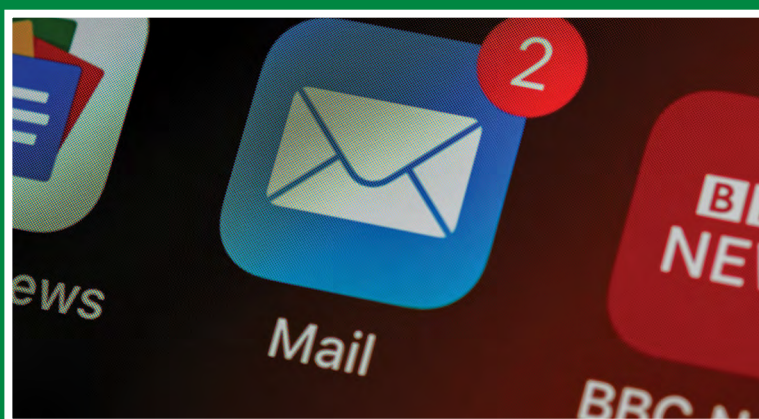
topic, Felsenstein added, "then he is giving a strong indication that he simply does not understand what the functional information in DNA is."

—GLENN BRANCH

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