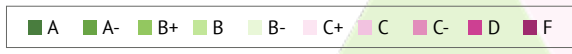
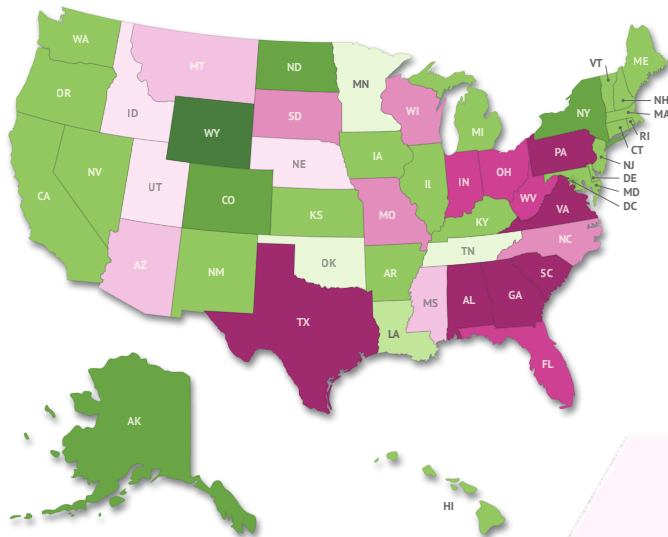


reports

OF THE NATIONAL CENTER FOR SCIENCE EDUCATION | SUMMER 2023 | VOLUME 43 | NO 3

A THREE-YEAR PROGRESS REPORT

“Making the Grade?”



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Dear NCSE Supporters,

Never underestimate the power of competitiveness. Or shame. Or both. When NCSE is working to encourage state legislators and boards of education to treat evolution and climate change thoroughly and accurately in their science standards, the best tactic is often simply to point out that other states are doing a better job of preparing their students for success in the workplace, college and beyond. “Making the Grade?”—a report on the treatment of climate change in state science standards, prepared by NCSE in collaboration with the Texas Freedom Network Education Fund in 2020—is an excellent example of how successful this strategy can be, and how that strategy can have lasting effects, three years along and counting. Read all about it on page 3.

Speaking of collaborations, NCSE has had a long and happy partnership with the University of California Museum of Paleontology (UCMP) and its Director of Education and Outreach, Lisa White. UCMP’s pioneering Understanding Evolution (which NCSE helped to develop) and Understanding Science websites are resources that we are proud to share with our teacher network. Enjoy our interview with White on page 6.

Just as we try to hold state decisionmakers accountable, we also seek opportunities to hold ourselves to the highest standards. We’ve been telling you for months about the amazing lesson sets we’ve developed so that teachers can provide their students with engaging activities to help them resolve misconceptions about evolution, climate change, or the nature of science. But how do we establish that these lessons really are of the highest quality? One way, which we’ve been implementing over the last two years, is to have teachers use them in their classrooms and provide us with feedback about how they work. Another is to ask reputable external reviewers to evaluate the lessons. In this issue, NCSE Director of Teacher Support Lin Andrews and Curriculum Specialist Cari Herndon describe how we’re working to earn a Next Generation Science Standards Design Badge for one of our evolution lesson sets. (p. 10).

The rest of 2023 will be busy—we just completed a weeklong Teacher Ambassador training workshop in June and we are launching a new national survey on nature of science teaching practices in the fall. More on both of those events in future issues of *RNCSE*.

We never forget that none of this would be possible without you, the incredibly loyal and generous supporters of NCSE. Thank you for your continued trust in us to achieve the mission we all care so much about.



Ann Reid is executive director of
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“Making the Grade?” A Three-Year Progress Report

■ A ■ A- ■ B+ ■ B ■ B- ■ C+ ■ C ■ C- ■ D ■ F

The headline of a [recent story](#) in *The Nation* declared, “Connecticut Will Require Public Schools to Teach Climate Change,” and asked, “Can More States Follow?” The story was of interest to NCSE not so much because of the topic—after Connecticut’s four-year struggle to enact a statutory requirement to teach climate change in accordance with the NGSS, it wasn’t news to us—as because of the invocation of [“Making the Grade? How State Public School Science Standards Address Climate Change,”](#) the 2020 report from the National Center for Science Education and the [Texas Freedom Network Education Fund](#) (TFNEF). As *The Nation* noted, the report gave “20 states a C+ or lower for how they addressed climate change in their science standards, with six—Alabama, Georgia, South Carolina, Pennsylvania, Texas, and Virginia—receiving an F.” Even after three years of sustained attention to the report, it was still gratifying to see that it was continuing to shape the discussion of climate change education.

When NCSE and TFNEF decided to assess state science education standards early in 2020, it was with a specific and limited purpose in mind: to educate Texas policymakers and stakeholders about the need to improve the treatment of climate change in Texas’s state science standards. The two organizations have a long history of working together to defend science education in the Lone Star State against ideological attack, both from the legislature and from the (elected) state board of education, so it was a natural fit. After designing a rubric, partly

based on Edward W. Maibach’s celebrated octosyllabic summary of climate change—it’s real; it’s us; it’s bad; there’s hope—NCSE and TFNEF recruited three Ph.D. scientists with varying specialties to evaluate the standards: Sarah Myhre, a climate scientist specializing in paleoecology; Steve Rissing, a retired evolutionary biologist; and Casey Williams, an educational psychologist specializing in climate change education.

During the summer of 2020, the reviewers independently evaluated each of the 31 sets of state science standards then in use, including the [Next Generation Science Standards](#), which are used in 20 states and the District of Columbia. They were asked to examine the middle school science standards and high school standards for biology, chemistry, physics, earth (or earth and space) sciences, and environmental sciences, since these are the standards for courses

in which climate change is most likely to be discussed and which students are most likely to take. With respect to each of Maibach’s four points, they assessed how extensively and explicitly climate change was discussed, how coherently and clearly climate change was incorporated in the standards, and how well the standards prepared students for further study in higher education and for responsible participation in civic deliberation about climate change. Overall grades for the states were calculated on a curve from a weighted average of the reviewers’ ratings.

When the “Making the Grade?” report was released, it instantly received coverage in Texas, thanks to the fact that the state science standards received the grade of

“Making the Grade? How State Public School Science Standards Address Climate Change” [was] the 2020 report from the National Center for Science Education and the Texas Freedom Network Education Fund

F, one of only six states to do so. There were stories in the [Houston Chronicle](#) and the [Dallas Morning News](#), to say nothing of a commentary piece, “[Texas shorting students in climate-crisis know-how](#),” by TFNEF’s Kathy Miller and NCSE’s Ann Reid in the *Waco Tribune-Herald*. Over the next few years, as Texas sporadically revised its state science standards, activists constantly brandished the ignominious grade in the service of arguing for improving the treatment of climate change. There were improvements, particularly in high school standards for Earth Systems Science and Environmental Sciences, although there were also missed opportunities for improvements, as when the state board of education insisted on language in the eighth-grade science standards that diluted the scientific accuracy of their treatment of climate change.

Outside Texas, there was immediately a modicum of national coverage, including a commentary by NCSE’s Ann Reid and TFNEF’s Val Benavidez in [Bulletin of the Atomic Scientists](#), as well as reports in local media outlets across the country focusing on the grade received by their states, including Virginia, Arizona, and Indiana. As in Texas, there was evidence that “Making the Grade?” helped to bolster the efforts of those seeking improvements in the treatment of climate change in their state science standards. For example, the report appeared just in time to encourage improvements in Indiana’s standards, which received a D; the treatment of climate change in the new set of standards adopted in 2022 is similar to, but a bit more expansive than, that of the Next Generation Science Standards, which received the grade of B+ in “Making the Grade?” I made a point of congratulating the Hoosier State on its achievement in a [commentary](#) published in the *Indianapolis Star*.

As *The Nation’s* story illustrates, “Making the Grade?” continues to be relevant. In addition to the media attention already mentioned, the report has been discussed in articles in the [Financial Times](#), the [Washington](#)

[Post](#), and [The New York Times](#). More surprisingly, it’s been repeatedly cited in the scholarly and teaching literature, and not just by NCSE staff. (Lin Andrews and I contributed a discussion of the report to the April 2021 issue of *In the Trenches*, a publication of the National Association of Geoscience Teachers.). “Making the Grade?” has surfaced in venues ranging from the predictable, such as a 2021 article entitled “It’s About Time: Perceived Barriers to In-Service Teacher Climate Change Professional Development,” to the unpredictable, such as a 2022 article entitled “Essential Strategies for School Nurses to Move Upstream in Support of Healthy Students and a Healthy Planet”—although, come to think of it, school nurses certainly have a role to play in climate change education!

Reflecting on the enduring influence of the “Making the Grade?” report, it seems fair to conclude that NCSE was in a uniquely good position to help evaluate the treatment of climate change in state science standards.

Thanks to our long-standing practice of cooperating and collaborating with local, state, and national organizations on matters of shared concern, it was easy for us to work together with TFNEF (which provided invaluable support to the project, including designing and maintaining the [climategrades.org](#) website), especially Dan Quinn there. Thanks to our network of concerned experts, it was easy for us to recruit Myhre, Rissing, and Williams as reviewers, for whose thoughtfulness we are indebted. Thanks to our dedicated, experienced, and enthusiastic staff, it was easy for us to design the study in such a way as to address the concerns of policymakers as well as to engage the interest of researchers. And all of this was made possible thanks to the support of people like you!

Reflecting on the enduring influence of the “Making the Grade?” report, it seems fair to conclude that NCSE was in a uniquely good position to help evaluate the treatment of climate change in state science standards.

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



Selected Scholarly Citations of “Making the Grade?”

- Ansari RA, Landin JM (2022). [Coverage of climate change in introductory biology textbooks, 1970–2019](#). *PLoS ONE* 7(12): e0278532.
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- Reiner KL, Haas-Howard C (2022). [Essential strategies for school nurses to move upstream in support of healthy students and a healthy planet](#). *NASN School Nurse* 37(4):217–222.
- Sims RJ, Tallapragada M, Payton TG, Noonan K, Prosser KL, Childress MJ (2021). [University experiences of marine science research and outreach beyond the classroom](#). *Integrative and Comparative Biology* 61(3):1078–1088.

Selected Press Coverage of “Making the Grade?”

Houston Chronicle

[Education watchdogs give Texas an “F” for its climate change curriculum](#)

The Dallas Morning News

[Texas earns an ‘F’ in how it teaches students about climate change, groups say](#)

Yale Climate Connections

[Many states get poor grades on their climate education standards](#)

UK National Association for Environmental Education

[How well is climate change addressed in schools?](#)

The Philadelphia Inquirer

[Amid climate change crisis, Pa.’s science curriculum falls short](#)

Financial Times

[Schools face calls to boost environmental teaching](#)

The New York Times

[Many States Omit Climate Education. These Teachers Are Trying to Slip It In.](#)

Washington Post

[In one state, every class teaches climate change—even P.E.](#)

E&E News

[Texas officials target climate science in textbooks](#)

The Nation

[Connecticut Will Require Public Schools to Teach Climate Change. Can More States Follow?](#)



Lisa White is Director of Education and Outreach at the [University of California Museum of Paleontology \(UCMP\)](#), where she helmed the development of the [Understanding Evolution website](#) (with support from NCSE) and the [Understanding Science website](#). In 2022 she received the Society for the Study of Evolution's Stephen Jay Gould Award as well as NCSE's [Friend of Darwin award](#). The interview has been edited for length and clarity.

Glenn Branch: You came to UCMP after a long stint as Professor of Geosciences at San Francisco State University. What was the appeal of the transition from formal to informal education?

Lisa White: The appeal was the opportunity to share science more broadly using all the great tools and resources (online and in-person) the UCMP provides. I loved being a faculty member at San Francisco State University. In addition to teaching, research, and administrative duties, for years

I created hands-on programs for pre-college students and teachers to learn about Earth science outside of the classroom in meaningful ways. Towards this effort I used UCMP web resources to expand the paleontological and geological content in these programs. As a faculty member I sat on the advisory boards for Understanding Evolution and Understanding Science and was continually inspired to break down complex science topics into simpler language and be a more effective messenger of science to a diversity of communities. What better platform could there be for a paleontologist who throughout her career has enjoyed explaining Earth science phenomena to general audiences than a university-based paleontology museum like UCMP?

I have been surprised at how the process and experience of developing resources for informal educational use has made me a better scientist. The degree of specialization required when I was more active in research left little time and energy to consider how my paleontological work could have broader appeal and impact. As the education and outreach director at UCMP, I now am constantly thinking about and designing materials and programs that are multidisciplinary in nature, drawing from the Earth and life sciences, and using

educational research data to inform the learning design.

GB: UCMP and NCSE have a long history of collaboration, including on the Understanding Evolution website. Can you comment on the significance of that collaboration?

LW: The collaboration with NCSE has been tremendously important in shaping and further refining Understanding Evolution resources with clear and unambiguous language about the science of biological evolution. NCSE has its finger on the pulse of groups and audiences that, unfortunately, promote belief systems opposed to evolution and commonly push back on the evidence for evolution. NCSE's knowledge of these audiences, and its skills in prioritizing strategic and intentional communication to counter misunderstandings about evolutionary science, has made the NCSE-UCMP partnership essential to countering attacks aimed at pushing evolution out of science classrooms.

GB: Not all readers may be as familiar with the companion website Understanding Science. Can you describe what it offers?

LW: Understanding Science offers a view of science that represents a more accurate picture of how science really works. Instead of presenting science as the result of an outdated linear model of "the

scientific method,” the website presents science as a modern and coherent set of commonly accepted practices that drive research into a given field of inquiry, thus reflecting the true nature and process of science. These accepted practices include gathering evidence about the natural world, testing ideas, and sharing outcomes with other scientists and with the public. The website also explains the importance of data collection and analysis, discussing findings in an open community, publishing results, peer-review, and ultimately the acceptance of new scientific explanations when the prevailing ones fail to explain observations. This updated picture of science provides explanations and resources appropriate for the

general public, and moreover shares an array of teaching and learning resources supporting science teachers and students at grade levels from kindergarten through college.

GB: What kind of feedback have you received from teachers and students about the site?

LW: Students most often comment on the clear and straightforward nature of the information presented on the site and how relieved they are to be able to explore features and examples of science at their own pace. Teachers value many sections of the website and most often comment on the How Science Works flowchart and supporting graphics. They frequently acknowledge how

useful it is in changing thinking about the “scientific method” and correcting common misconceptions in science. The flowchart appears in high school and college science text-books, is part of adopted K–12 curriculum in several districts, and even made its way on to a science fair T-shirt and award ribbon!

GB: As you know, our focus at NCSE is on socially controversial topics in science. To what extent do formal educators and informal educators cooperate on the task of supporting the teaching of these topics?

LW: Formal and informal educators share the goal of creating vetted, easily accessible resources that demystify complex and controversial topics in science.

But they often aren’t able to share their approaches across the formal/informal divide. Because I have been a member of both communities, I see the barriers as not insurmountable, particularly in today’s culture, with its emphasis on broader impacts and means for communicating and sharing science through multiple channels—from social media to science educational journals dedicated to how people best teach and learn. I like to think that at UCMP I’m doing my part in overcoming these barriers!



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Artwork by Ray Troll © 2017 www.trollart.com

UPDATES

Are there threats to effective science education near you? Do you have a story of success or cause for celebration to share? E-mail any member of staff or info@ncse.ngo.

CALIFORNIA, LOS ANGELES

The Los Angeles Unified School District Board of Education unanimously passed a climate literacy resolution during its February 8, 2022, meeting. The resolution committed the district to “transforming our teaching of climate change to meet the scale and urgency of the crises by implementing, infusing, and developing climate change education across all curricula, and in every grade PK–12, a commitment that will require the allocation of significant resources.” The resolution originated with the Climate Curricula Committee, a group of students and educators affiliated with the Los Angeles chapter of the Climate Reality Project.

ILLINOIS

In late September 2022, the campaign of incumbent governor J. B. Pritzker, a Democrat, launched a television advertisement against his Republican challenger Darren Bailey that featured quotations from textbooks published by Bob Jones University Press and used at Full Armor Christian Academy, a private Christian school founded by Bailey and his wife in 2016. Among the quotations was “Dinosaurs and humans were definitely on the earth at the same time,” from a life sciences textbook. The advertisement concluded, “Darren Bailey is too extreme for Illinois.” In the November 8, 2022, general election, Bailey was defeated by an 11-percentage-point margin.

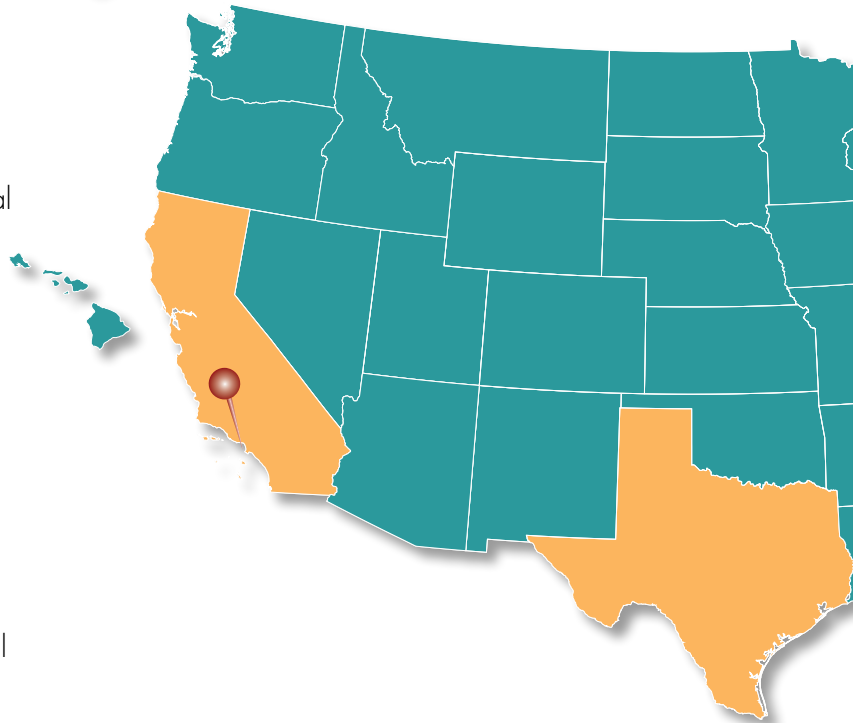
NEW JERSEY

Assembly Bill 783 and Senate Bill 598, a pair of identical bills that would require the state board of education to adopt rules to prevent public school teachers in the state from engaging in what they describe as “political, ideological or religious advocacy in the classroom” and establish penalties for violations “up to and including termination of employment,” were introduced in the New Jersey legislature in January 2022. The rules demanded by the bills would require teachers to “provide students with materials supporting both sides of a controversial issue being addressed and to present both sides in a fair-minded, nonpartisan manner,” where “controversial issue” was defined as “an issue that is part of an electoral party platform at the local, state, or federal level.” As *Ars Technica* (January 29, 2019) observed in discussing a

spate of similar measures in 2019, “a large number of state party platforms specifically mention evolution and climate change.” Assembly Bill 783 was introduced by Gerard Scharfenberger (R–District 13) and Robert Auth (R–District 39). Senate Bill 4166 was introduced by Michael L. Testa Jr. (R–District 1) and Joseph Pennachio (R–District 26). The bills are identical to predecessors introduced by the same legislators late in the 2020–2021 legislative session, Assembly Bill 6136 and Senate Bill 4166, which died in committee when the legislative session ended, as NCSE previously reported.

TEXAS

The Texas state board of education declined to improve the state social studies standards by adding material about climate change. Required by a new state law to revise the standards, the board was presented at its September 26, 2022, meeting with a proposal to amend the revisions to add two additional references to climate change in the standards for high school world geography studies (to standards 8A and 8B in particular). The proposal was defeated shortly before the board voted to end debate, prompting Carisa Lopez of the Texas Freedom Network to comment, “The refusal



to update 12-year-old standards by teaching students about topics like climate change and heroes like Dolores Huerta is a new low for this board.” The unamended revisions to the social science standards were finally adopted at the board’s November 18, 2022, meeting. Earlier, in late August and early September 2022, the board voted to delay a thorough revision of the social science standards until 2025. According to *Education Week*, the vote bowed “to conservative pressure against drafts intended to make history instruction more inclusive,” despite the work of educators, subject matter experts, and community leaders who prepared a draft of revisions to the standards, which are more than a decade old.

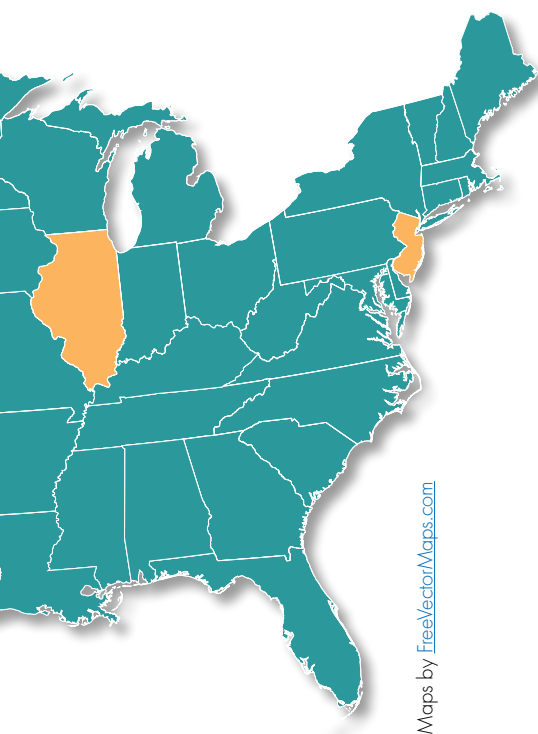
NATIONAL

A bill in the U.S. Congress with a provision supporting climate change education died in committee on January 3, 2023, when the 117th Congress adjourned sine die. H.R. 4521, the America COMPETES Act of 2022, was amended on the House floor on February 2, 2022, to authorize the National Oceanic and Atmospheric Administration to institute a competitive grant program aimed in part at developing and improving educational material and teacher training on the topic of climate change. The bill passed the House on February 4, 2022. Among the legislative findings listed in the amendment were “[T]he evidence for human-induced climate change is overwhelming and undeniable” and “Only 30 percent of middle school and 45 percent of high school science

teachers understand the extent of the scientific consensus on climate change”—a reference to the NCSE/Penn State survey of climate change educators conducted in 2014–2015. The amendment was introduced by Debbie Dingell (D–Michigan), who previously sponsored or cosponsored bills with similar provisions: H.R. 2310 in 2021, H.R. 2349 in 2019, and H.R. 5606 in 2018. Bills with similar provisions have also appeared in the Senate under the sponsorship of Edward J. Markey (D–Massachusetts): S. 966 in 2021, S. 477 in 2019, and S. 2740 in 2018. NCSE consistently endorsed these bills as important for improving climate literacy.

NATIONAL

A resolution in the U.S. House of Representatives expressing support for climate change education died in committee on January 3, 2023, when the 117th Congress adjourned sine die. House Resolution 29, which would have expressed the House of Representatives’s support for “teaching climate change in public and private schools at all grade levels,” was introduced on January 11, 2021, by Barbara Lee (D–California) and 26 of her colleagues. The resolution is identical to House Resolution 574 from the previous legislative session, which also died in committee. NCSE was mentioned in the resolution as a source for the claim that “37 States and the District of Columbia recognize human-caused climate change in their science education standards.”



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WHAT WE’RE UP AGAINST

Critiques Elicit Crickets

Invited by Peaceful Science (a website operated by S. Joshua Swamidass) to engage in dialogue about *Thinking about Evolution*, a 2020 book written by

four authors associated with the old-earth creationist organization Reasons to Believe, the evolutionary biologist John Harshman offered a detailed critique of the chapter entitled “Does evolution explain the fossil record?” His critique concluded by calling for further information from Reasons to Believe about its “progressive creation” model: “If progressive creation is to have any hope of being tested against common descent, we need more details about what groups are claimed to be related by common descent, and what groups are not.” Harshman’s critique was published in July 2021. Subsequently, although Reasons to Believe was expected to continue the dialogue, no response ever materialized. In a thread on Peaceful Science’s forum, Harshman is offering a monthly ironic update such as “Another month gone, and the crickets continue to chirp.” —GLENN BRANCH



NCSE Pursues the Gold Standard for Science Lessons

There's no shortage of science lessons and activities on the web. A search of "science" at the popular Teachers Pay Teachers site, for instance, returns 750,000+ results. Narrowing that search by adding "NGSS" (the [Next Generation Science Standards](#)) still results in 18,000 possibilities. So how do teachers sifting through all these lessons and activities ensure the quality of what they hope to teach their students?

One way—arguably the best way—is to choose a curriculum that has been vetted by an expert peer-review panel that applies a rubric with relevant and substantive criteria to determine how well lessons and units are designed. And, given the wide use of the NGSS, such a rubric will include assessing how well lessons and units correspond with the NGSS.

This is exactly why the National Center for Science Education decided to submit its lesson sets to such a rigorous vetting process. Starting in late 2022, NCSE has been preparing one of its lessons and activities for submission to the NextGenScience Peer Review Panel (PRP) through NextGenScience at WestEd in the hopes that it will earn an [NGSS Design Badge](#)—a digital badge, considered the gold standard for science instructional materials, which assures anyone who comes across it that it is of high quality.

DESIGNED WITH THE NGSS IN MIND

The NCSE [lesson sets](#) were designed with the NGSS in mind. Today, 20 states and the District of Columbia have adopted the NGSS, while 25 states have used the NGSS-related recommendations in the National Research Council's *A Framework for K–12 Science Education* to develop their own standards. The NGSS define not only what students should be learning but also how teachers should be teaching, emphasizing

inquiry-based learning centered on investigating phenomena and designing solutions. Director of Teacher Support Lin Andrews worked with our team of Teacher Ambassadors to base each of the lesson sets on this style of learning, ultimately creating lesson sets that are aligned with the NGSS.

However, any curriculum developer can claim that a resource is aligned to the NGSS: that doesn't mean that the resource is a quality resource. Many science resources use alignment tables

Students Deserve High-Quality Curriculum Materials

The Carnegie Corporation of New York in conjunction with Horizon Research recently released a [report](#) entitled "K–12 Science Education in the United States: A Landscape Study for Improving the Field." A variety of criteria were included in the rubric on which K–12 education was evaluated for the report. Professional learning, instruction, instructional materials, and state standards were categorized based on whether they contained five characteristics: a knowledge base, actors, a field-level agenda, infrastructure, and resources. If a category lacked all five characteristics, it was termed *emerging*; if it contained some or rudimentary versions of all five traits, it was considered *forming*; and if all five characteristics were fully formed, consistent, and sustainable, it was deemed *evolving and sustaining*.

Upon evaluation, only one educational component considered was categorized as being in the *evolving and sustaining* phase—state standards. Most educators would not be surprised by this judgment, since the Next Generation Science Standards are about to celebrate their 10-year anniversary and have been adopted by or influential in 45 states.

But the report also suggested that the instructional materials and assessments teachers need to comply with these standards are not keeping pace.

There is a growing body of evidence that high-quality curricular materials are critical for student success. NCSE is committed to developing the highest-quality climate change, evolution, and nature of science lessons and activities possible.

to highlight which activities align to different aspects of the NGSS. Other resources rely on an in-house evaluation using the [Educators Evaluating the Quality of Instructional Materials \(EQulP\) Rubric for Science](#), the same rubric used by the NextGen-Science Peer Review Panel (PRP) to award its design badges. This rubric is commonly employed by teachers and administrators to independently evaluate resources they are interested in; by providing a completed rubric, publishers are effectively allowing interested stakeholders to skip their own evaluation. However, because all these methods are completed by the curriculum designers, none are independently verified.

In addition, a growing body of evidence shows that when curriculum that is standards-based, rigorous, and easy to use is employed in the classroom, students see higher gains in their learning. Science curricula that meet these standards are considered to be High-Quality Instructional Materials (HQIM), and demand is increasing at every level of the education system—state, district, and school—for teachers to use High-Quality Instructional Materials in their classrooms. So it's important to NCSE that teachers can verify that our lesson sets are not only aligned with but also designed for the NGSS in the way HQIM should be.

Once materials are submitted in pursuit of an NGSS Design Badge, the PRP completes individual assessments of the materials using the EQulP Rubric. After completing their assessments, the PRP will review their findings, then compile the findings into a report that is shared with the submitter. The PRP assigns one of three scores: Example of high-quality NGSS

design (E), Example of high-quality NGSS design if Improved (E/I), or Quality Work in Progress. Materials that earn an E/I are provided with feedback in order to improve the quality of the materials and resubmit them for reevaluation. Materials that earn an E are eligible for an NGSS Design Badge. Of all the materials reviewed by the PRP, only 3% have achieved an E rating and the coveted NGSS Design Badge.

A LENGTHY AND COSTLY PROCESS

Achieving an NGSS Design Badge is a lengthy and costly process that requires a significant amount of preparation and work. NCSE therefore decided to focus on submitting only one lesson set at this time. We used the EQulP Rubric to identify the lesson set that would be the best fit and determined that [It's Time to Lose the Ladder](#) had the most NGSS Design Badge factors already in place. We strengthened some areas of this lesson set, while also expanding it to meet as many NGSS high school standards regarding natural selection and evolution as possible.

In the months since the Supporting Teachers team began this project, we've made significant progress. The expanded storyline uses convergent evolution, as addressed in [Teacher Ambassador Jeff Grant's](#) original Nature's Doppelgängers activity, as the introductory anchoring phenomenon, giving students the opportunity to develop questions about natural selection, model building, and convergent evolution. We have also developed new activities, allowing students to explore their own misconceptions about evolution, then resolve them. This newest lesson features a scien-

HS-LS4-4.

Adapted from: [Ionizing radiation and melanism in Chernobyl tree frogs](https://onlinelibrary.wiley.com/doi/full/10.1111/eva.13476)
<https://onlinelibrary.wiley.com/doi/full/10.1111/eva.13476>

Part One:

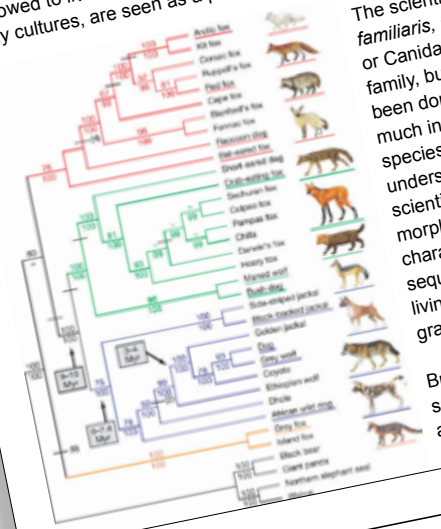
Nuclear power has been used to generate electricity since 1954. Inside of radioactive material heats a coolant, such as water, to create steam, which power electrical generators. Because of the dependency on radioactive and other precautions must be utilized to protect the people who work exposure.

On April 26, 1986, the Chernobyl Nuclear Power Plant suffered a partial meltdown and there were several explosions. These events caused radioactive material to be released into the atmosphere and contaminate the area. Over 100,000 people were evacuated from what is now known as the Chernobyl Exclusion Zone. This zone covers approximately 1,000 square miles. To this day, it is prohibited for people to enter extended periods of time in the Chernobyl Exclusion Zone.



Adapted from *The Social Dog: History and Evolution*
Sarah Marshall-Pescini and Juliana Kaminski
<https://www.sciencedirect.com/science/article/pii/B9780124078111>

The domestic dog is a very successful species. Wherever people live, the only carnivore species that, despite the fact it has the potential to be dangerous, is allowed to live in close proximity to us. Dogs are allowed to be part of many cultures, are seen as a part of the family. How did the domestic dog become so successful?



The scientific name of the domestic dog is *Canis familiaris*, and it is a member of the family Canidae. The domestic dog is a very successful species. Wherever people live, the only carnivore species that, despite the fact it has the potential to be dangerous, is allowed to live in close proximity to us. Dogs are allowed to be part of many cultures, are seen as a part of the family. How did the domestic dog become so successful?

	Before Reading	
	Agree	Disagree
Domestic dogs evolved from wolves.		
Science can answer all questions.		
Domestication is another word for taming.		
Evolutionary fitness is a matter of which individuals are bigger, faster, or stronger than others.		

Using the table below, identify 3 different cause and effect pairs from the text to support your answer.

Cause	Effect

tific text, adapted for the classroom, which students use to obtain information about and explain complex concepts related to domestication and artificial selection. A fundamental aspect of science is the ability to read and interpret scientific papers, as outlined in the Science and Engineering Practices of the NGSS. When students engage with scientific literature and use the evidence from the text in order to explain complex ideas, they are developing this essential practice. This type of standards-aligned activity brings It's Time to Lose the Ladder into better compliance with the EQUiP Rubric.

In addition to adding new activities meant to dig deeper into scientific concepts, we are working to include a range of assessments in order to ascertain whether students understand natural selection and evolution as well as whether their misconceptions about those topics have been resolved. One such assessment is based on the journal article "[ionizing](#)

[radiation and melanism in Chernobyl tree frogs.](#)" (see documents, p. 11)

Students are asked to use the story of the Chernobyl tree frogs and real-world data in order to explain the role played by natural selection in the average coloration of tree frogs in and around Chernobyl. They are also asked to read two headlines regarding this discovery and determine which one is scientifically accurate and which one perpetuates a misconception, namely that individuals, as opposed to populations, evolve.

From writing to evaluation to revision, the entire process of obtaining an NGSS Design Badge can take over a year for just one lesson set. Each lesson must be designed with the standards in mind, weaving together opportunities for students to develop their ability to use the Science and Engineering Practices, apply the Crosscutting Concepts, and grapple with the Disciplinary Core Ideas—the three foundational dimensions of science learning found in the NGSS.

In order to ensure that the submitted materials are closely aligned with the NGSS, NextGenScience West Ed employs multiple independent reviewers who examine the materials, consult with hopeful submitters, and arrive at a consensus decision. This means that in addition to committing a significant amount of time to try to ensure our materials are HQIM, there is also a substantial fee required to have them independently evaluated. We estimate that the cost of evaluating each lesson set will be approximately \$5,000. (If the materials earn an E/I and require revisions, additional fees would be required.)

When teachers, administrators, and districts turn to our lesson sets to help students resolve their misconceptions, we want them to feel confident that they are using High-Quality Instructional Materials. We want teachers that use our resources to know that NCSE's lesson sets not only convey the scientific concepts in evolution, climate change, and the nature of science, but also have been vetted by both educational and scientific experts. An NGSS Design Badge is the gold standard for science education instructional materials, signaling to stakeholders inside and outside of the classroom that our materials are evidence-based, rigorous, easy-to-use, and equitable. It is with your generous support that we will be able to achieve this lofty goal.

NCSE's Lesson Sets

In 2022 the National Center for Science Education released [15 lesson sets](#), intended to address common misconceptions in evolution, climate change, and the nature of science. Five lesson sets were developed, with input from our Teacher Ambassadors, for each topic. These lesson sets offer teachers a unique resource meant to supplement what they are already doing in their classrooms, quickly and efficiently. Our lesson sets reflect the best pedagogical practices for the science classroom and support aspects of the Next Generation Science Standards.

Since their release, the lesson sets have received an overwhelmingly positive response. In the 2022–2023

school year, they were used as the anchor for a variety of professional development sessions, in which teachers from across the country were introduced to the lesson sets and then used them in their classrooms. So far the lesson sets have been downloaded over 1,000 times by educators from all 50 states and the District of Columbia, a testament to the need for such a resource. Mary Markham, a science teacher in Kentucky, recently shared, "[The lessons] provided support for teaching difficult topics such as climate change and evolution ... and made me feel that what I am teaching is important and that my efforts to teach difficult topics thoroughly and accurately are worth it."

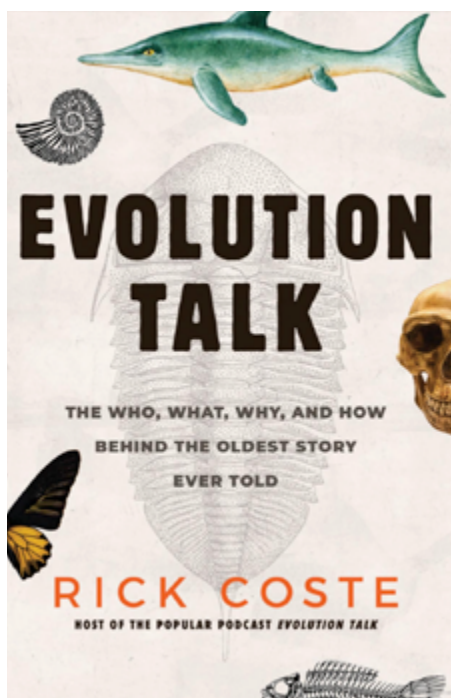
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THE RNCSE REVIEW



Evolution Talk: The Who, What, Why, and How Behind the Oldest Story Ever Told

author: Rick Coste
publisher: Prometheus Books
reviewed by: Bertha Vazquez

Evolution Talk by Rick Coste is a colorful journey through the history of evolutionary theory. Evolution is considered by many to be the greatest story ever told, and, as stated in the book's introduction, it is the origin story of our own existence. It becomes obvious in the book's first pages that Coste possesses great enthusiasm for this important topic and delivers his information with the passion it deserves.

Divided into four parts, *Evolution Talk* starts by introducing its readers to the often-overlooked thinkers who came before Darwin. Coste paints a human picture of how their work was ignored, attacked, or celebrated across the centuries. Each thinker inspired some of their peers while angering others. This section provides an excellent context for the history-making ideas that seamlessly follow in part two.

Part two takes a deep dive into the lives and groundbreaking work of Charles Darwin and Alfred Russel Wallace. Coste pays close attention to Darwin's own life, for he received both tremendous opposition and admiration after the publication of *On the Origin of Species*. Coste does not shy away from discussing Darwin's own doubts about the existence of God or his concern for the blowback he would receive once his work was published. A 21st-century person can certainly relate to Darwin's fear of being ostracized from society for his "dangerous" ideas. Unsurprisingly,

Darwin suffered from anxiety and intestinal distress in his later years.

In part three, Coste provides the reader with an absorbing history of life on Earth in just 70 pages, concluding by presenting several evolutionary concepts developed decades after the contributions of Darwin and Wallace. The misconception that seeing the world through the lens of evolution makes for a cold, harsh view of life is addressed in chapter 34, "Altruism." Good guys can indeed finish first. Cooperation and kindness are beneficial behaviors inherited by the individuals of many species, including humans.

In part four, Coste discusses contemporary concepts such as evolutionary psychology and the future of evolution. Chapter 44 is dedicated to the predictive power of evolution. The ability of a theory to help determine future outcomes is an important scientific concept. And speaking of theories, as a science teacher myself, I deeply appreciated chapter 42, "Just a Theory." Most biology teachers would agree that the common use of the word "theory" makes teaching evolution to students particularly difficult. Perhaps we could hand a copy of *Evolution Talk* to anyone who claims evolution is "just a theory."

While an important addition to the library of anyone who loves evolutionary biology, *Evolution Talk* would

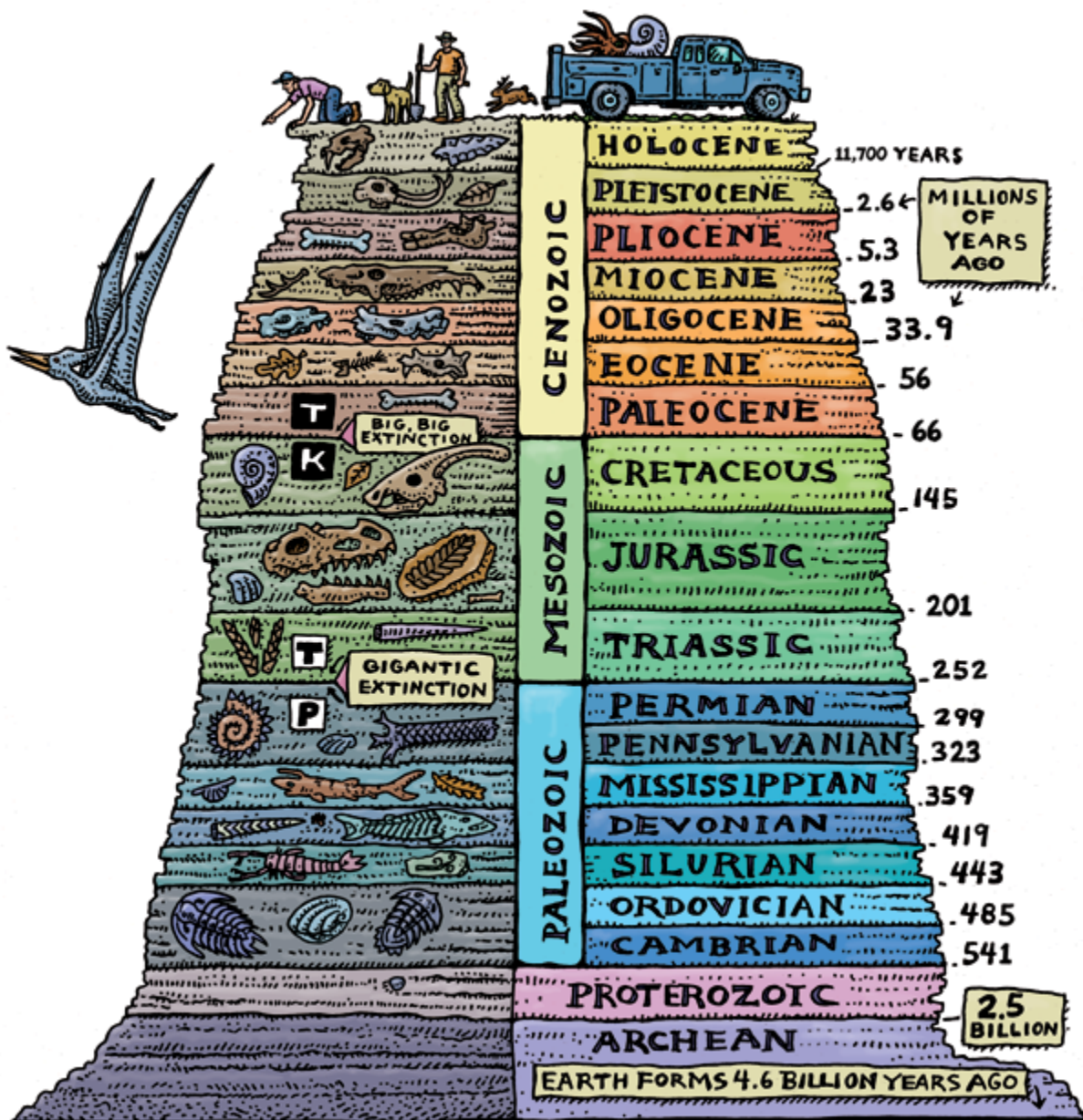
While an important addition to the library of anyone who loves evolutionary biology, Evolution Talk would also be an excellent gift choice for introducing the science of evolution to a novice on the subject.

also be an excellent gift choice for introducing the science of evolution to a novice on the subject. This is not your dry run-of-the-mill thesis on evolution; the writing is witty and amusing, reflecting the jaunty style of Coste's [podcast](#) of the same name. It's a very enjoyable read.

Evolution Talk ends the same way it began, with Coste conveying his awe for the idea that changed how we see the world. "Ask yourself if it would be too bold to consider all life came from one single filament, as Erasmus Darwin did so many years

ago," he writes. "You can breathe a sigh of relief, for others have considered it for you and have followed the path of that filament through time. It leads to you, and to the squirrel whose tail nervously twitches at your presence, as well as the acorn she holds" (p. 240). If readers do not begin the book with a sense of wonder about this extraordinary topic, they will certainly finish it with one.

Bertha Vazquez is a middle school science teacher and director of the Teacher Institute for Evolutionary Science, a program of the Center for Inquiry. bvazquez@centerforinquiry.org



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Supporters in the SPOTLIGHT



NCSE is pleased to congratulate **Bruce Alberts** of the University of California, San Francisco, on receiving Sigma Xi's Gold Key Award for 2022, "[f]or extraordinary contributions to his profession and for fostering critical innovations to enhance the health of the research enterprise, to cultivate integrity

in research, and to promote the public understanding of science for the purpose of improving the human condition," and for receiving a Fellows' Medal, the group's highest honor, for 2022 from the California Academy of Sciences. Alberts is also a past recipient of NCSE's Friend of Darwin award.



David Applegate was sworn in as the 18th Director of the United States Geological Survey on August 15, 2022. A natural hazards scientist, Applegate has worked at the USGS for 18 years. Secretary of the Interior Deb Haaland, who swore Applegate in, commented, "As people, wildlife and ecosystems

face the impacts of the climate crisis, David's long and impressive tenure will continue to be essential to ensuring that the Department continues to be an international leader in developing the climate science needed to understand the Earth's past, present and future climate."



Bruce Lieberman, professor in the University of Kansas Department of Ecology and Evolutionary Biology and senior curator in the Division of Invertebrate Paleontology at the Biodiversity Institute and Natural History Museum, was named director of the University of Kansas Paleontological Institute in September

2022. "Lieberman is a world expert on invertebrate paleontology, with extensive experience managing projects and an impressive track record of funding by federal agencies," said Jorge Soberón, University Distinguished Professor and director of the Biodiversity Institute, who co-chaired the search committee.



NCSE is pleased to congratulate **Eugenie C. Scott**, NCSE's founding executive director, on receiving the Lifetime Achievement Award for 2022 from the California Freethought Day Committee. "Under her leadership," the committee observed, "NCSE fought against 'intelligent design' and climate change denial

in public schools." Scott accepted the award at the October 9, 2022, California Freethought Day event held in Sacramento, California, and streamed online.



NCSE is pleased to congratulate **Keith Yamamoto**, an NCSE supporter and donor—and the husband of NCSE's executive director **Ann Reid**—who is a cellular and molecular pharmacologist and biologist and the vice chancellor for science policy and strategy at the University of California,

San Francisco, on his becoming president-elect of the American Association for the Advancement of Science. Yamamoto's election was announced in a May 11, 2022, press release from the AAAS.

BOARD NEWS

A recent meeting of NCSE's board of directors was the last for **Vicki Chandler** and **Naomi Oreskes**, whose terms expired. Both joined the board in 2017.

Chandler, the Dean of Natural Sciences at Minerva Schools at KGI, is a leading plant geneticist; she is a member of the National Academy of Sciences, serving on its governing council from 2007 to 2010, and of the National Science Board.

Oreskes, Professor of the History of Science at Harvard University, is the author (with Erik M. Conway), of the pioneering expose of organized climate change denial, *Merchants of Doubt* (2010). Her honors include NCSE's Friend of the Planet award.

"NCSE is immensely grateful to both Vicki Chandler and Naomi Oreskes for their invaluable service," commented Ann Reid, NCSE's Executive Director.

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