reports

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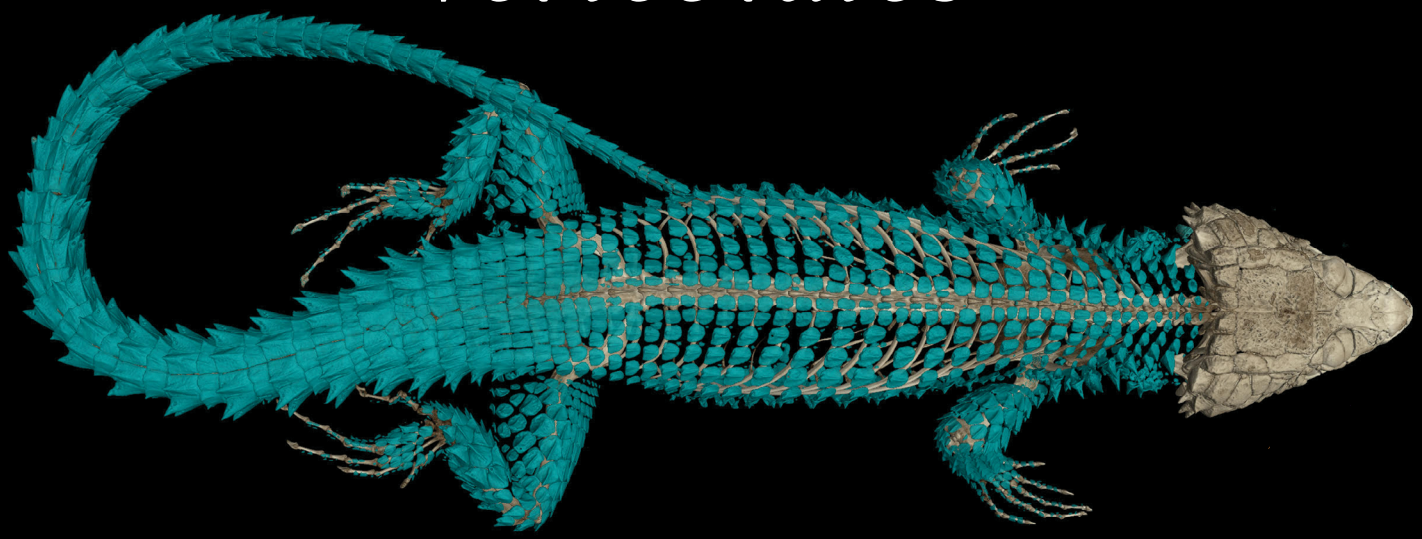
p. 3

Vertebrates



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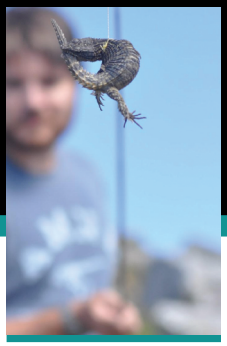

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Dear NCSE Members,

I have often told the story that while I loved science when I was in school, I never considered becoming a scientist (well, other than a brief fantasy of growing up to be Jacques Cousteau—shattered by extreme sea sickness the first time I got on a boat). The things I liked about science, like solving word problems in chemistry and physics classes, and learning all the cool words that describe biological processes in biology classes, just didn't seem much like a job. I didn't have the foggiest notion of what it would be like to actually do science. It wasn't until I got a job in a molecular biology lab (to bide my time before applying to med school) that I was exposed to the real process of hypothesizing, experimenting, and evaluating evidence. And I took to it like a duck to water. It makes me sad to think that many students probably still graduate from high school with little sense of how much fun science can be.

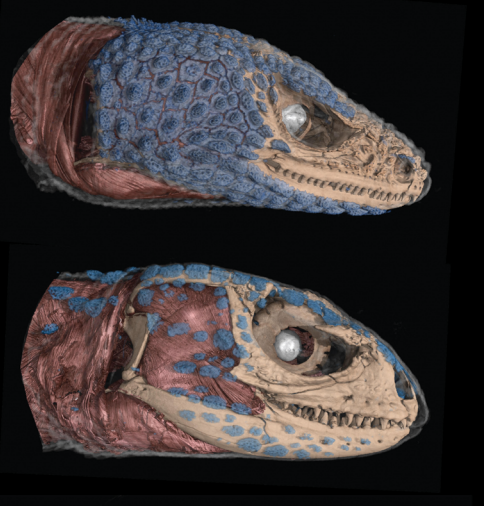
Paleontologist Ed Stanley, on the other hand, is devoted to showing students from an early age that science can be incredibly cool, as he puts it. He tries to give biology teachers the tools to make that coolness more of a reality in their classrooms. In this issue of *RNCSE*, you'll learn more about Stanley's work on the openVertebrate (oVert) Project, an effort to provide free digital 3-D vertebrate anatomy models and data to researchers, educators, students, and the public. NCSE connected with Stanley through one of our Teacher Ambassadors, and he graciously agreed to give a talk at an NCSE-sponsored symposium at the National Association of Biology Teachers conference in fall 2021.

Among those Stanley rubbed elbows with at the conference was NCSE's Supporting Teachers team, which has grown quite a bit over the past year. You can learn more about each of the four team members, including the paths that brought them to NCSE and their current responsibilities, on page 12. The book reviewed in this issue is also focused on science education. *Teaching Climate Change for Grades 6–12* (page 14) wants nothing less than to empower science teachers to take on the climate crisis through implementation of the Next Generation Science Standards. The book's author, Kelley T. Le, is the subject of our Random Samples interview (page 5).

I would be remiss if I didn't give a huge shoutout to our Supporting Teachers team. They've just launched a set of evolution education lessons, free to use, that help teachers tackle some of the most pervasive misconceptions about evolution. And, unlike the kinds of science I used to get in school, these new lessons challenge students to analyze evidence both physical and digital, draw conclusions, and, dare I say it, have fun. One of the lessons includes an activity in which students stick their hands through long tubes (trust me, it's super engaging) to determine the pros and cons of the evolution of limblessness in squamates—the exact topic of Ed Stanley's NABT symposium talk.

Your generous support makes it possible for us to connect teachers and scientists as we did at NABT and to provide teachers with lessons that elevate rather than deflate student interest in evolution, climate change, and the nature of science. I discovered the thrill of scientific inquiry by dumb luck, years after I left school. Thanks to your support of NCSE, many students will soon experience that epiphany right in their science classrooms.

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



Vertebrates Anytime, Anywhere

All photos courtesy Edward Stanley, Florida Museum of Natural History

The Isle of Wight, located off England's southern coast, is a quintessentially English seaside destination. People flock there during holiday to experience the island's many family-friendly activities, from walks along the shore to castle explorations. Paleontologist Ed Stanley's family vacationed there every summer during his childhood. Once, when he was seven or eight, he and his parents visited a natural history museum on the island, which is a rich source of fossils. The young Stanley saw that a dinosaur foot was clearly mislabeled—the foot had too many toes for the dinosaur to which it was purported to belong. He told his father, who then ushered him over to a museum scientist.

"'Look, can you tell our kid he's wrong about this?'" Stanley remembers his father saying. The scientist responded that in fact Stanley was right—that the interpretative signage was out of date. And then the scientist did something that has stayed with Stanley all these years: he invited the family behind the curtain, so to speak, to see more of the museum's specimens and learn how they were cared for and prepared. "This isn't an I-was-right story. I was just a brat," Stanley says self-effacingly. "But the important part was when the scientist invited us to the back. It didn't cost him anything to do that, but he certainly didn't have to. And it was unbelievably cool."

It was a formative experience, Stanley says. Now the Director of the Digital Discovery and Dissemination Laboratory at the Florida Museum of Natural History, Stanley is able to take a turn giving others a behind-the-curtain peek at museum specimens. A central part of his work involves using computed tomography (CT) to turn all kinds of organisms into online manipulable three-dimensional models. He has used the technology to digitize reptiles, amphibians, fish, and even insects. "In every museum that has a collection, the vast majority of specimens are unavailable to the public and quite frankly inaccessible to researchers as well," Stanley says. "Philosophically, I have a very strong feeling that natural history museum collections should be as open and accessible and available to people as possible. Historically, natural history museum collections have not been that. They started off as these cabinets of curiosities for aristocrats to show off their weird things—they were literal cabinets in their houses that only they and the people around them saw."

"Philosophically, I have a very strong feeling that natural history museum collections should be as open and accessible and available to people as possible."

The scanned images of organisms that would otherwise be stored away and inaccessible are marvelous. The Mexican beaded lizard (*Heloderma horridum*), for instance, is colorized bright green, its body coiled and open jaws displaying sharp teeth. A 3D animation lets the viewer circle around the lizard's skeletal structure. And this image, and a host of others, can be experienced by anyone from just about any Internet-connected device.

Stanley was a pioneer in the use of high-resolution CT scanning. While at the

American Museum of Natural History a number of years ago, he used the technique to study the morphology of armored African lizards, particularly the variation among species in the bony elements in their skin. Once he appreciated the power and benefits of being able to examine 3D-digitized artifacts—the experience for the viewer is for all intents and purposes free, specimens are not destroyed in the process, and the viewing can happen virtually anywhere and anytime—Stanley began considering ways to expand access to the CT scans. He and his colleagues at the Florida Museum of Natural History decided to collaborate with Doug Boyer at Duke University, the mastermind behind the MorphoSource website, to develop the openVertebrate (oVERT) project, which aims to provide free digital 3D vertebrate anatomy models and data to researchers, educators, students and the public. oVERT was ultimately funded by a large National Science Foundation grant, on which Stanley and Boyer are among the co-principal investigators.

"The squamates are the most diverse form of tetrapods. They're massively successful. They live everywhere. And the crazy thing is, a lizard-like body form is what people think of as being quite primitive—it hasn't changed for hundreds of millions of years."

"The thing that the oVERT project allows you to do is to build this kind of evolutionary framework around any question," Stanley says. "You might think it would be interesting to study the evolution of limblessness in a group. But if you can only get access to a small number of specimens, you would decide to just look at a very small part of the question. But now that we have these data up and available and free to use, suddenly, if you wanted to do a study of limb loss across all vertebrates, you could absolutely do that. That's suddenly on the table. Or if you wanted to teach a class about convergent evolution, for example, you could download any dataset you want. So now you can tailor classes and lessons to the people in your class. If you have people who are super interested in hummingbirds, you can show the convergent evolution of the throat bones in honeycreepers and hummingbirds."

Stanley goes on to offer an example of his own "any question" moment. "I was thinking the other day, 'I wonder if the tear duct of lizards changes in shape or size based on whether they live in a dry or wet area.' Just off the top of my head. So instead of having to write a big grant to go and travel to all these different museums and get permission to dissect these things, I just download 10 different datasets. And then I'm able to say, 'Oh yeah, that seems to hold up,' or, 'That seems like an interesting thing I can pursue further,' or, 'Nah, there doesn't seem to be any pattern there, that was a waste of time."

The oVERT site has garnered millions of pageviews and tens of thousands of downloads. About half of the users the project has been able to track are researchers, a quarter are educators, and the rest are a "grab bag," as Stanley puts it. A great number of engagements have come from artists who are interested in deeply understanding organic forms. "Artists are often extraordinary anatomists," Stanley says, "because they have to understand how the scaffold of a body works in order to paint or draw things in a realistic way. It's always fun to see people using oVERT in a way that we weren't expecting."

One component Stanley purposely wrote into the oVERT grant was the offering of professional learning opportunities for high school science teachers in the use of the website. It was at one of these sessions that Stanley met NCSE Teacher Ambassador Jennifer Broo, who wound up developing a lesson that included the oVERT website as a primary resource. And when Lin Andrews, NCSE's Director of Teacher Support, reached out to the teacher ambassadors seeking ideas for speakers for an evolution symposium NCSE was hosting at the National Association of Biology Teachers conference in 2021, Broo enthusiastically offered up Stanley as a possibility. The talk would center on the evolution of limblessness in snakes to coincide with an activity in NCSE's newly launched evolution Lesson Set One: The Origin of a Species. Speaking after Stanley at the Symposium would be NCSE Teacher Ambassador Rebecca Brewer, who helped design and write up the activities in the lesson set.

Though snakes don't constitute his area of research, Stanley was glad to speak to the audience of educators. (You can view the entire symposium here. His fascination with the topic was evident: he was animated and enthusiastic and funny. "It's hard not to like squamates," Stanley explains. "The squamates are the most diverse form of tetrapods. They're massively successful. They live everywhere. And the crazy thing is, a lizard-like body form is what people think of as being quite primitive—it hasn't changed for hundreds of millions of years. A ton of them have lost their legs for a number of reasons. One of those lineages that lost its legs accounts for one third of all squamates, and they're adapted to all of these different environments. A legless lizard is a pretty restricted body plan. It's a head, and a long torso, and then a small tail. And that's not a lot to work with. But snakes—which is the lineage I'm talking about—have done amazing things! They've evolved venom, some of them are warmblooded or at least can control their body temperatures by shivering, they give birth to live young, they lay eggs, they live in the sea, they live on land, they live underground, they live up in trees—they've colonized the entire world!"

Stanley says he tries to make a point—in his day-to-day conversations with educators and young people as well as in his talks—of conveying his sense of excitement and enthusiasm about the natural world because he knows from his own experience that it can make a difference. True, people's interest in things can wax and wane, and this is especially true for seven- and eight- year-olds. But the right interaction at the right moment with an engaged museum scientist might just turn an interest into a vocation.

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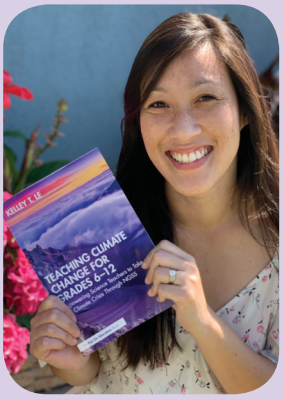
RanDom SamplES with Kelley T. Le



Kelley T. Le is the director of the Science Project at the University of California, Irvine, where she supports K–16 educators, educational leaders, and school districts with science, engineering, and equity for justice-centered education. Her book *Teaching Climate Change for Grades 6–12* was published by Routledge in 2021 and is reviewed on page 14. *The interview has been edited for length and clarity.*

Glenn Branch: Your book is clearly aimed primarily at science teachers, but can you say a bit about why a broader audience might find it of interest?

Kelley T. Le: Teachers typically plan backwards, starting with core ideas then transitioning to lesson plans to present those ideas. This is also how all of us, teachers or not, should think about the climate crisis. We should start by imagining a world in which we've solved climate change and then ask: What would that reality look, sound, and feel like? What were the steps that we took individually and collectively to get there? Which actionable steps can be taken today to get closer to that vision? When we acknowledge the capacity that students, teachers, school leaders, and community members already have, we can authentically position them as capable problem-solvers for the climate crisis. It's really a matter of helping to activate that agency already within.

Climate change is a complex, intersectional, and urgent issue that requires a diversity of solutions from every sector in society. If we want to provide students with 21st-century skills and knowledge, we need to support them to see how the disciplines merge to provide deep content knowledge and opportunities for diverse solutions. For K–12 educators, my book is a resource to help them take the first step in reflecting on their personal teaching practices, and be part of the

critical mass needed to take on climate change centered on justice and culturally relevant approaches. Readers who are not themselves educators will learn, I hope, not only about the responsibilities and the opportunities facing these educators but also about how they can support and even model some of the approaches.

GB: Earlier in your career you were a high school science teacher. How do your experiences from the classroom inform the book?

KTL: I'm a first-generation Southeast Asian scholar from inner city Los Angeles, who went back to my community to teach. In that time, I learned that students were most engaged when I taught science in culturally relevant and solution-oriented ways grounded in climate and environmental justice issues. When science helped them to explain local phenomena related to human health, the environment, or injustice in ways that supported meaningful action, they saw the value of what they were learning. I also learned that I don't have to know everything about climate change to teach about it. Acknowledging the limits of my knowledge actually provided more opportunities to co-construct experiences with students. Together, we engaged in the process of science, sharing the responsibility to meet content and district mandates in a way we found highly meaningful.

GB: A distinctive feature of your book is the repeated opportunities for readers to reflect on their attitudes and practices as they progress. How do you hope they will benefit from doing so?

KTL: If you don't ask the right questions, you will never get the right solutions. This is true for both teaching pedagogy and the climate crisis. Our teaching pedagogy is informed (whether we're aware of it or not) by our deeply rooted beliefs and values. I often ask educators to reflect on whether or not they feel they are teaching and preparing students for the needs and issues of the 21st century. If the answer is "yes," I ask them to share more (to help articulate their beliefs and values) and encourage them to continue connecting with others to amplify their efforts. If the answer is "no," I encourage them to reflect with me on what might be the purpose of 21st-century science education to see where we can meet in the middle. We can't ignore the fact that societal needs and demands have changed.

We need to get to the root of the problem and begin asking the right questions to support teachers, and that starts with giving them time to think about their theory of action guiding their everyday pedagogical decisions. Without that time for reflection, even the best professional development will never make it into the classroom. My hope is that teachers will see a benefit to evidence-based practices that call for students to situate their learning experiences in real-world contexts that consistently give deeper meaning to the content—that's what *Teaching Climate Change for Grades 6–12* tries to provide.

GB: The final chapter of your book, entitled "Education for Climate Action," turns to discuss ways of teaching climate change that encourage students to take action on the climate crisis. Can you say a bit about the rationale underlying education for climate action?

KTL: Teachers are recognizing that when they teach climate change, students are often already engaged in the ethical dimensions of the topic. For example, teachers might introduce climate change by first talking about a local phenomenon such as wildfires, and how those further exacerbate existing environmental injustices such as poor air quality in inner cities. When a teacher stops instruction at this point without providing opportunities for students to engage in critical dialogue, ask deeper questions about the history of the existing conditions, or how to bring about future change by creating culturally relevant and meaningful solutions, it's a missed opportunity for students to apply their knowledge to an issue that directly affects them.

Teaching climate change abounds with opportunities to support students in their development into scientifically literate citizens who are, and will continue to be, directly affected (although some more than others) by the effects of climate change. My book aims to support science educators to meet those opportunities with intention.

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

Supporters in the SPOTLIGHT

NCSE is pleased to congratulate **P. Dee Boersma,** Professor of Biology at the University of Washington, on her election to the American Academy of Arts and Sciences in 2021.

Taner Edis's *Weirdness! What Fake Science and the Paranormal Tell Us about the Nature of Science* (Pitchstone Press, 2021) was published. The publisher writes:

> By exploring many of the odd beliefs embraced by large sections of the public that are rejected by the scientific mainstream, [Edis] makes the case for science in a way that pro-science memes and slogans simply can't. "One reason weird beliefs are so popular is that they are attractive and fun," says Edis. "Using weirdness as a device to discuss science introduces an element of fun that prevents philosophical arguments from becoming dry and technical, and that helps soften anti-science reactions." ... "Unlike most books on unscientific beliefs," Edis adds, "I don't concentrate on the debunking—I mostly take it for granted that creationism, Bigfoot, etc., are false—but explore what the falsehoods tell us about the nature of science. I try to be honest about science's imperfections, and so I hope to engage those who might normally be suspicious of mainstream science to consider other things I have to say. At the same time, pro-science skeptics and scientists themselves who read *Weirdness!* will end up with a more sophisticated, more critical view of what science is all about and why it succeeds."

Edis is Professor of Physics at Truman State University; he edited Why Intelligent Design Fails (Rutgers University Press, 2004) with **Matt Young.**

Nina Jablonski of Pennsylvania State University was elected to the National Academy of Sciences. The National Academy of Sciences recognizes achievement in science by election to membership, and—with the National Academy of Engineering and the National Academy of Medicine—provides science, engineering, and health policy advice to the federal government and other organizations. Jablonski's latest book, coauthored with Sindiwe Magona, is the children's book *Skin We Are In: A Celebration of the Evolution of Skin Colour* (2018).

Jeffrey Wynter Koon's *Cultural Insanity, the Key to Understanding Our World & Ourselves* (BookBaby, 2021) was published. Koon writes:

> Cultural insanities arise from actions or policies that unnecessarily thwart human fulfillment, including disregard of festering problems, e.g., the Sixth Extinction, unsustainability, overpopulation, global warming, monocultures, and abuse of antibiotics. Some aspects of our brain's functioning are part of the problem, but simple scientifically literate methods can reduce people's blindness to such cultural insanities. Of particular interest to readers of RNCSE will be part 4, one of three historical case studies, which shows the historical emergence of a "buried" cultural insanity (biblical literalism) involving geologic time and evolution. Creationist geological concoctions are self-contradictory, and ignore facts and the use of deep time in many sciences. Creationist pressures on K–12 science education are culturally insane because they have undermined scientific literacy in this country.

A long-time member of NCSE, Koon is an independent scholar.

NCSE is pleased to congratulate **Naomi Oreskes**, the Henry Charles Lea Professor of the History of Science and affiliated professor of Earth and Planetary Sciences at Harvard University, on receiving an honorary degree from Clark University in Worcester, Massachusetts, on June 13, 2021. The university president's office described her as "an internationally renowned geologist, science historian, and author of both scholarly and popular books and articles on the history of earth and environmental science." Oreskes is a member of NCSE's board of directors.

Dan Phelps, the president and founder of the Kentucky Paleontological Society, received the Harrell L. Strimple Award for 2021 from the Paleontological Society. The award recognizes outstanding achievements in the field of paleontology by a person not professionally employed as a paleontologist. Phelps received NCSE's Friend of Darwin award in 2017.

Mary Elizabeth Savina of Carleton College and **Mark Urban-Lurain** of Michigan State University were among the 564 new Fellows of the American Association for Advancement of Science for 2021. Congratulations to both! (And let the NCSE office know if we overlooked your name on the list.)

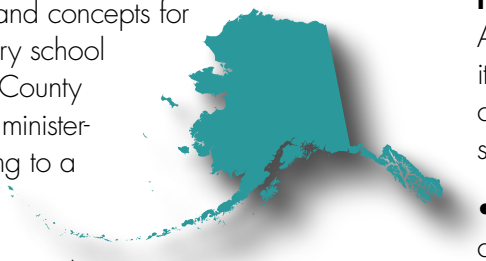
Elizabeth Shreeve's *Out of the Blue: How Animals Evolved from Prehistoric Seas* (Candlewick Press, 2021) was published. The publisher writes, "Where did the first animals come from? And how could mud-loving hippos possibly be related to fast-swimming dolphins? Young readers will find answers in this lively, beautifully illustrated picture book that describes the origins of life in the oceans and transition of animals onto land, starting some 500 million years ago." Aimed at readers 6 to 9 years old, the book received starred reviews from Kirkus Reviews and *School Library Journal*.

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

California's Assembly Bill 130, passed by the legislature on July 8, 2021, and approved by the governor on July 9, 2021, contained a provision appropriating $6 million in the 2021–2022 fiscal year "to contract for the creation of free and open education resources that are K–12 standards-based curriculum units on climate change and environmental justice and the integration of environmental principles and concepts developed pursuant to Section 71301 of the Public Resources Code [which addresses the development of environmental principles and concepts for elementary and secondary school pupils]." The San Mateo County Office of Education is administering the process. According to a July 16, 2021, press release from Ten Strands, a non-profit organization aimed at raising environmental literacy in California, "Senator Ben Allen [D–District 26] led the way in championing the proposal to change the way California teachers and students understand climate change and environmental justice issues while developing critical thinking skills around global topics. Ten Strands ... worked with Senator Allen to garner support for this budget request," recruiting "[o]ver 165 nonprofits, county offices of education, school districts, teachers, regional parks, and organizations" to endorse the appropriation. Ten Strands will be involved in creating the curriculum units, which will be in the public domain.



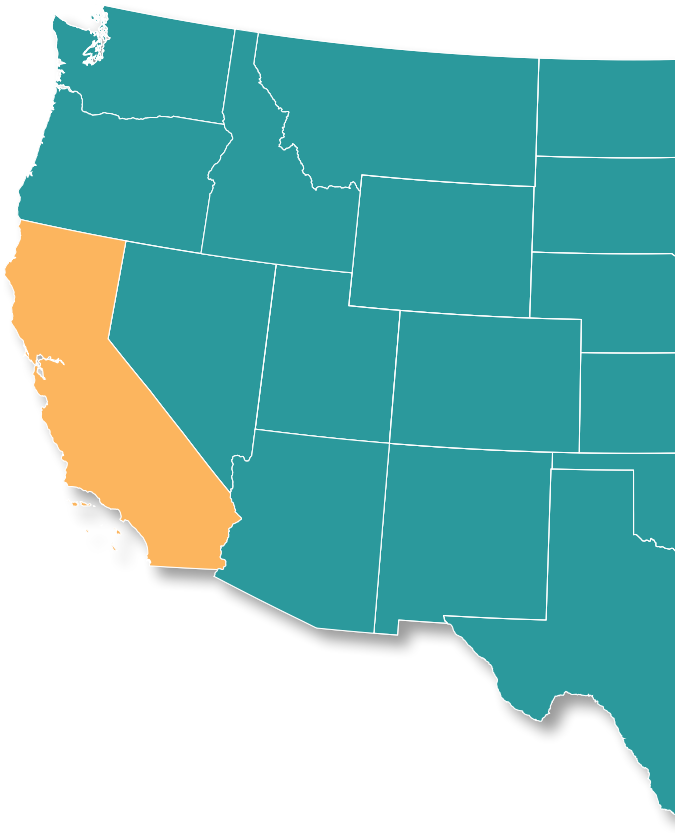
MAINE

Maine's House Paper 1409, introduced on January 5, 2022, and signed into law on May 3, 2022, will direct the commissioner of education to establish a pilot program to provide professional development grants for climate education. The three-year pilot program will assist "school districts in partnering with nonprofit community-based organizations to create and implement plans to provide teacher training in [the] [N]ext [G]eneration [S]cience [S]tandards and interdisciplinary climate education," with priority given to historically underserved schools and communities. The program will receive a bit more than $2 million in funding. Ever since a NCSE/Penn State survey conducted in 2014–2015 revealed the systematic underpreparation of public school science educators to teach climate change, legislative interest in addressing the problem swelled, with legislation to provide and fund teacher professional development on climate change introduced in a number of states and successfully enacted in Washington and California. Maine's House Paper 1409 was sponsored by Lydia Blume (D–District 3) and five of her colleagues in the House of Representatives and David Woodsome (R–District 33) and two of his colleagues in the Senate.

NEW YORK

As the New York legislature began the second half of its 2021–2022 legislative session, no fewer than eight climate change education bills were revived and reassigned to committee.

- Bill 617 and Senate Bill 4683 would establish a climate change education grant program "to award grants to eligible applicants to support climate change education grant programs for young people or to provide optional teacher training or professional development programs relevant to the advance of climate change literacy in young people."

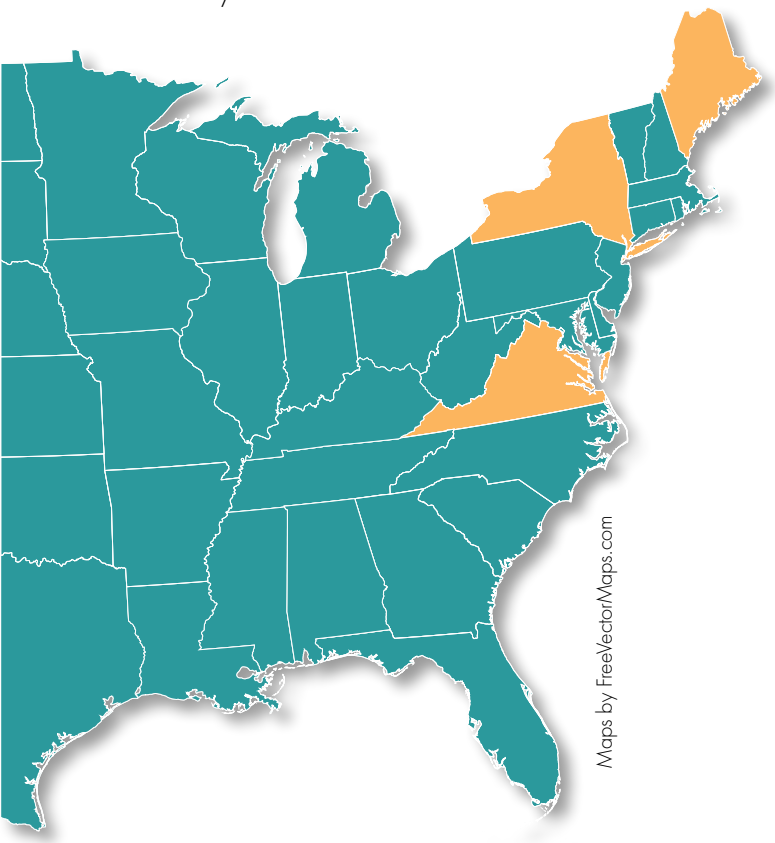


- Senate Bill 596 would require the state commissioner of education to offer "recommendations to the board of regents relating to the adoption of instruction in climate science in senior high schools," including "the effect and impact of greenhouse gasses" and New York's commitment to reducing greenhouse gas emissions.

- Senate Bill 654 would require the state commissioner of education to "create and require climate change instruction within the current established science curriculum" for grades one through twelve of New York's public schools. Correspondingly, school authorities would be required to support the instruction.

- Assembly Bill 2325 and Senate Bill 1081 would require the state commissioner of education to "establish a model environmental curriculum on climate change to be taught in all public elementary and secondary schools," included in the standards of instruction for not only science but also history, social studies, health, and mathematics.

- Assembly Bill 3468 would require the state commissioner of education to "create and establish a comprehensive and accurate climate change and sustainability curriculum which shall be taught in grades kindergarten through twelve in all public and charter schools." Local districts would be expected to use the curriculum or a substantially similar curriculum.



Maps by FreeVectorMaps.com

UNITED KINGDOM, ENGLAND

A climate education bill that would require "matters relating to climate change and sustainability to be integrated throughout the curriculum in primary and secondary schools and included in vocational training courses" was introduced in Parliament on November 23, 2021, by Nadia Whittome (Labour–Nottingham East). A student group, Teach the Future, helped to draft the bill; Teach the Future's Scarlett Westbrook told the *Independent,* "We need to ensure climate education is no longer exclusive to those who take optional subjects or briefly glazed over, but instead centred in all subjects as we will all be impacted by this crisis." As of late April 2022, the bill had not yet received its second reading.

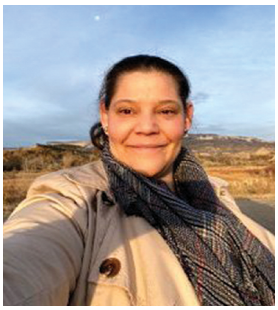
- Senate Bill 4781 would require the state commissioner of education to "make recommendations to the board of regents relating to adjusting curricula for social studies, economics, geography, and government classes in New York schools to include requirements for climate change education."

At the end of the 2019–2020 legislative session, five climate change education bills introduced in the New York legislature died in committee.

VIRGINIA

Virginia's House Bill 362, prefiled on January 11, 2022, would have, if enacted, required instruction on climate change in the state's public schools. The department of education would have been required to develop a "program of instruction on the causes of and potential solutions for climate change" by January 1, 2023, and to devote a year to prepare local school boards to incorporate the program. Local school boards would then have implemented the program during the 2024–2025 school year. The initial sponsor of the bill was Suhas Subramanyam (D–District 87), later joined by Marcus B. Simon (D–District 53). The bill died in committee on February 15, 2022. Virginia's state science standards received the grade of F in "Making the Grade?"—the 2020 study from NCSE and the Texas Freedom Network Education Fund—for their treatment of climate change. Reacting to the study, a spokesperson for the department of education told the Virginia Mercury that climate change is discussed further in the ancillary curriculum framework, which aids districts in developing curricula to comply with the standards. But it is unclear to what extent districts follow the framework's guidance.

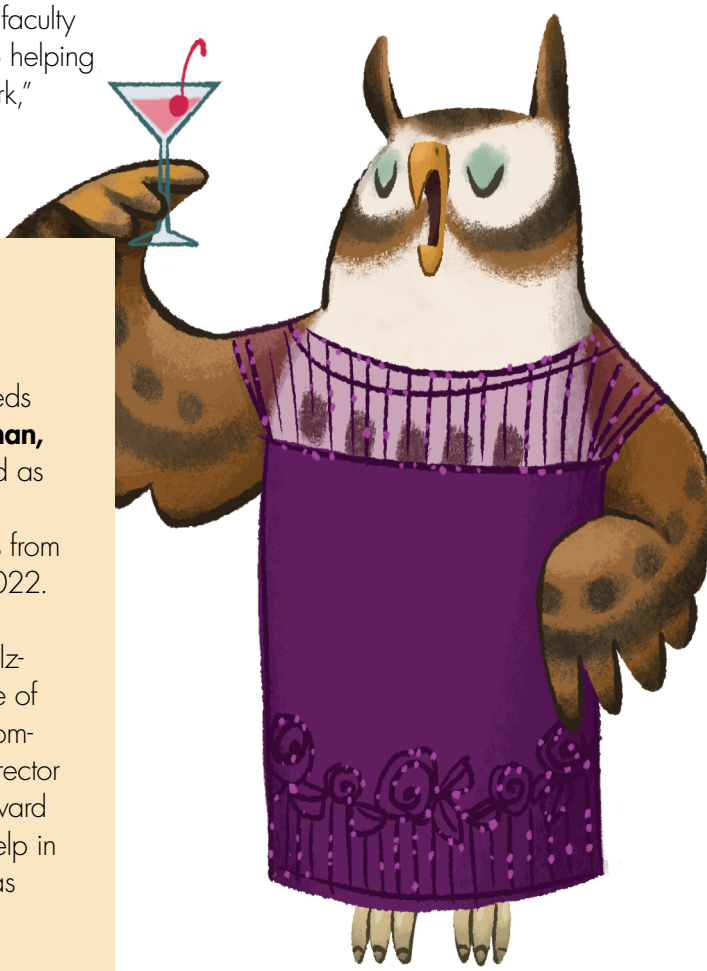
Two New Members on NCSE's Board



NCSE is pleased to announce the addition of **Maya Garcia**, the Science and STEM Specialist for the Colorado Department of Education, to its board of directors. A former classroom science teacher, Garcia previously served as the director of STEM for the District of Columbia Office of the State Superintendent of Education, where she was instrumental in the adoption and implementation of the Next Generation Science Standards. She has served as the president of the DC Science Teachers Association and has received a Fulbright Distinguished Teaching Award. She also serves on the National Academies Board on Science Education.

NCSE is also pleased to announce the addition of **Jo Handelsman,** Director of the Wisconsin Institute for Discovery at the University of Wisconsin-Madison, where she is also a Vilas Research Professor and a Howard Hughes Medical Institute Professor, to its board of directors. Handelsman also served as Associate Director for Science in the White House Office of Science and Technology Policy from 2014 to 2017. She has been deeply involved in efforts to improve undergraduate science education, gender equity in science, and junior faculty mentoring. "I look forward to helping advance NCSE's crucial work," Handelsman remarked.

On NCSE's board of directors Garcia and Handelsman join president **Kenneth R. Miller**, secretary **Benjamin D. Santer**, treasurer **Michael Haas, Vicki Chandler, Sarah George, Joseph L. Graves Jr., Michael B. Lubic, Michael E. Mann, and Naomi Oreskes**. At the same time, Barry Polisky, a molecular biology researcher, departed, having served on the board since 2016. "We're grateful to Barry Polisky for his years of service," NCSE's executive director Ann Reid commented. "But we are delighted to welcome Maya Garcia and Jo Handelsman, with their depth of experience and expertise, to the board."

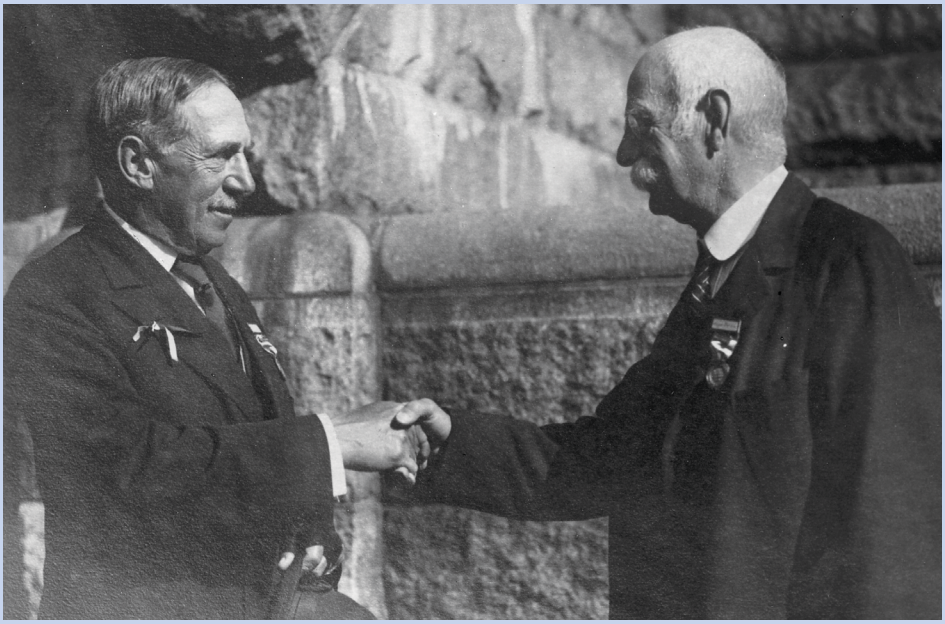


Farewell to Rae Holzman and Welcome to Astrid Broertjes

NCSE welcomes **Astrid Broertjes** as its new Director of Operations, responsible for administering human resources, managing the office and the administrative staff, and overseeing finance, accounting, and bookkeeping. Broertjes comes to NCSE from Recycle for Change, a non-profit organization in Richmond, California.

She succeeds **Rae Holzman,** who served as Director of Operations from 2011 to 2022. "NCSE is incredibly grateful to Rae Holzman for more than a decade of her cheerful competence," commented NCSE's executive director Ann Reid. "And we look forward to having Astrid Broertjes's help in keeping NCSE running just as smoothly behind the scenes."

Leonard Darwin



Smithsonian Institution Archives, Accession 90-105, Science Service Records, Image No. SIA2008-0866.

Leonard Darwin, right, greets paleontologist and geologist Henry Fairfield Osborn (1857–1935), both of whom were honorary presidents of the Third International Congress of Eugenics in 1932.

Leonard Darwin was born on January 15, 1850, in Down House, just outside London. He was the eighth child (out of 10) and fourth son of Charles Robert (1809–1882) and Emma Wedgwood Darwin (1808–1896; Charles's first cousin). Following a military career in which he rose to the rank of major, Leonard Darwin served in Parliament, after which he was president of the Royal Geographical Society from 1908 to 1911. From 1911 to 1928, Leonard Darwin chaired the British Eugenics Society and advocated the sterilization of people "endowed with bad hereditary qualities" to block "a contaminated tributary to the great stream of life" and thereby avoid "an immense amount of human misery, degradation, and inefficiency … in all future generations" ("Sterilization in America," *The Eugenics Review*, 1923, 15 (1), 335–344). Leonard Darwin never formally studied science or graduated as a scientist, but was a friend and confidant to fellow eugenicist Henry Fairfield Osborn, who helped the defense team before and during John Scopes's trial. Horatio Hackett Newman, a eugenicist whose testimony was read into the record of the Scopes trial, often promoted Leonard Darwin's harsh eugenic beliefs (as in his *Evolution, Genetics, and Eugenics*, University of Chicago Press, 1932). Leonard Darwin—who believed that eugenics was the practical application of evolution—presided at the First International Congress of Eugenics (July 24–29, 1912, in London). At the second such congress (September 25–27, 1921, in New York City), he promoted "eliminating the unfit." He was convinced that only eugenics could save Western civilization.

Leonard Darwin closely followed the events leading to the Scopes trial. Just before the trial began, he assured John Scopes, "that which is true cannot be irreligious … May the son of Charles Darwin send you in his own name one word of warm encouragement" (quoted from Tom Blaney's *The Chief Sea Lion's Inheritance: Eugenics and the Darwins*, Matador, 2011).

After the trial, Leonard Darwin continued to promote eugenics. In 1926, he dedicated his 529-page *The Need for Eugenic Reform* to his father's memory, writing,"If I had not believed that he would have wished me to give such help as I could towards making his life's work of service to mankind, I should never have been led to write this book."

The 93-year-old Leonard Darwin—Charles and Emma's last surviving child—died on March 26, 1943, in Forest Row, East Sussex, where he is buried in Forest Row Cemetery.

Randy Moore is the H. T. Morse–Alumni Professor of Biology at the University of Minnesota, Twin Cities. His most recent book, is *The Scopes Trial: An Encyclopedic History* (McFarland, 2022). Rmoore@umn.edu

Meet the (New) Team

The Supporting Teachers team has grown quite a bit over 2021 and 2022. As it developed accurate, active, and engaging lesson plans on evolution, climate change, and nature of science, and now works to put those lessons in the hands of teachers, the team blossomed from one—Director of Teacher Support Lin Andrews—to four. We thought our supporters might be interested in learning more about this group, so we've asked each to write a few words about the path that brought them to NCSE and their current work at the organization.

Lin Andrews

As long as I can remember, all I ever wanted to be when I grew up was a zoologist. I was determined to be the next Jane Goodall or Dian Fossey. I wanted to travel the wilds of the planet and save as many animals as I could.

So, upon graduating high school, I attended the University of Memphis to become a biologist with an emphasis in zoology. I studied invertebrates, mammals, and my greatest passion, amphibians and reptiles. But one thing that my course of study didn't prepare me for is how little I would make as a zoologist or biologist in the research field. My husband and I were barely scraping by while I worked at a nature center as he finished college. So I decided to get a more financially stable job, as a paraeducator at a nearby middle school. From the first moment I worked with students, I was hooked.

Soon I began a transition-to-teaching program at Wichita State University. I obtained my teaching certification in biology and chemistry as well as a master's degree in curriculum and instruction, and then spent 20 years in the classroom. These were among some of the most important of my life. So why did I leave teaching to become Director of Teacher Support at NCSE?

While I miss the classroom every day, I've seen how the public education system doesn't always support authentic science in the classroom. I've lived through several battles over the teaching of evolution in my state; I've been chastised for discussing socially controversial topics in science with my students; and I've seen teachers do more harm than good by sending mixed messages to students about climate change and evolutionary science.

My work at NCSE allows me to help my fellow teachers to navigate the turbulent waters that threaten to capsize the work of teachers everywhere. I know firsthand how challenging that can be.

Cari Herndon

I graduated from Otterbein University right as the Great Recession began. I accepted a job teaching English in Korea, believing that it would provide me with not only financial security but also opportunities to experience a new country with a rich culture. What I did not know was that it would infuse me with a passion for teaching as well.

Following my year in Korea, I enrolled at DePaul University to earn a teaching degree. This was during the time that the Next Generation Science Standards (NGSS) were being written and released, and as a part of my studies, I followed their progress. This new framework for teaching science called for a level of content depth and scientific practice that I found to be incredibly exciting, especially compared to the way I learned science as a K–12 student.

After receiving my graduate degree, I worked for Chicago Public Schools as a middle school science teacher and for the District of Columbia Public Schools for a total of 9 years. Between my teaching positions, I also worked as an Education Coordinator for National Park Trust, an organization I still hold near and dear to my heart. Throughout all this I was tasked with writing and revising curriculum. I left my teaching position last school year, determined to follow my passion for writing engaging curricula, which led me to the National Center for Science Education.

I have found within NCSE a community of like-minded professionals, committed to supporting teachers in their efforts to teach evolution, climate change, and other socially—but not scientifically—controversial topics. As a part of my work, I match NGSS

standards and related topics to different misconceptions students have. From there, I create a series of lessons in which students engage with evidence, analyze data, and draw conclusions. Students follow a storyline, asking their own questions and discovering answers using real data. My hope is that the "sticky"—interesting, and hence easy to retain—science behind our lessons inoculates students against misconceptions they may encounter elsewhere.

Outside of my work, I enjoy being in nature, especially swimming, hiking, and birdwatching. I also enjoy traveling to different countries and visiting parks in our amazing National Park system.

Blake Touchet

For as long as I can remember, I have always wanted to be a teacher. However, I think it says a lot about the status of education in the United States that I have always been met with a dismissive attitude when sharing my career aspirations. "You're too smart to be a teacher. You could do so much more. Only a teacher? Why do you want to babysit all day?" I have experienced reactions and questions such as these my whole life—but I have always found them ridiculous. Too smart to be a teacher? Why would we not want intelligent people teaching our children? I could be doing more? Who does more for society than teachers? Only a teacher? Teachers play arguably the most significant role in childrens' lives aside from their parents and help to develop and maintain our democratic way of life. Civilization simply could not exist without teachers.

Throughout my career, I have always attempted to maximize my positive impact on my community. After teaching a few years, I realized that I could reach beyond the students in my classroom, so I started writing curricula and assessments and leading professional development sessions for other teachers in my district. A few years later, I cast my net even wider and became a Teacher Leader Advisor for the Louisiana Department of Education and took on other statewide roles. When the opportunities arose to join national science education organizations, I jumped at the chance. I joined the Teacher Institute for Evolutionary Science as one of their very first Teacher Corps members and I also joined NCSE as a Teacher Ambassador. I was able to network with amazing teachers around the country to bring their great ideas back to my community and share my local perspective with the world.

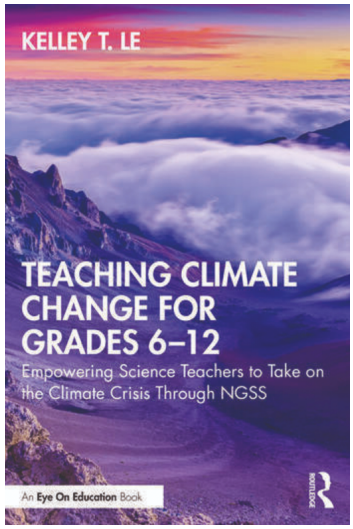
Today, I am the Partnership Specialist for NCSE's Supporting Teachers program. My primary roles include forming partnerships with school districts to train and assist teachers and administrators who are field testing our curriculum materials, mentoring NCSE's Teacher Ambassadors who help design and implement our curriculum, and promoting general engagement among our online professional learning community of teachers. Before entering my current role, I taught middle and high school science for 12 years. I recently completed a doctorate in educational leadership.

When I'm not busy being (only!) a teacher, I enjoy reading and spending time exploring the Louisiana outdoors with my wife and two sons.

Heather Grimes

I have been awed by nature and science for as long as I can remember. In college, I was captivated by evolution and ended up graduating with a degree in anthropology. I later enrolled in a field studies program in which I compared the dialects of capuchin monkeys in Central America. Shortly afterwards, I shifted gears and began focusing more on the administrative end of research and learning. After spending a decade working in various academic support roles at higher education institutions, I was led to where I am now as the Program Coordinator for NCSE's Supporting Teachers program. In my ever-evolving role, I am the glue that holds our projects together and I keep the clockwork moving by providing all manner of support to Supporting Teachers staff, curriculum field testers, Teacher Ambassadors, and mentors.

I live on a small homestead in Massachusetts with my spouse, cats, and chickens. When I'm not working, I enjoy crafting, reading, photography, gardening, hiking, and archery.



Teaching Climate Change for Grades 6–12

author: **Kelley T. Le**
publisher: **Routledge**
reviewed by: **Glenn Branch**

As the evidence for the reality and the seriousness of anthropogenic climate change continues to accumulate, American science education is slowly pivoting. As of 2020, 20 states (plus the District of Columbia) had adopted the Next Generation Science Standards, which highlight global climate change as one of four sub-ideas in the core idea of Earth and Human Activity at both the middle school and the high school level; a further six states had adopted standards that treat climate change at least as well, according to a 2020 study from NCSE and the Texas Freedom Network Education Fund. Yet in the first nationally representative survey of public middle and high school science educators, conducted by researchers at NCSE and Penn State in 2014–2015, a majority—57.1 percent—reported that they had received no formal instruction on climate change during their pre-service coursework.

Clearly, then, there is a need to equip science teachers to teach climate science effectively. *Teaching Climate Change for Grades 6–12*, written by a former classroom science teacher who now directs the Science Project at the University of California, Irvine, is aimed primarily at in-service teachers seeking to integrate climate change in their curricula. Kelley T. Le (the subject of our Random Samples interview on page 5) addresses her intended audience familiarly—"Let's begin with what you know, care about, and take action on," she suggests (p. 2)—and offers multiple opportunities, in the form of "exhibit" sidebars, for her readers to pause and reflect on their knowledge, attitudes, and practices regarding climate change and climate change education. Each chapter is also supplemented by quotations from various luminaries in climate change education—including NCSE's Lin Andrews (p. 66)—a selection of teacher resources (usually available online), and a list of references.

After a foreword by NOAA's Frank Niepold and Le's introduction, the book is divided into three parts—"Looking Back to Move Forward"; "Developing Scientific Literacy Using Climate Science"; and "Practices to Build Capacity for Student Agency"—containing two chapters apiece. The first of these parts emphasizes the novelty of the NGSS, focusing on their encouragement of inquiry-based learning, their treatment of the nature of science, and their amenability to equity education, before turning to climate change in the NGSS in particular. Le argues that the NGSS is particularly supportive of teaching climate change for reasons involving both the scientific content and the pedagogical approach of the NGSS: "Nearly one-third of the NGSS relates directly or indirectly to climate change content," she observes, adding that, owing to its socially controversial nature, it is "the ideal vehicle" to learn about the nature of science (pp. 53, 57).

The second part of the book sketches the basics of climate science and offers five excellent takeaways, based on up-to-date research in science education, about how to teach climate change effectively. In summary:

1. Teach the scientific consensus on climate change.
2. Do not debate about climate change.
3. Teach climate change through the lens of systems thinking.
4. Teach climate change as a socioscientific issue.
5. Teach the cause of current climate change along with the need to seek diverse and intersectional solutions. (pp. 98–99)

Le then develops her argument that climate change is particularly apt for teaching about the nature of science,

a central aspect of scientific literacy, within the framework of the NGSS, with specific advice about anchoring phenomena, investigative phenomena, and storylining.

Finally, in the third part of the book, Le describes ways to develop and iteratively improve lessons with meaningful storylines before turning—a bit awkwardly—to a discussion of helping students to evaluate misinformation and disinformation in the media, including the Heartland Institute's climate change denial efforts. Given the abundance of such misleading sources of information and their influence over students and their communities, which Le explicitly acknowledges, a longer discussion would have been welcome. The final chapter, "Education for Climate Action," addresses teachers who want to help their students get involved in taking action on climate change. While the suggestions here are generally sensible, there is no acknowledgement of the possibility of ideological backlash against the idea of teaching for climate action, which teachers should be aware of though not cowed by.

Teaching Climate Change for Grades 6–12 amply succeeds in its ambition to empower science teachers to take on the climate crisis through NGSS.

Teaching Climate Change for Grades 6–12 amply succeeds in its ambition to empower science teachers to take on the climate crisis through NGSS (to paraphrase the book's subtitle), thanks not only to its informed content but also to the thoughtful approach to communicating with the intended audience. Le offers practical guidance in terms that science teachers will understand and can put to use. By the same token, however, readers who are not themselves science teachers and thus not as interested in and conversant with pedagogical considerations may find the book less than appealing. But along with the Paleontological Research Institute's excellent *The Teacher-Friendly Guide to Climate Change* (2017), *Teaching Climate Change for Grades 6–12* deserves a place on the bookshelf of science teachers who want to improve the effectiveness of their efforts to teach climate science accurately, honestly, and thoroughly.

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

WHAT WE'RE UP AGAINST
The ICR's Sinister New Logo

The Institute for Creation Research, the young-earth creationist organization founded by Henry M. Morris in 1970, recently unveiled a new logo, explaining, "The new DNA icon spotlights the marvelous creativity of the Lord Jesus Christ's design within living creatures. ... The blues and greens in the new ICR logo represent our innovative biological research and renewed effort to clearly communicate creation truth in order to glorify the Lord Jesus Christ and equip Christians with a strong, reliable defense of the faith." Unexplained, however, was why the displayed spiral is left-handed when DNA's spiral is right-handed. (True, there is a rare left-handed variant of DNA, called Z-DNA, but it isn't simply a mirror image of ordinary DNA.) The ICR's president Randy Guliuzza was quoted as saying, "ICR's most pressing assignment is to fundamentally change the way people understand biology. Our task is to construct a completely new theory of biological design that incorporates recent discoveries and respects the biblical narrative." Alas, the ICR subsequently flipped the logo without acknowledging the error.

—GLENN BRANCH

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For 40 years, NCSE has brought evolution to life for kids across the country. Your support helps defend accurate evolution education for years to come.

NCSE celebrated its 40th anniversary at a recent event in Oakland, California.

Among those present were (above, from left to right): Robert "Mac" West, founding board member; Eugenie C. Scott, founding executive director; Kenneth R. Miller, current board president; and Ann Reid, current executive director.

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