

reports

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Dear NCSE Supporters,

At NCSE, we have always been careful to differentiate between what constitutes accurate science education and what drifts over into political or ideological opinion. In an ideal world, there would be no overlap; facts would be facts and that would be that. But of course, this viewpoint falls short on two counts. On the one hand, science is not really about “facts”; that’s one of the misconceptions that we strive hard to correct in our lessons. Science, instead, is about using evidence to derive the best possible explanations for how the natural world works, and every scientific conclusion includes some degree of uncertainty. On the other hand, there is no ideal world where political and ideological opinions have no influence on science and scientists. What is studied, who studies it, and how results are interpreted are all questions that are deeply influenced by the political and cultural environments in which science takes place.

Helping teachers convey to their students that science produces a great many useful and credible results while also acknowledging that science and scientists can sometimes be wrong or wrong-headed (and guiding students how to decide whom and what to trust) is just one more challenge that NCSE tackles. [Teaching about the nature of science](#), which is squarely within NCSE’s portfolio, is a great way to meet that challenge.

I raise these points here because as you read through this issue of RNCSE, you will come across discussions of topics that NCSE rarely tackles head-on. In the interview on page 6, board member and evolutionary biologist Joseph L. Graves Jr. explains how his most recent book *A Voice in the Wilderness: A Pioneering Biologist Explains How Evolution Can Help Us Solve Our Biggest Problem* (reviewed on page 11) seeks to illuminate how evolutionary biology has been misused to undergird racist ideas but also has the power to dispel the myth of race. On page 5, Liza Rodler and Rachel Renbarger of FHI360, with which NCSE is collaborating on a potential research project, discuss the findings of a recent white paper that demands that climate education be grounded in equity as well as science because it is the poorest and most marginalized communities in our society who will bear the heaviest burden of climate change.

The staff at NCSE often wrestle with how to balance our passion for accurate science education—and our need to maintain credibility with people across political and religious boundaries—with our own personal interests in critically important social and political issues that unquestionably intersect with science, education, and science policy. We’ll continue to be careful to maintain our focus helping individual teachers face challenges in their classrooms. But it’s not a bad idea to wrestle with those broader questions from time to time, and that’s what you’ll find in this issue of RNCSE. We appreciate your feedback.



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



Bringing NCSE's Professional Learning Model to Tennessee

The NCSE Supporting Teachers program recently held its second Leadership Academy in Nashville, Tennessee. Hosted by the Evolutionary Studies Institute at Vanderbilt University from June 19 to 22, 2023, and led by four NCSE staff, the primary goal of the event was to build our teacher ambassadors' capacity to lead professional learning workshops in their regions of the country.

The 12 teacher ambassadors began with a deep dive into the research supporting NCSE's approach to curriculum, pedagogy, and professional development, which helps teachers resolve student misconceptions about socially but not scientifically controversial topics such as evolution and climate change. "It was helpful to review NCSE's vision and mission," said NCSE Teacher Ambassador [Alex Swavely](#), of Lancaster, Pennsylvania.

The teacher ambassadors then learned more about the [Next Generation Science Standards](#) (NGSS) and the NCSE approach to creating and implementing curriculum using phenomenon-based inquiry, a process called storylining. As well as examining case studies to investi-

gate effective practices, the teacher ambassadors discussed challenges that teachers face when adopting and adapting NGSS-aligned curricula, and shared possible solutions.

...the primary goal of the event was to build our teacher ambassadors' capacity to lead professional learning workshops in their regions of the country

Authentic Scientific Data

The next day, the group took a field trip to the [Coon Creek Science Center](#) to hunt for fossils and learn about marine life in the Middle Tennessee region 70–75 million years ago. This expedition allowed the teacher ambassadors to get hands-on experience with fossil discovery and identification, which feature prominently in most of NCSE's [evolution lesson sets](#), in order

to communicate these experiences to teachers and students.

Because NCSE's lesson sets attempt to use authentic scientific data and practices as much as possible, we felt that giving the teacher ambassadors an authentic field experience would enhance their confidence and abilities to convey these experiences to other teachers and their students.



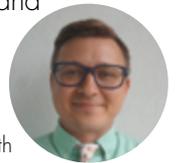
Upon returning to Nashville, the teacher ambassadors spent the next day preparing to lead their own professional learning workshop. This involved a storyboarding exercise to familiarize them with the lessons they would be leading in the workshop, planning an agenda, preparing materials, and practicing the lessons and presentations with each other.

The Academy culminated with the teacher ambassadors taking the spotlight and leading local Tennessee science teachers through a full-day workshop focused on two of our lesson sets. In [Good is Good Enough?](#), the Tennessee teachers used three-dimensional replicas of fossil horse teeth to investigate how changes in climate and vegetation led to large-scale changes in tooth size over millions of years due to natural selection. They then applied what they learned to create a hypothetical phylogenetic museum display of horse evolution and

diversification that was free of misconceptions. In [Climate Change in Your Own Backyard](#), the teachers participated in a dice-rolling activity that simulated the effects of global warming on extreme weather events, learned about the increasing rates at which billion-dollar disasters have been occurring in the United States, and investigated a variety of local climate impacts, including hurricanes, droughts, tornadoes, and wildfires. "It was really useful to conduct a low-stakes presentation in order to get a feel for how to present the lesson sets and values of NCSE," Alex Swavely reflected.

We look forward to the teacher ambassadors taking these experiences back to their home states and sharing NCSE's message and lessons with science teachers all over the country in the coming years.

Blake Touchet is a Teacher Support Partnership Specialist with NCSE. touchet@ncse.ngo



Click the buttons below to watch videos of NCSE Teacher Support Partnership Specialist Blake Touchet as he walks educators through the research and theories that underpin NCSE's approach to helping students resolve science misconceptions. Touchet presented a version of these videos to the teacher ambassadors gathered in Tennessee.

NCSE
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Science Education

VIDEO ONE

**The NCSE Approach
to Resolving
Misconceptions**

How our curriculum and
pedagogy align with research
about reconstructing
knowledge

VIDEO TWO

New White Paper Calls for Strengthening Climate Change Education

[Editor's Note: The National Center for Science Education is currently working with FHI 360 to secure a grant to support climate change education in rural, small, and low-resourced school districts.]

More and more young people are mobilizing against the growing threat of climate change. They have the passion and energy for the fight. But they also need high-quality climate change education that is grounded in science so they have the knowledge and skills to turn their passion into sustainable progress.

The trouble is, the quality of K–12 climate change education in the United States is inconsistent, with local school districts offering anything from comprehensive interdisciplinary approaches to climate misinformation.

This has to change.

In our white paper, "[Strengthening Climate Change Education in the United States](#)," we analyzed recent research on K–12 climate change education. On the basis of this research, we developed four strategic recommendations for a systemic approach to improving climate change education and helping educators get the resources they need to support young people:

- Federal, state, and local leaders and school administrators must prioritize supporting climate change education that is accurate and effective. Most importantly, they must back up that support with policies, legislation, and resources.
- State policymakers and district administrators must demand and provide curricula and materials that are grounded in science and anchored in hope. Curricula that are evidence-based and align with the Next Generation Science Standards will give young people effective tools for addressing climate change. Curricula that are focused on solutions can show young people what's possible and encourage them to participate in climate action.
- Our research found that teachers want more training in climate change education, since fewer than half of science teachers received formal pre-service coursework in this area. Education leaders and policymakers must provide pre-service coursework and in-service professional

development for science teachers and other educators. This must include strategies for supporting educators in rural, small, and low-resourced districts, which might not have the resources to provide or participate in certain types of training and professional development.

- Climate science brings together several areas of study outside science proper, including health, ethics, engineering, economics, and politics. Arts programs have been shown to increase engagement in science. Teachers of subjects outside science and after-school educators should collaborate with science teachers to integrate climate change education into their subject areas. This approach also can engage students who initially might not be interested in climate change or science.

For these solutions to be truly systemic and sustainable, they must incorporate the voices of young people, especially those from marginalized communities. These communities are at the intersection of educational, economic, and environmental injustice; they often bear the brunt of the climate crisis. Climate change education that is grounded in equity as well as science also can better support these communities as they seek climate justice.

Despite recent political attacks on science-based climate change education, young people are continuing to take the lead in the fight against climate change. Adopting a systemic, equity-grounded approach to strengthening climate change education can give science teachers and other educators the resources they need to help young people counter climate misinformation, find sustainable solutions, and change the future.

Liza Rodler is an education research associate at [FHI 360](#), a global nonprofit headquartered in Durham, North Carolina, who focuses on understanding how education systems can best support marginalized students and families. lrodler@fhi360.org



Rachel Renbarger is an education researcher at [FHI 360](#) who works to improve research methods in education, prioritizing equity and criticality. rrenbarger@fhi360.org





Joseph L. Graves Jr. is MacKenzie Scott Endowed Professor of Biology at North Carolina Agricultural and Technical State University, where he studies the genomics of adaptation as well as biological and social concepts of race in humans. He is the author of [*The Emperor's New Clothes: Biological Theories of Race at the Millennium*](#) (2001), [*The Race Myth: Why We Pretend Race Exists in America*](#) (2004), [*Principles and Applications of Antimicrobial Nanomaterials*](#) (2021); [*Racism, Not Race: Answers to Frequently Asked Questions*](#) (2022, with Alan H. Goodman), and most recently [*A Voice in the Wilderness: A Pioneering Biologist Explains How Evolution Can Help Us Solve Our Biggest Problems*](#), reviewed on p. 13. He joined NCSE's board of directors in 2021.

Paul Oh: What motivated you to write A Voice in the Wilderness?

Joseph Graves: This book is the story of why and how I became an evolutionary biologist. It is meant to encourage others who belong to socially subordinated groups to pursue their dreams, and how doing so can make a difference for their communities, as well as the rest of the world.

PO: You write in A Voice in the Wilderness that “evolutionary science will not only help us survive the existential crises facing us, but also help us improve the human condition.” Please say more.

JG: While existential crises have always been with us, those we face now are both qualitatively and quantitatively different. These include the emergence of novel pathogens as human populations begin to encroach more and more upon what remains of the natural world, environmental crises that are being precipitated by anthropogenic climate change, and the spread of racism and authoritarian forces across the globe that threaten what remains of democracy. I argue in *Voice* that without deploying our understanding of human evolution towards the establishment of social justice, we will not be able to successfully meet any of these crises.

PO: You've repeatedly stated that evolutionary science is indispensable in arguing against racism. Can you briefly articulate that argument here?

JG: All racist ideologies are based on the idea of the existence of profound biological differences between purported races of humans. Specifically, that Eurasians possess evolved biological differences in intelligence and personality that have allowed their success in founding and maintaining great civilizations, and that the problems of these modern societies stem from the genetically innate inferiority of persons of African descent. In a series of peer-reviewed journal publications and three books (*The Emperor's New Clothes*, *The Race Myth*, and *Racism, Not Race*) I debunk not only the existence of biological races within our species, using evolutionary principles, but also the idea that some populations within our species are innately better or worse than others. Specifically, I have shown how natural selection and genetic drift have never acted in a way to provide superior intelligence to some populations and not others.

PO: A Voice in the Wilderness intersperses your personal experiences with your work and research. How have your personal experiences shaped the scientist you have become?

JG: Science has never been simply the objective examination of nature. The questions that individual scientists, as well as the enterprise of science as a whole,

pursue are influenced by the social position of the scientists themselves. Born a second-class citizen of the United States, and educated in a system of white supremacy,

I became sensitive to how that enterprise differentially benefited some groups, and often ignored the needs of others. The agenda of modern science is still tainted by its focus to provide comfort for the wealthy. This has the effect of narrowing the demography of science. My success in opening the doors to science careers for historically marginalized populations results from my focus on deploying science for the purpose of social justice.

PO: How do NCSE's efforts to ensure that all students get an accurate science education resonate with your own priorities as an evolutionary biologist and scholar?

JG: I joined the board of NCSE precisely because of its work to protect the quality of science instruction for all students. If evolutionary science and climate change are lost to the curriculum, then the most powerful tools for understanding biology and society are also lost. This would differently impact the communities that are already suffering from a lack in investment in their education. We dare not allow the attacks on critical thinking and science to continue.

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



**We're
there for
teachers.**

Support NCSE

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.

ALABAMA

As the November 8, 2022, general election neared, Yolanda Flowers, the Democratic candidate for governor of Alabama, visited Dinosaur Adventure Land, the Lenox, Alabama, attraction run by the flamboyant young-earth creationist and convicted felon Kent Hovind. (A video of their discussion was posted on YouTube, but is no longer available: Hovind's YouTube account was reportedly terminated for violations of the terms of service.) The conversation focused on prison reform rather than creationism, although Flowers expressed enthusiasm about Dinosaur Adventure Land. Throughout her campaign, Flowers emphasized her belief in the Bible, but to no avail: incumbent governor Kay Ivey, a Republican, won re-election by a 38-percentage-point margin.

CONNECTICUT

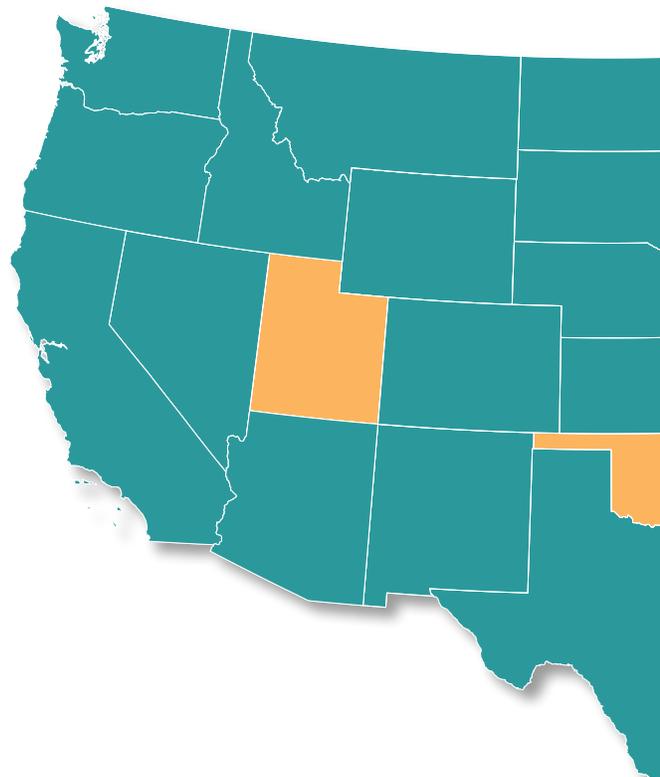
Three proposed bills on climate change education—one opposing it; two supporting it—died in the Connecticut legislature in April 2023 when a deadline for bills to be reported out of committee passed.

- Proposed House Bill 5063, if enacted, would have revised “the climate change curriculum [sic: presumably “standards”] to add a requirement that students are exposed to the debate and research concerning the amount and effects of anthropomorphic [sic: presumably “anthropogenic”] carbon dioxide levels.” The bill was proposed by John E. Piscopo (R–District 76), a previous sponsor of similar legislation.
- Proposed House Bill 5271, if enacted, would have required that “the climate change curriculum in the Next Generation Science Standards be taught as part of the state-wide science curriculum for public schools and that such teaching begin in elementary school.” Connecticut adopted the NGSS in 2013 and subsequently enacted a bill including the same requirement as House Bill 5271.
- Proposed House Bill 6396, if enacted, would have prohibited local and regional boards of education from punishing or restricting educators with regard to “teaching about subjects in which ideological differences of

opinion exist.” Climate change was cited as such a subject, and the sponsor, Christine Palm (D–District 36), previously sponsored a string of bills aimed at supporting climate change education in Connecticut.

OKLAHOMA

Oklahoma's Senate Bill 140, styled “the Oklahoma Science Education Act,” would have ostensibly provided Oklahoma's teachers with the right to help students “understand, analyze, critique and review in an objective manner the scientific strengths and scientific weaknesses of existing scientific theories covered in the course being taught,” while prohibiting state and local administrators from exercising supervisory responsibility. No particular theories were identified as controversial, but a string of similar bills in the Oklahoma legislature—most recently Senate Bills 613 and 662 in 2021, which died in committee in the same year—were clearly aimed specifically at evolution. Senate Bill 140's sole sponsor, Nathan Dahm (R–District 33), was also the sole sponsor of 2021's Senate Bill 662, which is substantially similar to Senate Bill 140. The bill died in March 2023 when the deadline for Senate bills to be reported from committee passed.

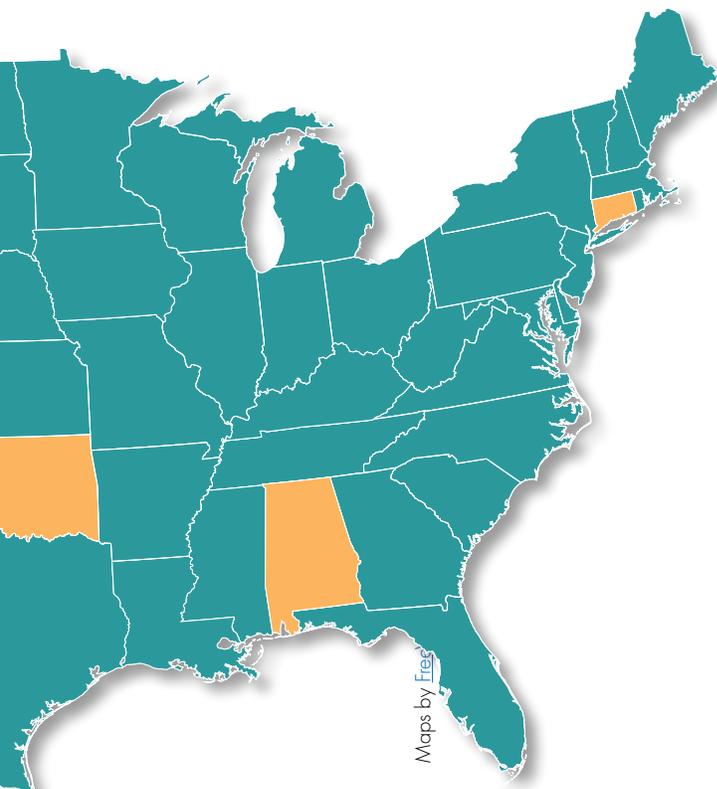


OKLAHOMA

Oklahoma's Senate Bill 943, a "school choice" bill that cited "climate change ideology" as a potential justification to divert state education funds away from the state's public school system, died in committee in March 2023, when the deadline for Senate bills to be reported from committee passed. Initially sponsored by Shane Jett (R-District 17), later joined by Julie Daniels (R-District 29), the bill would have allowed parents and guardians "to access educational services that meet the needs of their individual children by directing State Aid for which each child is eligible to the education provider of their choice," but in counties with a population of less than 10,000, only if the student is "eligible to enroll in a public school in this state that has been determined by a reporting agency to be a trigger district." A trigger district was defined as one in which any of thirteen "concepts or activities have been advocated or tolerated" including "climate change ideology including, but not limited to, disparaging the oil and natural gas industry or the agriculture industry." No definition of "climate change ideology" was provided in the text of the bill, but the *Tulsa World* understood the bill to be targeting districts "that teach about climate change."

UTAH

"Climate change was restored to Utah's supplemental state standards for science and engineering education by one vote late Thursday night," the *Deseret News* reported in May 2023. Previously, while considering a draft of standards for courses such as human anatomy, genetics, geology, meteorology, and marine biology/oceanography, the Standards and Assessment Committee of the board voted 3–2 to remove a standard that "called for students to be taught how to evaluate proposed designed solutions intended to reduce the impacts of climate change" from the meteorology standards. Also under consideration but not adopted was a proposal to "include alternative theories about how rocks formed, such as the impact of the Great Flood described by the Book of Genesis." Subsequently, after hearing from more than 100 Utahns calling for the restoration of the standard, the board voted 8–7 to adopt the standards as originally drafted by a committee of educators, scientists, and parents.



CANADA, SASKATCHEWAN

Creationism emerged as a theme in a controversy involving a private Christian school and its sponsoring church in Saskatoon. In November 2022, former students of the former Christian Centre Academy (now Legacy Christian Academy) told the provincial legislature that the Accelerated Christian Education (ACE) curriculum used by the school is scientifically inaccurate, citing its claim that humans and (non-avian) dinosaurs coexisted. Saskatchewan's Minister of Education Dustin Duncan reportedly was awaiting the results of investigations before making any decisions. The school is also under investigation for criminal abuse complaints, with prosecutors reportedly considering whether to file charges, and is facing a proposed class action lawsuit seeking \$25 million in compensation, immediate and permanent closure of the school, and a permanent ban on defendants' working in schools with minors.



A New Anti-Evolution Exhibit on the Enchanted Islands

As an evolutionary biologist, it is thrilling to say that I (Jim) am one of the fortunate few who have taught evolutionary ecology on the Galápagos Archipelago, in my case, to 31 equally fortunate students over the last four years. These islands are among the places Charles Darwin explored and where the seeds of evolutionary theory were planted in his mind. Even though Darwin did not have a eureka moment there, these islands feel like ground zero for evolution.

I (Ellie) was one of Jim's students on the Galápagos in 2022. At the same age as Darwin was when he reached the islands, I was eager to follow Darwin's footsteps on this haven in the Pacific. I found Herman Melville's description of the islands as "enchanted" fitting with their history of conniving pirates, relentless explorers, and strange creatures. They are a Neverland for aspiring biologists like me. In the Galápagos, it is easy to get hooked on the intricacy of natural selection, to learn to see the history of native species written plainly in the arch of a tortoise shell. Although I was not with Jim's class in person in 2023, I attended vicariously via a steady stream of photos Jim sent of the adventures over the three weeks. Among the photos were displays of a creationist exhibit.

In 2018, Glenn Branch reported ([RNCSE 38:3, p. 5](#)) that the Seventh-Day Adventist Church was soon to break ground on a creation museum in the town of Puerto

Ayora on the island of Santa Cruz in the Galápagos. The facility, opened in February 2020, is located on expensive real estate along Charles Darwin Avenue, a street which leads to the Charles Darwin Research Center that oversees much of the research conducted on the islands.

It is cryptically labeled the Origins Museum of Nature, which is comprised of an "exhibit hall" on the first floor of a two-story building that also houses the Loma Linda Adventist Education Unit and the Seventh-Day Adventist Church and thus easily overlooked by passersby.

The exhibit hall is a single room that includes displays lining the walls plus videos and virtual experiences. The first displays as one enters the hall provide information on the biology, geology, and environmental issues of the islands. The emphasis of the displays then shifts to addressing various topics including natural laws, physics and mathematics.

The facility appears to explain nature, but with the central message that *evolution is improbable to the point of being impossible*. The word "evolution" never appears in the exhibit.

In his 1802 book *Natural Theology*, William Paley famously

argued that complexity in nature implies a God for the same reason that the existence of a watch implies an intelligent watchmaker. The exhibit presents the same worn and overused argument in support of "intelligent design" and against evolution, which the museum misrepresents as a random process.



The final display and message at the exit of the exhibit hall.
All photos by Jim Krupa

For instance, one exhibit informs us that hexagons, such as the six-sided cells of honeycombs, are the most efficient shape found in nature. We are asked, *how do animals know the hexagon is the most efficient design?* We are told that it is because God designed the perfect forms of nature. This is supported by quotes from scientists such as Galileo ("Mathematics is the language with which God has written the universe") and the Nobel prize-winning



The building as seen from Charles Darwin Avenue housing the Origins Museum of Nature, the Loma Linda Adventist Education Unit, and the Seventh-Day Adventist Church.

physicist Paul Dirac (“God is a mathematician of a very high order, and he used advanced mathematics in constructing the universe.”). The message: the laws of nature are part of design.

Yet another display explains the physics of light in relation to the complex eyes of trilobites, described as designed to capture light. The display concludes, “The eye of the

trilobite is complex and suddenly appeared. Something so beautiful cannot be explained by random processes but suggests intelligent and useful design.”

Another display is on blood coagulation. This displays the complex process involving a “coagulation cascade” with 13 reaction factors. The display explains these reactions occur in a specific order, thus the

odds that the cascade happens randomly, we are told, are 1 in 6,227,020,800—implying that evolution is impossible.

The tour through the exhibit hall ends with a final display providing these words: “Wherever we look, nature reveals signs of planning and purpose. These are signatures of a great God that planned everything in detail. These fingerprints are scattered in the atoms and molecules, in the intricate network of biochemical mechanisms that govern living beings....”

The museum inhibits, rather than promotes, inquiry. Here, questions about how the world works are answered with the response, *that’s how God designed it.*

It is not by chance this facility is in Puerto Ayora. The town is constantly inundated with tourists in numbers greater than the other towns on the islands. We can only hope that in the Galápagos, rejection of evolution will not submerge scientific evidence, so that Darwin’s seeds of evolutionary theory will continue to take root and grow for generations to come.



One of several video kiosks in the exhibit hall.

Jim Krupa is Professor of Biology at the University of Kentucky and a 2019 recipient of NCSE’s Friend of Darwin Award. james.krupa@uky.edu



Ellie Tierney graduated with honors from the University of Kentucky in 2023 and is now a graduate student in the School of Natural Resources and the Environment at the University of Arizona. Ellentierney@arizona.edu





Supporters in the SPOTLIGHT



Daniel Fairbanks's *Gregor Mendel: His Life and Legacy* (Prometheus Books, 2022) was published. The publisher writes, "This book commemorates Mendel's life and legacy at the bicentennial of his birth. It interweaves traditional accounts of his history with newly discovered evidence to reveal an

extraordinary teacher, a resolute priest and abbot, and a complex and guileless scientist whose momentous discoveries have remained essentially unchanged for more than a century and a half." Fairbanks is Professor of Biology and University Research Officer at Utah Valley University.



NCSE is pleased to congratulate **Jo Handelsman**, a member of NCSE's board of directors, on her election to the National Academy of Sciences, in recognition of her distinguished and continuing achievements in original research. Handelsman is Director of the Wisconsin Institute for Discovery as well as a Vilas

Research Professor and Howard Hughes Medical Institute Professor at the University of Wisconsin, Madison. Handelsman previously received the Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring from President Obama in 2011 and was inducted into the American Academy of Arts and Sciences in 2019.



Michael E. Mann, the presidential distinguished professor in the Department of Earth and Environmental Science at the University of Pennsylvania, director of the Penn Center for Science, Sustainability, and the Media, and a member of NCSE's board of directors, received the 2022 Stroud

Award for Freshwater Excellence from the Stroud Water Research Center. The center's executive director David Arscott commented, "Water is the primary medium through which we feel the impacts of climate change, and Michael Mann is a leading voice on climate change. His groundbreaking research and masterful science communication have given weight and shape to the conversations needed to initiate climate action."



NCSE Executive Director **Ann Reid** was elected as a Fellow of the American Association for the Advancement of Science, as announced in a January 31, 2023, press release, in recognition of her "distinguished work in promoting the public understanding of science and in defending the integrity of science education." Election as a Fellow of the AAAS is among the highest distinctions in the scientific community. Also elected as a Fellow of the AAAS was **Jason R. Wiles** of Syracuse University, a recent recipient of NCSE's Friend of Darwin award.



—GLENN BRANCH

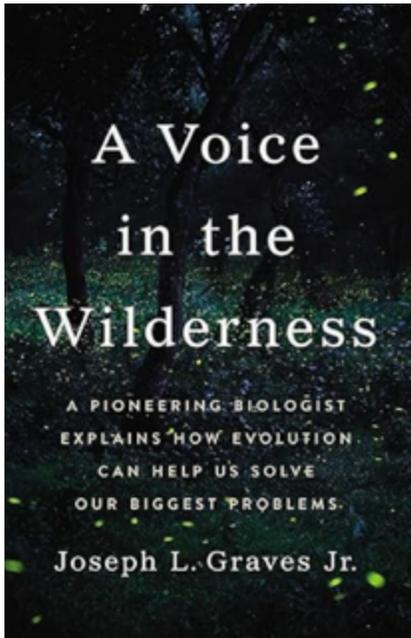


WELCOME TO WENDY JOHNSON

NCSE is pleased to welcome Wendy Johnson as a new Teacher Support Partnership Specialist in the Supporting Teachers program.

A former classroom teacher in Michigan, Johnson earned a B.A. in biology education at Hope College, and a M.S. in biological sciences and a Ph.D. in curriculum, instruction, and teacher education and ecology, evolutionary biology, and behavior at Michigan State University. At NCSE, she will be helping to develop and maintain relationships with local school districts, providing in-person and virtual professional development to teachers, and assisting with mentoring and recruiting teachers.

THE RNCSE REVIEW



A Voice in the Wilderness: A Pioneering Biologist Explains How Evolution Can Help Us Solve Our Biggest Problems

author: Joseph L. Graves Jr.

publisher: Basic Books

reviewed by: Vassiliki Betty Smocovitis

Written by Joseph L. Graves Jr., a well-known evolutionary geneticist at North Carolina A&T State University and the first African American to receive a PhD in evolutionary biology (in 1988), *A Voice in the Wilderness* is a mix of reflection, memoir, and scientific explication, as well as an exhortation to appreciate the explanatory power of evolutionary biology and its potential to help solve some of humanity's biggest problems. Graves takes the reader through a kind of personal journey exploring the way in which his two passions, evolutionary science and social justice, have intersected in his life and work. [Read our Random Samples interview with Graves on p. 6.]

Part I, entitled "Black Darwin," is devoted to Graves's family background and education, which was shaped by the challenges facing an African American entering a scientific field with a dominant Eurocentric focus. Graves takes us through his personal struggles as well

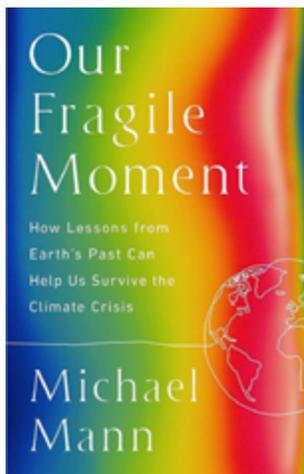
as his triumphs in science, and in the process introduces us to some of the towering figures in late-twentieth-century ecology and evolutionary biology who inspired him and then enabled him to

*...a mix of reflection,
memoir, and scientific
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the explanatory power
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and its potential to help
solve some of humanity's
biggest problems*

obtain his PhD at Wayne State University. Graves started his doctoral work at the University of Michigan in a pro-

gram with a stellar reputation in ecology and evolutionary biology, but was derailed, as it were, by his extensive involvement in social justice movements in the early 1980s that took him away from his studies. That he completed his dissertation at an urban campus in Detroit, a city rich in African American history and in union activism, is not at all accidental, he notes: the mix of politics and science was instrumental to his eventual success.

Part II of the book, entitled "Why Evolution Matters," takes the reader through Graves's career as successful evolutionary researcher, educator, program director, and indeed leader in a number of national initiatives to raise awareness of not only the importance of the science of evolutionary biology but also its dangers, especially when misused to disparage entire classes of people. Graves is especially attuned to racialized thinking in evolutionary biology and draws on a wide range of scholarship in anthropology, sociology, and the history of science to expose the fallacies and misunderstandings common in these wrongheaded approaches. He also takes pains to include discussions of class, gender, and sexual orientation. But the ways in which evolution matters aren't limited to its misuse, and Graves accordingly devotes entire chapters to explaining the importance of evolutionary biology to humanity as it faces contemporary challenges such as pandemics, climate change, and the persistent problem of disparities and inequities in a world where the relationship between social injustice and science has too often been ignored, if not entirely rendered



*Our Fragile Moment.
How Lessons from Earth's Past
Can Help Us Survive the
Climate Crisis*

author: Michael E. Mann

publisher: Public Affairs

reviewed by: Spencer Weart

The world's most powerful computers, swallowing oceans of data and running for weeks at a time, can offer only a rough idea of how global temperatures will rise as humanity keeps pumping carbon dioxide gas (CO₂) into the atmosphere. The climate system is so irreducibly complex, to borrow a term from the creationists, that different ways of calculating things like cloudiness give significantly different answers. Some computer runs calculate that doubling the level of the gas will bring a warming of 2 °C (dangerous), while others say 4° or even 5° (catastrophic). With so much uncertainty, it

is natural to ask whether the elaborate computations can be trusted at all.

Paleoclimatology to the rescue. In recent decades, legions of experts in different fields have found ingenious ways to measure the atmosphere and climates far back into the past. They have found that both the CO₂ level and temperature have varied over wide ranges. Overall, it turns out that doubling CO₂ went along with a temperature rise of roughly 2–4.5 °C, pretty much as the computer models say. When wholly different methods reach the same numerical conclusion,

invisible. Having deep familiarity with Biblical scripture, furthermore, a byproduct of his Baptist upbringing, Graves also offers us his reflections on the complicated relationship between science and religion.

In short, *A Voice in the Wilderness* offers a deeply personal discussion of evolution that guides readers through some of the most dangerous minefields in the history of science, while offering hope for solving some of the most pressing, and indeed existential, problems facing humanity. The book is well-written, and some of the sections are especially compelling, evoking a range of emotions from sadness to

anger as Graves recounts his family experiences and his own struggles as an African American scientist encountering structural racism. As a historian of science, I was especially moved by the chapter titled “America’s Biggest Lie,” that featured Louis Agassiz, the notorious Swiss American polygenist, a supporter of separate creation for human races. The inclusion of visual images—daguerreotypes—of seven enslaved people objectified by Agassiz and treated like nonhuman animals is a gut-wrenching example of the misuse of science. I also found especially useful Graves’s recounting of his quasi-debate with political scientist Charles Murray at Williams College in 1994, and his

that goes a long way toward establishing confidence in the result. In the most recent report by the Intergovernmental Panel on Climate Change (IPCC), for the first time the authors relied on paleoclimatology as much as on computer models, if not more, to project future global temperatures.

Arguably the foremost living paleoclimatologist is Michael E. Mann (a member of NCSE’s board of directors). His investigation of temperatures over the past millennium—the famous “hockey stick” graph, hooking sharply upward after 1900—played an important role in the IPCC’s landmark 2001 announcement that an unprecedented global warming was visibly underway. The finding threatened powerful industrial and ideological interests, who attacked Mann’s work and harassed him personally with everything from lawsuits to anonymous threats. Mann fought back fearlessly, meanwhile continuing to publish important work.

He has not stopped there. Inspired by Carl Sagan and Stephen Schneider, two scientists who worked hard to

detailed refutations of claims made in Murray’s notorious *The Bell Curve: Intelligence and Class Structure* (1994) written with Richard J. Herrnstein.

A Voice in the Wilderness is an important book for anyone interested in science education, not only in order to gain greater understanding of the explanatory power of evolutionary biology and its place in modern culture but also to understand the fallacies surrounding the intersection of biology and race.

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reach out to the public, Mann somehow finds time to talk to journalists and anyone else with a good question. An internet search of his name finds numerous examples just during the past year in media from the *Wall Street Journal* to CNN. More, he has written or co-authored a variety of articles and books, ranging from a dense technical and personal account of the “hockey stick wars” ([The Hockey Stick and the Climate Wars, 2013](#)) to a picture book for young children ([The Tantrum that Saved the World](#), with Megan Herbert, 2022). Now Mann has finally written a book, [Our Fragile Moment: How Lessons from Earth’s Past Can Help Us Survive the Climate Crisis](#) centered on his own field of paleoclimatology. Like all his work, but even more so, the book deserves a wide audience.

Studies of Earth’s past reveal a wild variety of climate systems. A world with alligators and palm trees in the Arctic. A world covered with ice down to the equator. A world of deserts, both oceans and land mostly barren. A world with a mild and exceptionally stable climate—the world where our

civilization flourishes. In between these different worlds, a set of devastating mass extinctions, each driven by a rapid change in the composition of the atmosphere and the climate. Mann describes what happened in each of these cases, and why. And at every point he draws lessons for how our present climate could change. The main difference between most of the extinction-level events in the past and our current situation, he points out, is that we are changing the atmosphere orders of magnitudes faster. He is no prophet of doom, however, reassuring readers that the worst catastrophes can be avoided if (if!) we act vigorously to restrain our greenhouse gas emissions.

Mann has a lot of things on his plate and the book shows signs of haste. It is loosely organized, with topics popping up wherever he finds a hook, along with personal anecdotes and other digressions on subjects that are not exactly relevant. That does make for a lively book, easy to read, short, and with a minimum of technicalities. Some of the explanations get complicated because, well, the climate system is complicated.

But the important points come through clearly. Mann barely touches on the history of paleoclimatology, focusing on our current understanding including his own recent work. The field is developing so rapidly that some of the book’s discussions will soon be out of date, but Mann is generally careful to differentiate between what is solidly known and what is open to revision.

This is not the first book I would give to somebody curious about the climate crisis. But it would be a great second book for anyone who wants a deeper understanding. Mann uses concrete examples from the past to explain all the forces that are known to make climates change, and with what specific consequences (mostly harmful). Along the way he shows how scientists are combining computer models with geological evidence to illuminate the most important of all the problems that we face.

Spencer Weart was Director of the Center for History of Physics at the American Institute of Physics from 1974 to 2009; he is the author of *The Discovery of Global Warming* (second edition, 2008) and maintains a [website](#) of the same name. sweart1@gmail.com



WHAT WE’RE UP AGAINST The Rumble of Shifting Goalposts

The headline of a November 8, 2022, press release from the Heartland Institute, notorious for its efforts to dispute the existence of a robust scientific consensus on climate change, blared, “97% consensus on climate change? Survey shows only 59% of scientists expect significant harm.” The results of the survey, conducted by the Fairleigh Dickinson University poll for the Heartland Institute, are not comparable with the bulk of research on the expert acceptance of climate change however, since about 75 percent of

the respondents earned only undergraduate degrees in relevant disciplines. Even so, the survey report—though not the press release—reveals that 96 percent of the respondents believe that global climate change is occurring. The respondents were also asked to estimate what percentage of climate change is due to human activity: the average estimate was 75 percent, with 54 percent of the respondents selecting a value between 76 and 100 percent.

—GLENN BRANCH

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