

reports

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Celebrating Scopes and Commemorating Kitzmiller NCSE'S PLANS FOR 2025



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Dear NCSE Supporters,

As we close the books on 2024 and begin the new year, it's a good time to reflect on the exciting work we've accomplished and the important milestones ahead. This quarter's *RNCSE* is packed with updates, achievements, and a sneak peek into what's coming in 2025 — an exciting year for NCSE as we commemorate the anniversaries of both the Scopes Trial and the *Kitzmiller v. Dover* case. We're still finalizing the details of how we'll mark these milestones, but the impact of these two landmark events on science education and public understanding continues to resonate today.

In this issue, we're thrilled to share that NCSE has been honored by the North American Association for Environmental Education, recognizing our ongoing commitment to environmental education. We also celebrate the hard work of three of our board members, J. Marshall Shepherd, Joseph L. Graves, and Michael E. Mann, who received special recognition for their contributions to science!

In addition to these accolades, we're excited to offer you an insightful interview with Katie Hinde, whose groundbreaking research into maternal biology and animal behavior is featured in *Random Samples*. Plus, you'll find an article by NCSE's Blake Touchet on our presence at the National Association of Biology Teachers (NABT) conference where we led several sessions including a very popular Evolution Symposium.

For those who love a good book, this issue includes two intriguing reviews: Arthur G. Hunt takes a deep dive into Nick Lane's *Transformer: The Deep Chemistry of Life and Death*, a thought-provoking exploration of the origins of life, while our own Wendy Johnson reviews a new educational game, "Earth Matters", which combines science and play in a unique way.

As always, thank you for your continued support of NCSE. We look forward to what's next as we continue to advance science literacy and protect the integrity of science education. Stay tuned for more exciting announcements in the months to come!



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NCSE RINGS IN 2025 WITH CELEBRATIONS AND NEW INITIATIVES

One hundred years ago, a science teacher named John T. Scopes was tried and convicted for teaching human evolution in a Dayton, Tennessee, public high school. Eighty years after the infamous Scopes “Monkey Trial,” a federal judge in Pennsylvania ruled that teaching “intelligent design” in public schools violated the U.S. Constitution. Both trials have had a profound effect on science education over the years, and NCSE will accordingly be marking the two milestones in 2025 with a variety of celebrations and educational events.

“As someone who taught evolution in a public school in the Southeast, I recognize how important the outcomes of these landmark trials have been for our ability to provide kids with an accurate understanding of biology and science in general,” NCSE Executive Director Amanda L. Townley said. “And each day we see how fragile these hard-fought gains are as we at NCSE push back and guard against ideological incursions in the classroom. It will be an honor and a privilege for NCSE to shine a spotlight on the 100th anniversary of the Scopes ‘Monkey Trial’ and to recognize the importance of *Kitzmiller v. Dover* 20 years after the decision was handed down.”

In addition to marking the Scopes centennial and the *Kitzmiller v. Dover* 20th anniversary, NCSE in 2025 is also catching March Mammal Madness fever, facilitating another My COAST professional development for teachers, launching a fellowship for scholars aimed at tackling science misconceptions, and analyzing the results of a national survey of middle and high school teachers regarding climate change, evolution, the nature of science, and trust in science — all part of a truly exciting year!

Here’s a deeper dive into some of what NCSE has in store for the coming year:

Scopes Centennial with a sprinkling of *Kitzmiller v. Dover*

NCSE is partnering with Evolutionary Studies at Vanderbilt University to host a two-day [Scopes “Monkey” Trial Centennial Symposium](#) in July 2025, featuring leading scholars



in evolution, law, and religion. The symposium, free and open to the public, includes sessions such as “The History of the Trial,” “Evolution Today,” and “Evolution and Religion.” Townley, NCSE Board President Kenneth R. Miller, and former board member Barbara Forrest will be speaking on the theme “Modern Challenges to Teaching Evolution.” Part of their talks will doubtless center on the impact of the *Kitzmiller v. Dover* federal trial and decision — Forrest and Miller were expert witnesses for the plaintiffs. The symposium, as might be expected, features many friends of NCSE, such as board member Joseph L. Graves Jr. and no fewer than nine recipients of NCSE’s Friend of Darwin award.

Prior to the symposium, NCSE will lead professional development for local Tennessee science teachers leveraging a new set of innovative evolution activities created by NCSE known as [Story Shorts](#). These modular, standards-aligned activities help students overcome common evolution misconceptions.

Along with the two-day symposium, NCSE is also organizing a panel on Scopes and *Kitzmiller* for Evolution 2025, a conference in June hosted by the Society for the Study of Evolution, the American Society of Naturalists, and the Society of Systematic Biologists. Planning for the Evolution 2025 panel is in the very beginning stages; [stay tuned](#) for more information.

MARCH MAMMAL MADNESS

“If you’re learning, you’re winning!”

March Mammal Madness

Since 2013, science and non-science nerds alike have fervently filled in tournament brackets each year and “watched” as animals battled it out in a complex and fun thought experiment known as [March Mammal Madness](#). According to MMM founder Katie Hinde, associate professor of evolutionary biology at Arizona State University, the event has exploded in popularity, both among the general public and among teachers and students. Last year, for instance, teachers put the MMM bracket in the hands of 830,000 students worldwide. (See our [Random Samples](#) interview with Katie Hinde, p. 10.)

This year, NCSE is a sponsor of March Mammal Madness. At the National Association of Biology Teachers (NABT) Conference in November 2024, NCSE organized an Evolution Symposium that featured a presentation by Hinde titled “A Lioness Walks Into an Orca:

How Stories Enhance Science Education,” as well as one by NCSE Science Education Specialist Blake Touchet and Teacher Ambassador titled “Mystery Mammal Madness: Curious Cases of Convergence.” The session was packed to overflowing with teachers drawn to March Mammal Madness and Hinde.

On Darwin Day, February 12, 2025, Hinde will reprise her talk virtually as part of NCSE’s annual Darwin Day celebration in collaboration with NABT. She’s promised to reveal more clues about this year’s bracket, including

the four divisions comprising the 65 combatants in the single-elimination tournament. Then, several weeks later in early March, the full bracket will be released to the public. Hinde dropped some cryptic hints about this year’s bracket theme, saying among other things that it will honor the 100th anniversary of the Scopes trial.

“We’re so excited to be partnering with Katie Hinde and the fabulous folks behind March Mammal Madness this year!” Townley said. “It’s such a great opportunity to provide more exposure for this fun, ingenious tournament, and we appreciate the opportunity to put NCSE’s work and resources in front of even more scientists and teachers thanks to MMM’s popularity.”

My COAST and the Sound Science Fellowship

We launched our [My COAST](#) initiative in 2024 with a very successful inaugural event on Skidaway Island, Georgia. Nearly 30 teachers engaged in hands-on learning experiences about the impacts of climate science on their local ecosystems and research being conducted to understand how the region is changing. They also learned how to use related NCSE climate change activities in workshops led by NCSE’s Science Education Outreach team.

In 2025, NCSE is following up with a second My COAST multi-day workshop in April in Key West, Florida. Partnering with Mote Marine Laboratory and Aquarium,



NCSE will again help teachers understand the vulnerabilities and resilience of a coastal area threatened by climate change, but in this case tailored to the specific needs and realities of Key West.

NCSE will also launch its [Sound Science Fellowship](#). Designed to address the ongoing challenges faced by

teachers as they navigate issues such as scientific misinformation, evolving educational standards, and societal resistance to critical scientific topics, the fellowship includes seven academics who will engage in research and service opportunities.

Beyond these new initiatives and partnerships, NCSE will of course continue to track and respond to ideological incursions into the science classroom. Just as Maynard Shipley's Science League of America kept concerned supporters up to date on attacks on science education in the Scopes era, so

our weekly [Monitor](#) keeps you up to date on attacks on science education a hundred years after the Scopes trial.

With a focus on the Scopes trial and the *Kitzmiller v. Dover* decision, and with the launch of new initiatives and partnerships, 2025 promises to be a year full of learning, exploration, and continued vigilance.



FAREWELL TO LIN ANDREWS

NCSE bids farewell to Lin Andrews. Joining NCSE in 2019 after teaching high school biology for 18 years, she expanded

the breadth and depth of NCSE's Supporting Teachers program.

During the COVID-19 pandemic, she worked with NCSE's Teacher Ambassadors to develop three misconception-based curricula on climate change, evolution, and the nature of science and with former Executive Director Ann Reid to develop a series of educational essays to help teachers understand the science of the pandemic throughout the crisis.

As program director, she worked extensively with the science teacher community, coordinating NCSE's outreach

efforts, representing NCSE at conferences, and contributing to journals such as *The American Biology Teacher*, *District Administrator*, and *In the Trenches*, the newsletter of the National Association of Geoscience Teachers.

Additionally, along with the NCSE Supporting Teachers team, Andrews developed and executed a two-year longitudinal study with over 30 curriculum field-test (CFT) teachers, looking at the supports and barriers teachers face when implementing NGSS storyline curricula. The results of that study were [described](#) in *Research Issues in Contemporary Education*.

In her final year at NCSE, Andrews oversaw the development of the new [NCSE Story Shorts and Teacher Toolkit](#), which resulted from the knowledge gained during the CFT study. All of us at NCSE wish her the best in her new endeavors.

—Glenn Branch

NAAEE 2024 Awards for Excellence



Outstanding Service to Environmental Education by an Organization



NCSE
National Center for Science Education

NCSE honored with Outstanding Service to Environmental Education

NCSE is proud to be the organizational recipient of the [Outstanding Service to Environmental Education award](#) for 2024. Conferred by the [North American Association for Environmental Education](#), the award recognizes exceptional contributions and services to advancing environmental

education — climate education in particular, in NCSE's case. NCSE Deputy Director Glenn Branch accepted the award on behalf of NCSE on November 9, 2024, in Pittsburgh, Pennsylvania, during the awards banquet of NAAEE's annual conference.



Member News



NCSE is happy to congratulate the evolutionary biologist **Joseph L. Graves Jr.** of North Carolina A&T University, a member of NCSE's board of directors, on receiving a Genius Award, the highest honor from the Liberty Science Center in Jersey City, New Jersey. Graves

was born in Westfield, New Jersey, a few miles from the center. He received the award at a gala event at the center on May 20, 2024, where he discussed misconceptions about biology and race, according to [a May 21, 2024, report](#).



NCSE is pleased to congratulate **Michael E. Mann**, a member of NCSE's board of directors who serves as the Presidential Distinguished Professor of Earth and Environmental Science and the director of the Penn Center for Science, Sustainability, and the Media at the University of Pennsylvania, on

receiving the John Scott Award for 2023 from the Franklin Institute and the University of Pennsylvania. The award is reportedly the oldest science award in the United States; it comes with a prize of \$15,000. "The award means a lot to me," Mann told the *Philadelphia Inquirer*. "Because it reflects sort of the legacy of Benjamin Franklin. He was an environmentalist. You could even argue he was an early climate scientist and a climate advocate."

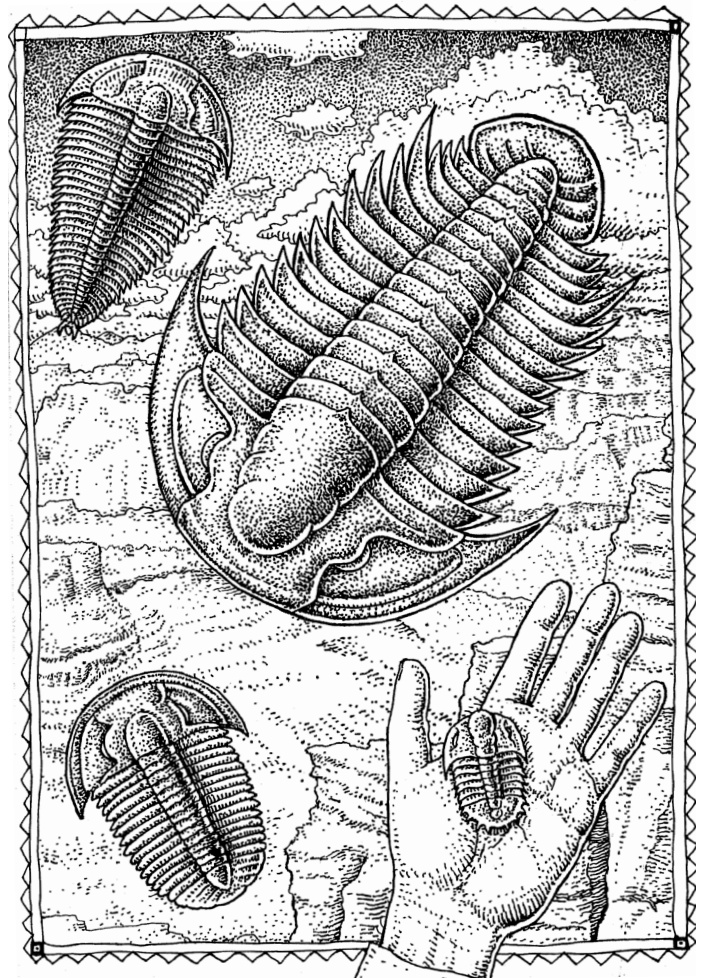


NCSE is delighted to congratulate **Ben Santer**, a member of NCSE's board of directors from 2012 to 2024, on receiving the 2024 John J. Carty Award for the Advancement of Science from the National Academy of Sciences.

[According to the NAS](#), "Santer is widely recognized for his leading work linking modern climate change to human activities. Over a more than 30-year career, Santer has pioneered new approaches

to identify human influence on climate change, investigating atmospheric temperature and water vapor, ocean heat content, sea surface temperature in hurricane formation regions, changes in the seasonal cycle of temperature, and many other climate variables. The research findings from these studies have shown that distinctive 'fingerprints' caused by human activities are now ubiquitous in Earth's climate system."

The Carty award is awarded every two years, to recognize noteworthy and distinguished accomplishments in any field of science within the National Academy of Sciences' charter. The award is presented with a medal and a \$25,000 prize.



Art work by Roy Troll www.trollart.com

UPDATES

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

FLORIDA, NASSAU COUNTY

The Nassau County School Board unanimously voted in June 2024 to deny a challenge to a high school world history textbook filed by a local conservative group, Citizens Defending Freedom, according to the *Fernandina Observer*. The group's objections included the treatment of human evolution, specifically the assertions that the australopithecine Lucy lived about 3 million years ago and that Neanderthals disappeared about 50 thousand years ago, and the treatment of global warming and climate change, which, according to the group, "have not been proven scientifically."

MARYLAND

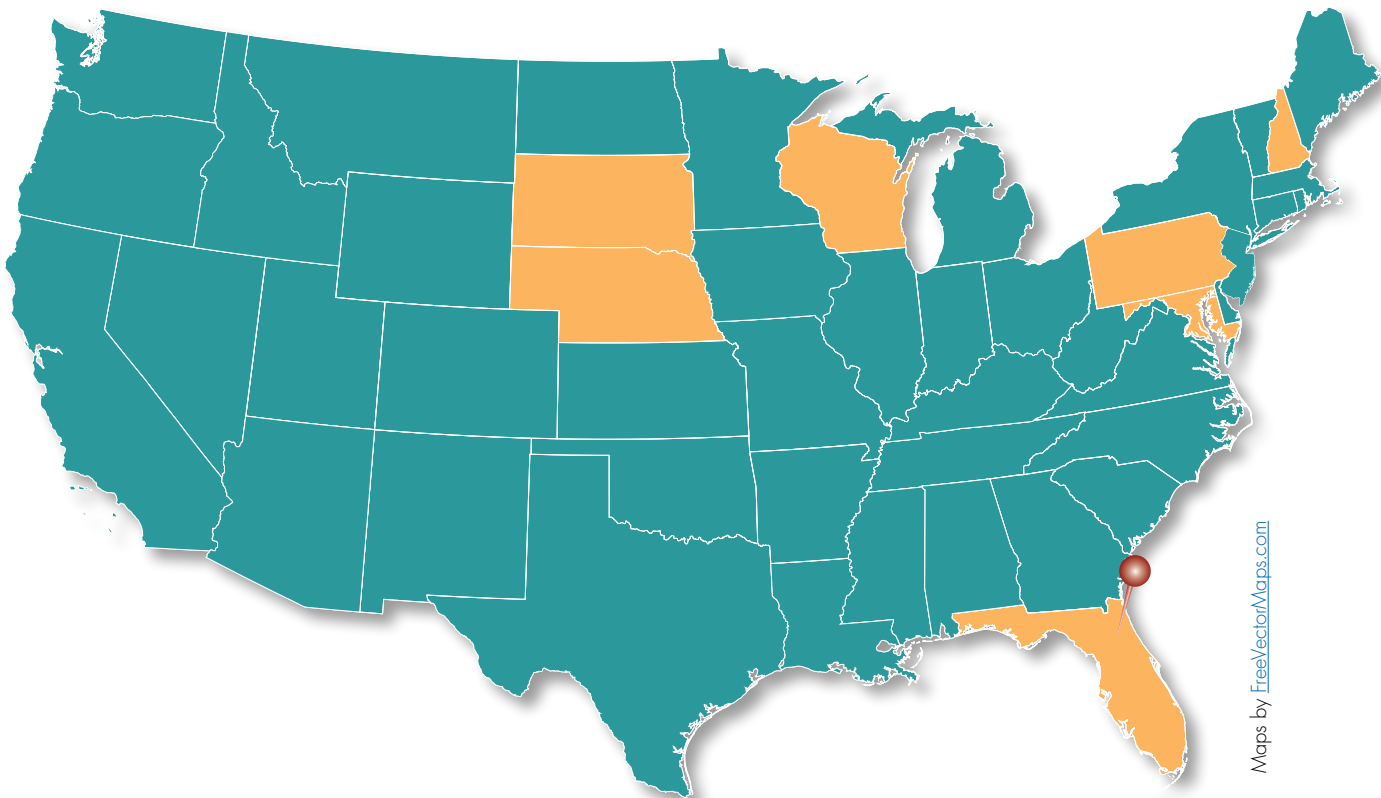
Maryland's House Bill 993, which would have established Maryland Climate Education Week, died in committee when the legislature adjourned sine die on April 8, 2024. If enacted, the bill would have required the state's governor annually to proclaim the first week of April as Maryland Climate Education Week. The proclamation would have urged the state's residents to "participate in educational activities and initiatives that promote an awareness of climate change" and "take action toward the State's climate commitments." Introduced by Dana Stein (D-District 11B), House Bill 993 sailed through the House of Delegates on a 100-3 vote.

NEBRASKA

Before the Nebraska state board of education voted in September 2024, to adopt a new set of state science standards, which resemble the previous, 2017, standards, Sherry Jones, a member of the board, complained of the exclusion of alternatives to "Darwinian evolution" at the board's August 2024 meeting and suggested the inclusion of "intelligent design, creationism, and other macro-evolutionary theories." Elizabeth Tegtmeier, the president of the board, was sympathetic to Jones's suggestion, but reported that "the general sentiment of the rest of the board is that Darwinian evolution is the only fact-based theory of the origin of life and is the only one which should be included in the standards and taught in Nebraska classrooms." At the board's September 2024 meeting, Jones, Tegtmeier, and Kirk Penner voted against adopting the standards.

NEW HAMPSHIRE

New Hampshire's House Resolution 30, which would have encouraged the state department of education to support climate education, is now indefinitely postponed, pursuant to a 191-183 vote in the House of Representatives on March 21, 2024.



If adopted, the resolution would have urged the legislature “and by extension the department of education [to] consider compiling and disseminating climate education curricula to school districts so that teachers may be prepared to implement climate change education in their classrooms in high schools, middle schools, and elementary schools.”

The preamble to the resolution asserts that the state’s “students are not getting comprehensive information about the scientific and human impacts of climate change” and that “today’s teachers should be provided the resources they need to be able to include climate change in their curriculums and lesson plans so that they are supported in this endeavor by the state.”

The resolution was sponsored by Wendy Thomas (D–District 12) and Tony Caplan (D–District 8), but, as New Hampshire Public Radio (March 21, 2024) reported, “The resolution was thought up by the youth team at 350 New Hampshire, an advocacy group focused on climate change.”

PENNSYLVANIA, PENNRIDGE

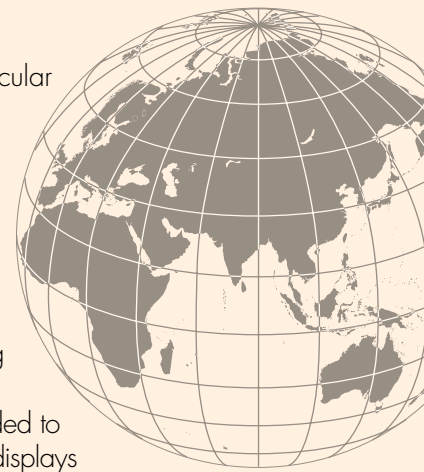
During a curriculum committee meeting of the Penridge School Board in June 2024, Jordan Blomgren, a member of the board although not of the committee, proposed exposing students to “both sides” of evolution and climate change—thereby “stunning onlookers,” according to the Bucks County Beacon. A local community activist commented on Facebook, “[T]his would be laughable if it didn’t impact our kids! ... [Blomgren’s] determination to push her extremist agenda is weakening education at Penridge.”

SOUTH DAKOTA

The South Dakota board of education voted to adopt a revised set of state science standards on April 22, 2024. Creationism, including “intelligent design,” continues to be absent from the standards, although at the meeting the board discussed whether the standards should reflect creationist ideas. The standards were approved after the state secretary of education assured the board that “various perspectives could be included in a list of supplemental science materials that teachers can consider for use in their classrooms,” according to a report from KELO-TV. The introduction of the revised standards, like the introduction of the previous standards, describes climate change and evolution as “particularly sensitive” issues and recommends that “parents engage their children in

UNITED KINGDOM, WALES

In June 2024, the National Secular Society called for a ban on creationism in Welsh schools after uncovering evidence that Llanidloes High School in Powys is endorsing creationist ideas. “Photographs obtained by the NSS show displays at the school combining science and geography content with quotes from the Bible intended to promote creationist ideas.” The displays were reportedly paid for with school funds. Teaching creationism is not banned in Wales as it is in England, and evolution is not required to be taught in primary schools.



discussions regarding these important issues, in order that South Dakota students are able to analyze all forms of evidence and argument and draw their own conclusions.

WISCONSIN

Two pairs of climate change education bills died in the Wisconsin legislature on April 15, 2024, when “any proposals that had not been enrolled or signed into law were adversely disposed.”

Assembly Bill 833 and Senate Bill 794 would, if enacted, have “authorize[d] the state superintendent of public instruction to adopt model academic standards related to climate change,” which would have “incorporate[d] a) an understanding of climate, b) the interconnected nature of climate change, c) the potential local and global impacts of climate change, and d) the individual and societal actions that may mitigate the harmful effects of climate change.”

Assembly Bill 829 and Senate Bill 786 would, if enacted, have created a program to award “scholarships to resident students who are enrolled in an institution of higher education [in Wisconsin] and who are engaged in studies directly related to programs preparing the students for careers in occupational areas addressing or responding to climate change.” The bill would have provided \$5 million biennially to fund the scholarships.

A “parental rights” bill that might have harmed climate education in Wisconsin, Assembly Bill 510, was passed by the legislature but vetoed by the governor, as NCSE previously reported.”



Every year, March Mammal Madness asks “Who would win?” between two animals in “an absurdly complex and wonderfully nerdy way,” according to the MMM website. In this issue, NCSE Executive Director Amanda L. Townley talks with Katie Hinde, the founder of March Mammal Madness and associate professor of evolutionary biology and the Senior Sustainability Scientist at Arizona State University. Hinde discusses the origins of the incredibly popular, worldwide phenomenon, why so many people — including thousands of educators and their students — love it, and the importance of science communication and outreach.

“In 2024, we had 9,400-plus educators, and they told us they were going to share the [March Mammal Madness] bracket with 870,000 learners ... in half of all counties in the United States, at least one educator is using March Mammal Madness with learners.”



Watch the interview

“It seems to resonate with people everywhere because people everywhere find animals fascinating and they find debates about which animal would win engaging, fun, thought experiments.”

Science and Storytelling at NABT

At the 2024 National Association of Biology Teachers conference in Anaheim, California, the theme of NCSE’s many sessions was storytelling: How do we help students make sense of the stories being told with data and data visualizations? How can we use storytelling and games to engage students in learning about evolution and ecology? How can teachers use storylines in their classrooms every day to make climate change relevant to students? These were just a few of the questions that we asked and attempted to answer with this year’s conference participants. This annual conference brings together educators, researchers, and practitioners in the life sciences to share lessons, strategies, and innovations in the field of biology education.

NCSE’s first session was a three-hour workshop titled “Scientific Literacy in

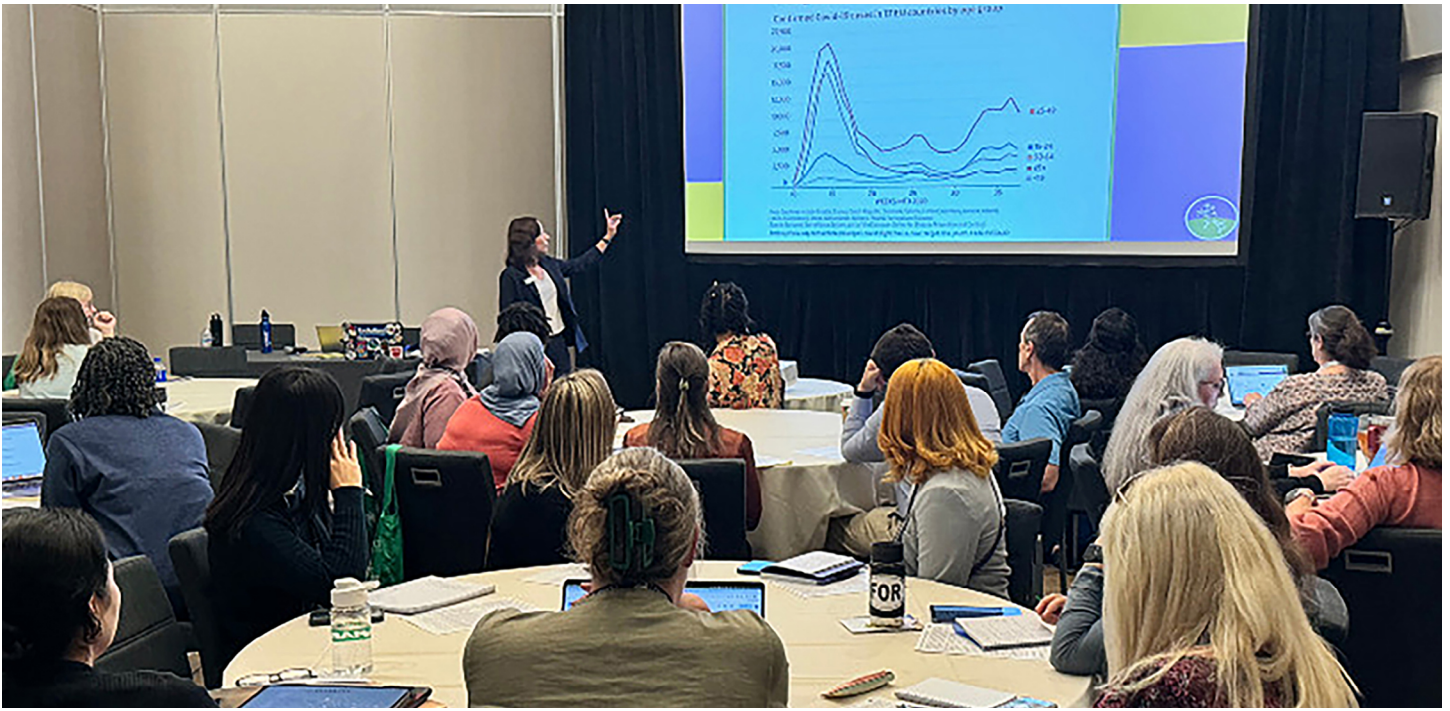


the Digital Age of Misinformation” in which Science Education Specialist Wendy Johnson and Interim Director of Education Blake Touchet introduced participants to our new scientific media literacy tool [DataWISE](#). This tool, which has generated [enthusiastic responses](#) from teachers as we’ve begun to unveil it at professional development opportunities around the country, is grounded in the idea that students need a systematic, scaffolded approach to determine the validity and reliability of data-based claims. In other words, this is a tool to build students’ capacity to determine if the stories they are being told by data and data visualizations are trustworthy. After introducing the components of the tool (Is this **Worthy**

of attention? **Inspect** the data. Does this make **Sense**? What **Emotion** is activated?) participants practiced applying the tool using our newly developed activities. They ended the session by planning out ways to incorporate the tool and activities into their regular classroom practice.

Our next session was the annual Evolution Symposium co-hosted by NCSE and NABT. This year’s event featured Katie Hinde, Associate Professor at Arizona State University’s School of Human Evolution and Social Change, and founder of March Mammal Madness. Hinde shared research linking humans’ evolutionary history of sociality and collective storytelling to the success of the [March Mammal Madness](#) tournament which has helped hundreds of thousands of students across the country engage in biology, evolution, and ecology since its inception in 2013. Following Hinde’s presentation, Touchet and Teacher Ambassador [Jeff Grant](#) walked participants through NCSE’s lesson [It’s Time to Lose the Ladder](#) which guides students through





the concept of convergent evolution and the creation of phylogenetic trees.



Teacher Ambassador
Jennifer Broo



Teacher Ambassador
David Amidon

The NCSE team wrapped up with two final sessions focusing on our newly developed [Climate Change Story Shorts](#). One session led by Johnson and Touchet discussed teachers' experiences with Next Generation Science Standards-aligned [storylines](#). During this session, participants shared their successes and struggles with using storylines and Johnson and Touchet described how NCSE has used research and teacher feedback to craft short, flexible, easy-to-use [Story Shorts](#) that maximize the benefits of this curricular approach while minimizing the barriers that teachers have experienced when implementing them. The last session allowed participants to experience NCSE's new Story Short [Sustainable Climate Solutions](#) from a student's perspective as they learn about the United Nations' Sustainable Development Goals, climate solutions, and how we can work to achieve net zero carbon emissions.

NCSE team members also attended the Honors Luncheon where Teacher Ambassadors [Jennifer Broo](#) and [David Amidon](#) received awards.

Broo was named this year's Outstanding Biology Teacher for the state of Ohio, and Amidon was awarded the Ecology and Environmental Science Teaching Award. The Evolution Education Award, co-sponsored by NCSE and BSCS Science Learning, was also presented to [Briana Pobiner](#). A previous recipient of NCSE's Friend of Darwin Award, Pobiner is a paleoanthropologist who leads the Smithsonian's Human Origins Program and has engaged in evolution education research and programming for K-12 classrooms.

As in past years, a follow-up to the Evolution Symposium with Katie Hinde will take place in February during NCSE and NABT's joint Darwin Day webinar. Be on the lookout for more information soon to celebrate Darwin Day with the kick-off of the 2025 March Mammal Madness tournament!

Blake Touchet is Interim Director of Education at NCSE. touchet@ncse.ngo



THE RNCSE REVIEW

Transformer: The Deep Chemistry of Life and Death

author: Nick Lane

publisher: Profile Books

reviewed by: Arthur G. Hunt



The Krebs cycle. For generations of biology majors, the term evokes a torrent of memories and emotions. It's often the culmination of a first biochemistry class, the focus of hours upon hours of memorizing. It's the topic that teaches biologists how to *really* count (not only ATPs but also protons and even electrons). Admit it — you've been there. And, at the end of the class, many have the same reaction: I'm never going to use this. Why do I have to learn these things?

For those interested in the life sciences (broadly speaking), Nick Lane explains in his book *Transformer: The Deep Chemistry of Life and Death* just why you need to learn these things. Lane is a professor of evolutionary biochemistry at University College London who has written several popular books on aspects of biochemistry and evolution, including *Life Ascending* (2009) and *The Vital Question* (2015). In his latest offering, Lane crafts a narrative that connects the Krebs cycle to disparate subjects of interest to life scientists and the lay public.

The core of this book is the Krebs cycle. Lane lays out its history and importance. And important it is. It has been drilled into every student how the Krebs cycle is the energetic dynamo of the cell, the connection between metabolism and the capture of energy in the forms of protonmotive force and ATP. Lane pays homage to these lessons from Biochemistry 101. But he also turns the concept on its head, visiting the subject of the reverse Krebs cycle. In so doing, he invites the reader to question the assumptions and logic that accompanies the standard portrayal of the cycle. Cycle or no? Catalytic or regenerative? Forward, reverse, or both? Lane explores the variety, the nuances, and the possibilities attendant on these questions.

After reading this book, the Krebs cycle emerges as a unifying theme that explains everything about biology, such is Lane's enthusiasm and craft.

Chapter 1 introduces the Krebs cycle and energetics — presenting both the chemistries and the scientists whose insights have been passed down to generations of life scientists. Chapter 2 adds to the mix carbon fixation, in forms both familiar and not so. Of course, the reverse Krebs cycle figures

largely in this. Chapter 3 takes us to the origin of life, continuing until the beginnings of cellular life. It is through the Krebs cycle that we can connect energetics with carbon flow, the origins of protonmotive force, and different hypothetical stages of compartmentation (the beginnings of cellular life). Chapter 4 describes the halting history of oxygen on earth together with the evolution of life, connecting the variety in the biosphere with the Krebs cycle. The tensions between the different manifestations of the cycle provide an engaging foundation for a discussion of key evolutionary time-points. Chapter 5 leaps ahead to a totally different subject — or is it? The subject is cancer, not usually seen alongside the origin of life and evolutionary transitions. However, the Krebs cycle also looms large here as well. Lane places the well-known Warburg effect — in which cancer cells produce energy through a non-standard process — squarely in the context of the Krebs cycle, represented here not as an alternative to but as a central player in the metabolic shift seen in cancer cells. Chapter 6 takes us inside our cells, to the mitochondria and the ever-present balancing act that is the generation and removal of reactive oxygen species in the cell. Of course, sitting at the center of these subjects is, inevitably, the Krebs cycle.

Transformer offers a compelling narrative that should grab the attention of any reader with interests in any of the

areas it discusses. And, I daresay, its multifaceted presentation could aid understanding, even inspire new insights. But also entertaining and informative are the back stories, in which Lane introduces the reader to the giants who shaped our understanding of biochemistry and to their less-well-known colleagues whose contribu-

tions were as important. Additionally, Lane provides insightful descriptions of methods, techniques, and classic experiments (many of which I fear are not taught today).

The story of science is one of unifying themes. After reading this book, the Krebs cycle emerges as a unifying theme that explains everything about

biology, such is Lane's enthusiasm and craft. Even if this is a few steps too far, reading *Transformer* is an indulgence I recommend.

Arthur G. Hunt is Professor in the Department of Plant and Soil Sciences at the University of Kentucky. Arthur.Hunt@uky.edu



Earth Matters

designer: Lori McDonald

publisher: Turn4Turn LLC

reviewed by: Wendy Johnson



How do you discuss a serious topic like climate change with children in a fun and age-appropriate way? With a board game, of course! "Earth Matters" is a board game for 2–5 players developed by a former art teacher that engages children in conversations about the causes, effects, and solutions to the climate crisis.

The game board is basically a giant graph with time on the x-axis and temperature on the y-axis. Scattered across the board are critical habitats and energy resources. When players land on one of these spaces, they collect tokens for points. To begin, players choose one of five animal pawns and a starting position on the left side

of the board. As the game proceeds, they can move to the right (forward in time) as well as up and down (increasing or decreasing temperature). This is a fun and engaging way to introduce graphing to children. If a pawn reaches the top row with the highest temperature, it becomes an endangered species; the player must return the collected tokens and start over. Habitat loss owing to increased temperature is a good, age-appropriate way to communicate the dangers of climate change to young children.

Game play is directed by a deck of cards with a range of different actions: some invite players to share their knowledge of nature or eco-friendly practices, some provide interesting

facts about living things, and some register events. Events that are good for the environment, such as gardens growing on rooftops or solar panels installed on homes, earn a player points or move them toward a lower temperature. Events that are bad for the environment, such as burning fossil fuels or using disposable diapers, cause a player to lose points or move toward a higher temperature.

I played the game with my 12-year-old daughter in about 30 minutes. Although the game is marketed for ages 8 and up, it was too simple for her. She easily answered most of the questions and rolled her eyes at a couple of the silliest cards (one commanded her, "Howl like a wolf!"). Just

a few years ago, she would have loved the chance to act out animals. The game is probably best suited for 6–10-year-olds.

Middle schoolers are excellent game reviewers because they excel at pointing out inconsistencies. For example, my daughter lost a point when she drew a card that said, “You just drank a sugary, caffeinated, carbonated, high-fructose corn syrup drink.” She objected, “That isn’t fair. That doesn’t have anything to do with the environment,” and certainly the card didn’t make the relevance clear. I was more bothered by the possibility that climate change deniers would interpret the soda card as just another example of a liberal agenda to control personal choices. But that was the only card that triggered that thought.

There were other game situations that bothered my daughter. One card said, “Five islands in the Solomon Island chain are underwater. The hot-

test player may cool down three degrees.” It didn’t make sense to her that a negative effect of climate change would move a player down in temperature. I agreed with her assessment. Similarly, I noticed that the energy tokens worth the most points were fossil fuels. It seemed strange that the greatest reward went to the energy sources with the worst impact on the environment. But the fossil fuel resources are near the top of the board, which corresponds to higher temperature and greater risk of extinction, so perhaps it makes sense.

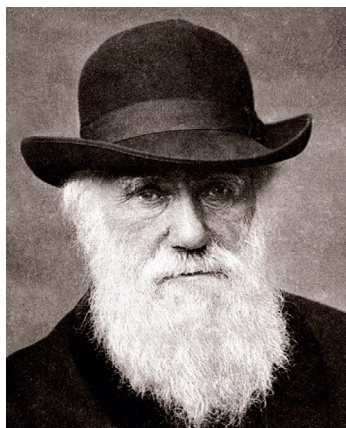
Other aspects of the game that annoyed my daughter actually turned out to provide teachable moments. For example, she drew a card that said, “Everyone remembers to vote. All players move one step.” She wondered out loud, “What does voting have to do with the environment?” I explained that candidates can have different ideas about how important it is to protect the environment and how we should go about doing it, and

that how we vote is critical for addressing the climate crisis. Another time she was stumped to name four materials that are recyclable, so I had to give her a hint. As a mom and former science teacher, I count these lessons as major wins.

Overall “Earth Matters” is a cute game. The pieces are sturdy, the artwork is appealing, and I really liked how small shells and rocks served as game pieces. It is more educational than most board games for this age group that I’m familiar with, but I think it would be best played with an adult to guide the discussion. Since there are not suggested answers to the questions and the discussions stimulate questions about technology, voting, personal choices, and collective action, the best use of the game may be as a vehicle for discussing these important topics with children.



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WHAT WE'RE UP AGAINST

Creationists Unclear on the Concept of a Sequel

Advertising a new book from its own press, Robert F. Shedinger’s *Darwin’s Bluff* (2024), the

Discovery Institute wrote, “Tucked away in the surviving papers of Charles Darwin is a manuscript of almost 300,000 words. It was Darwin’s sequel to *On the Origin of Species*, but it was never finished.” Sequel? The manuscript was what Darwin called his “big species book.” Its first part was revised and included in *Variation of Animals*

and *Plants Under Domestication* (1868); the remainder was eventually published as *Charles Darwin’s Natural Selection: Being the Second Part of his Big Species Book Written from 1856 to 1858* (Cambridge University Press, 1975). As the subtitle indicates, Darwin stopped working on the big species book in 1858, after receiving a famous letter from Alfred Russel Wallace. Instead, he produced what he described as an abstract of it: *On the Origin of Species* (1859).

— GLENN BRANCH

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