



Sept 22 - Oct 1, 2023
The Best 10 Days of the Year!

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THE MAMMOTH WORLD OF SCIENCE

Signature Events

Snook's Science in the Park

SCI Talks presented by Mammoth

Women in STEAM Networking Event

Bedtime Stories presented by Bright Side Bookshop



Dr. Beth Shapiro

How to Clone a Mammoth

W. L. Gore & Associates
Keynote
Presentation

For event updates and reservations, visit scifest.org or download the Festival app

‘ENTHUSIASTIC REALIST’

Beth Shapiro to deliver festival keynote on de-extinction

KERRY BENNETT

Since 1990, when Michael Crichton’s blockbuster “Jurassic Park” was first published—then brought to life on the big screen by Steven Spielberg in 1993—the prospect of cloning dinosaurs and other prehistoric animals such as woolly mammoths has captured our collective imagination. Although heavily fictionalized, Crichton’s story was based on actual work being done in the fledgling field of ancient DNA at the time, which began with the first study of DNA isolated from the remains of animals that used to be alive, which was published in the scientific journal *Nature* in 1984.

Dr. Beth Shapiro, herself a pioneer in the field of ancient DNA, will deliver the W. L. Gore & Associates Keynote Presentation on Sept. 22 to kick off the 10-day Flagstaff Festival of Science—along with her own unique brand of what she calls ‘enthusiastic realism’ about the potential of using ancient DNA for de-extinction, the modern term for the Crichton-esque proposal to bring long-extinct species back to life.

For, as she puts it, “It’s really cool to investigate the DNA of an animal that’s thousands of years old, and to think about whether modern technology might be able to bring it back.” But what’s even more exciting and meaningful to Shapiro, Professor of Ecology and Evolutionary Biology at the University of California, Santa Cruz, is using this same biotechnology to introduce ancient traits—those discovered while mining the genomes of long-dead species—into living species to help make them more resilient to climate change.

One example she will discuss is using DNA from the frozen remains of extinct woolly mammoths along with advanced gene editing technologies to alter the genome of Asian elephants, potentially making them adapted to Arctic climates, for example with thicker hair and other cold-resistant characteristics. By reintroducing mammoth-like creatures into

the region, some scientists hypothesize they can ultimately reverse the effects of climate change by slowing the thaw of Arctic permafrost and restoring natural Arctic grasslands.

Biodiversity and conservation are central to Shapiro’s work, and her involvement in the nonprofit Revive & Restore is an important extension of her research. Its mission is “to enhance biodiversity through genetic rescue of endangered and extinct species.” She is a member of the organization’s Board of Directors and advisor of the Great Passenger Pigeon Comeback Project. The project’s goal is to bring back the Passenger Pigeon, a keystone species for North American eastern forests that went extinct in 1914, in an effort to help restore the ecology of these forests.

Science journalism was Shapiro’s first passion

Surprisingly, science wasn’t Shapiro’s initial career path. Like many young people growing up in the 1980s, Beth Shapiro spent a lot of time outdoors near her home in Georgia, exploring the forest, collecting rocks, investigating the world around her and making up stories to amuse her friends. In fact, she says, she always wanted to be a journalist. In high school, she was hired by the local TV station to do a local news segment—which led her to study broadcast journalism at the University of Georgia (UGA), where she became news director at a local radio station during her freshman year.

But it was a UGA intensive summer program combining geology, anthropology and ecology that piqued her interest in science. Camping out at national parks across the country—including the Grand Canyon—she gained an interdisciplinary understanding of the natural processes that shape our environment, and how adaptations to ongoing change will ultimately reshape life on Earth.

“It was an amazing experience,” said Shapiro. She decided to continue studying science in order to become a better science journalist. She earned her bachelor’s and master’s degrees in ecology at UGA, spending time performing ecological research at the Smithsonian Tropical



Research Institute in Panama. It was there that her passion for being a scientist intensified.

But it wasn’t until 1999, when she was selected as a Rhodes Scholar and began working on her PhD at the University of Oxford, that Shapiro stumbled on ancient DNA and the idea of de-extinction. Still in its infancy, Shapiro joined the Henry Wellcome Ancient Biomolecules Centre at the University of Oxford under the direction of Alan Cooper and began exploring the DNA of ancient woolly mammoths, steppe bison and arctic horses buried in the frozen tundra of Siberia and Alaska. “That was super cool,” she said, as the fascinating research combined history, geology and genetics.

After receiving her doctorate from Oxford, Shapiro went on to academic positions at The Pennsylvania State University and then UCSC. She has received several prestigious fellowships and awards—including a MacArthur Fellow and Packard Fellow—and has

published hundreds of scholarly articles in scientific journals, including *Science* and *Nature*. She hasn’t lost her passion for journalism, however. Shapiro has also authored several popular books for non-scientists, including “How to Clone a Mammoth” and “Life as We Made It,” blending her scientific pragmatism with compelling storytelling and advocacy. Her books will be available for sale after the keynote presentation.

These days, Shapiro is Director of Evolutionary Genomics for UCSC’s Genomics Institute and co-directs UCSC’s Paleogenomics Lab, a group of graduate students, post-doctoral scholars and senior scientists who study molecular evolution from a paleo perspective. She teaches courses in Evolutionary Biology, Molecular Ecology and Paleogenomics.

Her advice for aspiring scientists in the Flagstaff community? “Get outdoors!” She encourages young people to go hiking or bike riding and explore the world, and to actively participate in science by using tools like iNaturalist (a social network of scientists and citizen scientists who map and share observations of biodiversity) and resources such as Merlin Bird ID (a smartphone app that can instantly identify bird species through photos and sounds).

Shapiro will deliver the W. L. Gore & Associates Keynote Presentation Friday, Sept. 22, at 7 p.m. in NAU’s Ardrey Auditorium. Visit scifest.org for more information and to reserve a seat.

Message from the President

It's time for the best 10 days of the year!

I hope everyone is as excited as I am about this year's theme, *The Mammoth World of Science*, inspired by the work of this year's Keynote speaker, Beth Shapiro PhD. At the W. L. Gore & Associates Keynote Presentation, Dr. Shapiro promises to share a fascinating look at evolutionary biology, revealing how the science of de-extinction is used to revitalize and stabilize



SHERRY SHAFER

our ecosystems. Join us on Friday, September 22 in-person or live-stream for the keynote launch of the 2023 Festival. Reserve your ticket on our app or website soon – it will fill up fast.

It's hard to believe that the Flagstaff Festival of Science has been able to celebrate STEAM (science, technology, engineering, arts, and math) for 34 years with loads of demonstrations, workshops, tours, talks, walks, and more – all for free. We couldn't do it

without the generosity of the dozens of volunteers, sponsors, donors, community partners, and presenters who provide their time, treasures, and talent year-round to make it all come together for 10 special days. I am continually inspired by the outpouring of help and enthusiasm from all of our partners. It's an honor to be able to spread the joy of exploration and discovery through STEAM to our community and have it enthusiastically received year after year by all participants. Thank you.



- Kerry Bennett
- Chrissina Burke
- Marti Canipe
- Merri Sue Carter
- Julie Comnick
- Kathy Farretta
- Brian Klimowski
- Michele Losee
- Brandon Lurie
- Helena Murray
- Adam Marsh
- Kelly Saganey
- Sherry Shaffer
- Greg Vaughan
- Joe Wagner

Thank you!

**Flagstaff Festival of Science
Board of Directors**

NAU
is a proud partner of the
**Flagstaff
Festival
of Science**
nau.edu

FESTIVAL OF SCIENCE 2023 EVENT SCHEDULE

Sept. 21

Flagstaff Dark Skies Coalition Star Party

Buffalo Park, 6 p.m. to 10 p.m. on Sept. 21, 22 & 23

Join us and enjoy the dark skies of Northern Arizona with telescope viewing, presentations, and a variety of activities for all ages, hosted by the Flagstaff Dark Skies Coalition.

Science Bedtime Stories (ON DEMAND VIDEOS THROUGHOUT THE FESTIVAL)

Festival Website (scifest.org) and App, Available starting at 7 p.m.

“The Red Tail Tale on the Arizona Trail”

Rodo Safranac reads his illustrated story, “The Red Tail Tale on the Arizona Trail,” for our youngest science enthusiasts to enjoy as they wind down to sleep. In his book, Rowen, a young, red-headed explorer, and Rojo, a clever, red-tailed hawk meet, bond, and experience a wonderful adventure on the fascinating Arizona National Scenic Trail.

“Sharuko”

Monica Brown reads her coming of age story, “Sharuko: el arqueólogo Peruano/Peruvian Archaeologist.” Growing up in the late 1800’s, Julio Tello spent time exploring in the foothills of the Peruvian Andes. His bravery earned him the boyhood nickname Sharuko, which means “brave” in Quechua.

“A Rattler’s Tale”

Nancy Marshall reads her action-packed book “A Rattler’s Tale: When Wild Animals Encounter Humans.” Captivatingly illustrated by a fisheries biologist, discover what happens when a skunk meets Mom in the shed and when the mountain lion lands on the family car.

“All About the Grand Canyon”

Don Lago reads “All About the Grand Canyon.” With rich storytelling about this natural wonder, our youngest science enthusiasts will also enjoy beautiful illustrations as they wind down to sleep.

Sept. 22

The A in STEAM. Using Art to learn about Symmetry!

Winslow Public Library, 1:30 p.m. to 2:30 p.m.

In this fun, hands-on activity, participants will use pre-cut colorful shapes to create their own tile using symmetry.

Learning About Our Star: The Sun

Community Room—East Flagstaff Community Library, 2:00 p.m. to

3:00 p.m.

Learn about the nearest star to us, the Sun, and how nature interacts with day and night. Children will do interactive activities that will promote math, reasoning, and fine motor skills, while igniting their curiosity to learn more about our universe!

Plein Air in Open Spaces

Buffalo Park Ramada, 3 p.m. to 5 p.m.

Join us at Buffalo Park for an afternoon of drawing and painting outdoors, observing the natural world. Flagstaff Open Spaces has art supplies and easels available for free! All ages and abilities are welcome!

A Mammoth Science Ballet

NAU Ardrey Auditorium, 6:30 p.m. to 6:50:00 p.m.

This performance—inspired by de-extinction science and the work of keynote speaker Beth Shapiro, PhD—will feature waltzing mammoths and pirouetting black-footed ferrets. Reservations required: scifest.org or the app. See Keynote Presentation for more information.

W. L. Gore & Associates

Keynote Presentation:

How to Clone a Mammoth

NAU Ardrey Auditorium, 7 p.m. to 8:30 p.m.

The Festival’s keynote presentation will feature Beth Shapiro, pioneer and global leader in the high-profile field of ancient DNA. Is it possible to bring extinct species back to life? And even if it is technically possible, is it a good idea? Drawing from her research and her broad knowledge of the field, Shapiro, Professor of Ecology and Evolutionary Biology at the University of California, Santa Cruz, will walk through what is and is not possible when it comes to “de-extinction.” She will highlight how the same technologies that might bring species back could instead be used to prevent living species from becoming extinct. Through the exploration of our evolutionary and cultural history, Shapiro will uncover a course for the future. Reservations required: scifest.org or the app.

Campus Sky Viewing

NAU Campus Observatory, 7:30 p.m. to 10 p.m. on Sept. 22, 23, 24, 29 & 30

Explore the wonders of the night sky from NAU’s Campus Observatory.

Sept. 23

Science Day at Walnut Canyon National Monument

Walnut Canyon National Monument

Visitor Center, 9 a.m. to 12 p.m.

Join National Park Service archeologists and wildlife biologists on National Public Lands Day (free entrance) to learn about Walnut Canyon’s human and natural history. Learn about prehistoric hunting by visiting a flint knapping demonstration, trying your hand at throwing at an atlatl, and checking out real mammoth dung. Learn about bats, their ecology and behavior from a wildlife biologist.

Cliffs Ranger Station Open House

Walnut Canyon National Monument Visitor Center, 9 a.m. to 12 p.m.

Visit the newly furnished Cliffs Ranger Station on National Public Lands Day (free entrance). Cliffs Ranger Station is one of Arizona’s oldest surviving log structures and Walnut Canyon National Monument’s original headquarters. Usually closed to the public, for this event the cabin is accessed by an easy self-guided 1.5-mile roundtrip hike from the Walnut Canyon National Monument Visitor Center.

Snook’s Science in the Park

Wheeler Park, 10 a.m. to 2 p.m.

Look through a solar telescope; inspect animal bones in a zooarchaeology activity; observe the natural world and create your own art; and drive a robotic rover at Snook’s Science in the Park! The fun is endless at our popular family science fair, where YOU are the scientist for the day!

Dow Spring Hike

Dow Spring Trailhead on Forest Road 131, 10 a.m. to 12 p.m.

Kaibab National Forest South Zone archaeologist Charlie Webber will lead a hike to a collection of archaeological sites located around Dow Spring that reveal an amazing slice of history. For the 1.25 mile, hour long hike please bring water, closed-toe footwear and sunscreen. Reservations required: scifest.org or the app.

Meet and Greet the da Vinci Robot at FMC!

Flagstaff Medical Center McGee Auditorium, 1 p.m. to 4 p.m.

The da Vinci Robot is a state-of-the-art robotic surgery machine. Come learn about the device and try it for yourself!

Explore the Lifesaving World of Emergency Medical Services (EMS)

Sechrist parking lot on FMC West Campus, 1 p.m. to 4 p.m.

Climb aboard a real helicopter and

ambulance and meet local first responders at this outdoor event! Learn how they deliver precise, effective care in emergency situations.

Designed to Move: Seeds That Float, Fly or Hitchhike through the Desert Southwest

Museum of Northern Arizona—Pearson Hall, 2 p.m. to 3 p.m.

East Side of Highway 180, Accessed via N. Winding Brook Road

Seeds are designed to move. Their ingenious solutions to the challenges of dispersal have inspired countless innovations. Join Adelheid Fischer, curator of “Designed to Move,” to celebrate the beauty of desert seeds and how they can inspire artists, designers and engineers.

What If? Writing Speculative Fiction about De-Extinction

Flagstaff Downtown Library Community Room, 3 p.m. to 4:30 p.m.

What would happen if we brought an extinct species back to life? What effect would this have on society and the environment? Choose an extinct organism, write a poem or short story exploring this issue and share it with other writers!

Tynkertopia Open House

Tynkertopia, 3 p.m. to 5 p.m.

3330 E. Elder Drive

Become a “tynkerer”—visit Tynkertopia, Flagstaff’s award-winning STEAM Community Center, and learn how we invite curiosity, inspire wonder, encourage playfulness and celebrate unique solutions.

NAU Robotics Workshop: an interactive experience to learn about robots!

NAU Engineering Building (Building 69) Room 224, 3 p.m. to 5 p.m.

15600 S. McConnell Dr.

Join us for an interactive opportunity to dive into the exciting world of robotics! Learn from experts and enthusiasts, and get hands-on experience interacting with and controlling flying robots, driving robots, wearable robots, robotic arms and virtual reality systems. Reservations required: scifest.org or the app.

The State of the Climate:

What’s New in Climate Science and Solutions AND Energy Efficiency Incentive Information

Lowell Observatory, 6 p.m. to 8 p.m.

Regional experts will discuss the state of the climate in northern Arizona, emerging technology and policy solutions to slow and capture fossil fuel emissions, and progress on the

City of Flagstaff’s carbon neutrality plan. Following the panel discussion, meet with local companies and city officials to learn about energy efficiency incentives, including weatherization and heat pumps.

Sept. 24

Walking on the Moon: Where Apollo Astronauts Trained

Landfill Road Trailhead, 9 a.m. to 12 p.m.

See for yourself the crater field in Coconino National Forest where Apollo astronauts trained for walking on the moon! Be prepared for this 3.5-mile hike across uneven terrain—bring sturdy shoes, water, hat, jacket, sunscreen and snacks. Not suitable for young kids or dogs. Please cancel your reservation if you cannot attend. View this short video before our adventure: <https://astrogeology.usgs.gov/rpif/videos/making-craters> Reservations required: scifest.org or the app.

Explore, Learn, Discover: Geocaching at Tynkertopia

Tynkertopia, 10 a.m. to 3 p.m.

3330 E. Elder Drive

Bring your family to Bushmaster Park to experience geocaching using your smartphone and Google Maps to locate hidden treasure at specific coordinates. The last cache will contain a small prize for each family that locates all the caches. Reservations required: tynkertopia.org/events/special-events/

The History of Science in Flagstaff: Missions and Madness Adventure Game

Wheeler Park War Memorial, 10 a.m. to 12 p.m.

Learn how science shaped Flagstaff by playing an adventure game that’s part scavenger hunt, part Dungeons and Dragons and part boot camp. It’s also a great way to get some exercise as you walk around downtown historic sites! Reservations required: scifest.org or the app.

Public Day at Elden Pueblo

Elden Pueblo, 10 a.m. to 4 p.m.

Join us at Elden Pueblo to learn how we discover and interpret secrets of the ancient civilizations here in Flagstaff as we dig into the past, analyze artifacts and practice ancient hunting games.

Writing About Science

Planet Science Store, 11 a.m. to 12:30 p.m.

This workshop is an introduction to science writing, leading participants

FESTIVAL OF SCIENCE 2023 EVENT SCHEDULE

through a guided writing session focused on several examples of recent scientific research. Reservations required: scifest.org or the app.

Tour the US Naval Observatory Flagstaff Station

US Naval Observatory, 1 p.m. to 2 p.m.

Take this daytime tour of the Observatory guided by members of the Observatory staff. Visit several of our large telescopes and learn about the mission of the Naval Observatory. Reservations required: scifest.org or the app.

Bookmans Science Writing Fair

Bookmans Flagstaff Entertainment Exchange, 2 p.m. to 3:30 p.m.

There are so many ways to spread knowledge to readers of all ages in accessible, fun ways. Join this workshop to learn how to turn environmental information about the Colorado Plateau into comic books, poetry, broadsides, fiction, essays and more!

View the Night Sky at the US Naval Observatory

US Naval Observatory, 7:30 p.m. to 9:30 p.m.

10391 W Naval Observatory Rd
Join Naval Observatory astronomers (weather permitting) to view the night sky with their larger telescopes, the 61-inch and/or 1.3 meter. Reservations required: scifest.org or the app.

Sept. 25

Walk on Mars

Northland Preparatory Academy Gym, 8 a.m. to 5 p.m.

3300 Sparrow Ave

Explorers of all ages are welcome to walk across a giant, gym-sized landscape map of Mars to learn about the Red Planet!

Tour the US Naval Observatory Flagstaff Station

1 p.m. to 2 p.m. & 3 p.m. to 4 p.m.

10391 W Naval Observatory Rd
Take this daytime tour of the Observatory guided by members of the Observatory staff. Visit several of our large telescopes and learn about the mission of the Naval Observatory. Reservations required: scifest.org or the app.

Science in Anime

Community Room—East Flagstaff Community Library, 3:15 p.m. to 4:30 p.m.

Is there science in anime? Learn about different anime and their connections to science!

The Ethics of Ancient DNA Research (IN PERSON and VIRTUAL)

Lowell Observatory, 4 p.m.

NAU anthropologist Justin Lund will discuss the ethics of studying ancient DNA in Indigenous communities as well as the legal and social implications of genomic research. Webinar registration at scifest.org or the app.

Race Robots with the CocoNuts!

Boys and Girls Club of Flagstaff, 4:15 p.m. to 5:45 p.m.

301 S Paseo Del Flag
Come build a robot and race it with your friends! Everyone is welcome, all ages. Parents, please plan to stay and assist young kids with this activity.

Climate Change and the Colorado River Compact's Next 100 Years (IN PERSON and VIRTUAL)

Lowell Observatory, 5 p.m.

The seven states that signed the Colorado Compact in 1922 are now struggling to find a long-term water management system that reflects the impact of climate change and long-term droughts. Learn from Tim Duane, previous faculty at the University of San Diego School of Law, where he taught climate change law and policy, environmental law and policy and public lands and natural resources law. Webinar registration at scifest.org or the app.

Lowell Observatory Open House

Lowell Observatory, 5 p.m. to 10 p.m.

Experience astronomical history and wonder at Lowell Observatory! Don't miss your chance to walk through Lowell's beautiful historic grounds, see the 126-year-old Clark Telescope and stargaze at the Giovale Open Deck Observatory through six advanced telescopes under Flagstaff's beautiful dark skies.

Grand Canyon Astronomy

Planet Science, 5 p.m.

109 N Leroux St

Hear from Kevin Schindler as he shares his experience as Grand Canyon's Astronomer in Residence and the exciting work he oversees in his role!

Astronomy Discovery Center

Building Site Hard Hat Tours

Lowell Observatory, 5 p.m. AND 6 p.m.

Join Lowell Observatory for behind-the-scenes hard hat tours of the in-process Kemper and Ethel Marley Foundation Astronomy Discovery Center (ADC) at Lowell Observatory. Taking place during the Open House, tours are at 5 p.m. and 6 p.m. Reservations required: scifest.org or the app.

Panel Discussion: Healthy Forests and a Fire-Adapted Flagstaff

Coconino Center for the Arts, 6:30 p.m. to 8 p.m.

A panel of experts from the Flagstaff Fire Department, USFS and NAU discuss forest and fire management efforts across the greater Flagstaff area.

View the Night Sky at the US Naval Observatory

US Naval Observatory, 7:30 p.m. to 9:30 p.m.

10391 W Naval Observatory Rd
Join Naval Observatory astronomers (weather permitting) to view the night sky with their larger telescopes, the 61-inch and/or 1.3 meter. Reservations required: scifest.org or the app.

Sept. 26

Cloud Walk at Buffalo Park

Buffalo Park Entrance, 9 a.m., 11:00 a.m., 1:00 p.m.

Join Brian Klimowski (National Weather Service Meteorologist-in-Charge) for a 45-minute walk in Buffalo Park. We'll talk about the science behind the weather we observe, the impact of the anticipated El Niño, severe storms, and of course all about the clouds we see! Reservations required: scifest.org or the app.

Science-Themed Toddler Tales

Flagstaff Downtown Library Community Room, 10 a.m. to 10:30 a.m.

Your toddler will delight in this special time for science-themed stories, songs, games and more!

MNA Paleontology

Collections Open House

Museum of Northern Arizona Brady Geology Building, 3 p.m. to 4 p.m.

East Side of Highway 180, Accessed via N. Winding Brook Road

Visit the Museum of Northern Arizona's Brady Building for a behind-the-scenes look at MNA's favorite dinosaur and other reptile fossils from our paleontology collection.

NPS Science: Learn about Bats and Be an Archeologist

Bushmaster Park—East Side Ramadas, 3 p.m. to 5 p.m.

Join archeologists and wildlife biologists from Flagstaff Area National Monuments for a fun-filled afternoon. Be an archeologist by screening for artifacts, identifying what you find, and drawing artifacts. Learn about bats, their ecology and behavior from a wildlife biologist.

Build-A-Bot Workshop

Tynkertopia, 3:30 p.m. to 5 p.m.
3330 E. Elder Drive

Come to Flagstaff's STEAM Community Center and create your own Bot using a wide variety of recycled materials—it's fun, creative, purposeful and mindful!

Crafty Corner—Festival of Science

Community Room—East Flagstaff Community Library, 3:30 p.m. to 4:30 p.m.

Join us at the East Flagstaff Community Library as we celebrate the Festival of Science with an awesome craft project!

Tagging Monarch Butterflies won Their Fall Migration

Bubbling Ponds Fish Hatchery-Cornville, 3:30 p.m. to 5 p.m.

Help tag migrating monarchs for scientific research with Southwest Monarch Study! Nets, tags and data collection training provided. Wear long pants and sturdy shoes (no sandals). Reservations required: swmonarchs.org/upcoming-events.php

Let's Build an Eclipse Viewer!

Flagstaff Downtown Library Community Room, 3:45 p.m. to 4:45 p.m.

Kids will learn about upcoming eclipses and build a cereal box viewer for safely observing an eclipse. Please bring your own empty cereal boxes.

The Sunset Crater-Cinder Lake Apollo Mission Testing and Training Historic District (IN PERSON and VIRTUAL)

Lowell Observatory, 4 p.m.

Join local historians Kevin Schindler and Ben Carver as they describe the effort to get the Apollo mission testing and training sites at Sunset Crater and Cinder Lake listed on the National Register of Historic Places. Webinar registration at scifest.org or the app.

Dinosaurs of the Navajo Nation

Museum of Northern Arizona—Pearson Hall, 4 p.m.

Local paleontologist Adam Marsh will share his fascinating research on the Late Triassic and Early Jurassic period fossils discovered across the Navajo Nation starting in the 1930s.

McMillan Mesa Family Program

Buffalo Park, 4 p.m. to 5:30 p.m.

Willow Bend, in partnership with the City of Flagstaff's Open Space Program, will lead a guided family-focused tour of McMillan Mesa. The tour will include a short hike and fun hands on outdoor focused activities for the whole family. Learn about urban forestry, open space, wildlife and more! Reservation required: www.willowbendcenter.org/mcmillan-mesa

Mars Rover Update (IN PERSON and VIRTUAL)

Lowell Observatory, 5 p.m.

Join USGS planetary scientists Alicia Vaughan and Ryan Anderson as they talk about the latest discoveries and share incredible recent images from the Perseverance and Curiosity Mars rovers! Webinar registration at scifest.org or the app.

"Dark Sky" Your Home

Coconino Center for the Arts, 5 p.m. to 6:00 p.m.

For all DIYers, contractors, homeowners, architects, and business owners: how to make your home or business Dark Sky friendly. Join the experts at the Flagstaff Dark Skies Coalition to better understand your outdoor lighting and how to keep our city dark, and how you benefit!

From Mind to Design: Using free and easy 3D design software to explore and create imaginative 3D objects

NAU Cline Library Maker Lab, 5:30 p.m. to 7 p.m.

In this hands-on session, users will learn about the Thingiverse design community where they can explore and download 3D printable files. Attendees will then learn how to edit and expand on these objects to create their own unique designs using the free and open-use software Tinkercad. Reservations required: scifest.org or the app.

Astronomy Nights

Tynkertopia, 6:15 p.m. to 7:45 p.m.

3330 E. Elder Drive

Join us at Tynkertopia for telescope viewing and participating in astronomy activities for children with astronomer Scott Barrows!

NAU Research Spotlight Talk:

The Double Asteroid Redirection Test: A Crash Course in Planetary Defense (LIVE STREAM ONLY)

Webinar, 6:30 p.m.

Dr. Cristina Thomas (NAU) discusses NASA's first planetary defense test mission, which impacted into the moon of a binary near-Earth asteroid on September 26, 2022. Webinar registration at scifest.org or the app.

Sept. 27

Science-Themed Preschool Express

Flagstaff Downtown Library Community Room, 10:00 a.m. to 10:30 a.m.

Surprises galore are in store when we get together for science-themed stories, songs, games and more!

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Prehistoric Storytime for Families

Community Room—East Flagstaff Community Library, 10:30 a.m. to 11:15 a.m.

Families are invited to join us for fun and interactive storytimes featuring prehistoric stories.

Downtown Geology Tour

Mountain Sports Flagstaff, 1:00 p.m. to 2:00 p.m.

Join Willow Bend Environmental Education Center on a guided Downtown Geology Tour for an exclusive and unique opportunity to explore downtown like never before. The tour will cover the ancient history of stones used to build downtown's iconic buildings and highlight progression of architectural styles. Sponsored by Mountain Sports Flagstaff and 1% for the Planet. Reservations required: <https://willowbendcenter.org/2023-downtown-geology/>

STEM Poster Session

NAU DuBois Center, 1:00 p.m. to 4:00 p.m.

Open to all Flagstaff STEM students, researchers and institutions at a wide range of educational and professional levels. Bringing together STEM students and STEM professionals to interact, communicate, collaborate and share with the Flagstaff community.

Downtown “Through the Lens of Time” Guided Tour

Meeting Location Provided After Reservation Made, 2:30 p.m. to 3:30 p.m.

Join Willow Bend and SWCA for a one-of-a-kind natural history guided walk through downtown. Led by photographer and author John Vankat, the tour will follow key locations highlighted in his book, *The San Francisco Peaks and Flagstaff Through the Lens of Time*. Reservations required: www.willowbendcenter.org

Tagging Monarch Butterflies on Their Fall Migration

Bubbling Ponds Fish Hatchery- Cornville, 3:30 p.m. to 5:00 p.m.

Help tag migrating monarchs for scientific research with Southwest Monarch Study! Nets, tags and data collection training provided. Wear long pants and sturdy shoes (no sandals). Reservations required: swmonarchs.org/upcoming-events.php

Build-A-Bot Workshop

Tynkertopia, 3:30 p.m. to 5:00 p.m. 3330 E. Elder Drive

Come to Flagstaff's STEAM Community Center and create your own Bot using a wide variety of recycled materials—it's fun, creative, purposeful

and mindful!

Creation Station: Blast from the Past

Flagstaff Downtown Library Community Room, 3:45 p.m. to 4:30 p.m.

Come to a dino-tastic program of stories and crafts.

The Story of a Snowflake (IN PERSON and VIRTUAL)

Lowell Observatory, 4:00 p.m.

Join Brian Klimowski (Meteorologist in Charge at the National Weather Service) as he discusses the amazing snowfall last Winter, and tells the engaging story of one of those snowflakes and its atmospheric adventure as it grows and eventually falls to the ground in Flagstaff. Webinar registration at scifest.org or the app.

For Birds, Just Add Water

Kachina Wetlands Entrance, 4:00 p.m.

Join Northern Arizona Audubon for a stroll through Kachina Wetlands and learn how a formerly dry meadow became one of the most important stopovers in northern Arizona for migratory birds. The two-mile stroll will also include bird identification and ecology and will end at dusk with a stunning view of the San Francisco Peaks at sunset. Reservations required: scifest.org or the app.

The Ferruginous Hawk: Northern Arizona's Best Kept Secret (IN PERSON and VIRTUAL)

Lowell Observatory, 5:00 p.m.

Join Master Falconer Michele Losee of the International Raptor & Falconry Center as she introduces us to Quinn, the rarest hawk in Northern Arizona, and find out why Ferruginous Hawks are still on the Endangered Species list. Webinar registration at scifest.org or the app.

The Science of Beer

Mother Road Brewery—Roy's 66 Room, 5:00 p.m. to 6:00 p.m.

Please join NAU's Brewing Science Certificate team in a discussion about the science behind the pint. Dr. Andy Koppisch, Dr. Emily Cope, Dr. David John and Devon Randall will be diving into the chemistry and microbiology of brewing and fermentation.

Animal Bones! Identifying Different Bones and Animals

Planet Science, 5:00 p.m. to 6:00 p.m.

Dr. Chrissina Burke (NAU) shows participants the process of identifying what animal a bone belongs to. Participants will explore how we can use our knowledge about how animal

bodies function to identify what animal the bones belong to.

Climate Fresk Workshop

NACET Accelerator Building—Conference Room, 5:30 p.m. to 8 p.m.

Climate Fresk is a card game that teaches participants how climate change works and empowers them to take effective action. In this collaborative game, participants draw a fresco representing the work of the Intergovernmental Panel on Climate Change. Reservations required: scifest.org or the app.

Healthy Eating: The Effects Food Has on Us

Chabad of Flagstaff, 5:30 p.m. to 6:30 p.m.

Participants will be able to create easy quick treats that are healthy and good for the body, to demonstrate how proper food can keep you energized without the sugar spikes and tiering effects. Reservations required: scifest.org or the app.

Astronomy Nights

Tynkertopia, 6:15 p.m. to 7:45 p.m. 3330 E. Elder Drive

Join us at Tynkertopia for telescope viewing and participating in astronomy activities for children with astronomer Scott Barrows!

A Trip Through Time Around the San Francisco Peaks (LIVE STREAM ONLY)

Webinar, 6:30 p.m. to 7:30 p.m.

Rephotography, or the science and art of matching historical photographs to their modern-day counterparts, can tell us a great deal about our forest home. Ecologist, author and photographer John L. Vankat will share his recent rephotographing of more than 100 locations. Webinar registration at scifest.org or the app.

Sept. 28 Science-Themed Toddler Tales

Flagstaff Downtown Library Community Room, 9:15 a.m. to 9:45 a.m.

Your toddler will delight in this special time for science-themed stories, songs, games and more!

Science-Themed Preschool Express

Flagstaff Downtown Library Community Room, 10:00 a.m. to 10:30 a.m.

Surprises galore are in store when we get together for science-themed stories, songs, games and more!

Building LEGO Skeletons

Community Room—East Flagstaff Community Library, 3:00 p.m. to 4:00 p.m.

Join other LEGO fans to engineer some fun! Imagine, create, play and learn as we build LEGO skeletons of real or imagined animals.

Build-A-Bot Workshop

Tynkertopia, 3:30 p.m. to 5:00 p.m. 3330 E. Elder Drive

Come to Flagstaff's STEAM Community Center and create your own Bot using a wide variety of recycled materials—it's fun, creative, purposeful and mindful!

Magnificent Mammals of the Ice Age

Flagstaff Downtown Library Community Room, 3:45 p.m. to 4:45 p.m.

Youth, ages 8+, are invited to learn about several mammals from the Ice Age and create their own design on paper, relaying characteristics from the prehistoric mammals that they've learned about, into their creation!

McMillan Mesa Community Guided Hike

Buffalo Park, 4:00 p.m. to 6:00 p.m.

Willow Bend, in partnership with the City of Flagstaff's Open Space Program, will be leading an interpretive walk of McMillan Mesa. Learn about McMillan Mesa's urban forestry, open space, wildlife and more! This program is for adults and kids over 12 years old. Reservation required: www.willowbendcenter.org/mcmillan-mesa

The People of Ancient Peru: Diet, Migration and Llamas (IN PERSON and VIRTUAL)

Lowell Observatory, 4:00 p.m.

Hundreds of years before the Inka, the Wari was the first expansive state to control vast regions of Peru. Join NAU bioarchaeologist Corina Kellner as she explores the Nasca people of Peru and the Wari Empire based on isotope analysis. Webinar registration at scifest.org or the app.

Global Volcanism Update (IN PERSON and VIRTUAL)

Lowell Observatory, 5:00 p.m.

At any given moment, more than 20 volcanoes are actively erupting somewhere on Earth. Come hear USGS volcanologist Greg Vaughan talk about some of the most spectacular recent volcanic eruptions! Webinar registration at scifest.org or the app.

Women in STEAM Networking Event

Wanderlust Brewery, 5:30 p.m. to 7:30 p.m.

A night for celebrating Women in STEAM, this event will be an opportunity to share experiences and create a network of artists and scientists

you can tap into for collaboration and advice.

Astronomy Nights

Tynkertopia, 6:15 p.m. to 7:45:00 p.m.

3330 E. Elder Drive

Join us at Tynkertopia for telescope viewing and participating in astronomy activities for children with astronomer Scott Barrows!

Science-Telling Through Story

Kitt Recital Hall, 6:30 p.m. to 8 p.m.

Listen to science come alive as scientists with NAU's Center for Ecosystem Science and Society (Ecosys) tell stories of finding adventure in remote corners of the Earth and discovering new meaning in their work.

Pride in Your Community: Out in STEM

Community Room—East Flagstaff Community Library, 6:30 p.m. to 7:30 p.m.

Join us at the East Flagstaff Community Library for a discussion of the impact made by LGBTQ+ folks in the STEM workforce!

Sept. 29 Controlling Rodents Without Poisons: Restoring Balance on the Galápagos Islands

Lowell Observatory, 4 p.m.

Listen as SenesTech founder Loretta Mayer explains how an overpopulation of rats is putting the animals and humans of the Galápagos Islands in jeopardy. Dr. Mayer shares how she is working to restore ecological balance to this area without resorting to poison.

Complexities of Co-Existing with Carnivores—A Global Perspective

Lowell Observatory, 5 p.m.

Environmental Scientist, Dr. Duan Biggs (NAU), Conservation Biologist, Dr. Alex Braczcowski (NAU and Griffith University, Australia), and Emily Renn (NAU and Grand Canyon Wolf Recovery Project) will share their experiences from the field on how community science can strengthen co-existence with carnivores.

SCI Talks Presented by Mammoth (IN PERSON and VIRTUAL)

Coconino Center for the Arts, 6:30 p.m. to 8:30 p.m., Doors Open at 6 p.m.

Four TEDx-style talks from local scientists, artists, and educators. In each 15-minute talk, the speakers will share what drives their enthusiasm for their field of study. Quantum Scientist Ines Montano will explain how we

FESTIVAL OF SCIENCE 2023 EVENT SCHEDULE

are on the precipice of a technological revolution. Ecologist Jut Wynne will share his experiences with caves from around the globe. Artist Robert Long relays how his artwork aims to amplify intimate, obscure forms of life to give underrepresented organisms louder voices and to visualize their self-worlds. Terra BIRDS founder John Taylor describes his organization's work to teach environmental stewardship in our schools through gardening. Webinar registration at scifest.org or the app.

Sept. 30 Harrenburg Wash Guided Tour

Pumphouse Wash Trailhead, 9 a.m. to 11 a.m.

Attend a tour of the Harrenburg Wash Natural Area to learn about the area's hydrology and history and a restoration project underway to enhance our local riparian habitat. Reservations required: scifest.org or the app.

Lava River Cave Guided Hike

Lava River Cave Trailhead, 9 a.m. to 11 a.m.

Take a guided tour of the Lava River Cave and hear about the origin of the cave and the processes that formed some of the interesting features found in a lava tube. Proper hiking shoes or boots, clothing and lights required for this strenuous hike. Reservations required: scifest.org or the app.

Post-Fire Botany walk!

Parking Pull Out at the Intersection of Lockett Meadow Rd and Forest Road 418, 9 a.m. to 10:30 a.m.

Attend a family friendly stroll through the Pipeline fire scar to see what is re-emerging after last year's fire. We will casually walk around about one mile off trail. Please wear good hiking shoes. Reservations required: scifest.org or the app.

Tynkertopia Open House

Tynkertopia, 10 a.m. to 4 p.m.

3330 E. Elder Drive

Become a "tynkerer"—visit Tynkertopia, Flagstaff's award-winning STEAM Community Center, and learn how we invite curiosity, inspire wonder, encourage playfulness, and celebrate unique solutions.

Camp Colton on the Prairie

Camp Colton, 10 a.m. to 12 p.m.

Explore Camp Colton and experience a little bit of everything that Camp offers with a focus on environmental education, games, arts and crafts, outdoor activities—and, of course, lots of fun!

The Diverse World of Sustainable Building

Willow Bend Environmental Education Center, 10 a.m. to 2 p.m.

Explore a variety of buildings that highlight a wide array of sustainable methods and technologies, including rainwater harvesting, solar design and PV! Pick up a self-guided tour packet at Willow Bend on the day of the tour or download at coconino.az.gov/sustainablebuilding

Plein Air in Open Spaces—Picture Canyon

Picture Canyon Natural and Cultural Preserve, 10 a.m. to 12 p.m.

Join us at Picture Canyon for a morning of drawing and painting outdoors. Flagstaff Open Spaces has art supplies and easels available for free! All ages and abilities are welcome!

Outdoor Microbe & Vector Tour!

Buffalo Park, 10 a.m. to 12 p.m.

Families will walk through a short loop at Buffalo Park to interact with several scientists that introduce microbe and vector species that are studied at TGen North and are found locally (e.g., ticks, mosquitoes, Valley fever fungus, wastewater microbes, etc). Meet at a TGen booth at Buffalo Park.

Dow Spring Hike

Dow Spring Trailhead on Forest Road 131, 10 a.m. to 12 p.m.

Kaibab National Forest South Zone archaeologist Charlie Webber will lead a hike to a collection of archaeological sites located around Dow Spring that reveal an amazing slice of history. For the 1.25 mile, hour long hike please bring water, closed-toe footwear and sunscreen. Reservations required: scifest.org or the app.

CCA Youth Art Drawing Workshop (Ages 8 to 10)

Coconino Center for the Arts, 10 a.m. to 12 p.m.

In a small group art workshop, students will create a drawing of an object that is special to them. Local artist and art educator, Erika Tsouras, will lead students to view and reflect on the exhibit in the CCA gallery which features photographs of personal items surrendered to U.S. border patrol by hopeful immigrants. No art experience required! All supplies provided. Reservations required: scifest.org or the app.

Science Day at MNA Open House

Museum of Northern Arizona Brady Geology Building, 11 a.m. to 4 p.m.

East Side of Highway 180, Accessed

via N. Winding Brook Road

Join us at the Museum of Northern Arizona for a fun day of science activities, including an outdoor nature scavenger hunt on the museum's grounds.

National Weather Service Open House

National Weather Service, Bellemont, 11:00 a.m. to 4:00 p.m.

Visit the National Weather Service in Bellemont and chat with the Meteorologists that forecast the weather and warn for the storms we see here in northern Arizona! Learn about the monsoon, technology we use, partners we work with, and how El Niño may impact the upcoming Winter! Live weather balloon launches at 1 and 4 pm.

Post-Fire Botany walk!

Parking Pull Out at the Intersection of Lockett Meadow Rd and Forest Road 418, 11 a.m. to 12:30 p.m.

Attend a family friendly stroll through the Pipeline fire scar to see what is re-emerging after last year's fire. We will casually walk around about one mile off trail. Please wear good hiking shoes. Reservations required: scifest.org or the app.

CCA Youth Art Drawing Workshop (Ages 11 to 16)

Coconino Center for the Arts, 1 p.m. to 3 p.m.

In a small group art workshop, students will create a drawing of an object that is special to them. Students will learn skills in observational drawing, shading and emphasis in order to create a meaningful portrait. No art experience required! All supplies provided. Reservations required: scifest.org or the app.

The Last of the Ice Age Mammoths on the Colorado Plateau

Museum of Northern Arizona Branigar Hall, 2 p.m. to 3 p.m.

Listen to a talk with paleontologist David Gillette as he tells the story of the Huntington Mammoth of Central Utah, an ancient resident of the Colorado Plateau.

A Century of Ecological Change at Hart Prairie

Hart Prairie Preserve, 2 p.m. to 5 p.m.

Ecologist, author, and photographer John L. Vankat will lead an easy guided walk at The Nature Conservancy's Hart Prairie Preserve. Reservations required: scifest.org or the app.

The Healing Art: Shakespeare's Understanding of the Human Body

Museum of Northern Arizona—Branigar

Hall, 3:30 p.m. to 4:30 p.m.

FlagShakes will explore how our understanding of the human body and emotions has changed through the centuries as seen through Shakespeare's plays.

"The Seeds Our Ancestors Planted" Film Screening, Panel & Live Food Demo

Murdoch Center, 6 p.m. to 8 p.m.

203 E Brannen Ave
"The Seeds Our Ancestors Planted" is an inspiring short film that follows Diné Flagstaff High School student Kai Begay as he joins a growing food renaissance across Navajo Nation. Featuring a Q&A with filmmakers and a food demonstration where attendees will learn to cook a tasty and nutritious ancestral plant-based dish.

Photographing Flagstaff's Dark Skies: Astrophotography Basics & Insights with John Gartin

Coconino Center for the Arts, 6:00 p.m. to 9:30 p.m.

Learn approaches to Astrophotography in a combined classroom and field-based workshop with astrophotographer John Gartin. Participants will learn how to use their own camera settings, the impact of different camera settings, foreground composition, site scouting, and more. Please visit www.scifest.org or the festival app for a list of required materials. Reservations required: scifest.org or the app.

Oct. 1 Historical Archaeology Tour of Apex, Arizona

Meeting Location Provided After Reservation Made, 8 a.m. to 2 p.m.

Join NAU's Apex, Arizona Archaeology Project for a guided tour of a Depression-era logging camp along the Grand Canyon Railway and learn about historical archaeology in Arizona. Tour will be outside of Tusayan, Arizona. Reservations required: scifest.org or the app.

Neighbor Appreciation Day at Meteor Crater & Barringer Space Museum

Meteor Crater, 8 a.m. to 6 p.m.

Join us for Appreciation Day and view the best-preserved meteorite impact site on Earth!

You'll also have the chance to sign-up for an exclusive full rim tour which begins at 9:00 a.m.. Reservations required: visit the Planet Science store (109 N Leroux St, Flagstaff), call (928) 220-3815 or email info@planet-sciencestore.com.

sciencestore.com.

The History of Science in Flagstaff: Missions and Madness Adventure Game

Wheeler Park War Memorial, 10 a.m. to 12 p.m.

Learn how science shaped Flagstaff by playing an adventure game that's part scavenger hunt, part Dungeons and Dragons and part boot camp. It's also a great way to get some exercise as you walk around downtown historic sites! Reservations required: scifest.org or the app.

Guided Hike at Rogers Lake Community Forest

Rogers Lake County Natural Area, 10:30 a.m. to 12 p.m.

The Rogers Lake Community Forest will be the first of its kind in the Southwest. On this guided hike, learn more about the community forest, the significance of the land and the county's collaboration with the Forest Service. Reservations required: scifest.org or the app.

Are Saker Falcons Losing the Game of Life?

Community Room—East Flagstaff Community Library, 1 p.m. to 2 p.m.

Master Falconer Michele Losee of the International Raptor & Falconry Center discusses why the Saker Falcon is an endangered species that is losing the game of life. Meet Enequina, IRFC's Saker Falcon up close!

USGS Open House

USGS Flagstaff Science Campus, 1 p.m. to 4 p.m.

2255 N Gemini Rd

Visit USGS to explore geology, geography, biology, hydrology, planetary science and mapping!

Keyhole Sink Guided Hike

Meeting Location Provided After Reservation Made, 2 p.m. to 4 p.m.

Join retired Kaibab National Forest archaeologist and Willow Bend Board Member Neil Weintraub for a 1.5 mile round trip hike to the Keyhole Sink Native American petroglyphs that are about 1000 years old. Reservations required: www.willowbendcenter.org

Chasing The Southwest Monsoon (LIVE STREAM ONLY)

Festival Zoom Account, 5:30 p.m. to 6:30 p.m.

The North American Monsoon is spectacular, dangerous, beautiful and full of surprises. This presentation will showcase the photographs, science and adventure of chasing monsoon storms in and around Arizona. Register at scifest.org or the app.

Learning from the past STEMs into the future at Gore



Since the Flagstaff Festival of Science began in 1989, festival organizers have provided Northern Arizona with fun and informative festivals highlighting the endless possibilities that result from Science, Technology, Engineering and Math (STEM). W. L. Gore & Associates, Inc. (Gore) has been a proud partner since the festival's origins, and we are pleased to support this year's "Mammoth World of Science" highlighting the work of Beth Shapiro, PhD at the W. L. Gore & Associates sponsored keynote event! As we look to the past, let's also look ahead to the future and ways STEM can solve complex challenges and protect the planet.

Celebrating 65 years of innovation at Gore

Gore began in a family home 65 years ago, and today, we're an Enterprise of more than 12,000 Associates across 25 countries working to improve lives around the world. Since 1958, Gore has solved complex technical challenges in some of the most demanding environments — from outer space to the world's highest peaks to the inner workings of the human body — all with STEM at the forefront.

Just as the Flagstaff Festival of Science demonstrates every year, STEM's endless possibilities have fueled Gore's material science expertise and innovation. But STEM isn't only the source for how we create at Gore. STEM plays a big part in our efforts to be more sustainable. At Gore, we believe one of the greatest contributions we can make to sustainability is through innovations that have a positive impact on human health as well as the planet.

As we learn from Dr. Beth Shapiro, climate change has made profound changes to our planet in the past, and we all share in the responsibility to understand the implications of climate change and to reverse its detrimental effects for a brighter future.

It's up to us

STEM plays an important role in driving innovative solutions to protect the environment and the planet in the future. And we all play an important role — from recycling small daily use items, to helping businesses create sustainable solutions. What role will you play?

Check out Gore's Sustainability Report at Gore.com for more information.

A labor of glove — diverting 42 tons of waste from landfills

Gore creates implantable medical devices and provides innovative health solutions, and the quality and safety of our devices is a priority — not only for our patients and their physicians, but for the safety of Associates who make these life-improving devices. Personal protective equipment (PPE) nitrile gloves are an essential part of our manufacturing process, and we create more than two million medical devices a year — so those gloves add up! With the help of the Kimberly-Clark RIGHTCYCLE program, in 2022, Gore diverted 42 tons (that's the size of a small jet, or six elephants!) of PPE nitrile glove waste from landfills, giving them a second life through recycling. Gore was the largest contributor to the RIGHTCYCLE program in 2022, and we are proud to receive the 2023 RIGHTCYCLE Greenovation Award! Daily recycling of seemingly small items — such as a glove — can have a big impact.

Collaborating with Patagonia to keep you warm and dry — sustainably!

Gore and Patagonia have worked together for more than 20 years, creating gear to keep you warm and dry — whether you're an avid winter sports enthusiast, or you enjoy just playing outside. Patagonia has been a strong influence for companies around the world with their impressive sustainability goals. Later this year, Patagonia will be launching a new product featuring the GORE-TEX ePE (expanded polyethylene) membrane. The new membrane is a key milestone in Gore's ongoing sustainability journey, providing high-performing, durable products that are engineered for long useful life. Gore has been a leader in textile innovation for decades, and we look forward to continuing sustainable innovation to help people around the world do what they love in the great outdoors.



It's Electric! Reducing carbon emissions

At Gore, we've adopted a science-based approach to address our reduction in greenhouse gas emissions. Here in Flagstaff, we've partnered with Arizona Public Service (APS), and all our electricity purchased from APS is 100% renewable, removing more than 15,000 tons of carbon dioxide equivalent from Gore's carbon footprint. And just down the hill, Phoenix experiences more than 300 days of sunshine per year so we added solar panels to our Phoenix campus, generating more than 40% of the campus's annual electricity demand. We've also added vehicle charging stations for our Associates and we've invested in electric vehicles for Associates to use for business travel in Arizona. These adjustments not only benefit our Associates but minimize Gore's carbon footprint.

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SPONSORING THE FUTURE OF STEM



As a company rooted in Science, Technology, Engineering and Math (STEM), W. L. Gore & Associates, Inc. (Gore) is a strong supporter of STEM programs in Northern Arizona. As a major sponsor of the Flagstaff Festival of Science for 34 years, a sponsor of the annual KAHTOOLA Uphill Race to support Camp Colton's outdoor environmental experiential programs, and providing local classrooms with science experiences, Gore remains a dedicated advocate for STEM throughout the community.

In collaboration with the Arizona Community Foundation of Flagstaff, we proudly invest in Northern Arizona's K-12 STEM educational experiences by annually awarding Gore STEM Grants to community organizations.

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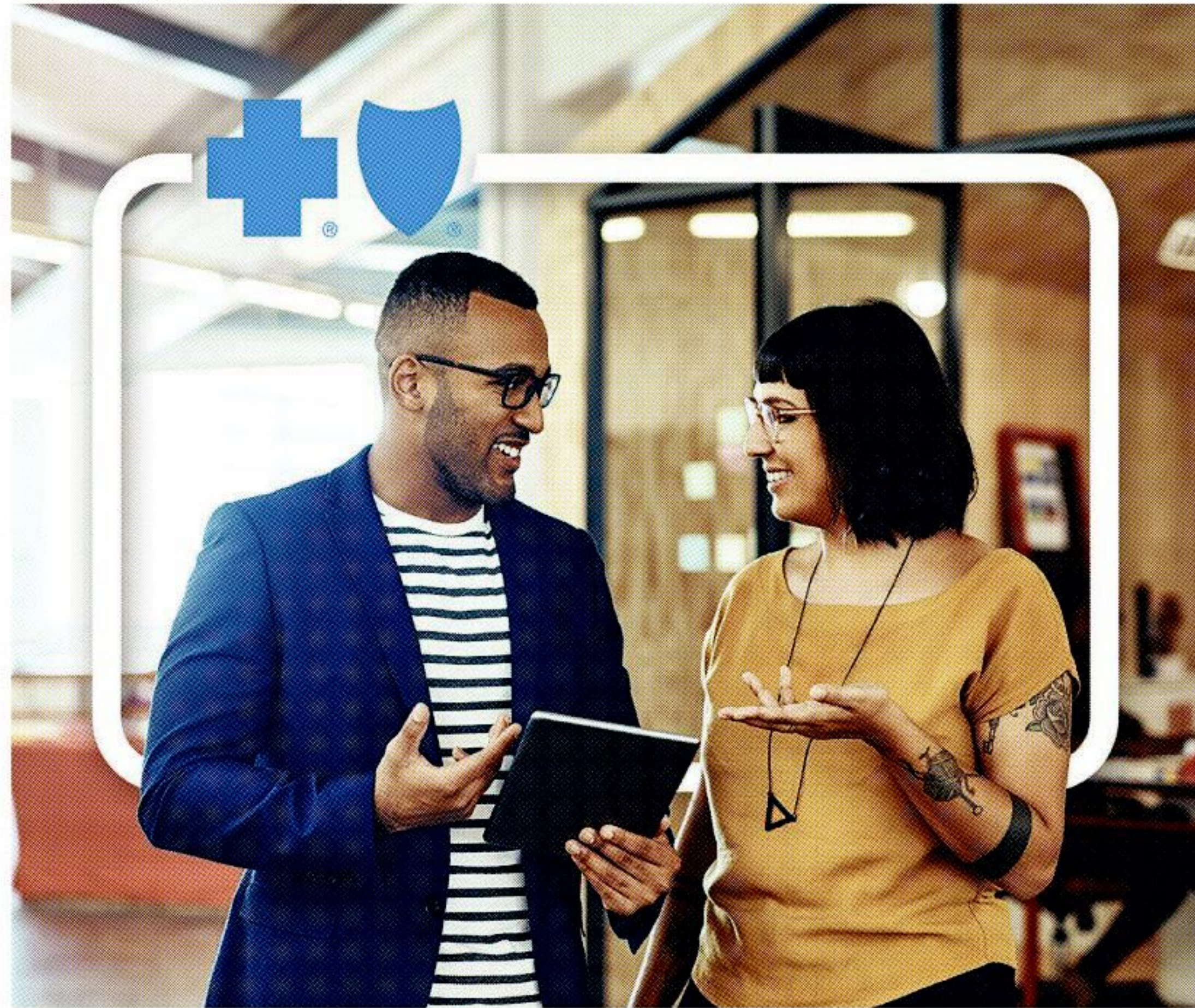
This year, we are pleased to announce the following 2023 STEM grant recipients:

**Flagstaff Festival of Science • Arizona Trail Association
Flagstaff Dark Skies Coalition • Civitan Foundation
Dirty Hands Happy Heart Corp. • Arizona Science Center
Willow Bend Environmental Education Center
Tynkertopia • The Arboretum at Flagstaff
Lowell Observatory • Puente de Hozho
STEM City • Grand Canyon Youth
Arizona Natural History Assn - Elden Pueblo Project**

Part of our mission of *Together, improving life* is to support our communities where our Associates live, work and volunteer. For more information, contact us at gorecommunity@wlgore.com.

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Our Winter and the Journey of a Snowflake

BRIAN KLIMOWSKI

The winter of 2022-2023 will go down in history as one of the snowiest for much of the Western U.S. The mountains of California, Arizona and Utah all documented record snowfall, which both paralyzed communities and provided much needed replenishment of moisture in drought-stricken areas. Here in the Flagstaff area, we received between 150-180" of snow, officially putting this past winter as the 5th snowiest on record for the Flagstaff airport with 163.1". Flagstaff's official weather records date back to September 1898.

First, some fun facts and statistics regarding the snow. The snow that fell last winter contained a LOT of water—so much that it completely removed drought conditions from the Flagstaff area. The combined liquid equivalent of the snow that fell was about 23" in the high country with much less falling over the lower deserts. This was roughly equivalent to a years' worth of precipitation—and it all fell within about 4 months! If we do a VERY rough calculation of the volume of melted snow/water that fell over northern Arizona, we're looking at about 1,400,000,000,000 cubic feet (23 million acre-feet) of water. This would be equivalent to approximately 90% of the total volume of Lake Powell if every drop was put into the lake! That much water would weigh 620,000,000,000,000 pounds (31.3 billion tons)—about the weight of 85,800 Empire State Buildings!

Every snowflake that participated in the winter snowfall had a unique, and interesting origin story. Let's learn more about the origins of a typical Flagstaff snowflake, and how moisture over the Pacific can end up as a blanket of snow in our backyards here in Flagstaff.

On an ordinary day in January, in the vast expanse of the Pacific Ocean, a small water molecule embarked on an extraordinary journey. Once part of the ocean's expansive body, it was heated by the sun's rays, evaporated into the atmosphere, and befriended a dust particle on which it condensed into a microscopic water droplet.

High in the atmosphere where the air is frigid and the moisture abundant within the juvenile, growing storm, the water droplet began to grow. Rising higher and higher into the atmosphere on relentless updrafts of air, this little droplet cooled as it rose higher, and eventually froze in an atmosphere that was very cold—less than 20 degrees Fahrenheit. Now made of

ice, our little crystal grew faster as it was blown over the West Coast, stealing water mass from less fortunate water droplets. Governed by the specific bonding properties of H₂O molecules, the crystal soon developed perfect six-sided symmetry as its branches became more defined. It became a beautiful snow crystal several millimeters wide somewhere high over Las Vegas, Nevada.

This crystal is only one of billions—each is like a canvas, waiting for nature's brush to paint its unique design. No two are the same. The conditions in the upper atmosphere are crucial, with the slightest changes in temperature or humidity resulting in a different crystal structure. Blown by the increasing jet stream and storm dynamics, our crystal reached the mountains of western Arizona, where it was subjected to a multitude of atmospheric conditions. It was a bumpy ride, but the storm is large and strong, and the winds kept the crystal high in the atmosphere.

Finally, our fully formed snow crystal grew large enough to become too heavy for the winds to keep it aloft. It fell to the ground, at a rate of a couple feet a second. This fall to the ground is gentle one, and may take 30 minutes to an hour to complete. Along the way, our snow crystal is likely to bump into thousands of other snow crystals; sticking to some, bouncing off others, until it becomes a complex snowflake—a mass of snow crystals stuck together, and falling to the ground ever faster.

Upon reaching the ground, the snowflake gently settles, joining others to create a soft, pristine layer of snow. Each snowflake is a testament to the journey it had taken and the conditions it had encountered. In a typical heavy Arizona snowstorm, this story will occur 1.2 sextillion (1,200,000,000,000,000,000) times. And no journey will be the same.

The winter of 2022-2023 was spectacular for the number of and intensity of storms that impacted the western U.S. Looking outdoors on most winter mornings in northern Arizona, the view bore witness to the amazing journeys of millions and millions of snowflakes. The warming of spring melted this great snowpack, and some of this water eventually made its way back to the ocean... completing the water cycle that has been repeated for millennia.

The San Francisco Peaks are barely visible through clouds of snow after a winter storm rolled through Flagstaff earlier this year.

RACHEL GIBBONS,
ARIZONA DAILY SUN



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