

Decoding important wildlife DNA

NSF awards \$11.9M to project co-led by ASU that will create a national resource to sequence, analyze DNA of important species; insights gained will have potential to help humans

By Mikala Kass, ASU News
September 24, 2026

Story highlights

ASU will co-lead an NSF-funded project to create a national resource to sequence and analyze the DNA of important species.

The genetic insights can lead to new medicines, better crops and materials, and smarter conservation methods.

ASU will work with tribal communities to respect Indigenous data sovereignty throughout the project.

The project will also lean on ASU's expertise to collect and store samples, train up the next generation of geneticists, and reveal the mysteries of life-forms called protists.

There is a wealth of knowledge to be found in the DNA of our nation's spectacular wildlife.

A team of researchers co-led by Arizona State University will create a national resource to sequence and analyze the DNA of important species and uncover genetic insights that can become breakthrough medicines, resilient food crops and high-performance materials, as well as monitor ecosystem health and protect at-risk species.

The project, Designing Scalable Community-driven Infrastructure to Support Biodiversity Genomics, or SCIBG, recently earned an \$11.9 million grant from the National Science Foundation. SCIBG will be a collaborative effort between ASU, Rockefeller University and the

University of Kansas.

The team will create a pipeline for collecting DNA samples from species in the wild, storing the samples, and making high-quality reference genomes that other researchers and the public can download for scientific use.

SCIBG supports the international [Earth BioGenome Project](#), currently headquartered at ASU's [Julie Ann Wrigley Global Futures Laboratory](#). The project aims to sequence all of the planet's 1.8 million known eukaryotic species. Eukaryotes include all animals, plants, fungi and protists. The rest — bacteria and archaea — are known as prokaryotes.

[Harris Lewin](#) and [Krystal Tsosie](#), who co-lead the project from ASU, note that SCIBG serves as an Earth BioGenome Project hub in the U.S. to help meet its ambitious goals as well as create a record of U.S. biodiversity that can support national security.

The project will boost further research in medicine, biotechnology, agriculture and conservation, and reinforce U.S. leadership in genomics and the bioeconomy.

“Think of the genomic data as part of a massive highway that supports research in all those domains of application. All modern biology uses genomes in some way to find answers to critical questions.” says Lewin, a research professor in the Julie Ann Wrigley Global Futures Laboratory.

ASU is an ideal hub for this kind of work. It's situated in the heart of the Sonoran Desert, filled with specially-adapted species found nowhere else in the world, from the iconic saguaro cactus to the orange and black Gila monster.

The university is also home to the [Center for Biological Collections and Discovery](#), which holds biological specimens from around the world, and the [Desert Southwest Genomics Center](#), which can generate high-quality reference genomes. ASU's campuses are also located on the homelands of Indigenous peoples, including the Akimel O'odham and Pee Posh, whose deep traditional knowledge of local wildlife will be a central information source for the project.

“What makes our project and ASU's involvement unique is the data governance, data ethics and data policy in conjunction with respect to tribal nations,” says Tsosie, who is Diné (a member of the Navajo Nation). “ASU has a special relationship to the 22 tribal nations in the state of Arizona. Building in those pieces alongside the science is so unique.”

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Harris Lewin

Research professor, Julie Ann Wrigley Global Futures Laboratory

Sequencing for the public

Lewin will lead SCIBG's Community Access Sequencing Program, a peer-reviewed system through which any U.S. researcher could nominate a species to be sequenced for a high-quality reference genome.

"Our criteria to choose from nominated species will balance the scientific goals of the Earth BioGenome Project with other needs that address broad societal goals, such as ecosystem health, agriculture, medicine, conservation and biotechnology," he says.

The genomes will be published on [GenBank](#), a database led by the National Center for Biotechnology Information. That genome data will be openly available to the public. To decide whether certain data should become public, the team will consider the laws and rights of Indigenous peoples, threats to species conservation, and potential biosecurity concerns.

"We want to think about open data but with proper gates, and that's built into this project," adds Tsosie.

Science and sovereignty

Tsosie leads the effort to set rules for how samples and genetic information are permitted, accessed and credited — also called data governance. For the SCIBG project, the rules will follow regulations across federal, state and tribal jurisdictions, with particular care for Indigenous data sovereignty.

"It's not just purely about the science, it's also about the implications of the science on people," says Tsosie, an assistant professor in the [School of Life Sciences](#).

In the past, scientists and surveyors wanting to understand an ecosystem would take samples from Indigenous lands without asking and without crediting the caretakers of the landscapes the samples came from. Tsosie is helping address that history through proper labeling of museum specimens collected in the past, as well as respectful protocols for collecting samples for SCIBG going forward.

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Krystal Tsosie

Assistant professor, School of Life Sciences

The team will pilot adding traditional knowledge labels to species that are already in the ASU Biocollections as well as to future samples collected in partnership with tribal nations. These labels

ensure that a species' cultural context, and credit for the stewardship of that species, is tied to its record whenever it is studied.

SCIBG will also engage with tribal experts to learn about the cultural relevance of species — for example, whether a plant is considered sacred — and use those conversations to shape decisions on whether to make its genomic data public or not.

Training future geneticists

[Jay Goldberg](#), an assistant professor in the School of Life Sciences, is developing training materials to support the workforce and community involvement needed for this project.

“One of our goals is to use the training module to empower Indigenous communities with the skills and knowledge necessary for participating in genomics research. The idea is for communities not just to contribute their own sequences, but to collaborate with us throughout the whole research process,” says Goldberg, who is a member of the Sault Ste. Marie Tribe of Chippewa Indians.

He will create a hands-on course that gives students, early-career researchers and community members practical experience with the steps involved in producing a reference genome.

A library of life

[Hojun Song](#), a professor in the School of Life Sciences, will lead field sample collection at sites that are part of NSF's [National Ecological Observatory Network, or NEON](#). He will also identify species already preserved in ASU's collections that are good candidates for DNA sampling. Song directs the [Center for Biological Collections and Discovery](#), which includes both the ASU Natural History Collections and the NEON Biorepository.

“Biological collections and biorepositories serve as the irreplaceable, physical ‘library of life,’ preserving tangible proof of our planet's shared biological heritage across generations,” Song says.

Rather than static relics of the past, repositories are active scientific centers. They house specimens like dried plants, insects and cryopreserved tissues that serve as definitive reference points for thousands of species. Scientists can use these specimens to compare with field observations and document changes over decades and even centuries.

The NEON Biorepository at ASU can preserve specimens by freezing and storing them, which is an important stage in the process of creating a reference genome for a species.

Mysterious life-forms

[Jeremy Wideman](#) is taking on a big challenge at a small scale — sequencing up to a dozen mysterious kingdom-level branches on the tree of life composed of organisms called protists. These eukaryotes are not animals, plants or fungi. They include kelp (brown algae), diatoms, slime mold and the parasite that causes malaria, as well as thousands if not millions of species yet to be discovered.

“We know comparatively very little about protists. To understand the evolution of eukaryotes, cells, life cycles and lifestyles, we need many more genomes from many more representatives that are not animals, plants or fungi,” says Wideman, an assistant professor in the School of Life Sciences and the [Biodesign Center for Mechanisms of Evolution](#).

But sequencing protist DNA is difficult — it’s currently impossible to sequence an entire genome from a single cell, and some protists can’t be cultured in a lab to create larger samples. Additionally, some protists have genomes larger than the human genome, and some are just hard to find. Wideman is testing new methods that would help scientists work with protist samples and analyze their DNA.

“All these elements are coming together to create a critical mass at ASU for biodiversity genomics, making ASU one of the national leaders in the space,” Lewin says.

This story originally appeared on [ASU News](#).

Main image



Azhar Husain, collections manager of the Cryogenic Collections at the NEON Biorepository at Arizona State University, places specimens in a liquid nitrogen freezer for cryopreservation. ASU

will co-lead an NSF-funded project to create a national resource to sequence and analyze the DNA of important species. Photo by Andy DeLisle/ASU Knowledge Enterprise

Text image(s)



“What makes our project and ASU's involvement unique is the data governance, data ethics and data policy in conjunction with respect to tribal nations,” says Assistant Professor Krystal Tsosie. Above: Tsosie gives a lecture at 2024's IndigiData, an Indigenous data science education workshop, in the ASU Alameda building that houses the Center for Biological Collections and Discovery. Photo by David Goodwater/ASU VisLab



Biological collections are a “library of life,” says Professor Hojun Song. Above: Song stands near shelves holding invertebrate bycatch samples in the NEON Biorepository. Photo by Andy DeLisle/ASU Knowledge Enterprise