



# Natural History Collections

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 **School of  
Life Sciences**  
Arizona State University



## Natural History Collections

For more than six decades, the School of Life Sciences complex has been the place for undergraduate, graduate, and research programs in the life sciences, in The College of Liberal Arts and Sciences at Arizona State University, and the epicenter of the school's history. The teaching and research activity that occurs within its classrooms, lecture halls, greenhouses, laboratories, and central courtyard serve as the vanguard of conservation efforts in the Greater Sonoran Desert Region. There are live reptile exhibits on display in the building's hallways, and a small population of the endangered Quitobaquito pupfish live in a pond in the building's courtyard.

The School of Life Sciences manages and oversees these living collections of the Natural History Collections. The school seeks to expand the collections, thereby expanding access to available knowledge and resources of life sciences through state-of-the-art collections, research, and learning facilities and by sharing our innovative studies and programming with the world.

## The need

The life sciences are at the forefront of important discoveries such as combating disease, and contributing to the development of novel therapeutics and innovative medical devices. The life sciences improve our health, quality of life, and overall well-being. The life sciences also provide insights about the environment and all living species and guide conservation efforts that can help save our shared planet. In addition, there are deeper reasons for studying the life sciences. The life sciences empower us to answer fundamental questions about ourselves — Where did we come from? What are we made of? What is the basis for our existence?

Although the life sciences play a vital role in the fabric of our society, this critical discipline is chronically underfunded. Compounding this problem is the immediate need to preserve biodiversity. According to the United Nations, "Nature is declining globally at rates unprecedented in human history," with species extinction accelerating. This can lead to many issues, none currently more deadly to humans than the frequency and severity of disease outbreaks, such as the COVID-19 pandemic. Furthermore, without a public informed and well-educated about how humans impact and are impacted by the natural world, the structure and proper functioning of ecosystems will fail and the world as we know it will cease to exist.

ASU's School of Life Sciences is leading the way in dynamic higher education strategies, transforming science education and collaborative research at every level. Our students' academic journey is individual, adaptive and impactful — both on campus and online. We are training the next generation of innovators, preparing our students to thrive in active and demanding fields solving critical problems at the intersection of life sciences and society. Students benefit from interdisciplinary centers, cutting-edge faculty labs and nationally and internally impactful research programs.

ASU has one of the largest life sciences schools in the country. With 10 undergraduate majors, 13 graduate degree programs, three graduate certificates and three accelerated undergraduate and graduate programs, we train and mentor more than 9,000 university students each year. Our internationally recognized faculty includes a Pulitzer Prize winner, MacArthur Fellow, four Guggenheim Fellows and five Fulbright American Scholars.

The intellectual powerhouse of the New American University, the School of Life Sciences is at the forefront of inquiry. Faculty-led research has paved the way to a staggering array of groundbreaking discoveries, including the creation of a plant-based vaccine for the Ebola and Zika viruses; using the genetics of a roundworm to search for innovative cures to cancer; incorporating immune cells into a 3D intestinal model to study infections that target the human gut; exploring strategies to make undergraduate biology classes inclusive for all students; tracking the spread of invasive

plants in a subtropical hotspot in Nepal and creating new gene sequencing technology that helps doctors individualize cancer treatments.

ASU's Natural History Collections provides research materials, training and hands-on experiences to help solve society's gravest challenges. Although the collections have a long history at ASU, it is the newly envisioned collection space that will transform the way the world has access to conservation-solving information — understanding the deeper and more recent past, monitoring the now, leveraging knowledge to forecast and manage a sustainable future.

Every day we find new evidence of just how interconnected our world is — we ask big questions, publish groundbreaking research for the scientific community and engage citizen scientists who share our passion for science. We provide global access so that communities are able to study the millions of objects in our collections, that span the full spectrum of the natural sciences.

**Science is for everyone, and with your help we will share it with the world.**

The Natural History Collections are comprised of nine different collections that support the university's teaching, research and public outreach functions. The collections emphasize flora and fauna from the arid Southwest of North America, especially Arizona and Sonora, Mexico. Collectively, our holdings rank among the largest collections of Sonoran Desert biota in the world. These biological samples are housed in a 24,000-square-foot state-of-the-art facility that includes climate control, teaching space and community outreach areas. One of the top five most rapidly growing natural history collections nationwide, the collection was recently selected by the National Ecological Observatory Network as the primary host of its national biorepository for the next 30 years. The collection will receive almost one million specimens derived from **individual and bulk samples** annually.



## The opportunity

There are several steps the School of Life Sciences is taking to ensure our world is able to combat critical declines in biodiversity, by preserving and collecting samples of living organisms, supporting life sciences research, digitizing natural history collections and providing access, both in person and online.

### Creating the National History Collections Research and Learning Center

In 2014, 24,000 square feet of the Alameda Building (southwest of the Tempe campus) was renovated to house the Natural History Collections. A second wave of renovations of an additional 6,000 square feet will allow the School of Life Sciences to add attractive, dynamic and open research and learning spaces. This will include a shared molecular research lab, software development suites and integrated meeting or learning spaces.

These renovations will transform the Alameda Building into the National History Collections Research and Learning Center. The center will be both a repository and research center for long-term biodiversity monitoring and forecasting at a continental level. The center expansion will ensure

adequate space to conserve the additional specimens, as well as ensure in-person access to underserved populations, inspiring conservation best practices to the general public. New growth for ASU's Natural History Collections will support future discovery and monitoring of species in our global environments.

Renovations will also include amplifying the living museum in the Life Sciences Center on ASU's Tempe campus featuring flora and fauna of the Sonoran Southwest. This will encourage students to better understand global efforts to work toward a more systematic approach for sharing, managing and using scientific collections for the benefit of the human race.

The Research and Learning Center will support natural history collections and create learning experiences for visitors in the following ways:

Research will support future discovery and monitoring of species in our global environments and create a Genomics Center to accelerate state-of-the-art research and learning within one of the most rapidly growing collections in North America.

Learning and public outreach efforts will develop a new generation of on-campus exhibits and virtual learning experiences and renovate displays at the entrance to the School of Life Sciences courtyard.

A collaboration with ASU partners eXploration and EdPlus will provide virtual educational experiences globally. These can include experiences such as discovering Greater Sonoran Desert Region and Tropical Biodiversity — on campus and online.



### Creating a global network for biodiversity data

With strengths in biodiversity data, data science and software development, the center's research themes and activities are well positioned to become a major part of ASU's online curriculum. The Natural History Collections are the leading group producing the Symbiota software platform for networking biocollections data. It is the no. 1 software for this purpose in North America, with nearly 1,200 natural history collections, 60 million individual occurrence records and 25 million specimen images. These investments will help us build a biodiversity data discovery and monitoring network for the Americas.

To round out the vision, the Natural History Collections will integrate the iNaturalist app. The app has more than one million global users and is ideally suited to complement an inclusive vision to move ASU to the forefront of biodiversity knowledge engagement. Funds will also support graduate students as the next generation users.

### Creating bio-explorations of the greater Sonoran region and new world tropics

Bio-explorations present current and future generations with information about the importance of retaining species diversity, to inspire appreciation and awareness of nature through physical activities, field studies and data analysis and to discover the elements of biodiversity and its impact on healthy ecosystems. Our bio-explorations will encourage scientists and students to discover and monitor the biodiversity of a specific area/region. To further our expertise and scientific knowledge, we propose bio-explorations in the Greater Sonoran Region and of the tropical Panamanian Island Coiba. Funds will support program costs and graduate student and post-doctoral support.

# The impact

Through each of these efforts and within five years of final build-out, ASU will be able to double the number of scientific researchers accessing the collections to a minimum of 500 researchers annually. This access will generate increased public information, which will enable ASU to drive and double the number of projects to approximately 100 projects. Funds will enable the collections team to establish and grow biodiversity monitoring programs in Hawaii, Papua New Guinea, Mexico, Guatemala, Costa Rica, Panama, Colombia, Ecuador and Gabon (tropical West Africa). We believe that the amount of science derived from these efforts will solve multiple biodiversity issues using biodiversity knowledge and predictive modeling to inform decision making thereby impacting societal concerns (Fig. 1).

The transmission or “spillover” of wildlife viruses to humans is a critical threat to global health, with major outbreaks of viral pathogens, including filoviruses, paramyxoviruses and coronaviruses, originating in wild mammals. Unfortunately, the data required to determine whether certain taxonomic groups (such as bats) are host to a broader diversity of viruses with zoonotic potential than other taxa are problematic, lacking, or otherwise disconnected. We plan to build a novel data intelligent service for mammal and viruses or disease vectors using strengths from the NEON infrastructure to monitor multiple existing zoonotic diseases, with a focus on organismal to population-scale data. Results will especially address the extent to which people from historically marginalized groups are included in NEON spheres and engaged as stakeholders. Results will be disseminated via professional societies and working groups relevant to zoonotic disease monitoring and journals related to biodiversity, science and technology studies and information science.

In addition, we expect that through our efforts the annual number of visitors to the collections will double, allowing us to serve almost 5,000 K-12 students and teachers annually. We will increase the museum’s outreach exhibits to include rotating exhibits showcasing our newest discoveries.

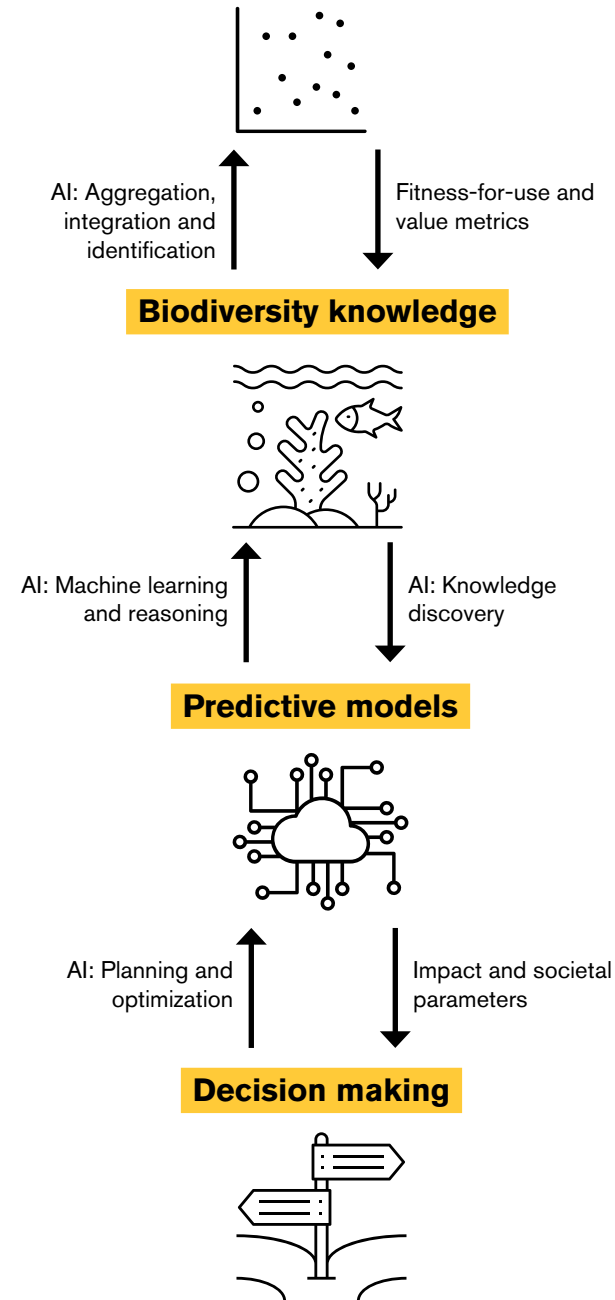
The Natural History Collections will become the strongest network for biodiversity data throughout the Americas, through an online hub for biodiversity knowledge and learning, and providing global access to our expansive collections.

Society is at a crucial juncture in our history. If no action is taken, we will experience more pandemics and other health risks, there will be adverse consequences to food security, greater risks to businesses and the exacerbation of climate change that will cause increased extreme weather events like tsunamis, hurricanes and tornadoes. These risks could lead to the destruction of property and lives as well as type specimens of irreplaceable value.

Our work in the School of Life Sciences through the Natural History Collections solve some of the most important issues our society faces – issues such as social justice, environmental preservation, animal protection, world peace and fundamental human rights. By investing in the collections at ASU, we will not only preserve our world but we also preserve our humanity.

## Primary biodiversity data sources

Figure 1: Biodiversity AI “landscape”



## Philanthropic opportunity

<b>Collections naming</b> _____	<b>\$5 million</b>
<b>Creating a new collections research and learning center</b> _____	<b>\$1.8 million</b>
“New growth for ASU’s Natural History Collections to support future discovery and monitoring of species in our global environments”. _____	<b>\$1,000,000</b>
“Creation of a Genomics Center to accelerate state-of-the-art research and learning within the most rapidly growing collection in North America”. _____	<b>\$800,000</b>
<b>Learning and outreach - “Educating local and global biodiversity communities”</b> _____	<b>\$1.2 million</b>
“Creating a new generation of on-campus exhibits and virtual learning experiences” _____	<b>\$700,000</b>
“Discovering Greater Sonoran and Tropical Biodiversity - on campus and online” with graduate students _____	<b>\$500,000</b> (5 graduate fellowships)
<b>Bio-exploration of the greater sonoran region and new world tropics</b> _____	<b>\$1.0 million</b>
Field studies with graduate students and postdocs: Accessing the Biodiversity of the Greater Sonoran Region/Accessing the biodiversity of the tropical Panamanian Island Coiba. _____	<b>\$500,000</b> each region
<b>Biodiversity data science – providing access to a global network for biodiversity data</b> _____	<b>\$1.0 million</b>
Building a biodiversity data discovery and monitoring network for the Americas/Becoming the strongest network for biodiversity data throughout the Americas.	
<b>Endow undergraduate research scholarship</b> _____	<b>\$25,000</b>