

**Testimony in Support of FY 2020 Funding for the
National Science Foundation**

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Submitted by:

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Senate Committee on Appropriations

Subcommittee on Commerce, Justice, and Science, and Related Agencies

The Natural Science Collections Alliance appreciates the opportunity to provide testimony in support of fiscal year (FY) 2020 appropriations for the National Science Foundation (NSF). **We encourage Congress to provide the NSF with at least \$9 billion in FY 2020.**

The Natural Science Collections Alliance is a non-profit association that supports natural science collections, their human resources, the institutions that house them, and their research activities for the benefit of science and society. Our membership consists of institutions that are part of an international network of museums, botanical gardens, herbaria, universities, and other institutions that contain natural science collections and use them in research, exhibitions, academic and informal science education, and outreach activities.

Scientific collections, and the collections professionals and scientists who make, care for, make accessible, and study these resources, are a vital component of our nation's research infrastructure. Whether held at a museum, government laboratory or archive, or in a university science department, these scientific resources consist of data (for example, genetic, tissue, organism, and environmental) that are a unique and irreplaceable foundation from which scientists are studying and explaining past and present life on earth.

Natural science collections advance scientific research and education, and that informs actions to improve public health, agricultural productivity, natural resource management, biodiversity conservation, and American economic innovation. Current research involving natural science collections also contributes to the development of new cyberinfrastructure, data visualization tools, and improved data management practices. A few examples of how scientific collections have saved lives, enhanced food production, and advanced scientific discovery include:

- Scientists used museum specimens in U.S. collections to gather data on the distribution of the mosquito *Culex quadrofasciatus*, which is known to carry West Nile Virus and other pathogens. These data were used to construct models for the distribution of this mosquito under different climate scenarios to predict regions where the species may expand in the future. These predictions can help public health officials plan for potential disease outbreaks.

- Citrus bacterial canker disease wreaks havoc on fruit crops in Florida. Using plant specimens collected a century ago, scientists have analyzed the bacterium and traced its source. Knowledge of how the bacteria spreads allows scientists to develop effective control methods and to protect the U.S. citrus industry.
- In 2018, researchers from Boston University documented Tau proteins in the brains of fluid preserved museum specimens of Downy Woodpecker (*Dendrocopus pubescens*). These proteins are also found in humans with traumatic brain injury. Because of the life history traits (behaviors) of woodpeckers, the researchers argue these birds may have evolved a level of resistance to traumatic head injuries that might offer insights about potential treatments for humans with traumatic brain injury.
- In 1993, a deadly disease appeared in the southwestern United States. Using NSF-supported biological collections at Texas Tech University and University of New Mexico, the agent was determined to be Hantavirus carried by a few species of rodents. When rodent populations increased following an El Niño weather event, the animals spread into human environments and increased the transmission of Hantavirus. With the vector known, it was possible to lessen the risk to humans by reducing opportunities for disease transmission. Using other specimens, scientists have now identified more than 40 other strains of Hantavirus worldwide that are carried by bats, moles, and shrews. Similar work is underway to identify the carrier of Ebola in Africa.

Scientific collections enable us to tell the story of life on Earth. There are more than 1,600 biological collections in the United States. These resources are the result of more than 200 years of scientific investigation, discovery, and inventory of living and fossil species. Scientists have collected, studied, and curated more than one billion specimens within those collections. This work is on-going as new questions continue to be asked. The institutions that care for scientific collections are important research infrastructure for the United States that also provide students with hands-on training opportunities.

The NSF plays a unique role in protecting and expanding access to our nation's scientific collections. NSF supports research that uses existing collections as well as studies that gather new natural history specimens. The Directorates for Biological Sciences (BIO), Geosciences (GEO), and Social and Behavioral and Economic sciences support research and student training opportunities in natural history collections. The NSF is also an important supporter of national biological research infrastructure that houses natural history collections, such as living stock collections and field stations.

NSF funds state-of-the-art work to digitize high priority specimen collections. The result of this effort is that irreplaceable biological specimens and their associated data are now accessible through the Internet to researchers, educators, and the public. More than 95 million specimens are now online, with millions more awaiting digitization. This effort involves biologists, computer scientists, and engineers in multi-disciplinary teams who develop innovative imaging, robotics, and data storage and retrieval methods, and projects using crowd-sourcing are engaging the broader public. These new tools expedite the digitization process and contribute to the

development of new products and services of value to other industries. Museum specimens and associated data represent an extraordinary resource for teaching core concepts in science.

In addition to supporting research, NSF's science, technology, engineering, and mathematics (STEM) education programs enhance the ability of museums, botanic gardens, zoos, and other research institutions to provide science learning opportunities for students. NSF's Advancing Informal STEM Learning program furthers our understanding of informal science education outside of traditional classrooms. The program makes important contributions to efforts to make STEM more inclusive of historically underrepresented groups.

Conclusion

Investments in the National Science Foundation and its efforts to support scientific and educational advances in natural science collections have always been in the national interest. Scientific collections contribute to improved public well-being and national economic security. It is not possible to replace this important documentation of our nation's heritage. Specimens collected decades or centuries ago are increasingly used to develop and validate models that explain how species, including viruses, parasites, and pathogens have dispersed around the world, as well as how and when they might infect humans now and in the future.

The NSF is the primary funding source that provides support to institutions that preserve at-risk scientific collections. These small grants help ensure these collections are not destroyed and their data lost.

Investments in NSF programs that support natural science collections research and education are essential if we are to maintain our global leadership in innovation. Please support funding of at least \$9 billion for NSF for FY 2020.

Thank you for your thoughtful consideration of this request and for your prior support of the National Science Foundation.