



ENTOMOLOGY AND BIOLOGICAL COLLECTIONS

ESA Transition Document

OVERVIEW

Biological collections may bring to mind pinned insects on view in museums, but what is seen is on display is but a small part of what is encompassed by within such resources. Collections are a foundational part of the U.S. research infrastructure, enabling scientists to understand our changing world, chart the evolution of infectious diseases, and develop solutions against invasive pests. However, collections are consistently under-resourced and are at risk due to a shortage of scientists trained in collections-based research and management. To assure continued U.S. leadership in many scientific disciplines that use specimens held in U.S. collections, the Entomological Society of America (ESA) recommends initiating a workforce development program, increasing and expanding infrastructure support for biological collections, and establishing collections-focused grants for the development of new analytical methods and technological advances.

CHALLENGES

Biological collections serve as a rich source of data for modern research, an irreplaceable historical scientific reference, an essential educational tool, and a resource to support regulatory and policy decision-making. Specimens in collections allow scientists to understand how biodiversity has changed over time in relation to climate shifts, land-use change, and other environmental factors. Collections help to rapidly identify and track species that carry diseases or invasive agricultural pests capable of damage in the billions of dollars annually. Studying the variability within and among populations stored in physical collections helps us understand complex biological processes.

U.S. support over many generations for the preparation, curation, maintenance, and management of biological collections is a considerable benefit to the U.S. and to the global scientific research enterprise. The U.S. maintains a significant percentage of global collections, cementing U.S. leadership across many scientific disciplines and enabling international collaborations with the best and the brightest from around the world. The costs to maintain biological collections are low when compared with the high return on investment realized via their benefit to public, environmental, and agricultural health. A failure to sustain this support moving forward will degrade the investment that has already been made and result in irreplaceable losses.

Current public support for the maintenance of biological collections has primarily been provided through the Collections in Support of Biological Research (CSBR) program at the National Science Foundation (NSF) at a value of roughly \$3-5 million per year. These funds cannot support training or salaries for collections managers, nor can they be used to train new collections managers. Consequently, collections staff reductions have led to an insufficient number of taxonomists and other scientists trained in collections management, resulting in delayed responses to informational inquiries, loss of public diagnostic services, reduced access for research, longer loan processing times, and closing of selected or entire collections when staff are not available to support them. These are not challenges that will be solved by merely digitizing collections, but there is also a lost opportunity to modernize the role of collections managers by providing them with the support and training to take advantage of new analytical methodologies and technology that could help maximize the utility of collections.

We are at a critical juncture. Failure to act now to build the next generation of scientists, including taxonomists trained in collections management, will result in a loss of accumulated knowledge and expertise as the current generation retires from the workforce or leaves through attrition.



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RECOMMENDATIONS

To strengthen U.S. support of biological collections and ensure that the U.S. can reap the benefits, ESA offers the following recommendations:

Establish a Collections-Focused Workforce Development Program: Establish an NSF program under the Directorate for Biological Sciences (BIO) to support taxonomy and museum studies specifically focused on training the next generation of curatorial researchers and staff. This program will require support for curriculum development, graduate student and post-doctoral support, and faculty recruitment to incentivize and revitalize interest in this scientific discipline. In addition, the program should also provide opportunities for scientists to obtain training or certification in collections management, integrating physical sample management with digital curation. The program should target academic institutions with their own active biological collections and those with established collaborative relationships with active collections.

Increase Infrastructure Support for Biological Collections: The NSF's CSBR program, run out of BIO, should be significantly expanded with new funds beyond its current \$3-5 million per year. This support should continue to be used to help improve facilities and infrastructure to maintain collections and capitalize on opportunities for expansion as needs and expertise change. However, the increased funding should also enable the employment of qualified, non-term-limited collection managers and staff to support existing collections. As new trainees graduate, there should be an established funding mechanism to hire them to fill the existing workforce deficit.

Establish Biological Collections-Focused Research Programs: To spur the development of new analytical methods and technological advances to enable generation of novel evidence and knowledge through biological collections, we recommend the creation of the following research programs:

Extended Specimen Database: This new extramural research program should be jointly supported through NSF BIO and NSF's Directorate for Geosciences (GEO) and focus on integrating physical samples and related physical preparations with other digital data collected from biological specimens to include genetic, phenotypic, behavioral, and environmental data as well as location, field condition, and biotic interactions that would enhance the interpretation of data derived beyond the physical specimen alone. To date, this kind of information is often separated across multiple data platforms. This network will integrate across existing platforms to enable scientific investigations to improve the understanding of interactions between biological organisms and their environment. This project will result in greater virtual accessibility of collections and the data contained therein.

Innovative Analytical Techniques for Investigations of Biological Collections: The National Institute of Standards Technology (NIST) should develop a program focused on new approaches for non-destructive uses of biological collections and strategies to harvest big data (historical distributions, ecological data and genetic and population insights) contained therein.

The Entomological Society of America is the largest organization in the world serving the needs of entomologists and other insect scientists. ESA stands as a resource for policymakers and the general public who seek to understand the importance and diversity of earth's most diverse life form—insects. Learn more at www.entsoc.org.

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