Summary Report

One Health Listening Session | July 2, 2024

The One Health-focused listening session of the BIOFAIR Data Network Project held on July 2, 2024 was led by BIOFAIR Data Network Steering Committee members John Bates (Field Museum), Sinlan Poo (Memphis Zoo), Greg Watkins-Colwell (Yale Peabody Museum), and Julia Portmann (Map of Life), in collaboration with Key Domain Representatives Kelly Speer (University of Michigan Pathogen Biorepository), Marcia Revelez (CDC Biorepository), and Joseph Cook (University of New Mexico Museum of Southwestern Biology, Museums and Emerging Pathogens in the Americas ECHO Program or MEPA).

Among the 29 session participants were representatives from MEPA, Northern Arizona University, Oklahoma City Zoo, University of Michigan Museum of Zoology, Yale Peabody Museum, University of Connecticut, National Institute of Standards and Technology, University of Kansas Biodiversity Institute, The Field Museum, University of New Mexico, Map of Life, University of Michigan, EcoHealth Alliance, Cornell University, Centers for Disease Control and Prevention (CDC), University of Michigan, iDigBio, Global Biodiversity Information Facility (GBIF), Fundação Oswaldo Cruz (Fiocruz), University of North Carolina Charlotte, The University of Arizona, Memphis Zoo, University of Michigan, U.S. Customs and Border Protection, and the Biodiversity Collections Network (BCoN).

Summary

Attendees discussed the development of an integrated data and sample network for biodiversity research, with a focus on One Health principles and the involvement of various collections institutions, agencies, NGOs, and other stakeholders. They also explored the potential of using metagenomics for pathogen screening in museum specimens and the need for improved surveillance based on strategically developing new specimen collections and associated data. Lastly, they deliberated on the challenges of data centralization, sample management, and funding for government-led initiatives for pathogen surveillance.

Key Topics Discussed

Introduction to the BIOFAIR Data Network Project and the One Health Listening Session

The session started with a brief introduction to BCoN and the NSF-funded BIOFAIR Data Network project (Award No. 2303588). The BCoN Steering Committee is part of a broader community representing various traditional museum groups, botanic gardens, paleontologists,

culture collections, zoos, and other types of biodiversity collections. BCoN aims to promote the integration, use, and impact of biodiversity data and collections. The group has promoted the development of an Extended Specimen Network as a unifying goal for biodiversity collections over the next decade. The One Health listening session was part of a series of six domain-focused sessions for catalyzing cross-domain collaborations towards building an integrated, open, Findable, Accessible, Interoperable, and Reusable (FAIR) data network. The listening sessions will be followed by an interdisciplinary virtual workshop in early 2025 to delve deeper into discussions about a collaborative path forward. The goal of this workshop will be to bring together non-conventional data communities to develop recommendations and create a roadmap that outlines the gaps, needs, and actions needed to build a FAIR, open, integrated biological and environmental sample and data network.

Potential Stakeholders for Future Partnerships

Attendees participated in a brainstorming session to identify important One Health data stakeholders, and suggestions were populated into a brainstorming document. Stakeholder groups identified by the participants included biodiversity collections institutions (museums, botanic gardens, living collections, zoos, etc.), advocacy groups, federal agencies, non-governmental organizations, and individual labs. Partners for Amphibian and Reptile Conservation (PARC) was suggested as a key stakeholder in the amphibian disease realm. Some non-governmental organizations (NGOs) involved in disease work include the Wildlife Conservation Society, the Nature Conservancy, the Audubon Society, and the National Animal Health Laboratory Network (NAHL), which is involved in disease surveillance and diagnostics.

Extended Specimen, CDC Sample Policy, and MEPA Initiative

The Key Domain Representatives shared perspectives from the Museums and Emerging Pathogens in the Americas (MEPA) initiative and the CDC Biorepository. Kelly Speer argued for making One Health whole by bringing organismal biology to the table. Speer discussed how holistic collecting can more fully realize the concept of the extended specimen and its importance in understanding host-pathogen interactions and One Health. Marcia Revelez, Chair of the CDC sample policy board, emphasized her role to facilitate collaboration between CDC and the natural history community. Revelez also shared the work of the CDC Biorepository and its archival role in public health research. Joe Cook then discussed the MEPA initiative, which brings together experts from diverse fields to address One Health issues across the Americas. Cook argued for developing a strategic approach to future sample collection and building sustainable locally-anchored infrastructure throughout the Global South. Following the presentations, participants discussed how to maximize resources for disease surveillance work with wildlife.

Museums' Pathogen Handling Capabilities

Participants discussed the extent to which museums can handle Biological Safety Levels (BSL) 3 and 4 pathogens. It was suggested that BSL 4 pathogens were out of their scope and BSL 3

pathogens were usually managed through collaborations with non-museum BSL 3 labs. Typically, frozen tissue collections are BSL 2 and can be handled by museums and in BSL 2 biosafety cabinets. Participants shared that some collections were moving towards being able to handle BSL 3, but BSL 4 pathogen repositories were scarce across the US. Caution was emphasized when handling such pathogens given the possibility of deactivating samples. It was suggested that saving biological material in smaller amounts for research purposes could be a viable option. The idea of establishing a network to handle discovered BSL 3 and 4 pathogens was proposed. A question was raised about the storage and cataloging of samples from domestic or livestock animals, which was acknowledged as under-represented in natural history collections, in addition to commensal species such as house mice. Collaboration with the U.S. Department of Agriculture was suggested as a possibility to enhance collections' capabilities in this regard.

Improving Surveillance and Data Collection for Disease Research

Participants considered the example of the emergence of hantavirus, where museum collections were used to identify deer mice as important reservoirs of the 1993 outbreak in southwest United States. Some of the key points shared were:

- The potential for using metagenomics to screen museum specimens for pathogens, such as hantavirus, and the importance of improving sample-based surveillance and data collection for disease research.
- Concerns about traditional funding's reluctance to support disease research beyond the disease's immediate threat and the lack of high-quality data for modeling disease outbreaks.
- The need for improved sample-based surveillance and data collection and argued for a major investment of funds to proactively conduct metagenomic sequencing of relevant museum specimens.
- Challenges faced by museums include health and safety risks, limited enthusiasm and space for collections growth, and the need for these institutions to adapt and educate agencies at the local and federal levels about their work.

Breakout Discussions on a National Emerging Zoonotic Pathogen Service

Attendees participated in a breakout session to discuss developing a hypothetical National Emerging Zoonotic Pathogen Service, along the lines of a National Weather Service, that could issue doppler radar warnings for locations or periods of time that are high-risk for pathogen spillovers. Discussions focused on strategic sampling in the context of emerging zoonoses and the inclusion of a One Health approach to tackle a Pathogen X scenario. Attendees were divided into 4 groups for small group discussions after which they provided a brief report of their group's discussions. Key issues discussed were:

- The need for a forecasting institute and real-time assessments, particularly those using specimen-backed data.
- Challenges and potential solutions for data centralization and sample management at the CDC.

- Developing a specimen management plan for research projects involving specimen collecting.
- The importance of improved communication, particularly in relation to the import and export of samples, and the need for a central agency to manage and distribute information.
- Wide-scale data availability needed to accurately track disease spread real-time (e.g., farm locations).
- The need to consider industry bottom lines when developing forecasting solutions for limiting disease spread.

Addressing Data Centralization and Sample Management Challenges

The final discussion focused on how to make data available to relevant stakeholders (researchers, agencies, practitioners, communities, etc.) and how to make high-quality 'digital twin' data stored in collections FAIR and integrated with other informatics initiatives. Among the key points shared were:

- Concerns about securing funding for government-led initiatives and the importance of engaging with the philanthropic community.
- The need for integrated data sharing, proper sample preservation, and the power of connecting specimen-based genetic data with repositories like GenBank as currently done by multiple museum databases.
- Paths forward include continuing to develop a broad, museum-initiated database network or beginning with one focal issue, such as strategic sampling, that is a priority for funding.
- The potential for expanding database accessibility by allowing for less technical search functionality.

It was suggested that these issues be discussed further at the final workshop planned for the spring of 2025 to produce recommendations.

Recommendations

- Continued efforts are needed to make wildlife specimen samples and data more accessible and discoverable for One Health purposes.
- The museum community should more widely adopt existing database platforms that integrate specimen data directly with GenBank and One Health-related initiatives.
- The museum community should consider developing data portals/interfaces tailored for public health and biomedical researchers.
- Options should be explored for restructuring museum database queries to be more accessible for non-biodiversity researchers.
- Museums and other collections need to improve field protocols, documentation, and accessibility of specimen preservation history, quality, and methods.
- The philanthropic community needs to be engaged in funding One Health initiatives involving museum collections.

- Agencies such as CDC need to explore ways to improve communication and data sharing between different agencies involved in pathogen surveillance and import/export.
- Continued advocacy is needed for better integration of museum collections in pathogen-specific research initiatives.