US COLLECTIONS PARTNERS PRESENT: 2023

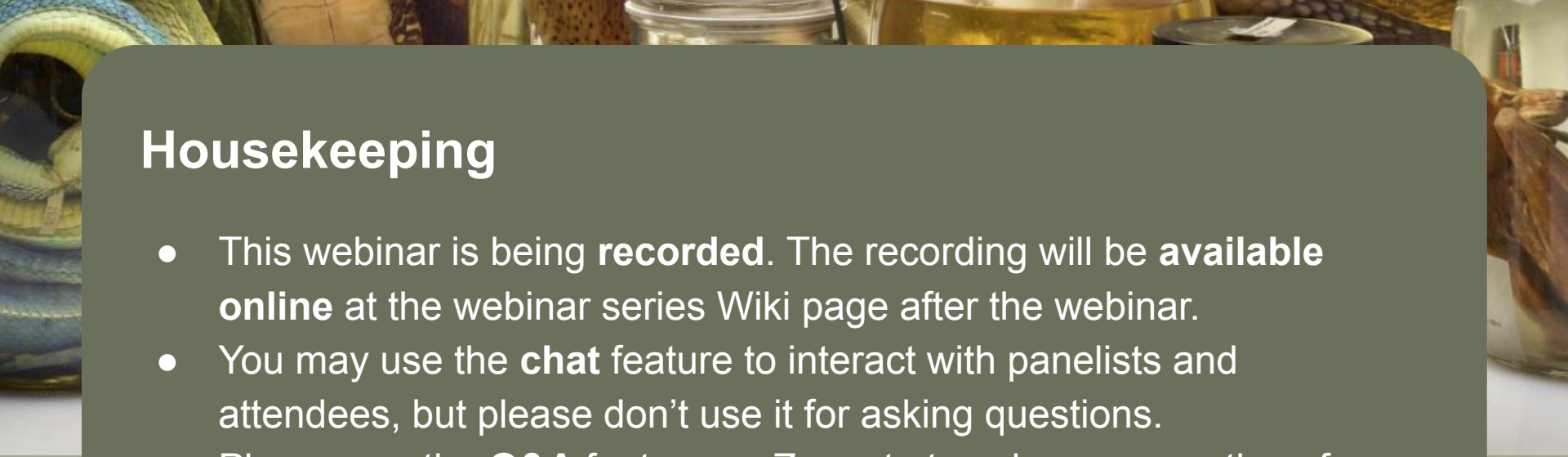
ENVISIONING A

BIOLOGICAL COLLECTIONS ACTION CENTER

Responses to the NASEM report with presentations from the Interagency Working Group on Scientific Collections, AIBS, and BCoN

Scott Miller, Kevin Hackett, Diane DiEuliis, Jyotsna Pandey, Breda Zimkus

MARCH 21, 2023



Housekeeping

- This webinar is being **recorded**. The recording will be **available online** at the webinar series Wiki page after the webinar.
- You may use the **chat** feature to interact with panelists and attendees, but please don’t use it for asking questions.
- Please use the **Q&A** feature on Zoom to type in your questions for the speakers. Alternatively, you can use the **Raise Hand** feature on Zoom, and we will call on you to ask your question.
- We will also be using the **Discourse** platform to capture questions and comments; more on that later.
- Questions will be addressed **after** the presentations.

WEBINAR SERIES

MARCH 7

Visions of an Action Center from NASEM Report Authors Part 1

Pam Soltis
Andy Bentley
Barbara Thiers

MARCH 14

Visions of an Action Center from NASEM Report Authors Part 2

Pam Soltis
Joe Cook
Scott Edwards
Talia Karim
Shirley Pomponi

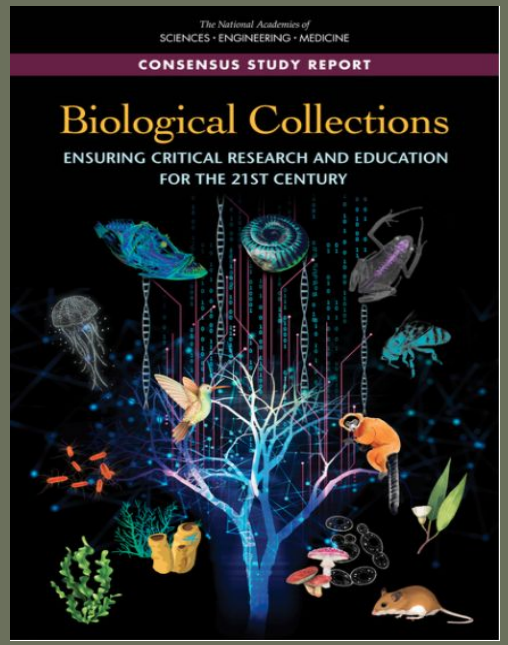
MARCH 21

Responses to the NASEM report with presentations from the IWGSC, AIBS, & BCoN

Scott Miller
Kevin Hackett
Diane DiEuliis
Jyotsna Pandey
Breda Zimkus

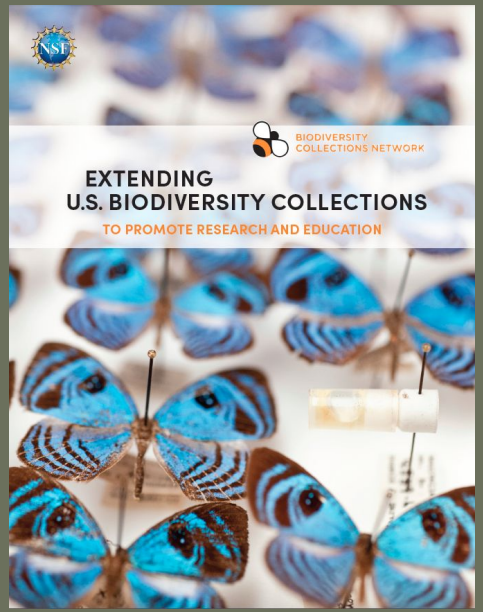
AMERICAN INSTITUTE OF BIOLOGICAL SCIENCES
BIODIVERSITY COLLECTIONS NETWORK
iDigBio Integrated Digitized Biocollections
NSC ALLIANCE
SPNHC
NATIONAL MUSEUM of NATURAL HISTORY

What is the Biological Collections Action Center?



NASEM 2020

Action Center for Biological Collections



BCON 2019

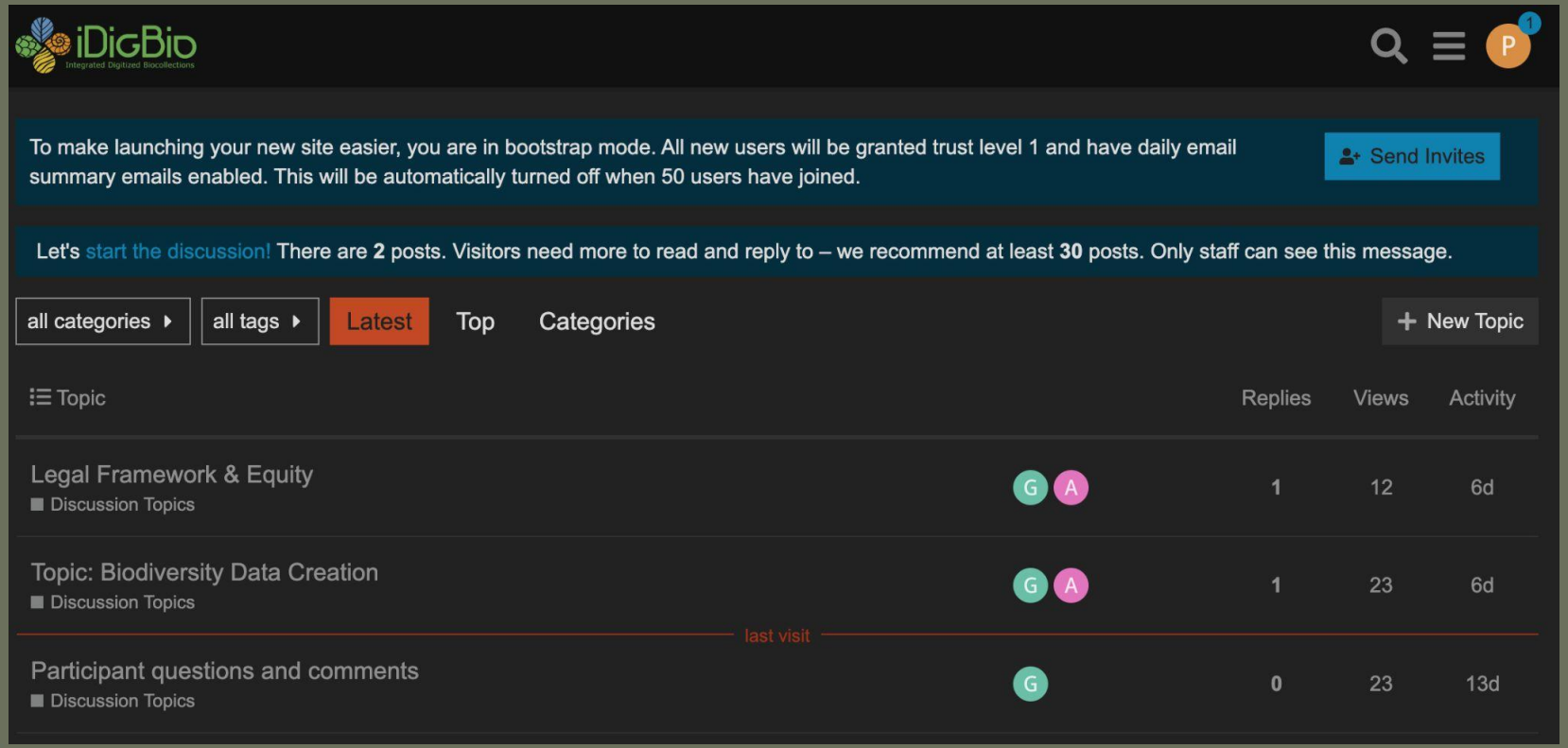
Central Organizing Unit

AUGUST 09, 2022

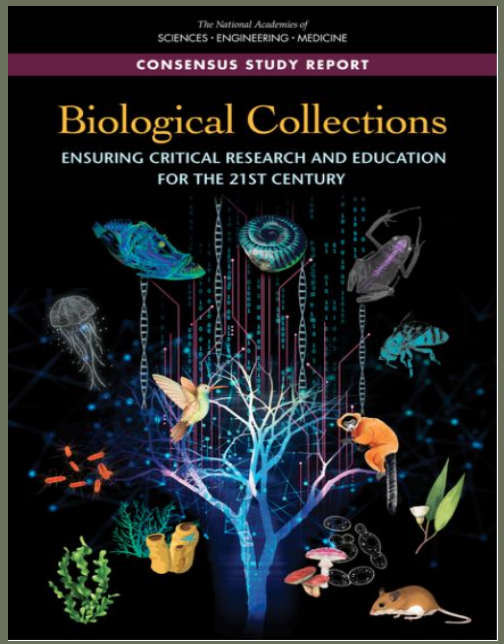
FACT SHEET: CHIPS and Science Act Will Lower Costs, Create Jobs, Strengthen Supply Chains, and Counter China

In President Biden's first year in office, the Biden-Harris Administration has implemented an industrial strategy to revitalize domestic manufacturing, create good-paying American jobs, strengthen American supply chains, and accelerate the industries of the future. These policies have spurred an historic recovery in manufacturing, adding 642,000 manufacturing jobs since 2021. Companies are investing in America again, bringing good-paying manufacturing jobs back home. The construction of new manufacturing facilities has increased 116 percent over last year.

Discourse Platform: discourse.idigbio.org



What is the Biological Collections Action Center?



NASEM 2020

Recommendation 8-1: The National Science Foundation, in collaboration with other institutions that provide funding and other types of support for biological collections, should help **establish a permanent national Action Center for Biological Collections to coordinate action and knowledge, resources, and data-sharing among the nation's biological collections** as they strive to meet the complex and often unpredictable needs of science and society. Such an action center should **include a physical space and cyberinfrastructure to develop and implement collaborative strategic efforts and further build and nurture communities of practice** for research, education, workforce training, evaluation, and business model development, among other community-wide needs.

Previous Discussion

US COLLECTIONS PARTNERS PRESENT: 2023

ENVISIONING A

BIOLOGICAL COLLECTIONS ACTION CENTER

Perspectives from the Interagency Working Group on Scientific Collections

Scott Miller (Smithsonian), Kevin Hackett (USDA), Diane DiEuliis (DOD)

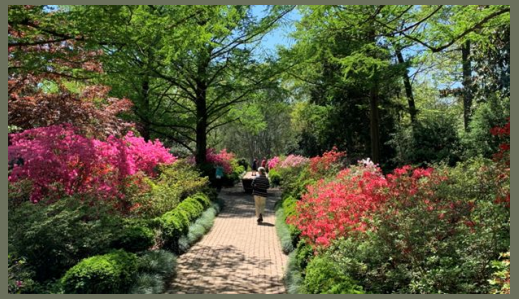
Interagency Working Group on Scientific Collections

- convenor with insight and participation across science broadly
  - 15 agencies and departments that own or fund collections
- collections are R&D infrastructure needing base funding
  - America COMPETES 2010 (42 USC 6624.104)
  - National Strategic Overview for R&D Infrastructure (2022)
- economic models – self-funding, non-monetary value
  - Report available at https://iwgsc.nal.usda.gov
  - Specimens often most valuable for secondary uses
  - Interest in particular collections often increases over time
- current and future uses of collections
  - New report in production
- Disclaimer: views presented here are personal,
  - not official positions of USG or agencies

USDA Collections

Roles:

1) Agricultural research: crop and livestock breeding; pest and pathogen studies
2) Pest and pathogen Identifications at ports
3) Natural history studies
4) Bioeconomy/biotechnology
5) Genomics, e.g.,



ltar

EARTH BIOGENOME PROJECT
sequencing life for the future of life

ARS Peoria Microbial Galaxy

Description: One of the largest public collections of microbes in the world, housing 1 of 2 U.S. patent collections (1700 patents)
Needs:

1) Staff to support its microbial pipeline: bioinformatics, synbio, physiology
2) Greater collaboration on microbe discover and novel pathogens

Contributions:

1) Extensive sharing of specimens (5,000 per year to 40 countries)
2) Expertise, especially on databases and distribution systems

U.S. National Collection of Insects and Mites at Smithsonian and Beltsville

Description: ARS-Smithsonian co-located collection of 36M specimens (pin or slide mounted, some ethanol or freezer preserved) for taxonomy and systematics; develop digital and molecular ID tools and databases; essential for genomics: i5K, Ag100Pest, Beenome100, Earth BioGenome

Needs:

1) Infrastructure, including larger pipelines for data transfer
2) Training/research building
3) Grants for pro-active research

Contributions:

1) Widely shared, diverse workforce w/ broad knowledge of collections management
2) Participation in workshops, training

USDA National Animal Germplasm Collection at Ft. Collins

Description: 1.2 living samples from all livestock, and exotic species such as bison, elk, yak; develop genotyping for stock ID. Stakeholder network of 3,000 U.S. contributors. Supports NIH genomics medicine model program and SI/NOAA coral conservation

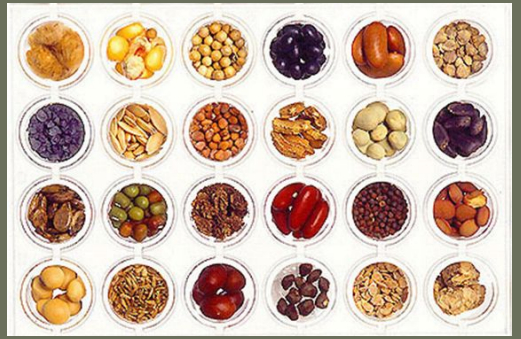
Needs:

1) Staff: molecular genetics, computational biology, cell line development
2) Increased collaboration with academia to utilize collections to solve problems in climate change and sustainability

Contributions:

1) Broad expertise in collection management
2) Intergovernmental network of gene banks

National Laboratory for Genetic Resources Preservation at Ft. Collins



Description: 600K plant accessions (mostly seeds) representing 14K+ species; annually test 6,000 seeds

Needs:

1) Multispectral imaging to document seed characteristics of crops and their wild relatives

Contributions:

1) Provides “black box” (secure seed storage) for 450K+ non-USDA accessions from 70+ sources
2) Storage, since the lab is only at half-capacity for -18C freezer seed storage

Liquid nitrogen storage

-18 ^{o}C freezer storage

National Arboretum at Washington, D.C.

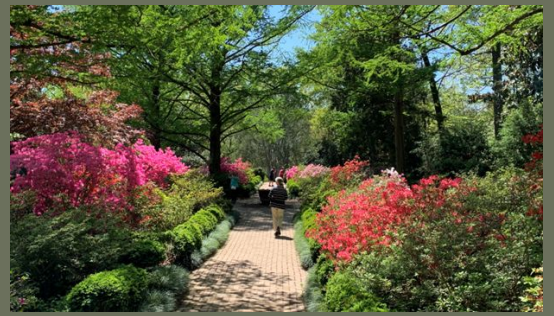
Description: 1 million preserved plant specimens with a focus on agricultural and economic crops; provides ID for other agencies to protect biosecurity; part of the Natl Plant Germplasm System, growing and conserving 25K+ accessions; develops new ornamentals

Needs:

1) Improved data integration between collections
2) Greater IT/storage/computational support

Contributions:

1) Fully digitized herbarium; developing ARS-wide collections portal
2) Expertise at intersection of research (plant breeding), conservation (germplasm), and preservation (herbaria)
3) Training/mentoring



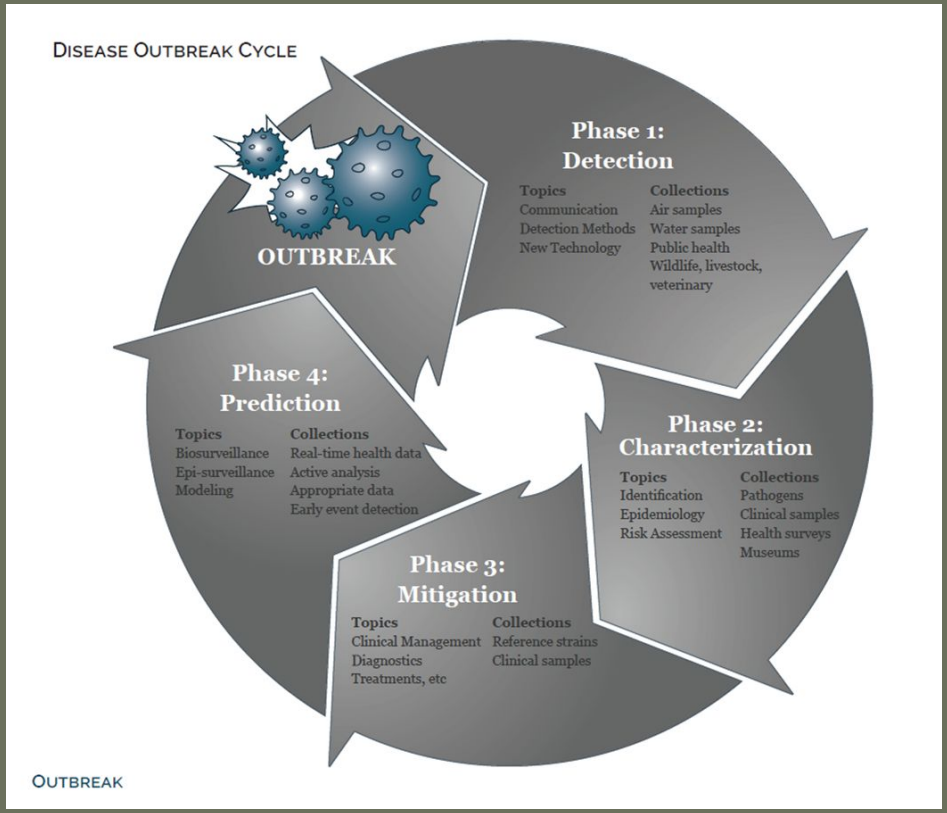
Emerging Uses of Traditional Collections

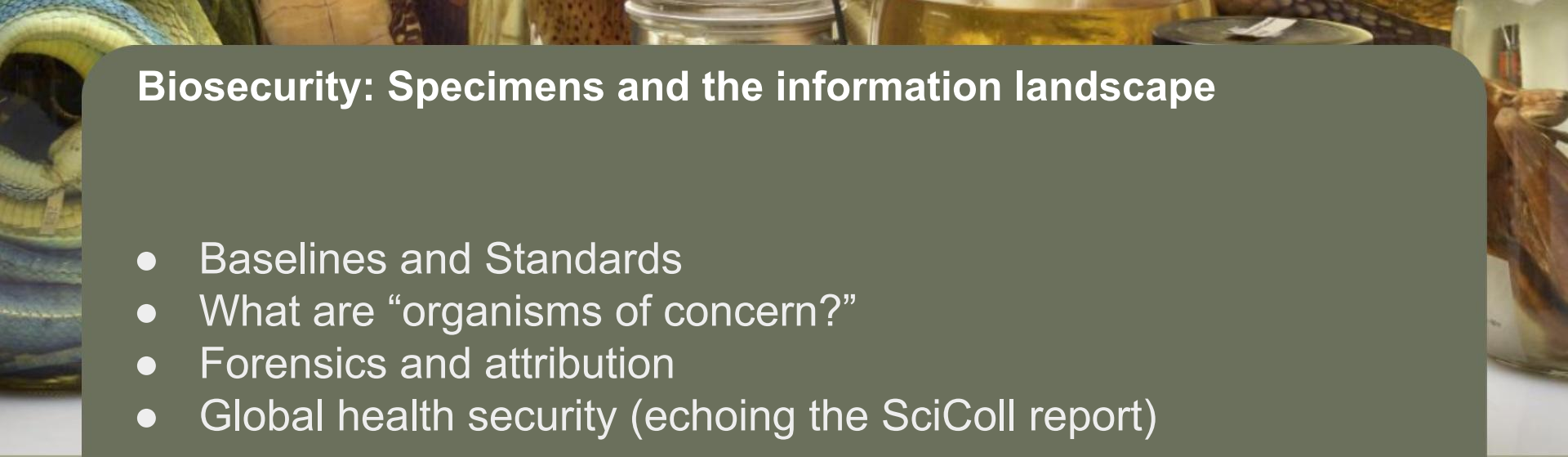
- At the intersection of Zoonotic Disease & Emerging Infectious diseases: mitigating Pandemics
- In support of Biosecurity
- Role in the US Bioeconomy: drivers of innovation, as well as vouchers for biosecurity

Emerging Infectious Diseases

- Collections are critical throughout this cycle.

- https://scicoll.org/scicollpubs/EID_2015March.pdf





Biosecurity: Specimens and the information landscape

- Baselines and Standards
- What are “organisms of concern?”
- Forensics and attribution
- Global health security (echoing the SciColl report)

https://wmdcenter.ndu.edu/Portals/97/Biospecimens%20and%20the%20Information%20Landscape%2010232019.pdf

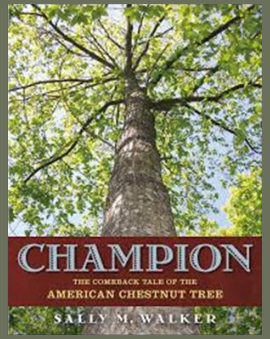
What is the “Bioeconomy”?

“Economic activity driven by research and innovation in the life sciences and biotechnology that is enabled by technological advances in engineering and in computing and information sciences.”

- Biotech R&D
- Pharmaceuticals, Medical Diagnostics
- Agriculture
- Chemicals
- Materials, Sensors
- Power, tools
- Foods
- Consumer goods
- *ETC!*

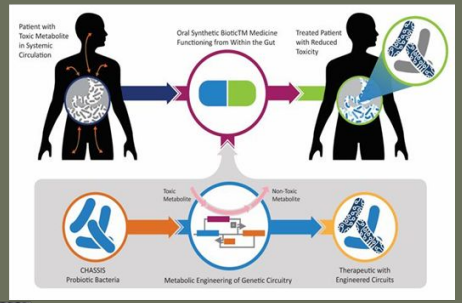
Safeguarding the Bioeconomy, 2020 National Academy of Sciences

Species rescue



Cement = 8% CO2 each year; we can make cement with algae. We can also use algae to make gas and jet fuel.

Synthetic Spider silk
“Moon Parka”
“mylo Leather”



Engineered microbes for probiotics

Engineered microbes that fix nitrogen for corn, reducing use of fertilizers

BROADER VISION FOR AN ACTION CENTER

Address at least ALL kinds of biological collections, maybe more

Embrace existing efforts and partners

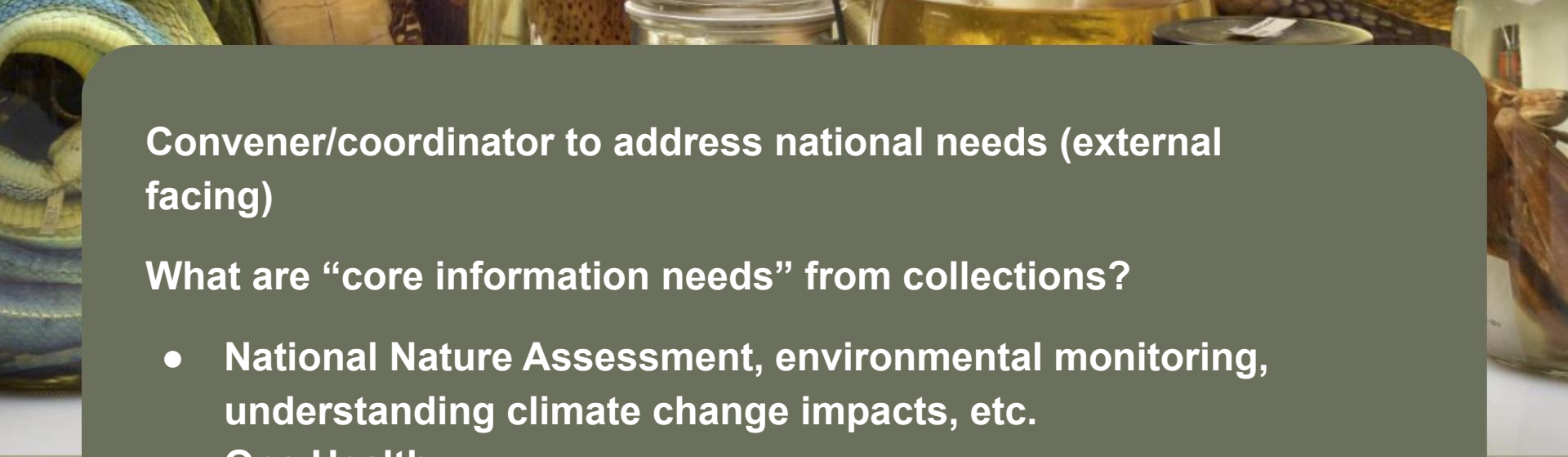
- **International: GBIF, ISBER, Global Collections Group (73 museums), BHL**
- **National: USCCN, SPNCH, BCON, AZA, disciplinary societies**

Enable non-traditional uses including bioeconomy, while also addressing ABS and equity

Provide cyberinfrastructure with economies of scale

- **Including data standards, FAIR, extended specimen concept, etc.**

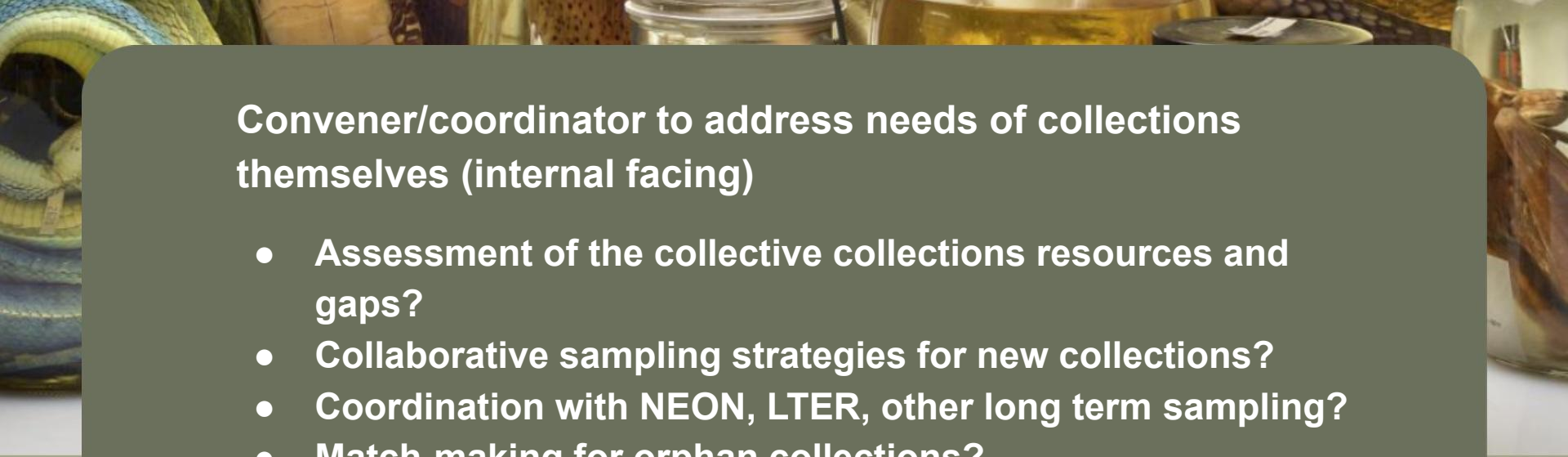
Build capacity and workforce broadly



Convener/coordinator to address national needs (external facing)

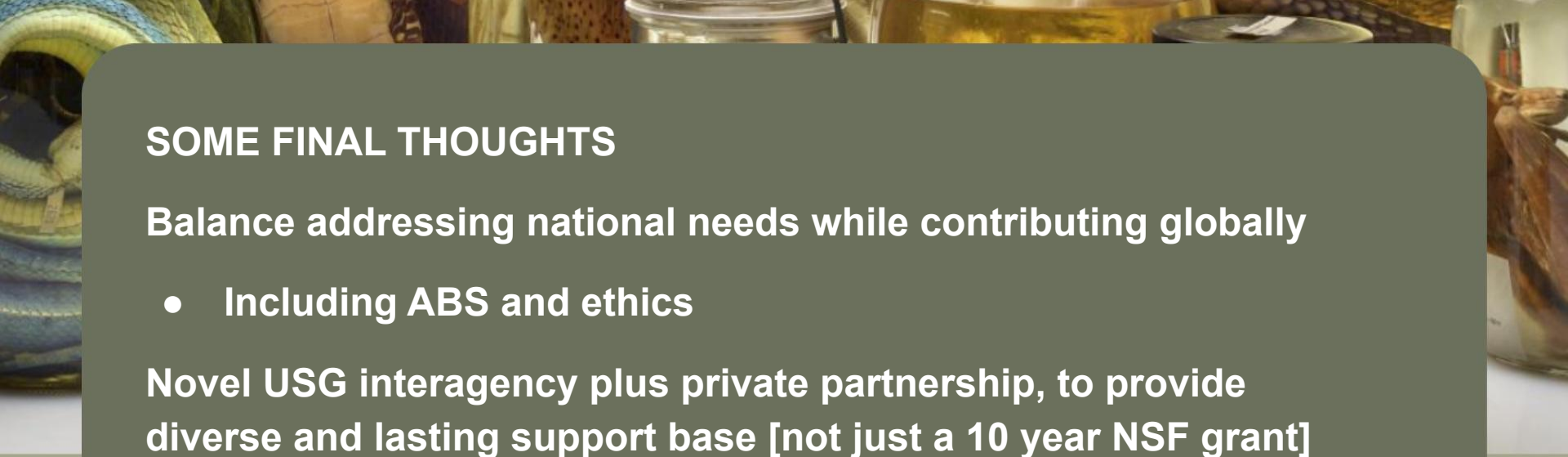
What are “core information needs” from collections?

- National Nature Assessment, environmental monitoring, understanding climate change impacts, etc.
- One Health
- Biosecurity
- Bioeconomy
- Specific needs, e.g., pest and invasive species identifications



Convener/coordinator to address needs of collections themselves (internal facing)

- **Assessment of the collective collections resources and gaps?**
- **Collaborative sampling strategies for new collections?**
- **Coordination with NEON, LTER, other long term sampling?**
- **Match-making for orphan collections?**
- **Help with planning best practices, for both collections and “business”**
- **Build capacity and workforce broadly**



SOME FINAL THOUGHTS

Balance addressing national needs while contributing globally

- Including ABS and ethics

Novel USG interagency plus private partnership, to provide diverse and lasting support base [not just a 10 year NSF grant]

Creative solution to issues around collections from federal lands (e.g., NPS, BLM)?

- Ownership versus custody versus access
- Note CESU and CFWRU federal-state partnership models

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Perspectives from AIBS

Jyotsna Pandey

Public Policy Director, American Institute of Biological Sciences
Executive Director, Natural Science Collections Alliance
Member, BCoN Steering Committee

AMERICAN INSTITUTE OF BIOLOGICAL SCIENCES

OUR VISION

To advance the biological sciences to promote increased understanding of all life.

OUR MISSION

To promote the use of science to inform decision-making and advance biology for the benefit of science and society.

OUR MEMBERS

AIBS brings together a diverse group of member organizations, including scholarly societies, professional associations, academic institutions and departments, museums and science collections, field stations, and others, to advance common goals.

www.aibs.org

AIBS' WORK IN SUPPORT OF COLLECTIONS

- Collections and Funding Advocacy
- Natural Science Collections Alliance (nscalliance.org)
- The Biodiversity Collections Network (bcon.aibs.org)
- U.S.A. Nagoya Protocol Action Group (LearnNagoya.com)

BIODIVERSITY COLLECTIONS NETWORK

NATURAL SCIENCE COLLECTIONS ALLIANCE

USA NAGOYA PROTOCOL ACTION GROUP

JOURNAL ARTICLE

Policy for Bioeconomic Growth

FREE

Jyotsna L Pandey

BioScience, Volume 70, Issue 6, June 2020, Pages 459–460,
https://doi.org/10.1093/biosci/biaa049
Published: 29 April 2020

PDF

JOURNAL ARTICLE

Building the Bioeconomy Workforce of the Future

FREE

Jyotsna L Pandey

BioScience, Volume 71, Issue 1, January 2021, Pages 9–10,
https://doi.org/10.1093/biosci/biaa124
Published: 17 September 2020

PDF Split

Issue Section:

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Leadership in Biology
an AIBS initiative

Catalyzing advances in science, strengthening the profession, and bringing information to decision makers.

Strengthening the Bioeconomy

The Annual Meeting of the AIBS Council of Member Societies and Organizations

December 10, 2020
12:00 - 5:00 PM Eastern
Online

Leadership in Biology
an AIBS initiative

Catalyzing advances in science, strengthening the profession, and bringing information to decision makers.

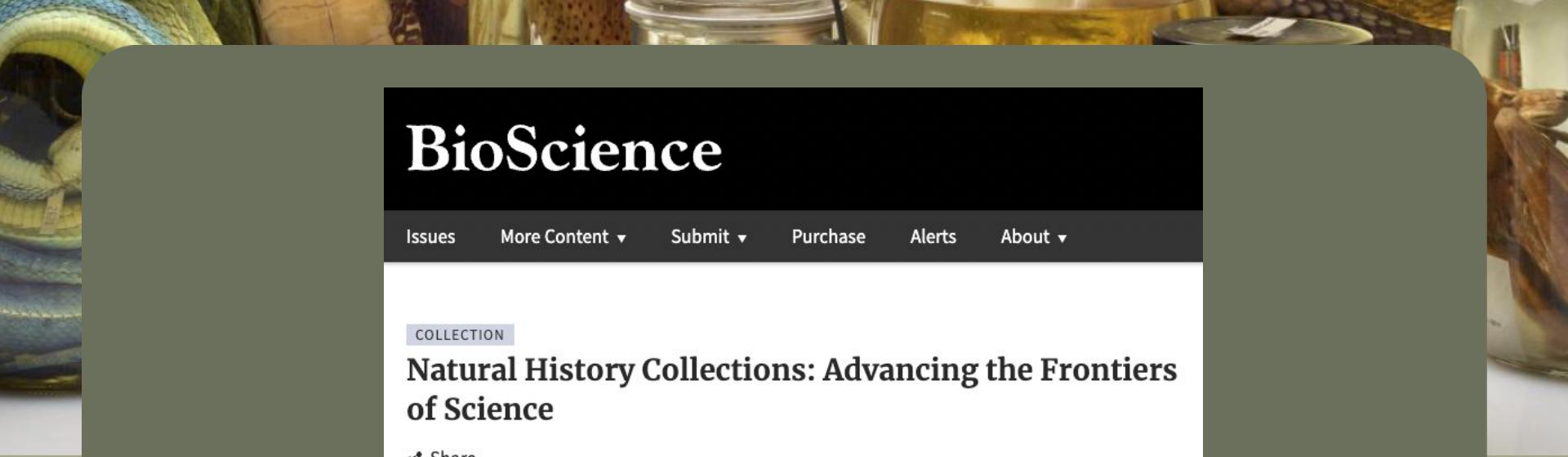
Addressing Biological Informatics Workforce Needs

Leadership in Biology
an AIBS initiative

Catalyzing advances in science, strengthening the profession, and bringing information to decision makers.

Beyond Specimens

The Annual Meeting of the AIBS Council of Member Societies and Organizations



BioScience

COLLECTION

Natural History Collections: Advancing the Frontiers of Science

Share

Natural history collections – whether a natural history museum, botanical garden, herbaria, tissue collection, university-based biodiversity collection, or a living stock collection – are a global network of research institutions and affiliated scientists and educators that are a foundation for interdisciplinary and global research and education. New tools and techniques are catalyzing important research. This special collection of natural history collection-related articles from *BioScience* highlights some of the exciting new ways scientists and educators are mobilizing and using biodiversity data from natural history collections. Additional articles are regularly being published, so visit the journal's archive for more articles.

SOME AREAS OF FOCUS FOR THE ACTION CENTER

Best Practices and Educational Resources (digitization, legal compliance, ethical considerations, etc.)

Enhancing cross-domain collaborations, novel research, and collections data use to address societal needs

Coordination with other National and International Data Initiatives

Professional Development & Training

Open Science & FAIR Principles

Workforce Development

Diversity, Equity, and Inclusion

Extended Specimen Network & Digital Extended Specimen

Leveraging professional societies to engage stakeholder communities

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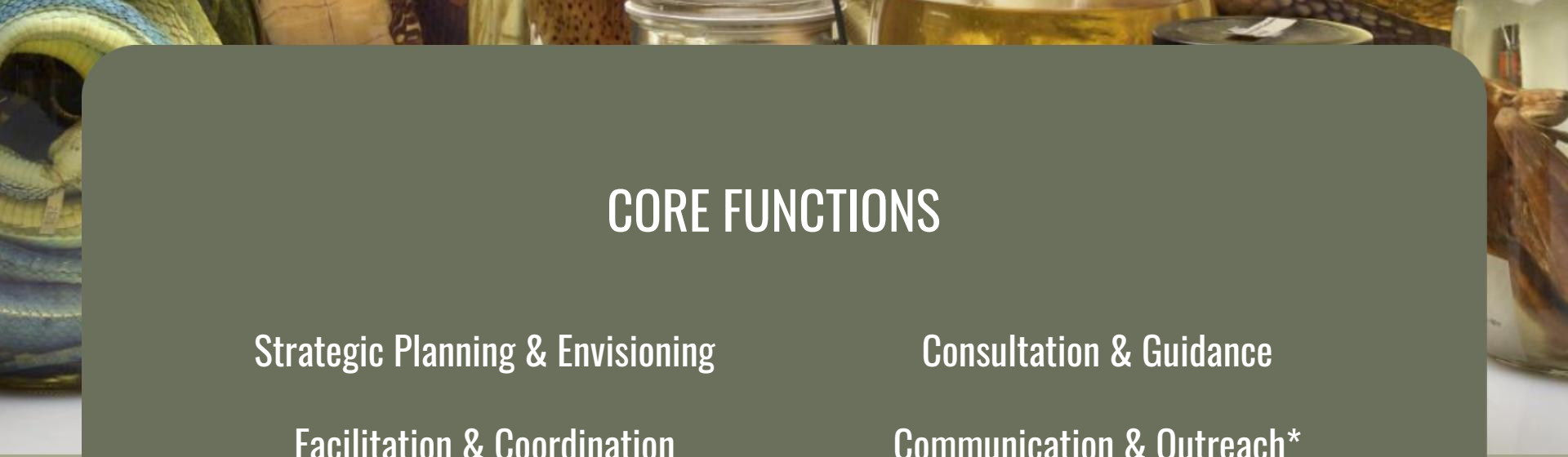

CORE FUNCTIONS

Strategic Planning & Envisioning

Consultation & Guidance

Facilitation & Coordination

Communication & Outreach*

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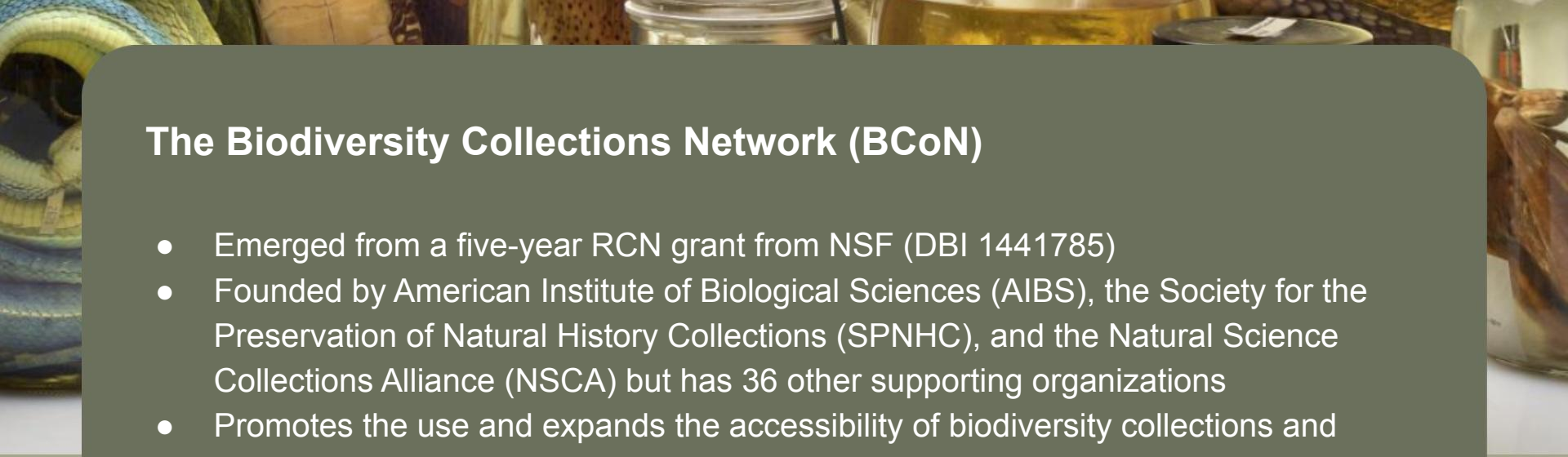
Perspectives from BCoN

Breda Zimkus
Museum of Comparative Zoology, Harvard University
BCoN Steering Committee Member



The Biodiversity Collections Network (BCoN)

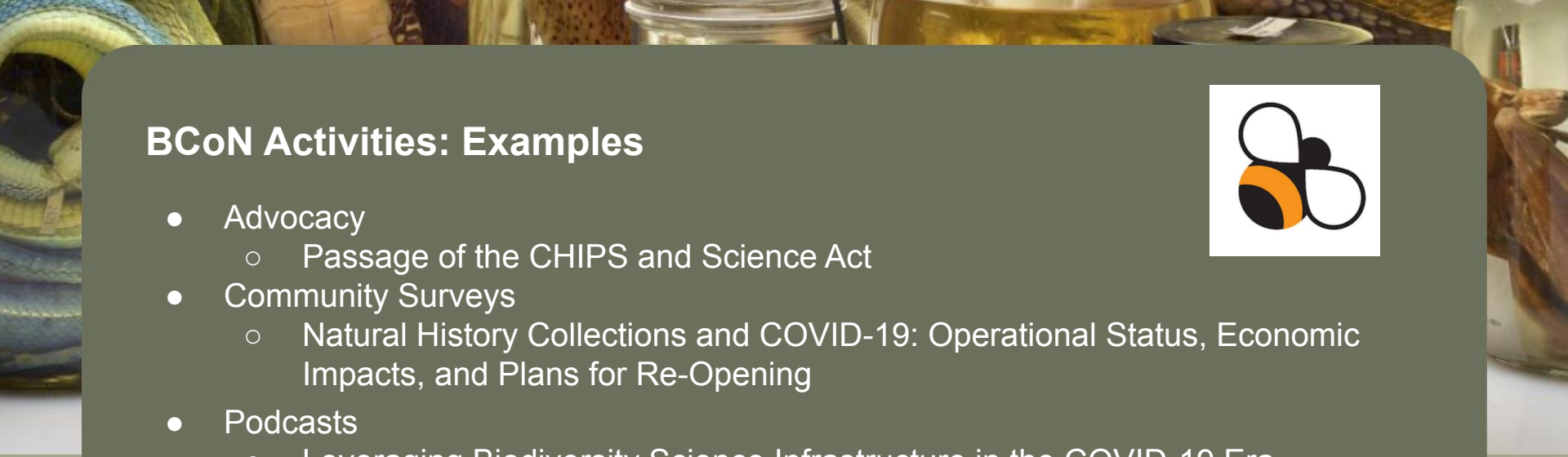
- Emerged from a five-year RCN grant from NSF (DBI 1441785)
- Founded by American Institute of Biological Sciences (AIBS), the Society for the Preservation of Natural History Collections (SPNHC), and the Natural Science Collections Alliance (NSCA) but has 36 other supporting organizations
- Promotes the use and expands the accessibility of biodiversity collections and their data
- Extends the impact of biodiversity collections as critical infrastructure for research and education for the benefit of life on earth

BIODIVERSITY COLLECTIONS NETWORK

bcon.aibs.org

BCoN Steering Committee

- Brings together representatives from a wide range of U.S. biological collections from living, preserved, and fossilized biological and geological collections



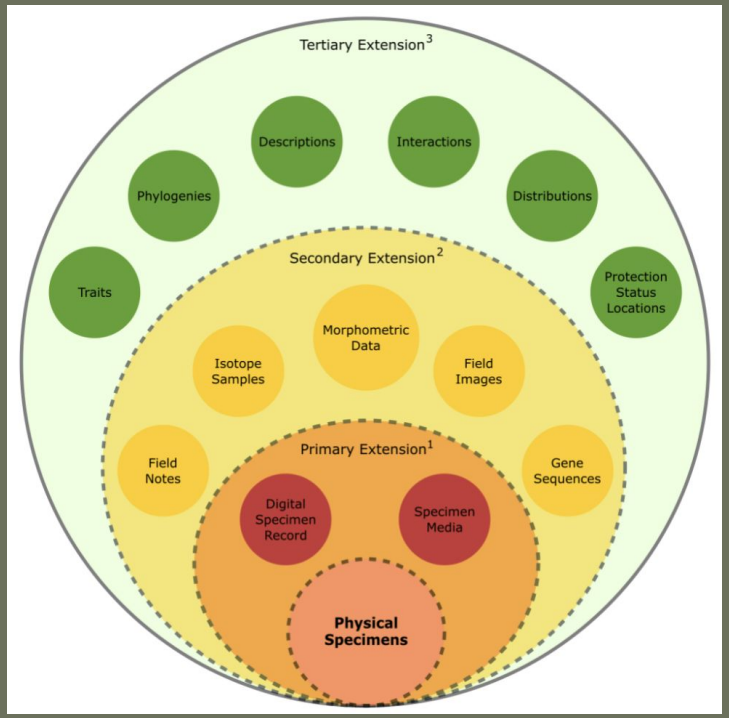
BCoN Activities: Examples

- Advocacy
  - Passage of the CHIPS and Science Act
- Community Surveys
  - Natural History Collections and COVID-19: Operational Status, Economic Impacts, and Plans for Re-Opening
- Podcasts
  - Leveraging Biodiversity Science Infrastructure in the COVID-19 Era
- Webinars
  - The Need for a Specimen Management Plan Requirement (with USCCN)
- Workshops
  - Addressing legal issues involved in digitized collections using the Nagoya Protocol as a test case
- Publications
  - Reports
  - Peer-Reviewed Journal Articles

BCoN Activities: the Extended Specimen Network (ESN)

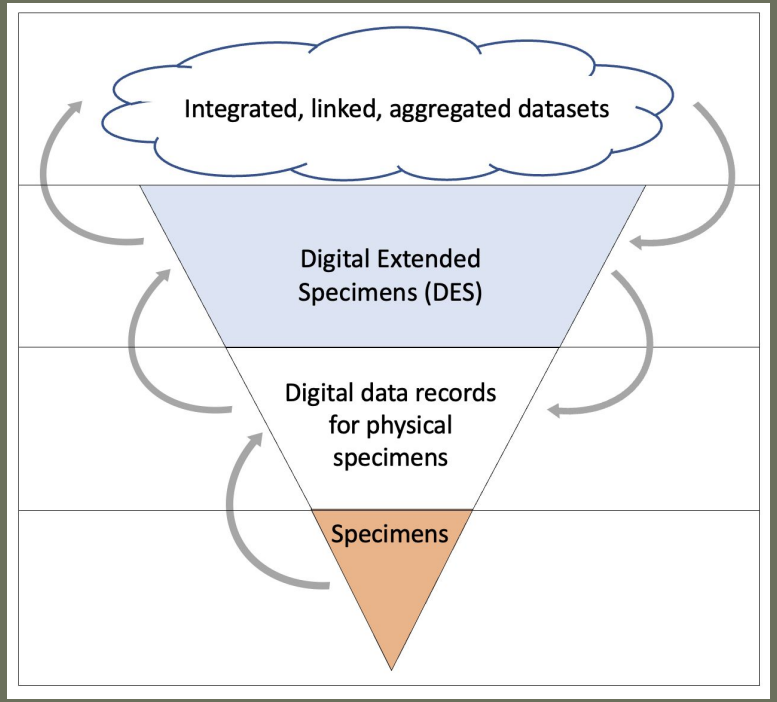
- Promoting the development of the ESN as a unifying goal for biological collections over the next decade and beyond
- Published the Extended Specimen Report using input gathered from stakeholders regarding future directions for collections (Lendemer et al., 2019)

EXTENDED SPECIMEN NETWORK



The Extended Specimen Network (ESN): Making Connections

- Persistent identifier (PID) used to uniquely identify digital information about a specimen
- Connections enable novel analyses, coordinated coanalyses, and transdisciplinary studies
- Biodiversity collections could link out to the DES or ingest data back to databases
  - Eliminates need to make connections manually
  - More easily demonstrate the utility of our collections



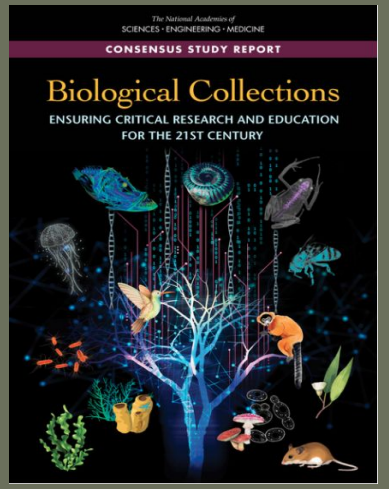
Hardisty et al., 2022

BCoN and NASEM Recommendations: Areas of Overlap

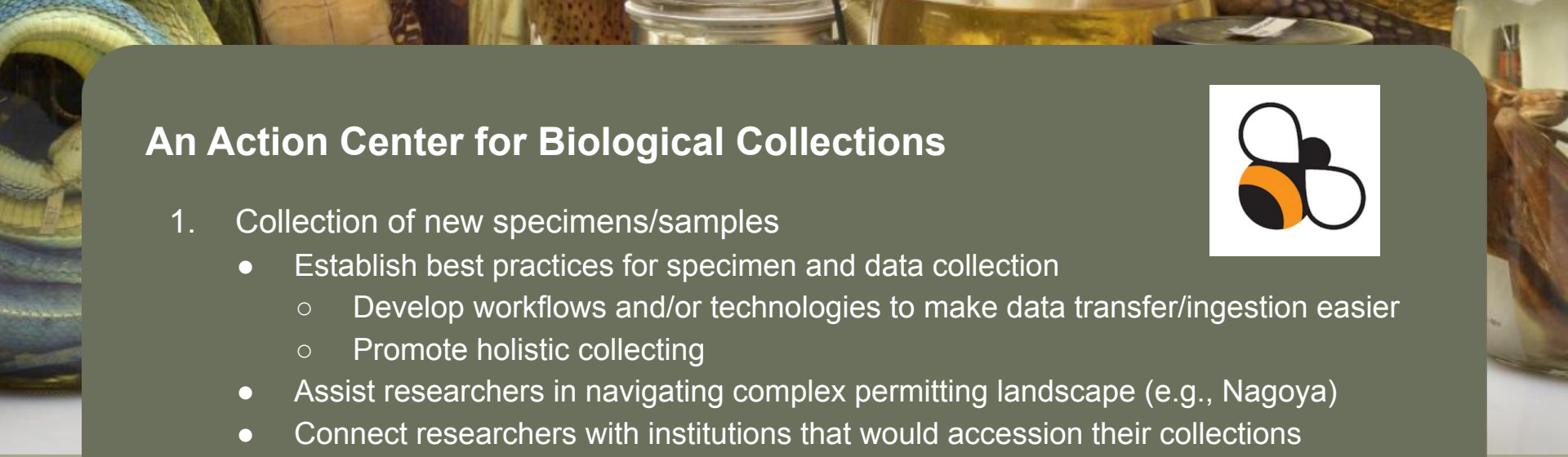
BCoN (2019):
Central Coordinating Unit

Five Conceptual Pillars of the ESN
(Thiers et al., 2021)

1. Collection of new specimens/samples
2. Continued digitization
3. Data Integration
4. Education and Workforce Training
5. Infrastructure and sustainability



NASEM (2020):
Action Center for Biological Collections

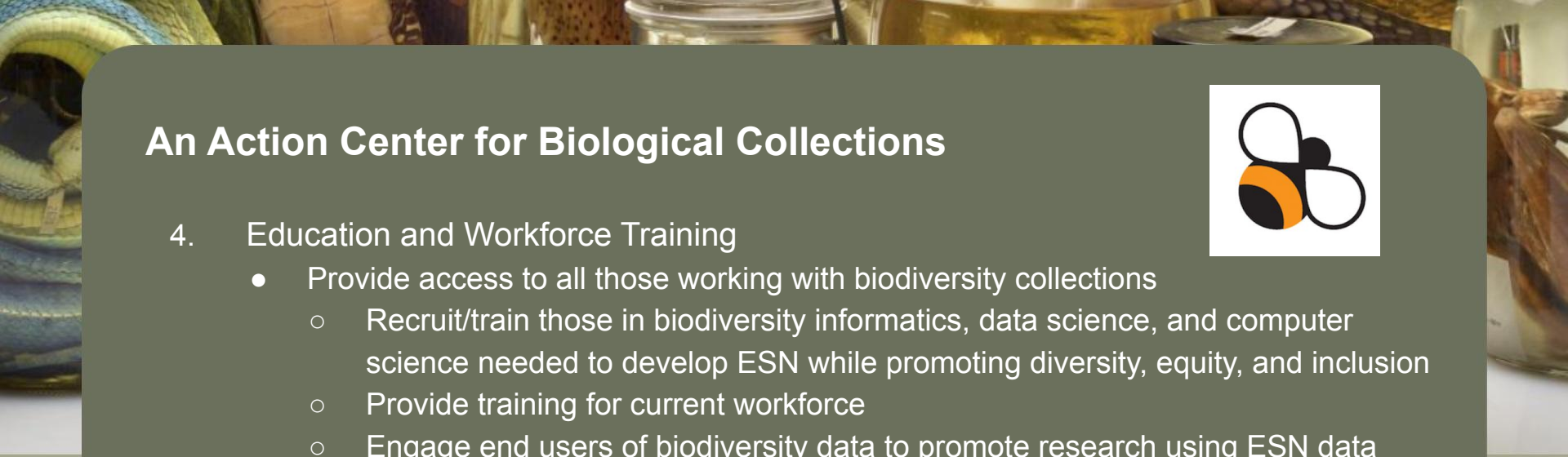


An Action Center for Biological Collections

1. Collection of new specimens/samples
    - Establish best practices for specimen and data collection
        - Develop workflows and/or technologies to make data transfer/ingestion easier
        - Promote holistic collecting
    - Assist researchers in navigating complex permitting landscape (e.g., Nagoya)
    - Connect researchers with institutions that would accession their collections

2. Continued digitization
    - Spearhead development of next-generation digitization technologies and workflows to improve efficiency, particularly for harder to digitize collections
    - Promote digitization as part of normal acquisition process

3. Data Integration
    - Lead development of cyberinfrastructure needed for integration across ESN



An Action Center for Biological Collections

4. Education and Workforce Training
    - Provide access to all those working with biodiversity collections
        - Recruit/train those in biodiversity informatics, data science, and computer science needed to develop ESN while promoting diversity, equity, and inclusion
        - Provide training for current workforce
        - Engage end users of biodiversity data to promote research using ESN data

5. Infrastructure and sustainability
    - Advocacy for biodiversity collections to ensure long-term sustainability of physical specimens and digital data on ESN
    - Institutional infrastructure: support in strategic planning
        - ESN allows documentation of value of collections using metrics
    - Community infrastructure: improve coordination and promote collaboration

THANK YOU FOR YOUR PARTICIPATION

Please complete the webinar series survey using the QR code (via phone), the link in the chat, or you will be redirected after this webinar.

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