Taking the Pulse of Natural History Collections During COVID-19 Series: Where are we now?

September 17: Where do we go from here?

Rob Gropp, Biodiversity Collections Network (BCON) & AIBS

Roland Roberts, National Science Foundation

Scott Miller, Smithsonian Institution

Pam Soltis, iDigBio / Florida Museum of Natural History

iDigBio is funded by grants from the National Science Foundation's Advancing Digitization of Biodiversity Collections Program [DBI-1115210 (2011-2018) and DBI-1547229 (2016-2021)]. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

Creating and Capturing Opportunities

Robert Gropp, Ph.D.

Executive Director, AIBS & NSC Alliance

Global Issues
Not Just Problems, Opportunities

Organizations Must Change

- Resilient
- Responsive
- Forward Looking & Strategic
- Innovative
- Business-minded
- Governance & Leadership

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BioScience®
A Forum for Integrating the Life Sciences
American Institute of Biological Sciences

Resiliency: The Answer for Professional and Scientific Societies

It has been said that one should never let a good crisis go to waste. There are always lessons to be learned and opportunities to be seized. Of late, there is certainly no lack of serious crises facing society. There is also no lack of crises confronting the scientific enterprise—particularly, professional societies and related research and science education organizations.

Prior to the emergence of SARS-CoV-2, scientific societies were challenged by myriad threats. Any of these issues individually has the potential to influence the vitality and sustainability of a field's professional associations. Taken together and in conjunction with economic, cultural, and social disruptions arising from the SARS-CoV-2 pandemic, a perfect storm has formed that will fundamentally alter organizations that have for centuries incubated new fields of study, disseminated vetted scientific information, fostered networking and communities of shared interests through annual meetings, and educated and mentored the next generation of scientists.

Prior to the emergence of the COVID-19 pandemic, scientific societies were endeavoring to identify how to sustainably operate journals in a business and communications environment characterized by chaos, conflicting international regulation, and often untested business models—some of which require high-volume rather than high-quality publication. Many journal editors were struggling to convince overburdened scholars to review manuscripts. Some organizations were struggling to identify strategies for engaging current members while trying to attract a new generation. Then, there are the challenges of engaging internationally. For most societies in the biological sciences, particularly in fields associated with organismal biology, ecology, and evolution, there was a recognition that these fields do not reflect the diversity of society.

These are significant challenges, any of which threatens the sustainability of a nonprofit scientific society or research organization. The significance of these issues, however, was amplified in 2020 when scientific societies were forced to begin canceling scientific conferences with significant budget ramifications, when student and early career researchers began to question whether to continue in academia given growing insecurity about employment and funding, and risk-averse volunteer governing board members were challenged to rapidly make decisions about the future of their organization with limited information.

The American Institute of Biological Sciences is helping our member organizations tackle these and other challenges. In June, we launched Building Resilient Societies. This online discussion and resource-sharing series helps leaders of scientific societies and related organizations identify resources and strategies that will empower them as they work to reposition their organizations to sustainably and effectively serve their fields into the future. The series has begun to explore the factors that help make organizations resilient, how to increase diversity and inclusion while combating bias, and how best to plan meetings in an era of uncertainty. Future programs are being planned now.

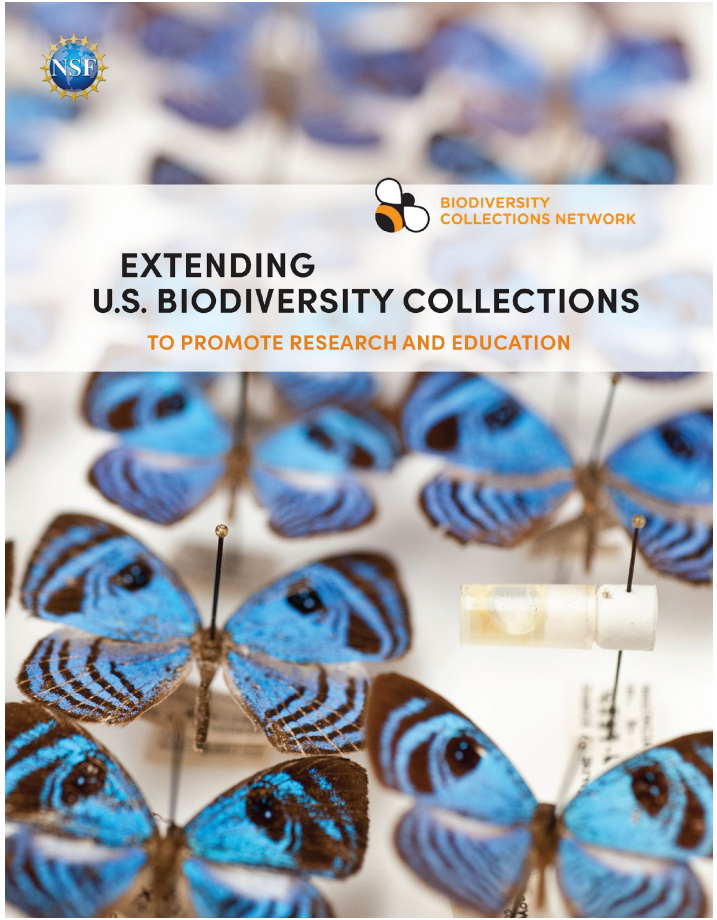
Let us not waste the crises now confronting scientific societies. Let us seize this opportunity to make the changes needed to build more resilient scientific societies.

ROBERT E. GROPP
Executive Director

doi:10.1093/biosci/biaa085

Community Practice Changes

- Convergence
- Inter- and multi-disciplinary
- Collaboration
- New tools
- Support community infrastructure, organizations (e.g. scientific associations)


NSF
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EXTENDING
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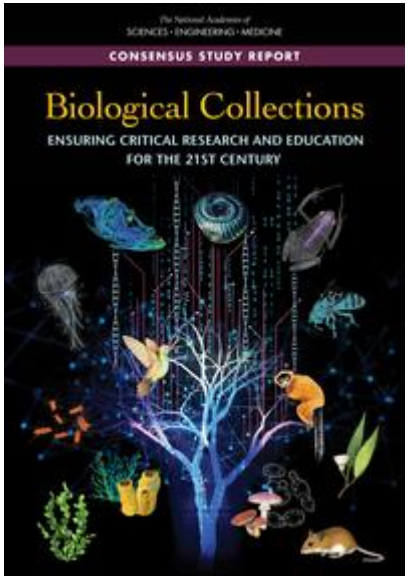
TO PROMOTE RESEARCH AND EDUCATION


SCIENCES · ENGINEERING · MEDICINE
CONSENSUS STUDY REPORT
Biological Collections
ENSURING CRITICAL RESEARCH AND EDUCATION
FOR THE 21ST CENTURY

Policy

- Unified
- Bold
- Responsive
- Compelling
- Coordinated
- Connection to other priorities

Resources

https://www.aibs.org/position-statements/

http://nscalliance.org/governmentpolicy/

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NSF-BIO: COVID-19 Response & Collections

Roland P. Roberts
Program Officer; BIO-DBI

Fundamental Research Aiding in COVID-19 Response

The Coronavirus Aid, Relief, and Economic Security (CARES) Act

Credit: South Carolina National Guard

NSF RAPID Mechanism: Rapid Response Research

- Severe urgency regarding availability of, or access to data, facilities or specialized equipment
- Previously used to respond to Hurricane Katrina, Superstorm Sandy, Ebola, Zika

COVID-19-Related Awards

Award Type	No. of Awards	Total Awarded
RAPID	519	$79,513,103
EAGER	29	$6,327,315
SBIR/STTR	11	$2,777,368
ALL	**562**	**$104,707,878**

COVID-19 Related Awards – Collections

RAPID: Rapid Creation of a Data Product for the World's Specimens of Horseshoe Bats and Relatives, a Known Reservoir for Coronaviruses. Mast & Paul

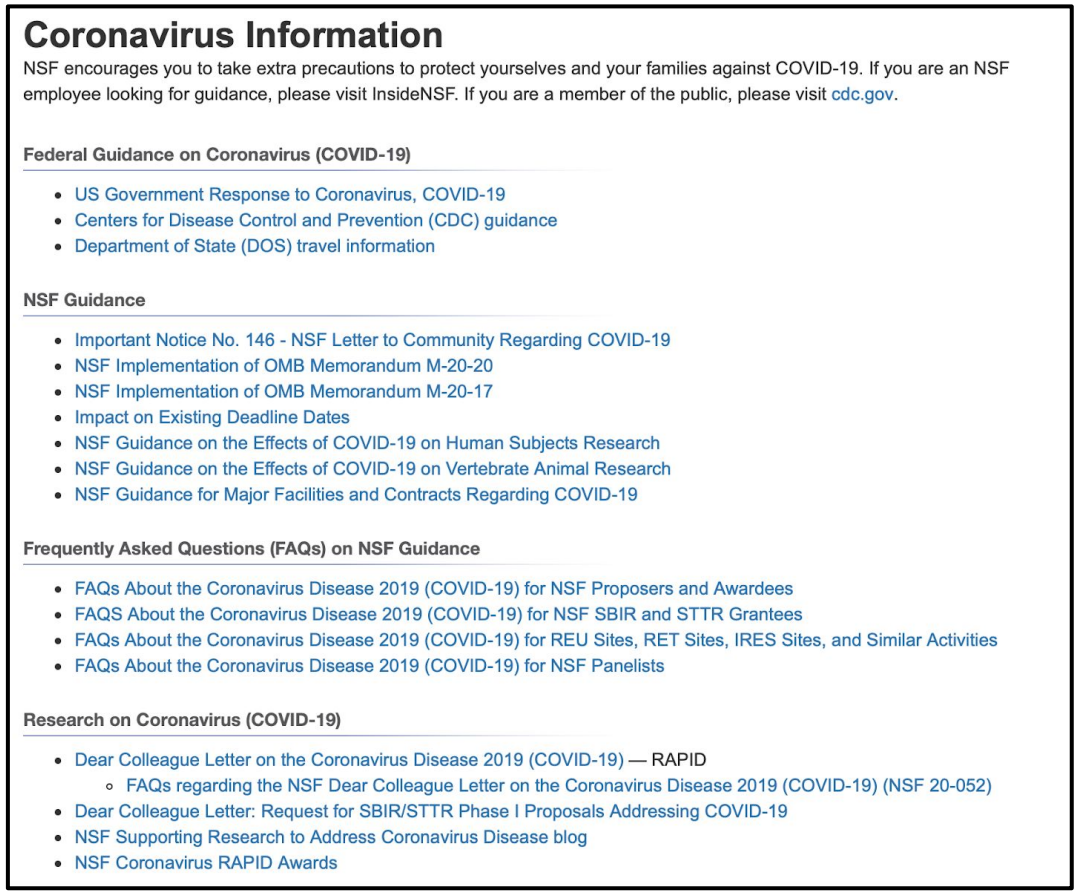
Goal: Development of georeferenced, vetted, and versioned data products of the world's specimens of horseshoe bats and their relatives for use by researchers studying the origins and spread of SARS-like coronaviruses, including the causative agent of COVID-19.

COVID-19 Related Awards – Collections

Infrastructure for Predicting, Understanding, and Mitigating Zoonotic Disease Outbreaks. Soltis & Paul

Goals: Stage a series of workshops that will catalyze collaborations around suites of data housed in natural history collections. Identify gaps in biodiversity and infectious disease data to address basic research and broader social issues pertinent to zoonotic diseases. Develop a strategy for framing an integrated agenda for transdisciplinary training and research.

Co-funded by RUE to facilitate student involvement.



Coronavirus Information

NSF encourages you to take extra precautions to protect yourselves and your families against COVID-19. If you are an NSF employee looking for guidance, please visit InsideNSF. If you are a member of the public, please visit cdc.gov.

Federal Guidance on Coronavirus (COVID-19)

- US Government Response to Coronavirus, COVID-19
- Centers for Disease Control and Prevention (CDC) guidance
- Department of State (DOS) travel information

NSF Guidance

- Important Notice No. 146 - NSF Letter to Community Regarding COVID-19
- NSF Implementation of OMB Memorandum M-20-20
- NSF Implementation of OMB Memorandum M-20-17
- Impact on Existing Deadline Dates
- NSF Guidance on the Effects of COVID-19 on Human Subjects Research
- NSF Guidance on the Effects of COVID-19 on Vertebrate Animal Research
- NSF Guidance for Major Facilities and Contracts Regarding COVID-19

Frequently Asked Questions (FAQs) on NSF Guidance

- FAQs About the Coronavirus Disease 2019 (COVID-19) for NSF Proposers and Awardees
- FAQS About the Coronavirus Disease 2019 (COVID-19) for NSF SBIR and STTR Grantees
- FAQs About the Coronavirus Disease 2019 (COVID-19) for REU Sites, RET Sites, IRES Sites, and Similar Activities
- FAQs About the Coronavirus Disease 2019 (COVID-19) for NSF Panelists

Research on Coronavirus (COVID-19)

- Dear Colleague Letter on the Coronavirus Disease 2019 (COVID-19) — RAPID
  - FAQs regarding the NSF Dear Colleague Letter on the Coronavirus Disease 2019 (COVID-19) (NSF 20-052)
- Dear Colleague Letter: Request for SBIR/STTR Phase I Proposals Addressing COVID-19
- NSF Supporting Research to Address Coronavirus Disease blog
- NSF Coronavirus RAPID Awards

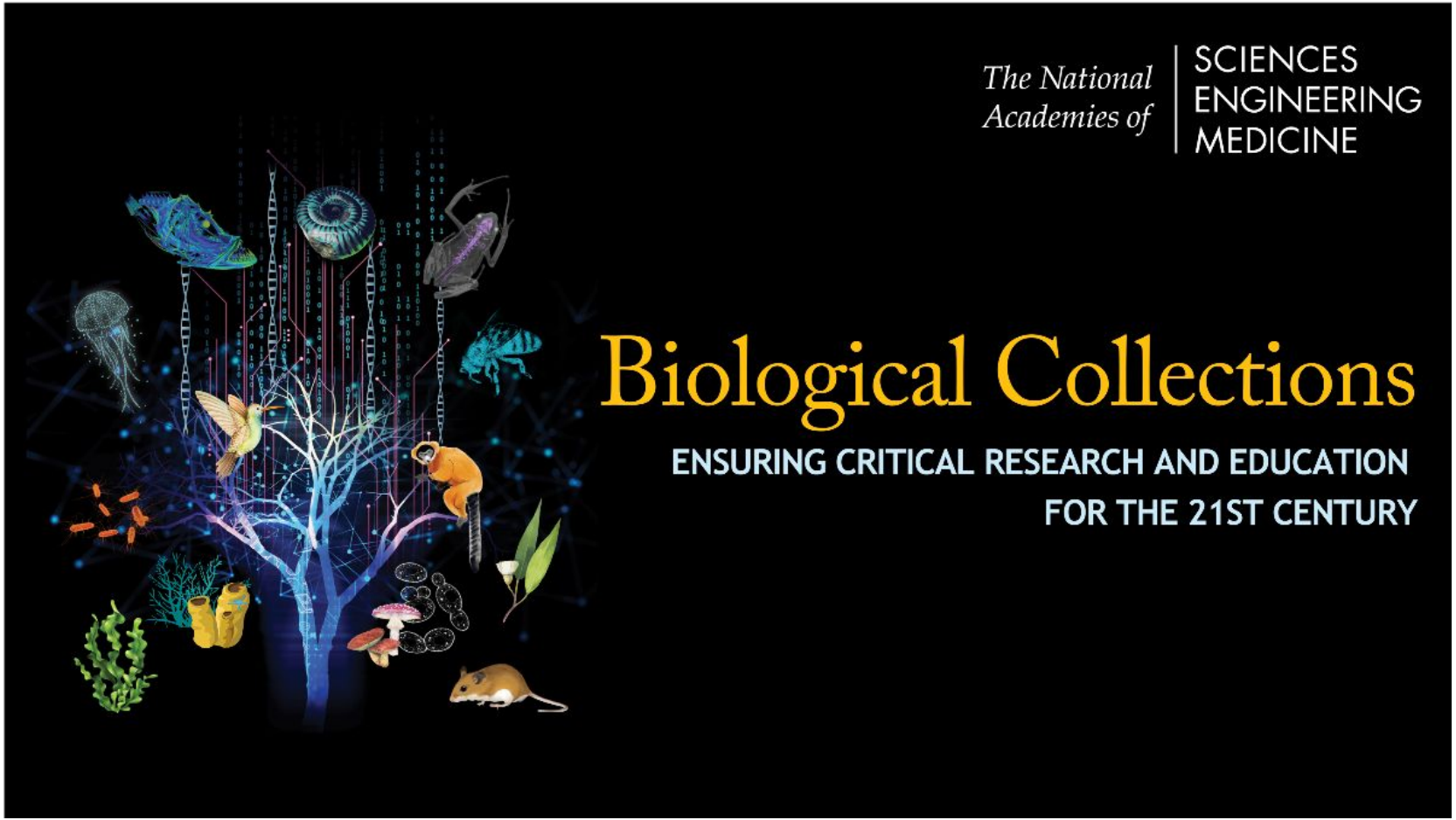
Supporting NSF Grantees During COVID-19

https://www.nsf.gov/news/special_reports/coronavirus/

Recent Studies/Publications – Collections

BIODIVERSITY
COLLECTIONS NETWORK


Tertiary Extension3
Descriptions
Interactions
Phylogenies
Distributions
Traits
Protection Status Locations
Secondary Extension2
Morphometric Data
Isotope Samples
Field Images
Field Notes
Primary Extension1
Gene Sequences
Digital Specimen Record
Specimen Media
Physical Specimens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Two updates:

Interagency Working Group on Scientific Collections

REALM: REopening archives, libraries and museums: testing SARS-CoV-2 persistence

Scott Miller, Smithsonian

17 September 2020

Scientific Collections as Infrastructure

- Law and policy in the USA recognize scientific collections as distributed infrastructure
  - America Competes Act 2010 (42 USC 6624.104)
  - White House Office of Management and Budget memos
  - White House Office of Science and Technology Policy memos (especially 20 March 2014)
- “Scientific collections … an essential base for developing scientific evidence and … resource for scientific research, education, and resource management.”
- USG goal is “systematic improvement of the development, management, accessibility, and preservation of scientific collections …”

Economic Analyses of Collections

- IWGSC Study Group, 2018-2020
- ~60 page report, pending open access publication by Smithsonian Institution Scholarly Press
- Six services provided by collections and their cost centers
- Five methods for documenting benefits generated
- Implications for evidence-based management and policies

Six Services Provided

1. *Accessioning* material into collection
2. *Preserving* and maintaining contents
3. *Documenting* holdings and disseminating information
4. Providing *access* to qualified users
5. *Data* curation (error correction, adding metadata, linkage to publications and online data)
6. Increasing public understanding through *education and outreach*

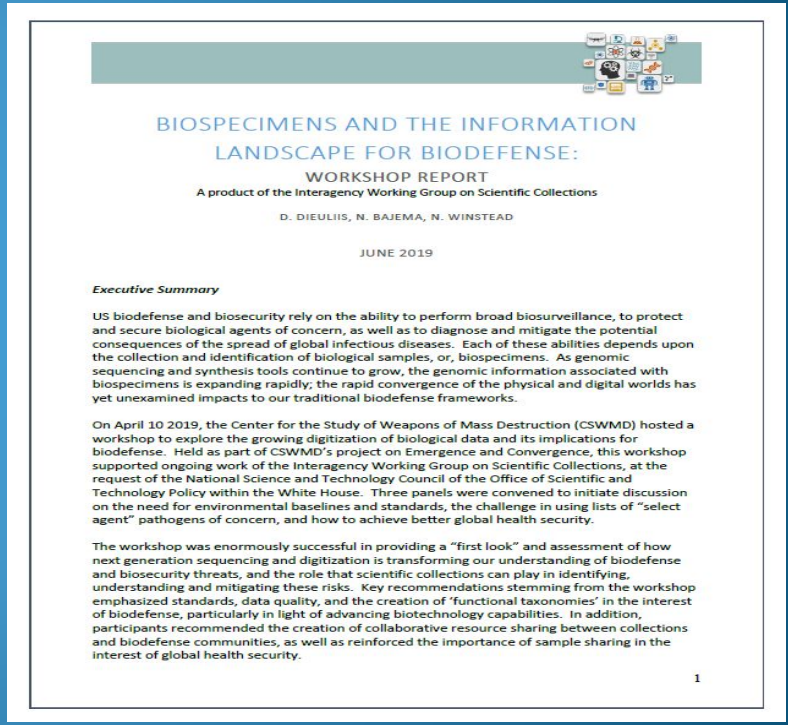
Five Methods for Estimating Benefits

1. Technology/Knowledge transfer ("*Value chains*")
2. Success Stories ("*Winning lottery tickets*")
3. Option Value ("*Insurance policies*")
4. Value added by users ("*Co-investment*")
5. Counter-factual Scenarios ("*It's a Wonderful Life*")

Biospecimens and the Information Landscape for Biodefense

- Workshop with **National Defense University**, April 2019

- "First look" assessment of how next generation sequencing and digitization is transforming our understanding biodefense and biosecurity threats, and the role that scientific collections can play in identifying, understanding and mitigating these risks.



BIOSPECIMENS AND THE INFORMATION LANDSCAPE FOR BIODEFENSE:

WORKSHOP REPORT

A product of the Interagency Working Group on Scientific Collections

D. DIEULIIS, N. BAJEMA, N. WINSTEAD

JUNE 2019

Executive Summary

US biodefense and biosecurity rely on the ability to perform broad biosurveillance, to protect and secure biological agents of concern, as well as to diagnose and mitigate the potential consequences of the spread of global infectious diseases. Each of these abilities depends upon the collection and identification of biological samples, or, biospecimens. As genomic sequencing and synthesis tools continue to grow, the genomic information associated with biospecimens is expanding rapidly; the rapid convergence of the physical and digital worlds has yet unexamined impacts to our traditional biodefense frameworks.

On April 10 2019, the Center for the Study of Weapons of Mass Destruction (CSWMD) hosted a workshop to explore the growing digitization of biological data and its implications for biodefense. Held as part of CSWMD's project on Emergence and Convergence, this workshop supported ongoing work of the Interagency Working Group on Scientific Collections, at the request of the National Science and Technology Council of the Office of Scientific and Technology Policy within the White House. Three panels were convened to initiate discussion on the need for environmental baselines and standards, the challenge in using lists of "select agent" pathogens of concern, and how to achieve better global health security.

The workshop was enormously successful in providing a "first look" and assessment of how next generation sequencing and digitization is transforming our understanding of biodefense and biosecurity threats, and the role that scientific collections can play in identifying, understanding and mitigating these risks. Key recommendations stemming from the workshop emphasized standards, data quality, and the creation of 'functional taxonomies' in the interest of biodefense, particularly in light of advancing biotechnology capabilities. In addition, participants recommended the creation of collaborative resource sharing between collections and biodefense communities, as well as reinforced the importance of sample sharing in the interest of global health security.

1

REALM PROJECT

REopening Archives, Libraries, and Museums

Web: oc.lc/realm-project
Social: #REALMproject

Laboratory testing of SARS-CoV-2 persistence

- Extensive literature search online
- Total of 50 tests in groups of 5 materials, prioritized iteratively
- High concentration of COVID-19 virus applied to materials in artificial saliva
- Samples evaluated for presence of virus after 0, 1, 3, 4 and 6 days (or other combinations)
- Virus grown in mammal cells
- Ambient conditions e.g. 72 degrees F. and 40% R.H.

Test set 1: Public library materials

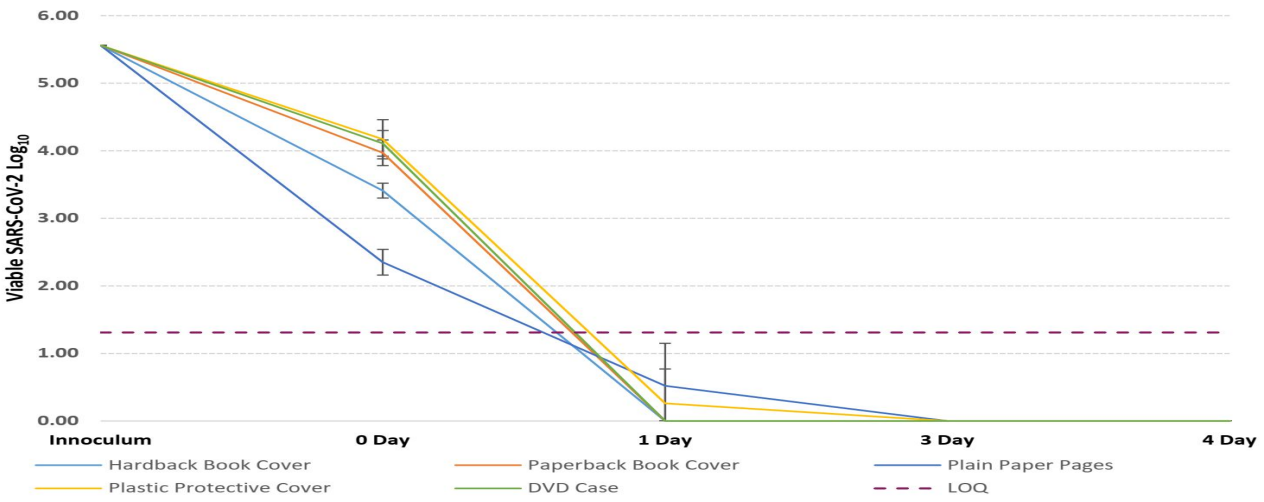
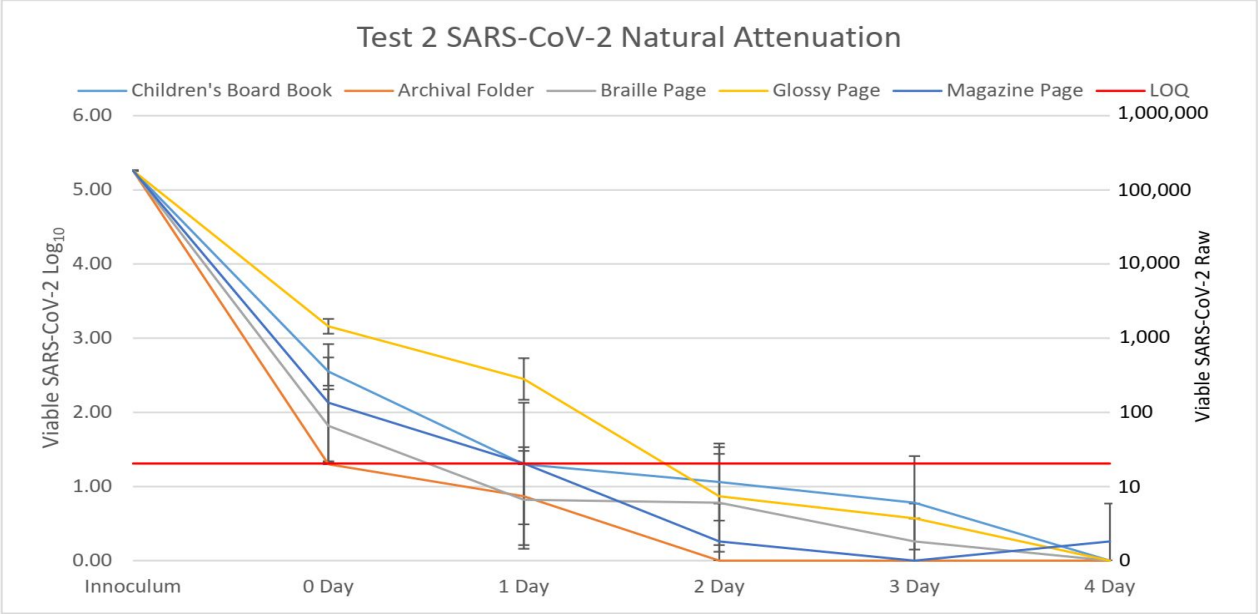


Figure 3. Natural attenuation of SARS-CoV-2 at days 1, 3, and 4 during test 1.2.

Test set 2: More library material



Test set 3: storage materials

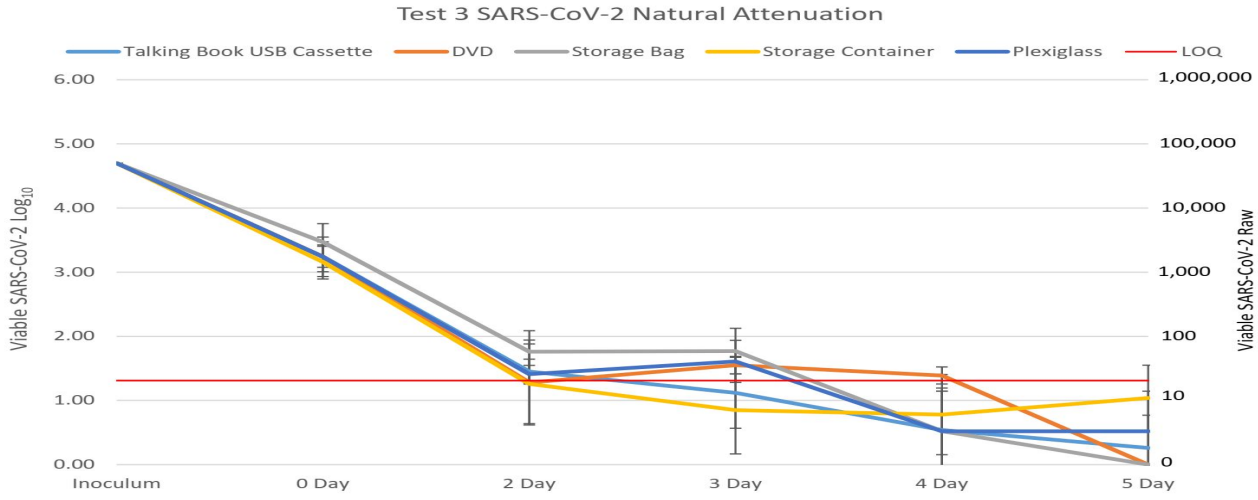
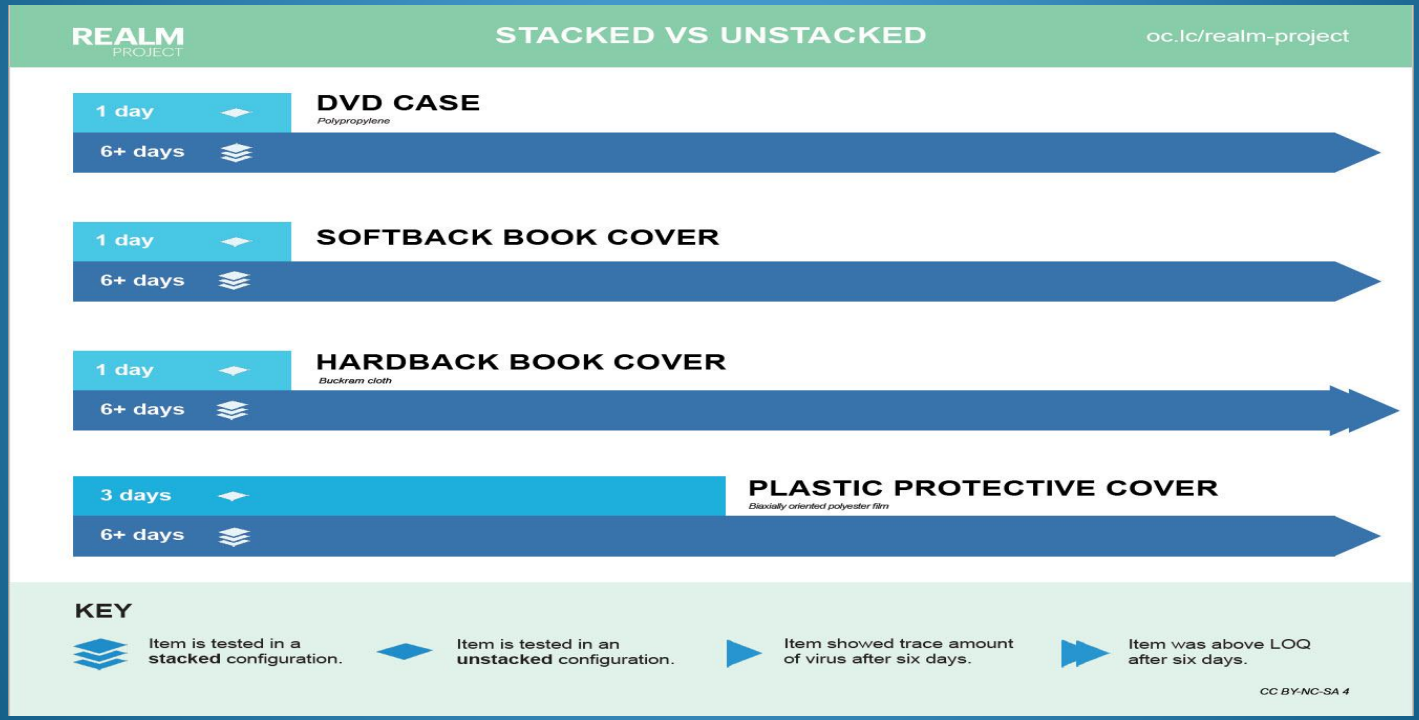


Figure 3. Test 3 attenuation of SARS-CoV-2 at days 0, 2, 3, 4, and 5, with ± 95% confidence intervals indicated by the black vertical bars for each test date and item.

Tests 1 & 4: Impact of stacking



The context

What we do not know about this virus

- What is the infectious dose?
- How much virus is shed by people?
- How important is contact transfer?

Operational issues

- Setting, e.g., public library versus research library
- How long can you quarantine material?
- Risk context in the region?
- PPE, amount of contact, etc.?

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COVID-19:
New Collaborations & New Opportunities

Pamela S. Soltis

University of Florida & iDigBio

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CETAF-DISSCO COVID-19 TASKFORCE

Thanks to all Task Force Members:

Inspiration,
Creativity,
Dedication

Ana Casino

Dimitris Koureas

Wouter Addink

Immediate Motivation

- How can the natural history community contribute?
  - Questions:
    - What is the natural host of SARS-CoV-2?
    - Where did SARS-CoV-2 originate?
    - What is the pattern of transmission?
  - Resources:
    - Natural history collections – baseline information on potential hosts
    - Genetic resources – information on viruses
    - Literature
  - How to mobilize?

Task Force Activities

1. Post-COVID prioritization of research foci on animal virus carriers
2. Develop guidelines for the preservation of viral evidence in deposited biological specimens and samples
3. Develop a biodiversity-related knowledge hub on COVID-19
4. Improve metadata registering practices on genetic material deposition

What information do we need?

Rhinolophus

Gaps!

Rhinolophus

Greater Roles for Natural History Collections

Editorial

BioScience®
A Forum for Integrating the Life Sciences
American Institute of Biological Sciences

Human Health, Interagency Coordination, and the Need for Biodiversity Data

JENNIFER M. ZASPEL
JULIE M. ALLEN
CHRISTOPHER D. TYRRELL
NATE LEMOINE
LUKE M. JACOBUS
CRYSTAL KLEM
JILLIAN GOODWIN
JOHN M. BATES

Viewpoint

Integrating Biodiversity Infrastructure into Pathogen Discovery and Mitigation of Emerging Infectious Diseases

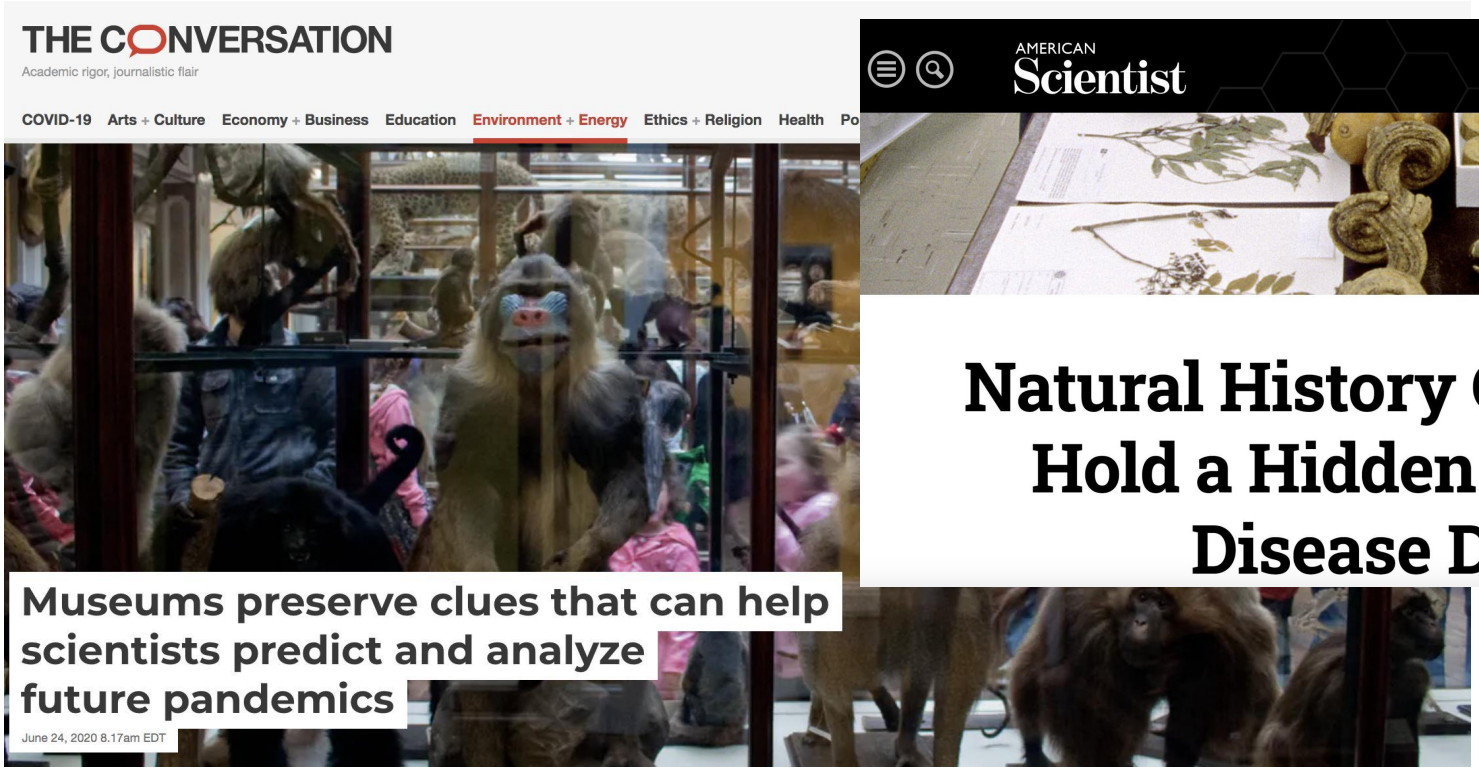
JOSEPH A. COOK, SATORU ARAI, BLAS ARMIÉN, JOHN BATES, CARLOS A. CARRION BONILLA, MARIA BEATRIZ DE SOUZA CORTEZ, JONATHAN L. DUNNUM, ADAM W. FERGUSON, KARL M. JOHNSON, FAISAL ALI ANWARALI KHAN, DEBORAH L. PAUL, DEEANN M. REEDER, MARCIA A. REVELEZ, NANCY B. SIMMONS, BARBARA M. THIERS, CODY W. THOMPSON, NATHAN S. UPHAM, MAARTEN P. M. VANHOVE, PAUL W. WEBALA, MARCELO WEKSLER, RICHARD YANAGIHARA, AND PAMELA S. SOLTIS

Science eLetters

Building Biorepository Capacity Internationally Would Stimulate More Effective Pathogen Surveillance and Mitigation: A Response to Watsa et al. 2020

- Jocelyn P. Colella, Assistant Professor and Curator of Mammals,Biodiversity Institute, University of Kansas
- + 16 other authors

Greater Roles for Natural History Collections



Natural History Collections Hold a Hidden Trove of Disease Data

COVID-19 is just one societal problem...

Welcome to IPBES

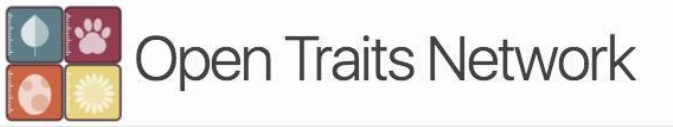
ipbes
Science and Policy for People and Nature

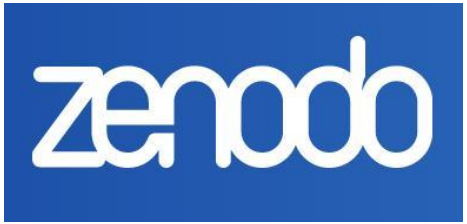
Nature and its vital contributions to people, which together embody biodiversity and ecosystem functions and services, are **deteriorating worldwide**.

Direct and indirect **drivers of change have accelerated** during the past 50 years.

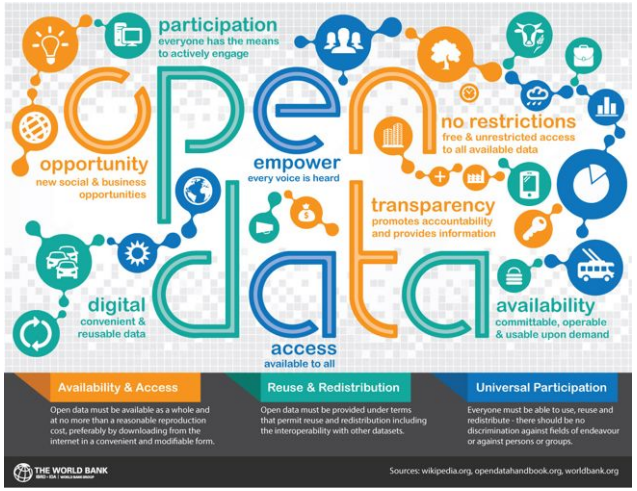
- changes in land and sea use
- direct exploitation of organisms
- climate change
- pollution
- invasion of alien species

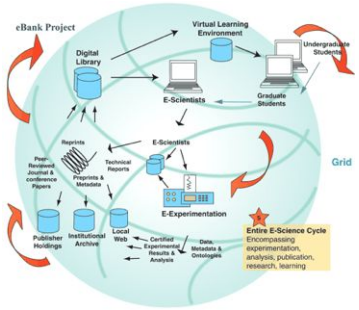
Solution: Robust, interconnected infrastructure – linking data across repositories





Innovations & Implementation





GBIF Global Biodiversity Information Facility

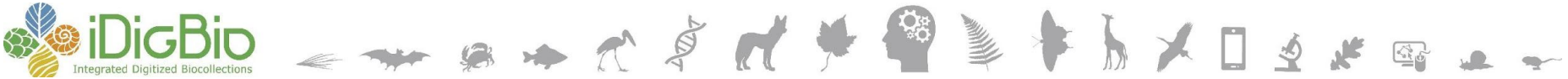
NCBI

iDigBio Integrated Digitized Biocollections

New Opportunities

- New conversations and collaborations: new science, new messages
  - RDA and NCBI (via FDA)
  - Workshop series
- Global connections
  - Strengthening community – professional organizations
  - Conferences: Digital Data Conference, SPNHC, Botany
- Expanded use of collections data in teaching: BLUE, BCEENET
- Training workshops & webinars
- Diversity and inclusion

 New opportunities to engage more people, train more people, increase diversity and participation, and learn from more people



Summary

- Natural history collections and associated data are important resources for the study of COVID-19 and for prediction, mitigation, and prevention of future pandemics
- Natural history collections have important roles in addressing many other 21st-century societal problems
- Gaps: Better data integration and cyberinfrastructure
- Innovation and implementation
- New opportunities through virtual events:
  - broader participation & engagement, increase diversity, expanded training

Thank you!

www.idigbio.org

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Q&A panel discussion

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Please help by providing feedback about this webinar series!

Survey link:

https://ufl.qualtrics.com/jfe/form/SV_aVL7wEfLYUXcbFb

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Join us for our next virtual planning webinar and the other "Adapting to COVID: Resources for Natural History Collections in a New Virtual World" webinars

Upcoming webinars include:

October 27: Virtual Project Management, Tips and Tools
Speakers: Diego Barroso; Project Manager TORCH TCN, BRIT, Jen Zaspel; Terrestrial Parasite Tracker Lead PI & David Jennings, Project Manager, iDigBio

November 18: Engaging Public Participation in Collections Digitization
Speakers: Austin Mast; iDigBio, Florida State University & Katie Pearson, Project Manager California Phenology TCN

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FM FLORIDA MUSEUM
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