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## Forum on Microbial Threats: Annual Report 2022 (2023)

### DETAILS

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### CONTRIBUTORS

Forum on Microbial Threats; Board on Global Health; Health and Medicine Division; National Academies of Sciences, Engineering, and Medicine

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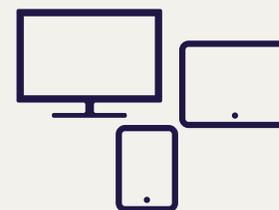
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# **Forum on Microbial Threats**

Annual Report 2022







**Peter Daszak,  
Ph.D.**  
(Chair)  
EcoHealth Alliance



**Kent Kester,  
M.D.**  
(Vice Chair)  
International AIDS Vaccine  
Initiative

## Message from the Chairs

More than 3 years after the recognition of the COVID-19 pandemic, the world is still grappling with how to return to normalcy in work and life, how to address acute and long-term sequelae from COVID-19 and the many intractable questions around how best to prepare for the next pandemic. These challenges have been compounded by the convergence of other re-emerging infectious disease threats: widespread transmission of mpox, a surge of respiratory syncytial virus infections, and continued outbreaks of highly pathogenic avian influenza. In addition, the development and spread of drug-resistant fungal pathogens, an emerging threat with unmet research and public health needs, was recognized in the first World Health Organization's fungal priority pathogen list.<sup>4</sup>

Microbial threats are diverse and span from the burden of reemerging infections and neglected tropical diseases to the spread of antimicrobial resistance and the impact from infectious agents of animals and plants on human health. The pandemic has reshaped existing global efforts to address many of these persistent issues (for better or for worse). Furthermore, the pandemic has taken a significant toll on the public health, clinical, and research workforce needed to respond to infectious disease threats. But it has also generated new understanding and perception of infectious disease threats in the public, sparked innovative strategies for global outbreak preparedness, and catalyzed broader partnerships in these preparedness efforts. The urgency and breadth of infectious disease threats underline the enduring value and contribution that the Forum on Microbial Threats provides to the discourse on science and technology, policies and regulation, and political and financial commitment to these issues.

<sup>4</sup> The WHO released its first fungal "priority pathogens" list in October 2022, see <https://www.who.int/news/item/25-10-2022-who-releases-first-ever-list-of-health-threatening-fungi> (accessed June 1, 2023).

Visit the forum at  
[nas.edu/microbialthreats](https://nas.edu/microbialthreats)

Since its establishment in 1996, the Forum on Microbial Threats has provided a structured opportunity for leaders from a wide range of disciplines and industries to debate the most effective ways to understand, anticipate, and “manage” emerging infectious diseases. Over the past decade, the forum has fostered dialogue toward improving clinical medicine, public health, policy, research, and the medical countermeasures pipeline for infectious disease threats; advanced a cross-disciplinary One Health approach that brings together our understanding of human, animal, plant, and environmental health; and built a readiness to work on the full infectious disease landscape that includes the impact on global health security and economies.

In 2022, reflecting the challenges that the global community is facing, the forum held two workshops on the intersection of plant agriculture, fungal pathogens, and human health;<sup>5</sup> and on translating lessons from R&D efforts during the COVID-19 pandemic to future disease outbreaks.<sup>6</sup> Our members have remained active through virtual gatherings, and this energy was only amplified when we resumed in-person meetings at the end of 2022. We continued to work closely with the One Health Action Collaborative to assess the future of One Health in the United States and globally, and to connect with stakeholders to implement the adaptation of the One Health approach in various outbreak preparedness programs. The diverse membership of the forum and the action collaborative is positioned to help champion policies that are cross-disciplinary and “big picture,” but remain relevant to public health and medicine.

Looking forward to 2023, the forum remains dedicated to confronting the challenge of evolving microbial threats and serving our nation. The COVID-19 pandemic compelled public acknowledgment of long-term illnesses associated with infectious diseases, and reinforced the need for a cross-disciplinary platform for engagement and collaboration on how to better understand common underlying mechanisms between the different infection-associated chronic illnesses. The forum exemplifies a commitment to meet the needs of the global community, balancing its attention between critical challenges associated with the ongoing pandemic and innovative approaches to tackle neglected infectious disease threats, including antimicrobial resistance and arthropod-borne diseases. We stand ready to contribute our full efforts to clarify scientific and policy issues, engage with global partners, and identify new strategies to bolster global health security in a connected world.

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<sup>5</sup> In June, the forum held a workshop on *The Role of Plant Agriculture Practices on Development of Antimicrobial Resistant Fungi Affecting Human Health* (<https://www.nationalacademies.org/our-work/the-role-of-agricultural-practices-on-development-of-antimicrobial-resistant-microbes-affecting-human-health-a-workshop-series>)

<sup>6</sup> In December, the forum convened the public workshop on *Applying Lessons Learned from COVID-19 Research and Development to Future Epidemics* (<https://www.nationalacademies.org/our-work/advances-from-covid-19-in-development-regulation-and-communications-of-new-tools-and-technologies-for-future-pandemic-preparedness-a-workshop>)

# A Thank You to Rima

Rima Khabbaz, M.D., retired in March 2022 as the director of the National Center for Emerging and Zoonotic Infectious Diseases (NCEZID) at the U.S. Centers for Disease Control and Prevention (CDC). She has been a member of the forum since 2006, stepping into the leadership role of vice chair in 2020. We are fortunate to have had her insightful contributions and leadership in shaping discussion around topics that span from emerging zoonotic diseases to antimicrobials resistance and capacity building. Her recognition of the value of a One Health approach and support of prudent, practical implementation of One Health to counter emerging viral diseases, antimicrobial resistance, and fungal threats have inspired all of us to meet her example.

Rima stepped away from NCEZID after 38 years of public service, starting as an Epidemic Intelligence Service officer in the National Center for Infectious Diseases' (NCID's) Hospital Infections Program. From there, Rima served as a medical epidemiologist in NCID's Retrovirus Diseases Branch, where she made major contributions to defining the epidemiology of non-HIV retroviruses, specifically human T lymphotropic viruses I and II in the United States, and to developing guidance for counseling individuals infected with the virus. She served in leadership positions during CDC's response to numerous outbreaks of new and/or reemerging infections, including Nipah, Ebola, West Nile virus, SARS, mpox, and COVID-19. Following the hantavirus pulmonary syndrome outbreak in the southwestern United States in 1993, she led the agency's efforts to set up national surveillance for this syndrome. She also led the CDC field team to the nation's capital during the public health response to the anthrax attacks of 2001. Rima played a key role in developing and coordinating CDC's blood safety and food safety programs related to viral diseases. From 2010 to 2017, as CDC's deputy director for infectious diseases and director of the Office of Infectious Diseases, she helped lead the efforts of CDC's infectious disease national centers and advance the agency's crosscutting infectious disease priorities, including the integration of advanced molecular detection technologies into public health.



**Rima Khabbaz, M.D.**  
Former director, NCEZID  
Forum vice chair  
(until March 2022)



**Rima speaking at the Institute of Medicine's Richard and Hinda Rosenthal Symposium in 2014, *Antimicrobial Resistance: A Problem Without Borders*.**

### **JULIE PAVLIN**

**Director, Board on Global Health**

I first met Rima when I became a member of the forum many years ago, and she was so gracious and welcoming and immediately made me feel like a valued member of the group. She was always kind and generous with her wisdom. We miss her and wish her the best of a well-deserved retirement!

### **SCOTT DOWELL**

**Deputy Director, Vaccine Development & Surveillance – Surveillance and Epidemiology; Bill & Melinda Gates Foundation; forum member**

A bittersweet feeling knowing that Rima is starting a fun new chapter with Muin and family, and sadness at the thought of continuing these meetings without her wisdom and integrity.

All the best to you Rima!

### **JONNA MAZET**

**Vice Provost – Grand Challenges, University of California, Davis; forum member**

Congratulations, Rima! We will miss you, but I bet we will still see you. You can't get all the way away forever ;)

All my best wishes.

### **PETER DASZAK**

**President, EcoHealth Alliance; forum chair**

Rima—You've brought the best of the gold standard that the CDC represents on how to fight emerging diseases proactively, and by embracing new technologies but at the same time maintaining a deep respect for the shoe-leather epidemiology that lies at the heart of many public health issues. Your leadership of the NCEZID has brought a renewed appreciation of the One Health nature of emerging zoonoses, and how to overcome challenges to the type of collaboration we need to defeat them. It's hard to measure success, but the extreme high regard people have for the CDC (including myself), and the respect of scientists from around the world are a testament to your hard work.

It's been a real pleasure to work with you. I've personally learned a great deal, and the forum has been a better organization because of your support, advice, and expertise. Through many dozens of conference calls and Zoom calls, in-person meetings, and long discussions after our workshops, you've worked tirelessly to help steer the forum through turbulent times, including a full-blown pandemic and the challenges that it has brought.

I'm sure I speak for all of us in thanking you for your service to the forum, and hope that we will have an opportunity to meet again in person!

# Executive Summary

Established in 1996, the Forum on Microbial Threats provides a cross-disciplinary platform that engages thought leaders and subject matter experts to highlight and discuss key issues around how to better understand, prepare for, and address emerging infections.

## PUBLIC MEETINGS

In 2022, the forum convened two public workshops and collaborated with the Forum on Drug Discovery, Development, and Translation on a third workshop that together reflected the myriad of challenges facing the global community:

- June 21, 22, and 27: [The Role of Plant Agricultural Practices on Development of Antimicrobial Resistant Fungi Affecting Human Health](#) — examined the evidence gap and opportunities for cross-sector coordination to address human activities and environmental drivers and antimicrobial resistance in fungal pathogens.
- October 13 and 14: [Accelerating the Development and Uptake of Rapid Diagnostics to Address Antibiotic Resistance](#) — discussed the current landscape of rapid diagnostics to address antibiotic resistance, challenges and opportunities for spurring innovation, and practical next steps for accelerating the development of new diagnostic tools. Collaboration with the Forum on Drug Discovery, Development, and Translation.
- December 7 and 8: [Applying Lessons Learned from COVID-19 Research and Development to Future Epidemics](#) — reflected on sustaining critical scientific infrastructure for stakeholder coordination and innovations that can facilitate rapid and effective responses to emerging threats.



## PUBLICATIONS

The forum also published three full-length workshop proceedings and two short summaries that captured discussions ranging from operationalizing the One Health approach to prepare for and respond to infectious diseases outbreaks,<sup>4</sup> to the translation of innovations from the COVID-19 pandemic to address tuberculosis,<sup>5</sup> and fundamental lessons learned in organizational responses to the pandemic.<sup>6</sup> The proceedings were widely disseminated, reaching up to more than 5,700 downloads across more than 100 countries.

## FORUM MEMBERSHIP

In all, the forum welcomed 10 new members with expertise in One Health, plant pathology, antimicrobial resistance, microbial ecology, clinical microbiology, clinical epidemiology, and anti-infectives research, among others. Moving into 2023, the forum will rely on the expansive expertise of its members in its continued engagement with various stakeholders to clarify scientific and policy issues surrounding the evolving challenges of microbial threats and strengthen global health security in our increasingly connected world.

<sup>4</sup> Systematizing the One Health Approach in Preparedness and Response Efforts for Infectious Disease Outbreaks, available at <https://nap.nationalacademies.org/catalog/26301>

<sup>5</sup> Innovations for Tackling Tuberculosis in the Time of COVID-19 workshop proceedings, available at <https://nap.nationalacademies.org/catalog/26530> and at <https://nap.nationalacademies.org/catalog/26404>

<sup>6</sup> Toward a Post-Pandemic World: Lessons from COVID-19 for Now and the Future, workshop proceedings available at <https://nap.nationalacademies.org/catalog/26556> and at <https://nap.nationalacademies.org/catalog/26259>



**Workshop planning committee members and speakers engaged in a panel discussion at the Keck Center. Left to right: Elizabeth Hermesen (forum member and workshop committee), Dan Barouch (workshop committee), William Gruber (invited speaker).**

# Reflecting Back

## Forum Activities in 2022

The forum held two public workshops that examined the role of plant agricultural practices in the emergence of drug resistant fungal pathogens and explored how response to future epidemics can learn from the accelerated research and development that emerged from the pandemic.

**June 21–22, 27** | At the workshop, *The Role of Plant Agricultural Practices on Development of Antimicrobial Resistant Fungi Affecting Human Health*, experts from agricultural policy, agrochemical research & development, plant pathology, public health, infectious diseases, and regulatory sectors came together to highlight the increasing concern of invasive fungal infections with limited treatment options in humans, the critical role of fungicides in preserving food safety and security, and current gaps in the understanding and evidence that link fungicide use to emerging resistance in pathogens that can cause invasive fungal infections. The workshop co-chairs and attendees commented on the One Health nature of the issue, given how efforts to address this have to balance considerations for the health of plants and human.

**“This workshop has taken a One Health approach to a serious problem affecting human health that has roots in crop agriculture. Our experts broke through seemingly far-flung silos surrounding plant and human health disciplines to better understand its complexities across food security, food safety and human health.”**

**—Sally Miller**

workshop planning committee co-chair



**Paige Waterman (professor of medicine and vice chair of clinical research at the Uniformed Services University of the Health Sciences; workshop planning committee co-chair) speaking with Tom Chiller (chief, mycotic diseases branch at the CDC; workshop planning committee member) at the June workshop.**



**Jason Newland, professor of pediatrics at Washington University School of Medicine in St. Louis and member of the workshop planning committee, shares a question at the workshop on December 7.**

**December 7–8** | Experts in public health, biomedical, clinical, and social and behavioral sciences gathered for a 1.5-day meeting, *Applying Lessons Learned from COVID-19 Research and Development to Future Epidemics*, to reflect on lessons learned from the accelerated research and development of medical countermeasures during the COVID-19 pandemic. Meeting participants discussed strategies to broaden partnerships in developing new biomedical products, and considered how applied social and behavioral research can help foster trust with the public.

**PUBLICATIONS** | The forum published three full-length workshop proceedings and two brief synopses that summarized public meetings held in 2021. These topics ranged from systematic operationalization of the One Health approach for infectious disease outbreaks, to fundamental lessons in community engagement and mobilization gleaned from the COVID-19 pandemic, and innovative technologies and approaches that can be translated from the COVID-19 response to enhance efforts to end tuberculosis.

These proceedings are a factual chronicle of the presentations and discussions at the workshops.

- [Systematizing the One Health Approach in Preparedness and Response Efforts for Infectious Disease Outbreaks: Proceedings of a Workshop](#)
- [Toward a Post-Pandemic World: Lessons from COVID-19 for Now and the Future: Proceedings of a Workshop](#)
- [Using Syndemic Theory and the Societal Lens to Inform Resilient Recovery from COVID-19](#)
- [Innovations for Tackling Tuberculosis in the Time of COVID-19: Proceedings of a Workshop](#)
- [Innovations for Tackling Tuberculosis in the Time of COVID-19: Current Tools and Challenges](#)

# One Health Action Collaborative



**Gail R. Hansen, D.V.M.,  
M.P.H.**  
OHAC Chair

The One Health Action Collaborative (OHAC) is an ad hoc convening body that fosters information sharing and collaboration among researchers and practitioners in animal, human, and plant health to advance aspects of the One Health approach. OHAC contributes to discourse and thought leadership that promotes the understanding and implementation of a One Health approach in addressing the threat of emerging infectious diseases and improving public health. OHAC has produced peer-reviewed journal articles, discussion papers, and even a podcast episode that aims to reach a wide audience to address a variety of topics, such as workforce development, environmental health, and food systems sustainability.

The group's current objectives revolve around how to address knowledge gaps in the understanding of pathogen spillover and spillback, reviewing best practices in integrating the One Health approach at the state and local level, and incorporating evidence-based research that accounts for different knowledge and value systems into the current One Health framework. Throughout 2022, OHAC cultivated discussions on applying a One Health approach at local and global levels and published a call-to-action for broadening the inclusion of different partners, research frameworks, and scientific worldviews into the One Health approach. Members of the action collaborative also conducted strategizing sessions to refine their goals and identify opportunities for impactful contributions to the current One Health movement and connect to the global health space.

# Ongoing OHAC Activities

## ONE HEALTH WORKERS

A workforce that is trained and skilled in One Health concepts is crucial to the sustainability of this field. Starting in 2021, OHAC members developed a survey to help evaluate the usefulness and benefits from the current One Health education programs and shed light on the unique challenges that One Health workers face. The objectives were to characterize students, recent graduates, workers, and employers in the One Health arena; understand the benefits of One Health education; elucidate challenges that One Health workers face; and assess whether employers are satisfied with the skillsets of employees who have received training in One Health. In 2022, OHAC members finalized a publication (under review) describing results from more than 500 responses received globally.

## OPERATIONALIZING ONE HEALTH

The One Health approach has been gaining traction in the wake of the COVID-19 pandemic as policy- and decision-makers at regional and local levels gained deeper understanding of the multifaceted dimensions of health. However, most guidance for One Health implementation is directed at the national level. Practitioners of One Health understand that local and regional systems are often the first line of defense against emerging health threats and have the potential to address them at the source. Recognizing this gap in guidance at the local and regional levels to operationalize and implement One Health policies and collaborations, including for nongovernmental organizations working in this space, OHAC members are exploring case studies of how One Health has been implemented locally in the United States. These examples can provide valuable lessons learned and inform an operational framework for creating and evaluating their One Health strategies, policies, and practice.

## EVOLUTION AND EXPANSION OF ONE HEALTH

The One Health approach has been effectively used in research, academia, and policy making to address complex health questions at different levels and scopes. While collaboration, communication, and coordination are cornerstones of One Health, the current approach has not explicitly and consistently accounted for the underlying power imbalances and inequities that may exist among stakeholders. It is important to understand that the current approach is based on a narrow worldview associated with histories of colonialism and oppression. There have been some efforts to incorporate ecological and biodiversity considerations and Indigenous People's traditional knowledge systems into One Health conversations. OHAC members recognize this progress and call for broader engagement and support mechanisms to include representation and knowledge from diverse worldviews, disciplines, and knowledge systems.



# One Health Action Collaborative

(AS OF DECEMBER 31, 2022)

**GAIL R. HANSEN, D.V.M., M.P.H. (CHAIR)**

Hansen Consulting, LLC

**KEVIN ANDERSON, PH.D.**

Retired

**CASEY BARTON BEHAVESH, D.V.M., DR.P.H., M.S.**

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**PETER DASZAK, PH.D.**

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**MARY E. WILSON, M.D.**

University of California, San Francisco,  
School of Medicine

\* Views and opinions expressed by Mumford and Togami are their own and do not necessarily reflect the views of the World Health Organization.

# Forum on Microbial Threats Sponsors

(AS OF DECEMBER 31, 2022)

## Federal Agencies

- National Institute of Allergy and Infectious Diseases
- Uniformed Services University of the Health Sciences
- U.S. Agency for International Development
- U.S. Centers for Disease Control and Prevention
- U.S. Department of Veterans Affairs
- U.S. Food and Drug Administration

## Industry

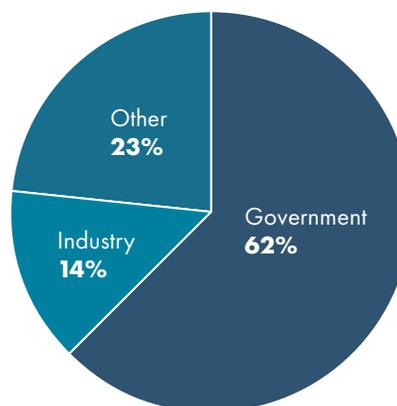
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- American Society of Tropical Medicine and Hygiene
- Infectious Diseases Society of America
- Society of Infectious Diseases Pharmacists

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- Burroughs Wellcome Fund
- EcoHealth Alliance
- ExxonMobil Foundation
- New Venture Fund
- Rockefeller Foundation



# Forum on Microbial Threats

(AS OF DECEMBER 31, 2022)

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EcoHealth Alliance

**KENT E. KESTER, M.D.** (*Vice Chair*)

International AIDS Vaccine Initiative

**EMILY ABRAHAM, DR.P.H.**

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**MATTHEW ZAHN, M.D.**

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Elizabeth Ashby, Associate Program Officer

Claire Biff, Research Assistant

Charles Minicucci, Research Assistant  
(until January 2023)

Justin Hammerberg, Senior Program Assistant  
(until November 2022)

Nicky Kuang, Senior Program Assistant  
(from February 2023)

Julie Liao, Director, Forum on Microbial Threats

Julie Pavlin, Senior Board Director, Board on Global Health

# Timeline of Forum Activities

**1996–2003** | Established in 1996 as the Forum on Emerging Infections, the forum changes its name to the Forum on Microbial Threats and continues to provide a structured opportunity to facilitate discussion and inquiry into the most challenging and complex science, technology, and public policy issues and to foster collaborations across private and public sectors and human, animal, and plant health communities.

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**2003–2013** | Throughout the decade, the forum grappled with diverse issues from antimicrobial resistance and influenza virus vaccines, fungal diseases and the impact of global environmental change on new infectious disease threats, to emerging advances such as tools in big data and discoveries in microbiome research.

## Selected Workshop Highlights (2003–2013)

**2003** | Learning from SARS: Preparing for the Next Disease Outbreak

**2004** | Pandemic Influenza: Assessing Capabilities for Prevention and Response

**2005** | Protecting Against Foodborne Threats to Health: The Practice and Policies of Surveillance, Proactive Prevention, Outbreak Investigations, and International Coordination

**2006** | Ethical and Legal Considerations in Mitigating Pandemic Disease

**2007** | Vector-Borne Diseases: Understanding the Environmental, Human Health, and Ecological Connections

**2008** | Global Issues in Water, Sanitation, and Health

**2009** | Influenza H1N1 Pandemic

**2010** | Antimicrobial Resistance: Implications for Global Health and Novel Intervention Strategies

**2010** | Fungal Diseases: An Emerging Challenge to Human, Animal, and Plant Health

**2011** | Improving Food Safety Through One Health

**2012** | The Social Biology of Microbial Communities

**2012** | The Science and Applications of Microbial Genomics

**2013** | The Influence of Global Environmental Change on Infectious Disease Dynamics

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**2014–2020** | Building on the understanding of fundamental knowledge and tools, the forum continued to host discussions on the broader contexts of preparedness and response to microbial threats, including the economics, social-behavioral, and governance considerations at the interface of human health and infectious diseases.

## Selected Workshop Highlights (2014–2020)

**2014** | Emerging Viral Diseases: The One Health Connection

**2014** | Vector-Borne Diseases: Exploring the Environmental, Ecological, and Health Connections

**2015** | The Ebola Epidemic in West Africa

**2015** | Global Health Risk Framework: Governance for Global Health

**2016** | Big Data and Analytics for Infectious Disease Research, Operations, and Policy

**2016** | Building Communication Capacity to Counter Infectious Disease Threats

**2017** | Combating Antimicrobial Resistance: A One Health Approach to a Global Threat

**2017** | Urbanization and Slums: New Transmission Pathways of Infectious Diseases in the Built Environment

**2018** | Understanding the Economics of Microbial Threats

**2018** | Readiness for Microbial Threats 2030: Exploring Lessons Learned Since the 1918 Influenza Pandemic

**2019** | Breaking Down Silos: The Convergence of Infectious Diseases and Noncommunicable Diseases

**2019** | Exploring the Frontiers of Innovation to Tackle Microbial Threats

**2020** | The Critical Public Health Value of Vaccines: Tackling Issues of Access and Hesitancy

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**2021–present** | The ongoing COVID-19 pandemic reinforces the value of a dedicated, cross-disciplinary platform for expert engagement and leadership that helps to identify research priorities and strategies to strengthen global health security for all in a connected world. Examples include examining the role of plant agricultural practices on the emergence of drug resistant fungal pathogens for human health, and the future of the accelerated research and development response that emerged from the pandemic.

#### **Selected Workshop Highlights (2021–present)**

**2021** | Systematizing the One Health Approach in Preparedness and Response Efforts for Infectious Disease Outbreaks

**2021** | Towards a Post-Pandemic World: Lessons from COVID-19 for Now and the Future: A Virtual Workshop

**2021** | Innovations for Tackling Tuberculosis in the Time of COVID-19

**2022** | The Role of Agricultural Practices on Development of Antimicrobial Resistant Microbes Affecting Human Health

**2022** | Applying Lessons Learned from COVID-19 Research and Development to Future Epidemics

# NATIONAL ACADEMIES

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The Health and Medicine Division (HMD), formerly known as the program unit of the Institute of Medicine, is a division of the National Academies. HMD's aim is to help those in government and the private sector make informed health decisions by providing evidence on which they can rely. Each year, more than 3,000 individuals volunteer their time, knowledge, and expertise to advance the nation's health through the work of HMD.

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