Assessing and Navigating Biosecurity Concerns and Benefits of Artificial Intelligence Use in the Life Sciences

Committee

Michael J. Imperiale

Co-Chair

Michael Imperiale is the Arthur F. Thurnau Professor Emeritus in the Department of Microbiology and Immunology at the University of Michigan. He previously served as Associate Vice President for Research – Research Policy and Compliance from 2017 to 2022 and as an Editor of the Journal of Virology, PLoS Pathogens, and mBio. He is currently Founding Editor-in-Chief of mSphere. Imperiale's research interests focused on the study of DNA tumor viruses. He was an inaugural member of the National Science Advisory Board for Biosecurity from 2005 to 2014; served on the Planetary Protection Subcommittee at NASA; and was a member of the Board of Directors of the Van Andel Institute Graduate School. In 2009, he was the recipient of the University of Michigan Distinguished Faculty Achievement Award and in 2016 he received the Rackham Distinguished Graduate Mentor Award. He was elected as a Fellow of the American Academy of Microbiology in 2010 and as a Fellow of the American Association for the Advancement of Science in 2011. Imperiale received a Ph.D. in biological sciences from Columbia University. He previously served as the chair of the National Academies Committee on Strategies for Identifying and Addressing Potential Biodefense Vulnerabilities Posed by Synthetic Biology and as a member of the Committee on Science, Technology, and Law.

Imperiale published an article in OECD Library in 2022 titled, "Integrity and security in the global research ecosystem," in which he and his co-authors describe policy initiatives to safeguard national and economic security and briefly summarized initiatives relevant to artificial intelligence.

Lynda M. Stuart

Co-Chair

Lynda Stuart is the Executive Director of the Institute for Protein Design and acting Professor in Biochemistry at the University of Washington School of Medicine. As a physician scientist with over 20 years of experience in immunology, global health, and product development she directs translational research and corporate and foundation collaborations, transforming laboratory breakthroughs into real-world impact. As Deputy Director of the Gates Foundation from 2013 to 2022, Stuart oversaw the pre-clinical development of vaccines, including mRNA vaccines, and antibody therapies to address urgent global health challenges. In the wake of Ebola, she contributed to the conceptualization of “just-in-time” platform approaches for pandemic responses. From 2020 to 2022 she led the Foundation’s COVID-19 discovery and translational vaccine response efforts. After leaving the Gates Foundation, Stuart spent one year as the Vice President of Infectious Disease at the mRNA company BioNTech.

Stuart is a Fellow of the American Society for Clinical Investigation. She also currently serves on the Scientific Advisory Committee of CEPI (Coalition for Epidemic Preparedness and Innovation) and is a member of the Scientific Technical Expert Group for the International Pandemic Preparedness Secretariat supporting the 100 Days Mission. Stuart received a Ph.D. in immunology from the University of Edinburgh and M.D. from the University of London.

Stuart published a 2024 article titled, “Community Values, Guiding Principles, and Commitments for the Responsible Development of AI for Protein Design,” in which she and her co-authors propose a set of values and principles to guide the responsible development of AI in the field of protein design.

Patrick M. Boyle

Member

Patrick Boyle is the Chief Scientific Officer at Ginkgo Bioworks, the leading horizontal platform for cell programming, providing flexible, end-to-end bioengineering services for organizations across diverse markets, from food and agriculture to pharmaceuticals to industrial and specialty chemicals. Over the past twelve years, Patrick has worked on Ginkgo's core microbial technologies at the intersection of biology, computation, and data. Ginkgo helps hundreds of companies to leverage software, robotics, and novel biological assets to bring new products to market. Dr. Boyle serves as a technical advisor to Social Impact, which is a small venture capital firm, investing in biotechnology and deeptech companies. Patrick was a 2014 fellow in the Johns Hopkins University Center for Health Security's Emerging Leaders in Biosecurity Program, a member of Schmidt Futures' Task Force on Synthetic Biology and the Bioeconomy, a member of the American Society for Microbiology's Climate Change Task Force, and is an advisor to Social Impact Capital. Patrick currently serves on the Board of Life Sciences for the National Academies of Sciences, Engineering, and Medicine (NASEM). Patrick has previously worked on two consensus studies for NASEM: "Biodefense in the Age of Synthetic Biology" (2018) and "Safeguarding the Bioeconomy" (2020). Prior to Ginkgo, Patrick received a PhD from Harvard Medical School in 2012, where he developed synthetic biology applications in bacteria, yeast, and plants in the lab of Dr. Pamela Silver. He received an SB in biology from the Massachusetts Institute of Technology in 2006.

Boyle has presented at several conferences on the use of automation to generate biological data for the training of AI models for biology and the implications of AI in biology.

Kjiersten M. Fagnan

Member

Kjiersten Fagnan is currently the Chief Informatics Officer of the Department of Energy Joint Genome Institute (JGI), a national user facility responsible for generating petabytes of environmental genomics data deposited into national repositories. She contributed to the development and establishment of JGI's data management system that has been in production for over 10 years. She also supported the team that built the biosecurity screening software for the first version of JGI's DNA synthesis platform that ensures JGI does not construct any pathogens on behalf of users. Additionally, she was part of the ACM Gordon Bell winning team in 2018 for the paper "Attacking the Opiod Epidemic: Determining the epistatic and pleiotropic genetic architectures for chronic pain and opioid addiction" that used high-performance computing infrastructure to synthesize and aggregate large omics data volumes. Fagnan received a Ph.D. in applied mathematics from the University of Washington.

Fagnan published a report in the DOE Office of Scientific and Technical Information in 2019 titled, "A Framework for Advancing AI in Science," in which her and her co-authors outlined discussions at a roundtable on enhancing access to research data and computing resources for AI research and development.

Gigi K. Gronvall

Member

Gigi Kwik Gronvall is an Associate Professor in the Department of Environmental Health and Engineering and a Senior Scholar at the Center for Health Security in the Johns Hopkins Bloomberg School of Public Health. An immunologist by training, she leads work to advance biosecurity, biosafety, pandemic preparedness, and the bioeconomy. Gronvall is the author of Synthetic Biology: Safety, Security, and Promise (2016) and Preparing for Bioterrorism: The Alfred P. Sloan Foundation's Leadership in Biosecurity (2012). She is a member of the Department of State's International Security Advisory Board, the Novel and Exceptional Technology and Research Advisory Committee (NExTRAC), and co-chair of the BioMADE Safety, Security, Sustainability and Social Responsibility (4S) Committee. Gronvall received a Ph.D. from Johns Hopkins University and was a National Research Council Postdoctoral Associate at the U.S. Army Medical Research Institute of Infectious Diseases in Fort Detrick, Maryland. She currently serves on the National Academies Forum on Microbial Threats and was previously a member of Committee on Strategies for Identifying and Addressing Potential Biodefense Vulnerabilities Posed by Synthetic Biology.

Gronvall served as an expert research participant to OpenAI, March 24-April 2, 2024.

Heidi Howard

Member

Heidi Howard is currently an Associate Professor at University College Cork, Ireland, and Bioethicist at Google DeepMind; she heads the chemical, biological, radiological/nuclear (CBRN) evaluations for large language models (LLMs). She is also an active member of the European Society of Human Genetics Policy and Ethics Committee. Since 2008 she has been studying the ethical, legal, and social aspects (ELSA) of emerging technologies in biomedicine. A large focus of Howard's work has been on genetics/genomics and data, including the model of provision direct-to-consumer, public health genomics, personalized medicine, and new technologies such a next-generation sequencing, gene editing, data-driven life sciences and AI. Howard received a Ph.D. in molecular genetics from McGill University and an M.Sc in bioethics from KU Leuven.

Ethan Jackson

Member

Ethan Jackson is Senior Director and Senior Principal Researcher at Microsoft where he leads Microsoft Premonition, Microsoft's AI platform for biosecurity and bio-intelligence, and manages an interdisciplinary team of researchers, engineers, and scientists. Dr. Jackson previously was lead author of Microsoft’s response to the AI Executive Order regarding topics on AI and biothreats and regularly engages the Executive Branch and Congress as a subject matter expert. He is the Chief Science Officer for the “Computing the Biome” program focusing on domestic biosecurity – one of the top programs at NSF’s Convergence Accelerator. In addition, his work extends to broader robustness of cyber-physical systems, which has been applied to harden essential parts of the Windows Operating System, develop aspects of the HoloLens augmented reality platform, and implement key protocols in Microsoft’s Cloud platform. He works at the intersection of technology, biology, and security, having managed programs with GSK, BMGF, Welcomme Trust, and directed the introduction of biosensing into Microsoft’s own data centers. Dr. Jackson’s program won Fast Company’s World Changing Ideas Award in 2021. He holds a Ph.D. in computer science from Vanderbilt University and a BS in computer engineering from University of Pittsburgh.

Suman Jana

Member

Suman Jana is an associate professor in the department of computer science and the data science institute at Columbia University. His primary research interest is at the intersection of computer security and machine learning. Jana works on building automated tools for fixing and finding privacy and security vulnerabilities in large real-world systems. His research has led to fixing and reporting of about 250 high-impact security vulnerabilities across a diverse range of popular software. Several open-source software including Apache Cordova, Mozilla Firefox, and cURL have incorporated his research software. His research has received seven best paper awards, a CACM research highlight, a Google faculty fellowship, a JPMorgan Chase Faculty Research Award, an NSF CAREER award, and an ARO young investigator award. Jana received an M.S. in computer science from the University of Utah and a Ph.D. in computer science from the University of Texas, Austin.

Jens H. Kuhn

Member

Jens H. Kuhn is a Principal at Tunnell Government Services tasked as one of two Principal Scientists and the Director of Virology (Contractor) at the National Institutes of Health/National Institute of Allergy and Infection Diseases/Division of Clinical Research/Integrated Research Facility at Fort Detrick, a biosafety level 4 facility. He was the first western scientist permitted to work in a former Soviet biological warfare facility, the State Research Center of Virology and Biotechnology "Vektor" in Siberia, Russia, within the U.S. Department of Defense's Cooperative Threat Reduction (CTR) Program. Kuhn specializes in pathogenesis of and medical countermeasures against highly virulent viral pathogens. He contributed to the Center for International and Security Studies at Maryland's Controlling Dangerous Pathogens Project and recently was a Taskforce Member of the Bulletin of the Atomic Scientists' Pathogens Project—Creating the Framework for Tomorrow's Pathogen Research. He has authored "Filoviruses: A Compendium of 40 Years of Epidemiological, Clinical, and Laboratory Studies" (2008) and co-authored "The Soviet Biological Weapons Program—A History" (2012). Kuhn received a Ph.D. in biochemistry and a Ph.D. in medical sciences from Freie Universität Berlin and an M.D. in human medicine from Universitätsmedizin Berlin, Germany. He previously served on the National Academies Committee on Animal Models for Assessing Countermeasures to Bioterrorism Agents.

Bradley A. Malin

Member

Bradley Malin is the Accenture Professor of Biomedical Informatics, Biostatistics, and Computer Science at Vanderbilt University and the Vice Chair for Research Affairs in the Department of Biomedical Informatics at Vanderbilt University Medical Center. He is the co-founder and co-director of the AI Discovery and Vigilance to Accelerate Innovation and Clinical Excellence (ADVANCE) Center at Vanderbilt. He is also one of the principal investigators of the National Institutes of Health's (NIH) Bridge2AI Center and the Infrastructure Core of the NIH's AIM-AHEAD program. His research is in the development and implementation of computational technologies to facilitate the collection, sharing, and automated analysis of biomedical data in a socially responsible manner. Malin is also a consultant to Microsoft for the development of data privacy technologies. He is an elected fellow of the National Academy of Medicine (NAM), the Institute of Electrical and Electronics Engineers (IEEE), the American Institute for Medical and Biological Engineering (AIMBE), the American College of Medical Informatics (ACMI), and the International Academy of Health Sciences Informatics (IAHSI). Malin received an M.Phil. in public policy and management from Carnegie Mellon University where he also received a Ph.D. in computer science. He previously served on eight National Academies committees as a member and 1 as a chair, notably AI for Scientific Discovery: Toward an International Grand Challenge - A Workshop which investigated the future role of AI in scientific discovery.

Amarda Shehu

Member

Amarda Shehu is a Professor of Computer Science in the College of Engineering and Computing at George Mason University, where she is also an Associate Dean for AI Innovation, Associate Vice Provost for Research for the Institute for Digital Innovation, and Mason representative in the National Institute of Standards and Technology AI Safety Institute Consortium. Shehu served as an NSF Program Director in the Directorate for Computer and Information Science and Engineering (CISE) from 2019 to 2022, where she led the National Science Foundation (NSF)-wide working group on the Harnessing the Data Revolution: Data Science Corps program and led CISE efforts in the COVID-19 RAPID Program and the Molecular Foundations in Biotechnology Program. Previously an NIH Predoctoral Fellow in the Nanobiology Program at Rice University, Shehu's research advances foundational and use-inspired AI research to enable and advance scientific discovery. Her laboratory has made significant advances at the intersection of AI, generative AI, and molecular biology. She is a 2022 Fellow of the American Institute for Medical and Biological Engineering and has received several awards, including the 2022 Outstanding Faculty Award from the State Council of Higher Education for Virginia, the 2012 NSF CAREER Award, and two Director Recognition award for her work at NSF. Shehu received a Ph.D. and M.S. in computer science from Rice University.

Alexander J. Titus

Member

Alexander Titus is Vice President, Artificial Intelligence & Machine Learning at Avidity Biosciences, Inc. and a Principal Scientist with the University of Southern California's (USC) Information Sciences Institute and Research Faculty at USC's Iovine and Young Academy. Previously, he was the Vice President of Strategy and Computational Sciences at Colossal Biosciences, where he led strategic projects across the organization, and his team worked cross-functionally to provide AI/ML and genotype-to-phenotype analyses to make de-extinction a reality. Titus joined Colossal from Google Cloud, where his work as a strategic business executive included leading AI/ML and life sciences solution work for the global public sector. Previously, he was the inaugural Assistant Director (now called Principal Director) for Biotechnology within the Office of the Chief Technology Officer at the Department of Defense (DoD), where he led the team developing the DoD's roadmap toward biotechnology modernization. Titus received a Ph.D. in Quantitative Biomedical Sciences from Dartmouth College and a B.S. and B.A. in biochemistry and biology, respectively, from the University of Puget Sound.

Titus is a member of the National Security Commission on Emerging Biotechnologies. He has also provided a written statement to the U.S. Senate AI Insight Forum in 2023 titled, "Risk, Alignment, & Guarding Against Doomsday Scenarios." He published a preprint article on arXiv in 2023 titled, "The Promise and Peril of Artificial Intelligence -- Violet Teaming Offers a Balanced Path Forward," in which he and his co-author review emerging issues with opaque and uncontrollable AI systems and propose an integrative framework called violet teaming to develop reliable and responsible AI.