The National Academies of
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Protecting Critical Technologies for National Security in an Era of Openness and Competition
Meeting #3

Workshop on Synthetic Biology
Speaker Biographies
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Patrick Boyle is the Head of Codebase at Ginkgo Bioworks, a Boston-based synthetic biology company that makes and sells engineered organisms. The Codebase team leads Ginkgo's customer facing programs and develops the company's "Codebase" portfolio of reusable biological assets. Ginkgo's Codebase includes thousands of novel strains, enzymes, genetic parts and diverse genetic repositories, including millions of engineered DNA sequences. During the COVID-19 pandemic, Patrick has been responsible for coordinating Ginkgo's COVID response programs, including a commitment of $25M to accelerate technical partnerships. This effort launched the Concentric by Ginkgo testing platform, which is providing workplace and classroom testing for COVID-19. It has also included numerous partnerships in therapeutics and vaccines, including a program to optimize the manufacturing of vaccine raw materials with Moderna. Prior to Ginkgo, Patrick received his PhD from Harvard Medical School in 2012, developing 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.

Diane DiEuliis is a Senior Research fellow at National Defense University. Her research areas focus on emerging biological technologies, biodefense, and preparedness for biothreats. Specific topic areas under this broad research portfolio include dual-use life sciences research, synthetic biology, the US bioeconomy, disaster recovery, and behavioral, cognitive, and social science as it relates to important aspects of deterrence. Dr. DiEuliis currently has several research grants in progress, and teaches in foundational professional military education.

Prior to joining NDU, Dr. DiEuliis was Deputy Director for Policy, and served as Deputy Assistant Secretary for Policy and Planning in the Office of the Assistant Secretary for Preparedness and Response (ASPR), Department of Health and Human Services. From to 2007 to 2011, Dr. DiEuliis was the Assistant Director for Life Sciences and Behavioral and Social Sciences in the Office of Science and Technology Policy (OSTP) in the Executive Office of the President. Prior to working at OSTP, Dr. DiEuliis was a program director at the National Institutes of Health (NIH), where she managed a diverse portfolio of neuroscience research in neurodegenerative diseases.

Dr. DiEuliis is a National Merit Scholar, and has a PhD in biology from the University of Delaware in Newark, Delaware. She is the author of over 70 publications.

Andrew Ellington received his B.S. in Biochemistry from Michigan State University in 1981, and his Ph.D. in Biochemistry and Molecular Biology from Harvard in 1988. His post-doctoral work was with Dr. Jack Szostak at Massachusetts General Hospital, where he developed methods for the *in vitro* selection of functional nucleic acids and coined the term 'aptamer.' He originally received the Office of Naval Research Young Investigator, Cottrell, and Pew Scholar awards, and later was a Vannevar Bush Faculty Fellow of the DoD and a Howard Hughes Professor. Dr. Ellington's lab works centers on the development of nucleic acid circuitry for point-of-care diagnostics, on accelerating the evolution of proteins and cells through the introduction of novel chemistries, and using orthogonal control systems to engineer complex organisms.

Drew Endy is a bioengineering professor at Stanford who studies synthetic biology. His goals are to enable civilization-scale flourishing and a renewal of liberal democracy. Prof. Endy helped launch new undergraduate majors in bioengineering at both MIT and Stanford, and also the iGEM competition, a global genetic-engineering "Olympics" enabling thousands of students annually. His past students now lead companies like Ginkgo Bioworks and Octant. He is married to Christina Smolke, CEO of Antheia, the essential medicine company. Endy served on the US National Science Advisory Board for Biosecurity (NSABB), the Committee on Science, Technology, & Law (CSTL), and the Pentagon's Defense Innovation Board (DIB). He currently serves on the World Health Organization's (WHO) Smallpox Advisory Committee and the International Union for the Conservation of Nature's (IUCN) Synthetic Biology Task Force. Esquire magazine recognized Drew as one of the 75 most influential people of the 21st century.

Steven L. Evans is a retire Research Fellow, formerly at Dow AgroSciences. He is currently interim Chief Technology Officer at BioMADE.org, a Manufacturing USA institute dedicated to innovation in bio-industrial manufacturing. Dr. Evans has 30 years experience in Discovery R&D, biotechnology regulatory and commercialization of crop traits and biological and biochemical pesticides. For the past thirteen years he has worked to advance the field of synthetic biology in public-private partnerships. He served in industrial leadership on the NSF Engineering Research Center (SynBERC) and is currently on the leadership team of the successor non-profit Engineering Biology Research Consortium (EBRC) in Emeryville, California. He co-chaired the BIO Synthetic Biology working group and remains involved in technology and policy implications of advanced technologies applied to agriculture, including environmental release, biosafety and biosecurity, and the UN-CBD assessment of synthetic biology. As part of Dow AgroSciences, Dr. Evans has been involved in development of several plant traits leading to the Herculex™ product line, in capability development in bioanalytical sciences, and in enabling the EXZACT™ Zinc Finger technology. Dr. Evans served on the 2016 NAS Preparing for Future Products of Biotechnology committee.

Richard Kitney is Professor of Biomedical Systems Engineering and Co-Director and Co-Founder of the Imperial College Centre for Synthetic Biology and Innovation. He is a Fellow of The Royal Academy of Engineering and Chaired the Academy's Inquiry into Synthetic Biology - and is a member of the UK's Ministerial Leadership Council for Synthetic Biology. Kitney (with Professor Paul Freemont) has been responsible for developing the Imperial College Synthetic Biology Hub. In 2013 they won the

competition to establish the UK's national industrial translation centre for synthetic biology - SynbiCITE. The centre interacts with and supports around 80 UK start-ups and SMEs in the field of synthetic biology/engineering biology. Kitney has considerable business experience, particularly in relation to start-ups and SMEs. He is the Co-founder and Chairman of Visbion Ltd – a medical imaging and biomedical information systems company, with over 1000 installations in 10 countries.

Kitney has published over 300 papers in the fields of synthetic biology, mathematical modelling, biomedical information systems, and medical imaging and has worked extensively in and with industry. He was an author of both of the UK Government's Roadmaps for synthetic biology. Kitney is also a Fellow of AIMBE, the America Academy of Biomedical Engineering.

Dave Rejeski is a Visiting Scholar at the Environmental Law Institute. He currently helps manage a program, funded by the Alfred P. Sloan Foundation, to support interdisciplinary research on the energy and environmental implications of the digital economy, with a focus on blockchain technologies, artificial intelligence, and sharing platforms. He served for over a decade as director of the Science, Technology and Innovation Program at the Woodrow Wilson Center, where his work focused on understanding emerging technologies, their underlying innovation ecosystems, as well as their impacts and implications for public policy and governance. Study areas included synthetic biology, nanotechnology, and additive manufacturing. Prior to the Wilson Center, he worked at the White House Office of Science and Technology Policy (OSTP), the Council on Environmental Quality (CEQ) and the Environmental Protection Agency (Office of Policy, Planning and Evaluation).

He is a Fellow of the National Academy of Public Administration (NAPA), a board member of American University's Center on Environmental Policy, and was recently part of a study conducted by the National Academies of Science, Engineering and Medicine on the future of biotechnology. He has also served on EPA's National Advisory Council for Environmental Policy and Technology (NACEPT), EPA's Science Advisory Board (SAB), the National Science Foundation's (NSF) Advisory Committee for Environmental Research and Education, and was a Visiting Fellow at the International Institute of Applied Systems Analysis (IIASA) in Austria. He has graduate degrees in public administration and environmental design from Harvard and Yale universities.

Mostafa Ronaghi is a scientist-entrepreneur, inventor, investor, company-founder, executive and director. Most recently, he was Chief Technology Officer, Senior Vice President and member of the Executive Committee at Illumina (Nasdaq: ILMN) from 2008 to 2021. While at Illumina Dr. Ronaghi started Illumina's Research & Technology Development group and developed/launched 11 sequencing platforms. In 2016, Dr. Ronaghi co-founded GRAIL, a next-gen liquid biopsy platform for cancer detection. He also co-founded the Illumina Accelerator Program in 2014, one of the most successful accelerator programs in the industry, which coached and invested in more than 50 start-ups, achieving one of the highest success rates for securing external institutional funding.

Prior to Illumina, Dr. Ronaghi was Principal Investigator at the Stanford Genome Technology Center from 1999 to 2008. Throughout his prolific career, Dr. Ronaghi co-founded several other companies, including

Pyrosequencing AB (founded in 1997; IPO in 2000 in Stockholm), focused on sequencing-by-synthesis technology (which was the first next-gen sequencing technology, and laid the groundwork for the leading technology developed by Illumina). He then co-founded ParAllele Biosciences in 2001, which was acquired by Affymetrix in 2005, which developed a first-of-its-kind technology for highly multiplex genotyping (used by the international Hapmap project to identify genetic variations across different population and diseases). He co-founded NextBio in 2004 (acquired by Illumina in 2013), where he developed a software platform to analyze molecular biological data. He also co-founded Avantome in 2008 (acquired by Illumina in 2008), as a low-cost DNA sequencer to democratize sequencing. He has advised and invested in more than 70 companies and is an inventor on over 30 issued and pending patents, as well as authored more than 80 scientific publications. He currently serves as a Board member at GRAIL, Seer (Nasdaq: SEER), 1Health, Clearlabs, and three other private companies. Dr. Ronaghi holds a PhD in Biotechnology from Royal Institute of Technology, Stockholm, and B.Sc in Biomedical Chemistry, University of Kalmar, Sweden.

Pamela Silver is the Adams Professor of Biochemistry and Systems Biology at Harvard Medical School and the Wyss Institute for Biologically Inspired Engineering. She received her BS in Chemistry and PhD in Biochemistry from the University of California. Her work has been recognized by an Established Investigator of the American Heart Association, a Research Scholar of the March of Dimes, an NSF Presidential Young Investigator Award, Claudia Adams Barr Investigator, an NIH MERIT award, the Philosophical Society Lecture, a Fellow of the Radcliffe Institute, and election to the American Academy of Arts and Sciences. She is among the top global influencers in Synthetic Biology and her work was named one of the top 10 breakthroughs by the World Economic Forum. She serves on the board of the Internationally Genetics Engineering Machines (iGEM) Competition and is member of the National Science Advisory Board for Biosecurity. She has led numerous projects for ARPA-E, iARPA and DARPA. She is the co-founder of several Biotech companies including most recently KulaBio and serves on numerous public and private advisory boards.

David R. Walt is the Hansjörg Wyss Professor of Bioinspired Engineering at Harvard Medical School and Professor of Pathology at Harvard Medical School and Brigham and Women's Hospital, is a Core Faculty Member of the Wyss Institute at Harvard University, Associate Member at the Broad Institute, and is a Howard Hughes Medical Institute Professor. Dr. Walt is co-Director of the Mass General Brigham Center for COVID Innovation. Dr. Walt is the Scientific Founder of Illumina Inc., Quanterix Corp., and has co-founded several other life sciences startups including Ultivue, Inc., Arbor Biotechnologies, Sherlock Biosciences, and Vizgen, Inc. He has received numerous national and international awards and honors for his fundamental and applied work in the field of optical microwell arrays and single molecules. He is a member of the National Academy of Engineering, the National Academy of Medicine, a Fellow of the American Academy of Arts and Sciences, a Fellow of the American Institute for Medical and Biological Engineering, a Fellow of the American Association for the Advancement of Science, a Fellow of the National Academy of Inventors, and is inducted in the US National Inventors Hall of Fame.