IDENTIFYING AND UNDERSTANDING

EMERGING BREAKTHROUGHS

IN SCIENCE AND TECHNOLOGY

THURSDAY, NOVEMBER 3, 2016 FROM 9:00AM - 4:00PM

NATIONAL ACADEMY OF SCIENCES, 2101 CONSTITUTION AVE., N.W., WASHINGTON, D.C.

Throughout history, breakthroughs in science and technology have had far reaching and often unforeseen impacts across the spectrum of human activity. Please join us for an exploration of the science and art of identifying emerging breakthroughs in science and technology, and assessing their social, political, economic, and security implications.

0900	**Opening Remarks and Panelist Introductions**
0915	**Panel Discussion with Audience Q&A** **Moderator: Dr. Bernard Meyerson**, Chief Innovation Officer, IBM **Ms. Mariette DiChristina**, Editor in Chief, Scientific American **The Honorable Zachary J. Lemnios,** VP Research Strategy and Worldwide Operations, IBM **Ms. Deborah Westphal**, CEO, Toffler Associates
1130	**Break for Lunch** Lunch will be available for purchase in the NAS cafeteria
1300	**Prof. Neil Gershenfeld, MIT** From Bits to Atoms
1400	**Dr. Bernard Meyerson, IBM** Creating Institutional DNA Supporting Innovation
1500	**Prof. Steven Salzberg, Johns Hopkins University** Metagenomic DNA Sequencing to Detect and Diagnose Infections
1600	**Adjourn**

This unclassified colloquium is sponsored by the Office of the Director of National Intelligence and is being organized in association with the National Academies of Sciences, Engineering, and Medicine. For questions about future colloquia, please contact Mitch Mellen at mitchbm@dni.gov or Dionna Ali at dali@nas.edu.

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SPEAKER BIOGRAPHIES

Moderator: Dr. Bernard S. Meyerson, an IBM fellow, serves as IBM's chief innovation officer, driving technical strategy and corporate initiatives within IBM's Corporate Strategy Organization. In 1980, Dr. Meyerson joined IBM Research, leading the development of high-performance silicon:germanium communications technology. He founded and led IBM's highly successful Analog and Mixed Signal business, ultimately leading IBM's global semiconductor development. In 2006, he assumed leadership of strategic alliances for the Systems and Technology Group. In 2010, he was appointed IBM Corporation's chief innovation officer, integrating his team into IBM's Corporate Strategy function, now responsible for the definition and execution of corporate-wide technical and business initiatives. Dr. Meyerson is a fellow of the American Physical Society (APS), IEEE, and a member of the NAE. His technical and business awards include the following: the Materials Research Society Medal, the Electrochemical Society Electronics Division Award, the IEEE Ernst Weber Award, the Electron Devices Society J.J. Ebers Award, the 2007 Lifetime Achievement Award from SEMI, and the 2011 Pake Prize of the APS (recognizing his combined original scientific research and subsequent business leadership). In 2014, Dr. Meyerson was honored by selection to present the Turing Lectures at the Royal Institute in London and the Universities of Cardiff, Manchester, and Edinburgh. More recently, Singapore's president honored Dr. Meyerson's service to the nation with Singapore's 2014 Public Service Medal. Most recently, in accepting a global pro-bono role, Dr. Meyerson was appointed chairman of the Meta-Council on Emerging Technologies for the World Economic Forum. In that role, he leads a diverse global team of industry, government, and university experts, the mission being the vetting and consolidation of inputs from 20 Global Agenda Councils of all major emergent technologies for presentation at the Davos meeting of the forum. He holds a Ph.D. in physics from the City University of New York.

Ms. Mariette DiChristina is the eighth Editor-in-Chief in the 171-year history of Scientific American, and the first woman to assume the role; she is also Director of Editorial & Publishing, Magazines, for Nature Research. A science journalist for more than 20 years, she received a Folio Top Women in Media Award in 2014 and was named an American Association for the Advancement of Science Fellow in 2011 for her work in science communication. She was the Vice-Chair (2014-2016) for the Meta-Council on Emerging Technologies, part of the World Economic Forum's Global Agenda Councils. She was also the president (in 2009 and 2010) of the 2,500-member National Association of Science Writers. She was a Visiting Scholar (2014 and 2015) and an adjunct professor in the graduate Science, Health and Environmental Reporting program at New York University for the several years.

The Honorable Zachary J. Lemnios is responsible for the formation and execution of the IBM Research strategy and operations across IBM's twelve global laboratories and network of collaboratories. Working across IBM, Mr. Lemnios drives the long-term research agenda including the execution of the major IBM research investments, grand challenges, big bets and strategic initiatives. In addition, Mr. Lemnios leads the Global Technology Outlook, the strategic assessment and recommendations used by IBM's CEO and Senior Vice Presidents annually to identify and leverage technology disruptions to shape the corporation's strategic vectors. Prior to joining IBM, Mr. Lemnios was the Chief Technology Officer of MIT Lincoln Laboratory and served three terms in high level civilian leadership in the Department of Defense with detailed and extended interactions across the whole of US government and with leaders across US allied nations. Mr. Lemnios was confirmed as The Honorable Assistant Secretary of Defense (Research & Engineering) by the United States Senate. In this position, Mr. Lemnios was the Chief Technology Officer for Department of Defense and shaped the Department's technical strategy to support the President's national security objectives and the Secretary's priorities. He launched Department and international initiatives in large data analytics, decision support, engineering education, electronic warfare, cyber, autonomy, advanced propulsion, hypersonics, and rail gun concepts as future capabilities for the nation. Mr. Lemnios received his BSEE from the University of Michigan and his MSEE from Washington University in St. Louis. He has served on numerous national security, industry and academic committees. He has authored over 40 papers, holds 4 patents in advanced GaAs de-

vice and MMIC technology and is a Fellow of the IEEE. Mr. Lemnios received special recognition from the Australian Government Department of Defence and was awarded Office of Secretary of Defense Medal for Exceptional Public Service and the Office of Secretary of Defense Medal for Outstanding Public Service.

Ms. Deborah Westphal is CEO of Toffler Associates. As CEO of Toffler Associates, Deborah brings skills and insights honed over 30 years working with some of the top minds and leaders of governments and Fortune 100 companies. She was recruited by Alvin Toffler early in the company's history, while working with the firm as Deputy Director, Developmental Planning for the U.S. Air Force. In this civilian role, Deborah helped connect global dots signifying future risks, and architected plans to meet those threats. Deborah has an MBA from Webster University and a BS in Electrical Engineering from the University of New Mexico, and has completed extensive continuing education with Harvard Business School and Wharton Business School. She is also a member of the Air Force Studies Board, National Academies of Sciences, Engineering, and Medicine. Deborah is a sought-after speaker for events focusing on the future of space, the future threats and opportunity landscape, and organizational transformation.

Prof. Neil Gershenfeld is the Director of MIT's Center for Bits and Atoms. His unique laboratory is breaking down boundaries between the digital and physical worlds, from creating molecular quantum computers to virtuosic musical instruments. Technology from his lab has been seen and used in settings including New York's Museum of Modern Art and rural Indian villages, the White House and the World Economic Forum, inner-city community centers and automobile safety systems, Las Vegas shows and Sami herds. He is the author of numerous technical publications, patents, and books including Fab, When Things Start To Think, The Nature of Mathematical Modeling, and The Physics of Information Technology, and has been featured in media such as The New York Times, The Economist, NPR, CNN, and PBS. He is a Fellow of the American Physical Society, has been named one of Scientific American's 50 leaders in science and technology, as one of 40 Modern-Day Leonardos by the Museum of Science and Industry, one of Popular Mechanic's 25 Makers, has been selected as a CNN/Time/Fortune Principal Voice, and by Prospect/Foreign Policy as one of the top 100 public intellectuals. Dr. Gershenfeld has a BA in Physics with High Honors from Swarthmore College, a Ph.D. in Applied Physics from Cornell University, honorary doctorates from Swarthmore College, Strathclyde University and the University of Antwerp, was a Junior Fellow of the Harvard University Society of Fellows, and a member of the research staff at Bell Labs.

Prof. Steven Salzberg is a Bloomberg Distinguished Professor of Biomedical Engineering, Computer Science, and Biostatistics, and is the Director of the Center for Computational Biology in the McKusick-Nathans Institute of Genetic Medicine at Johns Hopkins University. From 2005-2011, he was the Director of the Center for Bioinformatics and Computational Biology (CBCB) and the Horvitz Professor of Computer Science at the University of Maryland, College Park. From 1997-2005 he was Senior Director of Bioinformatics at The Institute for Genomic Research (TIGR) in Rockville, Maryland, one of the world's leading DNA sequencing centers at the time. Dr. Salzberg received his B.A., M.S., and M.Phil. degrees from Yale University, and his Ph.D. from Harvard University. He has authored or co-authored over 250 scientific publications, and his h-index is 118. Salzberg's laboratory focuses primarily on three areas: genome sequence assembly, transcriptome alignment and assembly, and metagenomics. His lab's open-source software systems for DNA sequence analysis are used by thousands of labs around the world. Salzberg also writes a popular science blog at Forbes, http://www.forbes.com/sites/stevensalzberg.

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