

# MIT Industrial Liaison Program Faculty Knowledgebase Report

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Launch of SENSE.nano: MIT.nano's First Center of Excellence

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May 25, 2017 8:00 am - 7:00 pm

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8:00am

Registration

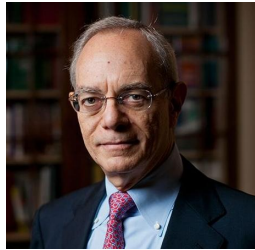
8:30am

Welcome

L. Rafael Reif

MIT President Emeritus

Ray and Maria Stata Professor, [MIT Electrical Engineering and Computer Science \(EECS\)](#)



L. Rafael Reif

MIT President Emeritus

Ray and Maria Stata Professor, [MIT Electrical Engineering and Computer Science \(EECS\)](#)

Rafael Reif served as the 17th President of the Massachusetts Institute of Technology (MIT) between July 2012 and January 2023, where he led MIT's pioneering efforts to help shape the future of higher education. A champion for both fundamental science and MIT's signature style of interdisciplinary, problem-centered research, he is also pursuing an aggressive agenda to encourage innovation and entrepreneurship.

In education, his central focus has been the development of the Institute's latest experiments in online learning, MITx and edX, which he spearheaded in his previous role as MIT provost. As of March 2017, the open online learning platform edX had engaged more than 11 million unique learners. The final report of his Institute-wide Task Force on the Future of MIT Education spurred rapid adoption of blended learning models in MIT classrooms and the October 2015 announcement of a MicroMaster's credential from MITx, the Institute's portfolio of massive open online courses.

In keeping with MIT's mission to "bring knowledge to bear on the world's great challenges," in May 2014, Dr. Reif launched the MIT Environmental Solutions Initiative, and in October 2015, Dr. Reif and his leadership team issued MIT's Plan for Action on Climate Change, centered on research, education, campus sustainability and a strategy of industry engagement.

To enhance MIT's innovation ecosystem and equip the next generation of innovators to drive their ideas to impact, in October 2016 Dr. Reif launched The Engine, an accelerator specially geared to help "tough tech" ventures deliver innovations that address humanity's great challenges. Additional steps include the October 2013 launch of the MIT Innovation Initiative, the creation of the MIT Hong Kong Innovation Node, a new Minor in Entrepreneurship and Innovation and the MIT Sandbox Innovation Fund Program.

To accelerate research and innovation at the nanoscale, MIT is also constructing MIT.nano, a major new facility at the heart of campus set to open in 2018. And because MIT's entrepreneurial ecosystem extends well beyond the campus, Dr. Reif is leading an ambitious, decade-long redevelopment initiative in Kendall Square.

On May 6, 2016, Dr. Reif announced the \$5 billion "MIT Campaign for a Better World." A member of the MIT faculty since 1980, Dr. Reif has served as director of MIT's Microsystems Technology Laboratories, as associate department head for Electrical Engineering, as head of the Department of Electrical Engineering and Computer Science (EECS), and as provost.

An elected member of the National Academy of Engineering and the American Academy of Arts and Sciences, Dr. Reif is the inventor or co-inventor on 13 patents, has edited or co-edited five books and has supervised 38 doctoral theses. He received the degree of Ingeniero Eléctrico from Universidad de Carabobo, Valencia, Venezuela, and his doctorate in electrical engineering from Stanford University.

[View full bio](#)

8:45am

Keynote

9:30am

## From Person-and-Machine to Environment-and-Ecosystem

The impetus for the SENSE.nano is the recognition that novel sensors and sensing systems are bound to provide previously unimaginable insight into the condition of individuals, as well as built and natural world, to positively impact people, machines, and environment. Advances in nano-sciences and nano-technologies, pursued by many at MIT, now offer unprecedented opportunities to realize designs for, and at-scale manufacturing of, unique sensors and sensing systems, while leveraging data-science and IoT infrastructure.

Brian Anthony  
Faculty Lead, Industry Immersion Program in Mechanical Engineering  
Co-Director, MIT Clinical Research Center  
Associate Director, [MIT.nano](#)



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Faculty Lead, Industry Immersion Program in Mechanical Engineering  
Co-Director, MIT Clinical Research Center  
Associate Director  
[MIT.nano](#)

Dr. Anthony is Associate Director of MIT.nano, Faculty Lead for the Industry Immersion Program in Mechanical Engineering, and Co-Director of the MIT Clinical Research Center. With over 25 years' experience in product realization—Dr. Anthony won an Emmy (from the Academy of Television Arts and Sciences) in broadcast technical innovation—Dr. Anthony designs instruments and techniques to monitor and control physical systems. His work involves systems analysis and design and calling upon mechanical, electrical, and optical engineering, along with computer science and optimization, to create solutions.

The focus of Dr. Anthony's research is computational instrumentation—the design of instruments and techniques to measure and control complex physical systems. His research includes the development of instrumentation and measurement solutions for manufacturing systems and medical diagnostics and imaging systems. In addition to his academic work, he has extensive experience in market-driven technology innovation, product realization, and business entrepreneurship and commercialization at the intersection between information technology and advanced manufacturing. His teaching interests include the modelling of large-scale systems in a wide variety of decision-making domains and the development of optimization algorithms and software for analyzing and designing such systems. He has extensive experience in market-driven technology innovation as well as business entrepreneurship.

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[View on LinkedIn](#)

9:50am

## From Flexible Fibers to Nanomagnetics: Minimally Invasive Sensors and Actuators of Neural Activity

Mammalian nervous system contains billions of neurons that exchange electrical, chemical and mechanical signals. Our ability to study this complexity is limited by the lack of technologies available for interrogating neural circuits across their diverse signaling modalities without inducing a foreign-body reaction. My talk will describe neural interface strategies pursued in my group aimed at mimicking the materials properties and transduction mechanisms of the nervous system. First, I will describe how fiber-drawing methods traditionally used by telecom and photonics industries can deliver neural probes capable of simultaneous electrical neural recording, optical stimulation, and drug and gene delivery into the brain and spinal cord of freely moving subjects. I will then show how these devices can be applied to direct neural growth and activity facilitating repair of damaged nerves. This talk will conclude with the description of an entirely wireless neuromodulation paradigm that relies on heat sensitivity in neurons and hysteretic heat dissipation by magnetic nanomaterials in alternating magnetic fields.

Polina Anikeeva  
Professor, MIT Materials Science and Engineering and MIT Brain and Cognitive Sciences,  
[MIT Brain and Cognitive Sciences](#)



Polina Anikeeva  
Professor, MIT Materials Science and Engineering and MIT Brain and Cognitive Sciences  
[MIT Brain and Cognitive Sciences](#)

Polina Anikeeva received her BS in Physics from St. Petersburg State Polytechnic University, and a PhD in Materials Science and Engineering from MIT. She completed her postdoctoral training at Stanford, where she created devices for optical stimulation and recording from brain circuits. Polina joined the MIT faculty in 2011 and is currently a Matoula S. Salapatras Professor of Materials Science and Engineering and a Professor of Brain and Cognitive Sciences. She serves as the director of the K. Lisa Yang Brain-Body Center. Anikeeva's Bioelectronics research group focuses on the development of minimal approaches to record and modulate the physiology of the nervous system, especially in the context of brain-body communication. Anikeeva is a recipient of the NSF CAREER Award, the DARPA Young Faculty Award, the TR35, the Vilcek Prize for Creative Promise, and the NIH Pioneer Award.

[View full bio](#)

While trillions of sensors that will soon be connected to the "Internet of Everything" (IoE) promise to transform our lives, they simultaneously pose major obstacles, which we are already encountering today. The massive amount of generated raw data (i.e., the "data deluge") is quickly exceeding computing capabilities, and cannot be overcome by isolated improvements in sensors, transistors, memories, or architectures alone. Rather, an end-to-end approach is needed, whereby the unique benefits of new emerging nanotechnologies – for sensors, memories, and transistors – are exploited to realize new system architectures that are not possible with today's technologies. However, emerging nanomaterials and nanodevices suffer from significant imperfections and variations. Thus, realizing working circuits, let alone transformative nanosystems, has been infeasible. In this talk, I present a path towards realizing these future systems in the near-term, and show how based on the progress of several emerging nanotechnologies (carbon nanotubes for logic, non-volatile memories for data storage, and new materials for sensing), we can begin realizing these systems today. As a case-study, I will discuss how by leveraging emerging nanotechnologies, we have realized the first monolithically-integrated three-dimensional (3D) nanosystem architectures with vertically-integrated layers of logic, memory, and sensing circuits. With dense and fine-grained connectivity between millions of on-chip sensors, data storage, and embedded computation, such nanosystems can capture terabytes of data from the outside world every second, and produce "processed information" by performing in-situ classification of the sensor data using on-chip accelerators. As a demonstration, we tailor a demo system for gas classification, for real-time health monitoring from breath.

Max Shulaker

Emanuel E Landsman (1958) Career Development Assistant Professor of Electrical Engineering and Computer Science  
MIT Department of Electrical Engineering and Computer Science



Max Shulaker

Emanuel E Landsman (1958) Career Development Assistant Professor of Electrical Engineering and Computer Science  
MIT Department of Electrical Engineering and Computer Science

Max Shulaker began as assistant professor in the Department of Electrical Engineering and Computer Science in 2016, where he leads the Novels (Novel Electronic Systems Group) at MIT. Prior to joining MIT, he was at Stanford University where he received his BS, Masters, and PhD in Electrical Engineering. Shulaker's research interests include the broad area of nanosystems. His research group focuses on understanding and optimizing multidisciplinary interactions across the entire computing stack – from low-level synthesis of nanomaterials, to fabrication processes and circuit design for emerging nanotechnologies, up to new architectures – to enable the next generation of high performance and energy-efficient computing systems. His research results include the demonstration of the first carbon nanotube computer (highlighted on the cover of Nature and presented as a Research Highlight to the US Congress by the US NSF), the first digital sub-systems built entirely using carbon nanotube transistors (awarded the ISSCC Jack Raper Award for Outstanding Technology Directions Paper), the first monolithically-integrated 3D integrated circuits combining arbitrary vertical stacking of logic and memory, the highest performance carbon nanotube transistors to-date, and the first highly-scaled carbon nanotube transistors fabricated in a VLSI-compatible manner.

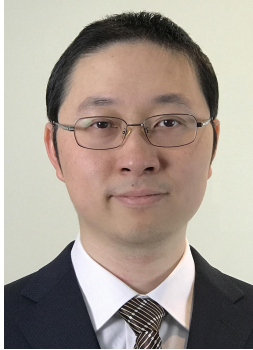
10:30am

### Mechanically Flexible Photonic Sensors

Conventional integrated photonic devices are fabricated on rigid semiconductor or dielectric substrates. Over the past few years, we have developed a suite of active and passive photonic devices and systems integrated on plastic substrates which can be bent, twisted, and stretched without compromising their optical performance. In this talk, we will review the latest progress in multi-material photonic integration on unconventional flexible substrates, and discuss emerging sensing applications of flexible photonics.

Juejun (JJ) Hu

Associate Professor, Department of Materials Science & Engineering



Juejun (JJ) Hu

Associate Professor, Department of Materials Science & Engineering

Juejun (JJ) Hu received the B.S. degree from Tsinghua University, China, in 2004, and the Ph.D. degree from Massachusetts Institute of Technology, Cambridge, MA, USA, in 2009, both in materials science and engineering. He is currently the Merton C. Flemings Career Development Associate Professor at MIT's Department of Materials Science and Engineering. His primary research interest is enhanced photon-matter interactions in nanophotonic structures, with an emphasis on on-chip spectroscopy and chemical sensing applications using novel infrared glasses. Prior to joining MIT, he was an Assistant Professor at the University of Delaware from 2010 to 2014. Hu has authored and coauthored more than 60 refereed journal publications since 2006 and has been awarded six U.S. patents. He has been recognized with the National Science Foundation Faculty Early Career Development award, the Gerard J. Mangone Young Scholars Award, the University of Delaware College of Engineering Outstanding Junior Faculty Member, the University of Delaware Excellence in Teaching Award, among others. Dr. Hu is currently the Deputy Editor of the OSA journal Optical Materials Express, and he is a Member on technical program committees for conferences including MRS, CLEO, OSA Congress, ACerS GOMD, ICG, and others. *(Based on [document published](#) on 13 September 2016)*

[View full bio](#)

10:50am

Network Break

This lecture will detail the creation of ultrasensitive sensors based on electronically active conjugated polymers (CPs) and carbon nanotubes (CNTs). A central concept that a single nano- or molecular-wire spanning between two electrodes would create an exceptional sensor if binding of a molecule of interest to it would block all electronic transport. The use of molecular electronic circuits to give signal gain is not limited to electrical transport and CP-based fluorescent sensors can provide ultratrace detection of chemical vapors via amplification resulting from exciton migration. Nanowire networks of CNTs provide for a practical approximation to the single nanowire scheme. These methods include abrasion deposition and selectivity is generated by covalent and/or non-covalent binding selectors/receptors to the carbon nanotubes. Sensors for a variety of materials and cross-reactive sensor arrays will be described. The use of carbon nanotube based gas sensors for the detection of ethylene and other gases relevant to agricultural and food production/storage/transportation are being specifically targeted and can be used to create systems that increase production, manage inventories, and minimize losses.

Timothy Swager  
John D. MacArthur Professor of Chemistry



Timothy Swager  
John D. MacArthur Professor of Chemistry

Timothy M. Swager is the John D. MacArthur Professor of Chemistry the Department of Chemistry at MIT and the Faculty Director of the Deshpande Center for Technological Innovation. In this latter role, Professor Swager works with the Center's Executive Director to define the Center's strategy for fostering innovation, assists with the commercialization of MIT technologies, and plays a key role in the grant selection process. Professor Swager also serves as the Center's liaison to the MIT academic community, and senior leadership, sitting on faculty and academic committees. Following Professor Swager's postdoctoral appointment at MIT, he joined the chemistry faculty at the University of Pennsylvania, returning to MIT in 1996 as a Professor of Chemistry, and served as the Head of Chemistry from 2005-2010. Professor Swager's research interests are in design, synthesis, and study of organic-based electronic, sensory, high-strength and liquid crystalline materials. He has published more than 400 peer-reviewed papers and more than 80 issued/pending patents. Professor Swager is the founder of four companies (DyNuPol, Iptyx, PolyJoule, and C2Sense) and has served on a number of corporate and government boards. He received a B.S. from Montana State University in 1983 and a Ph.D., from the California Institute of Technology in 1988.

[View full bio](#)

11:25am

## The Mid-IR Silicon Photonics Sensor Platform

Advances in integrated silicon photonics are enabling highly connected sensor networks that offer sensitivity, selectivity and pattern recognition. Such miniaturized optical sensors are ideal for non-invasive applications. Case studies like high sensitivity analyte detection in solution, and gas sensing in air, provide good insight into the tradeoffs being made en route to ubiquitous sensor deployment.

Anuradha Annaswamy

Senior Research Scientist  
MIT Department of Mechanical Engineering



Anuradha Annaswamy

Senior Research Scientist  
MIT Department of Mechanical Engineering

Dr. Anuradha Annaswamy received her PhD in electrical engineering from Yale University in 1985. She has been a member of the faculty at Yale, Boston University, and MIT, where she is currently the director of the Active-Adaptive Control Laboratory and a senior research scientist in the department of mechanical engineering. Her research interests pertain to adaptive control theory and applications to aerospace, automotive, and propulsion systems; cyber physical systems science; and CPS applications to Smart Grids, Smart Cities, and Smart Infrastructures. She is the author of a hundred journal publications and numerous conference publications, co-author of a graduate textbook on adaptive control (2004), co-editor of several reports including "Systems & Control for the future of humanity, research agenda: Current and future roles, impact and grand challenges," (Elsevier) "IEEE Vision for Smart Grid Control: 2030 and Beyond," (IEEE Xplore) and Impact of Control Technology, ([ieeecss.org/main/loCT-report](http://ieeecss.org/main/loCT-report), [ieeecss.org/general/loCT2-report](http://ieeecss.org/general/loCT2-report)).

Dr. Annaswamy has received several awards including the George Axelby and Control Systems Magazine best paper awards from the IEEE Control Systems Society (CSS), the Presidential Young Investigator award from NSF, the Hans Fisher Senior Fellowship from the Institute for Advanced Study at the Technische Universität München, the Donald Groen Julius Prize from the Institute of Mechanical Engineers, a Distinguished Member Award, and a Distinguished Lecturer Award from IEEE CSS. Dr. Annaswamy is a Fellow of the IEEE and IFAC. She has served as the Vice President for Conference Activities (2014-15), and is currently serving as the VP for Technical Activities (2017-18) in the Executive Committee of the IEEE CSS.



Our lab at MIT has been interested in how the nanoparticle corona – the region of adsorbed molecules surrounding the particle surface - can be engineered for molecular recognition. We have recently introduced a method we call CoPhMoRe or Corona Phase Molecular Recognition for discovering synthetic, heteropolymer corona phases that form molecular recognition sites at the nanoparticle interface, selected from a heteropolymer library. We show that certain synthetic heteropolymers, once constrained onto a single-walled carbon nanotube by chemical adsorption, also form a new corona phase that exhibits highly selective recognition for specific molecules. We have a growing list of biomolecules that we can detect using this approach including riboflavin, L-thyroxine, dopamine, nitric oxide, sugar alcohols, estradiol, as well as proteins such as fibrinogen. The results have significant potential in light of the fact that nanoparticles such as single walled carbon nanotubes can be interfaced to biological systems at the sub-cellular level, with unprecedented sensitivity. Several recent demonstrations indicate that spatial and temporal information on cellular chemical signaling can be obtained using arrays of such sensors. Other examples including sensor tattoos for mice, stable for more than 400 days in-vivo, will be shown. Lastly, I will highlight recent advances to control the trafficking and localization of nanoparticle systems in living plants using a mechanism that we call Lipid Exchange Envelope Penetration (LEEP). We demonstrate a living plant, interfaced with multiple nanoparticle types that can detect explosives, ATP and dopamine within or from outside the plant, and communicate this information to a user's cell phone. Engineering the nanoparticle corona in this way offers significant potential to translate sensor technology to previously inaccessible environments.

Michael Strano

Professor of Chemical Engineering  
MIT Department of Chemical Engineering



Michael Strano

Professor of Chemical Engineering  
MIT Department of Chemical Engineering

Professor Michael S. Strano is currently the Charles and Hilda Roddey Professor in the Chemical Engineering Department at the Massachusetts Institute of Technology. He received his B.S. from Polytechnic University in Brooklyn, NY and Ph.D. from the University of Delaware both in Chemical Engineering. He was a post doctoral research fellow at Rice University in the departments of Chemistry and Physics under the guidance of Nobel Laureate Richard E. Smalley. From 2003 to 2007, Michael was an Assistant Professor in the Department of Chemical and Biomolecular Engineering at the University of Illinois at Urbana-Champaign before moving to MIT. His research focuses on biomolecule/nanoparticle interactions and the surface chemistry of low dimensional systems, nano-electronics, nanoparticle separations, and applications of vibrational spectroscopy to nanotechnology. Michael is the recipient of numerous awards for his work, including a 2005 Presidential Early Career Award for Scientists and Engineers, a 2006 Beckman Young Investigator Award, the 2006 Coblentz Award for Molecular Spectroscopy, the Unilever Award from the American Chemical Society in 2007 for excellence in colloidal science, and the 2008 Young Investigator Award from the Materials Research Society, the 2008 Allen P. Colburn Award from the American Institute of Chemical Engineers, and recently selected as a member of Popular Science's Brilliant 10.

[View full bio](#)

12:05pm

Magnifying vibrations in Bridges and Buildings - Seeing Tiny Vibrations in Large Structures.

To the naked eye, buildings and bridges appear fixed in place, unmoved by forces like wind and rain. These large structures do experience imperceptibly small vibrations that, depending on their frequency, may indicate instability or structural damage. We have developed a technique to "see" vibrations that would otherwise be invisible to the naked eye, combining high-speed video with computer vision techniques. A technique called "motion magnification" to break down high-speed frames into certain frequencies, essentially exaggerating tiny, subpixel motions.

William Freeman

Thomas and Gerd Perkins Professor of Electrical Engineering and Computer Science  
MIT Department of Electrical Engineering and Computer Science

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Thomas and Gerd Perkins Professor of Electrical Engineering and Computer Science  
MIT Department of Electrical Engineering and Computer Science

William T. Freeman is the Thomas and Gerd Perkins Professor of Electrical Engineering and Computer Science at MIT, and a member of the Computer Science and Artificial Intelligence Laboratory (CSAIL) there. He was the Associate Department Head from 2011 - 2014.

His current research interests include machine learning applied to computer vision, Bayesian models of visual perception, and computational photography. He received outstanding paper awards at computer vision or machine learning conferences in 1997, 2006, 2009 and 2012, and test-of-time awards for papers from 1990 and 1995. Previous research topics include steerable filters and pyramids, orientation histograms, the generic viewpoint assumption, color constancy, computer vision for computer games, and belief propagation in networks with loops.

He is active in the program or organizing committees of computer vision, graphics, and machine learning conferences. He was the program co-chair for ICCV 2005, and for CVPR 2013.

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12:25pm

STEX Presentation

Marcie Black, CEO & Co-Founder, [Advanced Silicon Group](#)  
Ioannis (John) Kyriassis, CTO & Co-Founder, [Chromation](#)  
Jan Schnorr, CEO & Co-Founder, [C2Sense](#)  
Dr. Roger Nassar, CEO & Founder, [RAN Biotechnologies](#)  
Pavel Bystricky, CTO & Co-Founder, [American Boronite Corporation](#)  
Matthew Carey, Director of Business Development, [Humatics](#)  
Romain Lacombe, CEO & Co-Founder, [Plume Labs](#)  
Andy Vidan, CEO, [Composable Analytics](#)  
Xinjie (Jeff) Zhang, CEO & Co-Founder, [Novarials Corporation](#)

12:45pm

Lunch Break, Networking, and STEX Demos

2:00pm

Afternoon Keynote  
Gururaj "Desh" Deshpande  
President & Chairman, [Sparta Group LLC](#)



Gururaj "Desh" Deshpande  
President & Chairman  
[Sparta Group LLC](#)

Gururaj "Desh" Deshpande is a Trustee of the Deshpande Foundation along with his wife Jaishree. He is also the President and Chairman of Sparta Group LLC, a family investment office and is also the Chairman of Tejas Networks.

Dr. Deshpande has pursued an entrepreneurial career for the last three decades. He is involved either as the founder, a founding investor or chairman of several companies including Cascade Communications, Sycamore Networks, Coral Networks, Tejas Networks, Cimaron, Webdialogs, Airvana, Sandstone Capital, A123 Systems and Curata.

Dr. Deshpande lives in Boston and serves as a life-member of the MIT Corporation, and his support has made possible MIT's Deshpande Center for Technological Innovation.

The Deshpande Foundation strengthens ecosystems that create significant social and economic impact through entrepreneurship and innovation. Leveraging the experience gained at the MIT Center, the Deshpande Foundation has facilitated the setup of five other centers; Deshpande Center for Social Entrepreneurship in India, EforAll (formerly known as the Merrimack Valley Sandbox) in Lowell/Lawrence Massachusetts, the Pond-Deshpande Center at the University of New Brunswick in Canada, the Dunin Deshpande Queens Innovation Center at Queens University in Kingston, Ontario and the Gopalakrishnan Deshpande Center for Innovation and Entrepreneurship at the Indian Institute of Technology, Madras, India. Deshpande Foundation also provided the founding grant for MassChallenge in Boston, National Science Foundation Innovation Corps (I-Corps™), Public Health Foundation of India (PHFI) and the UPOP program at MIT.

Dr. Deshpande holds a B. Tech. in Electrical Engineering from the Indian Institute of Technology - Madras, an M.E. from the University of New Brunswick in Canada, and Ph.D. from Queens University in Canada.

Deshpande co-chaired the National Council to support President Obama's innovation and entrepreneurship strategy from 2010 to 2015.

2:45pm

#### A New Approach for Personalized Medicine in Cancer

In this talk, I will present a microchannel resonator for weighing single cells with unprecedented precision and describe how it can be used in a new approach for personalized medicine in cancer.

Scott Manalis

Andrew and Erna Viterbi Professor of Biological Engineering  
Koch Institute for Integrative Cancer Research  
MIT Department of Biological Engineering

Scott Manalis

Andrew and Erna Viterbi Professor of Biological Engineering  
Koch Institute for Integrative Cancer Research  
MIT Department of Biological Engineering

Scott Manalis received a B.S. in physics from the University of California, Santa Barbara and a Ph.D. in applied physics from Stanford University. He was the recipient of the Presidential Early Career Award for Scientists and Engineers (PECASE) from the Department of Defense. He has also been selected by Technology Review magazine as one of the 100 innovators under the age of 35

The Manalis laboratory develops quantitative and real-time techniques for biomolecular detection and single cell analysis. They use conventional silicon processing techniques to fabricate fluidic devices, and exploit the unique physical properties associated with micro- and nanoscale dimensions for developing precision measurement methods. They have previously developed a suspended microchannel resonator (SMR) that enables mass to be measured in the aqueous environment with a resolution that is a million-fold better than existing methods. The lab is using the SMR to determine if the growth response of a patient's cancer cells to anticancer drugs can be used in new strategies for selecting optimal therapies.

[View full bio](#)

3:05pm

#### Printable Electronics - Functional Features at Nanoscale Dimensions

There is a huge need for printing of electronic devices that are extremely inexpensive but provide simple computations and interactive functions. Our new printing process is an enabling technology for high-performance, fully printed electronics, including transistors, optically functional surfaces, and ubiquitous sensors.

John Hart  
Department Head and Professor, [MIT Department of Mechanical Engineering](#)



John Hart  
Department Head and Professor  
[MIT Department of Mechanical Engineering](#)

[John Hart](#) is Professor of Mechanical Engineering and Head of the Department of Mechanical Engineering at MIT. He is also the Director of the MIT Laboratory for Manufacturing and Productivity and the [Center for Advanced Production Technologies](#). John's [research group](#) focuses on the science and technology of production, including work on additive manufacturing, materials processing, automation, and computational methods. John has been recognized by awards from the United States NSF, ONR, AFOSR, DARPA, SME, and ASME, along with two R&D 100 awards. He has also received the MIT Ruth and Joel Spira Award for Distinguished Teaching in Mechanical Engineering and the MIT Keenan Award for Innovation in Undergraduate Education, for his leadership in undergraduate manufacturing education using new pedagogical models and digital resources. John is a co-founder of [Desktop Metal](#) and [VulcanForms](#), and a Board Member of [Carpenter Technology Corporation](#).

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3:25pm

### Toward Nanocrystal Sensors

Our laboratory focuses on the science and applications of nanocrystals, especially semiconductor nanocrystal (aka quantum dots). Our research ranges from the very fundamental to applications in electro-optics and biology. There is an ongoing effort to address the challenges of making new compositions and morphologies of nanocrystals and nanocrystal heterostructures, and new ligands so that the nanocrystals can be incorporated into hybrid organic/inorganic devices, or biological systems. We are collaborating with a number of biology and medical groups to design nanocrystal probes that meet specific challenges.

Moungi Bawendi

Lester Wolfe Professor of Chemistry  
MIT Department of Chemistry

Moungi Bawendi

Lester Wolfe Professor of Chemistry  
MIT Department of Chemistry

Professor Moungi Bawendi received his A.B. in 1982 from Harvard University and his Ph.D. in chemistry in 1988 from The University of Chicago. This was followed by two years of postdoctoral research at Bell Laboratories, working with Dr. Louis Brus, where he began his studies on nanomaterials. Bawendi joined the faculty at MIT in 1990, becoming Associate Professor in 1995 and Professor in 1996.

Professor Bawendi has followed an interdisciplinary research program that aims at probing the science and developing the technology of chemically synthesized nanocrystals. Prof. Bawendi has been at the forefront of the science and technology of semiconductor nanocrystal quantum dots for over two decades. This work has included the development of novel methods for synthesizing, characterizing, and processing quantum dots and magnetic nanoparticles as novel materials building blocks, studying the fundamental optical properties of quantum dots using a variety of spectroscopic methods, including the development of optical tools to study single nanocrystals, and combining quantum dots with various optical and electronic device structures to study their device properties. His work has also included developing applications of quantum dots in biological and biomedical imaging and sensing, in light emitting devices, photodetection, and solar energy conversion.

Professor Bawendi has published over 250 papers on the science and technology of quantum dots and other materials systems, and has helped four start-up companies in commercializing quantum dot technology. A fifth company spun out from Bawendi's laboratory uses knowledge gained from his work on quantum dots, applying it to a medical device.

Bawendi has won numerous awards for his work. Among these are the Raymond and Beverly Sackler Prize in the Physical Sciences, the EO Lawrence award in Materials Chemistry from the US Department of Energy, the Fred Kavli Distinguished Lecture in Nanoscience from the Materials Research Society, and the American Chemical Society Award in Colloid and Surface Chemistry.

Bawendi is a fellow of the American Association for the Advancement of Science, a fellow of the American Academy of Arts and Sciences, and a member of the National Academy of Sciences.

[View full bio](#)

3:45pm

### Networking Break

4:00pm

Panel: Sensing, Society & Technology

Tom Ashbrook

Host, On Point, [WBUR](#)



Tom Ashbrook

Host, On Point

[WBUR](#)

On Point's host, Tom Ashbrook, is an award-winning journalist brought to public radio following the attacks of September 11, 2001, when he was enlisted by NPR and WBUR-Boston for special coverage, after a distinguished career in newspaper reporting and editing.

Tom's career in journalism spans 20 years as a foreign correspondent, newspaper editor and author. He spent 10 years in Asia — based in India, Hong Kong and Japan — starting at the South China Morning Post, then as a correspondent for the Boston Globe. He began his reporting career covering the refugee exodus from Vietnam and the post-Mao opening of China, and has covered turmoil and shifting cultural and economic trends in the U.S. and around the world, from Somalia and Rwanda to Russia and the Balkans. At the Globe, where he served as deputy managing editor until 1996, he directed coverage of the first Gulf War and the end of the Cold War.

Tom received the Livingston Prize for National Reporting, and was a 1996 fellow at Harvard's Nieman Foundation before taking a four-year plunge into Internet entrepreneurship, chronicled in his book "The Leap: A Memoir of Love and Madness in the Internet Gold Rush."

Raised on an Illinois farm, Tom studied American history at Yale and Gandhi's independence movement at Andhra University, India. Before taking up journalism, he worked as a surveyor and dynamiter in Alaska's oil fields, a teaching fellow with the Yale-China Association, a Hong Kong television personality, and a producer of international editions of Chinese kung fu films.

Professor Emeritus, MIT Department of Electrical Engineering & Computer Science  
Founder, Chairman & CTO, [Rethink Robotics](#)



Professor Emeritus, MIT Department of Electrical Engineering & Computer Science  
Founder, Chairman & CTO

[Rethink Robotics](#)

A mathematics undergraduate in his native Australia, Rodney received a Ph.D. in Computer Science from Stanford in 1981. From 1984 to 2010, he was on the MIT faculty, and completed his service as a Professor of Robotics. He was also the founding Director of the Institute's Computer Science and Artificial Intelligence Laboratory, and served in that role until 2007. In 1990, he co-founded iRobot (NASDAQ: IRBT), where he served variously as CTO, Chairman and board member until 2011. Rodney has been honored by election to the National Academy of Engineering, and has been elected as a Fellow of the American Academy of Arts and Sciences, the Association of Computing Machinery, the Association for the Advancement of Artificial Intelligence, the Institute of Electrical and Electronics Engineers and the American Association for the Advancement of Science. Rodney is also an accomplished presenter, and speaks regularly to promote the value of robotics and artificial intelligence in venues throughout the world.

Vladimir Bulovic

Director, [MIT.nano](#)

Fariborz Maseeh (1990) Professor of Emerging Technology, [MIT Electrical Engineering and Computer Science \(EECS\)](#)



5:30pm	1-Minute Poster Pitches
6:00pm	Poster Session with Refreshments
7:00pm	Closing Remarks