MIT Industrial Liaison Program Faculty Knowledgebase Report

2023 MIT Japan Conference

January 27, 2023 8:15 am - 5:30 pm

Download Conference Program in PDF

8:15 AM — Registration

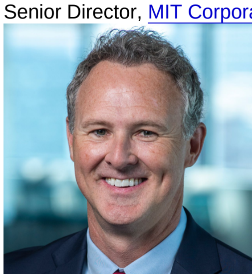
9:00 AM — Welcome and Introduction

John Roberts
Executive Director (Interim), MIT Corporate Relations

John Roberts
Executive Director (Interim)
MIT Corporate Relations

John Roberts has been Executive Director of MIT Corporate Relations (Interim) since February 2022. He obtained his Ph.D. in organic chemistry at MIT and returned to the university after a 20-year career in the pharmaceutical industry, joining the MIT Industrial Liaison Program (ILP) in 2013. Prior to his return, John worked at small, medium, and large companies, holding positions that allowed him to exploit his passions in synthetic chemistry, project leadership, and alliance management while growing his responsibilities for managing others, ultimately as a department head. As a program director at MIT, John built a portfolio of ILP member companies, mostly in the pharmaceutical industry and headquartered in Japan, connecting them to engagement opportunities in the MIT community. Soon after returning to MIT, John began to lead a group of program directors with a combined portfolio of 60-80 global companies. In his current role, John oversees MIT Corporate Relations which houses ILP and MIT Startup Exchange.

Steven Palmer
Senior Director, MIT Corporate Relations

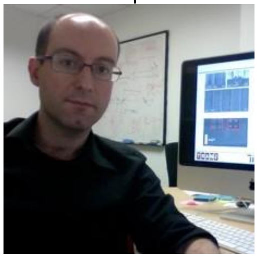


Steven Palmer
Senior Director
MIT Corporate Relations

Steve Palmer is a Senior Director within MIT's Office of Corporate Relations. Steven comes to OCR with many years of experience building relationships, advancing diplomacy, and seeking new business initiatives in both the public and private sectors. He has spent his career highlighting and translating technological issues for policy makers, engineers, analysts, and business leaders. Steven has worked in government, industry, and academia in the U.S. and abroad. He is also an Executive Coach at MIT Sloan and Harvard Business School. Steven earned his Bachelor of Science at Northeastern University, and his M.B.A. at MIT Sloan where he was in the Fellows Program for Innovation and Global Leadership.

9:15 AM

AI-Enhanced Vision: Seeing the Invisible
George Barbastathis
Professor of Optics and Mechanical Engineering, MIT Department of Mechanical Engineering



George Barbastathis
Professor of Optics and Mechanical Engineering
MIT Department of Mechanical Engineering

George Barbastathis received the Diploma in Electrical and Computer Engineering in 1993 from the National Technical University of Athens and the MSc and PhD degrees in Electrical Engineering in 1994 and 1997, respectively, from the California Institute of Technology (Caltech.) After post-doctoral work at the University of Illinois at Urbana-Champaign, he joined the faculty at MIT in 1999, where he is now Professor of Mechanical Engineering. He has worked or held visiting appointments at Harvard University, the Singapore-MIT Alliance for Research and Technology (SMART) Centre, the National University of Singapore, and the University of Michigan – Shanghai Jiao Tong University Joint Institute in Shanghai, People's Republic of China. His research interests are three-dimensional and spectral imaging; phase estimation; and gradient index optics theory and implementation with subwavelength-patterned dielectrics. He is member of the Institute of Electrical and Electronics Engineering (IEEE), and the American Society of Mechanical Engineers (ASME). In 2010 he was elected Fellow of the Optical Society of America (OSA).

If you point your camera to a scene, and the camera registers nothing meaningful—does it mean that nothing was really there? Hardly! Even if a human observer cannot detect and interpret it, much information may still have been recorded in the pixels. How, then, should one capture and decode it to reveal the hidden scene?

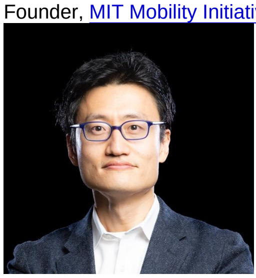
With my research group, we have decoded several challenging scenes with important applications for industry. For example, we have peeked inside integrated circuits non-invasively to work out if their manufactured topology matches the design file; quantified mechanical effects in the retinal fibrous structures and vasculature to forecast glaucoma progression; and measured the particle size distribution in drying powders toward early detection of undesired agglomeration events.

In all these cases, even the most advanced state-of-the-art imaging methods cannot capture the relevant phenomena with sufficient fidelity or economy. It is a unique feature of our work that physical models are explicitly weaved into data-driven models. Thus, our algorithms perform well in test cases, and are also interpretable and resilient. We have also demonstrated significant savings: for example, reduction by two orders of magnitude in total scanning and computation time.

Funding acknowledgments: Parts of this work were funded by the United States Intelligence Advanced Research Projects Activity (IARPA); Singapore's National Research Foundation (NRF); and by Takeda Development Centre Americas, Inc. (successor in interest to Millennium Pharmaceuticals, Inc.)

9:55 AM

Behavior and Computation: What defines the future of urban mobility
Jinhua Zhao
Professor of Cities and Transportation
Founder, MIT Mobility Initiative



Jinhua Zhao
Professor of Cities and Transportation
Founder
MIT Mobility Initiative

Jinhua Zhao is the Professor of Cities and Transportation at the Massachusetts Institute of Technology (MIT). Prof. Zhao integrates behavioral and computational thinking to decarbonize the world's mobility system.

Prof. Zhao founded the MIT Mobility Initiative, coalescing the Institute's efforts on transportation research, education, entrepreneurship, and engagement. He hosts the MIT Mobility Forum, highlighting transportation innovation from MIT and across the globe.

Prof. Zhao directs the JTL Urban Mobility Lab and Transit Lab, leading long-term collaborations with transportation authorities and operators worldwide and enabling cross-culture learning between cities in North America, Asia, and Europe.

Prof. Zhao leads the program "Mens, Manus, and Machina (M3S): How AI Impacts the Future of Work and Future of Learning" at the Singapore MIT Alliance for Research and Technology (SMART).

He is the co-founder and chief scientist for TRAM.Global, a mobility decarbonization venture.

Research Interest

He brings behavioral science and transportation technology together to shape travel behavior, design mobility systems, and reform urban policies. He develops computational methods to sense, predict, nudge, and regulate travel behavior and designs multimodal mobility systems that integrate automated and shared mobility with public transport. He sees transportation as a language to describe a person, characterize a city, and understand an institution and establishes the behavioral foundation for transportation systems and policies.

View full bio

The transportation world is booming but in flux: the industry is being reshuffled, communities and cities are often confused and anxious about their mobility future, and the ecosystem pressure is daunting. Mobility is in the midst of profound transformation with an unprecedented combination of new technologies: autonomy, electrification, connectivity, and AI, meeting new evolving priorities: decarbonization, public health, and social justice.

In this talk, Prof. Zhao sharply focuses on two forces that drive the mobility future: behavior and computation. Behaviorally he investigates is travel social? is travel emotional? and is travel perceptual? He uses a behavioral lens to examine mobility technologies and translates business decisions into a set of behavioral inquiries. Every single organization or company exists to change someone's behavior. Computationally, he brings the cutting-edge AI and machine learning methods to sense, predict, nudge and regulate travel behavior. He demonstrates the power of bringing behavioral and computational thinking together, in order to make mobility services predictive, individualized, and experimental. He will illustrate how to design multimodal mobility systems that integrate shared and autonomous services with public transit.

10:35 AM

Networking Break

10:50 AM

Developing Membrane Materials for a Sustainable Future

Zachary P Smith
Robert N. Noyce Career Development and Professor of Chemical Engineering
MIT Department of Chemical Engineering

Nearly 80% of global greenhouse gas (GHG) emissions comes from electricity, heat, and transportation energy consumption, and from byproducts of industrial processes. To reduce this footprint while still meeting societal needs, sustainable energy sources and low-energy industrial processes are required. This presentation will focus on one technology gap in this area – developing and applying membranes to separate and capture gases. A market overview will be presented on current and emerging applications, followed by a discussion of membrane separation theory and general research and commercialization directions for materials development. A particular emphasis will be placed on (1) polymeric materials and (2) porous crystalline materials known as metal–organic frameworks (MOFs). In addition to describing current research directions, a segment of this talk will focus on a commercial membrane spinout from the Smith lab seeking to decarbonize the chemical and energy industry.

11:30 AM MIT Startup Exchange Lightning Talks

Stephen Conant
Vice President for Commercial
VEIR

Nick Mannarino
Strategy & Business Development
Amogy

Jake Guglin
CEO and Founder
Foundation Alloy

Daniel Oran
Founder and CEO
Irradiant Technologies

Paul Yang
Data Scientist
Einblick

Zack Hendlin
Co-Founder and CEO
Zing Data

Cherif Gamra
Director of Client Operations
TechNext

Jordan McRae
Founder and CEO
Mobilus Labs

Ramiro Almeida
Co-Founder and CEO
TRAM Global

Rick Pierce
CEO
Decoy Therapeutics

MIT Startup Exchange actively promotes collaboration and partnerships between MIT-connected startups and industry. Qualified startups are those founded and/or led by MIT faculty, staff, or alumni or are based on MIT-licensed technology. Industry participants are principally members of MIT's Industrial Liaison Program (ILP).

MIT Startup Exchange is a community of over 1,000 MIT-connected startups with roots across MIT departments, labs, and centers; it hosts a robust schedule of startup workshops and showcases and facilitates networking and introductions between startups and corporate executives.

STEX25 is a startup accelerator within MIT Startup Exchange, featuring 25 "industry ready" startups that have proven to be exceptional with early use cases, clients, demos, or partnerships and are poised for significant growth. STEX25 startups receive promotion, travel, and advisory support and are prioritized for meetings with ILP's 240 member companies.

12:30 PM Lunch with MIT Startup Exchange Exhibits

1:50 PM

Materials Innovation for Separations
Jeffrey Grossman
Professor of Materials Science and Engineering
MacVicar Fellow, MIT Department of Materials Science and Engineering

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Professor of Materials Science and Engineering
MacVicar Fellow
MIT Department of Materials Science and Engineering

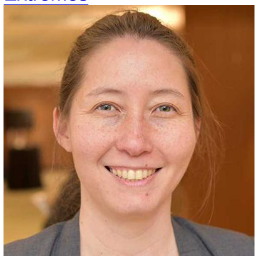
Professor Grossman received his Ph.D. in theoretical physics from the University of Illinois and performed postdoctoral work at the University of California at Berkeley. In 2009, he joined MIT, where he developed a research program known for its contributions to energy conversion, energy storage, membranes, and clean-water technologies. He served as the Head of the Department of Materials Science and Engineering from 2020-2023, and in 2021 he helped create and became the founding co-director of the MIT Climate and Sustainability Consortium, a new type of academia-industry partnership. In recognition of his contributions to engineering education, Grossman was named an MIT MacVicar Faculty Fellow and received the Bose Award for Excellence in Teaching. He has published more than 200 scientific papers, holds 17 current or pending U.S. patents, and co-founded two Massachusetts companies to commercialize novel membranes materials for efficient industrial separations: ViaSeparations, a company that commercializes graphene-oxide membranes to separate chemicals for manufacturing, and SiTration, a company that commercializes silicon membranes for chemical-free, energy-efficient extraction and recycling of critical materials.

View full bio

Our planet’s health needs an acceleration in the pace of progress towards clean and sustainable technologies that are critically dependent on materials innovation. Materials science and engineering provides the ability to understand and control matter at the atomic scale to realize optimized performance across an exhaustive set of metrics. Since many key mechanisms are dominated by the intrinsic properties of the active materials involved, our imperative is to predict, identify, and manufacture new materials as comprehensively and rapidly as possible to enable game-changing forward leaps rather than incremental advances. This lecture will discuss the impact of materials design in different applications, with a focus on our recent work on resilient nanofiltration membranes for more efficient industrial separations, which are responsible for 15% of global CO_2 emissions. Two commercial spinouts from this research will also be highlighted, one in the pulp and paper industry and one in battery recycling and mining.

2:30 PM

Design Before Disaster
Miho Mazereeuw
MIT Climate Grand Challenges, Preparing for a New World of Weather and Climate Extremes



Miho Mazereeuw
MIT Climate Grand Challenges
Preparing for a New World of Weather and Climate Extremes

Miho Mazereeuw is the Associate Head for Strategy and Equity and is an Associate Professor of Architecture and Urbanism at MIT and is the director of the Urban Risk Lab. Working on a large, territorial scale with an interest in public spaces and the urban experience, Mazereeuw is known for her work in disaster resilience.

In the Urban Risk Lab multi-disciplinary groups of researchers work to innovate on technologies, materials, processes, and systems to reduce risk. Operating on several scales, the Lab develops methods to embed risk reduction and preparedness into the design of the regions, cities and urban spaces to increase the resilience of local communities.

Miho Mazereeuw taught at the Graduate School of Design at Harvard University and the University of Toronto prior to joining the faculty at Massachusetts Institute of Technology. As an Arthur W. Wheelwright Fellow, she is completing her forthcoming book entitled Preemptive Design: Disaster and Urban Development along the Pacific Ring of Fire featuring case studies on infrastructure design, multifunctional public space and innovative planning strategies in earthquake prone regions. Her design work on disaster prevention has been exhibited globally. As the director of the Urban Risk Lab at MIT, Mazereeuw is collaborating on a number of projects with institutions and organizations in the field of disaster reconstruction/prevention and is currently working in Haiti, India, Japan and Chile.

Mazereeuw was formerly an Associate at the Office for Metropolitan Architecture and has also worked in the offices of Shigeru Ban and Dan Kiley. Mazereeuw completed a Bachelor of Arts with High Honors in Sculpture and Environmental Science at Wesleyan University and her Master in Architecture and in Landscape Architecture with Distinction at the Harvard Graduate School of Design where she was awarded the Janet Darling Webel Prize and the Charles Eliot Traveling Fellowship.

View full bio

Within the last decade, the cost of climate-related disasters has continued to rise steeply. However, the impacts of these disasters are not distributed equally. Resource constrained communities, in urban as well as rural areas often disproportionately feel the burden of these disasters. This talk will present technology, design and planning strategies which anticipate climate change and seismic disasters. Drawing from her forthcoming book *Design Before Disaster,* Mazereeuw will share case studies from Japan which have influenced her work. She will conclude by sharing current projects from the MIT Urban Risk Lab, which she leads. The projects range in scale from built housing prototypes, to online interactive planning strategies, to innovative AI and machine learning platforms to prioritize action. Based on the Urban Risk Lab's main principals, all projects work to connect everyday actions with actions during disaster. They also connect the digital world with the spatial and social worlds we design, build and want to protect.

3:10 PM

Engineering Now! Are We Ready?
Franz-Josef Ulm
Faculty Director, Concrete Sustainability Hub
Professor, Construction Management, Civil and Environmental Engineering, MIT Department of Civil and Environmental Engineering

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Faculty Director, Concrete Sustainability Hub
Professor, Construction Management, Civil and Environmental Engineering
MIT Department of Civil and Environmental Engineering

Franz-Josef Ulm is Professor of Civil & Environmental Engineering at MIT. A structural engineer by training he joined MIT in 1999, where he is responsible for Materials and Structures. He is an elected member of the US National Academy of Engineering, of the European Academy of Sciences and Arts and of the Austrian Academy of Sciences. He is Editor-In-Chief of the Journal of Engineering Mechanics of the American Society of Civil Engineers.

View full bio

Never before have the challenges for engineers been greater and more burning than in the face of climate change, from the energy transition to the sustainable construction of a just society. Will it be possible? In this talk, I will discuss some approaches that all originate from the same idea of preparing us engineers for these challenges and opportunities. With sustainability and resilience at heart, I will advocate that engineers and industries take up the new physical realities in a data-centric way and translate them into engineering solutions; from new multi-functional building materials such as concrete that can store energy, to smartphone-enabled infrastructure sensors and molecularly inspired retrofitting of our urban neighborhoods for more resilience and social justice in the face of climate change. As research continues to advance in all of these areas, it will depend on all of us to break out of our silos (academic, disciplinary, cultural) and translate these emerging approaches into actual sustainable solutions for our societies at large.

3:50 PM

Networking Break

4:10 PM

Automated, Integrated, Modular Systems for the Manufacturing of Biopharmaceutical Drug Products
Richard Braatz
Edwin R. Gilliland Professor, MIT Department of Chemical Engineering

Richard Braatz
Edwin R. Gilliland Professor
MIT Department of Chemical Engineering

Dr. Richard D. Braatz is the Edwin R. Gilliland Professor of Chemical Engineering at MIT, where he conducts research into advanced biomanufacturing systems. He is the Director of the Center on Continuous mRNA Manufacturing and leads process data analytics, mechanistic modeling, and control systems for projects on vaccine, monoclonal antibody, and gene therapy manufacturing. Dr. Braatz received an M.S. and Ph.D. from the California Institute of Technology and was the Millennium Chair and Professor at the University of Illinois at Urbana-Champaign and a Visiting Scholar at Harvard University before moving to MIT. Dr. Braatz has collaborated with more than 20 companies, including Novartis, Pfizer, Merck, Bristol-Myers Squibb, Biogen, Amgen, Takeda, and Abbott Labs. He has published over 300 papers and three books. Dr. Braatz is a Fellow of IEEE, IFAC, AIChE, and AAAS and a member of the U.S. National Academy of Engineering.

View full bio

Increased attention has been directed in recent years towards advanced manufacturing systems technologies towards making advances in product quality and productivity under such efforts known as Digital Manufacturing, Smart Manufacturing, and Industry 4.0. This presentation describes an integrated approach to accelerating process development that involves (1) greatly increased understanding and optimization of each unit operation while exploiting process intensification and continuous manufacturing, (2) automated high-throughput microscale technology for fast process R&D, (3) plug-and-play modular systems with integrated control and monitoring to facilitate deployment, (4) dynamic mechanistic models for unit operations for plant-wide simulation and control design, and (5) smart process data analytics to automatically select and apply the best data analytics and machine learning methods for a process dataset based on its characteristics and the user objectives. The strategies are illustrated in applications to monoclonal antibody, vaccine, and gene therapy manufacturing systems.

4:50 PM

Making Digital Tangible: Beyond the Metaverse Towards a MATTERverse
Hiroshi Ishii
Jerome B. Wiesner Professor of Media Arts and Sciences
Head of Tangible Media Group
Associate Director, MIT Media Lab

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Head of Tangible Media Group
Associate Director
MIT Media Lab

Hiroshi Ishii is the Jerome B. Wiesner Professor of Media Arts and Sciences at the MIT Media Lab. He was named Media Lab Associate Director in May 2008. He is the director of the Tangible Media Group, which he founded in 1995 to pursue new visions in Human-Computer Interaction (HCI): "Tangible Bits" and "Radical Atoms." Ishii and his team have presented their research at a variety of scientific, design, and artistic venues (including ACM SIGCHI, SIGGRAPH, Cooper Hewitt Design Museum, Milan Design Week, Cannes Lions Festival, Aspen Ideas Festival, Industrial Design Society of America, AIGA, Ars Electronica, Centre Pompidou, Victoria and Albert Museum and NTT ICC) **emphasizing that the development of a vision requires the rigors of both scientific and artistic review.** In 2006 Ishii was elected to the CHI Academy by ACM SIGCHI, and received the SIGCHI Lifetime Research Award in 2019.

Prior to joining the MIT Media Lab, from 1988-1994, Ishii led the CSCW research group at NTT Human Interface Laboratories Japan, where he and his team invented TeamWorkStation and ClearBoard.

Mainstream Human-Computer Interaction (HCI) research today primarily addresses functional concerns – the needs of users, practical applications, and usability evaluation. Tangible Bits and Radical Atoms are driven by a vision at the intersection of the arts and computer science to make the digital tangible.

Tangible Bits and Radical Atoms seek to realize seamless interfaces between humans, digital information, and the physical environment by giving dynamic physical form to digital information and computation. They make bits directly manipulatable and perceptible both in the foreground and background of our consciousness (peripheral awareness).

Our goal is to invent new media for artistic expression, communication, and design, taking advantage of the richness of our human senses and the skills we develop throughout our lifetime of interacting with the physical world, as well as the computational reflection enabled by real-time sensing and digital feedback.

During the past quarter century, our research can be seen as a battle against the Pixel Empire, represented most definitively in the trend of the “metaverse.” We believe that augmented physical/digital materials that people can touch and manipulate should be the new media to interact with the digital world instead of pixels in an HMD. We envision the “MATTERverse” as an alternative future of the pixel-oriented metaverse.

5:30 PM

Adjournment and Networking Reception