MIT Industrial Liaison Program Faculty Knowledgebase Report

2019 MIT Japan Conference

January 25, 2019 8:40 am - 6:00 pm

8:40am	Registration

9:20am

Opening Remarks
Gregory Ornatowski
Senior Director, MIT Corporate Relations
Director, MIT-ILP, Japan
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Dr. Ornatowski is currently a Senior Director in the Office of Corporate Relations (OCR) at MIT and the Director, MIT-ILP, Japan. He works with various companies in the automotive, electronics and materials industries. Prior to joining MIT, he worked as a consultant in the Boston area with Standard and Poor's DRI and Harbor Research.

Previously he spent nine years with General Electric, where he held various management positions in business development, strategic planning and marketing in the U.S. and Asia and worked with several of GE's technology-focused businesses. Dr. Ornatowski began his professional career as a management consultant working with the Tokyo office of the Boston Consulting Group.

In addition to his corporate experience, Dr. Ornatowski has taught at the MIT Sloan School of Management, Boston University, and Trinity College. He has also published articles in the Sloan Management Review, Far Eastern Economic Review, The Journal of the American Chamber of Commerce in Japan, and the Journal of Socio-Economics. He is fluent in Japanese, having lived and worked in Japan a total of 12 years, and has worked extensively with Asian and European companies as well.

Karl Koster
Executive Director, MIT Corporate Relations
Director, Alliance Management
MIT Office of Strategic Alliances & Technology Transfer

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Karl Koster is the Executive Director of MIT Corporate Relations. MIT Corporate Relations includes the MIT Industrial Liaison Program and MIT Startup Exchange.

In that capacity, Koster and his staff work with the leadership of MIT and senior corporate executives to design and implement strategies for fostering corporate partnerships with the Institute. Koster and his team have also worked to identify and design a number of major international programs for MIT, which have been characterized by the establishment of strong, programmatic linkages among universities, industry, and governments. Most recently these efforts have been extended to engage the surrounding innovation ecosystem, including its vibrant startup and small company community, into MIT's global corporate and university networks.

Koster is also the Director of Alliance Management in the Office of Strategic Alliances and Technology Transfer (OSATT). OSATT was launched in Fall 2019 as part of a plan to reinvent MIT’s research administration infrastructure. OSATT develops agreements that facilitate MIT projects, programs and consortia with industrial, nonprofit, and international sponsors, partners and collaborators.

He is past chairman of the University-Industry Demonstration Partnership (UIDP), an organization that seeks to enhance the value of collaborative partnerships between universities and corporations.

He graduated from Brown University with a BA in geology and economics, and received an MS from MIT Sloan School of Management. Prior to returning to MIT, Koster worked as a management consultant in Europe, Latin America, and the United States on projects for private and public sector organizations.

9:30am

The Promise, Limits and Future of Intelligent Autonomy in the Air and on the Ground
Nicholas Roy
Bisplinghoff Professor, Aeronautics & Astronautics
Director of Quest Systems Engineering, MIT Quest for Intelligence

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Nicholas Roy is the Bisplinghoff Professor of Aeronautics & Astronautics and a member of the Computer Science and Artificial Intelligence Laboratory (CSAIL) at the Massachusetts Institute of Technology. He has a B.Sc. in Physics and Cognitive Science an M.Sc. in Computer Science, both from McGill University. He received his Ph. D. in Robotics from Carnegie Mellon University in 2003. He has made research contributions to planning under uncertainty, machine learning, human-computer interaction and aerial robotics. He founded and led Project Wing at Google [X] from 2012-2014. He is currently the Director of Quest Systems Engineering in MIT's Quest for Intelligence.

View full bio

Artificial intelligence and machine learning are disrupting industries across the globe, from self-driving cars to smart home assistants to automated call centers. There are many potential benefits including improved safety and productivity and reduced environmental footprint, however, there are technological limits, and not every sector of the economy is reaping the same level of benefits. State of the art AI and robotics will be discussed, along with how these technologies are impacting a range of business sectors, such as transportation, telecommunications, construction, and media. Emerging technologies in both academic and industrial research and development labs will be highlighted, alongside a summary of current hard problems and how these technologies are likely to evolve over time.

10:10am

From Data to Information to Action: Reasoning, Uncertainty and Resource Limitations
John Fisher

Principal Research Scientist
MIT Computer Science and Artificial Intelligence Laboratory

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John Fisher is Principal Research Scientist at the MIT Computer Science and Artificial Intelligence Laboratory. His research focuses on information-theoretic approaches to machine learning, computer vision, and signal processing. Application areas include signal-level approaches to multi-modal data fusion, signal and image processing in sensor networks, distributed inference under resource constraints, resource management in sensor networks, and analysis of seismic and radar images. In collaboration with the Surgical Planning Lab at Brigham and Women's Hospital, he is developing nonparametric approaches to image registration and functional imaging.

He received a B.S. and M.S. in Electrical Engineering at the University of Florida in 1987 and 1989, respectively. He earned a Ph.D. in Electrical and Computer Engineering in 1997.

View full bio

How many conscious decisions does an adult make in a single day? Estimates vary widely, ranging from the low hundreds to an astounding 35,000. While not all decisions bear equal importance — "Should I study engineering or physics?" versus "Should I wear a blue shirt or a green shirt?" — there is a cost to the decision-making process itself. Uncertainty in the outcome may be difficult to quantify. Information sources may be numerous and complex. Time is often a critical limitation. As such, individuals expend resources — reasoning, information gathering, physical energy — in order to make decisions.

Analogously, in many distributed sensing problems, resource limitations (e.g. time, energy, computation, etc.) constrain the process of data integration and decision-making. In this talk, I will highlight some of the appealing properties of structured probabilistic models as a representation beyond their primary (and well known) use as a framework for inference. For example, Value of information (VoI) analysis, informed by the structure of the model, facilitates analysis of the trade-off between exploiting the informational utility of a distributed set of information sources and the resources necessary to acquire them, fuse them into a model of uncertainty, and ultimately reason over the representation for decision making. A critical aspect of this process is understanding the relations between information, uncertainty and risk.

In the course of this talk, I will present a variety of real-world applications of these methods highlighting both their advantages as well as pointing to new challenges.

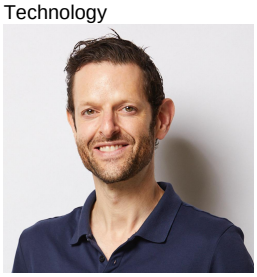
10:50am

Break

11:05am

Towards Accelerated Medical Innovation

Jeffrey M. Karp
Professor of Medicine, Brigham and Women's Hospital, Harvard Medical School
Principal Faculty, Harvard Stem Cell Institute
Affiliate faculty, Broad Institute and at the Harvard-MIT Division of Health Sciences and Technology



Jeffrey M. Karp
Professor of Medicine, Brigham and Women's Hospital, Harvard Medical School
Principal Faculty, Harvard Stem Cell Institute
Affiliate faculty, Broad Institute and at the Harvard-MIT Division of Health Sciences and Technology

Dr. Jeff Karp is a Professor of Medicine at Brigham and Women's Hospital, Harvard Medical School. He is also a principal faculty member at the Harvard Stem Cell Institute, and an affiliate faculty member at the Broad Institute and at the Harvard-MIT Division of Health Sciences and Technology.

He works in the fields of drug delivery, medical devices, stem cell therapeutics, and tissue adhesives. He has published over 125 peer-reviewed papers, with >21,500 citations, and has given over 300 invited lectures. He has over 100 issued or pending national and international patents. Several technologies developed in his lab have led to multiple products currently in development or on the market and for the launch of eight companies that have raised over $400 million in funding. Technologies include high-tech skincare (Skintifique, products sold in pharmacies throughout EU), tissue adhesives (Tissium, EU Approval in 2017) and 3D printed biomedical devices, immunomodulation with biologically responsive materials (Alivio Tx), small molecule regenerative therapeutics ($FREQ – NASDAQ), cannabinoid therapeutics (Molecular Infusions acquired by Suterra Wellness in 2019), biomedical devices to improve child safety (Landsdowne Labs), needles that automatically stop at their target (Bullseye Therapeutics), and a bioengineered luminal coating for controlled GI targeting (Altrix Bio).

Karp has received >50 awards and honors. Most recently Jeff received the highest award from the Society For Biomaterials for innovation – the Clemson Award for Applied Research. *Boston Magazine* recognized Karp as one of 11 Boston Doctors Making Medical Breakthroughs. The *Boston Business Journal* recognized him as a Champion in Healthcare Innovation and MIT's *Technology Review Magazine* (TR35) also recognized Karp as being one of the top innovators in the world (three members from his laboratory have subsequently received this award). Karp was elected to the American Institute for Medical and Biological Engineering's College of Fellows in 2013, a fellow of the Biomedical Engineering Society (BMES) in 2018, and a Fellow of the Royal Society of Chemistry and the Canadian Academy of Engineering in 2019. His work has been selected by *Popular Mechanic's* as one of the Top 20 New Biotech Breakthroughs that Will Change Medicine. He gave a commencement speech at his high school in 2011, and a TEDMED talk in 2014 on bioinspired medical innovation, and since 2015 has been a member of the TEDMED Editorial Advisory Board. In 2015 and 2016, he received Breakthrough Awards from the Kenneth Rainin Foundation, and in 2015 was a commencement speaker at the University of Toronto Faculty of Dentistry and Pharmacy. Karp also won an internal Shark Tank award judged by Kevin O'Leary (from ABC's Shark Tank). In 2018 Karp gave a TEDx talk on Radical Simplicity. Furthermore, in 2019 Karp was a grade 8 commencement speech at the Talcott Mountain Academy in Connecticut.

In addition to his research goals, Karp is dedicated to developing the careers of the next generation bioengineers at the forefront of regenerative medicine. He was selected as the Outstanding Faculty Undergraduate Mentor among all faculty at MIT and he received the HST McMahon Mentoring award for being the top mentor of Harvard-MIT students. To date, 22 trainees from his laboratory have secured faculty positions.

View full bio

For companies and academics aiming to innovate in the medical space, we often don't spend enough time thinking about the problem we are trying to solve. This goes far beyond reading the academic literature. We need to think critically and constantly pressure test our assumptions to really understand problems and turn them into opportunities for solutions. This often involves connecting biology and materials science to practical considerations for technology implementation by the clinician, as well as all the other factors, such as market pull, regulatory, reimbursement, manufacturing, and patents for example. It's about committing to a journey that can lead to critical insights that direct us towards the most tractable solutions. And for that, we need a different set of tools to help challenge our thinking and constantly bring in fresh ideas and perspectives

One approach we have implemented to constantly bring in new ideas, is to turn to nature for inspiration. Millions and millions of years of research and development at our fingertips, and all we need to do is look outside to the amazing creatures that inhabit our planet. We like to

11:45am

MIT Startup Exchange: Introduction with Lightning Talks
Manijeh Goldberg
Founder & CEO, Privo Technologies
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Privo Technologies

Manijeh Goldberg is the Founder and CEO of Privo Technologies. She has over 20 years of experience in the biomedical industry, in large companies and five startups. Goldberg is responsible for the leadership and overall management of Privo with an innovative drug delivery platform. She has developed US Key Opinion Leader (KOL) relationships, successfully lobbied to get PRV111 into a large, NIH funded clinical study, planned and executed training, and helped drive on-time trial enrollment. Goldberg holds a PhD in biomedical engineering, an MS in biomedical enterprise from Harvard Medical School, an MBA from MIT, and an MS in computer science and mathematics.

A.J. MacKinnon
Senior Director, Business Development and Strategic Partnerships, Affectiva
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Senior Director, Business Development and Strategic Partnerships
Affectiva

A.J. MacKinnon is Senior Director of Business Development and Strategic Partnerships at Affectiva. In this role, he is responsible for managing Affectiva's Asia business. MacKinnon has extensive experience living and working in Asia, leading and growing Japan/APAC businesses for Boston-based tech companies, including Nuance Communications and NetSilicon.

Chad Malone
Chief Strategy and Growth Officer, Figur8
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Chief Strategy and Growth Officer
Figur8

Chad Malone M.D. is the Chief Strategy and Growth Office of figur8. Malone brings more than 20 years of domestic and international experience in biomedical informatics, medical devices and clinical & translational science, incorporating a strong information technology background and experience in healthcare data strategy, clinical practice, and patient outcomes. He has extensive leadership in accelerating startups and executing turnarounds by focusing on technology optimization, new market creation, and devising and executing effective commercial strategies which drive rapid operational and revenue growth.

In any venture, his focus is on the patient. Serving the patient was his impetus for pursuing a second career as a physician. If outcomes, patient experience and clinical workflow optimization are improved through the right technology, the bottom line is an improvement in the quality of life of patients. In the past, Malone served as the Chief Strategy and Growth Officer of eHealth Technologies, VP of Channel Sales at Ingenix (Optum), VP of International Business Development at TenFold. He has been instrumental in accelerating a number of technologies throughout his career, namely, Zipongo (Digital Nutrition), Canary Speech (Early Voice Diagnostics), SolveBio (Genomic Informatics), CoNextions Medical (Orthopedic Device).

Alexander Shkolnik
Cofounder and CEO, LiquidPiston

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Cofounder and CEO
LiquidPiston

Dr. Alexander Shkolnik is cofounder and CEO of LiquidPiston, where he provides operational, strategic and technical oversight toward developing and commercializing a new type of advanced rotary engine. Shkolnik holds a PhD from MIT in computer science, where he was a National Science Foundation Graduate Research Fellow, and continued as a postdoctoral researcher. He had also studied at AIST in Japan (Tsukuba) under an NSF/JSF EAPSI Fellowship. Shkolnik has 50 patents issued or pending and has authored 25 peer reviewed journal and conference publications.

Oz Locker
SVP of Partnerships, ClimaCell
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SVP of Partnerships
ClimaCell

Oz Locker is the Senior Vice President of Partnerships at ClimaCell, leading the Global Go-

12:30pm Lunch with Startup Exchange Exhibits

2:00pm Electronic, Optical, and Magnetic Tools to Study the Nervous System

Polina Anikeeva
Professor, MIT Materials Science and Engineering and MIT Brain and Cognitive Sciences,
MIT Brain and Cognitive Sciences

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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. Salapatas 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

To understand the mechanisms underlying the function and dynamics of the nervous system, it is essential to develop tools capable of recording and modulating a diversity of signals employed by neurons and glia. In addition to addressing the signaling complexity of the nervous system, these tools must match the mechanical and chemical properties of the neural tissue to avoid foreign body response and functional perturbation to local circuits. Our group relies on materials design to address these challenges. By leveraging fiber-drawing methods inspired by telecommunications and textile industries, we create flexible and stretchable multi-functional probes suitable for recording and stimulation of neural activity as well as delivery of drugs and genetic information into the brain and spinal cord. We use these tools to probe brain circuits involved in control of motor functions, anxiety, and fear and to promote recovery following spinal cord and peripheral nerve injury. In addition to polymer-based fibers, we develop a broad range of magnetic nanotransducers that can deliver thermal, chemical, and mechanical stimuli to neurons when exposed to externally applied magnetic fields. Magnetic nanoparticles can undergo hysteresis and dissipate heat in alternating magnetic fields. This local temperature increase can be used to directly stimulate activity of heat-sensitive neurons or to trigger release of pharmacological compounds and designer drugs from thermally responsive carriers. Similarly, magnetic nanomaterials with large magnetic moments can be employed to deliver torques when exposed to slow-varying magnetic fields. Since biological tissues exhibit negligible magnetic permeability and low conductivity, magnetic fields can penetrate deep into the body with no attenuation allowing us to apply the nanomagnetic transducers to remotely control deep brain circuits associated with reward and motivation as well as adrenal circuits involved in regulation of corticosterone and (nor)epinephrine release.

2:40pm

Drivers of technological change in energy systems
Jessika Trancik
Professor in the Institute for Data, Systems, and Society

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Professor in the Institute for Data, Systems, and Society

Jessika Trancik is a Professor in the Institute for Data, Systems, and Society at the Massachusetts Institute of Technology. Her research examines the dynamic costs, performance, and environmental impacts of energy systems to inform climate policy and accelerate beneficial and equitable technology innovation. Her projects focus on all energy services including electricity, transportation, heating, and industrial processes. This work spans solar energy, wind energy, energy storage, low-carbon fuels, electric vehicles, and nuclear fission among other technologies. Prof. Trancik received her B.S. from Cornell University and her Ph.D. from the University of Oxford as a Rhodes Scholar. She is currently an external professor at the Santa Fe Institute, and was formerly at Columbia University's Earth Institute, and at WSP International/UNOPS (now Interpeace) in Geneva.

View full bio

Renewable energy installations have grown rapidly in recent decades as their costs have fallen. Will these trends continue and extend to other low-carbon energy industries, allowing these technologies to contribute measurably to climate change mitigation? Answering this question requires understanding the determinants of technological change. This research uncovers key drivers, from technology features to the formulation of policy. Several practical lessons emerge that can inform efforts by engineers and policy-makers in new areas such as energy storage, clean vehicles, and artificial intelligence.

3:20pm

Break

3:45pm

Inverse materials design through artificial intelligence and physics-based simulations
Rafael Gomez-Bombarelli

Jeffrey Cheah Career Development Chair,
Associate Professor, MIT Department of Materials Science and Engineering

Rafael Gomez-Bombarelli

Jeffrey Cheah Career Development Chair,
Associate Professor, MIT Department of Materials Science and Engineering

Professor Gómez-Bombarelli received his BS, MS, and PhD in chemistry from the University of Salamanca in Spain, followed by postdoctoral work at Heriot-Watt University in Scotland. As a postdoc at the Aspuru-Guzik lab at Harvard University he worked on high-throughput virtual screening for organic light-emitting diode (OLED) and battery electrolytes. He entered industry in 2016 as a senior researcher at Japanese technology company Kyulux, applying Harvard-licensed technology to build commercial OLED products. He joined the DMSE faculty in 2018.

Professor Gómez-Bombarelli's work has been featured in publications such as *MIT Technology Review* and the *Wall Street Journal*. He is co-founder of Calculario, a materials discovery company that uses quantum chemistry and machine learning to target advanced materials in a range of high-value markets.

View full bio

Machine learning tools, combined with theoretical simulations can effectively accelerate design of novel materials. Data-driven approaches can access the information embedded in years of experiments, perform rapid optimization of high-dimensional experimental conditions and design parameters, increase the accuracy and speed of physics-based simulations, or design new molecules and crystals automatically. By combining cutting-edge machine learning models on experimental data with automated theoretical simulations (molecular dynamics, electronic structure) the Gomez-Bombarelli addresses the design and optimization of novel materials in multiple areas such as small molecules (organic electrolytes for flow batteries), soft materials (lithium-conducting polymers, organic light-emitting diodes) and crystalline frameworks (zeolite catalysts). Here, we will describe recent results and ongoing work in using machine learning as the connector between multiple scales of simulation and experiment and automation of computer simulations.

4:25pm

The Next IT: Innovation Transformation & the Technologies of Virtuous Cycles?
Michael Schrage
Research Fellow, MIT Initiative on the Digital Economy, MIT Sloan School of Management

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Research Fellow, MIT Initiative on the Digital Economy
MIT Sloan School of Management

Michael Schrage is a research fellow with the MIT Sloan School of Management's Initiative on the Digital Economy. His research, writing, and advisory work focuses on the behavioral economics of models, prototypes, and metrics as strategic resources for managing innovation risk and opportunity. He is author of the award-winning book The Innovator's Hypothesis (*MIT Press*, 2014), Who Do You Want Your Customers to Become? (*Harvard Business Review Press*, 2012), and Serious Play (*Harvard Business Review Press*, 2000). His latest book, Recommendation Engines, was published in September 2020 by *MIT Press* as part of its Essential Knowledge series. He's done consulting and advisory work for Microsoft, Procter & Gamble, British Telecom, BP, Siemens, Embraer, Google, iRise, the Office of Net Assessment, and other organizations

Schrage has run design workshops and executive education programs on innovation, experimentation, and strategic measurement for organizations all over the world and is currently pioneering work in selvesware technologies designed to augment aspects, attributes, and talents of productive individuals. He is particularly interested in the future co-evolution of expertise, advice, and human agency as technologies become smarter than the people using them.

View full bio

Data-driven digital innovation continues to redefine how organizations create and manage value inside the enterprise and out. 'Network effects' are now as important as networks for business success. Training algorithms has become as important as training people. The global economics of innovation have profoundly changed, so innovators and fast-followers alike increasingly look to platform architectures, business models, and investments to take advantage of this growing wealth of digital opportunities. This talk explores, explains, and argues that the key to digital transformation is investing the human capital, creativity, competences, and capital of one's customers and clients. This insight is poorly understood yet key to the global success of companies ranging from Alibaba to Amazon to Tencent to Google to Netflix. Drawing from MIT Sloan School Initiative on the Digital Economy research, this talk presents an actionable framework for translating this concept into action.

5:05pm

Closing Remarks
Gregory Ornatowski
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5:10pm	Reception and Networking