MIT Industrial Liaison Program Faculty Knowledgebase Report

2020 MIT Japan Conference

January 24, 2020 8:40 am - 5:10 pm

8:40am	Registration

9:20am

Opening Remarks
Gregory Ornatowski
Senior Director, MIT Corporate Relations
Director, MIT-ILP, Japan
Gregory Ornatowski
Senior Director, MIT Corporate Relations
Director, MIT-ILP, Japan

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

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

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.

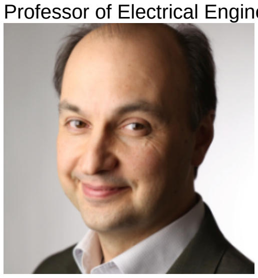
Koster is also the Director of Alliance Management in the Office of Strategic Alliances and Technology Transfer (OSATT). OSATT was launched in Fall 2019 as part of a plan to reinvent MIT’s research administration infrastructure. OSATT develops agreements that facilitate MIT projects, programs and consortia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

At the Dawn of the Nano Age - MIT.nano and the Future of Discovery
MIT.nano Consortium: Collaborate to Boost Nanoscale Research
Vladimir Bulovic
Director, MIT.nano
Fariborz Maseeh (1990) Chair in Emerging Technology
Professor of Electrical Engineering, MIT



Vladimir Bulovic
Director, MIT.nano
Fariborz Maseeh (1990) Chair in Emerging Technology
Professor of Electrical Engineering
MIT

Vladimir Bulovi? is a Professor of Electrical Engineering at the Massachusetts Institute of Technology, holding the Fariborz Maseeh Chair in Emerging Technology. He directs the Organic and Nanostructured Electronics Laboratory, co-leads the MIT-Eni Solar Frontiers Center, leads the Tata GridEdge program, and is the Founding Director of MIT.nano, MIT's new 200,000 sqft nano-fabrication, nano-characterization, and prototyping facility. He is an author of over 250 research articles (cited over 50,000 times and recognized as the top 1% of the most highly cited in the Web of Science). He is an inventor of over 100 U.S. patents in areas of light emitting diodes, lasers, photovoltaics, photodetectors, chemical sensors, programmable memories, and micro-electro machines, majority of which have been licensed and utilized by both start-up and multinational companies. The three start-up companies Bulovi? co-founded jointly employ over 350 people, and include Ubiquitous Energy, Inc., developing nanostructured solar technologies, Kateeva, Inc., focused on development of printed electronics, and QD Vision, Inc. (acquired in 2016) that produced quantum dot optoelectronic components. Products of these companies have been used by millions. Bulovi? was the first Associate Dean for Innovation of the School of Engineering and the Inaugural co-Director of MIT's Innovation Initiative, which he co-led from 2013 to 2018. For his passion for teaching Bulovi? has been recognized with the MacVicar Fellowship, MIT's highest teaching honor. He completed his Electrical Engineering B.S.E. and Ph.D. degrees at Princeton University.

View full bio

The Nano Age is upon us! With nano-scale advancements, we are reimagining Health and Life Sciences, Energy, Computing, Information Technology, Manufacturing, Quantum Science…and that is because nano is not a specific technology. It does not belong to a particular industry or discipline. It is, rather, a revolutionary way of understanding and working with matter, and it is the key to launching the next Innovation Age, the Nano Age.

Tools to build the Nano Age can be found at the heart of MIT campus, inside a comprehensive, 20,000-square-meter shared facility for nano-scale. MIT.nano designed to give researchers and innovators access to a broad and versatile toolsets that can do more – from imaging to synthesis, fabbing, and prototyping – entirely within the facility's protective envelope. Opening of MIT.nano in October 2018 also marked the beginning of a new era of nano-education at MIT, with handson learning spaces and advanced teaching tools integrated throughout the facility. On the top floor of MIT.nano, a versatile suite of prototyping labs is further designed to support incubation and initial growth of start-up-companies. There, inventors can translate nano-scale advancements into hand-held systems, transitioning academic pursuits into prototypes for a better World. Quantifying and analyzing technology translations from MIT.nano will give insights into the steps comprising the innovation process, which we expect will enable us to transform the mere art of innovation into a systematic science. Knowledge and insights gained, MIT.nano is committed to share broadly so we can accelerate the advancements of the Nano Age through both act and deed.

In his talk, Bulovic will describe the latest works of MIT's campus discoveries. He will share his vision for the innovation journeys in the labs and galleries of MIT.nano, shaped to deliver breakthrough solutions and spur public narratives that can define our time.

10:10am

Printing Optical Materials
Nicholas Fang

Professor of Mechanical Engineering
MIT Department of Mechanical Engineering

Nicholas Fang

Professor of Mechanical Engineering
MIT Department of Mechanical Engineering

Nicholas X. Fang received his BS and MS in physics from Nanjing University, and his PhD in mechanical engineering from University of California Los Angeles. He is currently professor of Mechanical Engineering at MIT. Prior to MIT, he worked as an assistant professor at the University of Illinois Urbana-Champaign from 2004 to 2010. Professor Fang's areas of research look at nanophotonics and nanofabrication. His recognitions include the ASME Chao and Trigger Young Manufacturing Engineer Award (2013); the ICO prize from the International Commission of Optics (2011); an invited participant of the Frontiers of Engineering Conference by National Academies in 2010; the NSF CAREER Award (2009) and MIT *Technology Review Magazine's* 35 Young Innovators Award (2008).

View full bio

Will future of smart lighting and window coatings enable energy-efficient cooling in smart buildings? Can printed color converters lead to next generation micro displays with high brightness, sharp image resolution, and ultra low-power consumption? Recently, exciting new physics of nanoscale optical materials has inspired a series of key explorations to manipulate, store and control the flow of information and energy at unprecedented dimensions. In this talk I will report our recent efforts on controlling light harvesting and conversion process using scalable micro/nanofabrication. These emerging optical materials show promise to a range of important applications, from optical networks and chip-scale photonic sensors to lasers, LEDs, and solar technology.

For example, pixelated color converters are envisioned to achieve full-color high-resolution display through down conversion of blue micro-LEDs. Quantum dots (QDs) are promising narrow-band converters of high quantum efficiency and brightness enabling saturated colors. However, challenges still remain to produce high resolution color-selective patterns compatible with the advanced blue micro-LEDs with pitch and pixel size approaching 1 µm. Here we demonstrate our preliminary study on scalable printing of high-resolution pixelated red and green color converters patterned through projection lithography. I will also discuss potential applications such as high-resolution wide-gamut microdisplay for mixed reality and high speed visible light communication.

In this talk, I will also introduce versatile 3D shape transformations of nanoscale structures by deliberate engineering of the topography-guided stress of gold nanostructures. By using the topography-guided stress equilibrium, rich 3D shape transformation such as buckling, rotation, and twisting of nanostructures is precisely achieved, which can be predicted by our mechanical modeling. Benefiting from the nanoscale 3D twisting features, giant optical chirality is achieved in an intuitively designed 3D pinwheel-like structure, in strong contrast to the achiral 2D precursor without nano-kirigami. The demonstrated nano-kirigami, as well as the exotic 3D nanostructures, could be adopted in broad nanofabrication platforms and could open up new possibilities for the exploration of functional micro-/nanophotonic and mechanical devices.

10:50am

Break

11:05am

Not too big to fail: Resilience of Critical Infrastructure Systems
Saurabh Amin

Robert N. Noyce Career Development Assistant Professor
MIT Department of Civil and Environmental Engineering

Saurabh Amin

Robert N. Noyce Career Development Assistant Professor
MIT Department of Civil and Environmental Engineering

Saurabh Amin is Robert N. Noyce Career Development Assistant Professor in the Department of Civil and Environmental Engineering, Massachusetts Institute of Technology (MIT). His research focuses on the design and implementation of high confidence network control algorithms for infrastructure systems. He works on robust diagnostics and control problems that involve using networked systems to facilitate the monitoring and control of large-scale critical infrastructures, including transportation, water, and energy distribution systems. He also studies the effect of security attacks and random faults on the survivability of networked systems, and designs incentive-compatible control mechanisms to reduce network risks. Dr. Amin received his Ph.D. in Systems Engineering from the University of California, Berkeley in 2011. He is a recipient of NSF CAREER award, and Google Faculty Research award.

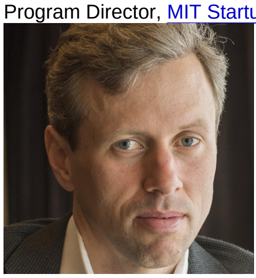
View full bio

Resilience of critical infrastructure systems is a key requirement in the vision of smart cities. These systems work continuously to enable the essential services such as water, gas, and electricity. They utilize diverse components organized as physical networks, and operated through heterogeneous and connected cyber elements. Many service utilities routinely face reliability concerns due to aging infrastructure, and lack the operational readiness that is needed to respond failures caused by natural disasters. Moreover, recent incidents have demonstrated that malicious entities can disrupt or gain control of these systems by exploiting cyber insecurities and/or physical faults. Indeed, sophisticated cyber intrusions and a number of successful physical attacks all confirm the insufficiency of the existing protection solutions. Such incidents can result in huge economic losses, and also pose threat to human lives. Since resiliency was not considered at the design stage of existing infrastructure systems, they continue to face significant risks from natural disasters and security attacks.

This talk is motivated by the need for a foundational approach for strategic security planning and operational response design, so that our infrastructure systems can better withstand, recover from, and adapt to both random and adversarial disruptions. The main agenda is to discuss how recently developed secure and distributed algorithms for network sensing and control can be implemented in practice to improve the resilience of large-scale infrastructure systems. These algorithms use ideas from control theory and large-scale optimization, along with game-theoretic analysis of strategic interaction between network operators and attackers. Through real-world case studies, we demonstrate that our algorithms can provide substantial improvements in strategic inspection and operational response capabilities of electricity and natural gas utilities facing risks of correlated disruptions.

11:45am

MIT Startup Exchange: Introduction with Lightning Talks
Marcus Dahllöf
Program Director, MIT Startup Exchange



Marcus Dahllöf
Program Director
MIT Startup Exchange

Marcus Dahllöf leads MIT Startup Exchange, which facilitates connections between MIT-connected startups and corporate members of the MIT Industrial Liaison Program (ILP). Dahllöf manages networking events, workshops, the STEX25 accelerator, opportunity postings, and helps define the strategic direction of MIT Startup Exchange. He is a two-time tech entrepreneur (one exit in cybersecurity), and has previously held roles in finance, software engineering, corporate strategy, and business development at emerging tech companies and Fortune 100 corporations in the U.S., Latin America, and Europe. Marcus was a member of the Swedish national rowing team and he is a mentor at the MIT Venture Mentoring Service.

Kazu Komoto
Robotics Software Engineer, Head of Deployment and Hardware
OSARO

Marinna Madrid
Cofounder & VP of Operations
Cellino

Allison Parker
VP of Marketing
Wise Systems

Ophir Gaathon
Cofounder & CEO
DUST Identity

Boaz Efroni Rotman
VP of Marketing & Business Development
Lightelligence

Nader Yaghoubi
Cofounder, President, & CEO
PathMaker Neurosystems

Yoichi Kadota
Director, Business Development Japan
Realtime Robotics

Chris Brown
Director of Quantum Solutions
Zapata Computing

Scott Healey
VP of Business Development
Kebotix

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 1,800 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 260 member companies.

MIT Startup Exchange and ILP are integrated programs of MIT Corporate Relations.

12:45pm

Lunch with Startup Exchange Exhibits

Additional exhibition:
- **twoXAR**: *Pharmaceuticals discovered with AI*

Andrew A. Radin
Cofounder & CEO, twoXAR

Andrew A. Radin
Cofounder & CEO
twoXAR

Andrew A. Radin is cofounder and Chief Executive Officer of twoXAR, a company dedicated to transforming how large biological datasets are harnessed to accelerate the identification and validation of new medicines. Radin developed the company's proprietary algorithm and leads product development. Prior to co-founding twoXAR, Radin held Chief Technology Officer roles at several early stage companies where he managed teams as large as a hundred technologists distributed around the world. Radin studied biomedical informatics in Stanford University's SCPD graduate program and holds an MS and BS in computer science from the Rochester Institute of Technology.

2:00pm New Technology for CO2 Capture

T. Alan Hatton
Ralph Landau Professor of Chemical Engineering Practice
Director, David H Koch School of Chemical Engineering Practice

T. Alan Hatton
Ralph Landau Professor of Chemical Engineering Practice
Director, David H Koch School of Chemical Engineering Practice

Our research focuses primarily on the development of electrochemical processes to facilitate chemical separations and to mediate the transformation of captured waste to useful commodity chemicals. The electrochemically-mediated separation processes that are currently under development and investigation in our group can primarily be divided into two areas: (i) carbon capture from both point (power plants, industrial emissions) and distributed (ambient air, ocean waters) sources; and (ii) water purification (including decontamination of wastewater and desalination). These research projects are supported by both government agencies and industrial partners.

We also have experience in the synthesis, characterization, and application of stimuli-responsive materials, which include nanoparticles, nanofibers, surfactants, polymers, and gels; these materials have a wide variety of applications in, for example, drug delivery, protein, environmental separations, rheology, and surface tension modification. We have particular experience with redox-active polymers for selective separations, and on the use of superparamagnetic nanoparticles (e.g. magnetic fluids) in environmental, biological and chemical separations.

Research advances in our group have resulted in the formation of a start-up company, Verdox Inc., developing electro-swing adsorption processes for removal of CO2 and other acid gases from process streams and the ambient environment. Other potential start-up ventures are currently under consideration.

View full bio

Significant changes in global climate patterns and increasing ocean acidities with their negative impacts on the health of our planet have been ascribed to the ever-increasing rise in atmospheric CO_2 levels, primarily attributed to anthropogenic sources such as the combustion of fossil fuels. The mitigation of these acid gas emissions is a daunting task, both because of the scale of the problem and because of the economic ramifications associated with the capture of the greenhouse gases and their subsequent utilization or subsurface storage. Effective means for the direct treatment of emissions with CO_2 concentrations of 5 to 15% (or higher), from a wide range of sources, such as in the power industries, at industrial facilities and from on-board vehicle exhausts, are sorely needed. Of late, there has also been some interest in the capture of CO_2 directly from the atmosphere, at concentrations close to 0.04%, which offers its own challenges for implementation.

The traditional means for CO_2 capture and release generally rely on either chemical or physical absorption in solvents at temperatures well below those at which the acid gas is generated, with subsequent heating to release the captured CO_2 and regenerate the sorbent. The captured CO_2 can then be compressed for injection and sequestration in subsurface geological formations, or used as a feedstock for the synthesis of fuels and chemical products. These capture processes require significant energy integration with the process plant which adds complexity and cost to the overall capture operation.

We will describe a number of approaches for the treatment of gas streams under ambient conditions (isothermal electrochemically mediated capture and release) and at very high temperatures (temperature and pressure swing with solid and molten metal oxides) that cover the spectrum of CO_2 capture needs including direct air capture, power generation, and a range of industrial processes. The general principles underlying these acid gas separation processes will be outlined, with an emphasis on the thermodynamic and transport considerations required for their effective implementation in carbon capture.

2:40pm

Electric Field Assisted Microfluidics for Healthcare and Biotechnology
Cullen R. Buie
Associate Professor of Mechanical Engineering, MIT
Director, MIT Laboratory for Energy and Microsystems Innovation
Co-founder & Chief Technology Officer, Kytopen

Cullen R. Buie
Associate Professor of Mechanical Engineering, MIT
Director, MIT Laboratory for Energy and Microsystems Innovation
Co-founder & Chief Technology Officer
Kytopen

Cullen Buie is an associate professor in MIT's Department of Mechanical Engineering and director of the Laboratory for Energy and Microsystems Innovation. His laboratory explores flow physics at the microscale for applications in materials science and applied biosciences. His research is applicable to a diverse range of problems, from anti-biofouling surfaces and biofuels to energy storage and bacterial infections.

In 2017 Kytopen, a start-up Buie co-founded that offers a method of genetic engineering 10,000 times faster than current methods, was among the first start-ups to be backed by The Engine, a start-up ecosystem launched by MIT. Buie was honored with the NSF Career Award in 2012, the DuPont Young Professor Award in 2013, the DARPA Young Faculty Award in 2013, and the NSF Presidential Early Career Awards for Scientists and Engineers in 2016.

Buie received his BS from The Ohio State University. He earned his master's and PhD in mechanical engineering at Stanford University and served as a postdoctoral fellow for one year at the University of California-Berkeley.

Electric fields can be a useful tool in the interrogation and genetic manipulation of cells. With respect to bacteria, the cell envelope is critical for understanding important physiological behaviors, such as extracellular electron transfer (EET) and antibiotic uptake. Through EET, microbes can transport electrons from their interior to external insoluble electron acceptors (e.g. metal oxides or electrodes in an electrochemical cell), which has attracted tremendous attention due to potential applications in environmental remediation and energy conversion. In this talk, we will present how bacterial envelope phenotypes such as EET can be quantified by cell surface polarizability, a dielectric property that can be measured using microfluidic dielectrophoresis. Next, we will discuss work in our laboratory to use very high electric fields (~10 kV/cm) in microfluidic devices to enable high throughput delivery of nucleic acids to bacterial populations. Results of this work hold exciting promise for rapid screening of bacterial envelope phenotypes and for accelerating genetic engineering of bacteria for industrial applications. Lastly, we will present recent efforts by a company spun out of the Buie Laboratory, Kytopen, which is leveraging the electroporation work to enable scalable non-viral transfection of mammalian cells. Applications of this work include adoptive cell therapies such as CAR-T, which are currently plagued by high costs and manufacturing issues.

3:20pm

Break

3:45pm

Self-assembled small molecule nanofibers in water: Tailoring surface chemistry and mechanical properties to applications
Julia Ortony

John Chipman Career Development Assistant Professor of Materials Science and Engineering
MIT Department of Materials Science and Engineering

Julia Ortony

John Chipman Career Development Assistant Professor of Materials Science and Engineering
MIT Department of Materials Science and Engineering

Julia Ortony joins the Department of Materials Science and Engineering faculty in January 2016. She earned her B.S. in chemistry at the University of Minnesota and her Ph.D. in materials chemistry at the University of California at Santa Barbara.

Professor Ortony’s research interests consist of two main thrusts: (1) The design and optimization of soft materials with nanoscale structure for important new technologies, and (2) The development of advanced instrumentation for measuring conformational and water dynamics analogous to molecular dynamics (MD) simulations. Professor Ortony's group (which is scheduled to start up in late fall of 2015) will combine these two efforts to investigate technologies ranging from energy to biological materials with special consideration paid to molecular motion.

Molecular self-assembly provides promising nanomaterials because they are water-processable, the constituent molecules are modular and scalable, and their surfaces can be easily functionalized. However, supramolecular nanomaterials generally exhibit high molecular exchange rates, hydrolytic degradation, and other instabilities that preclude their use in the demanding environments or the solid state. Here I introduce a new self-assembled nanofiber platform, recently developed in our lab, that exhibits unprecedented mechanical strength and dramatically reduced dynamic instabilities. The nanofibers have widths less than 6 nm, length of many microns, and pristine internal molecular order. In this talk, I will discuss the design and characterization of this platform and the possible new application space that is enabled by such enhanced stability.

4:25pm

Swarm Leadership and Building the Collective Mind
Peter Gloor
Research Scientist, Center for Collective Intelligence
MIT Sloan School of Management
Peter Gloor
Research Scientist, Center for Collective Intelligence
MIT Sloan School of Management

Peter Gloor is a research scientist at the Center for Collective Intelligence at MIT Sloan working on Collaborative Innovation Networks. He is also founder and chief creative officer of the software company galaxyadvisors and an honorary professor at the University of Cologne and Jilin University, China. Previously, Gloor was a partner with Deloitte and PwC and a manager at UBS. His latest books are *Sociometrics and Human Relationships* and *Swarm Leadership and the Collective Mind*. Gloor holds a PhD in computer science from the University of Zurich and was a postdoc at MIT's Lab for Computer Science.

View full bio

The future of business is swarm business – whether it’s at Uber, Airbnb, Tesla, or Apple, it’s not about being a fearless leader, but about creating a swarm that works together in collective consciousness to create great things that change the world. In Collaborative Innovation Networks (COINs), small teams of intrinsically motivated people enabled by the Internet work together to invent something radically new. A successful swarm channels the competitive energies of all stakeholders towards collaboration. I also propose a collaboration scorecard made up of seven key variables – “honest signals” – indicative of creative swarms, drawn from hundreds of industry projects. The “seven honest signals of collaboration” are “strong leadership”, “balanced contribution”, “rotating leadership”, “responsiveness”, “honest sentiment”, “shared context”, and “social capital”. I will illustrate these “honest signals of collaboration” using numerous industry examples ranging from startups to innovation teams at the R&D departments of Fortune 500 firms to teams of Healthcare researchers and patients.

5:05pm

Closing Remarks
Gregory Ornatowski
Senior Director, MIT Corporate Relations
Director, MIT-ILP, Japan
Gregory Ornatowski
Senior Director, MIT Corporate Relations
Director, MIT-ILP, Japan

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.

5:10pm

Reception and Networking