MIT Industrial Liaison Program Faculty Knowledgebase Report

2018 MIT AI in Life Sciences and Healthcare Conference

December 4, 2018 - December 5, 2018

Day One

8:00am	Registration with Light Breakfast
9:10am	Welcome Remarks 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.

Session 1: Tools and Impact
Erik Vogan

Program Director, MIT Corporate Relations Industrial Liaison Program

Erik Vogan

Program Director, MIT Corporate Relations Industrial Liaison Program

Erik Vogan joined the Office of Corporate Relations on June 1, 2015.

Erik brings to the Office of Corporate Relations numerous years of experience in big data and analytics, business development and partnering, and research and technology development, particularly in the areas of biotechnology and life sciences. Prior to joining the Office of Corporate Relations, Erik worked as a consultant to Boston-area venture capital and biotechnology companies and was a cofounder of Krypton Immuno-oncology.

At Beryllium Discovery Corporation, Erik was Vice President of Drug Discovery, leading functions in Business Development and Research. At Permeon Biologics, Erik founded the research laboratory and served as Director, Protein Sciences. Prior to that, Erik held positions as Head of Structural Biology at Acceleron Pharma and Senior Scientist at Wyeth Research.

Erik earned his B.S. in Genetics at the University of California, Davis and his Ph.D. in Biochemistry at Brandeis University working with Gregory Petsko, followed by postdoctoral work in the laboratory of Stephen C. Harrison at Harvard Medical School and Children's Hospital, Boston. Erik recently completed his MBA at MIT’s Sloan School of Management.

He has numerous patents, publications, and presentations to his credit.

9:10am

Machine Learning for Pharmaceutical Discovery and Synthesis

Klavs Jensen
Warren K. Lewis Professor, Department of Chemical Engineering at MIT
Professor, MIT Materials Science and Engineering

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Warren K. Lewis Professor, Department of Chemical Engineering at MIT
Professor
MIT Materials Science and Engineering

Klavs F. Jensen is the Warren K. Lewis Professor in Chemical Engineering and Materials Science and Engineering at the Massachusetts Institute of Technology. He is a co-director of MIT's consortium, Machine Learning for Pharmaceutical Discovery and Synthesis, which aims to bring machine learning technology into pharmaceutical discovery and development. From 2007- July 2015, he was the Head of the Department of Chemical Engineering. His research spans thermal-, electro-, and photo-chemistry in batch and flow, kinetics and optimization, automation, and machine learning to develop new methods that accelerate chemical discovery and development. His lab explores new automated reaction systems integrated with online analytics, robotics, optimization, and machine learning algorithms toward autonomous discovery.

Prof. Jensen is the co-author of ~500 refereed journal publications and the inventor of 63 US patents. He is the inaugural Editor-in-Chief of the Royal Society of Chemistry Journal Reaction Chemistry and Engineering. Prof. Jensen is a member of the US National Academy of Sciences, the US National Academy of Engineering, and the American Academy of Arts and Science. He is a Fellow of the American Association for the Advancement of Science (AAAS), the National Academy of Inventors, the American Institute of Chemical Engineers, and the Royal Society of Chemistry.

View full bio

This talk will describe ongoing efforts within DARPA and MIT-industry sponsored consortium projects focused on applications of machine learning techniques to pharmaceutical discovery and synthesis. We will summarize the integration of these techniques into a computer aided synthesis planning workflow that, for a given molecular target, predicts a rank ordered list of reaction paths that connect the target to purchasable starting materials via a series of feasible reaction steps. Secondly, we will describe on-going efforts to develop machine learning approaches for quantitative predictions of chemical structure and property relationships. Finally, we will briefly discuss progress on using natural language processing to extract chemical data from prior historical data.

9:40am

Future of Digital Medicine and Clinical Trials with Novel Machine Learning and AI Architectures

Pratik Shah

Principal Research Scientist
Health 0.0
MIT Media Lab

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Principal Research Scientist
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MIT Media Lab

Dr. Pratik Shah is a Principal Research Scientist at The MIT Media Lab. His research program creates novel intersections between engineering, medical imaging, machine learning, and medicine to improve health outcomes for patients. Ongoing research areas: 1) artificial intelligence and machine learning methods for the detection of cancer biomarkers using standard photographs vs. expensive medical images; 2) unorthodox artificial intelligence algorithms to design optimal and faster clinical trials to reduce adverse effects on patients; and 3) point-of-care medical technologies for real world data and evidence generation to improve public health. Past acknowledgments include the American Society for Microbiology's Raymond W. Sarber National Award, a Harvard Medical School and Massachusetts General Hospitals ECOR Fund for Medical Discovery postdoctoral fellowship, coverage by leading national and international news media outlets. Dr. Shah has been an invited discussion leader at Gordon Research Seminars; a speaker at Cold Spring Harbor Laboratories, Gordon Research Conferences, and IEEE bioengineering conferences; and a peer reviewer for leading scientific publications and funding agencies. Dr. Shah has a BS, MS, and a PhD in biological sciences and completed fellowship training at Massachusetts General Hospital, The Broad Institute of MIT and Harvard, and Harvard Medical School.

Phase 3 clinical outcome trials to evaluate new drugs, therapies, and vaccines are the most complex experiments performed in medicine. Around 50% of phase 3 trials fail, costing healthcare industries, governments, and academic research hospitals billions of dollars and delay life-saving treatments to patients. This talk will share novel phase 2 and 3 clinical trials designed by unorthodox "self-learning" AI algorithms to help accelerate medical product development and bring new innovations and advances to patients safely. Our clinical trial design achieves significant reduction in tumor sizes in patients suffering from glioblastomas (brain tumors) and offers personalized and precision dosing recommendations to individuals compared to human-expert policies. We outline a strategic plan to conduct clinical trials with devices, algorithms, and real-world evidence in accordance with the 21st Century Cures Act.

10:10am

Robust Data Analytics in Biopharmaceutical Manufacturing
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

Although process data analytics is a valuable tool for improving the manufacturing of biologic drugs, selection of the best method requires a substantial level of expertise. This talk describes a robust and automated approach for process data analytics tool selection that allows the user to focus on goals rather than methods. The approach first applies tools to automatically interrogate the data to ascertain its characteristics, e.g., nonlinearity, correlation, dynamics. This information is then used to select a best-in-class process data analytics tool. The approach is demonstrated for industrial data for the manufacturing of a monoclonal antibody.

10:40am

Networking Break

Session 2: Quest for Intelligence
Erik Vogan

Program Director, MIT Corporate Relations Industrial Liaison Program

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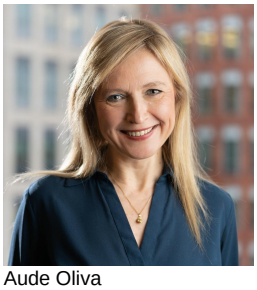
11:00am

The MIT Quest for Intelligence
Aude Oliva

Director of Strategic Industry Engagement, MIT Schwarzman College of Computing
MIT Director, MIT-IBM Watson AI Lab
Co-lead, MIT AI Hardware Program
Senior Research Scientist, CSAIL



Aude Oliva

Director of Strategic Industry Engagement, MIT Schwarzman College of Computing
MIT Director, MIT-IBM Watson AI Lab
Co-lead, MIT AI Hardware Program
Senior Research Scientist, CSAIL

Aude Oliva, PhD is the MIT director in the MIT-IBM Watson AI Lab and director of strategic industry engagement in the MIT Schwarzman College of Computing, leading collaborations with industry to translate natural and artificial intelligence research into tools for the wider world. She is also a senior research scientist at the MIT Computer Science and Artificial Intelligence Laboratory (CSAIL), where she heads the Computational Perception and Cognition group.

Oliva has received an NSF Career Award in computational neuroscience, a Guggenheim fellowship in computer science and a Vannevar Bush Faculty Fellowship in cognitive neuroscience. She has served as an expert to the NSF Directorate of Computer and Information Science and Engineering on the topic of human and artificial intelligence. She is currently a member of the scientific advisory board for the Allen Institute for Artificial Intelligence. Her research is cross-disciplinary, spanning human perception and cognition, computer vision and cognitive neuroscience, and focuses on research questions at the intersection of all three domains. She earned a MS and PhD in cognitive science from the Institut National Polytechnique de Grenoble, France.

The MIT Quest for Intelligence (The Quest) aims to build on MIT's rich history of innovation and impact in the study of intelligence, our next step towards the future. Comprised of two linked entities, The Core and The Bridge, The Quest aims to advance two fundamental intelligence challenges: Can we reverse engineer intelligence? And, how can we deploy our current and expanding understanding of intelligence to the benefit of society?

11:30am

Making Images Part of Medical Record
Polina Golland

Henry Ellis Warren (1894) professor of Electrical Engineering and Computer Science
MIT Department of Electrical Engineering and Computer Science

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MIT Department of Electrical Engineering and Computer Science

Polina Golland is a Henry Ellis Warren (1894) professor of Electrical Engineering and Computer Science at MIT and a principal investigator at MIT CSAIL. Her primary research interest is in developing novel techniques for medical image analysis and understanding. With her students, Golland has demonstrated novel approaches to image segmentation, shape analysis, functional image analysis and population studies. She has served as an associate editor of the IEEE Transactions on Medical Imaging and of the IEEE Transactions on Pattern Analysis. Golland is currently on the editorial board of the Journal of Medical Image Analysis. She is a Fellow of the International Society for Medical Image Computing and Computer Assisted Interventions.

View full bio

Currently, medical images require a physician to extract clinically relevant information. This talk will explore current work towards making images part of the quantitative medical history and to enable large-scale image-based studies of disease. Although large databases of clinical images contain a wealth of information, medical acquisition constraints result in sparse scans that miss much of the anatomy. These characteristics often render computational analysis impractical as standard processing algorithms tend to fail when applied to such images. Our goal is to enable application of existing algorithms that were originally developed for high resolution research scans to severely undersampled images. Application of the method is illustrated in the context of neurodegeneration and white matter disease studies in stroke patients.

Noon

Next-Generation Machine Learning for Biotechnology
James Collins

Termeer Professor, Institute for Medical Engineering & Science (IMES) at MIT
Professor, MIT Department of Biological Engineering
Professor, Wyss Institute at Harvard
Professor, Broad Institute of MIT and Harvard

James Collins

Termeer Professor, Institute for Medical Engineering & Science (IMES) at MIT
Professor, MIT Department of Biological Engineering
Professor, Wyss Institute at Harvard
Professor, Broad Institute of MIT and Harvard

James Collins is the Termeer Professor of Medical Engineering & Science and professor of biological engineering at MIT, as well as a Member of the Harvard-MIT Health Sciences & Technology Faculty. He is also a core founding faculty member of the Wyss Institute for Biologically Inspired Engineering at Harvard University, and an institute member of the Broad Institute of MIT and Harvard. Collins is one of the founders of the field of synthetic biology, and his patented technologies have been licensed by over 25 biotech, pharma, and medical devices companies. He has helped to launch a number of companies, including Synlogic (NASDAQ: SYBX), EnBiotix, Sample6 Technologies, and Senti Biosciences, and has received numerous awards and honors, including a Rhodes Scholarship, a MacArthur "Genius" Award, an NIH Director's Pioneer Award, the Sanofi - Institut Pasteur Award, as well as several teaching awards. Collins is an elected member of all three national academies - the National Academy of Sciences, the National Academy of Engineering, and the National Academy of Medicine - as well as the American Academy of Arts & Sciences, the National Academy of Inventors, and the World Academy of Sciences.

View full bio

Machine learning, a collection of data-analytical techniques aimed at building predictive models from multi-dimensional data sets, is becoming integral to modern biological research. By enabling one to generate models that learn from large data sets and make predictions on likely outcomes, machine learning can be used to study complex cellular systems, such as biological networks. In this talk, we discuss opportunities and challenges at the intersection of machine learning and biotechnology, ones that could impact disease biology, drug discovery, and synthetic biology.

12:30pm

Lunch

Session 3: Patient /Subject Insight
Sheryl Greenberg
Program Director, MIT Industrial Liaison Program

Sheryl Greenberg
Program Director
MIT Industrial Liaison Program

Sheryl Greenberg initiates and promotes the interactions and development of relationships between academic and industrial entities to facilitate the transfer of new ideas and technologies between MIT and companies, and has created numerous successful partnerships. By understanding the business, technology, and commercial problems within a company, and understanding the technologies and expertise of MIT researchers, Greenberg identifies appropriate resources and expertise to foster new technology applications and collaborative opportunities.

Prior to MIT, Greenberg created and directed the Office of Technology Transfer at Brandeis University. In the process of managing intellectual property protection, marketing, and licensing, she has promoted the successful commercialization of technologies as diverse as new chemicals and manufacturing, biotechnology, food compositions, software, and medical devices. She facilitated the founding and funding of new companies, as well as creating a profitable technology transfer program. She also facilitated the patenting, marketing, and licensing of Massachusetts General Hospital technologies. In addition to her cellular, biochemical, and genetic research experience in academic and corporate environments, she has also created intellectual property for medical uses. Greenberg has been an independent intellectual property and business development consultant, is a U.S. Patent Agent, and has previously served the Juvenile Diabetes Research Foundation as Co-Chair of the Islet Research Program Advisory Committee and grant reviewer. She currently also mentors startup companies and facilitates partnering them with large life science and healthcare companies.

View full bio

1:30pm

Learning About Breast Cancer from Images and Text
Adam Yala

PhD Candidate, MIT CSAIL

Adam Yala

PhD Candidate, MIT CSAIL

Adam Yala is a PhD Candidate at MIT CSAIL and his research interests lie in the intersection of Natural Language Processing, Machine Learning and applications of Deep Learning to Oncology. He was a lead developer of a pathology information extraction system and algorithms for cancer detection, early detection and cancer risk on both mammograms and MRI. His work has been deployed at Massachusetts General Hospital and he is the recipient of a Best Paper Award at EMNLP, an NSF Fellowship and an MIT EECS Fellowship.

Breast cancer is global problem with over 500,000 women dying from the disease every year, yet all of our decisions and insights are based on only a fraction of the information that exists at both the patient and population level. In this talk, we explore a machine learning approach to cancer that integrates rich patient information at population scale, and discuss the type of tools this enables. We have developed A.I systems for automatically reading mammograms, performing personalized risk assessment and mining medical records and implemented them clinically at Massachusetts General Hospital.

2:00pm

AI for Passive In-Home Patient Monitoring: From Wearables to Invisibles

Dina Katabi
Thuan and Nicole Pham Professor
MacArthur Fellow
Leader of NETMIT Research Group
Director of the MIT Center for Wireless Networks and Mobile Computing

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Dina Katabi is the Thuan and Nicole Pham Professor of Electrical Engineering and Computer Science, and the director of MIT's Center for Wireless Networks and Mobile Computing (Wireless@MIT). Katabi is also a MacArthur Fellow and a Member of the National Academy of Engineering. She received her PhD and MS from MIT and her BS from Damascus University. Katabi has received the ACM Grace Murray Hopper Award, the Faculty Research Innovation Fellowship, the Sloan Fellowship, the NBX Career Development chair, and the NSF CAREER award. Katabi's doctoral dissertation won an ACM Honorable Mention award and a Sprowls award for academic excellence. Further, her work was recognized by the IEEE William R. Bennett prize, three ACM SIGCOMM Best Paper awards, an NSDI Best Paper award, the SIGCOMM Test-of-Time award, and a TR10 award for her work on the sparse Fourier transform. Several start-ups have been spun out of Katabi's lab, such as PiCharging and Emerald.

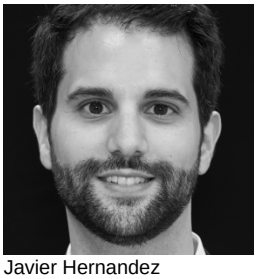
View full bio

This talk introduces Emerald, a novel MIT technology for in-home non-intrusive patient monitoring. The Emerald device is a WiFi-like box that runs customized machine learning algorithms to learn digital biomarkers from the wireless signals in the patient's home. It can remotely monitor the patient's gait speed, falls, respiratory signal, heart rate, and sleep quality and stages. The sensing is completely passive – i.e., the patient can go about her normal life without having to wear any sensors on her body, write a diary, or actively measure herself. This talk will discuss the technology and the results from pilot studies in various therapeutic areas.

2:30pm

Emotion AI and Future Health
Javier Hernandez

Research Scientist
Affective Computing Group
MIT Media Lab



Javier Hernandez

Research Scientist
Affective Computing Group
MIT Media Lab

Javier Hernandez is a Research Scientist at the Affective Computing group of the MIT Media Lab, where he leads the Emotional Navigation and Onsite Stress Measurement special interest groups. Hernandez is also founder and CEO of Global Vitals LLC, an MIT Media Lab spin-off with the goal of democratizing physiological sensing. His research is focused on the development of emotionally intelligent tools to further the understanding of humans while fostering greater health and quality of life, including contributions to daily life stress and the use of technology to improve its measurement, understanding, and management. Hernandez holds a PhD from the MIT Media Lab and an MS from the Robotics Institute at CMU. He was the recipient of the best student paper at the EAI International Conference on Wireless Mobile Communication and Healthcare in 2014, best poster award at the IEEE Conference on Body Sensor Networks in 2015, and honorable mention awards at EAI International Conference on Pervasive Computing Technologies for Healthcare in 2015, IEEE Engineering in Medicine and Biology Society in 2015, ACM Conference on Human Factors in Computing Systems in 2016, and International Conference on Human-Computer Interaction with Mobile Devices and Services in 2016.

AI and machine learning are becoming embedded in our wearables and smartphones, enabling new insights and interventions for improving lives for patients with conditions including autism, epilepsy, and depression. The latter is growing and forecast to become the #1 disease burden by 2030. How close are we to forecasting changes in mood, stress, and physical health before they happen? Could AI help us prevent future diseases such as depression, and help people stay healthy instead of becoming sick tomorrow? This talk will show the latest findings that suggest that a better mental health future could be possible with AI.

3:00pm

Networking Break

3:30pm

Session 4: Panel Discussion: Perspectives on AI in Life Science
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.

Ellie Chabi
Therapeutic Area Head - Glaucoma & Neuroprotection,
Lead, Artificial Intelligence Programs - Global Biomedical Science, Santen Pharmaceutical

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Therapeutic Area Head - Glaucoma & Neuroprotection,
Lead, Artificial Intelligence Programs - Global Biomedical Science
Santen Pharmaceutical

Ellie Chabi, MD is the Therapeutic Area Head for Glaucoma & Neuroprotection as well as the Lead for Artificial Intelligence Programs within Global Biomedical Science at Santen Pharmaceutical. Prior to joining Santen, she was at Genentech in late-stage ophthalmology. Chabi began her pharmaceutical career at Merck in the Neuroscience & Ophthalmology Clinical Research Group, working on a range of projects within Ophthalmology, as well as Neuroscience. In addition to experiences in drug and device development, Chabi has been extensively involved in due diligences for Business Development and Venture Capital teams. She is currently serving as a board observer for several companies. Chabi received her undergraduate and medical school education at the University of Wisconsin. In addition to residency training in ophthalmology and surgical fellowship training in Cornea & External Disease, she completed an ophthalmology research fellowship at Cornell University, as well as a bioentrepreneurship program at the University of California-San Francisco and Aresty Scholar Executive Education program at Wharton.

Ryan Davis
CEO, Secure AI Labs

Ryan Davis
CEO
Secure AI Labs

Ryan Davis is the CEO of SAIL and a graduate fellow from MIT Sloan. Secure AI Labs (SAIL) helps businesses access unshared data by protecting data during analysis. Advancing the same technology used to protect movie streaming, SAIL protects data by digitally enforcing data-use policies. Now data owners can control who, how and where their data is used, even after sharing, and businesses can access data as easily as renting a movie, and without the liability of holding personal data.

Martha Gray

J. W. Kieckhefer Professor of Health Sciences and Technology
Professor of Electrical Engineering and Computer Science
MIT

Martha Gray

4:30pm	Networking Reception

Day Two

8:30am	Registration with Light Breakfast

Session 5: Discovery and Development
John Roberts
Executive Director (Interim), MIT Corporate Relations

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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.

9:00am

The Roles of AI in Healthcare
Ernest Fraenkel
Professor, Biological Engineering
Associate Member, Broad Institute

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Professor, Biological Engineering
Associate Member, Broad Institute

Ernest Fraenkel is a professor of biological engineering at MIT. His laboratory seeks to understand diseases from the perspective of systems biology. They develop computational and experimental approaches for finding new therapeutic strategies by analyzing molecular networks and clinical and behavioral data. Fraenkel received his PhD in biology from MIT after graduating summa cum laude from Harvard College with an AB in chemistry and physics.

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What are the prospects for applying AI to improve healthcare? Three types of problems that AI can address in healthcare will be outlined, the most challenging of which is the development of new therapeutics. To address this challenge, we leverage recent advances in machine learning and high-throughput experimentation to apply the engineering cycle to drug discovery. The engineering cycle is based on iteratively measuring a system, modeling it computationally, and manipulating it. Each time the cycle is completed, the results improve. This iterative approach is fundamental to all engineering design but, until now, has had limited impact on drug discovery. Progress on unpublished projects relating to these efforts will be described, including a collaborative, multi-institutional project called Answer ALS.

9:30am

From Genomics to Therapeutics: Dissection and Manipulation of Human Disease Circuitry at Single-Cell Resolution

Manolis Kellis
Member, Broad Institute of MIT and Harvard
Professor, MIT Computer Science and Artificial Intelligence Lab

Manolis Kellis
Member, Broad Institute of MIT and Harvard
Professor
MIT Computer Science and Artificial Intelligence Lab

Manolis Kellis is a professor of computer science at MIT, a member of the Broad Institute of MIT and Harvard, a principal investigator of the Computer Science and Artificial Intelligence Lab at MIT, and head of the MIT Computational Biology Group (compbio.mit.edu). His research includes disease circuitry, genetics, genomics, epigenomics, coding genes, non-coding RNAs, regulatory genomics, and comparative genomics, applied to Alzheimer's Disease, Obesity, Schizophrenia, Cardiac Disorders, Cancer, and Immune Disorders, and multiple other disorders. He has helped lead several large-scale genomics projects, including the Roadmap Epigenomics project, the ENCODE project, the Genotype Tissue-Expression (GTEx) project, and comparative genomics projects in mammals, flies, and yeasts. He received the US Presidential Early Career Award in Science and Engineering (PECASE) by US President Barack Obama, the Mendel Medal for Outstanding Achievements in Science, the NIH Director's Transformative Research Award, the Boston Patent Law Association award, the NSF CAREER award, the Alfred P. Sloan Fellowship, the Technology Review TR35 recognition, the AIT Niki Award, and the Sprowls award for the best Ph.D. thesis in computer science at MIT. He has authored over 280 journal publications cited more than 148,000 times. He has obtained more than 20 multi-year grants from the NIH, and his trainees hold faculty positions at Stanford, Harvard, CMU, McGill, Johns Hopkins, UCLA, and other top universities. He lived in Greece and France before moving to the US, and he studied and conducted research at MIT, the Xerox Palo Alto Research Center, and the Cold Spring Harbor Lab. For more info, see: compbio.mit.edu

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Perhaps the greatest surprise of human genome-wide association studies (GWAS) is that 90% of disease-associated regions do not affect proteins directly, but instead lie in non-coding regions with putative gene-regulatory roles. To address this challenge, we generate transcriptional and epigenomic maps of cellular circuitry and use the resulting datasets to infer regulatory networks linking genetic variants to their target genes, their upstream regulators, the cell types where they act, and the pathways they perturb. We combine single-cell profiles, tissue-level variation, and genetic variation across healthy and diseased individuals to deconvolve bulk profiles into single-cell profiles, to recognize changes in cell type proportion associated with disease and aging, and to partition genetic effects into the individual cell types where they act. These methods are expanded to electronic health records to recognize meta-phenotypes associated with combinations of clinical notes, prescriptions, lab tests, and billing codes, to impute missing phenotypes in sparse medical records, and to recognize the molecular pathways underlying complex meta-phenotypes. Lastly, we develop programmable and modular technologies for manipulating these pathways, demonstrating tissue-autonomous therapeutic avenues in Alzheimer's, obesity, and cancer. These results provide a roadmap for translating genetic findings into mechanistic insights and ultimately new therapeutic avenues for complex disease and cancer.

10:00am

Interpretable AI
Dimitris Bertsimas
Boeing Professor of Operations Research
Co-Director, Operations Research Center (ORC)
Faculty Director, Master of Business Analytics, MIT Sloan School of Management

Dimitris Bertsimas
Boeing Professor of Operations Research
Co-Director, Operations Research Center (ORC)
Faculty Director, Master of Business Analytics
MIT Sloan School of Management

Dimitris Bertsimas is the Boeing Professor of Operations Research, the codirector of the Operations Research Center, and faculty director of the Master of Business analytics at MIT. His research interests include optimization, machine learning and applied probability and their applications in health care, finance, operations management, and transportation. Bertsimas has coauthored more than 200 scientific papers and four graduate level textbooks. He is the editor in Chief of INFORMS Journal of Optimization. He has supervised 67 doctoral students and is currently supervising 25 others. Bertsimas is a member of the National Academy of Engineering, an INFORMS fellow, and has received numerous prestigious research and teaching awards. He holds an SM in applied mathematics and a PhD in operations research from MIT.

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This talk introduces a new generation of machine learning methods that provide state of the art performance and are very interpretable, introducing optimal classification (OCT) and regression (ORT) trees for prediction and prescription with and without hyperplanes. This talk shows that (a) Trees are very interpretable, (b) They can be calculated in large scale in practical times, and (c) In a large collection of real world data sets, they give comparable or better performance than random forests or boosted trees. Their prescriptive counterparts have a significant edge on interpretability and comparable or better performance than causal forests. Finally, we show that optimal trees with hyperplanes have at least as much modeling power as (feedforward, convolutional, and recurrent) neural networks and comparable performance in a variety of real world data sets. These results suggest that optimal trees are interpretable, practical to compute in large scale, and provide state of the art performance compared to black box methods.

10:30am

Networking Break

11:10am

Identifying and Rationally Modulating Cellular Drivers of Enhanced Immunity

Alex K. Shalek
Core Member of IMES, Associate Prof of Chemistry, and Extramural Member of the KI, MIT
Institute Member of the Broad Institute
Member of the Ragon Institute

Alex K. Shalek
Core Member of IMES, Associate Prof of Chemistry, and Extramural Member of the KI, MIT
Institute Member of the Broad Institute
Member of the Ragon Institute

Alex K. Shalek is currently the Pfizer-Laubach Career Development Associate Professor at MIT, as well as a Core Member of the Institute for Medical Engineering and Science (IMES), an Associate Professor of Chemistry, and an Extramural Member of The Koch Institute for Integrative Cancer Research. He is also an Institute Member of the Broad Institute, an Associate Member of the Ragon Institute, an Assistant in Immunology at MGH, and an Instructor in Health Sciences and Technology at HMS. His research is directed towards the creation and implementation of new approaches to elucidate cellular and molecular features that inform tissue-level function and dysfunction across the spectrum of human health and disease. This encompasses both the development of broadly enabling technologies as well as their application to characterize, model, and rationally control complex multicellular systems. Dr. Shalek received his bachelor's degree summa cum laude from Columbia University and his Ph.D. from Harvard University in chemical physics under the guidance of Hongkun Park, and performed postdoctoral training under Hongkun Park and Aviv Regev (Broad/MIT).

View full bio

Session 6: Startup Exchange
Rebecca Xiong

Program Director, MIT Startup Exchange

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Program Director, MIT Startup Exchange

Dr. Rebecca Xiong joined Corporate Relations as Program Director, Startup Exchange in October 2018.

Dr. Xiong comes to Corporate Relations with more than 15 years of experience in the MIT Startup Ecosystem, having co-founded and worked at multiple MIT startups. Most recently, as Co-founder and Chief Scientist at SocMetrics, she leads product management, data science, and machine learning for SocMetric's personalization and marketing campaign products. Before SocMetrics, Xiong co-founded Going.com. Going.com connected people via local events to enhance their offline social life, and through Rebecca's leadership grew to 1M members, tens of millions of monthly pageviews, and finally its acquisition by AOL. Before these two entrepreneurial endeavors, Xiong held positions as Product Marketing Manager (DataPower, acquired by IBM), Senior Program Manager (Performaworks, acquired by Workscape), and Team Lead (Akamai Technologies). She also has research experience at Microsoft, Silicon Graphics, and Xerox Palo Alto Research Center.

Dr. Xiong earned her B.S. in Computer Science at the University of California at Berkeley, and her Ph.D. in Computer Science at the Media Lab at MIT with her thesis "Visualizing Information Spaces to Enhance Social Interaction." She was a National Science Foundation (NSF) Fellowship Recipient. She holds multiple patents and is very involved in the community, as the Lead Organizer of the Cambridge Parent Summit.

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).

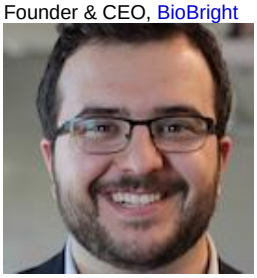
MIT Startup Exchange maintains a propriety database of over 1,500 MIT-connected startups with roots across MIT departments, labs and centers; it hosts a robust schedule of startup workshops and showcases, and facilitates networking and introductions between startups and corporate executives.

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 230 member companies.

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

11:50am

Startups Lightning Talks Part I
Charles Fracchia
Founder & CEO, BioBright

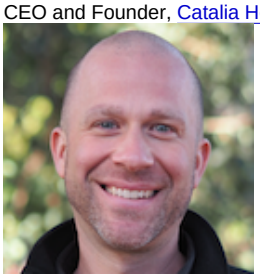


Charles Fracchia
Founder & CEO
BioBright

Charles Fracchia is founder and CEO at BioBright, a company building smart laboratory tools to improve reproducibility in biomedical research. BioBright has been featured in Scientific American, the innovators under 35 in MIT Tech Review, BioIT World, and SLAS. Fracchia did his graduate work between the MIT Media Lab and Harvard Medical School and obtained his BSc from Imperial College London.

Fracchia has presented his work at venues including the White House, MIT Sloan, NASA Ames, IBM Research, Airbus, O'Reilly and SciFoo. Over the years, the work has been sponsored by DARPA, NSF, Alphabet's X (formerly Google X), Knight Foundation, and Templeton Foundation.

Cory Kidd
CEO and Founder, Catalia Health



Cory Kidd
CEO and Founder
Catalia Health

Cory Kidd is the founder and CEO of Catalia Health, a patient care management company. The company develops a hardware and software platform that uses a combination of psychology and artificial intelligence to engage patients through interactive conversations. These conversations happen through mobile, web, and interactive robotic interfaces; together these interfaces create a relationship that can reach patients at any time they need support. The data reported back through the system gives Catalia Health's customers valuable information to understand the daily activities and needs of their patients.

Kidd is a serial entrepreneur who has been working in healthcare technology for nearly two decades. He received his MS and PhD at the MIT Media Lab in human-robot interaction and his BS in computer science at the Georgia Institute of Technology.

Stephen Harrison
SVP and Chief Scientific Officer, Engine Biosciences

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SVP and Chief Scientific Officer
Engine Biosciences

Stephen Harrison joined Engine in May 2016 with over 20 years' tenure in biotechnology and pharmaceutical R&D. Prior to Engine, he was CSO at Relypsa, where he developed a pipeline of gut-restricted polymer therapeutics. Before that, Harrison was VP of Research Biology at Nektar Therapeutics, a leader in polymer conjugate therapeutics, where he managed global oncology and pain research efforts for four years. Prior to Nektar, he was SVP of Research at KAI Pharmaceuticals. Harrison holds a PhD in molecular biology and an MA and BA in biochemistry, all from University of Cambridge, England.

Daisy Zhou
Cofounding Partner, Interpretable AI
Daisy Zhou

12:20pm

Startups Lightning Talks Part II
Matthew Osman
Cofounder and CEO, Legit

Matthew Osman
Cofounder and CEO
Legit

Before cofounding Legit, Matthew Osman was the youngest Vice President at a $1 billion structured credit hedge fund in London, where he specialized in credit strategies and tax structuring. He was called to the Bar of England and Wales in 2015 and has a degree in philosophy, politics, and economics from the University of Oxford.

An operating system for R&D powered by AI
Legit uses Natural Language Processing to interpret free text descriptions of a product, idea, or technology and then compares that description against 100 million pieces of technical literature, internal documentation, and customer requests. Legit is able to provide quantitative feedback on how differentiated products are from what already exists and how closely they align with market needs. Through this approach, Legit increases R&D efficiency, creates timely close-loop communication between R&D and customers, and allows for unprecedented real-time transparency into R&D spend and efforts.

Susan Conover
Cofounder and CEO, LuminDx
Susan Conover
Cofounder and CEO
LuminDx

Susan Conover is the cofounder and CEO at LuminDx, Inc., a company identifying skin disease instantly using deep learning. She attended MIT in the system design and management Master's program in 2015. Her background is in mechanical engineering from UT Austin and management consulting at Oliver Wyman, and her experience being diagnosed with melanoma 3 times catalyzed her to start this company.

Aditya Khosla
Cofounder & CTO, PathAI

Aditya Khosla
Cofounder & CTO
PathAI

Aditya Khosla recently completed his PhD in machine learning and computer vision at MIT. He also holds an MS from Stanford and a BS from Caltech. In his research, Khosla developed new methods for an array of applications in computer vision, including eye-tracking, prediction of image memorability, and visualization of deep networks. He is the recipient of a Facebook Fellowship, and his work has been widely covered by various media outlets, including BBC, The New York Times, and The Washington Post. Khosla has published over 30 papers in the fields of deep learning, computer vision, and neuroscience.

Leila Pirhaji
Founder & CEO, ReviveMed

Leila Pirhaji
Founder & CEO
ReviveMed

12:50pm	Buffet Lunch with Startup Exhibit
1:50pm	Adjournment