MIT Industrial Liaison Program Faculty Knowledgebase Report

2025 MIT Health Science Forum

May 8, 2025 9:00 am - 2:00 pm

8:30 AM	Registration and Light Breakfast
9:00 AM	Welcome and Introduction Miki Kato Program Director, MIT Industrial Liaison Program

Miki Kato
Program Director
MIT Industrial Liaison Program

Miki Kato joined the MIT Industrial Liaison Program as a Program Director in October 2021. Mr. Kato has over 20 years of experience in new business development, including various activities with MIT.

Prior to joining the ILP, Kato worked at FUJIFILM Corporation for 40 years in various new business development sectors. He was President of FUJIFILM Pharmaceuticals U.S.A., Inc., conducting the clinical trials of FUJIFILM pipeline drugs and leading the joint research project in drug delivery with MIT's Koch Institute. During his tenure, he also collaborated with the Department of Electrical Engineering at MIT for digital camera's CMOS image sensors and the Department of Materials Sciences and Engineering for high-speed photodetectors.

Kato has presented at several conferences at the Cambridge Innovation Center, including the 2018 Japan Innovation Forum with the Consulate General of Japan and the 60th-anniversary Kyoto-Boston sister city celebration Life Science Forum (2019) with the City of Boston, the Japan Society of Boston, and the Consulate General of Japan.

He holds an M.E. in Polymer Chemistry from Kyoto University and an M.S. in Management of Technology from MIT.

9:10 AM	Advanced Diagnostics Angela Belcher

Prof. Angela Belcher leads research focused on understanding and harnessing nature's own processes in order to design technologically important materials and devices for energy, the environment, and medicine. Prof. Belcher will introduce her efforts to develop novel probes for near-infrared imaging, which have produced promising data for imaging tumors in both ovarian and brain cancer for detection of 1/2 millimeter-sized tumors, as well as ovarian cancer animal studies showing a 40% increase in median survival using this new technology. The Belcher Lab has also developed a new optical imaging system to facilitate non-invasive, in vivo cellular-level imaging of whole mice and rats, with a demonstrated depth of 6 centimeters in muscle tissue.

9:40 AM

Innovation in Manufacturing Biomedicines: From New Modalities to Scalable, Accessible Therapeutics

Stacy Springs

Biologic medicines (e.g., monoclonal antibodies, gene and cell therapies, vaccines) are critical to treating and preventing disease. Recent regulatory approvals of exciting new biomedicines such as cell and gene therapies provide new hope to patients who have exhausted alternative therapies or suffer from a rare disease with no other treatment. To help patients access these medicines, biopharmaceutical companies must be able to manufacture very complex molecules safely, reliably, and in the quantities needed, which can range from the very large (industrialized) scale to the very small (personalized) scale. This presentation will review the challenges in manufacturing these complex biologic medicines as well as approaches to modernization of biomanufacturing with the goal of providing broadened access to biologic medicines. Dr. Springs will describe multiple approaches that MIT's Center for Biomedical Innovation and collaborators are taking to achieve this goal, including continuous manufacturing, novel purification strategies, novel analytical technologies for assessing novel product quality attributes, and rapid methods for sterility and viral safety assessment.

10:10 AM

Artificial Intelligence for State-of-the-Art Gene Therapy

Jacob Witten

Ionizable lipids are a key component of lipid nanoparticles (LNPs), a leading nonviral messenger RNA (mRNA) delivery technology. Here, we introduce Lipid Optimization using Neural networks (LiON), a deep-learning strategy for designing ionizable lipids. To train LiON, we generated a dataset of over 9,000 lipid nanoparticle activity measurements and fed this data into a directed message-passing neural network to predict nucleic acid delivery across diverse lipid structures.

Lipid optimization using LiON successfully predicted RNA delivery in both in vitro and in vivo held-out test sets and extrapolated to structures distinct from the training set. Next, we evaluated 1.6 million lipids in silico and identified two structures, FO-32 and FO-35, which demonstrated state-of-the-art local mRNA delivery to mouse muscle and nasal mucosa. FO-32 also matched the state of the art for nebulized mRNA delivery to the mouse lung, while both FO-32 and FO-35 efficiently delivered mRNA to ferret lungs—representing the first published example of mRNA delivery to ferret conducting airways.

Overall, this work highlights the potential of deep learning to enhance nanoparticle delivery and introduces LNPs with promising activity for pulmonary gene therapy.

10:40 AM

Networking Break

11:00 AM

AI Foundation Models for Chemistry, Protein Structure-to-Function, and Personalized Therapeutics

Manolis Kellis

Generative AI is fundamentally reshaping the understanding of biology, medicine, and therapeutics, elevating AI from an analytical tool to a true partner in discovery. Kellis presents work on building foundational AI models that span chemistry, protein structure, gene function, patient states, and therapeutic interventions, moving toward an integrated agentic-AI platform for precision medicine. In the domain of **protein structure and function**, he introduces ProCyon, a multimodal foundation model that unifies protein sequences, molecular functions, disease associations, therapeutic mechanisms, and structural information. This model enables zero-shot phenotype annotation, drug-binding prediction, and functional interpretation of disease variants, opening the door to annotating the dark proteome and guiding therapeutic targeting. In the field of **chemical space modeling**, Kellis describes the embedding of molecular structures integrated with global patent databases, drug-target interaction knowledge, and protein function, resulting in a chemically and functionally interpretable drug landscape. This framework supports the generation of novel molecules, functional annotation of the chemical space using co-embedded drug patents, and the discovery of structure-function relationships to advance drug development. For **patient trajectory modeling**, he presents a latent embedding of patient states derived from multimodal data, including omics, clinical records, imaging, and treatment histories, that enables improved diagnostics, detection of misdiagnosed cases through cross-modal consistency, and the design of personalized interventions tailored to individual trajectories relative to previously treated populations. In the area of **personalized therapeutics**, Kellis highlights work connecting molecular, cellular, and patient-level phenotypes to predict therapeutic responses and uncover mechanistic disease subtypes. This is achieved through foundational models that integrate molecular function, single-cell expression, protein structure-function data, and chemical information, resulting in AI-driven tools capable of generating causally grounded therapeutic recommendations at the patient-specific level. Finally, he presents Mantis, an **AI-powered, human-directed visual data science** workbench that allows researchers to explore and interrogate latent embedding landscapes across proteins, chemicals, patients, and therapies. Mantis provides interactive and interpretable visualizations and agentic workflows, where human intuition guides AI actions, revealing latent patterns and advancing the next generation of generative models for biomedicine. Together, these efforts are driving a **new paradigm in AI-enabled science**, uniting mechanistic interpretability, predictive power, and human-centered discovery to transform biomedical research and precision therapeutics.

11:30 AM

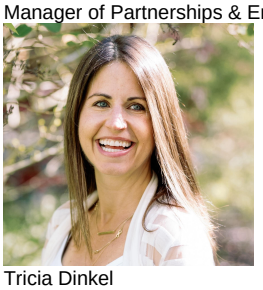
The MIT Center for Precision Cancer Medicine: Clinically-oriented CRISPR screening, RNA Biology, and Discovery of novel synergistic drug combinations with rapid translational potential

Michael B. Yaffe

The ***MIT Center for Precision Cancer Medicine*** develops collaborations between MIT faculty interested in rapidly translating genomic and post-genomic technologies to improve individualized cancer treatments. These collaborative approaches include (1) the use of clinically oriented CRISPR-based screens for drug sensitivity and resistance, focusing on CRISPRi, CRISPRa and CRISPR-based gene editing techniques under realistic metabolic and pharmacologic conditions; (2) *in vivo* CRISPR screens in immunocompetent murine disease models of glioblastoma, NSCLC, and CML to identify synergistic drug combinations; (3) phosphoproteomic and metabolic analysis of tumors leveraging temporal and spatial signaling with data-driven modeling and machine learning using the kinase library compendium of substrate motifs; (4) identification and targeting novel RNA biology to enhance anti-tumor drug and immunotherapy responses with an emphasis on RNA-binding proteins and RNA damage responses; (5) single cell analysis technologies including suspended microchannel resonators, DNA repair capabilities using multi-channel fluorescence reporters and signaling state determination using mass cytometry; and (6) manipulation of dendritic cells within the tumor microenvironment, including dendritic cell vaccines. I will highlight several examples demonstrating the success of these collaborative approaches, including CRISPRi and CRISPRa screens for enhancing the response of high-grade serous ovarian cancer to platinum/taxol or anti-microtubule ADC treatment, in vivo CRISPR screens in GBM for sensitization to FAK/Src inhibitors, phosphoproteomic analysis of tumors for which a driving oncogene is lacking, and the discovery of methods that enhance the response of solid tumors to immunotherapy by co-treatment with specific DNA-damaging agents.

12:00 PM

Startup Lightning Talks
Tricia Dinkel
Manager of Partnerships & Engagement, MIT Startup Exchange



Tricia Dinkel
Manager of Partnerships & Engagement
MIT Startup Exchange

Tricia Dinkel comes to Corporate Relations with several years of experience in the innovation ecosystem and managing relationships with startups and corporates. Tricia previously worked as Director of Navigate (NECEC's flagship innovation program) at the Northeast Clean Energy Council (NECEC) in Boston where she led all operations and partnership development for 400+ startups, 65+ innovation partners, and 200+ investors & corporates in North America and Europe. Prior to that role, Tricia held positions with increasing responsibility in program management at NECEC. Before that, her experience included Director of Data Analytics and Sustainability Reporting Manager at WegoWise Inc. in Boston, Associate Director at the Committee on Capital Markets Regulation in Cambridge, Senior Sustainability Coordinator at A Better City in Boston, and Assistant Director at The Green Alliance in Portsmouth, NH.

Tricia earned her B.A., in Environmental Studies/Natural Resource Policy at the University of Colorado, and her M.A., in Environmental Science Education at the University of New Hampshire. She served on the NECEC Diversity & Inclusion Committee and as a member of the USGBC (U.S. Green Building Council), Massachusetts Chapter.

Kate Rosner

David Crowley

Willie Reaves

Freddy Nguyen

12:40 PM

Lunch & Poster Board Session

Kento Abeywardane

Amir Kazeminia

Arjav Shah

Luca Mazzaferro

James F. Ryan

Saathvik Kannan

2:00 PM

Adjourn