MIT Industrial Liaison Program Faculty Knowledgebase Report

2024 MIT Health Science Forum

September 26, 2024 9:00 am - 1:15 pm

9:00 AM	Registration and Light Breakfast
9:30 AM	Welcome and Introduction Rebekah Miller
9:40 AM	The Infinite Loop: ML for Discovery, Delivery, and Rapid Manufacturing of Potential Medicines Bradley L. Pentelute We're facing a challenge in the world of chemistry: our lack of data is slowing down how we can use clever computer programs, known as machine learning, to create powerful new medicines. In this piece, I'll walk you through what we're doing to solve this problem by creating data highways from millions of small molecules, peptides, and small proteins. We are now able to use machine learning to discover and create new functional molecules quickly. Sometimes, these computer-designed molecules are even better than what we can make ourselves! Our next step is to create an infinite loop where we automatically design, build, and test potential new medicines.
10:10 AM	HiExM: High-Throughput Super-Resolution Imaging Enables Unique Insights for Drug Discovery John Day High-throughput imaging is one of the primary methods used in drug screening and discovery. Current methods focus on maximizing throughput with a trade-off of reduced image resolution. To address this gap, we developed High-throughput Expansion Microscopy (HiExM), a robust platform that leverages expansion microscopy to achieve nanoscale image resolution. Our method is compatible with standard culture ware, commonly employed immunostaining practices, and existing high-content confocal microscopes, making it widely adoptable. We use HiExM to access information about intracellular localization, organelle morphology, and toxicity of therapeutics that would otherwise be inaccessible.
10:40 AM	MIT’s Ecosystem Approach to Healthcare Innovation Bill Kubasek Collin M. Stultz Seema Basu
11:10 AM	Networking Break

11:35 AM

Humanizing Drug Development: Neurovascular Models of Neurological Diseases

Francesca Michela Pramotton
Postdoctoral Research Fellow
MIT Department of Biological Engineering

The Humanizing Drug Development (HDD) consortium focuses on developing an iPSC-derived neurovascular model of neurological diseases to investigate different transporter routes for drug delivery into the brain and for drug screening. Isogenic, self-assembled vascular networks of the blood-brain barrier are interfaced to midbrain organoids carrying familial Parkinson's or Alzheimer's disease mutations. These microphysiological systems are key to studying disease development and researching therapeutic possibilities.

11:55 AM

3D Microphysiological Skin Models for Subcutaneous Delivery of Therapeutics

Maria Proestaki
Postdoctoral Associate
MIT Department of Biological Engineering

The Humanizing Drug Development (HDD) Skin consortium focuses on developing a 3D microphysiological skin model for subcutaneous delivery of monoclonal antibodies or other therapeutics. The model consists of a self-assembled and perfusable blood vasculature while a lymphatic vasculature is also included in one integrated microfluidic device. This human skin microvascular model can be used for ADME or immune response studies and it can serve as a tool for predicting drug bioavailability.

12:15 PM

Startup Lightning Talks

Daniel Meyer

Kanav Setia

Maureen Deehan

Derek Miller

12:45 PM

Cell Painting to Accelerate Drug Discovery: Finding Disease Phenotypes and Candidate Therapeutics Using Images

Anne Carpenter

Cell images contain a vast amount of quantifiable information about the status of the cell: for example, whether it is diseased, whether it is responding to a drug treatment, or whether a pathway has been disrupted by a genetic mutation. We aim to go beyond measuring individual cell phenotypes that biologists already know are relevant to a particular disease. Instead, in a strategy called image-based profiling, often using the Cell Painting assay, we extract hundreds of features of cells from microscopy images. Just like transcriptional profiling, the similarities and differences in the patterns of extracted features reveal connections among diseases, drugs, and genes.

We are harvesting similarities in image-based profiles to identify, at a single-cell level, how diseases, drugs, and genes affect cells, which can uncover small molecules' mechanism of action, discover gene functions, predict assay outcomes, discover disease-associated phenotypes, identify the functional impact of disease-associated alleles, and find novel therapeutic candidates. This is leading to a growing impact on the pharmaceutical industry as cell morphology becomes a powerful data source for systems biology alongside molecular omics.

1:15 PM

Bagged Lunch with Exhibit

1:20 PM	Poster Session
	Kate Bridges
	Katarina DiLillo
	Julie McDonald
	Kathryn Yammine
	Anton Barybin
	Charlie Farquhar
	Emily Nieves