2022 MIT Health Science Technologies Conference

April 12, 2022 9:00 am - 5:00 pm

8:00 AM - 9:00 AM  Registration with Light Breakfast
Welcome and Introduction
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.

Sheryl Greenberg
Program Director, MIT Corporate Relations

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.

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10:20 AM - 10:50 AM  
Self-Replicating RNA Technologies for Vaccines and Cancer Immunotherapy  
Parisa Yousefpour  
Postdoctoral Associate, Darrell Irvine Lab  
Koch Institute for Integrative Cancer Research at MIT

Self-replicating RNAs termed replicons have begun to be explored as a promising platform technology for vaccines and gene therapy. Upon delivery to host cells, the replicon copies itself and therefore, allows for prolonged and increased transgene expression with a small initial dose. We employ the replicon platform for 1) vaccine development for sustained antigen expression coupled with the intrinsic adjuvanticity of replicons, and 2) cancer immunotherapy to stimulate multiple synergistic pathways of antitumor immunity. In addition, harnessing synthetic biology tools, we are developing next generation replicon platforms that incorporate microRNA-based classifier and small-molecule responsive gene circuits for internal and external regulation of transgene expression, respectively. Our recent advances and directions on gene delivery with replicons will be presented and discussed.

10:50 AM - 11:10 AM  
Networking Break

11:10 AM - 11:15 AM  
MIT Professional Education
Ariadna Rodenstein
Events Leader, MIT Startup Exchange

Ariadna Rodenstein joined MIT Startup Exchange in a new role as Events Leader in September 2019. She has responsibility for the development and execution of events featuring startups, and for helping to promote collaboration and partnerships between MIT-connected startups and industry. She works closely with the Industrial Liaison Program (ILP), also within Corporate Relations, and with other areas around the MIT innovation ecosystem and beyond. Prior to this, Ariadna worked for over a decade at Credit Suisse Group in New York City and London in a few different roles in event management and later became a Director for client strategy. She has combined her experience in the private sector with work in non-profits as a Consultant and Development Director at the New York Immigration Coalition, Immigrant Defense Project and Americas Society/Council of the Americas. Ariadna also served on the Board of the Riverside Clay Tennis Association in NY for several years. She earned her B.A. in Political Science and Communications from New York University (NYU), also doing coursework at the Instituto Tecnológico y de Estudios Superiores de Monterrey (ITESM) in Mexico City, and her M.A. in Sociology from the City University of New York (CUNY).

- **Kytopen**: The future in cell therapy discovery and manufacturing
- **Cellino**: Making personalized cell therapies scalable
- **Tevard Biosciences**: Pioneering tRNA/mRNA-based gene therapy platforms
- **Multiply Labs**: Cell therapy manufacturing, enabled by robotics
- **Kano Therapeutics**: Single-stranded DNA vectors for gene insertions and replacement
- **Volta Labs**: Simplifying the front-end workflows in genomic sequencing
- **CellChorus**: Dynamic single-cell analysis at scale
- **Secure AI Labs (SAIL)**: Creating secure patient registries for disease research
- **Fathom Data**: Simplifying access to bioprocessing data

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.

Cullen 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.
12:15 PM - 1:25 PM
Lunch with Startups Exhibit

1:30 PM - 2:00 PM
Ran Zheng
CEO
Landmark Bio

2:00 PM - 2:30 PM
Jongyoon Han
Professor of Electrical Engineering and Professor of Biological Engineering

Dr. Jongyoon Han is currently a professor in the Department of Electrical Engineering and Computer Science and the Department of Biological Engineering, Massachusetts Institute of Technology. He received B.S.(1992) and M.S.(1994) degree in physics from Seoul National University, Seoul, Korea, and Ph.D. degree in applied physics from Cornell University in 2001. He was a research scientist in Sandia National Laboratories (Livermore, CA), until he joined the MIT faculty in 2002.

Han has received a NSF CAREER award (2003) and an Analytical Chemistry Young Innovator Award (ACS, 2009). His research is mainly focused on applying micro/nanofabrication techniques to a very diverse set of fields and industries, including biosensing, desalination / water purification, biomanufacturing, dentistry, and neuroscience. He is currently the lead PI for MIT’s participation for NIIMBL (The National Institute for Innovation in Manufacturing Biopharmaceuticals).

2:30 PM - 3:00 PM
Timothy Lu
Associate Professor
Research Laboratory of Electronics
MIT Synthetic Biology Center
MIT Department of Biological Engineering
MIT Department of Electrical Engineering and Computer Science

Timothy Lu is an Associate Professor in the Department of Electrical Engineering and Computer Science and an Associate Member of the Broad Institute of MIT and Harvard. Tim received his undergraduate and M.Eng. degrees from MIT in Electrical Engineering and Computer Science. He obtained an M.D. from Harvard Medical School and Ph.D. from the Harvard-MIT Health Sciences and Technology Medical Engineering and Medical Physics Program. Tim has won the Lemelson-MIT Student Prize, Grand Prize in the National Inventor Hall of Fame’s Collegiate Inventors Competition, and the Leon Reznick Memorial Prize for “outstanding performance in research” from Harvard Medical School. He has also been selected as a Kavli Fellow by the National Academy of Sciences and a Siebel Scholar. Outside of the lab, Tim enjoys playing volleyball and tennis.

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Natural Killer (NK) cells and CD8+ cytotoxic T cells are two types of immune cells that can kill target cells through similar cytotoxic mechanisms. With the remarkable success of chimeric antigen receptor-engineered T (CAR-T) cells for treating hematological malignancies, there is a rapidly growing interest in developing CAR-engineered NK (CAR-NK) cells for cancer therapy. Compared to CAR-T cells, CAR-NK cells could offer some significant advantages, including (1) better safety, such as a lack of or minimal cytokine release syndrome and neurotoxicity in autologous setting and graft-versus-host disease in allogeneic setting, (2) multiple mechanisms for activating cytotoxic activity, and (3) high feasibility for “off-the-shelf” manufacturing. We are developing the next generation of CAR-NK cells by combining tumor-specific CAR, additional armors, and cytokine-induced memory-like (CIML) NK cells, with a goal to achieve better tumor-specific targeting, enhanced proliferation and persistence in vivo, resistance to the suppressive tumor microenvironment, and ultimately an effective and durable anti-tumor response in patients.
Richard D. Braatz joined the MIT Chemical Engineering Department as the Edwin R. Gilliland Professor. Before coming to MIT, Braatz was the Millennium Chair and Professor of Chemical and Biomolecular Engineering at the University of Illinois at Urbana-Champaign. He has been recognized internationally as a leader in process systems and control engineering. Professor Braatz brings to MIT a unique blend of fundamental controls theory, multiscale modeling, and challenging applications.

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Tam Nguyen
Ph.D. student in chemical engineering at MIT

Recombinant adeno-associated virus (rAAV) is one of the most commonly used platforms for in vivo gene therapy treatments. The reduced toxicity, robust and long-term transgene expression, and ability to transduce both dividing and non-dividing cells as well as target a wide range of tissues have made rAAV the most widely used viral vector. However, the standard method of producing rAAV via transient transfection of mammalian cells, specifically human embryonic kidney 293 (HEK293) cells, typically has low yield and generates a high portion of empty particles, laying extra burden on downstream processing. To elucidate the mechanisms of rAAV synthesis in HEK293 suspension-adapted cells, we have developed a mechanistic model based on the published understanding of the underlying biology and existing data. Quantitative analysis suggests the misaligned dynamics of capsid and viral DNA production result in the high ratio of empty particles. Through a model-based strategy, we explored a novel transfection method using low-dose multiple transfections in HEK293 cell culture that successfully increased the ratio of full to empty capsids in the viral harvest without compromising the viral titer. Molecular analysis through a next-generation rAAV production model attributed the improvements to changes in the kinetics of viral protein expression and DNA replication. Here, we demonstrate that the use of multiple transfection times is a practical method for increasing the genome titer and improving the percentage of full capsids for rAAV production. Our results also demonstrated the capability to manipulate product composition from an operational standpoint.
Reprogramming adaptive immunity
Michael Birnbaum
Associate Professor of Biological Engineering, MIT Department of Biological Engineering

Michael Birnbaum
Associate Professor of Biological Engineering
MIT Department of Biological Engineering

Michael obtained an A.B. in Chemical and Physical Biology at Harvard University in 2008. He then moved to Stanford University, where he completed his Ph.D. in Immunology in 2014. At Stanford, he worked in Professor K. Christopher Garcia’s laboratory, studying the molecular mechanisms of T cell receptor recognition, cross-reactivity, and activation. He then conducted postdoctoral research in Professor Carla Shatz’s laboratory, studying novel roles for immune receptors expressed by neurons in neural development and neurodegenerative disease. Michael joined the Department of Biological Engineering in 2016 as an Assistant Professor.

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Cell and gene immunotherapies are revolutionizing how we treat disease, with multiple FDA-approved therapies that have transformed cancer treatments. However, advances in gene delivery, manufacturing, and therapeutic cargoes are still required to increase the impact and scope of these promising approaches. The Birnbaum laboratory is working to develop approaches that improve the specificity of cellular engineering, and the potency of cells once engineered.

4:50 PM - 6:00 PM
Closing Remarks and Networking Reception