

Frontiers in Engineering & Medicine

Cancer + Biosensors

EVENT PROGRAM

COLUMBIA UNIVERSITY
MAY 14, 2021 | 11AM - 2:30PM



HOSTED BY



COLUMBIA UNIVERSITY
HERBERT IRVING COMPREHENSIVE
CANCER CENTER



COLUMBIA | ENGINEERING
The Fu Foundation School of Engineering and Applied Science

IN PARTNERSHIP WITH



IRVING INSTITUTE FOR CLINICAL
AND TRANSLATIONAL RESEARCH



Department of Biomedical Engineering
COLUMBIA | ENGINEERING
SINCE 2000

FACULTY FACILITATORS

Adam Bass (CUIMC) | Nicholas Arpaia (CUIMC) | Tal Danino (SEAS)



AGENDA

11:00 a.m.	Welcome & Opening Remarks <i>Anil Rustgi, MD + X. Edward Guo, PhD</i>
11:02 a.m.	The Cancer and Engineering Initiative at Columbia <i>Akiva Mintz, MD, PhD</i>
11:07 a.m.	SESSION 1: 2020 Award Winners 1A: Patient-specific leukemia-bone marrow organoid culture and therapeutic platform <i>Adolfo Ferrando, PhD + Gordana Vunjak-Novakovic, PhD</i> 1B: Single-cell analysis of drug response in glioblastoma <i>Samuel Sia, PhD + Peter Sims, PhD</i>
12:07 p.m.	Break
12:17 p.m.	SESSION 2: Biosensors in Cancer 2A: Current and emerging questions in cancer medicine: implications for biosensor development <i>Adam Bass, MD</i> 2B: Engineering platforms for cancer biosensing <i>Nicholas Arpaia, PhD + Tal Danino, PhD</i> 2C: Spark Talks - Machine learning for modeling dynamics in the tumor microenvironment <i>Elham Azizi, PhD</i> - Predicting T cell expansion capacity for Immunotherapy <i>Lance Kam, PhD</i> - Predicting and controlling spatial organization in model tumors <i>Laura Kaufman, PhD</i> - Recording biological events using cellular sentinels <i>Harris Wang, PhD</i>
1:17 p.m.	Break
1:27 p.m.	Open Discussion
2:17 p.m.	Closing Remarks: <i>Shih-Fu Chang, PhD</i>
2:30 p.m.	Networking (Wonder.me)

MEET OUR SPEAKERS



Nicholas Arpaia, PhD
Assistant Professor of
Microbiology & Immunology

Dr. Arpaia received a B.S. in Biochemistry from SUNY Geneseo in 2006 and went on to work in the laboratory of Dr. Gregory M. Barton in the Department of Molecular and Cell Biology at the University of California, Berkeley where he received a Ph.D. in Immunology and Pathogenesis in 2011. He later joined the laboratory of Dr. Alexander Y. Rudensky at Memorial Sloan Kettering Cancer Center where he completed a Postdoctoral Fellowship studying Molecular Immunology in 2016. Dr. Arpaia joined the Department of Microbiology & Immunology at Columbia University Irving Medical Center as an Assistant Professor in September of 2016.



Elham Azizi, PhD
Assistant Professor, Biomedical
Engineering; Herbert and Florence
Irving Assistant Professor, Cancer Data
Research (in the Herbert and
Florence Irving Institute for Cancer
Dynamics and in the Herbert Irving
Comprehensive Cancer Center)

Elham Azizi is Herbert & Florence Irving Assistant Professor of Cancer Data Research in the Irving Institute for Cancer Dynamics and Assistant Professor in the Department of Biomedical Engineering at Columbia University. Elham's research utilizes single-cell genomic technologies combined with statistical machine learning techniques to characterize interacting cells in the tumor microenvironment as well as their dysregulated gene circuitry. Elham completed her postdoctoral training at Memorial Sloan Kettering Cancer Center and Columbia University. She received a PhD in Bioinformatics from Boston University, an MS degree in Electrical Engineering from Boston University and a BS in Electrical Engineering from Sharif University of Technology. She is a recipient of the NIH NCI Pathway to Independence Award, the Tri-Institutional Breakout Prize for Junior Investigators and an American Cancer Society Postdoctoral Fellowship.



Adam Bass, MD
Founding Director of the Center
for Precision Cancer Medicine;
Director of Gastrointestinal
Oncology, HICCC

Adam Bass, MD is a physician-scientist who has worked for the last 10 years at the intersection of functional genomics, biology and targeted therapy in gastrointestinal cancers, with a special focus on tumors of the stomach and esophagus. He was recruited to Columbia in 2021 as the founding director of the new Center for Precision Cancer Medicine, which is a developing an effort spanning genomics, pre-clinical science and translational therapeutics with an ultimate goal to enable development of new ways to prevent and treat cancer based upon its underlying biology.



Shih-Fu Chang, PhD
Richard Dicker Professor of
Telecommunications; Professor of
Computer Science; Interim Dean
for The Fu Foundation School of
Engineering and Applied Science,
Dept of Electrical Engineering

Shih-Fu Chang has been the Senior Vice Dean and then Senior Executive Vice Dean of Columbia School of Engineering and Applied Science since 2012. In this capacity, he has served as the key partner to the Dean in advancing the vision, impact, and standing of the school, propelling Columbia Engineering to the top engineering school in the Ivy League. He played a key role in leading the school to develop the Engineering for Humanity vision; served as the primary interface with other schools in university-wide cross-disciplinary initiatives; led collaboration with industry in creating large research centers; co-spearheaded development of the school's strategy for diversity, equity, and inclusion; established innovative training programs for students historically underrepresented in STEM; and partnered with the Dean in leading successful recruiting and advancement of the growing faculty of the school. He is also the Richard Dicker Professor with appointments in both Electrical Engineering Department and Computer Science Department.

SPEAKERS

SPEAKERS



Tal Danino, PhD
Associate Professor of
Biomedical Engineering

Tal Danino's research explores the emerging field of synthetic biology, focusing on engineering bacteria gene circuits to create novel behaviors that have biomedical applications. The interaction of microbes and tumors is a major target of his work, where DNA sequences and synthetic biology approaches are used to program bacteria as diagnostics and therapeutics in cancer. Danino also brings this science outside the laboratory as a TED Fellow and through science-art projects. Danino received his BS in physics, chemistry, and math from the University of California in Los Angeles in 2005 and earned his PhD in bioengineering from the University of California, San Diego in 2011. He was a postdoctoral fellow at Massachusetts Institute of Technology from 2011 – 2015. He joined the faculty of Columbia Biomedical Engineering in 2016 and is a member of the Herbert Irving Comprehensive Cancer Center and Data Science Institute.



Adolfo Ferrando, MD, PhD
Professor of Pediatrics,
Pathology and Cell Biology
and Systems Biology, Institute
for Cancer Genetics; Associate
Director for Shared Resources,
Herbert Irving Comprehensive
Cancer Center

Dr. Ferrando joined the faculty of the Institute for Cancer Genetics in 2005 where he has developed a highly active research program that combines genomics, biochemical, genetic and experimental therapeutics approaches towards the identification of novel therapies for the treatment of high-risk leukemias and lymphomas. His laboratory has played major roles in the functional analysis of oncogenic NOTCH1 in T-cell acute lymphoblastic leukemia and in deciphering the genetic landscape and mechanisms of transformation, disease progression and relapse in this disease. His work has been recognized with multiple other honors, including the Leukemia and Lymphoma Society Scholar Award, the Pershing Square Sohn Prize for Young Investigators in Cancer Research and the William Dameshek Prize from the American Society of Hematology. He is an elected member the American Society of Clinical Investigation and the Association of American Physicians and currently serves in the editorial board of Leukemia, Blood Cancer Discovery and Genes and Development.

SPEAKERS



X. Edward Guo, PhD
Stanley Dicker Professor of
Biomedical Engineering;
Professor of Medical Sciences (in
Medicine); Chair, Department of
Biomedical Engineering

X. Edward Guo is Chair of the Department of Biomedical Engineering and an expert in bone biomechanics and bioengineering research. As director of Columbia's Bone Bioengineering Laboratory, he and his team have two major research thrusts. The first focus of their research is developing innovative three-dimensional imaging and modeling techniques for bone microstructure, such as individual trabecula segmentation and plate-rod finite element modeling methods. These novel techniques have been widely used by engineers and clinicians in studying osteoporosis and other metabolic bone diseases. In addition, these techniques have revealed genetic traits in bone microstructure among various racial groups such as Chinese, Caucasians, and African Americans. They are currently assembling teams to study genetic variations in various ethnic groups across China and Asia. More recently, the individual trabecula segmentation technique has discovered early changes in bone microstructure in osteoarthritis, a major disease without therapeutic interventions. The second line of research of Guo's group is mechanobiology of the skeleton. Using innovative single cell, in vitro, ex vivo, and in vivo approaches, they have developed innovative technologies to study cell responses to mechanical Loading and began to reveal the mystery of century old Wolff's law.



Lance Kam, PhD
Professor of Biomedical
Engineering and Medical
Sciences (in Medicine); Chair
of Undergraduate Studies

Lance Kam and the Kam lab use surface and biomaterial engineering principles to reveal how living cells interpret the complex details of their surroundings. These cues, which include the microscale distribution of signaling proteins and local mechanical properties of the environment, allow cells to organize into functional tissues that carry out sophisticated behaviors. Current projects include the use of these principles to control the activation and function of immune cells, leading to next-generation systems that can harness adaptive immunity to treat disease.

SPEAKERS



Laura Kaufman, PhD
Professor of Chemistry

Laura Kaufman received a B.A. in Chemistry and English from Columbia and a Ph.D. in Chemistry from the University of California, Berkeley where she used multi-dimensional femtosecond spectroscopy to study molecular motion in liquids in the lab of Graham Fleming. She did postdoctoral work in soft matter and biological physics at Harvard University in the lab of David Weitz and Sunney Xie. Her laboratory in the Department of Chemistry at Columbia is highly interdisciplinary and focuses on the dynamics of complex, crowded systems. In particular, the laboratory studies heterogeneous dynamics in supercooled liquids with single molecule microscopy, the mechanical properties and structure of biopolymer gels using rheology and microscopy, and cancer cell invasion in tissue approximations of tailored architecture and biochemistry.



Akiva Mintz, MD, PhD
Vice Chair of Translational Imaging; Director, Columbia University PET Center; Chief, Division of Nuclear Medicine

Dr. Mintz is a Physician-scientist with a 20 year history of performing innovative cancer imaging and therapeutic research. Dr. Mintz earned his MD and PhD degrees at the Pennsylvania State University College of Medicine and subsequently trained as a resident and molecular imaging fellow at the University of Pennsylvania. After residency, Dr. Mintz was faculty at Wake Forest School of Medicine, where he set up a successful research program that was funded by the NIH, foundations and industry. He served many institutional roles at Wake Forest, including PET Center Director, Vice Chair of Radiology, and coDirector of the Cancer Biology program in the NCI-funded Wake Forest Comprehensive Cancer Center. He was recruited to Columbia in 2017, where he serves as the Vice Chair of Translational Research in the Department of Radiology, Division Chief of Nuclear Medicine and Director of the Columbia University PET Center. Other institutional roles include Associate Director of the Irving Institute where he plays leadership roles in the pilot program and Translational Therapeutics Accelerator. Dr. Mintz was recently appointed the Chief Officer of Cancer and Engineering at the Columbia HICCC.

SPEAKERS



Anil Rustgi, MD
Interim Executive Vice President and Dean of the Faculties of Health Sciences and Medicine at Columbia University and the Director of the Herbert Irving Comprehensive Cancer Center at NewYork-Presbyterian Hospital/Columbia University Irving Medical Center

Anil K. Rustgi is the Director of the Herbert Irving Comprehensive Cancer Center at NewYork-Presbyterian/Columbia University Irving Medical Center. Dr. Rustgi is a world-renowned leader in the field of gastrointestinal oncology. His interdisciplinary research focuses on tumor initiation, the tumor microenvironment and tumor metastasis in the context of gastrointestinal cancers, including cancer of the esophagus, pancreas, and colon. Dr. Rustgi's lab works to translate their discoveries into improving molecular diagnostics and finding new experimental therapeutics for patients, and is funded through several grants including an NCI P01 (program project on esophageal cancer), an NCI U54 on Barrett's esophagus, two NIH R01 grants (for pancreatic cancer and colon cancer) and an American Cancer Society Research Professorship. He has more than 300 publications and his work has appeared in high-impact journals such as Nature, Nature Genetics, Nature Medicine, Cancer Cell, Genes and Development, Gastroenterology, Journal of Clinical Investigation, PNAS and New England Journal of Medicine.



Samuel Sia, PhD
Professor of Biomedical Engineering and Faculty Director, SEAS Entrepreneurship

Samuel Sia, Professor of Biomedical Engineering at Columbia University, has developed novel technologies for point-of-care blood tests, both in academic and industry settings. He co-founded Claros Diagnostics, whose prostate-cancer blood test for doctor's offices has FDA approval and is being commercialized by OPKO Health. Dr. Sia's work in global health diagnostics garnered coverage in Nature, Science, JAMA, Washington Post, BBC, and NPR. His lab-on-a-chip device has been tested in Rwanda for collecting/analyzing blood tests at a patient's bedside to diagnose infectious diseases. He founded Harlem Biospace, a biotech incubator facility in New York City (developed with NYC mayor's office) that has hosted over 50 biotech companies. He directs the entrepreneurship initiative for Columbia SEAS. Dr. Sia has a B.Sc. in Biochemistry from the University of Alberta, and a Ph.D. in Biophysics from Harvard University. Dr. Sia completed a postdoctoral fellowship in Chemistry and Chemical Biology at Harvard University.

SPEAKERS



Peter Sims, PhD

Assistant Professor of Systems Biology (in Biochemistry and Molecular Biophysics and in Systems Biology)

Dr. Sims is an Associate Professor at CUIMC in the Department of Systems Biology and the Department of Biochemistry & Molecular Biophysics where his laboratory develops technology for single-cell genomics and cell type-specific molecular profiling with applications to cancer, neuroscience, and immunology. He serves as Faculty Director of the Columbia Single Cell Analysis Core, which provides experimental and computational tools for single-cell analysis to Columbia investigators. Dr. Sims also directs the Systems Biology Track of the Integrated Program, which allows Ph.D. students at CUIMC to specialize in systems and computational biology.



Gordana Vunjak-Novakovic, PhD

University and Mikati Foundation Professor of Biomedical Engineering and Medical Sciences

Gordana Vunjak-Novakovic is University Professor, the highest academic rank at Columbia University and the first engineer at Columbia to receive this distinction. The focus of her lab is on engineering functional human tissues for use in regenerative medicine and in patient-specific “organs-on-a-chip” for studies of human pathophysiology, including human models of cancer. She is well published and highly cited (h=130), has mentored over 150 trainees, and launched four start-up companies with her students. She is a member of Academia Europaea, Serbian Academy of Arts and Sciences, National Academy of Engineering, National Academy of Medicine, National Academy of Inventors, and the American Academy of Arts and Sciences.

SPEAKERS



Harris Wang, PhD

Associate Professor of Systems Biology and Pathology and Cell Biology

Harris Wang is an Associate Professor at Columbia University jointly appointed in the Department of Systems Biology and the Department of Pathology and Cell Biology. Dr. Wang received his B.S. degrees in Mathematics and Physics from MIT and his Ph.D. in Biophysics from Harvard University. His research group mainly develops enabling genomic technologies to characterize the mammalian gut microbiome and to engineer these microbes with the capacity to monitor and improve human health. Dr. Wang is an Investigator of the Burroughs Wellcome Fund and the recipient of numerous awards, including the NIH Director’s Early Independence Award, NSF CAREER, Sloan Research Fellowship and ONR Young Investigator. In early 2017, Dr. Wang received the Presidential Early Career Award for Scientists and Engineers (PECASE) from President Obama, which is “the highest honor bestowed by the United States Government on science and engineering professionals in the early stages of their independent research careers.”



Health Care
Doctor
Hospital
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Nurse
Dentist
First Aid
Surgeon
Emergency

MEDICAL