



Department of Biomedical Engineering
COLUMBIA | ENGINEERING
— SINCE 2000 —

7th Annual
**ENGINEERING IN MEDICINE
SYMPOSIUM**

THURSDAY, 02.23.2023 | 10:30AM - 6:00PM EST



OPENING (Listed times are in EST)

10:30 Opening Remarks



Shih-Fu Chang, PhD *Dean, Columbia Engineering; Morris A. and Alma Schapiro Professor in Electrical Engineering and Computer Science, Columbia University*



Katrina Armstrong, MD *Executive Vice President for Health and Biomedical Sciences; Dean of the Faculties of Health Sciences and the Vagelos College of Physicians and Surgeons; Chief Executive Officer, Columbia University Irving Medical Center (CUIMC); Harold and Margaret Hatch Professor in the Faculty of Medicine*



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

10:44 Welcome from Symposium Co-Chairs



Nandan Nerurkar, PhD *Assistant Professor of Biomedical Engineering, Columbia University*



Elham Azizi, PhD *Herbert & Florence Irving Assistant Professor of Cancer Data Research in the Irving Institute for Cancer Dynamics and Assistant Professor of Biomedical Engineering*

SESSION 1: SINGLE-CELL GENOMICS

10:50 Remarks from Session Co-Chairs



Elham Azizi, PhD *Herbert & Florence Irving Asst. Prof. of Cancer Data Research in IICD; Assistant Professor of Biomedical Engineering*
Kelley Yan, MD, PhD *Warner-Lamber Assistant Professor of Medicine and of Genetics & Development, Co-Director of the Organoid and Cell Culture Core, CUIMC*

10:52 “Engineering immune cell function through mechanobiology”



Lance Kam, PhD *Professor of Biomedical Engineering and Medical Sciences (in Medicine), Columbia University*

11:04 “Modeling esophageal development and disease using 3D esophageal organoids”



Joel Gabre, MD *Assistant Professor of Medicine, Division of Digestive and Liver Diseases, Herbert Irving Comprehensive Cancer Center*

11:16 “Spatial genomics for deciphering disease pathology”



Sanja Vickovic, PhD *Assistant Professor of Biomedical Engineering; Director of Technology Innovation at New York Genome Center*

11:28 “Statistical machine learning for learning representations of embryonic development”



Bianca Dumitrascu, PhD *Assistant Professor of Statistics; Herbert & Florence Irving Assistant Professor of Cancer Data Research*

11:40 SESSION 1 Q&A

11:55 Break (10 min.)

SESSION 2: MACHINE LEARNING

12:05 Remarks from Session Co-Chairs



Christoph Juchem, PhD *Associate Professor, Biomedical Engineering and Radiology (Physics); Director, MR SCIENCE Laboratory*
Pierre Elias, MD *Assistant Professor in Cardiology and Biomedical Informatics; Medical Director for Artificial Intelligence, CUIMC*

12:07 “Determining the molecular intermediates between genotype and phenotype”



David A. Knowles, PhD *Assistant Professor of Computer Science, Columbia University*

12:19 “Biomedical data privacy in predictive modeling”



Gamze Gürsoy, PhD *Assistant Professor of Biomedical Informatics; Core Member of New York Genome Center*

12:31 “Creating an expert-AI team for eye disease detection”



Kaveri Thakoor, PhD *Assistant Professor of Ophthalmic Science (in Ophthalmology); Director of the Artificial Intelligence for Vision Science (AI4VS) Laboratory, CUIMC*

12:43 “Radiology and Machine Learning: Scenes from a Marriage”



Diego Jaramillo, MD, MPH *Professor of Radiology; Interim Chair, Department of Radiology, CUIMC*

12:55 SESSION 2 Q&A

13:10 Lunch Break (60 min.)

SESSION 3: NEUROSCIENCE OF DECISION-MAKING

14:10 Remarks from Session Co-Chairs



Paul Sajda, PhD *Vikram S. Pandit Professor of Biomedical Engineering; Professor of Electrical Engineering and Radiology (Physics), Columbia University*

Daniel Javitt, MD, PhD *Professor and Director, Division of Experimental Therapeutics, CUIMC*

SESSION 3: NEUROSCIENCE OF DECISION-MAKING *(continued)*

14:12 **“Propagating waves of neural activity encode decision-making in monkeys”**



Jacqueline Gottlieb, PhD *Professor of Neuroscience, Mortimer B. Zuckerman Mind Brain Behavior Institute, Columbia University*

14:24 **“Neural mechanisms of natural behavioral choice”**



Gwyneth Card, PhD *Associate Professor of Neuroscience; Principal Investigator, Mortimer B. Zuckerman Mind Brain Behavior Institute, Columbia University; Investigator, Howard Hughes Medical Institute*

14:36 **“Neuromodulation of perceptual decision-making”**



Qi Wang, PhD *Associate Professor of Biomedical Engineering; Director of Neural Engineering and Control Laboratory, Columbia University*

14:48 **“Probing human memory and decision making with direct brain recordings”**



Joshua Jacobs, PhD *Associate Professor of Biomedical Engineering, Columbia University*

15:00 **SESSION 3 Q&A**

15:15 **Break (10 min.)**

SESSION 4: DEVELOPMENT & AGING

15:25 **Remarks from Session Co-Chairs**



Nandan Nerurkar, PhD *Assistant Professor of Biomedical Engineering, Columbia University*

Kimara Targoff, MD *Associate Professor of Pediatrics; Director, Cardiac Development and Regeneration Laboratory, CUIMC*

15:27 **“Development and regeneration of the tendon enthesis”**



Stavros Thomopoulos, PhD *Robert E. Carroll and Jane Chace Carroll Laboratories Professor; Professor of Biomechanics (in Orthopedic Surgery and Biomedical Engineering), Columbia University; Director, Carroll Laboratories for Orthopedic Surgery*

15:39 **“Stress management: cell packings and tissue flows in developing embryos”**



Karen Kasza, PhD *Associate Professor of Mechanical Engineering, Director of Kasza Living Materials Laboratory, Columbia University*

15:51 **“Functional biomaterials for tissue regeneration”**



Treena Livingston Arinzeh, PhD *Professor of Biomedical Engineering, Director of the Tissue Engineering and Active BioMaterials Laboratory, Columbia University*

16:03 **“Imaging stem cell signals in cancer progression and therapy resistance”**



Tannishtha Reya, PhD *Professor, Department of Physiology and Cellular Biophysics; Director, Irving Cancer Drug Development Program; Herbert Irving Comprehensive Cancer Center*

16:15 **SESSION 4 Q&A**

16:30 **Break (10 min.)**

SESSION 5: TISSUE ENGINEERING & INSTRUCTIVE BIOMATERIALS

16:40 **Remarks from Session Co-Chairs**



Helen Lu, PhD *Percy K. and Vida L. W. Hudson Professor of Biomedical Engineering; Senior Vice Dean of Faculty Affairs and Advancement, Columbia Engineering*

Mildred Embree, DMD *Dr. Edwin S. Robinson Assistant Professor of Dental Medicine (Orthodontics), CUIMC*

16:42 **“Orchestrating cellular regeneration at tissue scale”**



Yvon Woappi, PhD *Herbert and Florence Irving Assistant Professor of Physiology & Cellular Biophysics, Dermatology, and Biomedical Engineering; Director of Synthetic Regeneration and Systems Physiology Laboratory, CUIMC*

16:54 **“Self-assembling nanotechnologies for precision immuno-engineering”**



Santiago Correa, PhD *Assistant Professor of Biomedical Engineering; Director, Nanoscale Immunoengineering Laboratory, Columbia University*

17:06 **“Structural biology of malaria parasites”**



Chi-Min (Mimi) Ho, PhD *Assistant Professor of Microbiology & Immunology, CUIMC*

17:18 **“Organs on chip models of disease”**



Gordana Vunjak-Novakovic, PhD *University Professor and Mikati Foundation Professor of Biomedical Engineering and Medical Sciences; Director, Laboratory for Stem Cells and Tissue Engineering, Columbia University*

17:30 **SESSION 5: Q&A**

17:45 **CLOSING REMARKS - Symposium Zoom Webinar Adjourned**

18:00 **POSTER SESSION *(In-Person Only)***

POSTER SESSION

PRESENTER	PI	TOPIC
Divya Bhansali	Kam Leong	1. Targeting the Protease-Activated Receptor-2 (PAR2) with Nanotherapeutics to Reduce Oral Cancer Pain
Sarah Cai	Kam Leong	2. Lipid Nanoparticle Gene Delivery to Mouse Brain Achieved by Focused Ultrasound via Systemic Delivery
Leonardo Campos	Christoph Juchem	3. Complex domain spectral fitting of proton magnetic resonance spectra reveals improvements in precision and accuracy relative to real fits not inherently replicated by zero filling
Salvatore Caruso	Stephen Tsang	4. Mutation Agnostic CRISPR Genome Surgery for RHO-Linked Retinal Dystrophies
Yumei Chen	X. Edward Guo	5. Localized cortical bone and cellular responses after short-term and long-term mechanical stimulation
Lauren Chiriboga	Elizabeth Olson	6. Designing a Coupled Common-Mode OCT Probe with a Voltage Electrode for Simultaneous Intracochlear Motion and Voltage Measurements in Guinea Pig
Teodora Dinescu	X. Edward Guo	7. Subchondral bone changes in a longitudinal study of guinea pig osteoarthritis
Joy Fan	Elham Azizi	8. Mapping genotype to phenotype through joint probabilistic modeling of single-cell gene expression and chromosomal copy number variation
Daniella Fodera	Kristin Myers	9. Spatial Mapping the Mechanical Properties of the Uterine Fibroid-Myometrium Boundary
Ross Giglio	José McFaline-Figueroa	10. Uncovering EGFR Inhibitor Transcriptional Signatures in Models of GBM
Cheng Gong	Raju Tomer	11. Optogenetic approaches to study brain network dysfunctions in an in vitro model
Zhixian Han	Joshua Jacobs	12. Single Neurons in the Human Medial Temporal Lobe Encode Distinct Aspects of Different Tasks
Siyu He	Elham Azizi, Kam Leong	13. Starfish reveals heterogeneous spatial dynamics in the breast tumor microenvironment
Nicholas Hou	José McFaline-Figueroa	14. Modeling the Effects of Tumor Heterogeneity on GBM Therapeutic Response
Ronald Instrella	Christoph Juchem	15. Uncertainty Propagation in Absolute Metabolite Quantification for In Vivo Magnetic Resonance Spectroscopy of the Human Brain
Youngbin Kim	Gordana Vunjak-Novakovic	16. BeatProfiler: automated GUI based cardiac analysis pipeline enables deep learning-based classification of cardioactive drugs and genetic diseases in vitro
Xiaoyue Li	Elisa Konofagou	17. Real-time lesion monitoring during FUS ablation using interleaved harmonic motion imaging guided FUS (Interleaved-HMIgFUS) in in vivo mouse and humans
Lauren Lisiewski	Nadeen Chahine	18. TGF- β 3-Releasing Bioinstructive Constructs Promote AF- and NP-like Intervertebral Disc Cell Phenotypes in 3D Printed Scaffolds
Roberta Lock	Gordana Vunjak-Novakovic	19. iPSC-derived macrophages modulate human engineered cardiac tissue function
Bruna Lopes da Costa	Stephen Tsang	20. Development of a prime editing strategy to treat mutations in the Crumbs homologue-1 (CRB1) gene
Sandra Maesta Pereira	Joshua Jacobs	21. Conjunctive Encoding in Human Place and Time Cells
Catherine Medeiros	Christoph Juchem	22. Influence of water- but not creatine-referenced proton magnetic resonance spectroscopy metabolite estimates by hidden lesions in cortex of individuals with multiple sclerosis
Margaretha Morsink	Gordana Vunjak-Novakovic	23. Cardiac fibroblast BAG3 regulates TGFBR2 signaling and tissue fibrosis.
Nicholas Nolan	Stephen H. Tsang	24. Therapeutic Editing of Rod Glycolysis Rescues Retinal Degeneration
David Park	Frank Provenzano	25. Learning Bandlimited Signals with Generative Adversarial Networks
Juan Rodriguez	Henry Hess	26. Mechanochemistry (not severing enzymes or MAP unbinding) accounts for microtubule breaking
Peter Shyu	X. Edward Guo	27. Osteoclast precursor cells regulate the (re)modeling response to mechanical loading in trabecular and endosteal bone, but not periosteal bone
Xiaoxiao Sun	Paul Sajda	28. Closed-loop phase-locked rTMS treatment decreases global cortical excitability in major depressive disorder patients
Naveed Tavakol	Gordana Vunjak-Novakovic	29. Bioengineered human microtissue model of the healthy and malignant bone marrow
Sebastian Theilenberg	Christoph Juchem	30. Field probe system for spatio-temporal B_0 field characterization in a head-only MR scanner
Melina Tourni	Elisa Konofagou	31. Electromechanical Cycle Length Mapping for Atrial Arrhythmia Detection and Cardioversion Success Assessment
Yang Xiao	Kam Leong	32. Spatial multi-omic profiling of human hippocampus reveals region-specific alterations in major depressive disorder
Erfan Zabeih	Joshua Jacobs, Jacqueline Gottlieb	33. Traveling waves regulate neuronal spiking activity across space and time
Isabelle Zinghini	Christoph Juchem	34. Multi-coil Shimming: An Alternative Method for B_0 Homogeneity in MRI

Cover image: 3D image of proprioceptive neurons in a freely moving fruit fly larva, captured using swept confocally-aligned planar excitation (SCAPE) microscopy, a technology developed by the Hillman Lab. Credit: Wenze Li, Rebecca Vaadia, Wesley Gruber and Elizabeth Hillman