Department of
BIOENGINEERING | UNIVERSITY OF UTAH

Uniting genetics, signal transduction and material science in the analysis of cancer invasion

Andre Levchenko, EngScD

John C. Malone Professor of Biomedical Engineering
Yale University

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11:45 am – SMBB Auditorium (2650)

Sorenson Molecular Biotechnology Building (USTAR Bldg) - 2nd Floor

Biography

Dr. Levchenko, John C. Malone Professor of Biomedical Engineering and inaugural director of the Yale Systems Biology Institute on the Yale West Campus, combines experimental results with computational models to learn about the interactions of proteins and cells in healthy and disease states.

Dr. Levchenko received a Master of Science degree in biophysics from the Moscow Institute of Physics and Technology, and after arriving in the United States as a refugee he went on to earn a Master of Science and a Doctor of Science degree in bioengineering from Columbia University. He was then a postdoctoral scholar in the California Institute of Technology's biology division. Prior to joining the Yale faculty in 2013, Dr. Levchenko was a faculty member in the Department of Biomedical Engineering at Johns Hopkins University, where he held affiliations with the Whitaker Institute for Biomedical Engineering, the Institute for Cell Engineering, the Johns Hopkins Medical School Epigenetics Center, the John Hopkins Institute for NanoBioTechnology, and the Center for Cell Dynamics.

Dr. Levchenko has authored more than 90 published research articles and several book chapters. He serves on the editorial boards of PLOS Biology and Science Signaling, among numerous others. He is a member of the New York Academy of Science, the Biophysical Society, the American Society for Biochemistry and Molecular Biology, the American Chemical Society, and the Biomedical Engineering Society. He is a recipient of the American Asthma Foundation Early Excellence Award and has been elected a fellow of the American Institute for Medical and Biological Engineering.

Presentation Abstract:

Living cells and the extracellular matrix (ECM) can exhibit complex interactions that define key developmental, physiological and pathological processes. In this talk, I will describe a new type of directed migration—which we term 'topotaxis'— guided by the gradient of the nanoscale topographic features in the cells' ECM environment. We have shown that the direction of topotaxis is reflective of the effective cell stiffness, and that it depends on the balance of the ECM-triggered signaling pathways PI(3)K–Akt and ROCK–MLCK. In melanoma cancer cells, this balance can be altered by different ECM inputs, pharmacological perturbations or genetic alterations, particularly a loss of PTEN in aggressive melanoma cells. I will argue that topotaxis is a product of the material properties of cells and the surrounding ECM, and propose that the invasive capacity of many cancers may depend broadly on topotactic responses, providing a potentially attractive mechanism for controlling invasive and metastatic behavior.