UCLA Engineering
HENRY SAMUELI SCHOOL OF
ENGINEERING AND APPLIED SCIENCE

BIOENGINEERING

PRESENTS

Toolboxes for the study of cellular biophysics

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ABSTRACT:

Traditional cellular analysis, from basic research to clinical diagnostics, has relied on assays requiring chemical labeling of molecular biomarkers. However, recent advances in technology enable the use of mechanical characteristics, size, morphology, and deformation of cells or how cells adhere/migrate, as label-free markers for cellular analysis. Changes in mechanical characteristics evolve with the cell-state and disease processes; therefore, quantitative understanding of cell mechanics and its molecular origins will facilitate promising biomedical applications from health monitoring or disease diagnosis to therapeutic cell preparation for regenerative medicine. This presentation will highlight two technologies, multiparameter deformability cytometry (mDC) and homogenous entropy-driven biomolecular assay (HEBA), and discuss how these technologies can facilitate our understanding of cellular biophysics. mDC is a microfluidics-based platform that enables high-throughput measurement of cellular mechanical properties. We validated its potential as a label-free phenotyping toolbox by successfully classifying various cell types, drug-treated cells, malignant cells, and differentiated cells. HEBA is a DNA-based molecular machinery that is designed to enable catalytic amplification of a molecular input. We demonstrated this method by achieving quick, simple, and ultrasensitive detection of various molecular markers (viral RNA/DNA, micro RNA, and proteins). Taken together, these results prove that mechanical phenotyping can provide fundamental insights into cellular biology and demonstrate how technological advances benefit life science research and clinical diagnostics.

BIOGRAPHY:

Dr. Donghyuk Kim received a B.S. degree in chemistry from the Hanyang University, Seoul, Korea. He received M.S. and Ph.D. degrees from the University of Minnesota. He is currently a postdoctoral associate in the Di Carlo laboratory in the Department of Bioengineering at UCLA.