The Faculty of Biotechnology and Food Engineering

Seminar

Assoc. Prof. Daphne Weihs

Faculty of Biomedical Engineering, Technion-Israel institute of Technology

Mechanobiology as a bioengineering approach to rapidly reveal the clinical metastatic risk of cancer

Abstract

The main cause (90%) of cancer-related deaths is due to metastasis, spreading of cancer to distant sites in the body. Metastasis requires cells to dynamically adapt to the changing environments that they traverse, inducing changes in cell morphology, intracellular structure and dynamics, cell-cell interactions, and cell-microenvironment interactions. Accordingly, we and others have shown that metastatic cells exhibit faster cytoskeletal dynamics and are internally[1] and externally softer than non-invasive cells. In addition, metastatic cancer cells apply stronger adhesive, traction forces as compared to benign.[2] Here, we show measurable differences in the mechanobiological interactions of invasive and non-invasive cells with a synthetic gel that provide the mechanical invasiveness of cells, which we show correlates with the metastatic risk in patients.

We have previously shown that a subpopulation of metastatic cancer cells from cell-lines will rapidly (<2 hours) and forcefully indent an elastic, physiological stiffness, synthetic, impenetrable gel to depths of 1-10μm, whereas benign breast cells do not indent[3–5]; the cell diameter is 20μm. We have recently shown that the indenting subpopulation of cells is also highly migratory and invasive as determined by Boyden chamber assay[6]; the latter takes 48-96 hours. We have identified coordinated reorganization of the cells' mechanostructure to apply force,[4] utilizing mechanisms that rely on the cytoskeleton dynamics and especially the actin. The mechanical invasiveness that is measured here is independent of tumor genetics and are governed by the strength and invasive propensity of the cells. We will show that the mechanical invasiveness measure is applicable to varied types of solid cancers (e.g. pancreatic and skin cancer), and also directly agrees with the clinical histopathology and patient outcomes. Thus, using our innovative mechanical invasiveness assay we can provide a rapid (2-hr) cancer diagnosis and prognosis of the likelihood for metastasis that can be adapted into the clinic to augment the standard practice, to e.g. affect choice of treatment for a newly diagnosed patient.

Wednesday, 6/11/19, 14:00 – 15:00, Room 300

Faculty of Biotechnology and Food Engineering