MECHANICAL ENGINEERING STUDENT SEMINAR

Wednesday, September 21 2022 at 11:30, D. Dan and Betty Kahn Building, Auditorium 1.
Online: https://technion.zoom.us/j/97289919038

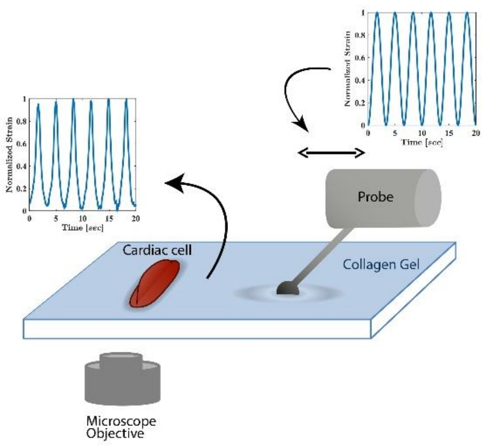
Biophysical basis of mechanical communication in cardiac cell beating

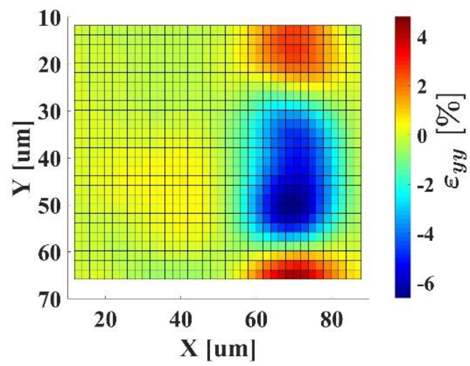
Ido Nitsan

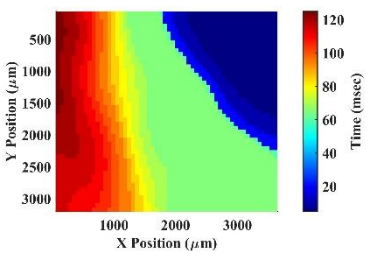
Adviser: Prof. Shelly Tzlil

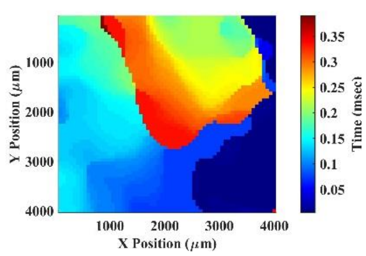
Intercellular communication is discussed almost exclusively as having a chemical or an electrical origin. However, we have directly demonstrated mechanical communication between cells and showed its uniqueness as a long-range interaction that induces long lasting alterations in interacting cells. Specifically, we showed that an isolated cardiac cell can be trained to beat at a given frequency by a 'mechanical-cell' – a probe that mimics the deformations generated by a beating cardiac cell – and that mechanical coupling between cardiac cells is essential for synchronized beating. By directly measuring the mechanical coupling between a cardiac cell and the mechanical cell, we show that beat-to-beat variability decays exponentially with coupling strength. Furthermore, we show that mechanical communication on ECM proteins is frequency dependent. Due to the dynamic viscoelastic properties of collagen hydrogels, the shape of the mechanical signal changes in a frequency dependent manner as it propagates through the gel, leading to a frequency dependent loading rate and therefore frequency dependent mechanical communication. Moving further to a more physiological setup, we show in a 2D cardiac tissue model, that weak mechanical coupling results in reentrant arrythmias (spiral waves). We demonstrate that the normal conduction wave can be recovered using mechanical stimulation

The seminar will be given in English









Seminars Coordinator: Assoc. Prof. Matthew Suss.