



The faculty of Biotechnology and Food Engineering Seminar

Dr. Yossi Mandel, MD, PhD

Institute for Nanotechnology and Advanced Materials (BINA),
Bar-Ilan University

Hybrid Retinal Prosthesis: High-Resolution Electrode Array Integrated with Neurons for Restoration of Sight

Abstract

Vision restoration in patients with outer retinal degenerative diseases, such as Age-related Macular Degeneration and Retinitis Pigmentosa can be achieved by bypassing the degenerated photoreceptors and the electrical stimulation of the relatively well-preserved inner retina through electrode implants. Although current retinal prostheses have been shown to provide useful vision in blind patients, the obtained visual acuity and quality are still relatively low. However, inherent limitations of current prosthetic technologies, such as the long distance between the electrodes to the target cells (bipolar cells) and non-selective stimulation of retinal circuits, make it very challenging to mimic natural vision for better restoration of sight

We propose a paradigm shift toward sight restoration with a hybrid retinal prosthesis aimed at overcoming the aforementioned limitations by better mimicking natural vision. The hybrid implant is composed of a high-density electrode array (pixel distance down to the cellular size of 10- 15 μ m), where each individual electrode is coupled with a glutamatergic neuron to create a tight neuron-electrode coupling. Following implantation of the hybrid prosthesis, the glutamatergic neurons integrate and synapse with the host retinal circuits. Patterned electrical stimulation of these glutamatergic neurons by the electrodes modulates glutamate release onto the synapse with the host bipolar cells after which the remaining retinal circuitry is activated in an identical manner to natural vision

In this talk I will present our results with generation of photoreceptor precursors from hESC. I will present the functional characterization of these cells by patch-clamp and calcium imaging techniques, which demonstrated that the intracellular calcium of the cells can be electrically modified. I will further discuss the many challenges and approaches taken in device fabrication and tissue engineering toward the development of hybrid retinal prosthesis.

**Wednesday, 7.11.18, 14:00 – 15:00, Room 300
Faculty of Biotechnology and Food Engineering**