MECHANICAL ENGINEERING STUDENT SEMINAR

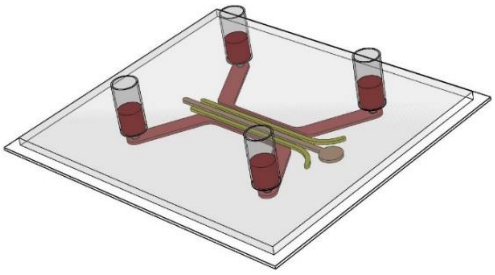
Wednesday, September 07 2022 at 13:00, D. Dan and Betty Kahn Building, Auditorium 1.
Online: https://technion.zoom.us/j/98621751114

In-vitro spermatogenesis in a microfluidic environment and sorting sperm using dielectrophoresis

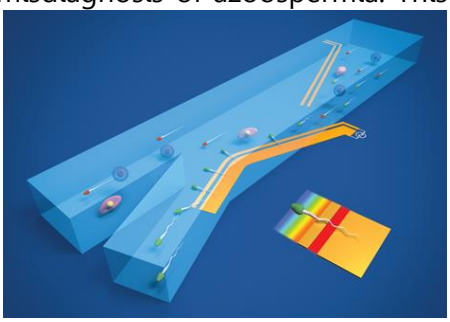
Sholom Shuchat

Advisers: Prof. Dan Mordechai, Prof. Gilad Yossifon, Prof. Mahmoud Huleihel

Spermatogenesis is the process whereby spermatogonial stem cells (SSC) develop and mature into sperm. Replicating the process in vitro would provide hope for pediatric cancer patients facing potential sterility due to aggressive treatments. As their testis produces no sperm, they currently freeze a testicular biopsy that contains SSCs. These biopsies however, cannot be transplanted back to the testis for fear of reintroducing the cancer. In vitro spermatogenesis may also provide a treatment option for adult patients with azoospermia due to maturation arrest, where for an unknown reason, spermatogenesis in the testes does not reach completion. Despite the importance, in vitro spermatogenesis has been an elusive goal for scientists. This work has focused on improving the process using microfluidics. Microfluidics offers the capability to better control the cellular environment. The smaller diffusion lengths enable the efficient supply of nutrients to the cells, while removing toxic waste and metabolites. Incorporation of active fluid flow was also tested and supporting cell types from adult mice were cultured in neighboring channels to allow cross-communication without cross-contamination. Our results showed that using our platform significantly increased cell viability and the percentage of differentiated meiotic and post-meiotic cells after seven weeks of culture was significantly higher.



A second project focused on using dielectrophoresis to sort live sperm from a semen sample containing dead cells and other debris. Nowadays only a single sperm is needed to fertilize an oocyte (egg). However, 1% of men are diagnosed with azoospermia, meaning no sperm is found in the ejaculate. Generally, only a minute portion of the sample is searched for sperm by eye under a microscope. If there are only a few sperm present, they are often missed leading to a misdiagnosis of azoospermia. This research found that when applying electric fields at specific frequencies a dielectrophoretic force pulls the tail onto the electrodes while simultaneously repelling the head, which contains all of the DNA, distancing it from potentially harmful electric fields. Dead sperm other cells, and debris are also repelled by the electrodes. This behavior is a biomarker for live sperm allowing the automatic retrieval of viable sperm from a sample.



Seminars Coordinator: Assoc. Prof. Matthew Suss.