



## Department of Chemical Engineering Distinguished Seminar Speaker



### Dr. Yaakov Nahmias

Director, Center for  
Bioengineering  
Hebrew University of Jerusalem

Host: Thomas Webster  
th.webster@neu.edu

**“Development of  
Predictive Tools for  
Liver Toxicology:  
Micro-well  
Bioreactors and  
Pluripotent Stem  
Cells”**

**Thursday, Feb 27**  
300 Richards Hall  
11:45 a.m. – 1:00 p.m.

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**ABSTRACT** The liver is the main organ responsible for the modification, clearance, and transformational toxicity of most drugs and toxins. Primary hepatocytes, the parenchymal cells of the liver, are the main cell type responsible for drug metabolism. Regrettably, primary human hepatocytes are scarce and rapidly lose metabolic function in culture.

Attempts to differentiate hepatocytes from pluripotent stem cells similarly result in minimal metabolic activity. In this talk we will describe our recent efforts to create predictive models of liver toxicity using microfluidics, integrated sensors, and three-dimensional cultures. We report on the fabrication of micro-well bioreactors capable of maintaining hepatocyte organoids for over 28 days *in vitro*. Cell viability is continuously monitored using on-chip frequency-based luminescence-quenching (FBLQ) nano-scale oxygen probes, and integrated off-chip glucose and lactate sensors. The approach is sensitive enough to identify sub-threshold effects of toxicity across multiple toxicological endpoints. We will also present a rapid differentiation of hepatocytes from human embryonic stem cells using a protocol mimicking important aspects in post-partum development. We show that self-assembled

organoids and microfluidic perfusion critically affect hepatic differentiation. Finally, end-point assays demonstrate utility of stem cells derived hepatocytes for toxicological screening.

**BIOGRAPHY** Dr. Nahmias received his B.Sc. in Chemical Engineering from the Technion - Israel Institute of Technology, and his Ph.D. in Biomedical Engineering at the University of Minnesota. Dr. Nahmias became a faculty member of the CEM at Massachusetts General Hospital in 2006, and an associate member of the Center for Bioengineering in the Service of Humanity at the Hebrew University of Jerusalem in 2009. His work focuses on the study and development of microscale liver tissues using microfabrication and cell patterning. The ultimate goal is to develop advanced liver tissues that will display differentiated function and an *in-vivo*-like response to challenges such as inflammation and viral infection. His recent work has been featured by JAMA, PNAS, and the Faculty of 1000 Medicine. Dr. Nahmias is the recipient of an NIH Mentored Scientist Career Development Award

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