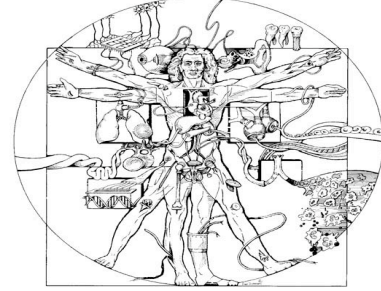


# Biomedical Engineering Seminar

Monday, September 21, 2009

2:00 pm

Keating 103



## **Yitshak Zohar, Ph.D.**

Professor, Department Aerospace and Mechanical Engineering

Bio5 Institute and the Arizona Cancer Center

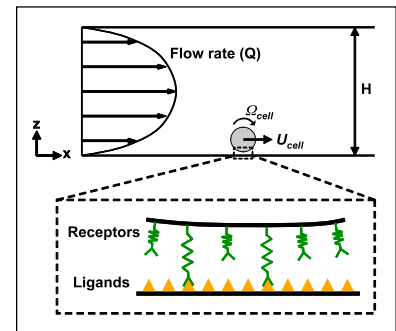
University of Arizona

### **“Attachment and Detachment of Circulating Tumor Cells in Microfluidic Devices”**

#### **Abstract**

Circulating tumor cells have been identified in peripheral blood from cancer patients and are probably the origin of intractable metastatic disease. These tumor cells are very rare, comprising as few as one cell per  $10^9$  cells in the blood of patients with metastatic cancer; hence, their isolation presents a tremendous technical challenge. Nonetheless, these cells represent a potential alternative to invasive biopsies as a source of tumor tissue for the detection, characterization and monitoring of non-haematologic cancers. Current strategies for isolating cancer cells circulating in the blood stream are still limited to complex analytic approaches that generate very low yield and purity. Here, selective binding of tumor cancer cells to a biologically functionalized surface, utilizing a microfluidic system, has experimentally been studied under both static (no-flow) and dynamic (flow) conditions. Cadherins make up a family of cell adhesion molecules, and one cadherin subtype only interacts with its particular counter receptor.

Cancer cells, in contrast with normal cells, typically down-regulate one type of cadherin, e.g. E-cadherin, and up-regulate another, e.g. N-cadherin. Hence, driving a cell mixture through properly functionalized micro-channels can be used as a highly selective tool for capturing metastatic tumor cells circulating in the blood stream. In this presentation, the fabrication of antibody-functionalized microchannels is described, and the specificity of target-cell capture within these fabricated microchannels is demonstrated. The kinetics and dynamics of cell attachment under shear flow will be analyzed experimentally and theoretically. Finally, detachment of captured cells due to hydrodynamic loading will be discussed.



#### **Biography**

Dr. Yitshak Zohar received the B.S. and M.S. degrees from the Technion-Israel Institute of Technology in Aeronautical Engineering in 1981 and 1984, respectively, where he worked on high-incidence aerodynamics. He obtained the Ph.D. degree in Aerospace Engineering from the University of Southern California in 1990. As a Research Associate at USC and UCLA (1990-1992) he gradually shifted his research interest into microsystem technology in general and microfluidics in particular. He joined the Department of Mechanical Engineering at the Hong Kong University of Science and Technology as a faculty member in 1992, where he participated in setting up the University Micro Fabrication Center and established the Department Micromachines Laboratory. At the end of 2003, he took up a Professor position in the Aerospace and Mechanical Engineering Department at the University of Arizona to develop a similar microsystem technology program establishing the UA Micro/Nano Fabrication Center. Over the 1990s, his research interests included the science and technology of Microsystems concentrating on microscale fluid mechanics and heat transfer. Around 2000, he has started to work on microfluidic systems life sciences applications; topics of interest include micro capillary electrophoresis of DNA; selectively-functionalized surfaces with bio-active layers; selective capture of bio species such as cancer cells; and dissociation of brain tissues into single cells. He served as the Co-Chair of the IEEE MEMS'2008 conference, and currently serving as an Associate Editor for the *Journal of MEMS, Sensors and Actuators A: Physical*, and *Microfluidics and Nanofluidics*.



Host: Jennifer Barton, Ph.D. (621-4116)

Persons with a disability may request a reasonable accommodation by contacting the Disability Resource Center at 621-3268 (V/TTY). Requests should be made as early as possible to allow time to arrange the accommodation.