Northeastern University
College *of* Engineering

Please join us for a
Special Chemical Engineering & Bioengineering Seminar

Friday, January 11, 2013
108 West Village H
11:45 a.m. – 1:00 p.m.

"Engineered Matrix to Study the Effect of Microenvironment on Maintenance of Cancer Stem Cells and Drug Response"

ESMAIEL JABBARI, Ph.D.
Departments of Chemical and Biomedical Engineering
University of South Carolina

ABSTRACT

Tumors are highly heterogeneous in which cells with self-renewal and high invasive capacity co-exist with cells that are more differentiated and non-invasive. Increasing evidence suggests that the heterogeneity of the tumor tissue is rooted in the existence of cancer stem cells (CSCs). Therefore, understanding the mechanism of CSC maintenance and its regulation by the microenvironment is critical to cancer prevention and treatment. Since cancer takes many years to grow, it is important to develop *in vitro* models to study the molecular basis of tumorigenesis and progression. Animal models in which tumors are grown in syngeneic animals or human tumors grown in immunocompromised animals do not adequately reproduce the features of human cancer *in vivo*. 3D cell culture systems with biologic materials that support adhesion and growth of many cell types have emerged as another approach to cancer stem cell research. However, it is not possible to isolate individual factors in the microenvironment and the effect on cell response with naturally derived materials. In an effort to control the cell microenvironment, my laboratory has developed novel inert permissive gels with controlled physical, mechanical, and biological properties that support the maintenance of CSCs and tumorsphere formation. Encapsulation of breast cancer cells in these matrices demonstrated that the extent of tumorsphere formation depends on cell type, and CSC maintenance is modulated by matrix stiffness. In addition, ligands conjugated to the gel matrix that interacted with heparin-binding cell surface receptors reinforced tumorsphere formation while hyaluronan-binding and integrin-binding receptors abolished tumorsphere formation. Furthermore, the response of CSCs and differentiated tumor cells encapsulated in a gel micro-patterned with ligands depended on the chemotherapy drug: Doxorubicin displayed toxicity to differentiated tumor cells while Salinomycin displayed toxicity to CSCs as well as differentiated tumor cells. This model 3D hydrogel system can be used for the discovery of new cancer biomarkers, cancer drug screening, personalized cancer treatment, and to understand the effect of individual factors in the microenvironment on epithelial to mesenchymal transition (EMT) and tumorigenesis.

BIOGRAPHY: Dr. Esmaiel Jabbari completed his PhD from Purdue University and postdoctoral studies at Monsanto Biotechnology, Rice University, and Mayo Clinic. He is the Director of Biomimetic Materials and Tissue Engineering Laboratory and Associate Professor of Chemical and Biomedical Engineering at the University of South Carolina. He has contributed to the field of biomimetic materials for applications in regenerative medicine and drug delivery. His research is supported by NSF, NIH, the AO Foundation, and the Oral and Maxillofacial Surgery Foundation. He received the Berton Rahn Award in Orthopedic Research from the AO Foundation in 2012 for his contribution to auto-inductive orthopedic biomaterials. He has published >130 book chapters and peer-reviewed journal articles and presented >200 seminars at national and international conferences on biomimetic materials and regenerative medicine. He is a member of numerous scientific organizations including BMES, SFB, TERMIS, MRS, EMBS, ACS, AIChE, and AACR.

Refreshments will be served.