

Amgen Seminar Series in Chemical Engineering
in
Cherry Auditorium, Kirk Hall, 1 PM

Presents on October 15, 2015

Reverse Engineering Tumor Invasion and Resistance using Micro/Nano Technologies

By

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Tumor invasion and metastasis, as well as the emergence of drug resistance, confound existing anti-cancer therapies and result in over 9 out of 10 cancer-related fatalities. However, this complex and emergent phenomenon remains poorly understood, particularly from a physical and mechanical perspective. Engineering approaches based on micro/nano technologies may enable new insights into cancer biology and their translation for preclinical drug testing. Here, I describe the use of engineered microenvironments to profile single cell invasion and drug resistance. These behaviors can be comprehensively analyzed in space and time using computer vision, revealing an unexpected analogy with phase transitions during binary mixture solidification. Finally, we describe ongoing efforts to evolve towards three-dimensional tissue architectures based on soft materials patterned with integrated microfluidics.

This series at the University of Rhode Island is made possible through the generosity of Amgen, West Greenwich, R.I.

Refreshments provided by the Joseph Estrin Endowment.