UCI Samueli School of Engineering | Department of Biomedical Engineering

2022-2023 Seminar Series

"Stem cell and cancer cell phenotypes revealed by biophysical properties"

Friday, January 27th, 2023
12:00 – 1:00 p.m.

McDonnell Douglas Auditorium

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Abstract: Cells are dynamic and shift phenotype and function in response to external cues. Methods to detect the phenotypes of living cells are limited and often rely on minimal numbers of cell surface markers that are not sufficiently specific. Dielectrophoresis (DEP) is a unique method for the analysis and separation of living cells that does not require labels or markers, but instead measures inherent composite biophysical properties. We used DEP to better understand stem cell and cancer cell phenotypes and functions. Neural stem cells differentiate into neurons, astrocytes, and oligodendrocytes, but distinguishing which cells will form each mature cell type is challenging. This creates problems for understanding brain development and for stem cell transplants to treat neurological diseases and injuries. We separated cells with distinct differentiated cell fates using DEP because they differed in the biophysical property whole cell membrane capacitance. We found membrane capacitance is sensitive to plasma membrane composition, particularly glycosylation, and identified glycosylation pathways that regulate neural stem cell fate, impacting the formation of differentiated cells in culture and in the brain. Recently, we discovered that similar approaches can be used to identify chemotherapeutic resistant cell in glioblastoma, the deadliest brain cancer. These studies pave the way for characterization of resistant cells that drive tumor recurrence and identification of effective treatments that target resistant cells. Cell biophysical properties provide a novel way to investigate cell identity and discover new determinants of important cellular functions such as differentiation and chemotherapeutic resistance.

Biography: Dr. Lisa Flanagan is Professor and Vice Chair for Academic Affairs in the Department of Neurology at the University of California, Irvine (UCI), with joint appointments in Biomedical Engineering and Anatomy and Neurobiology. Dr. Flanagan's research program combines neural cell biology and bioengineering to develop non-invasive methods to identify the fate potential of stem cells and optimize transplantation scaffolds for neural stem cells with the goal of improving the use of these cells to maximize repair of the central nervous system after debilitating conditions such as stroke. Before joining UCI, Dr. Flanagan completed her Ph.D. at University of California, San Diego and post-doctoral training at Harvard Medical School in Boston, Massachusetts. She received the National Science Foundation CAREER Award, serves on the Editorial Board for Scientific Reports, is a Fellow of the Center for the Neurobiology of Learning and Memory and has organized multiple international scientific conferences.

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