BIOENGINEERING Fall 2019 Seminar

Date: Thursday, September 26, 2019
Time: 12:00 pm - 1:00pm
Location: Exploratory Hall, Room L111
(Videoconferencing to SciTech, K. Johnson Hall Rm 254)

Darwin Reyes, Ph.D.

Biography: Dr. Reyes is a biomedical engineer and leader of the BioMEMS Project in the Microsystems and Nanotechnology Division, Physical Measurement Laboratory (PML) at the National Institute of Standards and Technology (NIST). After completing his Ph.D., he was awarded a National Science Foundation (NSF) Postdoctoral Fellowship to work with Professor Andreas Manz at Imperial College, London, U.K., where he worked for two years. Dr. Reyes started working at NIST (USA) as a National Research Council/NIST postdoctoral fellow. He is currently working in the development of microfluidic systems with electronic manipulation and measurement tools for cell-based assays and drug screening; electronic flow measurement sensors/methods; cell-substrate biomimetic interfaces with tunable elasticity; and thin, flexible wearable sensors. Dr. Reyes organized and co-chaired the 1st Workshop on Standards for Microfluidics held on June 1 & 2, 2017 at NIST Gaithersburg campus, in MD. After that workshop he co-founded and became the chair of the Microfluidics Association (MFA). He is also a member of the Executive Technical Program Committee of the MicroTAS Conference and Counselor of the American Electrophoresis Society (AES).

Title: Integrating Electronic Manipulation and Measurement Tools for Co-cultures/Organ-on-a-Chip Systems

Abstract: A wide variety of microphysiological platforms have been developed in recent years to replace the conventional static, 2D cell culture systems with *in vitro* models of human organs. The development of these micro-scale platforms, with the appropriate engineered cellular microenvironments, would provide for a way to bridge the gap between the use of preclinical animal models and the studies needed to be conducted in humans as part of the regulatory approval process. These platforms are seen as a viable tool for future use in personalized medicine, drug discovery, and drug testing. There have been increased efforts in the development of co-culture/organ-on-a-chip systems, but with only limited examples of integrated manipulation and measurement tools within then. Therefore, the development of integrated sensors in these systems is of critical importance to precisely determine changes in microenvironmental conditions as well as dynamic responses of cells to drug exposure during extended periods. The use of sensors allows for continuous monitoring of cell state, thus moving from endpoint only results to a continuous assessment of cell responses throughout the entire experimental period. With this in mind, we have developed a co-culture microfluidic platform with integrated manipulation and measurement capabilities, which allows for the concentration/cultivation of cells in co-cultures arrangements and to measure cell migration in monocultures. Our platform arranges cells in close proximity by dielectrophoretically trapping cells on opposite sides of a porous membrane with integrated gold microelectrodes. The physical separation provided by the porous membrane allows for optimal culture conditions on each side of the membrane (e.g., cell adhesive material and cell culture media). The same platform has been optimized for cell migration studies. This new system provides real-time, dynamic monitoring of cell migration employing impedance measurements and supplementary optical imaging. Overall, this microfluidic platform offers numerous opportunities for fundamental and applied research in cell biology as well as in diagnostics, personalized medicine, and tissue engineering.