ECE SPEAKER SERIES

Department of Electrical and Computer Engineering

Dr. Rajakkannu Mutharasan

Biosensors for Genes, Pathogens, Parasites, Biomarkers and Toxins

Our work over the last decade and a half has examined a number of platforms for detecting significant biological entities. These includes classical fluorescence based measurements (such as intracellular NAD(H) in bacterial and mammalian cells), optical evanescent field sensors for proteins, magneto-elastic film devices and electromechanical resonators, especially cantilevers that have integrated piezoelectric films. In this talk, I will focus on the latter device as its design has yielded extraordinary sensitivity. The methods we have developed allow for eliminating false negatives, a critical performance requirement for bioterrorism, medical, environmental and food safety applications. The cantilever sensors are self-excited devices that exhibit high-order modes near ~ 0.1 to 1 MHz and show sub-femtogram sensitivity. One significant property they demonstrate is that nonspecific binding is low or absent due to the surface being under constant out of plane oscillation. Several examples of practical importance (E. coli O157:H7, biomarkers, waterborne parasites, food and water toxins, and B. anthracis) will be illustrated using both antibody-based sensors and specific gene sequence as a molecular identifier without an amplification step.

March 21, 2016 • 10:00am- 11:00am • Egr Bldg 2 Rm W122

Raj Mutharasan received his bachelor's degree in chemical engineering from Indian Institute of Technology Madras (India) and a Ph. D in Chemical Engineering from Drexel University in 1973. After a post doctoral year at the University of Toronto in Canada, he joined Drexel University on the faculty and has been there since 1974. He is the Frank A. Fletcher Professor of Chemical and Biological Engineering. Currently he is the Program Director of NanoBiosensing at the National Science Foundation. He has served in many administrative capacities at Drexel including as the Interim Dean of College of Engineering (1997-2000). He led Engineering Curriculum Innovation Program – a seven university coalition on engineering education - at Drexel funded by the National Science Foundation during 1995-2004. He is a Fellow of American Institute of Chemical Engineers (2000), Fellow of American Institute for Medical and Biological Engineering (2006) and Fellow of the American Association of Advancement of Science (2011). His research interests are in biosensors and process biotechnology. His biosensors research is funded by the NSF, USDA, EPA, Pennsylvania Department of Health, and by the Department of Transportation/Department of Homeland Security.

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