DEPARTMENT OF MECHANICAL ENGINEERING COLLOQUIUM

UNIVERSITY OF CALIFORNIA
UC RIVERSIDE

**The Department of Mechanical Engineering**
PRESENTS

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**Friday, April 8, 2016**
**WCH Room 205/206**
**11:10-12:00PM**

## *Electrokinetic Micro- and Nanofluidic Technologies for Quantitative Detection of Viral Nucleic Acids*

***Abstract:***

Rapidly evolving acute respiratory infectious diseases (for example, Influenza, Severe Acute Respiratory Syndrome (SARS), Middle East Respiratory Syndrome (MERS), and West Nile Flavivirus (WNF)) now have significantly deleterious impacts on human health and economic productivity worldwide. Due to their highly contagious nature, and rapid negative impact on human health and economies, these diseases require developing a simple, high throughput, and immediate (within 30 minutes) screening methodology that can affordably and accurately determine virus diagnosis, so that treatments can be administered in a timely fashion. Furthermore, the expense of anti-virals now prohibits broad distribution even in developed countries. The diagnostic approaches that we are developing in the Pennathur lab enables rapid regionally based deployment of medications to stymie the spread of viruses. These approaches include (1) the development of a nanofluidic conductivity sensor for general nucleic acid detection, (2) fluorescent silver nanocluster DNA probes (AgNC-DNA) combined with microfluidic capillary electrophoresis (mCE), to detect and identify DNA sequences from HepA, HepB and HepC viruses, and (3) microfluidic tangential flow filtration (μTFF) of blood and serum for efficient on-chip sample preparation.

Specifically, we have developed a novel nanofluidic-based platform for the efficient detection of nucleic acids. The transduction method is label-free, inducing the formation DNA complexes that result in changes in flow velocity and current in a nanofluidic channel. This innovation takes into account the changes in surface and bulk conductivity in a nanochannel due to the concentration of ions in the bulk. Furthermore, we have developed a method for modifying a low cost, molecular beacon-like AgNC-DNA probe so that multiple DNA sequences can be detected and identified simultaneously and rapidly using microfluidic capillary electrophoresis. As a demonstration, we used this technique to design probes for nucleic acid targets of Hepatitis A, B and C virus. Finally, to truly make this work translational, we have developed a microfluidic based method for biological sample filtration. Such a method allows for facile integration with the above diagnostic sensors, and uses tangential flow filtration methods to effectively isolate targets of interest.

***About the Speaker:***

Dr. Pennathur received her B.S. and M.S. in Aerospace and Aeronautical Engineering from M.I.T. (2000 and 2001 respectively), and Ph.D. in Mechanical Engineering from Stanford University (2006). Prior to joining UCSB in 2007, she performed postdoctoral studies at both Sandia National Laboratories and University of Twente and held multiple positions at various companies and schools such as Sandia National Laboratories, Stanford University, National Institute of Standards and Technology, Tigris Corporation, Lockheed Martin, and MIT.