Joint Department of

BIOMEDICAL ENGINEERING

UNC CHAPEL HILL | NC STATE UNIVERSITY

Coulter Seminar Series Presents

"From Wearables to Insertables: Enabling Next-Generation Metabolite Monitoring with Responsive Biomaterials"

Mike McShane, PhD

James J. Cain Professor II in Biomedical Engineering
Head, Department of Biomedical Engineering
Texas A&M University

Dr. Mike McShane is James J. Cain Professor II in Biomedical Engineering at Texas A&M University, where he serves as Department Head and is also affiliated with Materials Science & Engineering and the Center for Remote Health Technologies and Systems. Prof McShane's primary research interests are in biomedical instrumentation and optics, biosensor technology, and biomaterials with emphasis on micro/nanofabrication for responsive materials. In this work, he has pioneered the use of micro/nanoparticles, capsules, and hydrogel-particle composites for development of optical biosensing systems and has assisted in commercialization of related products. Professor McShane is a Fellow of AIMBE and is a Senior Member of SPIE and also IEEE, for which he has served in numerous elected and appointed leadership positions including his current role as Senior Past-President of the IEEE Sensors Council.

ABSTRACT

Personal health monitoring is becoming increasingly accessible as the ease of producing low-cost, low-power embedded systems has fueled a rapid growth in consumer products aimed at "measuring me." Yet, a major technology gap is in the space of continuous chemical sensing. The majority of this talk will focus on describing our materials-focused solutions and related optical instrumentation aimed at closing this gap; it will also describe examples of how the same technology is being applied to various other applications, particularly bioreactors for cell manufacturing and tumor-egg models. Our research emphasis has been towards developing miniature, injectable biosensor implants with microscale and nanoscale organization to enable observation of interstitial biochemistry. These materials provide specificity through use of various receptors and enhance sensitivity through optical amplification by phosphorescence or Raman scattering. Further, they employ materials that can integrate naturally with tissue, such as porous gels, enhancing prospects for accurate, rapid response and long-term monitoring. These studies pave the way for modular sensing systems based on sensing microdomains embedded in hydrogels; the former serve as the selective responsive elements whereas the latter act to immobilize the sensing domains while providing a "friendly" surface to interface with the body. Prototype miniaturized, dedicated instrumentation to interrogate the implants will also be discussed. Examples of current and potential translational activities will be provided and some major remaining challenges to long-term in vitro and in vivo biochemical monitoring will be highlighted.

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