UNIVERSITY OF DELAWARE
ENGINEERING

DEPARTMENT OF BIOMEDICAL ENGINEERING

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COLBURN, ROOM 102

1:00PM

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ABSTRACT:

ENGINEERING MICROSYSTEMS FOR MEDICINE: FROM IMPLANTABLE DRUG FACTORIES TO NOVEL PLATFORMS FOR SINGLE-CELL ANALYSIS

Microscale devices can serve as a powerful tool for manipulating materials and controlling processes at a length scale relevant to biological systems. In this talk, I will discuss how microsystems can be utilized to address fundamental questions in medicine and life science. I will show two specific examples where we developed multi-component devices by combining microfabrication with novel materials, surface chemistry, and biomolecular engineering. First, I will describe a microfabricated implant that can protect transplanted therapeutic cells within immunocompetent hosts. These implants act as living drug factories inside the body and have the potential to treat chronic diseases such as diabetes and liver failure. I will outline the fundamental rules to design these implants, and show how we systematically optimized individual aspects of the device to achieve long-term efficacy. Our implants can maintain human xenografts in immunocompetent mice for several months and deliver therapeutic proteins on-demand. Second, I will present our most recent work on developing a microfluidic platform to enable high throughput sequencing of small regulatory RNAs (microRNAs) from single cells. I will describe how droplet-based microfluidics can be harnessed to enrich microRNA from individual cells, process them using DNA barcoding technology, and analyze them through Next Generation Sequencing. I will discuss the potential of this technology in disease diagnosis and as a powerful tool for cell biology. Finally, I conclude with a high-level overview of problems my future lab is interested in and our interdisciplinary approach to solving them.

BIOGRAPHY:

Suman Bose is a Research Scientist at the Koch Institute for Integrative Cancer Research at MIT, working in the laboratories of Professor Robert Langer and Daniel Anderson. He obtained his B.Tech. degree in Mechanical Engineering from the Indian Institute of Technology Kharagpur, and went on to receive his S.M. and Ph.D. degrees also in Mechanical Engineering from MIT. Suman's graduate research focused on developing bio-inspired microfluidic technologies for diagnostic and therapeutic applications. At the Koch Institute, Suman is using microsystems engineering to build implantable devices that can work as living drug factories inside patients. He is also developing new single-cell technologies to enable high-throughput sequencing of non-coding RNAs. He was recognized as one of the top 40 Healthcare Innovators by MedTech in 2016, and also received the JDRF postdoctoral fellowship in 2015 and the NIH K99/R00 Pathway to Independence Award in 2018.

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