BME Seminar
Friday, March 4th, 2016
UTEB 150 at Storrs & Videoconferenced to UCHC CG-079B
12:00-12:50 pm  *Refreshments will be served*

“DNA-based Materials”

Presented by: Dan Luo, PhD, Professor, Department of Biological and Environmental, Engineering, Cornell University

Abstract: Over the last 15 years, my group has been engineering DNA as both genetic (bio-) materials and generic (nano-) materials. In this talk, I will focus on how we have designed DNA as polymers in order to develop bulk-scale, DNA-based biomaterials for real-world applications. More specifically, I will elaborate on our DNA-based hydrogels, which are networked DNA molecules through the use of various DNA processing enzymes. They are either chemically crosslinked or physically entangled, all in a bulk scale. We have demonstrated a number of real-world applications from diagnostics to pharmaceutics. For example, branched DNA was used as nanoscale barcodes for the detection of pathogen DNA. Proteins were efficiently expressed from the DNA hydrogel in a cell-free fashion. In addition, we created a super-condensed, ultra-high dose DNA (scudDNA), similar to the compaction of a chromosome; these scudDNA with therapeutic DNA motifs successfully suppressed tumor growth in an animal model. Furthermore, by creating a DNA-based hydrogel made from ancient clay minerals and sea water, we showed that nucleic acids were immobilized on the clay hydrogel and were protected against nuclease, and that transcription and translation reactions were persistently enhanced. We have used DNA-clay interaction to realize large scale protein production. Our DNA-clay hydrogel also implicates that biochemical reactions during the early life evolution may have happened in a similar clay-DNA hydrogel environment. DNA have proven to be not only the molecule of life, but also the molecule for biomaterials.

Bio: Dr. Dan Luo is currently Professor in the Department of Biological and Environmental Engineering at Cornell University. He is a faculty member for the field of Biomedical Engineering and also a senior investigator for the Kavli Institute at Cornell for Nanoscale Science. Dr. Luo obtained his B.S. from the University of Science and Technology of China and his Ph.D. from The Ohio State University in 1997. He carried out his postdoctoral training in the Department of Chemical Engineering at Cornell under Prof. Mark Saltzman. Dr. Luo joined Cornell faculty in 2001 and was promoted to full professorship in 2011. He is a recipient of the National Science Foundation’s CAREER Award, the Cornell Provost’s Award for Distinguished Scholarship, the SUNY (New York State) Chancellor’s Award for Excellence in Scholarship and Creative Activities, the Journal of Materials Chemistry Editorial Board Award, New York State Faculty Development Award (“Distinguished Professor”), College Award for Outstanding Accomplishments in Basic Research, and Bill and Melinda Gates Foundation Point-of-Care Diagnostics Grand Challenge Award. He was also selected four times by top undergraduate students as a Cornell outstanding educator. Dr. Luo was elected as a College Fellow of the American Institute of Medical and Biological Engineering (AIMBE) in 2013.