



Tao Geng received his B.S. degree in Chemical Engineering and Technology from East China University of Science and Technology in China in 2003. After working on stem cell bioengineering and tissue engineering for three years, he completed his M.S. degree in Microbial and Biochemical Pharmacy at Shanghai Jiao Tong University in China in 2006. He subsequently joined Dr. Chang Lu's group at Purdue in the fall of 2007 for his Ph.D. degree. His research interests mainly focus on microfluidic cell analysis and manipulation, with special emphasis on developing novel integrated microfluidic chips for genetic and epigenetic analysis of cells. He is the recipient of the MicroTAS 2011 CEBS travel grant. Following the doctoral training, Tao will pursue a career in academia.



Agricultural & Biological ENGINEERING

Dissertation Defense

Speaker: Tao Geng
Title: Microfluidics for Genetic and Epigenetic Analysis of Cells
Major Professor(s): Dr. Chang Lu
Date: Thursday, March 22, 2012
Time: 9:30 am
Location: ABE 212

Abstract:

The translation of conventional genetic/epigenetic analytical techniques using macroscale apparatus to microfluidic format offers the advantages of enhanced sensitivity and speed, decreased sample cross-contamination and product loss, favorable fluidic properties, low cost and disposability. This work demonstrate a novel microfluidics-based chromatin immunoprecipitation assay which dramatically reduces the required cell number and assay time by conducting cell collection, cell lysis, chromatin fragmentation, immunoprecipitation, and washing on a microchip. Coupled with real-time PCR, the assay permits the analysis of histone modifications from as few as ~50 cells within 8.5 h. In addition, we also developed an integrated microchip that was able to physically trap a given amount of cells, lyse the cells using 10 square DC electrical pulses within 1.5 min, as well as purify and concentrate genomic DNA. Efficient integration of the three key steps successfully generated sufficient products amenable to off-chip real-time PCR assay from ~30 CHO-K1 cells and 10² CFU of Gram-negative bacteria *Salmonella*. DNA yield exhibited a great dependency on electrical field intensity and a good linearity with respect to the amount of bacterial cells.

Application:

The ability of performing sample preparation for both genetic and epigenetic analyses makes the microfluidic approaches adapted for dealing with real-world samples such as blood, saliva, urine, food, and wastewater. The method could be broadly applicable to clinical diagnosis, drug screening, forensic identification, food safety inspection, environmental monitoring and biowarfare testing.