Department of Chemical and Biomolecular Engineering

GRADUATE SEMINAR

Friday, March 30, 2012
10:00-11:00 AM
404 Min H. Kao Electrical Engineering and Computer Science Building

GUEST SPEAKER

Dr. Anushree Chatterjee
Postdoctoral Fellow, Theoretical Biology and Biophysics Group,
Center for Nonlinear Studies,
Los Alamos National Laboratory

Dr. Chatterjee obtained her Ph.D. (Chemical Engineering) from University of Minnesota, in 2006. The focus of Dr. Chatterjee’s research program is modeling Hepatitis C Virus RNA replication; from RNA regulation to virion production.

TITLE
Discovering Novel Drug Targets to Prevent Antibiotic-Resistance Transfer in Bacteria Using Systems Biology Based Approaches

ABSTRACT

The recent rise in microbial drug-resistance and limited discovery of new antibiotics is a growing challenge for future therapy of microbial infections with serious threat to global health and lives. For example, without potent antibiotics, the success of treatments such as cancer chemotherapy, organ transplantation and surgery would be severely compromised. It is projected that current antibiotics-based therapies may become ineffective within a decade or two. Thus, there is an urgent need to counter antibiotic resistance. One of the main factors driving the rise of drug resistant microbes is the transfer of antibiotic resistance genes present on mobile pieces of DNA (called plasmids) between antibiotic-resistant donor cells and antibiotic-sensitive recipient cells via mechanism of conjugation.

Dr. Chatterjee will discuss her recent results which combine computational biology and molecular biology for the discovery of novel drug targets to prevent antibiotic-resistance transfer in bacteria. She will discuss discovery of novel mechanisms by which key gene regulatory components control the transfer of tetracycline-resistance conferring plasmid pCF10 in Enterococcus faecalis, a bacterium that is especially capable of attaining and transferring antibiotic resistance in hospital settings. Her group recently uncovered a unique quorum-sensing based cell to cell communication system between donor and recipient cells, capable of suppressing conjugative transfer of antibiotic-resistance, thus providing an opportunity to control antibiotic resistance transfer. During quorum-sensing, donors and recipients communicate via release and detection of two antagonistic signaling molecules. Once inside the donor cell, direct interaction of these signaling molecules with key genes present on plasmid pCF10, gives rise to a complex gene-regulatory circuit which confers the donor cell with a robust bi-stable genetic switch controlling transfer of resistance. Finally, she will describe a novel mechanism of gene-regulation, via transcriptional interference and antisense RNA interaction, which her group found to constitute the bistable genetic switch controlling drug-resistance transfer. She will also show how they can alter this switch behavior by manipulating these regulatory mechanisms. The findings discussed in this talk elucidate novel mechanisms and a new approach to gene regulation that will potentially lead to next-generation of resistance-free antibiotics.