McElvain Seminar in Physical Chemistry

Tuesday **11:00am** **Room1315**

March 31, 2009 **Chemistry Building**

A Life Changing Decision Made by a Single-Molecule Stochastic Event: Deciphering a Genetic Switch in a Living Bacterial Cell

X. Sunney Xie
Harvard University
Department of Chemistry and Chemical Biology

In a living cell, gene expression—the transcription of DNA to messenger RNA followed by translation to protein—occurs stochastically, as a consequence of low copy numbers of DNA and mRNA molecules involved. Can one monitor these processes in a living cell in real time? How do cells with identical genes exhibit different phenotypes? Recent advances in single-molecule imaging in living cells allow these questions to be answered at the molecular level in a quantitative manner [1].

I will discuss that a stochastic single-molecule event of the dissociation of a protein from DNA is solely responsible for the switching of a cell's phenotype [2]. This is an example of the chemistry of life – a single-molecule action makes a life changing decision in a living cell, *i.e.*, determining its phenotype.

1. Xie, X. Sunney; Choi, Paul J.; Li, Gene-Wei; Lee, Nam Ki; Lia, Giuseppe "Single-Molecule Approach to Molecular Biology in Living Bacterial Cells," *Annu. Rev. Biophys*, **37**, 417-444 (2008).

2. Choi, Paul J.; Cai, Long; Frieda, Kirsten; Xie, X. Sunney "A Stochastic Single-Molecule Event Triggers Phenotype Switching of a Bacterial Cell," *Science*, **322**, 442-446 (2008).

[There will be a reception at 4:00 pm in Room 9341]