

## **Doug Shepherd (University of Colorado - Denver)**

### **Tutorial: Monte Carlo Methods**

In this tutorial, students will learn how to use random sampling to perform Monte Carlo simulation and will discuss various algorithms for Monte Carlo simulation. We will use Monte Carlo methods to fit a simple linear model to noisy data. We will then examine how the Metropolis-Hastings algorithm can be used to explore parameter uncertainties in solutions to the Chemical Master Equation. If time permits, we will create a Metropolis-Hastings sampler for a simple parameter uncertainty example.

### **Tutorial: Image processing**

In this tutorial, students will learn the various noise sources that are present in modern fluorescence microscopy instruments. We will derive a likelihood function for photons arriving at a camera detector and use this likelihood function to describe the uncertainty in the observation. We will then discuss how the noise in these experimental approaches may influence extraction of meaningful analyses, such as RNA copy number or the diffusion coefficient of a mobile protein. If time permits, we will execute a simple image processing example of live-cell super-resolution tracking data using these tools.