Department of Mathematics and Statistics
San José State University

Spring 2018 Course:

Math 285: Introduction to Systems Biology

MW: 1:30pm - 2:45pm

Syllabus: An introduction to contemporary mathematical systems biology with an emphasis on dynamical modeling of cellular processes, including reaction networks, gene regulation, and signaling pathways. Mathematical models include ODEs, stochastic Markov Chains, and (time-permitting) PDEs.

So what is systems biology anyway? The post-human genome project world (circa 2000) has seen an explosion in experimental "high throughput" biological data. This deluge of data has spurred new and innovative techniques for determining the mechanisms underlying biological function. Primary among these is mathematical systems biology which attempts to determine the underlying interaction structures capable of producing the observed behaviors such as stability (e.g. metabolism), bistability (e.g. hysteresis, switching systems), and oscillations (e.g. circadian rhythms, neuronal spikes).

Prerequisites: Math 129A, 134 or 170, and 161A, with a grade of C- or better or instructor consent

About the instructor: Matthew Johnston's research lies in the area of mathematical biology, with an emphasize of dynamical models of biochemical reaction networks. For more information, contact him at: `matthew.johnston@sjsu.edu`

$$\frac{d(gene_1)}{dt} = k_{1,s} \cdot \frac{1}{1 + k_{1,3} \cdot gene_3} - k_{1,d} \cdot gene_1$$

$$\frac{d(gene_2)}{dt} = k_{2,s} \cdot \frac{k_{2,1} \cdot gene_1}{1 + k_{2,1} \cdot gene_1} - k_{2,d} \cdot gene_2$$

$$\frac{d(gene_3)}{dt} = k_{3,s} \cdot \frac{k_{3,1} \cdot gene_1 \cdot k_{3,2} \cdot gene_2}{(1 + k_{3,1} \cdot gene_1) \cdot (1 + k_{3,2} \cdot gene_2)} - k_{3,d} \cdot gene_3$$