C&S BIO 150 COMPUTER LAB

Spring 2019

Instructor:	Tianyun (Jason) Lin	**Time:**	F 12:00 – 15:50
Email:	tlin56@ucla.edu	**Place:**	Young Hall 4335

Course Page (will post assignments and hints here)**:**

- https://tlin56.github.io/teaching/2019-spring-teaching-2

Office Hours: Monday 4pm - 5pm @Life Science 5229 (NOT TLSB!)

Interesting Read: Here I listed two cool books that might help you on the road of mastering modeling and problem solving in general.

- Morrison, Foster. *The art of modeling dynamic systems: forecasting for chaos, randomness and determinism.*, Courier Corporation, 2012.

- Hilborn, Ray, and Marc Mangel. *The ecological detective: confronting models with data.*, Vol. 28. Princeton University Press, 1997.

Tentative Lab Outline:

Week 1 . . . . **Intro to Matlab & ODE Solving**
What is Matlab; basic operations and coding; writing scripts and functions; loops; boolean; vectorize; save and load data; Matlab ODE solvers; we will also examine different types of numerical solvers for ODE and the effect of step size on the error.

Week 2 . . . . **Eigenvalues**
Brief explanation of how to find eigenvalues. Logic of basic methods and characteristic equations and polynomial.

Week 3 . . . . **Bistability**
Use Matlab to simulate and analyze dynamical systems that use ODE; use ODE45 to numerically solve; address fixed points and nullclines; also perform sensitivity analysis.

Week 4 . . . . **Predator-prey**
Develop agent-based model for predator-prey dynamics; study how "handling time" arise from individual dynamics.

Week 5 . . . . **Epidemic outbreaks**
Model outbreaks using SIR/SIRS model; study the speed, strength and size of outbreaks.

Week 6 . . . . **Michaelis Menten**
Michaelis-Menten enzyme-substrate dynamics and the Quasi Steady State Assumption.

Week 7 . . . . **Hodgkin-Huxley**
Use Matlab to simulate an excitatory system with the specific case-study of a neuron in mind

Week 8 . . . . **Network**
Use Gephi to study some properties of various networks and methods of how to visualize them.

Week 9 . . . . **Fractal**
Learn basic skills you need for analyzing fractals, including box counting method, manipulating images, thresholding, and a bit about regression and model comparison.

Week 10 . . . . **Game Theory**
Explore the interactions between strategies, games, and population outcomes.

Grading Policy: Lab assignment (90%), Participation (10%).

Lab Policy:

- Food and beverage without cap (with bottle cap is okay) is not allowed in the lab.

- Please ask questions! You are most likely not the only one who has them.

- Be collaborative rather than competitive and help each other! For those of you who already have some training in programming and modeling, please help others with little or no training, you can also learn from teaching others.

- Please let me know (either in person or through email) if you have any other question or feel like I can make the classroom dynamic more accessible to you.