University of California Riverside
BIEN 101
Fall 2017
4 Units

Department of Bioengineering
Quantitative Biochemistry
Instructor: Dr. Justin Chartron
TA: Brian Lupish

Meeting times & locations:	**LECTURES**	**Tue & Thu**	**2:10-3:30p**	**Spieth 2200**
	DISCUSSION	**Fri**	**5:10-6:00p**	**Boyce 1471**
		Fri	**6:10-7:00p**	**MSE 103**
Office Hours:	Dr. Chartron:	Wed & Thu	4:00-5:00p	MSE 239
	Brian Lupish:	Mon	1:00-2:00p	MSE 217

Contact Information: Dr. Chartron: jchartron@engr.ucr.edu
Brian Lupish: blupi001@ucr.edu

Textbooks: *Biochemistry* by Berg, Tymoczko, & Stryer (7th or 8th ed.)
Mathematical Modeling in Systems Biology: An Introduction by Brian Ingalls
https://www.math.uwaterloo.ca/~bingalls/MMSB

Prerequisites: BIOL005A, CHEM008A, MATH046

Course Description: *Provides Bioengineering students with an in-depth experience in applying mathematical modeling and simulation methods to understand the dynamics of biochemical systems. Prepares for designing new applications of genetic engineering.*

Course Objectives:

- During this course, students will build a strong foundation of knowledge about the key biomolecules that make life possible.
- Students will develop an understanding of how biochemical processes and the mechanisms that regulate them contribute to the function (or dysfunction) of cells and systems.
- Students will be able to qualitatively and quantitatively describe biochemical reactions that occur in the cell. They will be able to translate these quantitative descriptions into computational models and to interrogate them to reveal important system behaviors.
- Students will also gain confidence in reading the scientific literature and thinking critically about the dynamics of biological systems.

MATLAB Installation: Please follow online instructions to obtain a student license at http://sitelicense.ucr.edu/matlabstudent.html. While installing, when you reach the screen listing add-ins to install, select 'Curve Fitting Toolbox' in addition to the default selections. If you need additional help, please see the student help desk at Bourns A304.

Grading:

Component	Percentage
Assignments (x6)	30%
Implementations (x2)	30%
Midterm	15%
Final	25%

Assignments: Weekly assignments are due at the beginning of class on Tuesday. Late assignments will be accepted with a -10% penalty for every day beyond the due date.

Implementations: Implementations consist of both a written component and a coding/problem-solving component. Submission will include both a short 1-2 page discussion of a scientific paper, a computational model discussed in the paper, and your own analysis of that model *in silico.* A functional MATLAB script (.m file) must also be submitted electronically and should contain thoughtful documentation. Grading rubric for each implementation will be provided.

Exams: Only information provided to you in or during the exam is permitted. Exams are taken individually.

Student Responsibilities:

Readings: The recommended readings offer an alternate narrative to help you understand the principles of biochemistry. *Biochemistry* is a classic reference and will be useful in other biochemistry courses, such as BIEN 125, and throughout your career. *Mathematical Modeling in Systems Biology* covers modeling to greater depth than time allows in lecture. The author provides an online copy for free: https://www.math.uwaterloo.ca/~bingalls/MMSB.

The readings are intended to help you to understand new concepts, and during exams we will not ask about obscure details from the text. Please do not memorize the text!

Collaboration & Academic Honesty: Students are encouraged to discuss and work on problems together, but must submit their own, original solutions and explanations for homework assignments, implementation write-ups, and code. When working together on implementations, students must explicitly acknowledge shared work: “This implementation was completed in collaboration with Student X.” Plagiarism and other academic dishonesty will not be tolerated.

COURSE SCHEDULE

Week	Dates	Topics	Reference Readings	Assignments
0	9/28	Course overview; Chemistry review	Berg Ch. 1 Ingalls Ch. 1	
1	10/3 10/5	Biological macromolecules *DIS: MATLAB tutorial*	Berg Ch. 4 Ingalls Ch. 1	Assignment 1 Online
2	10/10 10/12	Proteins, lipids and carbohydrates *DIS: Protein analysis tools*	Berg Ch. 2	Assignment 1 Due* Assignment 2 Online
3	10/17 10/19	Protein-ligand interactions *DIS: Differential equations in MATLAB*	Berg Ch. 7, 36 Ingalls Ch. 2	Assignment 2 Due Assignment 3 Online **Implementation 1 Online**
4	10/24 10/26	Enzyme kinetics *DIS: Implementation 1*	Berg Ch. 8-9 Ingalls Ch. 3	Assignment 3 Due
5	10/31 11/2	Protein signaling cascades; Midterm review *DIS: Midterm review*	Berg Ch. 10, 14 Ingalls Ch. 6.1-6.2	**Implementation 1 Due Friday 5 pm** Assignment 4 Online
6	11/7 11/9	Bioenergetics and metabolism *DIS: NO MEETING (Holiday)*	Berg Ch. 15-17 Ingalls Ch. 4	**MIDTERM EXAM (11/7)**
7	11/14 11/16	Metabolic networks *DIS: Stability*	Berg Ch. 18, 27 Ingalls Ch. 5	Assignment 4 Due Assignment 5 Online
8	11/21	DNA, RNA, and regulation of gene expression *DIS: NO MEETING (Holiday)*	Berg Ch. 4-6 Ingalls Ch. 7.1-7.3	Assignment 6 Online Assignment 5 Due **Implementation 2 Online**
9	11/28 11/30	Genetic engineering *DIS: Implementation 2*	Berg Ch. 31-32	Assignment 6 Due
10	12/5 12/7	Synthetic biology; Final review *DIS: Final Exam Review*	Berg 31-32	**Implementation 2 Due Friday 5 pm**
11	12/15	**FINAL EXAM 11:30a-2:30p**		**FINAL EXAM**

*Assignments are due on Tuesdays before the start of class