

**Syllabus Spring 2025**  
**Biochemical/Cellular Sys Model - BINF 751**  
**George Mason University, Bioinformatic and Computational**  
**Biology, School of System Biology**

**INSTRUCTOR: Aman Ullah.**

Locations/times: Lecture: Wednesday 4:30PM - 7:10PM, Online (Zoom's link will be available on the blackboard).

Phone: (703) 993-7182; Email: [aullah3@gmu.edu](mailto:aullah3@gmu.edu)

Office Hour: Wednesday: 10:00 PM-1:00 PM or by an appointment through Zoom's Link.

### **Course Description:**

#### **Learning Objectives**

Students will acquire knowledge and skills related to the concepts and techniques necessary for the study of cellular and subcellular processes.

Computational and Mathematical Methods: The focus is on using computational and mathematical methods as tools for investigation.

#### **Application of Knowledge**

Students will learn how to articulate cellular or subcellular processes using mathematical equations. This implies translating biological phenomena into a language that involves mathematical representations.

Analysis Techniques: They will also be equipped to analyze these mathematical representations, implying the use of computational methods to gain insights into the processes being studied.

### **Course Introduction**

- Introduction to dynamical modeling in cell biology
- Focus on computational cell biology and computer modeling

### **Course Objectives**

- Understand concepts and techniques in computational cell biology
- Apply mathematical and computational techniques to model cellular functions
- Encourage collaboration between mathematicians and experimentalists

### **Course Scope**

- Progression from simple to complex cellular functions and mathematical techniques
- Emphasis on computer modeling and interdisciplinary approaches.

### **Course Goals**

- Provide tools for students to access modeling literature and appreciate theoretical approaches
- Promote interdisciplinary collaboration in the field of cell biology

## Textbooks

*Computational Cell Biology*: by Chris P. Fall, John Tyson, John Wagner, and Eric Marland. “*An Introductory Text on Computer Modeling in Molecular and Cellular Biology*”

*Mathematical Physiology*: by James Keener and James Sneyd.

**Note:** Lecture material will be based heavily on these textbooks.

## Prerequisites

Calculus and knowledge of a programming language.  
Knowledge of differential equations is helpful.

## Grading Policy

The course grade will be determined as follows:

Activities:	Percent of Final Grade:
Homework-	30%
Mid-Term (Take Home) -	20%
Final Exam (Take Home) -	30%
Final Project -	20%

Grades are assigned on the following basis.

98 to 100%:	A+
90 to 97%:	A
87 to 89%:	B+
80 to 86%:	B
77 to 79%:	C+
70 to 76%;	C
60 to 69%;	D
Less than 60%;	F

Homework assignments will be assigned several times during the semester. They will be due two weeks after they are assigned. Late Homework will not be accepted.

**Students are expected to attend all lectures and participate in the class discussions.**

## Class Announcements

Any pertinent class announcements will generally be sent to your GMU email accounts. The most current lecture content (including PowerPoint presentations) will be posted to the class Blackboard page following each class.

## Academic Honesty Policy

This course adheres to the Mason honor code, which states that students must not cheat, plagiarize, steal, or lie in matters related to their academic work. Please ensure that all work you submit is original and contains proper attribution. That being said, you can help each other out on the homework (this does not mean that you can copy each other's homework). If you have any doubts about what constitutes as plagiarism, please contact me.

### **Tentative Course Schedule:**

Tuesday, January 22<sup>nd</sup> --- Overview of the course and Dynamic Phenomenon in cells  
Tuesday, January 29<sup>th</sup> --- Biochemical Reactions  
Tuesday, February 5<sup>th</sup> --- Voltage Gated Ionic Currents, The Hodgkin-Huxley Model  
Tuesday, February 12<sup>th</sup> --- Excitability and action potential and Spiking  
Tuesday, February 19<sup>st</sup> --- Transporters and pumps, Reduction of Scale  
Tuesday, February 26<sup>th</sup> --- Reduction of Scale, Fast and Slow Time Scale  
Tuesday, March 5<sup>th</sup> --- **Midterm (Take home)**  
Tuesday, March 12<sup>th</sup> --- **No class -- Spring Recess**  
Tuesday, March 19<sup>th</sup> --- whole-cell models  
Tuesday, March 26<sup>th</sup> --- Intracellular communication  
Tuesday, April 2<sup>nd</sup> --- Spatial Modeling  
Tuesday, April 9<sup>th</sup> --- Calcium dynamics, Modeling intracellular Calcium waves and sparks  
Tuesday, April 16<sup>th</sup> --- Modeling intracellular Calcium waves and sparks  
Tuesday, April 23<sup>rd</sup> --- Final Project  
Tuesday, April 30<sup>th</sup> --- Final Project  
Tuesday, May 7<sup>th</sup> --- **(Final, Take-home exam due)**

*Changes if needed will be announced in the class.*

### **Advice**

If you want to do well in course: 1) Do all the homework. 2) Ask questions in class and office hours. 3) If you are having difficulty doing the homework, be sure to see the instructor for additional help.

### **Student Services**

#### **Disabilities**

If you have a documented learning disability or other condition that may affect academic performance you should: (1) make sure this documentation is on file with Office of Disability Services (SUB I, Rm. 4205; 703-993-2474; <http://ods.gmu.edu>) to determine the accommodations you need, and (2) talk with me to discuss your accommodation needs.

**Mason Live/Email:** Students are responsible for the content of university communications sent to their George Mason University email account and are required to activate their account and check it regularly. All communication from the university, college, school, and program will be sent to students solely through their Mason email account.

**University libraries:** University Libraries provide resources for distance learning students [See Library website: <http://library.gmu.edu/for/online>].

## **WEATHER**

For closings due to inclement weather, register for Mason-ALERT to receive text messages by email or phone.