

**BIOE 341 / 541**  
**Cell and Molecular Biology for Engineers**  
**Fall 2022**

**CLASS MEETING:** 10:50AM - 12:05PM T/TR CT BRC 284

**INSTRUCTOR**

Dr. Laura Segatori  
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**TEACHING ASSISTANTS**

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**COURSE WEBSITE**

CANVAS (<http://canvas.rice.edu/>)

**COURSE DESCRIPTION AND TOPICS**

Understanding the behaviors of biomolecules and cells in health and disease is a prerequisite to appropriately applying modern bioengineering principles. In this course, students will learn the fundamentals of cell and molecular biology and how transformative new technologies permit measuring and engineering these processes to uncover biological insights and improve human health. The topics covered in this course will include:

- Biomolecules
- Cell morphology and structure
- Binding interactions and enzymatic conversions
- Foundations of DNA, the central dogma of molecular biology, DNA replication, transcription, translation
- Regulation of gene expression
- Cellular signal transduction
- Cellular communication
- Tools of recombinant DNA, molecular cloning
- Gene editing and synthetic biology

## **COURSE OBJECTIVES**

- To understand the fundamental principles governing molecular interactions, enzymatic conversion, transfer of genetic information, and cell transduction mechanisms.
- To understand the molecular biology principles involved in the transfer of genetic information.
- To learn how to control fundamental cellular processes for research and biomedical applications.
- To learn genetic and protein engineering tools to control molecular and cellular processes.

## **OUTCOMES**

Students completing this course will learn to:

- Describe the chemical basis of life and the forces that dictate biology at the molecular scale.
- Describe fundamental cellular processes including gene regulation, transcription and translation, and cellular transduction mechanisms.
- Analyze information flow according to the central dogma of biology and how it is regulated at each hierarchical level.
- Calculate kinetics parameters that describe biomolecular interactions and enzymatic conversion.
- Calculate kinetics parameters that describe complex processes mediating transcription and translation.
- Gain an appreciation of modern tools for manipulating cellular systems.
- Apply genetic, protein, and metabolic engineering strategies for the design of biomolecular products for research and industrial applications.

## **CLASS ATTENDANCE**

It is expected that students attend all lectures and participate in class activities and discussions. Although class material will be mostly posted on the class website, attending class will be necessary for its analysis and understanding.

## **CLASS PARTICIPATION**

Students are expected to be actively engaged in the classroom as active engagement is an essential component of the learning process. Participation includes reading assigned material, active engagement in Inquiry-Based Learning (IBL) activities assigned in preparation for class discussion, and active engagement in class discussions in small groups or as instructed during the lecture.

## **OFFICE HOURS**

Office hours will be conducted either in person or remotely as announced by the instructor/teaching assistants in class on Canvas.

In-person office hours will be held in the instructor/teaching assistants' office unless otherwise stated.

Remote office hours will be conducted via Zoom. Zoom meetings will be accessible from Canvas.

When you arrive for remote office hours, please be patient if the instructor/teaching assistant is meeting with another student. Type your name in the Chat window and briefly state the topic or question you would like to discuss if you are placed in a waiting room.

## **COURSE RESOURCES**

All course materials will be posted to the course Canvas site.

*Do not rely solely on posted slides for notes - they do not contain all covered material and will need to be supplemented with your own notes.*

## **TECHNOLOGY RESOURCES**

- Students must have a working computer with a video camera, speaker and microphone, and a working internet connection that allows them to be on video if needed. Students should contact the Dean of Undergraduates if they have concerns about meeting this requirement. Graduate students should contact their department.
- If your computer/phone has no webcam/microphone, please let the instructor know as soon as possible and contact the Dean of Undergraduates if you need to request support via the [Access and Opportunity Portal](https://aop.rice.edu/application) (<https://aop.rice.edu/application>).

## **GRADING POLICY:**

Exam 1	20 %
Exam 2	20 %
Final Exam*	30 %
Homework Assignments	20 %
Participation**	10 %

*\*BIOE 541 students must also complete a team assignment*

*\*\*including in-class activities as well as completion-based assignments from reading material*

There will be two midterm examinations and a comprehensive final exam.

The midterm exams will be held in class and are tentatively scheduled for 09/26 and 11/22.

The final exam will be a timed take-home exam that will be made available on Canvas for the *entire* final exam period (as scheduled by the registrar, 12/6-12/12) and needs to be submitted within 3 hours from the time the assignment is downloaded.

All exams will be closed notes and closed books but you will be allowed to use a “cheat sheet” (A4 paper format, instructions will be provided in class). Detailed instructions about the material covered in each exam will be given in class.

There will be several homework assignments that will count for 20% of the total grade.

Homework assignments are due on the date/time specified on each assignment and must be submitted electronically through Canvas. Late submissions will be accepted only with prior approval of the instructor and will receive a 10% credit reduction for each day after the deadline. Homework will not be accepted after two full days beyond the posted deadline.

While each student must submit individual solutions to the homework problems, you are encouraged to work together. As for most science and engineering fields, group study, by stimulating critical thinking, typically provides a valuable method of learning and results in a broader understanding of the subject. However, please keep in mind that academic dishonesty will not be tolerated.

Assignments may be regraded if a written request with the original assignment is presented within one week from the date they were returned.

Graduate students are required to work on a team assignment. Directions will be provided by the instructor during the semester.

### **HONOR CODE POLICY**

Plagiarism is the undocumented inclusion of someone else's work within your work, and besides damaging your education, also violates Rice's Honor Code. The consequences for a Rice Honor Council violation typically range from an F in the course to a 2-semester suspension from Rice.

You are not allowed to give or receive help during the exams unless instructed otherwise by the instructor or the teaching assistants. Any suspicion of honor code violations for homework, quizzes, or exams will be reported to the Rice Honor Council. Information about the Rice Honor System can be found at

<http://honor.rice.edu/>.

We take plagiarism very seriously, be sure that you understand what an appropriate level of collaboration is before sharing information with a colleague. Please do not hesitate to contact the instructor for an explanation of what constitutes an Honor Code violation.

Outside of exams, you are encouraged to work with classmates on readings, homework assignments, and discussion problems. Note that all these activities are valuable preparation for exams - make sure that you know how to work through problems on your own and develop your own independent command of the material.

### **PREREQUISITES**

Pre-requisite or co-requisite: BIOE 252 and BIOC 201 or consent of the instructor.

### **TEXTBOOKS AND OTHER MATERIAL**

#### **Required:**

Class notes and material distributed during the semester (posted on *Canvas*)

#### **Recommended:**

Alberts, Molecular Biology of the cell. Science Publishers.

#### **Lectures:**

Lectures will be mostly given using a tablet to write notes and annotate slides and will be posted on *Canvas* after the lecture. They are not a substitute for reading the textbook and other assigned reading material.

### **EXPECTATIONS**

Students are expected to complete the reading assignments before the class meeting or as otherwise indicated by the instructor and to actively engage in class discussions.

Students are expected to return homework assignments on time and are responsible for remembering homework due dates and exam dates.

Students are responsible for logistic information provided in class (e.g., deadlines) and reported in the lectures posted on *Canvas*.

## **PRIVACY AND CONFIDENTIALITY**

In line with FERPA requirements, recorded classroom discussions involving students will be available only to students officially registered and enrolled in the class. If you have concerns about appearing on these recordings, please contact the instructor ahead of time.

## **SPECIAL NEEDS**

Any student with a documented disability seeking academic adjustments or accommodations is requested to speak with the instructor during the first two weeks of class to discuss the best way to meet the student's needs. All such discussions will remain as confidential as possible. Students with disabilities will need to also contact [Office of Disability Support Services](https://drc.rice.edu) (<https://drc.rice.edu>). The ODSS can help you document your needs and create an accommodation plan to ensure appropriate accommodations (disclosing your condition or diagnosis to course instructors may not be required).

## **SEXUAL MISCONDUCT IN ONLINE COURSE COMMUNITIES**

Rice's Sexual Misconduct Policy applies in all Rice online courses. Examples of sexual misconduct behavior in an online environment are text-based or image-based discussion posts of a sexual nature that are severely offensive or repetitive, unwelcome contact in or outside the course, etc. If you experience sexual misconduct in this course or outside of it, contact the instructor and/or the Office of Sexual Violence Prevention and Title IX Support via email at [titleixsupport@rice.edu](mailto:titleixsupport@rice.edu) or call (713) 348-3311.