



BIO-381 Molecular and Cell Biology - FALL 2022

Lecture Instructor: *Prof Denver Baptiste*
Contact Info: djnbapti@stevens.edu
Classroom Location: **Gateway South 216**
Meeting Time: Lectures: MWF, 8-8:50am (section A)

TAs: Va'Shayna William (vwilliam@stevens.edu), Elliot Dean (edean@stevens.edu)

Office Hours: By Appointment

Course Web Address: <https://sit.instructure.com/courses/61780>

PREREQUISITE(S): BIO281 or equivalent – It is anticipated that students have a prior knowledge of basic structure and function of the cell, cell's macromolecular composition, understand basics of gene expression (transcription, translation), cell division, cell communication, receptor ligand interaction, cell signaling and energy production.

COURSE DESCRIPTION

In this class students will study structure and function of the cell including its subcellular organelles and cytoskeleton. Class will detail biological macromolecules, enzymes, bio-membranes, biological transport, bioenergetics, cell division, protein synthesis and secretion, motility, and cancer.

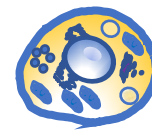
LEARNING OUTCOMES

The following are the three learning outcomes.

- 1) Explain in details general structure of the cell and function of the cell's structural components including compartments (organelles) and bio-molecules.
- 2) Explain in details cell communication, differentiation, and adaptation.
- 3) Explain in details gene regulation.

LEARNING OBJECTIVE

1. Explain, in details, the structure and function of the major organelles.
2. Explain the role of endo-membrane system in cell homeostasis.
3. Identify the major groups of cell surface receptors and the intracellular signaling pathways linked to these receptors.
4. Explain, in details, extracellular matrix-cell surface interactions and discuss the impact of the extracellular matrix on cell physiology and disease.
5. Explain, in details, the regulation of cell division.
6. Explain, in details, the process by which a normal cell transforms into a cancer cell.
7. Explain, in details, mechanisms of energy production.
8. Explain gene regulation.



FORMAT AND STRUCTURE

- In-person

COURSE MATERIALS

Class Material Options.

1. WileyPlus; bundled access to all homework assignments + eText \$69
2. Everything in 1 + print book rental \$99
3. Everything in 1 + loose-leaf version of the textbook \$119

Required Text Book:

Karp's Cell & Molecular Biology, Janet Iwasa and Wallace Marshall, 9th Edition ISBN 978-1-119-60130-2

How to set up WileyPLUS Content on Canvas:

https://players.brightcove.net/4931690914001/default_default/index.html?videoId=6177746486001

GRADING

<u>IN-CLASS PARTICIPATION</u>	(15%)
<u>WEEKLY HOMEWORK</u> (Chapter Review Questions)	(10%)
<u>3 EXAMS</u>	(45%)
<u>LABORATORY</u>	(30%)

WEEKLY HOMEWORK: Homework will be assigned at the end of each week. It will cover the learning goals and background information of the weekly topics discussed in class. The homework must be completed before the following class.

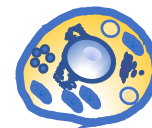
IN-CLASS PARTICIPATION includes a combination of attendance (2%) and in-class case studies discussions (8%)

“*” HOMEWORK DEADLINES ARE NOT SUBJECTED TO EXTENSIONS UNLESS THERE IS A SOLID REASON THAT CAN BE DOCUMENTED. – Please plan ahead!

GRADING SCHEME

ALL GRADES ARE COUNTED; NONE ARE DROPPED NOR ARE THEY CURVED.

Grade	Range	
A	100%	to 93%
A-	<93%	to 90%
B+	<90%	to 87%
B	<87%	to 83%
B-	<83%	to 80%
C+	<80%	to 77%
C	<77%	to 73%



C-	<73%	to 70%
D+	< 70	to 67%
D	<67%	to 60%
F	<60%	to 0%

ACADEMIC INTEGRITY

Undergraduate Honor System

Enrollment into the undergraduate class of Stevens Institute of Technology signifies a student's commitment to the Honor System. Accordingly, the provisions of the Stevens Honor System apply to all undergraduate students in coursework and Honor Board proceedings. It is the responsibility of each student to become acquainted with and to uphold the ideals set forth in the Honor System Constitution. More information about the Honor System including the constitution, bylaws, investigative procedures, and the penalty matrix can be found online at <http://web.stevens.edu/honor/>

The following pledge shall be written in full and signed by every student on all submitted work (including, but not limited to, homework, projects, lab reports, code, quizzes and exams) that is assigned by the course instructor. No work shall be graded unless the pledge is written in full and signed.

"I pledge my honor that I have abided by the Stevens Honor System."

Reporting Honor System Violations

Students who believe a violation of the Honor System has been committed should report it within ten business days of the suspected violation. Students have the option to remain anonymous and can report violations online at www.stevens.edu/honor.

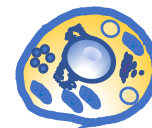
LEARNING ACCOMODATIONS

Stevens Institute of Technology is dedicated to providing appropriate accommodations to students with documented disabilities. The Office of Disability Services (ODS) works with undergraduate and graduate students with learning disabilities, attention deficit-hyperactivity disorders, physical disabilities, sensory impairments, psychiatric disorders, and other such disabilities in order to help students achieve their academic and personal potential. They facilitate equal access to the educational programs and opportunities offered at Stevens and coordinate reasonable accommodations for eligible students. These services are designed to encourage independence and self-advocacy with support from the ODS staff. The ODS staff will facilitate the provision of accommodations on a case-by-case basis.

Disability Services Confidentiality Policy

Student Disability Files are kept separate from academic files and are stored in a secure location within the Office of Disability Services. The Family Educational Rights Privacy Act (FERPA, 20 U.S.C. 1232g; 34CFR, Part 99) regulates disclosure of disability documentation and records maintained by Stevens Disability Services. According to this act, prior written consent by the student is required before our Disability Services office may release disability documentation or records to anyone. An exception is made in unusual circumstances, such as the case of health and safety emergencies.

For more information about Disability Services and the process to receive accommodations, visit <https://www.stevens.edu/office-disability-services>. If you have any questions please contact: Phillip Gehman, the Director of Disability Services Coordinator at Stevens Institute of Technology at pgehman@stevens.edu or by phone (201) 216-3748.



INCLUSIVITY

Name and Pronoun Usage

As this course includes group work and in-class discussion, it is vitally important for us to create an educational environment of inclusion and mutual respect. This includes the ability for all students to have their chosen gender pronoun(s) and chosen name affirmed. If the class roster does not align with your name and/or pronouns, please inform the instructor of the necessary changes.

Stevens Institute of Technology believes that diversity and inclusiveness are essential to excellence in academic discourse and innovation. In this class, the perspective of people of all races, ethnicities, gender expressions and gender identities, religions, sexual orientations, disabilities, socioeconomic backgrounds, and nationalities will be respected and viewed as a resource and benefit throughout the semester.

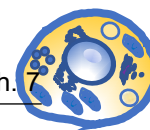
Suggestions to further diversify class materials and assignments are encouraged. If any course meetings conflict with your religious events, please do not hesitate to reach out to your instructor to make alternative arrangements.

You are expected to treat your instructor and all other participants in the course with courtesy and respect. Disrespectful conduct and harassing statements will not be tolerated and may result in disciplinary actions.

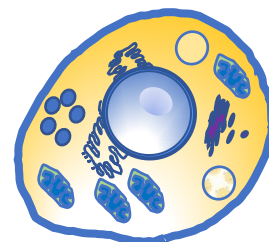
BIO381 Spring 2022 COURSE SCHEDULE

The instructor reserves the right to modify the schedule as necessary to assure the course objectives are met or exceeded. The student will be promptly informed of any such change:

	Date	Lecture	Reading/Homework
Wk1	Sep 2-F	Introduction to Cell Biology	Ch. 1
Wk2	Sept 5-M Sept 7-W Sept 9-F	Labor Day – No Class Bioenergetics /Enzymes/Metabolism Bioenergetics /Enzymes/Metabolism	Ch3 Ch3
Wk3	Sep 12-M Sep 14-W Sep 16-F	Bioenergetics/Enzymes/Metabolism Plasma Membrane Plasma Membrane	Ch. 3 Ch. 4 Ch. 4
Wk4	Sep 19-M Sep 21-W Sep 23-F	Plasma Membrane Plasma Membrane Aerobic Respiration	Ch. 4 Ch. 4 Ch. 5
Wk5	Sep 26-M Sep 28-W Sep 30-F	Aerobic Respiration Aerobic Respiration Review Exam 1	Ch. 5 Ch. 5
Wk6	Oct 3-M Oct 5-W Oct 7-F	Exam 1 – Chapters 1,3,4,5 Endo-membrane Systems Endo-membrane Systems	Ch. 8 Ch. 8 Ch. 8
Wk7	Oct 11-T* Oct 12-W Oct 14-F	Endo-membrane Systems (* Monday schedule) Endo-membrane Systems Endo-membrane Systems	Ch. 8 Ch. 8 Ch. 8
Wk8	Oct 17-T* Oct 19-W	Interactions between cells and their environment Interactions between cells and their environment	Ch. 7 Ch. 7



	Oct 21-F	Interactions between cells and their environment	Ch. 7
Wk9	Oct 24-M Oct 26-W Oct 28-F	Cytoskeleton/Cell motility Cytoskeleton/Cell motility Cytoskeleton/Cell motility	Ch. 9 Ch. 9 Ch. 9
Wk10	Oct 31-M Nov 2-W Nov 4-F	Transcription/Translation Transcription/Translation Transcription/Translation	Ch.11 Ch. 11 Ch. 11
Wk11	Nov 7-M Nov 9-W Nov 11-F	Control of Gene expression Control of Gene expression Review Exam 2	Ch. 12 Ch. 12
Wk12	Nov 14-M Nov 16-W Nov 18-F	Exam 2- Chapter 7,8,9,11) Cell Division Cell Division	Ch. 14 Ch. 14
Wk13	Nov 21-M Nov 23-W Nov 25-F	Cell Division Thanksgiving Break – No Class Thanksgiving Break – No Class	Ch.14
Wk14	Nov 28-M Dec 30-W Dec 2-F	Cell Signaling Cell Signaling Cell Signaling	Ch.15 Ch.15 Ch.15
Wk15	Dec 5-M Dec 7-W Dec 9-F	Cell Signaling Cancer Biology Review Exam 3	Ch. 15 Ch 16
	Dec 15-22	Exam #3 (Ch12, 14-16)	



BIO381 Lab
Molecular and Cell Biology Laboratory
Stevens Institute of Technology
Fall 2022

Instructor: Prof. Denver Jn. Baptiste

Course Schedule:

Tuesday: 11:00-1:50am (LF) and 2:00-4:50pm (LE)
Thursday: 8:00-11:50am (LA) and 2:00-4:50pm (LB)
Friday: 11:00-1:50pm (LC), and 2:00-4:50pm (LD)

Contact Info: djnbapti@stevens.edu

Office Hours: By appointment

TAs: Elliot Dean: edean@stevens.edu, Va'Shayna Williams: vwilliam@stevens.edu, Felicia Spadavecchia: fspadave@stevens.edu, Zahra Hashemi: zhashemi@stevens.edu

Lab Course Description

This laboratory course consists of laboratory sessions that will familiarize the students with a variety of laboratory techniques used in the broad field of cellular and molecular biology to study cell structure, cell organelles, and gene regulation in different model systems.

Objectives and Goals:

- Understand the use current techniques and model systems to explore mechanisms of cellular and molecular biology
- Gain knowledge in data collection, analysis, interpretation of results, and experimental design
- Ability to communicate science content in both written and oral format
- Understand the larger context of how disease states affect cellular function
- Ability to work in teams

Learning Outcomes

- Explain and apply scientific methods, such as, design an experiment, test a hypothesis, and use of experimental controls
- Understand the different parts of a compound microscope and staining technique (gram stain technique)
- Understand the principle of gene regulation by regulating expression of the green fluorescence protein (GFP) in bacteria
- Understand cell biology techniques such as, protein extraction, protein purification using chromatography and, protein analysis using gel electrophoresis (SDS-PAGE)
- Understand molecular biology techniques such as, Polymerase Chain Reaction (PCR) and DNA analysis using agarose gel electrophoresis
- Understand the principle of gene editing (CRISPR-Cas9 system)



Grading Procedures

- Attendance is mandatory
- No make-up will be given for a missed quiz. However, in the case of illness, a doctor's note will be accepted at the discretion of the course instructor

Students will be evaluated based on

- In-class participation (5%)
- Weekly Quizzes (65%)
- Lab report (30%)

ALL GRADES ARE COUNTED; NONE ARE DROPPED NOR ARE THEY CURVED.

ARRIVE TO LAB ON TIME! The beginning of each lab will include a brief description of the exercise, details on the procedures that will be used and important safety measures to be taken during the lab. Failure to arrive on time will mean missing critical information; thus, you will not be able to perform the lab for that week.

Weekly Quizzes

At the end of each lab period a quiz will be given. The quiz will cover the learning goals and background information of the day's experiment. The quizzes must be completed before the following class. There will be approximately 13 quizzes.

Lab Report

A lab report must be completed at the end of the course. Instructions on how to complete the lab report will be posted on canvas and the details discussed in class.

Course Materials

- There is no lab manual for this course. Handouts and other assigned articles will be posted on Canvas prior to the class session in which they will be discussed. However, this laboratory course will follow the readings associated with the BIO381 lecture course as much as possible. (Lecture course Textbook: Karp's Cell & Molecular Biology, Janet Iwasa and Wallace Marshall, 9th Edition ISBN 978-1-119-60130-2)
- A laboratory notebook is required. The laboratory notebook is a documented, and primary record of laboratory observations.
- Safety goggles and lab coats are required at all times. You will be provided with gloves for the lab.

ALL STUDENTS MUST FOLLOW SAFETY RULES FOR THE LABORATORY. FAILURE TO DO SO WILL RESULT IN THE STUDENT BEING DISMISSED FROM THE LAB

COURSE SCHEDULE

The instructor reserves the right to modify the schedule as necessary to assure the course objectives are met or exceeded. The student will be promptly informed of any change.

Week 1: Introduction to lab safety; practicing using the micropipettes

Week 2 : Microscopy 1: Introduction to the microscope; staining onion bulbs to visualize dividing cells (mitosis) —> Lecture topic: Biological Molecules



Week 3 : Microscopy 2: Gram stain technique and bacterial visualization using the light microscope →
Lecture Topic: Metabolism

Week 4: Biofuel enzyme analysis: Determining the reaction rate in the presence of an enzyme, substrate and change in temperature.

Week 5 : pGLO system (Day 1- bacterial transformation using a plasmid expressing a gene that codes for Green Fluorescent Protein (GFP)): Lecture topic: Plasma Membrane

Week 6 : pGLO system: Day 2- Data collection and analysis of pGLO transformation

Week 7 : pGLO system: Day 3 - GFP visualization using electrophoresis (SDS-PAGE)

Week 8 : Forensic DNA fingerprinting (restriction digest of DNA samples): Lecture topic: Interaction between cells and their environment

Week 9 :-PV92 PCR Informatics kits: DNA Extraction and Amplification

Introduction to CRISPR-Cas

Week 10-14: Collection and analysis of PV92 PCR Informatics Data, CRISPR-Cas9 technology will be used to edit the bacterial chromosome. In particular, we will use CRISPR-Cas9 to edit (mutate) the LacZ gene, which is a gene that expresses an enzyme (β -galactosidase) that digests lactose.

- **Week 10:** A) introduction to *CRISPR-cas9*, B) designing RNA guide: Use of open source gene editing tools.
- **Week 11:** bacterial transformation (heat shock) using the CRISPR-Cas9 system; grow the bacteria overnight at room temperature
- **Week 12:** Lecture topic: Gene Expression: plate the transformed bacteria on agar plates with substrate for LacZ; grow cells at overnight
- **Week 13:** Data collection and analysis- Preparation for Lab Report
- **Week 14:** Virtual Reality Activity: CRISPR-VR repairing the mutation that cause sickle cell anemia using CRISPR-Cas9; Lab report submission