

BIOL 12: Cell Structure and Function, Fall 2023

Professor Natasha Grotz, Ph.D.

Laboratory Coordinator: Amanda Socha, Ph.D.

Teaching Science Fellow: Jiaming Ma, '22

Graduate Teaching Assistants: Asan Abdulkareem, Julianna Donohoe, Danielle Douglas, Emily-Claire Duffy, Elizabeth Jones, Francois LeSage, Rachel Pepin, Katherine Quinn

Learning Fellows: Section 01: Jennifer Do-Dai '25, Isabel Petron '26, Gaia Yun '25

Section 02: Tara Karim '24, Maxwell Teszler '23, Devin Tulio '25

CLASS SCHEDULE

In-class meetings for Section 01 are Tuesdays and Thursdays from 10:10AM-12:00PM; in-class meetings for Section 02 are Tuesdays and Thursdays from 2:25-4:15PM. I do not intend to hold class meetings during x-hours. Please see the detailed class schedule on the following page.

Professor Grotz Office Hours: Wednesdays 9:30-10:30AM (231 LSC) and 1-2PM (231 LSC)
Thursdays 4:30-5:30PM (via Zoom)

COURSE GOALS & LEARNING OBJECTIVES

- 1. Become conversant in Cell Biology.** This will involve learning vocabulary relating to this field of study and using this vocabulary correctly. Developing a complete vocabulary is necessary to discuss cellular processes accurately. Moreover, having information readily available in one's mind is required to make mental connections that lead to new insights and facilitate problem solving.
- 2. Understand the experimental methods used to study cells.** We will discuss a broad range of techniques including different types of microscopy, biochemical and molecular analyses, and genetic approaches, all of which are routinely used by scientists to dissect how cells function. You will need to develop a thorough understanding of the underlying theory as well as the technical application of these techniques. A solid background in this area will allow you to apply this information to a diverse set of circumstances, including interpretation of experimental data and the ability to propose new experiments to answer specific questions.
- 3. Gain a working knowledge of cellular organization and function.** Our work in this course will allow you to gain a mastery of membrane structure and function and how cellular compartments are formed, how cells generate and utilize energy, how proteins are trafficked to the correct location and/or organelle within the cells, how cells respond to their environment, how signaling pathways within the cell elicit specific cellular responses, how cytoskeletal components are assembled and how they regulate cell shape and motility, how the cell duplicates and divides, how cells are organized into tissues, and how disruption of many of the above cellular processes can lead to cancer.
- 4. Develop the analytical skills of a Cell Biologist.** In this course, I will be asking you to think like scientists, whether it be critical analysis of data or the execution and/or interpretation of a scientific experiment. Further, you will gain experience approaching cell biology as a problem-solving endeavor in which you interpret microscopic images and/or utilize your knowledge of the mechanistic details of cellular processes. Class meetings, understanding checks, and exam questions will give you the opportunity to take what you have learned about a normal cellular process and predict a logical outcome when specific parameters are altered (i.e. by experimental manipulation, genetic mutation, drug treatment, etc.).
- 5. Discover the inner beauty of the cell.** Cells are incredibly complex and innately beautiful. Throughout the term you will frequently be viewing amazing images (and movies!) generated by diverse microscopy techniques. Even without a molecular understanding of how cells work, one can appreciate their beauty. Learning about their structure and function adds an extra dimension to this beauty.

CLASS SCHEDULE

Attendance Count	Date	Topic	Textbook*
Module 1			
How do we view cells?			
	9/12 T	Course Logistics & Intro to Cell Architecture	Ch. 1
1	9/14 Th	Microscopy	Ch. 18
		→ <i>Understanding Check 1 (Canvas)**</i>	
How do we analyze cells?			
2	9/19 T	Protein Structure & Function / Experimental Approaches	Ch. 2, 18
How are cell compartments built?			
3	9/21 Th	Thermodynamics & Enzymes	Ch. 3
		→ <i>Understanding Check 2 (Canvas)**</i>	
4	9/26 T	Membrane Structure & Composition	Ch. 4
5	9/28 Th	Transport Across Membranes	Ch. 4
		→ <i>Understanding Check 3 (Canvas)**</i>	
	10/1 Su	Pre-Exam Q & A	
	10/3 T	Exam 1 (Microscopy through Transport Across Membranes)	
Module 2			
How do cells generate and utilize energy?			
6	10/5 Th	Bioenergetics	Ch. 3, 5, 6
How do proteins know where to go in the cell?			
7	10/10 T	Protein Sorting: Nuclear	Ch. 12.3
8	10/12 Th	Protein Sorting: Secretory Pathway	Ch. 8
		→ <i>Understanding Check 4 (Canvas)**</i>	
9	10/17 T	Protein Sorting: Secretory Pathway	Ch. 8
How do cells receive, integrate and process information?			
10	10/19 Th	Cell Signaling	Ch. 15
		→ <i>Understanding Check 5 (Canvas)**</i>	
	10/22 Su	Pre-Exam Q & A	
	10/24	Exam 2 (Focus on Energy through Cell Signaling)	
Module 3			
How do cells regulate cell shape and motility?			
11	10/26 Th	Cytoskeleton-Intro & Actin	Ch. 9
12	10/31 T	Cytoskeleton-Microtubules	Ch. 9
13	11/2 Th	Cytoskeleton-Intermediate Filaments and Connections between Cells	Ch. 7, 9
		→ <i>Understanding Check 6 (Canvas)**</i>	
How do cells duplicate?			
14	11/7 T	Cytoskeleton during Mitosis	Ch. 14
15	11/9 Th	Cell Cycle	Ch. 14
		→ <i>Understanding Check 7 (Canvas)**</i>	
What happens when cell biology “fails”?			
16	11/14 T	Cancer	Ch. 16
	11/16 Th	Pre-Exam Q & A	
	TBA	Exam 3 (Focus on Cytoskeleton through Cancer)	

*No textbook is required. Relevant chapters in the 9th edition of Karp’s Cell and Molecular Biology are provided for reference. Two copies of this textbook are on reserve at Baker-Berry Library.

**Understanding Checks are one hour in duration and will be available from 10PM on Thursday to 1PM on Sunday.

HEALTH & SAFETY

Attendance

You are expected to attend class in person; however, there may be times when you need to miss class due to emergent circumstances like illness or other medical reasons. If you are unable to attend class, please reach out to me as soon as possible.

Attendance at your assigned laboratory section is **mandatory**. If you are unable to attend your assigned laboratory section due to emergent circumstances such as those described above, please contact Dr. Amanda Socha immediately to discuss alternative arrangements.

If needed, I will work with you and your dean to chart the best path forward. While alternative arrangements may be made, this path may also include a recommended incomplete, course withdrawal, or withdrawal from the term.

Note that this course will utilize a “flipped” format in which you will listen to and engage with recorded lecture material before our class meetings. Small group-learning activities as well as “question and answer” opportunities will comprise the majority of class. There is no way to completely replicate the learning experience of in-person group work if you must miss class due to any of the above circumstances. However, barring unexpected circumstances, class recordings will be available on Canvas. In addition, the in-class exercises (in Google Slides) will be available to you, and the keys will be posted on Canvas after class. We will be utilizing fixed groups throughout the term. I highly encourage groups to work creatively to include group members who cannot attend class due to emergent circumstances such as those mentioned above.

COVID-19

For information regarding COVID-19 guidance and resources, please see <https://covid.dartmouth.edu/home>.

ACCOMODATIONS

Students requesting disability-related accommodations and services for this course are required to register with Student Accessibility Services (SAS; [Apply for Services webpage](#); student.accessibility.services@dartmouth.edu; 1-603-646-9900) and to request that an accommodation email be sent to me in advance of the need for an accommodation. Then, students should schedule a follow-up meeting with me to determine relevant details such as what role SAS or its [Testing Center](#) may play in accommodation implementation. This process works best for everyone when completed as early in the quarter as possible. If students have questions about whether they are eligible for accommodations or have concerns about the implementation of their accommodations, they should contact the SAS office. All inquiries and discussions will remain confidential.

Note: The first Understanding Check is a timed (one hour) assessment scheduled at the end of the first week of class and will be available from 10PM on Thursday, 9/14/23, until 1PM on Sunday, 9/17/23.

TEXTBOOK (not required)

On the schedule, I have provided information about relevant chapters in the 9th edition of **Karp’s Cell and Molecular Biology** by Karp, Iwasa and Marshall. However, I am not requiring that you purchase and/or read the textbook. Exams will cover material that is presented in lecture recordings and materials, class meetings, and in the classroom exercises. The textbook can be used as a reference to help clarify your understanding of this material. Some students find this very helpful, while other students don’t find the textbook useful at all. In deciding whether to purchase the textbook, consider what study strategies are most productive for you. A used copy of the 8th edition of Karp would be a useful, cost-effective alternative to the most recent edition. Two copies of the 9th edition have been placed on reserve at Baker-Berry Library.

EXPECTATIONS

Here's what I expect from you:

- 1) To listen to and engage with lecture materials BEFORE class meetings
- 2) To attend class mentally prepared to think about Cell Biology
- 3) To be willing to ask questions and participate in class discussions and exercises
- 4) To utilize active learning techniques to master course material
- 5) To arrive to laboratory sessions on time and prepared
- 6) To complete assignments on time

Here's what you can expect from me:

- 1) To bring expertise and enthusiasm to the class
- 2) To be willing to answer questions and facilitate discussion
- 3) To challenge you to stretch beyond your comfort zone
- 4) To encourage you to try new approaches for studying and learning that are “active”
- 5) To provide opportunities for you to practice problem solving
- 6) To foster an inclusive learning environment

FACILITATING YOUR LEARNING PROCESS

Preparing handwritten study guides that include drawings is an “active” strategy by which your brain can process and retain information. If you would like to learn more about the most effective strategies for studying and learning (and the research underlying these recommendations), we highly recommend the book “**Make It Stick: The Science of Successful Learning**” by Brown, Roediger III, and McDaniel. Jiaming Ma, the Teaching Science Fellow, has read this book and is happy to talk about its contents and how to use these strategies in BIOL 12.

Several lines of evidence indicate that “reflection” and “retrieval practice” facilitate learning MUCH better than re-reading your notes. The Reflection assignments provide a vehicle for you to think and write about information presented in the lecture recordings and to identify questions. The Understanding Checks allow you to “practice retrieval and application” of the course material and identify gaps in your understanding. Getting an answer wrong is actually one of the best ways to learn and remember information for the future.

METHODS OF ASSESSMENT AND GRADES

22%	Exam 1
24%	Exam 2
24%	Exam 3
23%	Lab Grade
2%	Understanding Checks
2%	Reflections on lecture materials
3%	Attendance/Participation

Exams will evaluate your understanding of the materials presented in the lecture recordings and in-class exercises and will test your ability to apply this knowledge to solve problems. Exams will be taken in person (see schedule). You may bring one handwritten 8.5 x 11 inch page (two-sided) with notes and drawings to the exam.

Lab will utilize a combination of assessment methods (i.e. pre-lab quizzes, in-lab team assignments, and independent lab summary assignments) to evaluate your understanding of laboratory methods, experiments, and data analysis. Please refer to the BIOL 12 laboratory syllabus for more information.

Understanding Checks (administered as Canvas Quizzes) are timed assignments to help you evaluate your understanding of the course material, and 2% of your final grade will be determined based on the number of Understanding Checks that you complete (see below). They will be administered most weeks throughout the term, and you will have one hour to complete each Understanding Check between Thursday at 10PM and Sunday at 1pm. These assignments are designed to be difficult so that you can identify gaps in your ability to: **1) accurately** discuss experiments and cellular processes, **2) apply** the material covered in lectures and class activities to answer questions, and **3) solve** problems. During the window of availability for the Understanding Check, you will be able to take the Understanding Check multiple times if you would like. The correct answers will be viewable after the availability window closes on Sunday at 1PM. You will **ONLY** receive credit and be able to view the correct answers for the Understanding Check **IF** you have submitted it before the deadline. Access to these questions and answers will be a valuable resource when studying for exams.

Note that some questions on Exams and Understanding Checks will require you to use reasoning to reach a conclusion that was not explicitly stated in the lecture material or class.

Understanding Checks will be open resource. You may refer to your notes as well as the posted lecture recordings and PowerPoints. However, to productively use this tool to assess your individual learning, I encourage you to complete Understanding Checks independently (without collaboration, discussion, or exchange of information with others). Although these assignments are open resource, the one-hour time limit means that you will not have sufficient time to look through your notes for every question; therefore, I strongly encourage you to prepare **study guides** that you can quickly reference during the Understanding Checks.

The questions on the Understanding Checks will focus primarily on the material covered during that week with the following two exceptions: the first Understanding Check of Modules 2 and 3 will focus on material for the week of the exam and the week after. This schedule means you will not have an Understanding Check scheduled on the same week you have an exam. Please see the schedule for more detailed information.

A note about Canvas automatic grading for Understanding Checks: The value of administering Understanding Checks via Canvas is the speed with which you will receive feedback. The Understanding Checks will heavily utilize “multiple answer” questions in which you will be asked to choose **ALL THE CORRECT ANSWERS**. This type of question provides a vehicle to assess your understanding of many concepts and terms in a single question and therefore provides a more comprehensive view of your knowledge and ability to apply it to problems. Students are often confused and/or frustrated by the grading rubric that Canvas uses for this type of question, so I want to explain a few things here: **1)** To calculate scores for Multiple Answers questions, Canvas divides the total points possible by the number of correct answers for that question. This amount is awarded for every correct answer selected and deducted for every incorrect answer selected. **2)** For example, for a 1-point question that has 5 possible answers, 3 of which are correct, you would receive 0.33pts for each correct choice and a deduction of 0.33pts for each incorrect choice. **3)** No points are awarded or deducted for correct or incorrect answers that are not selected. **4)** You may receive 0 credit for question, even if some of the answers you selected were correct. **5)** The lowest score you can receive for a question is zero; you will never receive a negative score for a question.

Note: Although you will receive a numerical score on the Understanding Checks that you complete, your performance will not count towards your final grade; rather, the contribution to your final grade will be based solely on the number of Understanding Checks that you take.

# of Understanding Checks taken	% of final grade awarded
7	Full credit (2%)
6	1.5%
5	1%
4	0.5%
3 or less	0%

Class meetings: Students are expected to listen to pre-recorded lectures and engage with lecture materials **BEFORE** the meeting on each topic. Lecture recordings, the associated slides, and vocabulary lists will be available on Canvas.

Reflections (administered as Canvas Surveys) will be due the day before the class meeting on each topic (by 7:45PM for section 1/10A section and by 11:59PM for section 2/2A section). In each survey, you will be asked to summarize important concepts in the assigned lecture material and will have the opportunity to ask questions or identify points of confusion. I will use class meeting time to answer common questions and points of confusion from the submitted reflections. There will be a total of 16 Reflection Surveys, and 2% of your final grade will be calculated using the tiered system shown here.

# of Reflections Submitted	% of final grade awarded
15-16	Full credit (2%)
13-14	1.5%
11-12	1%
10	0.5%
9 or less	0%

Attendance & Participation at all class meetings is expected. Class meetings will be used primarily for small group-learning activities and clarification of lecture material. 3% of your final a grade will depend on **class attendance/participation** which will be determined using the tiered system shown here. Note

# Classes Attended	% of final grade awarded
14-16	Full credit (3%)
12-13	2%
11	1%
10 or less	0%

that the 16 dates that count toward participation are noted on the class schedule. **To receive credit for attendance on any given day, you must attend the entire class period** unless otherwise specified. I recognize that you may need to miss class due to emergent circumstances like illness or other medical reasons. Hence, I am using a tiered system for participation that allows for students to miss up to two classes and still receive full credit for participation. **I expect you to use this flexibility wisely and only as needed based on the circumstances described above.**

GRADING POLICIES

You will be able to view your graded exams on Gradescope. Please review these carefully and be sure you understand the errors that you made. As we move through the term, we will be building upon material and techniques that we have discussed previously, so it is important that you address gaps in your understanding.

All exams are graded carefully and consistently. However, we have an error correction policy in place so that we may rectify any inadvertent mistakes that may occur during the grading process. After reviewing your graded Exam 1 or Exam 2, you may submit an error correction request if and only if you find an arithmetic error or detect an omission or error by the grader. You may submit an error correction request within one week of receiving your graded Exam 1 or Exam 2. Requests made after the one-week deadline will not be considered.

To submit an error correction request, email a statement to Dr. Socha (amanda.l.socha@dartmouth.edu) indicating the number of the question to be re-evaluated (including question letter(s) if appropriate) and the reason for re-evaluation.

A final word about grades and exams: You are not competing against each other for grades in BIOL 12. I want to be very clear and reiterate this point: You are not competing for grades in this class with anyone but yourself. All grades, up until the final letter grades are decided, are recorded as numerical scores. I do NOT assign letter grades to individual exams. Here are two important points about grades in BIOL 12:

- i. **A final score of 90% or above will always be at least an A minus.** No one is ever penalized for learning what we teach them. Thus, it is entirely possible for everyone in the class to receive a grade of A minus or better. However, my experience suggests that this will not happen.
- ii. **If you achieve a numerical score of 50% or above, you will pass the course.**

ACADEMIC HONOR

The Dartmouth College Student Handbook states, "Fundamental to the principle of independent learning are the requirements of honesty and integrity in the performance of academic assignments, both in and out of the classroom. Dartmouth operates on the principle of academic honor, without proctoring of examinations. Any student who submits work which is not his or her own, or commits other acts of academic dishonesty, violates the purposes of the college and is subject to disciplinary actions, up to and including suspension or separation."

<https://policies.dartmouth.edu/policy/academic-honor-principle-1>

There are a number of situations in which a student in BIOL 12 might find themselves tempted to violate the Academic Honor Principle. These situations include (but are not limited to) the following:

- a) Exams must be completed independently (no collaboration, discussion, or exchange of information with others). The answers that you provide must be entirely your own work. You may not use any electronic device to access or exchange information during the exam, but you may bring one handwritten 8.5 x 11 inch page (two-sided) to the exam and refer to it while you complete the exam.
- b) Science is a collaborative field, and we encourage collaboration for many aspects of the course while still requiring demonstration that each individual has an understanding of key concepts. During lab meetings, you will work with one or more lab partners and prepare collaborative in-lab team assignments. However, lab summary assignments are to be prepared **independently**. Any lab summary assignment submitted for grading must represent the **original work** (words, graphs, tables etc.) of the student submitting the assignment. Do not share computer files of work (including text, graphs, tables, etc.) to be submitted for grading! Failure to write the lab summary assignments independently will be considered a violation of the Dartmouth Honor Principle.
- c) Although using an AI-content generator such as ChatGPT can be a useful way to learn more about specific aspects of cell biology, the use of an AI-content generator to complete assignments in this course is prohibited. In other words, you may not ask these systems to directly provide answers to assignments you are submitting. This pertains to Understanding Checks, Exams, Reflections, and all lab assignments.
- d) All outside resources are to be cited. For more information on citing sources, please see: <https://writing.dartmouth.edu/support/sources-and-citations>.

If you have questions about how the Honor Principle applies to other aspects of this course, please do not hesitate to contact me.

Honesty is the foundation of the academic pursuit of knowledge. In recognition of this, the faculty will not overlook any violations of the Academic Honor Principle. Indeed, faculty are obligated to report potential violations of the Academic Honor Principle to the Office of Community Standards & Accountability.

ADDITIONAL COURSE INFORMATION

Religious Observances

Dartmouth has a deep commitment to support students' religious observances and diverse faith practices. Some students may wish to take part in religious observances that occur during this academic term. If you have a religious observance that conflicts with your participation in the course, please meet with me as soon as possible—before the end of the second week of the term at the latest—to discuss appropriate course adjustments.

Socioeconomic Differences and Financial Difficulty

Our community is composed of students from a variety of financial backgrounds. Socioeconomic diversity can be invisible, and you may be experiencing financial difficulties related to the cost of textbooks, materials, or other necessities for our class of which I am not aware.

If you encounter financial challenges related to this class, there may be sources of support for you. If you feel comfortable sharing your experience with me, you may. You may also consider meeting with a financial aid officer to discuss options, reaching out to the First-Generation Office if you are a first-generation student, browsing the [Funding Resources](#) page, or, for unexpected expenses, applying to the Barrier Removal Fund through the Financial Aid tile in [DartHub](#).

Mental Health and Wellness

The academic environment is challenging, our terms are intensive, and classes are not the only demanding part of your life. There are a number of resources available to you on campus to support your wellness, including: the [Counseling Center](#) which allows you to book triage appointments online, the [Student Wellness Center](#) which offers wellness check-ins, and your [undergraduate dean](#). The student-led [Dartmouth Student Mental Health Union](#) and their peer support program may be helpful if you would like to speak to a trained fellow student support listener. If you need immediate assistance, please contact the counselor on-call at (603) 646-9442 at any time. Please make me aware of anything that will hinder your success in this course.

Title IX

At Dartmouth, we value integrity, responsibility, and respect for the rights and interests of others, all central to our Principles of Community. We are dedicated to establishing and maintaining a safe and inclusive campus where all community members have equal access to Dartmouth's educational and employment opportunities. We strive to promote an environment of sexual respect, safety, and well-being. Through the Sexual and Gender-Based Misconduct Policy (SMP), Dartmouth demonstrates that sex and gender-based discrimination, sex and gender-based harassment, sexual assault, dating violence, domestic violence, stalking, etc., are not tolerated in our community.

For more information regarding Title IX and to access helpful resources, visit Title IX's website (sexual-respect.dartmouth.edu). As a faculty member, I am required to share disclosures of sexual or gender-based misconduct with the Title IX office.

If you have any questions or want to explore support and assistance, please contact the Title IX office at 603-646-0922 or TitleIX@dartmouth.edu. Speaking to Title IX does not automatically initiate a college resolution. Instead, much of their work is around providing supportive measures to ensure you can continue to engage in Dartmouth's programs and activities.

Consent to Record

(1) Consent to recording of course meetings and office hours that are open to multiple students.

By enrolling in this course,

- a) I affirm my understanding that the instructor may record meetings of this course and any associated meetings open to multiple students and the instructor, including but not limited to scheduled and ad hoc office hours and other consultations, within any digital platform, including those used to offer remote instruction for this course.
- b) I further affirm that the instructor owns the copyright to their instructional materials, of which these recordings constitute a part, and my distribution of any of these recordings in whole or in part to any person or entity other than other members of the class without prior written consent of the instructor may be subject to discipline by Dartmouth up to and including separation from Dartmouth.

(2) Requirement of consent to one-on-one recordings

By enrolling in this course, I hereby affirm that I will not make a recording in any medium of any one-on-one meeting with the instructor or another member of the class or group of members of the class without obtaining the prior written consent of all those participating, and I understand that if I violate this prohibition, I will be subject to discipline by Dartmouth up to and including separation from Dartmouth, as well as any other civil or criminal penalties under applicable law. I understand that an exception to this consent applies to accommodations approved by SAS for a student's disability, and that one or more students in a class may record class lectures, discussions, lab sessions, and review sessions and take pictures of essential information, and/or be provided class notes for personal study use only.

If you have questions, please contact the Office of the Dean of the Faculty of Arts and Sciences.