BIOL 12: Cell Structure and Function, Fall 2022
10 class period

Professor Sharon E. Bickel, Ph.D.
Laboratory Coordinator: **Jessica DeSimone Warren**, Ph.D.
Teaching Science Fellow: **Tanner Riley**, '22
Graduate Teaching Assistants: **David Boone, Chinaza Nnam, Alicia Santos, Evelyn Turnbaugh, Alexandrea Turnquist**
Learning Fellows: **Namitha Alluri** '25, **Sara Lydon** '23, **Noa Phillips** '23

CLASS SCHEDULE

In-class meetings from 10:10-11:15 AM on Mon, Wed & Fri and Thurs X hour, 12:15-1:05 PM
NOTE: We will be utilizing almost all X-hours.
Please see the detailed class schedule on the following page.

Professor Bickel Office Hours: **Thursdays, 1:45-2:45pm via Zoom** (link available on Canvas)

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

Date	Topic	Textbook*
	Module 1	
	How do we view cells?	
9/12 M	Course Logistics & Intro to Cell Architecture	Ch. 1
9/14 W & 9/16 F	Microscopy	Ch. 18
	→ *Understanding Check 1 (Canvas)***	
	How do we analyze cells?	
9/19 M & 9/21 W	Protein Structure & Function / Experimental Approaches	Ch. 2, 18
	How are cell compartments built?	
9/22 Th & 9/23 F	Thermodynamics & Enzymes	Ch. 3
	→ *Understanding Check 2 (Canvas)***	
9/26 M & 9/28 W	Membrane Structure & Composition	Ch. 4
9/29 Th & 9/30 F	Transport Across Membranes	Ch. 4
	→ *Understanding Check 3 (Canvas)***	
10/3 M	**Pre-Exam Q & A**	
10/3 7-9pm	***Exam 1 (Microscopy through Transport Across Membranes)***	
	Module 2	
	How do cells generate and utilize energy?	
10/6 Th & 10/7 F	Bioenergetics	Ch. 3, 5, 6
	How do proteins know where to go in the cell?	
10/10 M & 10/12 W	Protein Sorting: Nuclear	Ch. 12.3
10/13 Th & 10/14 F	Protein Sorting: Secretory Pathway	Ch. 8
	→ *Understanding Check 4 (Canvas)***	
10/17 M & 10/19 W	Protein Sorting: Secretory Pathway	Ch. 8
	How do cells receive, integrate and process information?	
10/20 Th & 10/21 F	Cell Signaling	Ch. 15
	→ *Understanding Check 5 (Canvas)***	
10/24 M	**Pre-Exam Q & A**	
10/24 7-9pm	***Exam 2 (****Focus on* ***Energy through Cell Signaling)***	
	Module 3	
	How do cells regulate cell shape and motility?	
10/27 Th & 10/28 F	Cytoskeleton-Intro & Actin	Ch. 9
10/31 M & 11/2 W	Cytoskeleton-Microtubules	Ch. 9
11/3 Th & 11/4 F	Cytoskeleton-Intermediate Filaments and Connections between Cells	Ch. 7, 9
	→ *Understanding Check 6 (Canvas)***	
	How do cells duplicate?	
11/7 M & 11/9 W	Cytoskeleton during Mitosis	Ch. 14
11/10 Th & 11/11 F	Cell Cycle	Ch. 14
	→ *Understanding Check 7 (Canvas)***	
	What happens when cell biology "fails"?	
11/14 M	Cancer	Ch. 16
TBA	**Pre-Exam Q & A**	
11/22 Tu ***8:00am-11:00am***	***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 noon on Friday to noon on Sunday.

HEALTH & SAFETY

Attendance

You are expected to attend class and your assigned laboratory section in person. However, for the health and safety of our class community, please: **do not attend class or lab when you are sick**, nor when you have been instructed by Student Health Services to stay home.

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 one of the circumstances mentioned above.

Attendance at your assigned laboratory section is **mandatory**. ***If you are unable to attend your assigned laboratory section due to illness, please contact Dr. Jessica Warren immediately to discuss alternative arrangements.***

Safety

Students are expected to adhere to Dartmouth College policies regarding COVID-19 (https://covid.dartmouth.edu/home). Should the College guidelines change, I will communicate resulting implications for our class community via Canvas announcement.

ACCOMODATIONS

Students requesting disability-related accommodations and services for this course are required to register with Student Accessibility Services (SAS; Getting Started with SAS 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 noon on Friday, 9/16/22 until noon on Sunday, 9/18/22.*

TEXTBOOK (not required)

On the schedule, I am providing information about relevant chapters in the 9th edition of **Cell and Molecular Biology: Concepts and Experiments** by Gerald Karp, Janet Iwasa and Wallace 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. Tanner Riley, 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.

I will be posting a list of important **vocabulary terms** for each topic we cover. I encourage you to use the lecture materials to make sure you understand these terms/phrases and can use them appropriately. Successfully answering Exam and Understanding Check questions requires that you have broad mastery of vocabulary terms.

METHODS OF ASSESSMENT AND GRADES

22% Exam 1
23% Exam 2
24% Exam 3
23% Lab Grade
3% 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 low-stakes, timed assignments to help you evaluate your understanding of the course material prior to exams. 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.

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 administered most weeks throughout the term. You will have one hour to complete each Understanding Check within the 48-hour window during which it is available (Friday noon-Sunday noon).

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, we 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. 1% of your final grade will be based on the number of Understanding Checks that you complete before the Sunday deadline each week. 2% of your final grade will be based on the cumulative scores of Understanding Checks that you complete. You will ONLY 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.

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.

Class meetings: We will spend two class meetings discussing each topic listed on the Class Schedule. Students are expected to listen to pre-recorded lectures and engage with lecture materials BEFORE the first class meeting on each topic. Lecture recordings, the associated slides, and vocabulary lists will be available at least one week before the first class meeting for each topic.

Reflections (administered as Canvas Surveys) will be due at **8 AM** the day of the first class meeting on each topic. In each survey, you will be asked to summarize important concepts in the assigned lecture material. Reflections are also an 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
14-16	Full credit (2%)
12-13	1.5%
10-11	1%
9	0.5%
8 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 the first day of class (9/12) and the Pre-Exam Q & A classes (10/3 and 10/24) will NOT count toward participation. There are a total of 31 class meetings that will count towards participation. **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 illness, medical reasons, or the need to isolate due to COVID-19. Hence, I am using a tiered system for participation that allows for students to miss up to six 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.**

# Classes Attended	% of final grade awarded
25-31	Full credit (3%)
22-24	2%
16-21	1%
15 or less	0%

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 imperative 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 by the grader.

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

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.

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 three 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.**
iii. **The median grade of BIOL 12 will mostly likely be a B.** That means if the median numerical score for the course is 62%, then a grade of 62% is a B.

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 the classroom and outside. 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 who 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://students.dartmouth.edu/community-standards/policy/academic-honor-principle

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.

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

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, or before the end of the second week of the term—at the latest, to discuss appropriate adjustments. Dartmouth has a deep commitment to support students' religious observances and diverse faith practices.

Financial Difficulty

If you encounter financial challenges related to this class, please let me know.

Campus Resources

We recognize that the academic environment at Dartmouth is challenging, that our terms are intensive, and that classes are not the only demanding aspect of your life. Many of you may be facing challenges given public health concerns and a host of other factors (known and unknown). There are a number of resources available to you to support your needs. Many offices are prepared to meet with you via Zoom or phone. For concerns about health and wellness, contact Dartmouth Health Service (603-646-9400 or Secure Message in DartHub), Counseling Services (603-646-9442), and the Student Wellness Center. For academic needs, contact your undergraduate dean (603-646-2243), Student Accessibility Services (603-646-9900), and the Academic Skills Center (603-646-2014). Students with concerns related to campus employment should contact the Student Employment Office (603-646-3641). Those with visa-related concerns should contact the Office of Visa and Immigration Services (603-646-3474). I

encourage you to use these resources to take care of yourself throughout the term, and to speak with me if you experience difficulties.

Sexual Misconduct and 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 have equal access to the educational and employment opportunities Dartmouth offers. We strive to promote an environment of sexual respect, safety, and well-being. In its policies and standards, Dartmouth demonstrates unequivocally that sexual assault, gender-based harassment, domestic violence, dating violence, and stalking are not tolerated in our community.

The Sexual Respect Website (https://sexual-respect.dartmouth.edu) at Dartmouth provides a wealth of information on your rights with regard to sexual respect and resources that are available to all in our community.

Please note that faculty members are obligated to share disclosures regarding conduct under Title IX with Dartmouth's Title IX Coordinator. Confidential resources are also available, and include licensed medical or counseling professionals (e.g., a licensed psychologist), staff members of organizations recognized as rape crisis centers under state law (such as WISE), and ordained clergy (see https://dartgo.org/titleix_resources).

Should you have any questions, please feel free to contact Dartmouth's Title IX Coordinator or the Deputy Title IX Coordinator for the Guarini School. Their contact information can be found on the sexual respect website at: https://sexual-respect.dartmouth.edu.

Regarding Technology

At this time, my expectation is that all class meetings and lab section meetings will be held in person. However, if pandemic conditions worsen to the degree that in-person teaching/learning is not possible, we will transition to Zoom class meetings (dartmouth.zoom.us). If this occurs and you are experiencing technology barriers that are affecting your ability to participate and complete the coursework, please contact me as soon as possible.

NOTIFICATION to Students Regarding 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.