Bio12: Cell Structure and Function
Spring 2021

M, W, F 8:55-10:00 AM, X-hour: Th 9:10-10:00 AM

Professor Magdalena Bezanilla, Ph.D.
Laboratory Directors: **Jessica DeSimone Warren**, Ph.D.
Graduate Teaching Assistants: **Brae Bigge, Bassam Hafi, Kasey Hernandez, Asmaa Mohamed, Alex Rapp, David Ritz**
Teaching Fellow: **Miranda Greig, '19**

COURSE GOALS & LEARNING OBJECTIVES

1. **Become conversant in Cell Biology.** This involves learning vocabulary related to cell biology and using this vocabulary correctly. Developing a complete vocabulary is critical for discussing cellular processes accurately. Moreover, being fluent with this vocabulary is important for quickly making 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 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.** Cell biology is a science and I will be asking you to think like scientists, such as applying critical analyses of data and/or interpreting scientific experiments. Furthermore, 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 discussion 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, mutation, drugs).

5. **Discover the inner beauty of the cell.** Cells are incredibly complex but also 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

How do we view cells and analyze cells?

1.	M	3/29	Course Logistics & Microscopy	Chapter 1,18
2.	W	3/31	Microscopy	Chapter 18
3.	T	4/1	Protein Structure & Function	
	F	4/2	***Problem Solving***	Chapter 2
4.	M	4/5	Experimental Approaches I	Chapter 2
5.	W	4/7	Experimental Approaches II	
	T	*4/8*	*Office hour*	*Chapter 18*
	F	4/9	***Problem Solving***	
	M-T	**4/12-13**	**TEST 1, Lectures #1-5, and all pre-lecture material**	

How do cells generate and utilize energy?

6.	M	4/12	Enzymes	Chapter 3
7.	W	4/14	Membrane Structure and Composition	Chapter 4
8.	T	4/15	Transport Across Membranes I	Chapter 4
	F	4/16	***Problem Solving***	
9.	M	4/19	Transport Across Membranes II	Chapter 4
10.	W	4/21	Glycolysis & Aerobic Respiration	Chapters 3, 5, 6
	T	*4/22*	*Office hour*	
	F	4/23	***Problem Solving***	
	M-T	**4/26-27**	**TEST 2, Emphasis on Lectures #6-10, and all pre-lecture material**	

How are proteins sorted and how do cells receive and integrate information?

11.	M	4/26	Protein Sorting I	Chapter 8
12.	W	4/28	Protein Sorting II	Chapter 8
13.	T	4/29	Protein Sorting III	Chapter 8
	F	4/30	***Problem Solving***	
14.	M	5/3	Cell Signaling	Chapter 15
15.	W	5/5	Cell Signaling	Chapter 15
	T	*5/6*	*Office hour*	
	F	5/7	***Problem Solving***	
	M-T	**5/10-11**	**TEST 3, Emphasis on Lectures #11-15, and all pre-lecture material**	

How do cells regulate cell shape, motility and division?

16.	M	5/10	Cytoskeleton – Actin I	Chapter 9
17.	W	5/12	Cytoskeleton – Actin II	Chapter 9
18.	T	5/13	Cytoskeleton – Actin III	Chapter 9
	F	5/14	***Problem Solving***	
19.	M	5/17	Cytoskeleton – Microtubules	Chapter 9
20.	W	5/19	Cytoskeleton – Microtubules & Cell division	Chapter 9, 14
	F	*5/20*	*Office Hour*	
	F	5/21	***Problem Solving***	
	M-T	**5/24-25**	**TEST 4, Emphasis on Lectures #16-20, and all pre-lecture material**	

How do cells regulate duplication, form tissues and what happens when this "fails"?

21.	M	5/24	The Cell Cycle	Chapter 14
22.	W	5/26	The Cell Cycle	Chapter 14
	T	*5/27*	*Office hour*	
23.	F	5/28	Cancer	Chapter 16
	M	5/31	NO CLASS MEMORIAL DAY	
	W	6/2	***Problem Solving***	

During Finals Slot - TEST5 Emphasis on Lectures #21-23, and all pre-lecture material

TEACHING APPROACH

Using Zoom, we will meet ***synchronously*** during the course timeslot (BL). As best as I can, I intend to create a classroom setting. Lectures will be interactive with plenty of time for questions. Some class days will be dedicated to problem solving. For these days, we will use the virtual gathering space Gather.town. All synchronous Zoom sessions will be recorded and posted on Canvas so that you can review them as needed when you study for tests. Be sure to read the "Consent to Record" document (end of this syllabus, also available on Canvas), since you are agreeing to this by enrolling in the class. On Canvas, you will find important information detailing technological resources (VPN, Canvas, zoom) we will use (and how to get them installed and running on your devices). You will also find information regarding what good participation looks like in a remote learning context. Please review this information as soon as you can and follow the steps for technological onboarding before our first class meeting, if possible.

OFFICE HOURS

Office hours will be held every week on Monday 3-4PM and during every other X-hour.

Office hours will be remote via zoom:
https://dartmouth.zoom.us/j/98910666149?pwd=T2ZpZGRoVlR3RmtHZHduUVFWSkJsUT09

Meeting ID: 989 1066 6149
Passcode: 224356

Note that I am generally available to answer questions after lecture.

TEACHING SCIENCE FELLOW

Miranda Greig '19 was a biology major at Dartmouth. She holds weekly review sessions and you can schedule meetings with her for additional help with material. Check out the Miranda link on Canvas.

VOCABULARY TERMS

In order to help you develop the language necessary to accurately discuss experiments and cellular processes, I will be posting a list of important vocabulary terms with the lecture material. I encourage you to use the lecture slides and the textbook to ***write out*** definitions, make sure you understand these terms and can use them appropriately. Many students find flashcards a useful strategy. The online resource "Quizlet" https://quizlet.com/ will let you easily generate electronic flash cards.

EXPECTATIONS

Here's what I expect from you:

1) If possible, print out the powerpoint slides and take notes on the printout
2) To come to every class, mentally prepared to think about Cell Biology
3) To be willing to ask questions and participate in class discussions and problem solving exercises
4) To listen to pre-lecture recordings BEFORE class, when required
5) To utilize active learning techniques to master course material
6) To arrive to laboratory exercises on time, and prepared
7) To use your cell phone during class ONLY for course related activities

Here's what you can expect from me:

1) To bring expertise and enthusiasm to the virtual classroom
2) To be willing to answer questions and facilitate virtual classroom discussions
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

METHODS OF ASSESSMENT AND GRADES

Tests	75%
Lab grade	20% - see lab syllabus for details
Participation	5% - see below for details

Tests will be a mixture of mastery of the information and applying your knowledge to problem solving. Tests will be open note. You will have two hours to complete the test in a 22 hour window starting on the scheduled test date at 5 PM Eastern and finishing the next day at 3PM Eastern.

Barring documented illness, family emergency or academic conflict, **failure to take a test at the scheduled time will result in a grade of zero.** Documentation of illness requires that you contact Dick's House or a doctor near you to determine if you need treatment. You must alert me in advance of the exam if you are unable to take the exam at the scheduled time.

Participation Grade (5% of final grade):
Participation points **(3% of final grade)** will be tiered depending on your attendance so that you will not be penalized for a few absences due to illness or other situations that prevent you from attending class:

- 0-3 absences → 3 points (full credit)
- 4-7 absences → 2 points
- 8-11 absences → 1 point
- 12 or more absences → zero points

Part of your participation grade **(2% of final grade**) will be based on short quizzes that you will complete after viewing pre-lecture recordings. Short videos will be used to present material that is important for in class discussion and/or problems. In order to receive credit, you must complete the quiz by 11:59 PM the day before the specified class. I will use these quizzes 1) to help us assess your understanding of the material and 2) to ensure that you watch the assigned videos before class. While taking the quiz you may refer to any notes you took while watching the video.

Tests and grading policies:
The following points summarize the grading procedures with respect to exams:

[1] After the exam has been graded and returned, a copy of the answer key will be posted on the Bio12 Canvas site. Review this answer key carefully and be sure to understand the errors in your exam and why you made them.

[2] The number of points given for each answer is final. If, after reviewing your answers and comparing them to the posted answer key before the deadline (see below), you find an arithmetic error or detect an omission by the grader for one of the questions, you must observe the following procedures for error correction:

a) Prepare an electronic cover page (file format: Word or PDF) and name the file as "Error correction request-your name".

b) If you determine that your answer is consistent with the key, but you did not receive full credit, simply indicate the number of the question to be re-evaluated and state in one or two short, descriptive sentences (typed) what makes your answer correct. The citation of a text page, diagram, or reference to a lecture date/number may also be helpful.

Error correction requests:
Must be emailed to Dr. Jessica DeSimone Warren (Jessica.DeSimone.Warren@dartmouth.edu) within ***7 days*** after you receive the graded test.

I will not accept questions regarding errors in grading after these deadlines. The error correction process will take a few days. You will be notified through email after the re-evaluation is completed.

A final word about grades and exams:

You are not competing against each other for grades in Bio12. I want to be very clear about that 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 grades, from 0% to 100%. I do NOT assign letter grades to individual exams. Here are two important points about grades in Bio12:

[i] **A grade of 90% or above will always be at least an A minus** No one is ever penalized for learning what I teach them. Thus, it is entirely possible for everyone in the class to receive a grade of A minus or better.

[ii] **In order to receive a D, you have to achieve a final grade of at least 50%.** In other words, a final grade less than 50% is an E.

TEXTBOOK

On the schedule, I provided information about relevant chapters in the 8th edition of **Cell and Molecular Biology: Concepts and Experiments**, by Gerald Karp. However, you are *not required* to purchase and/or read the textbook. Tests will cover material that is presented in recorded lectures or covered in the classroom. The textbook can be used as a reference to help clarify your understanding of this material. In deciding whether or not to purchase the textbook, consider what study strategies are most productive for you. Also, if you intend to apply to med school, vet school or graduate school then you may find having the textbook will be useful as a familiar source of information when you begin to review what you have learned in preparation for the MCAT or GRE exams.

FACILITATING YOUR LEARNING PROCESS

Several lines of evidence indicate that certain activities promote learning and retention MUCH better than re-reading your notes. If you would like to learn more about the most effective strategies for studying and learning (and the research underlying these recommendations), I highly recommend the book "**Making it Stick: The Science of Successful Learning**" by Brown, Roediger III, and McDaniel.

CAMPUS RESOURCES (on site and remote)

I 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 greater challenges than usual given the sudden changes to our way of life, public health concerns, and a host of other factors (known and unknown).

There are a number of campus resources available to support your needs. While the situation is constantly evolving, many offices are prepared to meet with you via phone or Zoom. For concerns about health and wellness, you may reach out to the Dartmouth Health Service (603-646-9400 or Secure Message in DartHub), Counseling Services (603-646-9442), and the Student Wellness Center. For academic needs, you may 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 may connect with the Student Employment Office (603-646-3641). Those with visa-related concerns may reach out to the Office of Visa and Immigration Services (603-646-3474). I encourage you to take advantage of these resources, and to speak with me if you need support in the class.

NOTE TO STUDENTS WITH PHYSICAL OR LEARNING DISABILITIES

Students requesting disability-related accommodations and services for this course are encouraged to schedule a phone/video meeting with me as early in the term as possible. In order for

accommodations to be authorized, students are required to consult with Student Accessibility Services (SAS; student.accessibility.services@dartmouth.edu; SAS website; 603-646-9900) and to email me their SAS accommodation form. I will then work together with SAS if accommodations need to be modified based on the online learning environment. If students have questions about whether they are eligible for accommodations, they should contact the SAS office. All inquiries and discussions will remain confidential.

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 this course, please speak with me as soon as possible to discuss appropriate accommodations.

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, as faculty members, we 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://sexual-respect.dartmouth.edu/reporting-support/all-resources/confidential-resources). Should you have any questions, please feel free to contact Dartmouth's Title IX Coordinator (Kristi.Clemens@Dartmouth.edu) (and deputies if appropriate).

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. Students who submit work which is not their own or who commit other acts of academic dishonesty forfeit the opportunity to continue at Dartmouth."

There are a number of situations in which a student in Bio12 might find themselves tempted to violate the Academic Honor Principle. These situations include (but are not limited to) the following:

a) Examinations must be completed without outside reference to materials and must be completed without communication with anyone else, including the internet (the only permissible exception is that students may request clarification of any exam question from the course instructor who is present expressly for that purpose). The answers that you provide must be entirely your own work.

b) Our policy permits the re-submission of exams for potential error correction by the instructor. **Any alteration of the answers between the time when the graded papers were returned to the student and the time when the paper was submitted for re-grading constitutes a breach of the Academic Honor Principle. To deter this practice, we scan exams before grading them.**

c) 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. You will work with a partner during the laboratory sessions to perform all in-lab activities including microscopy, data collection, and hypothesis generation. We encourage you to collaborate with your partner and peers in the analysis of your data, including discussion of data presentation and

interpretations. **While the ideas and overall interpretations may result from collaboration, we require that the textual and graphical content of any lab report submitted for grading be prepared by you individually without the assistance of anyone else.** Do not copy directly from the lab manual, and do not share electronic data, textual or graphical files.

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, the Faculty Handbook of Dartmouth College states explicitly that **College faculty are obligated to report potential violations of the Academic Honor Principle to the Dartmouth College Committee on Standards**.

CONSENT TO RECORDING

(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.