

Bio19: Honors Cell Structure and Function

Fall 2021

M, W, F 8:50-9:55 AM, X-hour: Th 9:05-9:55 AM

Professor Magdalena Bezanilla, Ph.D.
Laboratory Directors: **Jessica DeSimone Warren, Ph.D.**
Graduate Teaching Assistants: **Casey Latario & Nora Welsh**
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

MODULE I

How do we view and analyze cells?

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|----|---|------|--|---------------|
| 1. | M | 9/13 | Course Logistics & Microscopy | Chapter 1, 18 |
| 2. | W | 9/15 | Microscopy | Chapter 18 |
| | F | 9/17 | <i>Problem-Solving</i> | |
| 3. | M | 9/20 | Protein Structure | Chapter 2 |
| 4. | W | 9/22 | Experimental Approaches I | Chapter 2 |
| 5. | F | 9/24 | Experimental Approaches II/ <i>Problem-Solving</i> | Chapter 18 |

How are cellular functions carried out and compartmentalized?

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|----|---|------|---|-----------|
| 6. | M | 9/27 | Enzymes | Chapter 3 |
| 7. | W | 9/29 | Membranes | Chapter 4 |
| 8. | F | 10/1 | Transport Across Membranes I | Chapter 4 |
| 9. | M | 10/4 | Transport Across Membranes II/ <i>Problem-Solving</i> | Chapter 4 |
| | W | 10/6 | <i>Review for exam 1</i> | |

Th 10/7 EXAM 1, 2:30-4:30 PM, Lectures #1-9 (including all Pre-lecture Material)

MODULE II

How do cells generate and utilize energy?

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|-----|---|-------|------------------------|---------------|
| 10. | F | 10/8 | Aerobic Respiration | Chapters 3, 5 |
| 11. | M | 10/11 | Photosynthesis | Chapter 6 |
| | W | 10/13 | <i>Problem-Solving</i> | |

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

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|-----|---|-------|---|------------|
| 12. | F | 10/15 | Protein Sorting I | Chapter 8 |
| 13. | M | 10/18 | Protein Sorting II | Chapter 8 |
| 14. | W | 10/20 | Protein Sorting III/ <i>Problem-Solving</i> | Chapter 8 |
| 15. | F | 10/22 | Cell Signaling I | Chapter 15 |
| 16. | M | 10/25 | Cell Signaling II/ <i>Problem-Solving</i> | Chapter 15 |
| | W | 10/27 | <i>Review for exam 2</i> | |

Th 10/28 EXAM 2, 2:30-4:30 PM, Lectures #10-16 (including all Pre-lecture Material)

MODULE III

How do cells regulate cell shape, motility, and division?

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|-----|----|-------|---|------------|
| 17. | F | 10/29 | Cytoskeleton – Actin I | Chapter 9 |
| 18. | M | 11/1 | Cytoskeleton – Actin II | Chapter 9 |
| 19. | W | 11/3 | Cytoskeleton – Actin III/ <i>Problem-Solving</i> | Chapter 9 |
| 20. | Th | 11/4 | Cytoskeleton – Microtubules I NOTE X-HOUR | Chapter 9 |
| 21. | F | 11/5 | Cytoskeleton – Microtubules II | Chapter 9 |
| 22. | M | 11/8 | The Cytoskeleton during Cell Division/Problem Solving | Chapter 14 |

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

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|-----|---|-------|---|------------|
| 23. | W | 11/10 | The Cell Cycle I | Chapter 14 |
| 24. | F | 11/12 | The Cell Cycle II/ <i>Problem-Solving</i> | Chapter 14 |
| 25. | M | 11/15 | Cancer | Chapter 16 |

Final Exam Review Session → TBA

EXAM 3, During Scheduled Final Exam Slot, Lectures #17-25 (including all Pre-lecture Material)

I have a no computer use policy for Bio19 this term. I will discuss the rationale for this policy in class. Please do not use laptops or other electronic devices in class. The only exception will be the use of cell phones for “communicating” your answers to in-class questions (see below).

TEACHING APPROACH

Classes will be a mix of lectures and problem-solving with plenty of time for questions and answers. All lectures will be recorded and posted on Canvas so that you can review them as needed when you study for exams.

EXPECTATIONS

Here's what I expect from you:

- 1) If possible, to 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 classroom
- 2) To be willing to answer questions and facilitate 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

COVID-19 INFORMATION

Attendance:

You are expected to attend class in-person unless you have made alternative arrangements due to illness, medical reasons, or the need to isolate due to COVID-19. 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. You will be able to view recordings of class in Canvas if you are unable to attend.

Safety:

In accordance with [current College policy](#), all members of the Dartmouth community are required to wear a suitable face covering when indoors, regardless of vaccination status. This includes our classroom, the labs, and office hours. If you need to take a quick drink during class, please dip your mask briefly for each sip. Eating is never permitted in the classroom. (The only exception to the mask requirement is for students with an approved disability-related accommodation; see below.) If you do not have an accommodation and refuse to comply with masking or other safety protocols, I am obligated to assure that the Covid health and safety standards are followed, and you will be asked to leave the classroom. You remain subject to course attendance policies, and dismissal from class will result in an unexcused absence. If you refuse to comply with masking or other safety protocols, and to ensure the health and safety of our community, I am obligated to report you to the Dean's office for disciplinary action under Dartmouth's [Standards of Conduct](#). Additional COVID-19 protocols may emerge. Pay attention to emails from the senior administrators at the College. I will communicate any changes and their resulting implications for our class community via Canvas.

Accommodations:

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.

OFFICE HOURS

Office hours will be held on Mondays from 4-5 PM via zoom (link available on Canvas page) and during every X-hour (except as noted in the schedule) in the classroom (LSC 205).

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's Materials' page on Canvas for more information.

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.

METHODS OF ASSESSMENT AND GRADES

Grading Breakdown:

Tests	66%
Participation	3% - see below for details
Quizzes	3% - see below for details
Research Proposal	10% - see Lab syllabus for details
Lab grade	18% - see Lab syllabus for details

Tests will be a mixture of mastery of the information and applying your knowledge to problem solving. You will be allowed to bring one 8.5 X 11 piece of paper with **hand-written** notes to use during the exam.

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 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 (3% 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:

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

If you are unable to attend class due to an illness, contact me as soon as possible. This will be considered an excused absence.

Quizzes (3% of final grade):

Pre-lecture videos will be used to present material that is important for in class discussion and/or problems. After watching the video, you will take a quiz, and 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. All quizzes will sum to 3% of your final grade.

Grading Policies:

Exams will be completed in-person and will be uploaded to Gradescope by the course faculty for grading. After the exam has been graded, you will be able to view your graded exam on Gradescope. A copy of the answer key will be posted on the Bio19 Canvas site. You should review this answer key thoroughly and thoughtfully to be sure to understand the errors in your exam and why you made them.

All exams are graded carefully and consistently. The number of points awarded for each answer is final. 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 answers and comparing them to the posted answer key, you may submit an error correction request if and only if:

(1) You find an arithmetic error or detect an omission by the grader.

OR

(2) You determine that your answer IS CONSISTENT WITH THE ANSWER KEY, but you did not receive full credit.

To submit an error correction request:

- a) Prepare an electronic cover page (file format: Word or PDF) and name the file as "Error correction request-your name".
- b) 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.
- c) Email your error correction request document to Dr. Jessica DeSimone Warren (Jessica.DeSimone.Warren@dartmouth.edu) within 7 days after you receive the graded exam. Error correction requests will not be considered after this deadline.

The re-evaluation process will take a few days. You will be notified via email once the re-evaluation process is complete.

A final word about grades and exams:

You are not competing against each other for grades in Bio19. 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 Bio19:

1. **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.
2. **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 have provided information about relevant chapters in the 8th edition of **Cell and Molecular Biology: Concepts and Experiments**, by Gerald Karp. However, I am *not requiring* that you purchase and/or read the textbook. Exams will cover material that is presented in lectures, pre-lecture recordings, or covered in the classroom exercises. 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.

In-class Questions

I will also use Poll Everywhere for in-class questions. One purpose of in-class questions is that it allows me to gauge your understanding in real time. The best way for me to gain an accurate appraisal is if the majority of the class answers each of the in-class questions.

Additionally, research has demonstrated that in-class questions help students to actively engage with the course material, and this facilitates learning and synthesis.

You will be “clicking” anonymously – I will not see what answers you give. The data will be tabulated for the entire class, not for individual students. Although your grade will not depend on clicker question participation, I hope all of you will participate fully throughout the term.

CAMPUS RESOURCES

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. 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.

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 Bio19 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.**
- 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 assignment 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

With the evolving COVID-19 situation, there may be a situation that entails a switch to remote instruction. If that is the case, please be mindful of the following:

- (1) Consent to recording of course and group office hours
 - a) By enrolling in this course, you affirm your understanding that this course and any associated **group** meetings involving students and the instructor, including but not limited to scheduled and ad hoc office hours and other consultations, may be recorded within any digital platform used to offer remote instruction for this course;
 - b) You further affirm that the instructor owns the copyright to their instructional materials, of which these recordings constitute a part, and distribution of any of these recordings in whole or in part without prior written consent of the instructor may be subject to discipline by Dartmouth up to and including expulsion;

- c) You authorize Dartmouth and anyone acting on behalf of Dartmouth to record your participation and appearance in any medium, and to use your name, likeness, and voice in connection with such recording; and
- d) You authorize Dartmouth and anyone acting on behalf of Dartmouth to use, reproduce, or distribute such recording without restrictions or limitation for any educational purpose deemed appropriate by Dartmouth and anyone acting on behalf of Dartmouth.

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

By enrolling in this course, you affirm that you will not under any circumstance make a recording in any medium of any one-on-one meeting with the instructor without obtaining the prior written consent of all those participating, and you understand that if you violate this prohibition, you will be subject to discipline by Dartmouth up to and including expulsion, as well as any other civil or criminal penalties under applicable law.