

Bio12: Cell Structure and Function Fall 2014

M, W, F 8:45AM-9:50AM,
X-hour: Th 8:45AM-9:50AM
Room 200, Life Sciences Center (LSC)
Instructor: Prof. Roger Sloboda
Lab Instructors: Dr. Cori Anderson and Dr. Lara Park
Teaching Sciences Fellow: Natalia Vecerek, '14
Graduate Teaching Assistants: Corey Allard, Sierra Cullati, Elora Demers,
Jessica Desimone, Hannah Opalko, Giulia Orazi

Bio 12, 14F, Learning Objectives:

1. Learn the vocabulary of cell biology and become conversant with its use.
2. Understand the basic components of cells (including molecules, macromolecules, membranes, organelles, and the soluble component of the cytoplasm) and their cellular functions.
3. Learn how cells are viewed and studied, including approaches from the fields of microscopy, biochemistry, molecular biology, and genetics (note that prior knowledge of any of these fields is not required to be successful in Bio 12).
4. Understand how the cell is organized (the interplay between cytoskeleton, organelles and membranes), produces energy (glycolysis, mitochondria and chloroplasts) divides (mitosis), moves (cilia, flagella, amoeboid movement, and motility of intracellular particles), and communicates with the outside world (membrane receptors and signal transduction).
5. Be able to apply this information to experimental settings in which one or another of the above (i.e. #4) are altered (either by the environment, mutation, drugs, experimental manipulation, or disease) and predict a logical outcome.

Office Hours:

Prof. Sloboda will hold office hours on **Tuesdays from 10 – 11 AM** and **Thursdays from 5 – 6 PM** in my office in LSC 222. I will also try to be available on the Sundays that precede exams. I will let you know if so when the time comes. If office hours become crowded, we may move out to the lounge that is just outside my office or to another room in LSC. If this happens, I will put a note on my office door redirecting you. If a conflict arises and I am unable to hold office hours, I will reschedule that time and let everyone know via e-mail and/or an announcement in class. Note also that I am generally available before and after lecture, unless I am running to or arriving from a meeting. The scheduled optional review sessions are also good times to have your questions answered. Even if you have no questions, it is a good idea to attend those sessions for practice, i. e. try answering yourself the questions other people ask as a kind of self-check for how you are doing. Finally, it is very, very important that you get your questions answered in a timely fashion. Thus, I am happy to meet at other times if I am free, via a pre-arranged appointment, or you can post a question to me (and the rest of the class) **via Piazza** (you can find a link to this site on the left side of the course home page on Canvas). Note, however, that I may not answer a typed question if the response needed would be too complex to type, in which case I will figure out another way to get the answer to you.

Natalia Vecerek will have office hours in Silsby 113 on **Sundays and Thursdays from 7 – 9 PM**. Her office is 123 LSC, and her e-mail address is Natalia.M.Vecerek@Dartmouth.edu. The lab TAs will announce their office hours in their respective lab sections.

CLASS SCHEDULE

How do we view cells?

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|------|------|--|------------|
| 1. M | 9/15 | Introduction, course details, course goals | Chapter 1 |
| 2. W | 9/17 | Microscopy | Chapter 18 |
| Th | 9/18 | Optional Review of basic chemistry | |
| 3. F | 9/19 | Microscopy and Cell Architecture | Chapter 18 |

The Chemistry of Life

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|------|------|---------------------------|-----------|
| 4. M | 9/22 | Bioenergetics and Enzymes | Chapter 3 |
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How do we analyze cells?

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| 5. W | 9/24 | Experimental Approaches | Chapter 18 |
| Th | 9/25 | Microscopy Review and Problem Solving | |
| 6. F | 9/26 | Experimental Approaches | Chapter 18 |

How are cell compartments built?

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|-------|------|------------------------------------|-----------|
| 7. M | 9/29 | Membrane Structure and Composition | Chapter 4 |
| 8. W | 10/1 | Transport Across Membranes | Chapter 4 |
| 9. Th | 10/2 | Transport Across Membranes | Chapter 4 |
| F | 10/3 | Optional, Pre-Exam Review | |

M 10/6 Exam 1, 8:00-9:50AM, Lectures #1-9: LSC 100

How do cells generate energy?

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|--------|------|---|--------------|
| 10. W | 10/8 | Bioenergetics: Glycolysis and aerobic respiration | Chapter 3, 5 |
| 11. Th | 10/9 | Bioenergetics: Photosynthesis | Chapter 6 |

How do proteins know where to go in the cell?

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|--------|-------|--|-----------|
| 12. F | 10/10 | Protein Sorting | Chapter 8 |
| 13. M | 10/13 | Protein Sorting | Chapter 8 |
| Tu | 10/14 | Please note that today is the annual Dartmouth Life Sciences Symposium. The topic is How Microbes Teach Us Cell Biology. It is not required that you attend, but if you have the time, you may find the talks interesting and relevant to what we are or will be discussing this term. | |
| 14. W | 10/15 | Protein Sorting | Chapter 8 |
| 15. Th | 10/16 | Discussion of a paper from the literature: KDEL, the ER retention signal | |

How do cells integrate and process information?

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| F | 10/17 | Homecoming; no class today | |
| 16. M | 10/20 | Cell Signaling | Chapter 15 |
| 17. W | 10/22 | Cell Signaling | Chapter 15 |
| Th | 10/23 | Optional Review | |
| 18. F | 10/24 | Cell Signalling | Chapter 15 |

M 10/27 Exam 2, 8:00-9:50AM, Lectures #10-18: LSC 100

How do cells move and change shape?

19. W 10/29	Cell motility and shape: Intermediate Filaments	Chapter 9
20. Th 10/30	Cell motility and shape: Actin	Chapter 9
21. F 10/31	Cell motility and shape: Actin	Chapter 9
22. M 11/3	Cell motility and shape: Microtubules	Chapter 9
23. W 11/5	Cell motility and shape: Microtubules	Chapter 9
24. Th 11/6	Discussion of a paper from the literature: FtsZ	
25. F 11/7	The cytoskeleton in action during cell division	Chapter 14

How do cells form tissues?

26. M 11/10	Tissues and cell-cell interactions	Chapter 7
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How do cells duplicate?

27. W 11/12	The cell cycle	Chapter 14
28. Th 11/13	Discussion of the original paper reporting the discover of cyclin	
29. F 11/14	The cell cycle	Chapter 14
30. M 11/17	Cancer	Chapter 16

Final Exam Review session, TBA

Final Exam (Lectures 20-31) Sunday November 24th, 8:00AM-11:00AM

Once again, some resources for assistance with class material:

1. Office hours (see page 1).
2. X-hour question answering sessions with Prof. Sloboda: Come to these sessions with a list of questions to ask so that you understand the material as the course progresses. Never wait until just before an exam to obtain answers; if you do, you will likely have become hopelessly overwhelmed and frustrated by then. The best way to do well is to stay current with the material.
2. Ask questions via Piazza. If you would like to ask a question outside of class/office hours, please use Piazza (you can find a link on the left side of the course page on Canvas; the first time you will be prompted to set up a username and password). You can post questions to the thread anonymously, and you can also answer student questions yourself, also anonymously (this is a good thing to do if you know the answer; note that I will also confirm such answers as being correct, etc.). Please check the thread before posting a question, as your question may have already been asked (this is also why I will ignore questions posed to me by regular e-mail, so as not to have to answer the same question many times over). If your question requires a great deal of info in the response, or if it would be difficult to type a coherent answer, I may ask you to come to office hours or see me before or after class instead. We may also address such questions during class time.
3. Course Teaching Assistants: Your lab TA is a Ph.D. student in the MCB graduate program and thus also an excellent resource for information.
4. Review previous class sessions. I will record each class and post the podcast links on Canvas.
5. Join a study group through the academic skills center, or form your own.

Textbook – *Cell and Molecular Biology*, by Gerald Karp, 7th edition

Additional Textbooks on Reserve

For those wishing to supplement the lectures and the assigned readings in Karp, I have listed below several textbooks that are highly recommended and suitable for other perspectives on the topics. All reading in these textbooks is optional. The following books are on reserve in the Dana Biomedical Library, 37 Dewy Field Road:

Essential Cell Biology, 3rd edition (2012) by Alberts et al. This text has been the Bio12 textbook in past years but is in many ways too simplistic. If you need more background before diving into Karp, try this book.

Molecular Cell Biology – Dartmouth Custom, 7th edition (2013) by Lodish *et al.* This textbook also contains more material than Karp. Some students, particularly those eager to learn more, have really enjoyed reading this textbook.

Grade Distribution

Exam 1	100 pts
Exam 2	100 pts
Final Exam	100 pts
Lab grade	100 pts
Class participation	50 pts

Exams will include a mixture of testing your mastery of the information and applying your knowledge to new situations and asking you to predict an outcome.

Barring documented illness, failure to take an exam or attend a lab section at the scheduled time will result in a grade of zero.

Class participation will be assessed via clicker questions during class, and occasionally via brief on line quizzes prior to the start of class. Please note: participation is what is being assessed with these types of questions, not whether your answers are right or wrong.

Grading Policy For Exams:

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 and be sure you 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, you find an arithmetic error or detect an omission by the grader for one of the questions, you must observe the following procedures to correct the error:

- a) Do not write on the exam. Exams that have been written on will not be corrected. 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 and will not be tolerated. To deter this practice, we scan exams before grading them.
- b) Prepare a typed cover page with your name and HB number.
- c) If you find an addition error, indicate on the cover page that an addition error has occurred. Specify the page and question number(s.)

d) If you determine that your answer contains all of the information indicated in the key, but you did not receive full credit, simply indicate the number of the question on your cover page and state in one or two short, descriptive typed sentences the facts that make your answer correct. The citation of a text page, diagram, or reference to a lecture date/number would also be helpful.

e) Attach the typed cover sheet to your complete exam and return it to the Bio12 drop box in the short corridor between Room 200 and 201 in LSC before the deadline noted below. The error correction process will take a few days. You will be notified of the place and time to pick up your exam after the correction is completed.

We will not accept questions regarding errors in grading after the deadlines noted below. Nor will we accept requests that are not typed. Sorry for these rules, but if we do not impose them, things get a bit out of hand toward the end of the term.

These are the deadlines:

First Exam: 12:00PM (Noon) on October 20st

Second Exam: 12:00PM (Noon) on November 10th

We will not accept questions regarding errors in grading after these deadlines. There will be no such process for the final exam, as the final exam is, well, final.

A final word about grades and exams in Bio 12:

You are not competing against each other for grades in Bio 12. Let me 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 three important points to note about grades in Bio 12:

[i] A grade of 90% or above will always be at least an A⁻. No one is ever penalized for learning what I try to teach them. Thus, it is entirely possible for everyone in the class to receive a grade of A⁻ or better. However, my experience suggests to me that this will not happen (see page 7 of this syllabus).

[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.

[iii] This next point is really important, and note that it has two parts: The median grade [for both sections of Bio 12] will be a B.

a. That means that if the median of an exam is 62%, then a grade of 62% for that exam would be equivalent to a B. If the median is 29%, then a grade of 29% for that exam is a B. Note, therefore, that this portion of rule [iii] negates rule [ii] above.

b. If the median grade is 94% then a grade of 94% for that exam is an A/A⁻. Note, therefore, that this portion of rule [iii] negates rule [i] above.

A word about the word 'median' in this context. The median grade in a grade distribution is that grade above which half the class scored and below which half the class scored. Thus, the median of this grade distribution, 47, 55, 59, 76, 82, 90, 94, is 76. The mean (i. e. average, however, is 71.9). The median of 47, 55, 59, 76, 76, 76, 94, is also 76; the mean is 69.0. Sorry, but every term, some students have a tough time interpreting what is meant by the term median grade.

Class Participation:

Class participation will be assessed in two ways. For in class 'clicker' questions related to the Biology material, you will need to have a computer, a tablet or a phone (capable of sending a text message). The computer or tablet must be rigged to interact with a program called Lecture Tools (you can link to this program from Canvas via a button on the left hand side of the Bio 12 home page). Once set up, you can use your laptop, tablet, or smartphone to answer clicker questions during class. Your responses to questions posed in class will be used to assess class participation, as well as provide you with practice thinking about and answering questions. Note, however, that I will not be tracking whether you answer a question right or wrong, only whether or not you provide an answer. Thus, your responses will be completely anonymous and will not be graded. With respect to the Honor Principle, it is a clear violation to bring someone else's computer, tablet, or phone to class for them and use it to provide answers (clicks) as if the person were present. It is also a violation to provide, remotely, clicks for yourself or anyone else from some position in the known universe other than our Bio 12 classroom.

Occasionally, material related to a specific class will be made available via Canvas prior to the start of class. This will allow you to hear, see, and think about the material ahead of time, thereby freeing up lecture time for exploring topics in more depth, working on problem solving strategies, interactive exercises, and answering questions, etc. The goal is to devote lecture time to help you learn the material, not simply transmit information. For such cases there may be a short, online quiz available on Canvas that will be relevant to the on-line material. These quizzes are designed to gauge what makes sense to you, what is confusing, and what I should focus on clarifying in the subsequent class period. The quizzes must be completed by 7 am on the morning of the class. As above for the clicker questions, your responses will not be individually graded. However, you must complete them according to the Honor Principle rules in the preceding paragraph to earn the class participation component of your grade.

Finally, I will provide you with access to podcasts of each class. This means the slides and associated clicker questions, accompanied by the audio portion of class, will be posted on Canvas for you to review when you are studying.

Academic Honor Principle:

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 Biology 12 might be tempted to violate the Academic Honor Principle. These situations include (but are not limited to) the following:

- a) Examinations must be completed without reference to written materials other than those provided with the exam paper and must be completed without communication with anyone else (the only permissible exception is that students may request clarification of any exam question from me, which is why I make myself available during the exams). The answers that you provide must be entirely your own work.
- b) Our policy permits the re-submission of exams for correction of errors made during the grading process. Any alteration of the answers on an exam made between the time when the graded papers were returned to the student and the time when the paper was submitted for correction constitutes a clear, premeditated, and egregious breach of the Academic Honor Principle. To deter this practice, we copy exams before grading them.
- c) Laboratory experiments are performed in pairs or groups, and we encourage student collaboration. This includes data collection, analysis, and visual presentation of the data (graphs/tables). However, the writing of the text of the lab reports submitted for grading must represent the original words of the student submitting that report. While we encourage collaborative discussion of your data, all writing must be done

independently and individually. Do not share computer files of work (excluding graphs and tables) to be submitted for grading! The student misrepresenting the work of another as his or her own is in violation of the Academic Honor Principle, as is likely the student who loaned that information. Thus, it is possible that the Committee on Standards will find the student providing the original file also to be in violation of the Honor Principle.

Honesty is the foundation of the academic pursuit of knowledge. In recognition of this, the staff of Bio 12 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.

Note to Students with Physical or Learning Disabilities:

I encourage students with disabilities, including invisible disabilities such as chronic illnesses and learning disabilities, to arrange for accommodations that might be helpful. Please meet with me soon, preferably during the first week of classes, to discuss possible accommodations that have been approved by the folks at Student Accessibility Services. All discussions will be confidential, although the Academic Skills Center may be consulted to verify the documentation of the disability.

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.

How to be Successful in Bio 12 (see more at the 'tips' link on the Canvas home page):

- 1) Preview each reading assignment the night before class. Look at the figures, read the figure legends, and get a general feel for the vocabulary to be introduced and the topics to be covered in the upcoming class. Jot down any questions you have to focus your attention in lecture.
- 2) Attend lectures on time (class will start promptly at 8:45 AM), take notes on the material presented in lecture, and ask questions about the things you do not understand. Make sure you have answers to the questions you wrote down the previous night.
- 3) Re-read the reading assignment as well as your notes that very same afternoon or evening after the lecture, when things are still fresh in your mind. Correct or add points to your notes as you go along.
- 4) Review the notes and reading assignments from the previous week's classes sometime during the weekend.
- 5) Be curious and ask questions in class, in office hours, in lab and with fellow students, etc. Also ask yourself questions and challenge yourself to really understand the material.
- 6) Test your own knowledge by putting away your notes and drawing out structures and pathways from memory. Your goal is to be able to accurately re-create the details and mechanisms we discuss in class, and understand them. Do not just try to do this as a mental exercise (i. e. in your head). Do it on paper, as you would be doing it in an exam, and then compare your attempt with your notes and the textbook.
- 7) Attend all classes and review sessions.
- 8) Attend office hours, even if you have nothing to ask.

Laboratory Assignments and Point Breakdown:

The laboratory portion of Bio12 counts for 100 pts of your total Bio12 grade (450 pts).

1. Quizzes: There will be quizzes (5 points each) that begin promptly at the start of labs 1, 2, 3, 4, and 6. Each quiz will end ten minutes into the lab session. The quizzes will count for a total of 25 points of your lab grade.
2. Microscopy in-class assignment (5pts).
3. Lab Reports:

Three lab reports will be written during the term. You will have 1 - 2 weeks from the time you complete your lab to the time the report is due. Detailed instructions for each report will be given during the term. Please note the following dates:

- a. Hill Reaction Lab Report (15 pts), due week of October 13th.
 - b. Protein Purification Lab Report (25 pts), due week of November 3rd. This is the culminating lab report for labs 3 & 4. Note: in the event of an unexcused lab absence from either Lab 3 or Lab 4, you will still be required to write a lab report. However, your report grade will have a maximum of 15 points.
 - c. Experimental Design Lab Report (20 pts), due week of November 10th.
4. Experimental Design Methods:

Before lab 5, you will write out detailed methods of the experiment that you design. This assignment is in place of your lab 5 quiz and will be worth 5 points. Assignments will be due the week prior to lab.

5. Lab Abstract:

For Lab 6, you will write a short lab abstract. This assignment is worth 5 points and is due November 18th at 12:00PM.

Grading Policy For Lab Reports:

The following points summarize the grading procedures with respect to lab reports:

1. After the report has been graded and returned, review your report comments and be sure to understand the deductions on your report and why you made them.
2. If, after reviewing your report, you find an error, you must observe the following procedures for error correction:
 - a. Prepare a typed cover page with your name and HB number.
 - b. If you find an addition error, indicate on the cover page that an addition error has occurred.

- c. Next to each deduction will be a brief description of why the deduction was taken. If you determine that points were deducted but your report contains the information specified in the grader comment, indicate the page number to be re-evaluated and state in one or two short, descriptive sentences (typed) where you satisfied that comment.
- d. Attach the typed cover sheet to your graded report and return it before the following deadlines to the Bio12 drop box located outside the lab (LSC 202).

Chloroplast Report: 12:00PM (Noon) on October 27th
Protein Purification Report: 12:00PM (Noon) on November 17th
Experimental Design Report: 12:00PM (Noon) on November 24th

We will not accept questions regarding errors in grading after these deadlines. The error correction process will take a few days. You will be notified of the place and time to pick up lab reports after the re-evaluation is completed.