Bio12: Cell Structure and Function  
Fall 2015

M, W, F 8:45-9:50AM  
X-hour: Th 9:00-9:50AM  
Room 200, Life Sciences Center (LSC)  
Instructor: Prof. Roger Sloboda  
Lab Instructors: Dr. Cori Anderson and Dr. Nick Sylvain  
Teaching Science Fellow: Therese Kienemund, ’15 (please call her T)  
Graduate Teaching Assistants: Scott A. Alpizar*, Amanda M. Costa*,  
Andrew R. Crowley, Rufus Hards, Xue Xia, Zhenghan Wang*

Bio 12, 15F, 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.

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Office Hours:

Prof. Sloboda will hold office hours on Tuesdays and Wednesdays from 4 – 5 PM in LSC 222 or outside in the lounge with the cushy chairs. I will also be available most of the day on the Tuesdays prior to exams.

Therese Kienemund, ’15, our teaching science fellow, will hold review sessions in Silsby 113 on Sundays and Tuesdays from 7 – 9 PM. Her office is 123 LSC, and her e-mail is t.kienemund@dartmouth.edu. The lab TAs will announce their office hours in their respective lab sections.

If Prof. Sloboda’s office hours become crowded, we may move to another room in the 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

*These TAs are assigned to this section of Bio 12.
class. Note also that I am generally available before and after class, 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. Also, by hearing the other questions asked, you will realize others may have the same misunderstanding about the material that you do, i. e. you are not alone! 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, anonymously if you wish, 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). Piazza will be monitored by T and me as well as by the graduate TAs’. Note, however, that we may not answer a typed question if the response needed would be too complex to type, in which case we will figure out another way to get the answer to you.

CLASS SCHEDULE

How do we view cells?
1. W 9/16  Course Logistics & Introduction to Cell Architecture  Chapter 1
2. Th 9/17  Microscopy I  Chapter 18
3. F 9/18  Microscopy II  Chapter 18

Please note: There is material on Canvas providing background information on the basic chemistry you all should know in order to be successful in Bio 12. I strongly urge all of you, even if you feel confident with chemistry, to review this material (a pdf) prior to the end of the upcoming weekend (i. e. prior to class on Monday the 21st).

How do we analyze cells?
4. M 9/21  Protein Structure & Function  Chapter 2
5. W 9/23  Experimental Approaches I  Chapter 18
   Th 9/24  Optional Review/Q & A
6. F 9/25  Experimental Approaches II  Chapter 18

How are cell compartments built?
7. M 9/28  Thermodynamics & Enzymes  Chapter 3
8. W 9/30  Membrane Structure and Composition  Chapter 4
9. Th 10/1  Transport Across Membranes I  Chapter 4
10. F 10/2  Transport Across Membranes II  Chapter 4
    M 10/5  Optional Pre-Exam Review/Q & A
      W 10/7  EXAM 1, 8:00-9:50 AM, Lectures #1-10 (including chemistry) in Oopik Auditorium

How do cells generate and utilize energy?
11. Th 10/8  Glycolysis & Aerobic Respiration  Chapters 3, 5
12. F 10/9  Photosynthesis  Chapter 6

How do proteins know where to go in the cell?
13. M 10/12  Protein Sorting I  Chapter 8
14. W 10/14  Protein Sorting II  Chapter 8
## How do cells receive, integrate and process information?

<table>
<thead>
<tr>
<th>Date</th>
<th>Day</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>17.</td>
<td>W</td>
<td>Cell Signaling I</td>
</tr>
<tr>
<td>18.</td>
<td>Th</td>
<td>Cell Signaling II</td>
</tr>
<tr>
<td>19.</td>
<td>F</td>
<td>Cell Signaling III</td>
</tr>
<tr>
<td>20.</td>
<td>M</td>
<td>Optional Pre-Exam Review/Q &amp; A</td>
</tr>
</tbody>
</table>

**W 10/28**  
EXAM 2, 8:00-9:50 AM, Emphasis on Lectures #11-19, in Oopik Auditorium

## How do cells regulate cell shape and motility and interact with other cells to form tissues?

<table>
<thead>
<tr>
<th>Date</th>
<th>Day</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.</td>
<td>Th</td>
<td>Cytoskeleton – Intermediate Filaments</td>
</tr>
<tr>
<td>21.</td>
<td>F</td>
<td>Cytoskeleton – Actin I</td>
</tr>
<tr>
<td>22.</td>
<td>M</td>
<td>Cytoskeleton – Actin II</td>
</tr>
<tr>
<td>23.</td>
<td>W</td>
<td>Cytoskeleton – Microtubules I</td>
</tr>
<tr>
<td>24.</td>
<td>Th</td>
<td>Discussion of a paper from the literature: FtsZ</td>
</tr>
<tr>
<td>25.</td>
<td>F</td>
<td>Cytoskeleton – Microtubules II</td>
</tr>
<tr>
<td>26.</td>
<td>M</td>
<td>Connections between Cells</td>
</tr>
</tbody>
</table>

## How do cells duplicate?

<table>
<thead>
<tr>
<th>Date</th>
<th>Day</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>27.</td>
<td>W</td>
<td>The Cytoskeleton in Action during Cell Division</td>
</tr>
<tr>
<td>28.</td>
<td>Th</td>
<td>Discussion of a paper from the literature: cyclin</td>
</tr>
<tr>
<td>29.</td>
<td>F</td>
<td>The Cell Cycle</td>
</tr>
</tbody>
</table>

## What happens when cell biology fails to operate properly?

<table>
<thead>
<tr>
<th>Date</th>
<th>Day</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>30.</td>
<td>M</td>
<td>Cancer</td>
</tr>
</tbody>
</table>

**Optional Final Exam Review Session ➔ TBA**

**FINAL EXAM, SUNDAY, 11/22 : 8:00-11:00 AM, Emphasis on Lectures #20-30**

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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.

3. Ask questions. 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 if you wish (anonymous to the class but not to me), 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 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. T, our teaching science fellow, having taken Bio 12 very recently, is a great source of information about course content, etc. as well.

4. Course Teaching Assistants: Your lab TA is a Ph.D. student in the MCB graduate program and thus also an excellent resource for information.

5. Review previous class sessions. I will record each class and these will be available via echo360 on Canvas.

6. Join a study group through the Academic Skills Center, or form your own.

7. Come to review sessions, office hours, etc. and ask, hear, respond etc. to the give and take that occurs.

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

<table>
<thead>
<tr>
<th>Component</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exam 1</td>
<td>100 pts</td>
</tr>
<tr>
<td>Exam 2</td>
<td>100 pts</td>
</tr>
<tr>
<td>Final Exam</td>
<td>100 pts</td>
</tr>
<tr>
<td>Lab grade</td>
<td>100 pts</td>
</tr>
<tr>
<td>Class participation</td>
<td>50 pts</td>
</tr>
</tbody>
</table>

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:

Class participation will be assessed in two ways. For in class questions related to the material being covered, 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.
within a program called echo360 (you can link to echo360 from Canvas via a button on the left hand side of the Bio 12 Canvas page). Once set up, you can use your laptop, tablet, or phone to answer 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. 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 as if the person were present. It is also a violation to provide, remotely, answers for yourself or anyone else from some position in the known universe other than the 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 read, hear, see, and think about the material ahead of time, thereby freeing class time for exploring topics in more depth, working on problem solving strategies, interactive exercises, and answering questions, etc. The goal is to devote class 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 8 am on the morning of the class. As above for the in class 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.

**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 Canvas. Review this answer key and be sure you understand the errors in your exam and why you made them. If you do not understand what you did wrong, you are very likely to do it again on the next exam.

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 exams were returned to students and the time when the exam was submitted for error correction 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 21st
Second Exam: 12:00PM (Noon) on November 11th

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 [iii] itself.

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 27, 55, 59, 76, 76, 76, 94, is also 76; the mean is 66.1. Sorry, but every term, some students have a tough time interpreting what is meant by the term “median grade.”

Finally, I will provide you with access to recordings of each class, accessed via the echo360 link on the Bio 12 Canvas page. 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 photocopy exams before grading them.

c) Laboratory experiments are performed in pairs or groups, and we strongly 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 and the preparation of the data obtained in the form of figures, tables, etc. submitted for grading must represent the original work 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 (including graphs and tables) to be submitted for grading! Although you are encouraged to discuss lab data with your lab partners, you must prepare yourself the text and graphical content of each lab report you submit for grading. A student misrepresenting the work of another as his or her own would be in violation of the Academic Honor Principle, as is likely the student who provided 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 discuss the details of the accommodation recommended.

**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) That very same afternoon or evening, familiarize yourself with the reading assignment as well as your notes, when things are still fresh in your mind. Correct or add points to your notes as you go along. And please note the following. The study of how effective learners learn things indicates that certain activities promote learning and retention much better than simply re-reading your notes and the textbook and convincing yourself that the material is familiar to you. But on an exam, I am not showing you your notes and asking you if they look familiar… If you would like to learn more about the most effective strategies for studying and learning (and the research underlying these recommendations), have a look at the book entitled *Making it Stick: The Science of Successful Learning* by Brown, Roediger III, and McDaniel. One effective study strategy is called retrieval practice. The actual act of retrieving information (like working on practice exam questions, responding to a clicker question, or to a verbal question posed in class etc.) helps you to solidify your knowledge/memory and enhances your ability to retrieve that information in the future. Thus, I encourage you to build the study habit of retrieval practice into your own personal study routine.

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 Section Information:

Below is a calendar outlining each laboratory session for the term and relevant assignment due dates. This calendar will also be available electronically through Canvas and can be integrated together with your other courses for the term. Be sure to check the Canvas calendar regularly throughout the term for any changes to this calendar.

<table>
<thead>
<tr>
<th>Lab</th>
<th>Date</th>
<th>Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lab 1 – Microscopy</td>
<td>September 21st – 23rd</td>
<td>Laboratory Quiz In-lab microscopy assignment</td>
</tr>
<tr>
<td>Lab 2 – Ion Chromatography</td>
<td>September 28th – 30th</td>
<td>Laboratory Quiz Ion Chromatography Summary Assignment</td>
</tr>
<tr>
<td><strong>No Lab October 5th – 7th</strong></td>
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<td></td>
</tr>
<tr>
<td>Lab 3 – Gel Electrophoresis</td>
<td>October 12th – 14th</td>
<td>Laboratory Quiz Protein Gel Summary Assignment</td>
</tr>
<tr>
<td>Lab 4 – Hill Reaction</td>
<td>October 19th – 21st</td>
<td>Laboratory Quiz Lab Report</td>
</tr>
<tr>
<td><strong>No Lab October 26th – 28th</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lab 5 – Cell Motility</td>
<td>November 2nd – 4th</td>
<td>Laboratory Quiz Lab Abstract</td>
</tr>
<tr>
<td>Lab 6 – Experimental Design</td>
<td>November 9th – 11th</td>
<td>Methods Assignment Lab Report</td>
</tr>
</tbody>
</table>

How to determine your laboratory section:

On the first day of class you will be directed to fill out an online survey to determine your lab section based on your academic schedule. Conflicts of an academic nature will take priority, followed by work and extracurricular activities. Your lab section assignment will be the same for the entire term and it is your responsibility to ensure that you will be in attendance for all sessions. Be sure to check all exams and X-hours for your other classes throughout the term. This term there will be six lab sections; the students in these sections will come from both sections of Bio 12:

Section 1: Monday 1:45-5:45pm
Section 2: Monday 6:30-10:30pm
Section 3: Tuesday 1:45-5:45pm
Section 4: Tuesday 6:30-10:30pm
Section 5: Wednesday 1:45-5:45pm
Section 6: Wednesday 6:30-10:30pm
LABORATORY GRADES

Your work in the laboratory will contribute to 25% of your overall grade in Bio12. The lab grade will be composed as follows:

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Lab Quizzes</td>
<td>25%</td>
</tr>
<tr>
<td>In-Lab Microscopy Assignment (Lab 1)</td>
<td>5%</td>
</tr>
<tr>
<td>Chromatography Assignment (Lab 2)</td>
<td>15%</td>
</tr>
<tr>
<td>Protein Gel Assignment (Lab 3)</td>
<td>10%</td>
</tr>
<tr>
<td>Chloroplast Report (Lab 4)</td>
<td>15%</td>
</tr>
<tr>
<td>Cell Motility Abstract (Lab 5)</td>
<td>5%</td>
</tr>
<tr>
<td>Experimental Design (Lab 6)</td>
<td>5%</td>
</tr>
<tr>
<td>Experimental Design Report (Lab 6)</td>
<td>20%</td>
</tr>
</tbody>
</table>

ASSIGNMENTS

You are required to prepare your assignments electronically and submit a hard copy of the assignment at the beginning of your laboratory session. Printing problems are not an acceptable excuse for lateness so plan your assignment printing in advance.

Please note that more extensive details pertaining to the lab section of Bio 12 can be found at the Canvas page for Bio 12 Lab.