

Dept. Biology
Northeastern University

Biological Imaging: BioU581 or BioG281

Spring, 2007

Dr. Donald M. O'Malley, 422 Richards

Text: Molecular Biology of the Cell, Alberts, 4th Edition

Meets: Mon, Wed, Thurs: 10:30 to 11:35

Draft Syllabus

Dates will be updated

This course assumes a basic (not advanced) understanding of biochemistry and cell biology. Everyone should skim through Chapters 1-3; the general gist should be at least somewhat intelligible, although I don't expect anyone to know every detail! **note:** Sept. 23rd is the last day for *undergrads* to drop a class without a "W", while Nov. 18th is the last day to drop with a "W".

Lecture Schedule: Ignore days and dates (will be updated prior to Spring Semester)

<u>Week</u>	<u>Day/Date</u>	<u>Lecture Topic:</u>	<u>Reading Assignment</u>
1	Wed 9/7 Thur 9/8	Course Overview, Introduction to Photons Optical Physics for Light Microscopy	Skim Chaps 1-3 BB slides
2	Mon 9/12 Wed 9/14 Thur 9/15	Cell Imaging Methods Overview Cell Biology: A Tour of the Cell EM: guest lecturer – Dan Scheirer	Chap. 9 Text - Chaps 1-3 Chap. 9
3	Mon 9/19 Wed 9/21 Thur 9/22	Fluorescence Microscopy, Taylor and Salmon GFP – Cubitt et al., 1995; Lippincott Schwartz article Intracellular Compartments	handout handout & PDF Text - Chap. 12
4	Mon 9/26 Wed 9/28 Thur 9/29	Compartments – continued Organelles and Membrane Trafficking complete discussion of vesicular transport	Chap. 12 Chap. 13 Chap. 13
5	Mon 10/3 Wed 10/5 Thur 10/6	Begin: <i>Golgi Structure & ER Transport.</i> complete discussion of Intermediate compartment <u>Mid-Term #1</u> (covers thru Monday 10/3)	PDF PDF 12 lectures
6	Mon 10/10 Wed 10/12 Thur 10/13	<i>Columbus Day</i> CCD Cameras/ Video Enhanced DIC Discuss: <i>Neuronal Polarity-</i> Dotke and Bratti	No Class handouts PDF
7	Mon 10/17 Wed 10/19 Thur 10/20	Biological Membranes Lasers / Optical Tweezers: Arthur Ashkin article Discuss: <i>Single Particle Tracking of Cadherins</i> , Sako et al.	Text – Chap. 10 handouts PDF
8	Mon 10/24 Wed 10/26 Thur 10/27	Conclude SPT and Cadherin articles Imaging calcium with cameleons: FRET Confocal Calcium Imaging: O'Malley	BB PDF PDF

<u>Week</u>	<u>Day/Date</u>	<u>Lecture Topic:</u>	<u>Reading Assignment</u>
9	Mon 10/31	Lab Demo	lab handout
	Wed 11/2	Finish confocal imaging, nuclear calcium signaling	PDF
	Thur 11/3	begin Nerve Cell Imaging	posted slides
10	Mon 11/7	finish nerve cell imaging	posted slides
	Wed 11/9	2-Photon Imaging, Abbé Diff. Limit	PDF
	Thur 11/10	Mid-Term #2 (covers through Monday 11/7)	11 lectures
11	Mon 11/14	Guest Lecturer - Gary Laevsky – Keck Facility Manager	handout
	Wed 11/16	GL - Applications of Optical Tweezers (Mark Williams, Physics)	TBA
	Thur 11/17	molecular motor reviews	PDF
13	Mon 11/21	Discuss: <i>mRNA trafficking</i>	PDF
	Wed 11/23	<i>Review Materials for Final Exam</i>	class notes
	Thur 11/24	<u>Thanksgiving – Holiday</u>	Turkey
14	Mon 11/28	<i>in vivo</i> imaging: BLI and 2P	PDFs
	Wed 11/30	human brain mapping	PDF
	Thur 12/1	Guest Lecturer: John Gatley, human brain mapping	PDF
15	Mon 12/5	Background reading for FISH and Chips	text & PDF
	Wed 12/7	More on FISH and Chips	PDF
	Thur 12/8	Reading Day – no class	final study guide

2. Grading and Exams: Note: **Final Exam Date is December 16th, 8:00 am.** Please note that this is the last day of finals (quite unfortunately) but the **Final Exam cannot be given early**. So please plan to be here for the final if you wish to take this course: there will be no make up for the final exam.

100-92 = A	Pop Quizzes: 5 quizzes x 3 pts	= 15 points
89-91 = A ⁻	Term Paper	= 15 points
86-88 = B ⁺	2 Midterm Exams: 2 x 20 pts	= 40 points
82-85 = B	<u>Final Exam:</u>	= 30 points
79-81 = B ⁻	Total	= 100 points

Quiz and Exam Content: Midterms and Final Exam will **emphasize material covered in class**, including the class **discussions**. While **assigned** textbook, handouts and PDF readings are testable, there is too much material to memorize and so I will provide detailed information (study guides) about which material to focus upon for the exams. The *Final Exam* will be heavily weighted towards newer material, covered after the 2nd mid-term, but it will have a “cumulative” section with questions that integrate newer with older material.

Curvature: The exams are designed to test your knowledge and to be intellectually stimulating. It's quite possible that an exam average could be as low as 50%. This is not a concern because exams are always curved (for undergrads). By completing the assigned readings, attending class, and following directions for the course presentation, previous students have mostly scored A's or B's.

Missed Exams and Quizzes: There will be *No Make-Ups* for missed **Exams** or **Pop Quizzes** and a grade of zero will be given. In the case of a **documented emergency**, for Exams only, (quizzes cannot be made up), a substantial research paper relating to the missed material will be assigned.

3. Pop Quizzes, Required Class Attendance and Reading Assignments:

Because a large component of this course consists of in-class discussion of original research reports, attending class is essential. As a means of evaluating both attendance and completion of assigned readings, there will be 5 pop quizzes, worth 3 points each. Cumulatively, this will count for 15% of your total course grade. Pop quizzes will be given at the outset of the class and will be (at most) 10 minutes long, so it is important to arrive at class on-time.

Pop quizzes will evaluate one or two things: (1) your comprehension of the previous lecture or two, and (2), in instances where the quiz falls on the day of a **“Discussion”** paper, there will be questions that will evaluate your preparation to participate in the class discussion (see below). I will be *very generous* with **partial credit**: as long as you attend all classes (on-time) and do the assigned reading, you should do well on this component of the course.

4. Reading Assignments.

Reading assignments will come from 3 different sources:

- (1) Molecular Biology of the Cell textbook (Alberts et al., 4th Edition), *required*.
- (2) Class handouts (from time to time)
- (3) PDF versions of research articles and reviews: these will be posted on Black Board.

5. Discussion Papers

An especially important component of the reading assignments are the **Discussion Papers**, which should be read *in advance* of the class period in which they will be discussed (they are highlighted on the syllabus). Your reading of these papers will form the basis of a class-wide discussion, which will cover: the *methodology*, the *experiments performed* and the *interpretation of the resulting data*. Specifically, you should come to class prepared to answer the following questions about each assigned **Discussion paper**:

- (1) What was the **objective** of the research described in the article?
- (2) What was the **state of the field** prior to publication of this article?
- (3) What is the **take-home message** of the paper? Do you believe it?
- (4) *For each figure* in the paper: what is the **main point** of that figure?
- (5) What, in your opinion, was the **most important figure** of the paper? Why?
- (6) Were optical methods **essential** to the main findings? Were they **conclusive**?

Many of you should be capable of assessing these research reports in the manner just described, but students who have less background in cell biology and biochemistry may have trouble answering these questions. In such cases, *as an alternative*, you may compile a list of 10 *specific* things that you did not understand about the article. For example, for each figure, you could write a question about what *exactly* it is that you do not understand about the figure.

6. Laboratory: There is no laboratory for this course. One class period will consist of a lab demonstration which will include: confocal imaging, laser-ablation, 3D reconstruction, and high-speed video.

7. Term Paper: In coordination with the instructor, each student will select an original research article in the area of biological imaging to critique. The article (from a peer-reviewed journal) will be one that either presents a new approach in Biological Imaging or that uses state-of-the-art imaging techniques in a noteworthy way. Further details will be provided within the next two weeks.

8. Office Hours: 422 Richards Hall, Office of Don O'Malley, 373-2284
Monday: 3:00 – 5:00 **Friday:** 10:00 - 11:30
(if I am not in, check down the hall in my lab, Room 413)
You may stop by at other times and I will help if I can.
You can always e-mail questions to d.omalley@neu.edu

9. Seek Help Early. Ask for help early, so that you have time to carry out recommendations that I may make. Also, email any questions as they arise -- I will post anonymous replies to Blackboard.