QBIO 120b: Quantitative Biology Instrumentation Laboratory
Fall 2012

Instructor: Jeff Gelles (gelles@brandeis.edu; 781-736-2377)

Course description

This course aims to provide an understanding of modern instruments used in biological research, with special emphasis on bright-field and fluorescence light microscopes, spectrophotometers, and fluorimeters. The approach is a practical one geared to students who are or will be using these instruments in research. The course consists of six two-week-long lab projects. In the initial projects, students assemble optical instruments from their component parts and quantitatively characterize the performance of the instruments. In the later projects, students apply the understanding gained in the initial projects to getting the optimal performance out of commercial microscopes and fluorimeters and avoiding pitfalls in their use. The course also covers basic aspects of biological and biochemical sample preparation.

The six projects are:

- geometrical optics, Fourier optics, and the optics of the microscope
- fluorescence microscopy optics and TIRF
- brightfield and phase contrast microscopy
- fluorescence microscopy
- absorption spectroscopy
- fluorescence spectroscopy

Usually, students work on projects in pairs. We try to pair students with complimentary academic backgrounds in order to enhance the learning experience. For example, a life sciences Ph.D. student familiar with biological sample preparation might be paired with a physics Ph.D. student familiar with optics, so that the students can learn from each other as well as from the instructor.

Target audience

The course is designed to be taken by both life sciences and physical sciences Ph.D. students. It is specifically designed to accommodate the different academic backgrounds of the students enrolled in the different programs. The course is also appropriate for M.S. students and advanced undergraduate students who have sufficient laboratory training. Undergraduates should (and Ph.D. students may) consult the instructor to check that they have adequate preparation for the course.

Meeting place and times

The course meets for two three-hour lab sessions each week, Mondays 1:00 PM–3:50 PM and Fridays 1:30 PM–4:20 PM in Bassine Lab room 244. A detailed list of lab sessions is attached.

Organizational meeting

The first course meeting will take place Fri. August 31 at 1:40 in Bassine 244.

Written work

Each student individually completes a written report on each of the six lab projects. A report is **short** (typically little more than 2 pages of double-spaced text), focuses on a **single** aspect of the project (selected by the student), and gives background, reports data, and presents conclusions based on the data.

Reading

Readings for the course consist of lab descriptions plus supplemental readings taken from a variety of sources including the following:

1. Sears and Zemansky, (chapters on geometrical optics and diffraction), *University Physics* (Addison-Wesley)
2. Eugene Hecht, *Optics* (Addison-Wesley, 2001)
3. Shinya Inoue and Kenneth R. Spring, *Video Microscopy*, (Plenum Press, 1997)
4. Microscopy web sites http://www.microscopyu.com and www.olympusmicro.com

It is not necessary to purchase any texts for the course. As many of the readings as possible will be posted on the course LATTE web site. Students not yet registered for the course can contact the instructor for guest access.

Grading

Grading is based roughly 60% on lab reports and 40% on lab participation. There are no written examinations. Undergraduates may take the course pass/fail. All six lab reports must be satisfactorily completed to pass the course.

Instructor consultation

Prof. Gelles is present to work with students during all scheduled lab hours, and also by appointment and during his regularly scheduled office hours (Kosow 208, 1-3 pm Tuesdays).

QBIO 120 Fall 2012 Lab sessions

Notice that not all classes are on Mon/Fri and not all Mon/Fri have classes, due to the vagaries of the Brandeis academic calendar. Also notice that there will be no class on Oct. 19 due to a conflict with the QB retreat.

Fri Aug 31 1:30pm – 4:20pm	Organizational session
Fri Sep 7 1:30pm – 4:20pm	Lab 1
Mon Sep 10 1:00pm – 3:50pm	
Fri Sep 14 1:30pm – 4:20pm	
Thu Sep 20 1:00pm – 3:50pm	
Fri Sep 21 1:30pm – 4:20pm	
Mon Sep 24 1:00pm – 3:50pm	Lab 2
Fri Sep 28 1:30pm – 4:20pm	
Fri Oct 5 1:30pm – 4:20pm	
Tue Oct 9 1:00pm – 3:50pm	
Fri Oct 12 1:30pm – 4:20pm	Lab 3
Mon Oct 15 1:00pm – 3:50pm	
Mon Oct 22 1:00pm – 3:50pm	
Fri Oct 26 1:30pm – 4:20pm	
Mon Oct 29 1:00pm – 3:50pm	Lab 4
Fri Nov 2 1:30pm – 4:20pm	
Mon Nov 5 1:00pm – 3:50pm	
Fri Nov 9 1:30pm – 4:20pm	
Mon Nov 12 1:00pm – 3:50pm	Lab 5
Fri Nov 16 1:30pm – 4:20pm	
Mon Nov 19 1:00pm – 3:50pm	
Mon Nov 26 1:00pm – 3:50pm	
Fri Nov 30 1:30pm – 4:20pm	Lab 6
Mon Dec 3 1:00pm – 3:50pm	
Fri Dec 7 1:30pm – 4:20pm	
Mon Dec 10 1:00pm – 3:50pm	

(This information is also available on the Google Calendar feed http://www.google.com/calendar/ical/brandeis.edu_s2rutaosdjccb0r5aidkbbdcio%40group.calendar.google.com/public/basic.ics)