

QBIO 120b: Quantitative Biology Instrumentation Laboratory Spring 2009

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 and microscopes
- Fourier optics and imaging performance
- 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 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 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 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 *only 6 hours per week*: Mondays 1:10 – 4 pm and Wednesdays 1:10 – 4 pm. (The registrar's course schedule lists longer hours because the meeting times do not conform to the standard block schedule.) The course is held in the Physics (Abelson) Building Room 335.

Organizational meeting

The first course meeting will take place Wed. January 14 at 2:00 (N.B. not at 1:10!).

Schedule notes

No classes on 1/19, 2/16, 2/18 (Brandeis holidays), and 4/22 (Brandeis Thursday). On three Wednesdays, 1/21, 2/25, and 3/18, the class will meet from 2:10-5:00 to avoid conflict with the QB lunch meeting.

Written work

Each student individually completes a written report on each of the six lab projects. A report focuses on a single aspect of the project (selected by the student), and gives background, reports data, and presents conclusions based on the data. Grading is based roughly 70% on lab reports and 30% on lab participation. There are no written examinations.

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

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.

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, 9-11 Fridays).