

## BE517 Optical Microscopy of Biological Materials (Fall 2022)

### 1. Introduction

The goal of this class is to provide hands-on training in state-of-the-art optical microscopy techniques to address questions in biology. We will present basic concepts on microscopy, which will then be apply in various laboratory exercises using equipment available in the Micro and Nano Imaging Facility. By the end of the course, students will be familiarized with all the instruments in the imaging facility and have gained an appreciation for optical microscopy.

### 2. Instructors and Office Hours

Jerome Mertz:	Friday 4:00 pm – 5:00 pm	LSEB 202
Anderson Chen:	Monday 10:00 am – 11:00 am	LSEB 252

### 3. Course Hours

Lectures:	Monday and Wednesday 12:20-1:10 pm	STH B20
Labs:	Wednesday 2:30-5:15pm	ERA B11 & ERB B06
	Thursday 3:30-6:15pm	ERA B11 & ERB B06

**Attendance to lab and lecture is mandatory. Labs will start with a short lecture in ERA B11 and then move to ERB B06.**

### 4. Expectations and Grading Breakdown

Class participation (10%):

Lectures and lab handouts will be posted on Blackboard. You are required to read the lectures and lab handouts prior to the start of each. This way you will be able to constructively participate in class/lab discussions. Your active participation will help us assess your understanding of the class material.

Midterm Exam (25%):

There will be only one exam administered during the course. Please refer to the course calendar for the scheduled dates.

Lab Reports (40%):

Lab reports are due prior to the start of the following lab session. Any late lab reports will not be accepted. *Extensions will not be granted unless you can prove serious extenuating circumstances.*

Reports should be written in the form of a very short paper (3-4 pages without figures) for someone who is an expert in the field. You are expected to demonstrate critical analysis and

presentation. For example, think about the best way to present your data. Is a log plot a better way to present a trend? Should a plot that looks nonlinear be fit by a line? If you are expecting a line but your plot looks nonlinear, provide possible explanations, etc..

Though you will be working in teams on the labs, each student must write their own final report. That is, you can share data with your teammates, but the final reports must be written **in your own words**. Failure to do this could constitute plagiarism and will be considered cheating in this class. For information on BU's Academic Conduct Code, with examples, may be found at: <http://www.bu.edu/academics/policies/academic-conduct-code> .

The recommended format for the lab reports is: Introduction, Results and Discussion, and Summary. Discussion points introduced from outside the lab should be referenced. Please list your teammates at the top of your lab reports.

#### Final Project (25%):

Students are required to identify a paper specifically involving optical microscopy and present a 25-30 minute presentation on this paper. Your powerpoint presentation is required. Please refer to the syllabus for scheduling details. *Extensions will not be granted unless you can prove serious illness or other emergency.*

Final grades will be curved.

## 5. Other Resources

Items marked with an asterisk are mandatory course material that the student should review prior to starting the course.

- \*Course documents

- <http://learn.bu.edu>

- \*Microscopes – Basics and Beyond

- <https://micro.magnet.fsu.edu/primer/pdfs/basicsandbeyond.pdf>

- \*FIJI software (requires JAVA)

- <https://fiji.sc>

Youtube online iBiology Microscopy Course

<https://www.youtube.com/playlist?list=PLQFc-Dxlf4pSHREZvz41xHFSEp65iNkBL>

## 6. Course Schedule

Month	Date	Day	Week	Content
September	7	Wed	1	Intro/Basics –Part 1
	7/8	Wed/Thu		ImageJ/Fiji Tutorial
	12	Mon	2	Basics - Part 2
	14	Wed		Cameras and noise
	14/15	Wed/Thu		Lab 1 – Cameras, SNR
	19	Mon	3	Phase
	21	Wed		DIC
	21/22	Wed/Thu		Lab 2 – Phase/DIC
	26	Mon	4	Fluorescence basics
	28	Wed		Fluorescence lifetimes
	28/29	Wed/Thu		Lab 3 - Spectral Crosstalk and Unmixing
October	3	Mon	5	Photobleaching
	5	Wed		Correlation
	5/6	Wed/Thu		Lab 4 - Photobleaching
	11	Tue	6	FRET
	12	Wed		TIRF
	12/13	Wed/Thu		No Lab
	17	Mon	7	Light sheet
	19	Wed		Review
	19/20	Wed/Thu		Exam
	24	Mon	8	OCT
	26	Wed		Confocal
	26/27	Wed/Thu		Lab 5/6 – OCT/Confocal
November	31	Mon	9	Multiphoton
	2	Wed		Calcium sensing
	2/3	Wed/Thu		Lab 5/6/7 –OCT/Confocal/Multiphoton
	7	Mon	10	Non-fluorescence microscopes
	9	Wed		Optogenetics
	9/10	Wed/Thu		Lab 6/7 – Confocal/Multiphoton
	14	Mon	11	Superresolution I
	16	Wed		Superresolution II
	16/17	Wed/Thu		No lab
	21	Mon	12	Where is microscopy going?
	23	Wed		Thanksgiving recess



	<b>24</b>	<b>Thu</b>		<b>Thanksgiving recess</b>
	28	Mon	13	Student presentations
	30	Wed		Student presentations
<b>December</b>	<b>30/1</b>	<b>Wed/Thu</b>		<b>Student presentations</b>
	5	Mon	14	Student presentations
	7	Wed		Student presentations
	<b>7/8</b>	<b>Wed/Thu</b>		<b>Student presentations</b>

Items marked in red are university holidays.

Items marked in bold are lab sessions.