



Course Syllabus: Foundations in Bioimaging - B 316

Division	Biological and Environmental Sciences & Engineering Division
Course Number	B 316
Course Title	Foundations in Bioimaging
Academic Semester	Spring
Academic Year	2017/2018
Semester Start Date	01/28/2018
Semester End Date	05/24/2018
Class Schedule (Days & Time)	04:00 PM - 05:30 PM Sun Thu

Instructor(s)				
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Teaching Assistant(s)	
Name	Email

Course Information	
Comprehensive Course Description	The course covers basic optics and spectroscopy, optical microscopy techniques, advanced fluorescence microscopy, and single-molecule imaging techniques. The course also introduces label-free optical imaging methods including Raman and infrared microscopy, and holographic microscopy. Introduction to advanced methods for manipulation of single cells and single molecules (optical and magnetic tweezers), correlative light and transmission/scanning electron microscopy (TEM and SEM) an <i>in situ</i> liquid TEM will be also provided. Students also present an assigned paper that is related to imaging/microscopy.
Course Description from Program Guide	This course provides a comprehensive overview of bioimaging techniques including fundamental concepts and applications, which allow biology students to design imaging experiments for their own research. The course covers basic optics and spectroscopy, optical microscopy techniques, advanced fluorescence microscopy, and single-molecule imaging techniques. The course also introduces label-free optical imaging methods including Raman and infrared microscopy, and holographic microscopy. Introduction to advanced methods for manipulation of single cells and single molecules (optical and magnetic tweezers), and correlative light and electron microscopy (CLEM) will be also provided, together with some concept about the newest in-situ transmission electron microscopy (TEM) for biological applications
Goals and Objectives	This course provides a comprehensive overview of advanced bioimaging techniques including fundamental concepts and applications, which allow biology students to design imaging experiments for their own research.
Required Knowledge	No prerequisite.

Reference Texts	Principles of fluorescence spectroscopy (J. R. Lakowicz), Handbook of fluorescence spectroscopy and imaging (M. Sauer, J. Hofkens, J. Enderlein), Single particle tracking and single molecule energy transfer (C. Brauchle, D.C. Lamb, J. Michaelis Eds.), Optics (E. Hecht), Single molecule spectroscopy in chemistry, physics, and biology (A. Gräslund, R. Rigler, J. Widengren), Infrared and Raman Spectroscopic Imaging (R. Salzer, H. W. Siesler Eds.)
Method of evaluation	30.00% - Final exam 30.00% - Presentation 30.00% - Midterm exam 10.00% - Attendance and Participation
Nature of the assignments	paper presentation
Course Policies	In accordance with the University policy and professional standards, the highest levels of academic integrity are expected in this class. The code of student conduct is strictly enforced. Academic dishonesty will result in reductions in grades and/or expulsions from this class and/or the University.
Additional Information	

Tentative Course Schedule

(Time, topic/emphasis & resources)

Week	Lectures	Topic
1	Sun 01/28/2018 Thu 02/01/2018	Fundamentals of Light Absorption and Fluorescence / Fundamentals of Optics
2	Sun 02/04/2018 Thu 02/08/2018	Optical Microscopy Techniques / Fluorescence Microscopy
3	Sun 02/11/2018 Thu 02/15/2018	Fluorescent Protein Technologies / Fluorophores and Labeling
4	Sun 02/18/2018 Thu 02/22/2018	Fluorescence Correlation Spectroscopy / Single-Molecule Tracking
5	Sun 02/25/2018 Thu 03/01/2018	Super-Resolution Fluorescence Microscopy / Midterm Exam
6	Sun 03/04/2018 Thu 03/08/2018	Vibrational microspectroscopy (Raman Microscopy)
7	Sun 03/11/2018 Thu 03/15/2018	Hands-on experiment (Raman Microscopy) / Vibrational microspectroscopy (IR Microscopy)
8	Sun 03/18/2018 Thu 03/22/2018	Vibrational microspectroscopy (IR Microscopy) / Plasmonics
9	Sun 03/25/2018 Thu 03/29/2018	Optical Tweezers / Electron Microscopy for Bioscience Researches
10	Sun 04/01/2018 Thu 04/05/2018	Spring break
11	Sun 04/08/2018 Thu 04/12/2018	Correlative Light and Electron Microscopy (CLEM) / <i>In-situ</i> Electron Microscopy (<i>In-situ</i> CLEM and TEM imaging of liquid specimens)
12	Sun 04/15/2018 Thu 04/19/2018	Digital Holographic Microscopy / Presentation
13	Sun 04/22/2018 Thu 04/26/2018	Presentations
14	Sun 04/29/2018 Thu 05/03/2018	Presentations
15	Sun 05/06/2018 Thu 05/10/2018	Presentations
16	Sun 05/13/2018 Thu 05/17/2018	Presentations
17	Sun 05/20/2018 Thu 05/24/2018	Presentations
18		Final Exam

Note

The instructor reserves the right to make changes to this syllabus as necessary.