Fluorescence and Electron Microscopy: Imaging Cells and Molecules
GS04 1051 - 100 (7704); Mondays, 1-2pm (lectures*), 2-4pm (labs)

Course Directors:

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TAs:

Kara Schoenemann/Davi Goncalves(FM)
Xiangan Liu(EM)

Week 1 (1/06/2020)

Lecture: Principles of Light Microscopy, MSB 1.180 — **Morano**

- Optics (physics and practice)
- Introduction to microscopy: brightfield, darkfield, DIC, fluorescence

Week 2 (1/13/20)

Lecture: Hardware and Equipment, MSB 1.180 — **Morano**

- Understanding objectives, mirrors, lightpaths
- Widefield, confocal, spinning disk
- Cameras
- Automation and computer control

Lab: Preparation of samples and light microscopy, MSB 1.022 — **Morano and Margolin**

MLK Holiday (1/20/20)

Week 3 (1/27/20)

Lecture: Whole Cell Imaging, MSB 1.180 — **Margolin**

- Live cell imaging with fluorescent proteins and stains
- Longitudinal imaging: media support and microfluidics
- Fixed cell imaging: stains, indirect immunofluorescence

Lab: Live cell imaging, time-lapse imaging, & Immunofluorescence, MSB 1.022 — **Morano and Margolin**

Week 4 (2/03/20)

Lecture: New Technologies, MSB 1.180 **Margolin**

- FRET, two-photon, TIRF
- Single molecule and super-resolution methods (SIM, PALM, STORM, STED)

Lab: Super-resolution fluorescence microscopy, MSB 4.202 **Levental, Margolin**

Week 5 (2/10/20)

Lecture: Image Post-Processing, MSB 1.180 **Margolin**

- Deconvolution techniques and principles
- Kymographs, time-lapse and overlays
- Data analysis, quantitation, and management

Presidents' Day (2/17/20)

Week 6 (2/24/20)

Lecture: Introduction to Electron Microscopy, MSB 1.180 **Tsai**

- Transmission electron microscopy (TEM)
- Sample preparation and staining

Lab: Operational principles of TEM, MSB 2.221M **Tsai**

Week 7 (3/02/20)

Lab: Specimen Preparation for TEM, MSB 1.022 **Tsai**

Immuno-gold labeling of biological samples and negative staining

Week 8 (3/9/20)

Lab: TEM – Operation and Data Collection, MSB 2.221M **Tsai**

Operating a transmission electron microscope and data collecting using previously prepared samples

Spring Break (3/16 – 3/20/20)

Week 9 (3/23/20)

Lecture: Cryo-electron microscopy, MSB 1.180 **Hu**

- Cryo-electron microscopy (cryo-EM)
- Cryo-electron tomography (cryo-ET)

Lab: Preparation of biological samples for cryo-EM, MSB G.606 **Hu**

Week 10 (3/30/20)

Lecture: Cryo-EM – Operation and Data Collection, MSB 1.180 **Hu**

Operating a cryo-electron microscope and data collecting using previously prepared samples

Lab: Cryo-EM – Operation and Data Collection, MSB G.606 **Hu**

Week 11 (4/06/20)

Lecture: Cryo-EM – Image Processing, MSB 1.180 **Hu**

Basic image analysis: from 2D images to 3D reconstruction

Lab: Cryo-EM – Image Processing, MSB 1.180 **Hu**

Week 12 (4/13/20)

Lecture* (2 hours): Electron Cryomicroscopy, MSB 1.180 **Serysheva**

Vitrification of Biological Samples

Lab: Specimen preparation for cryo-EM, MSB 6.630 **Serysheva**

Grading **Pass/Fail**

The total grade is based on attendance (20%), lab participation (50%), and three assignments (10% each).

Assignments: Students will write Materials & Methods and Results Sections accompanied with a publishable multi-panel figure and a figure legend corresponding to data obtained from each section, i.e. fluorescence microscopy (Margolin and Morano), electron microcopy (Tsai), and cryo-EM (Hu and Serysheva).

Reading Materials

Students are encouraged to read reading materials, provided by instructors, before class.

Assignment Due Dates: pdf documents sent to Bo.Hu@uth.tmc.edu on the due dates (see below)

2/24/20 Assignment 1

3/23/20 Assignment 2

5/06/20 Assignment 3