[1]Biol.390.00/770.06
Microscopy and Image Analysis of Fine Cell Structure

Biological Sciences Department, Hunter College Wed: 11:10-12:50pm; Thurs: 12:10-5:15pm

Fall 2020

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Wk #, Date (W/Th)	***Lecture Topics*** **and Laboratory Techniques**
(1) Aug. *26/27*	*Introduction to Imaging and Biological Image Processing and Analysis* Introduction to image analysis software: ImageJ/FIJI, Icy and Imaris
(2) Sept. *2/3*	*Introduction to microscope components; PMTs vs. Cameras* Introduction to ImageJ: Importing images and menu tab tutorial
(3) Sept. *9/10*	*Andor Webinar: "History of Microscopy"* *Image properties* ImageJ: Single channel image processing
(4) Sept *16/17*	*Principles of transmitted light and fluorescence microscopy* ImageJ: Multi-channel and multi-dimension image processing
(5) Sept *23/24*	*Andor Webinar: "Transmitted light microscopy"* *Laser scanning and spinning disk confocal microscopy: Theory & applications* ImageJ: Plug-Ins; Assignment #1
(6) Oct. *30/1*	*Multispectral and FRET imaging: Theory & applications* Intro to Icy
(7) Oct. *7/8*	*Andor Webinar: "Fundamentals of Digital Imaging and Sensor Technologies"* *Live cell imaging; FRAP, FLIM: Theory& applications* Icy: Volume tracking of live cell imaging data sets;
(8) Oct. -/15	Intro to Imaris
(9) Oct. *21/22*	*MIDTERM EXAM* Imaris: Single channel image processing; Assignment #2
(10) Oct.*28/29*	*Multiphoton, TIRF microscopy:* Imaris: Multichannel and multi-dimension image processing
(11) Nov. *4/5*	*Journal article discussion* Imaris; Selection of term project.
(12) Nov. *11/12*	*Superresolution microscopy: SIM/PALM/STORM: Theory & applications* Imaris
(13) Nov. *18/19*	*Open topic* Comparison of Image Processing Software; Assignment #3
(14) Nov. ~~*25/26*~~	*No CLASS*/No LAB

[1] Updated August 25th, 2020

(15) Dec. 2/3 *Review of Theory*
Review of Software learned

(16) Dec. 9/- *FINAL EXAM*

(17) Dec. 16/17 Oral Presentations. Written Term Project Due

Method of Evaluation:

Grading is based on three laboratory assignments (10% each), two written exams (midterm and final - 20% each), term project written report (20%) and oral presentation (10%). Participation is **mandatory** — no exceptions (grade of IN if absent without legitimate excuse).

Learning Objectives:

- The students will learn about imaging various cellular structures using a range of illumination techniques: light, fluorescence, and laser scanning and spinning disc confocal microscopy and how to perform post-acquisition processing and analysis of image data. They will be expected to prepare publication-quality image figures.
- Lab assignments involve processing of raw data images acquired via transmitted light contrast techniques (DIC, Phase contrast), epifluorescence or laser-based advanced microscopy of various tissues (fix preparation methods or live cells). Three software analysis packages will be accessible for use remotely or on campus (at terminals in the Bioimaging Facility at Hunter College).
- The student is given the choice to design a final project that will reveal the localization and expression patterns of specific target molecules as well as fluorescent staining of subcellular organelles: ER, Golgi complex, mitochondria.

Required Readings & Video viewing:

* Nikon's Microscopy website: "The source of microscopy education"
  http://microscopyu.com
* iBiology Courses
  https://www.ibiology.org/online-biology-courses/microscopy-series/
  https://www.ibiology.org/online-biology-courses/bioimage-analysis-course/

Recommended Readings:

* Spector DL and Goldman RD, "Basic Methods in Microscopy" (2006)
  Protocols and Concepts from Cells: A Laboratory Manual, CSHL Press
* Stephens D "Cell Imaging" (2006) Methods Express
* Numerous journal articles which describe/discuss advances in the techniques taught.

Recording of Remote Classes: Students who participate in this class with their camera on or use a profile image are agreeing to have their video or image recorded solely for the purpose of creating a record for students enrolled in the class to refer to, including those enrolled students who are unable to attend live. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live.

Expectations for Cameras: Please be aware that the instructors in this course will require that the camera and audio be on during class sessions.

Online courses are subject to the same CUNY policies as are in-person courses regarding academic integrity, the acceptable use of computer resources, equal opportunity and non-discrimination, sexual misconduct, workplace violence, domestic violence, and reasonable accommodations for persons with disabilities.

Academic Integrity: "Hunter College regards acts of academic dishonesty (e.g., plagiarism, cheating on examinations, obtaining unfair advantage, and falsification of records and official documents) as serious offenses against the values of intellectual honesty. The College is committed to enforcing the CUNY Policy on Academic Integrity and will pursue cases of academic dishonesty according to the Hunter College Academic Integrity Procedures."

CUNY Academic Integrity Policy:

https://www.cuny.edu/about/administration/offices/legal-affairs/policies-procedures/academic-integrity-policy/

ADA Statement: "In compliance with the ADA and with Section 504 of the Rehabilitation Act, Hunter College is committed to ensuring educational access and accommodations for all its registered students. Hunter College's students with disabilities and medical conditions are encouraged to register with the Office of AccessABILITY for assistance and accommodation. For information and appointment contact the Office of AccessABILITY located in Room E1214 or call (212) 772-4857 /or VRS (646) 755-3129."

Hunter College Policy on Sexual Misconduct: "In compliance with the CUNY Policy on Sexual Misconduct, Hunter College reaffirms the prohibition of any sexual misconduct, which includes sexual violence, sexual harassment, and gender-based harassment retaliation against students, employees, or visitors, as well as certain intimate relationships. Students who have experienced any form of sexual violence on or off campus (including CUNY-sponsored trips and events) are entitled to the rights outlined in the Bill of Rights for Hunter College.

a. Sexual Violence: Students are strongly encouraged to immediately report the incident by calling 911, contacting NYPD Special Victims Division Hotline (646-610-7272) or their local police precinct, or contacting the College's Public Safety Office (212-772-4444).

b. All Other Forms of Sexual Misconduct: Students are also encouraged to contact the College's Title IX Campus Coordinator, Dean John Rose (jtrose@hunter.cuny.edu or 212-650-3262) or Colleen Barry (colleen.barry@hunter.cuny.edu or 212-772-4534) and seek complimentary services through the Counseling and Wellness Services Office, Hunter East 1123.

CUNY Policy on Sexual Misconduct Link: http://www.cuny.edu/about/administration/offices/la/Policy-on-Sexual-Misconduct-12-1-14-with-links.pdf"

CUNY Policy on Acceptable Use of Computer Resources: https://www.cuny.edu/wp-content/uploads/sites/4/page-assets/about/administration/offices/cis/it-policies/ComputerUsePolicy1.pdf

CUNY Policy on Acceptable Use of University Data in the Cloud:

https://www.cuny.edu/wp-content/uploads/sites/4/page-assets/about/administration/offices/cis/information-security/security-policies-procedures/Acceptable-Use-of-University-Data-in-the-Cloud-2019-8-19a.pdf (and related Data Classification Standard: https://www.cuny.edu/wp- content/uploads/sites/4/page-assets/about/administration/offices/cis/information-security/security-policies-procedures/Data-Classification-Standard-CUNY-2019-8-19a.pdf)

CUNY Intellectual Property Policy: https://www.cuny.edu/wp- content/uploads/sites/4/page-assets/about/administration/offices/legal- affairs/policies-procedures/Intellectual-Property-Policy.pdf

CUNY information on copyright:

https://www.cuny.edu/about/administration/offices/legal-affairs/intellectual-property/copyright-materials/

CUNY Equal Opportunity and Non-Discrimination Policy:

https://www.cuny.edu/about/administration/offices/legal-affairs/policies- procedures/equal-opportunity-and-non-discrimination-policy/