

01:146:350 Introduction to Light Microscopy for the Life Sciences Spring 2025

COURSE INSTRUCTOR AND CONTACT INFORMATION

Course Director: Prof. Zainab Tanvir (zainab.tanvir@rutgers.edu)

Guest lecturers TBD

Semester Offered: Fall 2026 (first 7 weeks 9/1-10/20)

Mon at 10:20 AM -11:30 AM, Tues 3:50 PM - 6:50 PM

Credits: 1

A) COURSE MEETING DAYS, TIMES, LOCATION, MODALITY

Classes will meet in person twice a week for 7 weeks (Sept 2-Oct 20 2025).

The course is divided into weekly 80-minute lectures and weekly 3-hour labs. Attendance is required for both.

Lectures will be held in Nelson Laboratories room B130.

We will meet in the same room for lab and walk over to Nelson C105 together.

STUDENT SUPPORT HOUR

Monday from 12:00 PM to 1:00 PM

B) COURSE DESCRIPTION

This course is offered each Spring semester, and is intended primarily for life science majors. It counts as Lab credit. Other students with background knowledge in Cell biology may also take this course.

Prerequisites: Fundamentals of Cell and Developmental Biology (01:146:270) or Essentials of Cell Biology and Neuroscience (01:146:295) or equivalent courses.

This course offers a comprehensive exploration of advanced imaging techniques essential for studying tissues, cells, and organelles in the life sciences. Through a blend of lectures and hands-on laboratory sessions, students will be introduced to a diverse array of methodologies, enabling them to investigate biological structures across various scales, ranging from molecules to organisms. The course will cover a spectrum

of imaging modalities, including conventional light microscopy, fluorescent microscopy, cutting-edge high-resolution light microscopy, and image analysis modalities.

C) REQUIRED TEXTS AND COURSE MATERIALS

The course material will consist of lecture slides, assigned reading materials and supplemental videos illustrating key concepts.

The material will be provided on Canvas.

E) TECHNICAL / TECHNOLOGY REQUIREMENTS

Required Materials: Each student should have access to a high-speed internet connection and a laptop to access Canvas and complete assignments.

F) LEARNING GOALS

Course Learning Goals

Learning Goals: The learning goals of this class include:

1. **Understanding Optical Principles:** Students should grasp the basic optical principles underlying light microscopy, including concepts such as refraction, reflection, magnification, and resolution.
2. **Mastering Microscopy Techniques:** Students should acquire proficiency in using light microscopes, including handling and adjusting various components of the microscope to optimize image quality.
3. **Sample Preparation Skills:** Students should learn techniques for preparing samples for microscopy, including fixation, staining, and mounting, ensuring samples are adequately prepared for observation.
4. **Interpretation of Microscopic Images:** Students should develop the ability to interpret images obtained through light microscopy, including identifying cellular structures, analyzing spatial relationships, and understanding the implications of observed phenomena.

5. Critical Thinking and Problem-Solving: Students should cultivate critical thinking skills and the ability to troubleshoot common issues encountered during microscopy experiments, such as suboptimal sample preparation or image artifacts.

6. Experimental Design and Optimization: Students should learn to design experiments involving light microscopy effectively, considering factors such as sample type, staining methods, and microscope settings to achieve reliable and meaningful results.

7. Data Analysis and Presentation: Students should be able to analyze data obtained from microscopy experiments, employ appropriate image analysis tools and software, and effectively present their findings through visual representations and written reports.

By achieving these learning goals, students can develop a strong foundation in light microscopy that prepares them for further studies or careers in fields such as biology, biomedical sciences, materials science, and beyond.

ASSESSMENT / GRADING COMPONENTS

Throughout the duration of this course, students will be tasked with completing weekly lab reports, totaling five reports in all. These reports will serve as a comprehensive record of the microscopic techniques discussed in class. Additionally, as a culmination of the course, students will prepare and submit a virtual poster and present it during the final week. This poster will focus on a specific microscopic technique, providing an in-depth exploration of its principles, applications, and advantages. Through these assignments, students will not only engage with hands-on laboratory work but also develop the ability to effectively communicate scientific concepts and findings.

WEIGHTING OF ASSESSMENTS

Each lab report will carry significant weight in the overall evaluation, accounting for 15% of the final grade. The poster, due during the last week of class will constitute 20% of the final grade. The last 5% to the final grade will be in class participation. Through consistent engagement and thoughtful contributions, students can demonstrate their comprehension of course materials and enhance their overall performance.

Lab reports (5x 15%) =	75%
Poster =	20%
Class participation =	5%
TOTAL =	100%

Grading scale: A >90, B+ >87, B >80, C+ >77, C >70, D >60, F <59

Rubrics for lab reports, poster presentations and attendance grading can be found here:

[Imaging Course Documents](#)

G) STUDENT SUPPORT AND MENTAL WELLNESS

Technology Challenges

Please visit the Rutgers Student Tech Guide page for resources available to all students. If you do not have the appropriate technology for financial reasons, please email the Dean of Students at deanofstudents@echo.rutgers.edu or contact the Dean of Students – Student Support Office: <https://success.rutgers.edu/resource/dean-students-student-support-office>

Disability Services

Lucy Stone Hall, Suite A145, Livingston Campus, 54 Joyce Kilmer Avenue, Piscataway, NJ 08854, Phone: (848) 445-6800
<https://ods.rutgers.edu/>

Rutgers University welcomes students with disabilities into all of the University's educational programs. To receive consideration for reasonable accommodations, a student with a disability must contact the appropriate disability services office where they are officially enrolled, participate in an intake interview, and provide documentation: <https://ods.rutgers.edu/students/documentation-guidelines>. If the documentation supports your request for reasonable accommodations, your campus's disability services office will provide you with a Letter of Accommodation. Please share this letter with your instructors and discuss the accommodations with them as early in your courses as possible. To begin this process, please complete the Registration form on the ODS website at: <https://webapps.rutgers.edu/student-ods/forms/registration>.

Other Links for Student Support and Mental Wellness

- Student Success Essentials: <https://success.rutgers.edu>
- Student Support Services: <https://www.rutgers.edu/academics/student-support>
- The Learning Centers: <https://rlc.rutgers.edu/>
- Rutgers Libraries: <https://www.libraries.rutgers.edu/>
- Bias Incident Reporting: <https://studentaffairs.rutgers.edu/bias-incident-reporting>
- Office of Veteran and Military Programs and Services: <https://veterans.rutgers.edu>
- Student Health Services: <http://health.rutgers.edu/>

- Counseling, Alcohol and Other Drug Assistance Program & Psychiatric Services (CAPS): <http://health.rutgers.edu/medical-counseling-services/counseling/>
- UWill: free immediate access to teletherapy; you can choose a therapist based on your preferences including issue, gender, language, ethnicity.
<http://health.rutgers.edu/uwill/>
- Office for Violence Prevention and Victim Assistance: vpva.rutgers.edu/
- Basic Needs Assistance (food, housing, and other essentials): <https://ruoffcampus.rutgers.edu/basic-needs>
- Rutgers Student Food Pantry: <https://ruoffcampus.rutgers.edu/food-pantry>

SCHEDULE OF TOPICS (SPRING 2024)

Date	Lecture Topic	Readings (on Canvas)	Assignments Due
9/1	Syllabus review, introduction to microscopy, physics of light	<u>Physics of Light and Optics, Ch 1-3, 9, 10 (Peatross&Ware)</u>	None
9/7	Sample illumination, contrast-enhancing techniques	<u>Comparing different Microscopy Techniques</u> Youtube/ Microbehunter	None
9/14	Fluorescent microscopy and sample preparations	A quick guide to light microscopy in cell biology (Kurt Thorn)	Lab report 1
9/21	Confocal microscopy	<u>Confocal Microscopy: Principals and Modern Practices</u> Elliot, 2019	Lab report 2
9/28	Super-resolution microscopy	<u>Tillberg et al., 2016</u> <u>Galbraith and Galbraith, 2011</u>	Lab report 3
10/5	Advanced and specialized microscopy	<u>Huisken et al., 2004</u> <u>Carisey et al., 2011</u> <u>Oheim et al., 2006</u>	Lab report 4
10/12	Non-microscopic biological imaging techniques	TBD	Lab report 5
10/19	Poster Presentations continued	None	Posters

Week	Lab Topic	Lab Activity
9/1	Introduction to Light Microscopy	Build a leeukenhoek microscope and/or foldscope and take pictures using hand held cellular devices
9/8	Sample Illumination Techniques	Use widefield microscopy, DIC/Phase contrast, epifluorescence, and polarized light to illuminate tissue on premade slides
9/15	Fluorescent Microscopy	Fix cells, stain with Phalloidin and MitoTracker Red, prepare slides and use fluorescent widefield microscope to image
9/22	Confocal Microscopy	Image slides prepared last week on confocal microscope to compare resolution to widefield microscopy images.
9/29	Super-resolution Microscopy	Image slides from week 3 on iSIM systems to compare resolution to confocal microscopy images.
10/13	Fluorescence recovery after photobleaching	Use live GFP expressing cells to assay fluorescence recovery after photobleaching
10/20	Poster Presentations	Students will present their posters

On 10/6 you will be required to complete a virtual lab on STED Microscopy

POLICIES

Attendance

In-person attendance is required for the lecture and lab components of the course.

Lab sections: there is one laboratory section (3 hours) per week. Attendance to lab is **mandatory** and the 3-h period will give the opportunity to practice hands-on skills and finalize team activities during class time to ensure all team members are present and collaborating to conclude activities.

Three (3) unexcused absences will constitute an automatic failing grade for the course.

If you are unable to attend class, we urge you to report absences using the University self-reporting absence system: <https://sims.rutgers.edu/ssra/>

Disability Accommodations

Rutgers University welcomes students with disabilities into all of the University's educational programs. In order to receive consideration for reasonable

accommodations, a student with a disability must contact the appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentation:

<https://ods.rutgers.edu/students/documentation-guidelines>.

If the documentation supports your request for reasonable accommodations, your campus disability services office will provide you with a Letter of Accommodations. Please share this letter with your instructors and discuss the accommodations with them as early in your courses as possible. To begin this process, please complete the Registration form on the ODS web site at: <https://ods.rutgers.edu/students/registration-form>.

Students are solely responsible for contacting the Office of Disability Services (ODS), register for accommodations and consult the policies and procedures of the Office of Disability Services website: <https://ods.rutgers.edu>.

Disability Services Phone: (848) 445-6800

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ACADEMIC INTEGRITY POLICY

Rutgers University takes academic dishonesty very seriously. By enrolling in this course, you assume responsibility for familiarizing yourself with the Academic Integrity Policy and the possible penalties (including suspension and expulsion) for violating the policy. Per the policy, all suspected violations will be reported to the Office of Student Conduct. Academic dishonesty includes (but is not limited to):

- Cheating
- Plagiarism
- Aiding others in committing a violation or allowing others to use your work
- Failure to cite sources correctly
- Fabrication
- Using another person's ideas or words without attribution, including re-using a previous assignment, unauthorized collaboration
- Sabotaging another student's work

If you are ever in doubt, consult your instructor. These policies align with the University's Academic Integrity policies: <http://nbacademicintegrity.rutgers.edu/>

STUDENT SUPPORT AND MENTAL WELLNESS

If you have prolonged health and/or financial issues that impact your academics and well-being over an extended period, please get in touch with the Dean of Students at deanofstudents@echo.rutgers.edu.

The Dean of Students may provide the instructor with a letter requesting flexibility and explain the concerns about students in crisis or extended difficulties.

- Student Success Essentials: <https://success.rutgers.edu>
- Student Support Services: <https://www.rutgers.edu/academics/student-support>
- The Learning Centers: <https://rlc.rutgers.edu/>
- The Writing Centers (including Tutoring and Writing Coaching): <https://writingctr.rutgers.edu>
- Rutgers Libraries: <https://www.libraries.rutgers.edu/>
- Office of Veteran and Military Programs and Services: <https://veterans.rutgers.edu>
- Student Health Services: <http://health.rutgers.edu/>
- Counseling, Alcohol and Other Drug Assistance Program & Psychiatric Services (CAPS): <http://health.rutgers.edu/medical-counseling-services/counseling/>
- Office for Violence Prevention and Victim Assistance: www.vpva.rutgers.edu/