

MCBA 742
Biological Microscopic Imaging II
Spring 2025

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Description

Electron microscopy. Through the combination of lecture and laboratory learning, students will leave this class understanding the scientific principles underlying the techniques as well as hands-on training for transmission electron and scanning electron microscopy sample preparation and imaging.

Prerequisites

There is no prerequisites for this course.

Learning Outcomes

After successful completion of this course, you will be able to:

1. process sample tissue, including fixing, sectioning, and staining for EM.
2. image samples on a TEM.
3. image samples on a SEM.
4. use basic image analysis software.

Required Texts

All required course materials and laboratory manuals will be provided on the first day of class.

Course Assignments and Grading

Laboratory Reports

Students will be expected to submit a total of 2 laboratory reports during the semester. The first topic will be based on transmission electron microscopy, due around the middle of the semester. The second topic will be based on scanning electron microscopy, due at the end of the semester.

Evaluation and Grading Scale

All graded materials will be promptly graded and returned. All grades will be posted on Blackboard. You are strongly encouraged to check your scores in Blackboard regularly. A final letter grade will be assigned based on percentages.

Assignment Weights	Percent
Lab Participation	26%
Light Microscopy Report	37%
Confocal Microscopy Report	37%
Total	100%

Lab Participation (14 labs @ 10 points) = 140 points

TEM Report = 200 points

SEM Report = 200 points

Total Points - 540 points

Grading Scale

89.5% - 100% = A

84.5% - 89.4% = B+

79.5% - 84.4% = B

74.5% - 79.4% = C+

69.5% - 74.4% = C

64.5% - 69.4% = D+

59.5% - 64.4% = D

0% - 59.4% = F

Course Policies and Procedures

All graduate students are subject to the academic policies, regulations, and academic standards of both The Graduate School and the department, school and/or college in which enrolled.

[USC graduate bulletin](https://academicbulletins.sc.edu/graduate/policies-regulations/graduate-academic-regulations) (<https://academicbulletins.sc.edu/graduate/policies-regulations/graduate-academic-regulations>)

Attendance Policy

When you miss class, you miss important information. If you are absent, you are responsible for learning material covered in class. If you have an [excused absence](https://academicbulletins.sc.edu/undergraduate/policies-regulations/undergraduate-academic-regulations) (<https://academicbulletins.sc.edu/undergraduate/policies-regulations/undergraduate-academic-regulations>), you will be permitted to make up coursework or complete an equivalent assignment agreed upon with me.

To arrange excuses for absences that can be anticipated at the start of the term, you should:

- Submit a request in writing (email is acceptable) stating the dates of the anticipated absence no later than the end of the second week of the course.

- Explain the reason for absence. In some cases, documentation may be required. Please [consult the policy](#) (<https://academicbulletins.sc.edu/undergraduate/policies-regulations/undergraduate-academic-regulations>) for additional information.
- Include any request for make-up work.

To arrange excuses for absences that cannot be anticipated at the start of the term, (e.g. legal proceedings or illness), you should, at the first opportunity, submit in writing a request stating:

- The date of absence
- The reason for absence. In some cases, documentation may be required. Please [consult the policy](#) for additional information.
- Any request for make-up work as soon as reasonably possible after you become aware of the need to be absent.

Academic Integrity

As a partner in your learning, it is important to both of us that any assignment submission is a pure reflection of your work and understanding. The introduction of artificial intelligence options to complete academic work jeopardizes my ability to evaluate your understanding of our course content and robs you of the ability to master the subject matter.

Suspensions of use of artificial intelligence aids will be referred to the Office of Academic Integrity as alleged violations of Cheating, defined as “unauthorized assistance in connection with any academic work” and/or Falsification, which includes “Misrepresenting or misleading others with respect to academic work or misrepresenting facts for an academic advantage”.

You are expected to practice the highest possible standards of academic integrity. Any deviation from this expectation will result in a minimum academic penalty of your failing the assignment, and will result in additional disciplinary measures. This includes improper citation of sources, using another student's work, and any other form of academic misrepresentation.

The first tenet of the Carolinian Creed is, "I will practice personal and academic integrity."

Below are some websites for you to visit to learn more about University policies:

- [Carolinian Creed](http://www.sa.sc.edu/creed) (<http://www.sa.sc.edu/creed>)
- [Academic Responsibility](http://www.sc.edu/policies/staf625.pdf) (<http://www.sc.edu/policies/staf625.pdf>)
- [Office of Student Conduct and Academic Integrity](https://www.sa.sc.edu/academicintegrity/) (<https://www.sa.sc.edu/academicintegrity/>)

- [Information Security Policy and Standards](https://sc.edu/about/offices_and_divisions/division_of_information_technology/security/policy/universitypolicy/)
(https://sc.edu/about/offices_and_divisions/division_of_information_technology/security/policy/universitypolicy/)

Disability Services

[Student Disability Resource Center](http://www.sa.sc.edu/sds/) (<http://www.sa.sc.edu/sds/>): The Student Disability Resource Center (SDRC) empowers students to manage challenges and limitations imposed by disabilities. Students with disabilities are encouraged to contact me to discuss the logistics of any accommodations needed to fulfill course requirements (within the first week of the semester). In order to receive reasonable accommodations from me, you must be registered with the Student Disability Resource Center (1705 College Street, Close-Hipp Suite 102, Columbia, SC 29208, 803-777-6142). Any student with a documented disability should contact the SDRC to make arrangements for appropriate accommodation.

Mental Health

If stress is impacting you or getting in the way of your ability to do your schoolwork, maintain relationships, eat, sleep, or enjoy yourself, please reach out to any of our mental health resources. Most of these services are offered at no cost as they are covered by the Student Health Services tuition fee. For all available mental health resources, check out [Student Health Services Mental Health](https://www.sc.edu/about/offices_and_divisions/health_services/mental-health/index.php) (https://www.sc.edu/about/offices_and_divisions/health_services/mental-health/index.php) and the quick reference list below.

- Wellness Coaching can help you improve in areas related to emotional and physical wellbeing (e.g., sleep, resiliency, balanced eating and more) – schedule an appointment at (803) 777-6518 or on [MyHealthSpace](https://myhealthspace.ushs.sc.edu/login_dualauthentication.aspx) (https://myhealthspace.ushs.sc.edu/login_dualauthentication.aspx)
- Access virtual self-help modules via [Therapy Assistance Online \(TAO\)](https://us.taoconnect.org/register) (<https://us.taoconnect.org/register>) – see [TAO registration instructions](https://www.sc.edu/about/offices_and_divisions/health_services/medical-services/counseling-and-psychiatry/online-support/index.php) (https://www.sc.edu/about/offices_and_divisions/health_services/medical-services/counseling-and-psychiatry/online-support/index.php).
- Access additional articles and videos on health and wellness topics on the Wellness Hub, thriveatcarolina.com, or by downloading the [CampusWell](https://www.campuswell.com/) (<https://www.campuswell.com/>) app and searching for University of South Carolina.
- Counseling & Psychiatry offers individual and group counseling and psychiatric services – schedule an appointment at (803) 777-5223 or on [MyHealthSpace](https://myhealthspace.ushs.sc.edu/login_dualauthentication.aspx) (https://myhealthspace.ushs.sc.edu/login_dualauthentication.aspx).
- Access the 24-hr Mental Health Support Line at (833) 664-2854.
- Access an anonymous [mental health screening program](https://www.uscscreening.org/welcome.cfm?access=website) (<https://www.uscscreening.org/welcome.cfm?access=website>)

Course Schedule

Week 1: January 8 – January 14

Lecture: TEM Specimen preparation (fixatives, buffers, resins), Tour of EM rooms and equipment

Lab: Processing of tissue (this will require intermittent time for 2 to 3 days).

Week 2: January 15-21

Lecture: No Lecture - MLK Day

Lab: Preparation of glass knives; block trimming, microtome training for thick specimens

January 22 – January 28

Lecture: Specimen prep continued, Ultramicrotomy (thin sectioning) and staining

Lab: Assisted thick and thin sectioning (Session 1)

Note: Thin sectioning is difficult and will take a considerable amount of time and several sessions to master. Plan your lab time accordingly and be patient.

Week 3: January 29 – February 4

Lecture: TEM design: Historical perspective on bio-TEM, vacuum systems, electron guns, electron optics, cameras, Tomography

Lab: Assisted thick and thin sectioning (Session 2)

Week 4: February 5 - February 11

Lecture: TEM design: Historical perspective on bio-TEM, vacuum systems, electron guns, electron optics, cameras, Tomography

Lab: “Independent” use of microtome, Grid staining

Week 5: February 12 - February 18

Lecture: TEM design: Historical perspective on bio-TEM, vacuum systems, electron guns, electron optics, cameras, Tomography

Lab: Continue “independent” sectioning, lead and uranyl acetate staining of sectioned samples; Overview of TEM operation, Basic TEM alignment and focus assignment with holey grids.

Week 6: February 19- February 25

Lecture: TEM design: Historical perspective on bio-TEM, vacuum systems, electron guns, electron optics, cameras, Tomography

Lab: Assisted TEM operation

Week 7: February 26 – March 3

Lecture: Immuno-EM procedures, basic cell ultrastructure, artifacts

Lab: “Independent” use of TEM and imaging of samples.

Week 8: March 4 – March 10

Lecture: Spring Break

Lab: No Labs.

Week 9: March 11 – March 17

Lecture: SEM specimen preparation, SEM design: vacuum systems, electron guns, electron optics, SEM detectors

Lab: SEM specimen prep, Critical point drying and sputter coating

Week 10: March 18– March 24

Lecture: SEM design: vacuum systems, electron guns, electron optics, SEM detectors

Lab: Overview of SEM operation

TEM reports due March 18

Week 11: March 25 – March 31

Lecture: No Lecture

Lab: Assisted SEM operation

Week 12: April 1 –April 7

Lecture: SEM design: vacuum systems, electron guns, electron optics, SEM detectors

Lab: SEM operation

Week 13: April 8 – April 14

Lecture: Volume SEM

Lab: Continue with SEM exercises

Week 14: April 15 – April 21

Lecture: Electron Microscopy Quiz Bowl

Lab: Finish SEM exercises

SEM Reports Due April 26