

Biology 350/550
Electron Microscopy
Course Description and Syllabus
Fall 2011

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Office Hours:

I am happy to meet with you anytime that I am free, and I will make every effort to be available. I encourage you to make appointments, as it ensures that I will be available. It is easiest to communicate with me via e-mail, as I move around the building constantly during the day, so if you try to get me by phone, we will end up playing phone tag.

Course Description

Electron Microscopy is a comprehensive course on the bare essential of specimen preparation, with the main focus being on microscope operation and the production of excellent micrographs/photographic plates from both the Transmission Electron Microscope (TEM) and the Scanning Electron Microscope (SEM). Both the theory and practice(s) of Electron Microscopy will be covered over the course of the semester during lecture and lab periods. In a nutshell, you will learn about the principles of electron microscopy in lecture and apply them during lab.

Course Objectives

By the end of this semester, you should possess the following skills/knowledge:

1. Ability to operate both the TEM and SEM at a level I deem appropriate.
2. Basic knowledge of the design and mechanics of scope operation for both microscopes.
3. Ability to convert raw data collected from scopes (negatives or digital images) into a publishable form via imaging software.
4. Basic knowledge of some of the specimen preparation steps involved in preparing specimens for both the TEM and SEM. We will not have time for you to practice the steps, as it is too time consuming. Most will be by demonstration only. You will be free to prepare specimens for the SEM and TEM if you wish to do so.

Liberal Education

How does this course fit into your overall liberal education experience at UW Oshkosh? First and foremost, Electron Microscopy is not something that can be mastered in one semester. What I will provide is an understanding of EM that will allow you to adapt protocols and procedures to new situations in the future. Your critical thinking skills, identified as an important learning outcome, will be developed in the process. Your writing skills and your ability to synthesize information will be honed during the two lecture exams, which will be essay in format.

Course Materials

All lectures will be via Powerpoint. The handouts of figures that I will refer to during selected lectures will be posted on D2L, as well as any information you need for lab. There is no assigned textbook, but feel free to check out books from the fairly extensive EM library if you want more information about a topic.

The Laboratory: What will happen in lab? Below I have given you an outline of the topic to be covered in lab each week. During lab, I will use a combination of lecture and demonstration to show you a technique. Once I am finished with the demo, we will then devote the remainder of the lab time to practicing the technique(s), with myself present to guide you along. I must stress here that attending lab is critical to success in the course. In extreme circumstances, I may be willing to let you make up a missed lab, but if it does not involve a serious illness, accident, or family emergency, you will be out of luck and have to rely on the help of your classmates. Note that you will attend either the Tuesday or Thursday section of the lab but **not both**. Both sections will be covering the same topics at the same time. If you need to attend a different section for just one session due to a conflict please let me know.

Cooperation: During the course of the lab sessions and other times, you will be working very closely with the other members of the class. I encourage you to help each other out when it comes of mastering the techniques, as this is a great way of learning them yourself. What I do not want, however, are group efforts when it comes to producing negatives and prints. Feel free to give pointers, but each of you have to do your own work.

Time Commitment: One last comment I will make is about how to succeed in this class. Considering the amount of work, I deem it impossible to complete the assigned objectives during class time alone. You will have to come in at other times if you want to do well. I do restrict use of the scopes without my supervision until I have officially checked you out: once I have done so, you can use them anytime of the day or night. All other equipment may be used without a formal "checkout", as long as you feel comfortable using it.

Lecture and Lab Schedule-Electron Microscopy Fall 2011

Week of	Lecture Topic	Lab Exercise
Sept. 7	Introduction, History of EM	No labs
Sept. 14	SEM specimen preparation	SEM sample preparation/SEM operation demo
Sept. 21	SEM design/systems/imaging	SEM operation/collection of digital images/SEM one-on-two
Sept. 28	Fixation	SEM operation/image optimization demo/SEM one-on-two
Oct. 5	Fixation, Dehydration, Infiltration	TEM fixation demo; SEM practice time
Oct. 12	Resins, Knives, Sectioning	Embedding and block trimming demo, TEM operation introduction
Oct. 19	Exam I-Lectures 1-6	Ultramicrotomy thick sectioning/staining demo/TEM alignment/TEM one-on-two
Oct. 26	TEM Image Formation	Ultramicrotomy/thin sectioning/staining demo./TEM one-on-two
Nov. 2	TEM Design and Systems	TEM Operation-taking pictures and developing negatives/TEM practice
Nov. 9	TEM Design and Systems	Scanning and digitizing images for publication, making plates for SEM and TEM/EDS demo
Nov. 16	Vacuum systems	
Nov. 23	No lecture-Thanksgiving break	Open lab on Tuesday
Nov. 30	Photography and digital imaging	Open lab
Dec. 7	EM applications, other microscope types	Open lab
Dec. 16	Second exam-lectures 6-12	Open lab

Grading

Since this is a very hands-on course, much of your grade will depend upon the time and effort you put into learning the techniques and operating the microscopes. If you put in the effort, you will do well. I am not expecting perfection, but I do expect you to do your best. With this in mind, the grading is weighted heavily towards my assessment of your performance of various tasks related to specimen preparation, scope operation, and production of final images. There will be two lecture exams, one at mid-term and one at the end of the semester to test your understanding of the concepts. For credit in Biology 550, students will be given exams that are more essay in nature and will focus more on synthesis of knowledge.

Graded Item	Due Date	Points Possible
SEM Checkout and Operation	Oct. 12	50
Exam I	Oct. 21	100
TEM Checkout and Operation	Nov. 9	50
Exam II	Dec. 16	100
SEM photographic plates	Dec. 18	200
TEM photographic plate	Dec. 18	200
Total		700
Grad project (if enrolled in 550)	Dec. 18	100
Grad Total		800

Grading Scale:

93-100=A
 90-92=A-
 87-89=B+
 83-86=B
 80-82=B-
 77-79=C+
 73-76=C
 70-72=C-
 67-69=D+
 63-66=D
 60-62=D-
 Below 60=F

Additional information on the grading criteria for each above item:

1. SEM checkout: On or before the due date, I will sit down with you on the SEM and observe and grade your ability to insert a specimen, turn in the beam, turn up the filament, obtain and initial image, saturate the filament, change the working distance, to up to a magnification of 10,000x, focus, stigmatize, adjust brightness and contrast, collect a high-resolution image at at least 2,000X.

2. TEM checkout: On or before the due date, I will sit down with you on the TEM and observe and grade your ability to insert a specimen, align the beam, align the condenser aperture, stigmatize the condenser lens, change magnification, stigmatize the objective lens at 200,000X, focus, and shoot a negative (which I will develop and evaluate as part of your grade, worth 10 pts.)

3. TEM Plates: *You will turn in two photographic plates of images gathered using the TEM. Each plate will contain four images, and each image will have a micron bar and a letter or number in the upper left hand corner for reference. Each plate will have a figure legend below it with the following information: the type of tissue in the image, and the distance represented by the micron bar. At least one of the eight total images needs to be at a magnification of 100,000X or higher. With each plate you will turn in the negatives scanned to obtain each image. Each of the eight images will be worth 25 points assigned as follows: 5 points for the quality of the negative, 5 points for focus, 5 points for contrast, 5 points for the reference and micron bar, and 5 points for the overall image quality.*

4. SEM Plates: *As with the TEM, you will turn in a two photographic plates, each containing four images. Reference letter, micron bar, and figure legend are the same as for the TEM plate. The point breakdown will be different as there are no SEM negatives. The 25 points per image will be assigned as follows: 10 points for focus, 5 points for contrast, 5 points for reference letter/number and micron bar, and 5 points for overall image quality.*

Academic dishonesty

Students are referred to the University of Wisconsin Oshkosh Student Discipline Code as detailed in specific provisions of Chapter 14 of the State of Wisconsin Administrative Code. Any student(s) found in violation of any aspect of the above Code (as defined in sections UWS 14.02 and 14.03) will receive a sanction as detailed in UWS 14.05 and 14.06. Examples of violations include: looking at another student's exam or answer sheet and copying the answers during an exam, talking or whispering to another student during an exam and receiving text messages during an exam on an electronic device. Sanctions range from a grade of zero for the assignment in question to an oral reprimand to expulsion from the University of Wisconsin Oshkosh. Students have the right to request a hearing and to appeal sanctions (as defined in UWS 14.08-14.10).