Through the use of texts, images, the world wide web, and equipment demonstrations, you will learn the theoretical basis of operation of, as well as sample preparation for, a transmission and a scanning electron microscope. With this knowledge, you should be able to design sample preparation protocols based on your knowledge of the equipment. A variety of specialized techniques, and the images obtained, will also be presented, along with a discussion of the types of research data obtained from these techniques. You will be able to identify the techniques used to create the images, and explain the use of these techniques to test scientific hypotheses.

Grades are based on performance on quizzes and exams, on the basis of

**Quizzes (100 points, 20%)**: There will be a quiz given in each lecture period except those sessions with exams. Each quiz will be worth 10 points, and the 10 best scores will be used to compute a final quiz grade (maximum credit 100 points). The quizzes will cover the material TO BE PRESENTED in the lecture of the day, and will require students to review the lecture notes (on BlackBoard) before coming to the class. There will be no make-up quizzes, as only the 10 best scores will be counted. If you take 10 or fewer quizzes, your grade will be the sum of all the quizzes you were present for. The quizzes will be given at the start of class. People coming late to class will miss the quiz, and will not be able to take the quiz once the lecture has started, as the quiz material will be presented in the lecture.

**2 interim examinations, (each 1 hour, each worth 100 point, each 20%) and 1 final, cumulative exam (2 hours, 40% of grade, 200 points)**. The exams will consist of short answer, fill in the blank, matching, and essay questions. Exam questions will be taken from lecture, the assigned readings, or any other materials assigned through Blackboard. The final exam is comprehensive. Additional reference texts are available in Love Library, or the EM Facility, Physical Science-1

**Students not enrolled in Biology 556 or 557 should visit the Facility to view equipment.**

**Tentative schedule of weekly lecture topics and readings**

1-Microscopes--an overview
   - Basic components and how they work and comparison of images and data obtained
   pp. 1-11, 93-95
2-Vacuum systems
   pp. 23-42
3-Lenses/ electronics
   pp. 13-22
4a-Transmission Electron Microscopy:
   - Image formation/Detectors
   pp. 43-64
4b-Scanning Electron Microscopy:
   - Image formation/Detectors
   pp 65-90
5-Interim Examination I (September 2 THROUGH September 23 classes)  
September 30 in class  
--bring blank essay paper or blue book--

6-Imaging: silver and silica based recording, printing  pp. 200-219

7-TEM Sample preparation I  pp 100-148  
Shadowing/negative staining/freeze fracture  pp 97-100, 126-142

8-TEM Sample preparation II  
Fixation chemicals/ solutions  pp 100-108  
Microwaves  
Cryogenics  pp. 108-114

9-TEM Sample preparation III  
Dehydration/ solvents/Embedding  pp. 114-118  
Sectioning

10-Interim Examination II (October 7 THROUGH October 28 class)  
November 4 in class  
--bring blank essay paper or blue book--

11-TEM Staining  pp. 118-126  
Cytochemistry/ Antibodies  pp 145-148

12-Tomography

13a-SEM sample preparation  pp151-168  
fixation solution considerations  pp 100-114, 162-168  
Chemicals/Cold  
Dehydration/Critical Point Drying (CPD)  pp. 113-114, 159-167  
coating  pp 152-158, 132-136

13b- Material Sciences sample preparation

14-Electron Microscopy and X ray analysis  pp. 173-199

INCLUSIVE FINAL EXAM (from day one through the last lecture)  
Monday December 14 from 1300-1500 in LS 132  
--bring blank essay paper or blue book--