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Department: Biology  
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Phone: 468-2268; Please provide a local telephone number when requesting a return call.  
Office: Math 103  
Office Hours: 3:00 – 5:30 WR or by appointment  
Class meeting time and place: Lecture - 12:00 to 12:50 MW S134A; Lab 2:00 - 4:50 MF S134A  

Course Description: An introduction to the theory and practical application of the scanning and the transmission electron microscope, with an emphasis on specimen preparation, operation of the microscopes, and biological ultrastructure.

Number of Credit Hours: 4

Course Prerequisites and Corequisites: Prerequisites graduate standing and permission of instructor; Corequisite BIO 555L.

Program Learning Outcomes:  
Program Learning Outcome #1: The student will demonstrate a good knowledge base in biological concepts and be able to integrate knowledge with critical thinking skills to become problem solvers. Knowledge base will include: levels of complexity (molecular/cellular through population/communities/ecosystems), biological principles and processes.

Program Learning Outcome #2: The student will clearly communicate scientific information, providing clear structure and transition, incorporating substantial primary literature-based supporting evidence, and demonstrating audience appropriate purpose, agenda, language and style.

Program Learning Outcome #3: The student will demonstrate an understanding of scientific methods and design original scientific research.

General Education Core Curriculum Objectives/Outcomes:  
This course is not included in the general education core curriculum.

Student Learning Outcomes:  
Students who complete Graduate Electron Microscopy will be able to:  
1. Identify the parts of the scanning and the transmission electron microscope and the function of each (PLO 1).  
2. Demonstrate proper operation of the scanning and the transmission electron microscope, critical point dryer, sputter coater, and ultramicrotome (PLO 1, 3).  
3. Prepare samples for scanning and for transmission electron microscopy and evaluate the suitability of a given preparative regimen for their research (PLO 1, 3)  
4. Produce and interpret electron micrographs (PLO 1, 2).  
5. Discuss the contributions of electron microscopy to research efforts in their field of study (PLO 1, 3).

Course Requirements:
Three major tests will be given in lecture, each worth 100 points. Dates of exams are included on the course calendar. A total of 400 points are available in lab. Points will be earned by completing equipment checkout quizzes and laboratory assignments. One week notice will be given before each quiz or before each lab assignment is due.

Each student will complete a graduate project, an investigation of how electron microscopy has contributed to their chosen field of study via an annotated bibliography of 10 primary research papers. Each work included must be a primary research article with a complete citation. You may use APA, MLA, or the format of a journal in your field for the citation. The entry should include a minimum of four complete sentences summarizing the article and its relevance in your field. There should be no errors in grammar or punctuation. The graduate project will contribute 50 points toward the final course grade.

Here is an example:
Hoch and colleagues used scanning electron microscopy to investigate leaf micromorphological features used by a plant pathogenic fungus to successfully infect a host plant. The fungus must initiate its penetration structure over a host stoma. Using ridges that were microfabricated on silicon wafers, the researchers found that the fungus was triggered to form this structure by ridge elevations with an optimum height of 0.5µm, a similar height to that found around the stomatal opening of susceptible bean plants. Elevations greater than 1 µm or less than 0.25 µm did not trigger infection structure development. This research was pivotal to the understanding of the role of leaf micromorphology in the infection process, and to future efforts examining these feature in the search for plant disease resistance.

Unsafe operation of equipment in this course could result in thousands of dollars of damage to the machinery. The improper handling of fixatives and other chemicals poses a very serious health risk. For these reasons, students are cautioned to follow procedures carefully and to receive permission before operating any equipment. Violation of this policy will result in a student's dismissal from the course.

Participation in the on-line student evaluations for both BIO 555 lecture and BIO 555L is a mandatory course requirement. Failure to participate will result in a 1% reduction in lecture and laboratory grades.

**Course Calendar:**

<table>
<thead>
<tr>
<th>Date</th>
<th>Day</th>
<th>Chapter/Topic</th>
<th>Text pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-15</td>
<td>Wed</td>
<td>Intro to EM, lab safety</td>
<td>4-13, 618-639</td>
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<tr>
<td>1-20</td>
<td>Mon</td>
<td>MLK Holiday</td>
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</tr>
<tr>
<td>1-22</td>
<td>Wed</td>
<td>Electron beams and lenses</td>
<td>150-161, 164-173</td>
</tr>
<tr>
<td>1-27</td>
<td>Mon</td>
<td>Electron beams and lenses</td>
<td>150-161, 164-173</td>
</tr>
<tr>
<td>1-29</td>
<td>Wed</td>
<td>Specimen manipulation and image formation in SEM</td>
<td>204-218</td>
</tr>
<tr>
<td>2-3</td>
<td>Mon</td>
<td>Specimen manipulation and image formation in TEM</td>
<td>171-180</td>
</tr>
<tr>
<td>2-5</td>
<td>Wed</td>
<td>Vacuum systems</td>
<td>180-188</td>
</tr>
<tr>
<td>2-10</td>
<td>Mon</td>
<td>Capturing and processing images</td>
<td>416-430</td>
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<tr>
<td>2-12</td>
<td>Wed</td>
<td>Capturing and processing images, con’t</td>
<td>219-220, 225-230, 370-371</td>
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<tr>
<td>2-17</td>
<td>Mon</td>
<td><strong>Lecture Exam I</strong></td>
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<tr>
<td>2-19</td>
<td>Wed</td>
<td>Chemical fixation and dehydration of biological samples</td>
<td>18-26, 33-35, 50-53</td>
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<tr>
<td>2-24</td>
<td>Mon</td>
<td>Post-dehydration prep for SEM</td>
<td>54-58, 63-63, 136-139</td>
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<tr>
<td>2-26</td>
<td>Wed</td>
<td>Post-dehydration prep for TEM</td>
<td>35-43, 74-78</td>
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Lab Schedule:

Week 1  SEM orientation (1-17)
Week 2  SEM supervised practice (1-24)
Week 3  SEM supervised practice (1-27), TEM orientation (1-31)
Week 4  TEM supervised practice (2-3, 2-7)
Week 5  TEM supervised practice (2-10, 2-14)
Week 6  SEM sample prep (2-17, 2-21)
Week 7  TEM sample prep (2-24, 2-28)
Week 8  Ultramicrotomy and staining (3-2, 3-6)
Week 9  Ultramicrotomy and staining (3-16, 3-20)
Week 10-11 Independent sample prep., micrograph interpretation (3-23, 3-27, 3-30, 4-3)
Week 12-14 X-ray microanalysis (4-6, 4-13, 4-17, 4-20, 4-24)
Week 15  Immunocytochemistry (4-27, 5-1)

Grading Policy:
Points will be earned in lecture and in lab. With a total of 750 points available, course grades will be assigned as follows:

90%+ of total points = A, 80 - 89% = B, 70 - 79% = C, 60 - 69% = D, Below 60% = F

There are no extra credit assignments in this course.

Attendance Policy:
Attendance is a factor in determining the course grade. An absence is defined as a student’s failure to attend lecture and/or lab on a particular day. Only students with an excused absence will be allowed to make up an exam or turn in an assignment late. Excused absences will be granted for: students participating in university sponsored events, serious illness, or a family emergency. A list of students to be absent from campus to attend various events is published and distributed to the faculty. Otherwise, you will need to bring written confirmation of illness or emergency from a doctor or family member to be granted an excused absence. Students with unexcused absences will receive a 0 for missed exams or assignments. Beginning with the fourth absence, 10 points per absence will be subtracted from the course grade.
Academic Integrity (A-9.I)
Academic integrity is a responsibility of all university faculty and students. Faculty members promote academic integrity in multiple ways including instruction on the components of academic honesty, as well as abiding by university policy on penalties for cheating and plagiarism.

Definition of Academic Dishonesty
Academic dishonesty includes both cheating and plagiarism. Cheating includes but is not limited to (1) using or attempting to use unauthorized materials to aid in achieving a better grade on a component of a class; (2) the falsification or invention of any information, including citations, on an assigned exercise; and/or (3) helping or attempting to help another in an act of cheating or plagiarism. Plagiarism is presenting the words or ideas of another person as if they were your own. Examples of plagiarism are (1) submitting an assignment as if it were one's own work when, in fact, it is at least partly the work of another; (2) submitting a work that has been purchased or otherwise obtained from an Internet source or another source; and (3) incorporating the words or ideas of an author into one's paper without giving the author due credit.

Please read the complete policy at http://www.sfasu.edu/policies/academic_integrity.asp

Withheld Grades Semester Grades Policy (A-54)
Ordinarily, at the discretion of the instructor of record and with the approval of the academic chair/director, a grade of WH will be assigned only if the student cannot complete the course work because of unavoidable circumstances. Students must complete the work within one calendar year from the end of the semester in which they receive a WH, or the grade automatically becomes an F. If students register for the same course in future terms the WH will automatically become an F and will be counted as a repeated course for the purpose of computing the grade point average.

The circumstances precipitating the request must have occurred after the last day in which a student could withdraw from a course. Students requesting a WH must be passing the course with a minimum projected grade of C.

Students with Disabilities
To obtain disability related accommodations, alternate formats and/or auxiliary aids, students with disabilities must contact the Office of Disability Services (ODS), Human Services Building, and Room 325, 468-3004 / 468-1004 (TDD) as early as possible in the semester. Once verified, ODS will notify the course instructor and outline the accommodation and/or auxiliary aids to be provided. Failure to request services in a timely manner may delay your accommodations. For additional information, go to http://www.sfasu.edu/disabilityservices/.

Acceptable Student Behavior
Classroom behavior should not interfere with the instructor’s ability to conduct the class or the ability of other students to learn from the instructional program (see the Student Conduct Code, policy D-34.1). Unacceptable or disruptive behavior will not be tolerated. Students who disrupt the learning environment may be asked to leave class and may be subject to judicial, academic or other penalties. This prohibition applies to all instructional forums, including electronic, classroom, labs, discussion groups, field trips, etc. The instructor shall have full discretion over what behavior is appropriate/inappropriate in the classroom. Students who do not attend class regularly or who perform poorly on class projects/exams may be referred to the Early Alert Program. This program provides students with recommendations for resources or other assistance that is available to help SFA students succeed.