**Principles of Electron Microscopy**  
**BIO 415**  
**Spring 2019**

**Instructor:** Dr. Josephine Taylor  
**Department:** Biology  
**Email:** jtaylor@sfasu.edu  
**Phone:** 468-2268; Please provide a local telephone number when requesting a return call.  
**Office:** S106  
**Office Hours:** 9:30 – 11:30 MW, 10:00 – 12:00 F 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 biological applications of transmission and scanning electron microscopy.

**Number of Credit Hours:** 4

**Course Prerequisites and Corequisites:** Prerequisites senior standing with a major or minor in the sciences and permission of instructor; Corequisite BIO 415L.

**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; provide clear structure and transitions; demonstrate scientific tone, language, and form.

Program Learning Outcome #4: The student will be able to design, carry out, and analyze experiments to answer biological questions using scientific methods and instrumentation; safe and appropriate use of laboratory equipment; experimental design; data analysis; and familiarity with professional standards in science.

Program Learning Outcome #5: The student will demonstrate preparation for future career and educational goals utilizing the knowledge and training during their academic program.

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

**Student Learning Outcomes:**  
Students who complete Principles of 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, 5).  
2. Demonstrate proper operation of the scanning and the transmission electron microscope (PLO 1, 4, 5).  
3. Describe procedures to prepare biological specimens for electron microscopy (PLO 1, 4, 5).  
4. Produce and interpret electron micrographs (PLO 1, 2, 4, 5).  
5. Discuss the applications of electron microscopy in research, industry, medical diagnostics and related fields (PLO 1, 5).
Course Requirements:
Principles of Electron Microscopy (BIO 415) is designed to provide undergraduate students with an introduction to the biological applications of scanning and transmission electron microscopy. Topics to be covered include preparation of biological samples, operation of the SEM and TEM, microtomy, imaging and interpretation, biological ultrastructure, and analytical EM techniques.

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. 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.

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 415 lecture and BIO 415L 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>Chapter/Topic</th>
<th>Text pages</th>
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<tbody>
<tr>
<td>1-23</td>
<td>Intro to EM, lab safety</td>
<td>4-13, 618-639</td>
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<td>1-28</td>
<td>Electron beams and lenses</td>
<td>150-161, 164-173</td>
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<tr>
<td>1-30</td>
<td>Electron beams and lenses</td>
<td>150-161, 164-173</td>
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<tr>
<td>2-4</td>
<td>Specimen manipulation and image formation in SEM</td>
<td>204-218</td>
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<tr>
<td>2-6</td>
<td>Specimen manipulation and image formation in TEM</td>
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<tr>
<td>2-11</td>
<td>Vacuum systems</td>
<td>180-188</td>
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<tr>
<td>2-13</td>
<td>Capturing and processing images</td>
<td>416-430</td>
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<tr>
<td>2-18</td>
<td>Capturing and processing images, con’t</td>
<td>219-220, 225-230, 370-371</td>
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<tr>
<td>2-20</td>
<td><strong>Lecture Exam I</strong></td>
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<tr>
<td>2-25</td>
<td>Chemical fixation and dehydration of biological samples</td>
<td>18-26, 33-35, 50-53</td>
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<tr>
<td>2-27</td>
<td>Post-dehydration prep for SEM</td>
<td>54-58, 63-63, 136-139</td>
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<td>3-4</td>
<td>Post-dehydration prep for TEM</td>
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<td>3-6</td>
<td>Ultramicrotomy</td>
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<td>3-11</td>
<td>Ultramicrotomy</td>
<td>79-109</td>
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<td>3-13</td>
<td>Specimen staining</td>
<td>122-131</td>
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<td>3-18 through 3-22</td>
<td>SPRING BREAK</td>
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<td>3-25</td>
<td>Interpreting micrographs</td>
<td>444-473</td>
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<tr>
<td>3-27</td>
<td>Interpreting micrographs</td>
<td>444-473</td>
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<td><strong>4-1</strong></td>
<td><strong>Lecture Exam II</strong></td>
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<tr>
<td>4-3</td>
<td>Bio. ultrastructure</td>
<td>478-607</td>
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<tr>
<td>4-8</td>
<td>Bio. ultrastructure</td>
<td>478-607</td>
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<tr>
<td>4-10</td>
<td>Bio. ultrastructure</td>
<td>478-607</td>
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<tr>
<td>4-15</td>
<td>Analytical EM</td>
<td>225-230, 370-373</td>
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<tr>
<td>4-17</td>
<td>Analytical EM</td>
<td>374-382</td>
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Lab Schedule:
Week 1  Lab orientation (1-25)
Week 2  SEM orientation (1-28, 2-1)
Week 3  SEM supervised practice (2-4, 2-8)
Week 4  TEM orientation (2-11, 2-15)
Week 5  TEM supervised practice (2-18, 2-22)
Week 6  SEM sample prep (2-25, 3-1)
Week 7  TEM sample prep (3-4, 3-8)
Week 8  Ultramicrotomy and staining (3-11, 3-15)
Week 9  Ultramicrotomy and staining (3-25, 3-29)
Week 10-11 Micrograph interpretation and figure legend writing (4-1, 4-5, 4-8, 4-12)
Week 12-13 X-ray microanalysis (4-15, 4-22, 4-26)
Week 14-15 Immunocytochemistry (4-29, 5-3, 5-6, 5-10)

Grading Policy:
Points will be earned in lecture and in lab. With a total of 700 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](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/](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.