BIOLOGICAL MICROTECHNIQUES

LECTURE SECTION
BIOL-4435.001
Center for the Sciences (CS) 114
Monday, Tuesday, Wednesday & Thursday
7:00-8:15 PM

LABORATORY SECTION
BIOL-4435.101
Center for the Sciences (CS) 231
Monday, Tuesday, Wednesday & Thursday
4:00-6:55 PM

INSTRUCTOR: DR. DAVID MOURY (Ph.D.)
Office: Science and Technology Building (ST) 319C
Office Phone: (361) 825-3259
E-mail: david.moury@tamucc.edu
Office Hours: Tuesday, Wednesday & Thursday 3:00 – 4:00 PM

A student may make an appointment to see me at times other than the scheduled office hours. I am available for consultation and extra help, but it is the student’s responsibility to request such help. If I am unavailable or need to relocate during office hours, I will post a note on the appropriate office or laboratory door.

REQUIRED BOOKS:
Main:
Secondary:

ADDITIONAL ITEMS:
http://www.protocol-online.org/prot/Histology/
http://stainsfile.info/StainsFile/jindex.html
A laboratory coat is required.

PREREQUISITES: Biology II (BIOL 1407), and one semester of Organic Chemistry (CHEM 3411).

COREQUISITES: Students must be concurrently enrolled in—and attending—the lecture section (BIOL-4435.001) and the laboratory section (BIOL-4435.101). Students must also have completed Laboratory Safety Seminar (SMTE 0091) during the current semester.

COURSE OVERVIEW: Biological Microtechniques (BIOL 4435) is an upper-division lecture/laboratory course that presents and discusses the preparation of small specimens for examination (usually at the microscopic level). This course is heavily laboratory oriented, and students are evaluated equally on their understanding of the underlying
principles of microtechnique, and their performance in using these principles to produce high-quality specimen preparations.

**SCHEDULE:** Especially in a time-compressed summer session, the schedule of a techniques-based course must be flexible to allow time necessary for techniques to work properly. Because of this, and to allow more laboratory time at the end of the semester, Lecture (“Theory”) and Laboratory (“Practice”) times are interchangeable.

**TENTATIVE TOPIC SCHEDULE:**

<table>
<thead>
<tr>
<th>DAY</th>
<th>DATE</th>
<th>TOPIC</th>
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<tbody>
<tr>
<td>Tue.</td>
<td>1 June</td>
<td>Introduction</td>
</tr>
<tr>
<td>Wed.</td>
<td>2 June</td>
<td>Animals—Euthanasia and Fixation: Processing and Media</td>
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<tr>
<td>Thur.</td>
<td>3 June</td>
<td>Plants—Fixation: Processing and Media</td>
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<tr>
<td>Mon.</td>
<td>7 June</td>
<td>Microscopy and Photomicrography</td>
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<tr>
<td>Tue.</td>
<td>8 June</td>
<td>Embedding: Processing and Media</td>
</tr>
<tr>
<td>Wed.</td>
<td>9 June</td>
<td>Wet Mounts, Permanent Whole Mounts, Coverslipping Sections</td>
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<tr>
<td>Thur.</td>
<td>10 June</td>
<td>Berlese Processing</td>
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<tr>
<td>Mon.</td>
<td>14 June</td>
<td>Anatomical Planes and Sections, Orienting Specimens in Blocks</td>
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<tr>
<td>Tue.</td>
<td>15 June</td>
<td>Microtomes: Sectioning, Floating, Affixing</td>
</tr>
<tr>
<td>Wed.</td>
<td>16 June</td>
<td>Staining</td>
</tr>
<tr>
<td>Thur.</td>
<td>17 June</td>
<td>Optics and Color Theory</td>
</tr>
<tr>
<td>Mon.</td>
<td>21 June</td>
<td>Practice</td>
</tr>
<tr>
<td>Tue.</td>
<td>22 June</td>
<td>Practice</td>
</tr>
<tr>
<td>Wed.</td>
<td>23 June</td>
<td>Practice</td>
</tr>
<tr>
<td>Thur.</td>
<td>24 June</td>
<td>Examination / Practice</td>
</tr>
<tr>
<td>Mon.</td>
<td>28 June</td>
<td>Practice</td>
</tr>
<tr>
<td>Tue.</td>
<td>29 June</td>
<td>Practice</td>
</tr>
<tr>
<td>Wed.</td>
<td>30 June</td>
<td>Practice</td>
</tr>
<tr>
<td>Thur.</td>
<td>1 July</td>
<td>Presentations and Critiques</td>
</tr>
<tr>
<td>Fri.</td>
<td>2 July</td>
<td>Presentations and Critiques</td>
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**STUDENT LEARNING OUTCOMES:** By the end of the course, students will have…

- Examined the process by which plant and animal specimens are routinely prepared for viewing by light microscopy (both as whole mounts and as sections) and discussed their chemical and/or physical bases, advantages and disadvantages (e.g., euthanasia, dissection, fixation, de/rehydration, infiltration, embedding, staining, sectioning/serial sectioning, mounting/permanent preservation and labeling).
- Discussed some special techniques that can be used in the preparation of specimens (e.g., narcotization, anesthesia, fixative removal, decalcification, histochemistry, immunohistochemistry, and molecular techniques).
- Become familiar with different types of microscopy (e.g., bright-field, dark-field, differential interference contrast, phase contrast, polarizing, confocal, transmission electron, scanning electron) and the optics behind them.
- Prepared an oral presentation on a biological microtechnique of the student’s choice.
- Prepared routine specimens and digitally recorded their images.
- Critiqued their own and others’ techniques, labeled specimens and labeled photographs.

**OTHER REQUIRED ITEMS AND IMPORTANT RULES:** Students should buy a laboratory coat. Basic-function calculators will be useful in many laboratories. We do not provide calculators; students must bring their own. Gloves, eye protection, and dissecting supplies
will be provided when needed. Food and drink is forbidden in any laboratory at any time. Because we are likely to go into a laboratory during any free time, students must **always** bring laboratory coats, long pants and closed-toe/heel shoes with them to laboratory **and** lecture periods. A student without a laboratory coat and appropriate clothing/footwear will **not** be allowed to enter the laboratory at any time (this includes laboratory time, lecture time, or the student’s own time). For periods in which the class will be collecting outdoors, students should wear appropriate old clothes (including long pants and closed-toe/heel shoes). Students are also encouraged to bring sunscreen, a hat, insect repellent and other items for outdoor work. (Time lost by a student who goes home to get a laboratory coat or shoes is **always un**excused, and any points lost during that time **cannot** be recovered.)

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**LABORATORY NOTICES**

A Laboratory Coat is REQUIRED!
Long pants are REQUIRED!
Long hair MUST be tied back!
NO food or drink in the laboratory!
NO open-top/open-heel footwear in the laboratory!

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**GRADING:** Your final letter grade will be based on your averages (given as percentages) in lecture and laboratory. The final course percentage will be derived from the lecture and laboratory grades weighted as follows:

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<tbody>
<tr>
<td>Lecture Grade:</td>
<td>50%</td>
</tr>
<tr>
<td>Laboratory Grade:</td>
<td>50%</td>
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Statistical manipulations (e.g., curving) **may** be performed once—at the end of the semester. The final grading scale will also be determined at the end of the semester, but the cut-off for each grade will be **no higher** than the following:

\[
A \geq 90\% > B \geq 80\% > C \geq 70\% > D \geq 60\% > F
\]

**Lecture Grade:** Your grade in lecture will be based on the percentage you earn out of 200 points which are distributed as follows:

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<tbody>
<tr>
<td>Examination:</td>
<td>150 points</td>
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<tr>
<td>Presentation on special technique:</td>
<td>50 points</td>
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<tr>
<td><strong>TOTAL POINTS POSSIBLE:</strong></td>
<td>200 points</td>
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**Examination:** In this course, I will give a single examination (150 points). I will take questions primarily from material covered in the lectures, laboratories, and from handouts and other assignments. The examination may consist of essay, short-answer,
compare-contrast, fill-in-the-blank, multiple-choice, matching, making and/or labeling drawings, and/or various types of “flex” questions (i.e., anything is fair game).

**Technique presentation:** Each student will research a special technique (student’s choice, but approved by the instructor), and give a 10-minute oral presentation about it. The presentation should include a written protocol for the technique that will be distributed to the class. (The protocol must be written by the student; a photocopy direct from a book or a printout from a web site is **not** acceptable.)

**Laboratory Grade:** The laboratory grade is based entirely on “products.” Your grade in laboratory will be based on the percentage you earn out of 200 points which are distributed as follows:

<table>
<thead>
<tr>
<th>Specimens (10 points each):</th>
<th>120 points</th>
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<tr>
<td>Photographs of 8 of these specimens (10 points each):</td>
<td>80 points</td>
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<tr>
<td><strong>TOTAL POINTS POSSIBLE:</strong></td>
<td>200 points</td>
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Specimens should be professionally prepared (i.e., undamaged, clean, and neat), labeled, and accompanied by a typed/printed self-critique. (I count off less for **uncorrectable** defects such as air bubbles, etc. if you point them out to me in your self-critique.) (Students should **not** try to scrape excess mounting medium from slides; it will not be dry by the end of the course.) Students may try as many times as needed to achieve professional-quality results on the following 12 specimens:

**Basic Techniques:**
1. **Mounting:** Whole Mount (slide) of a piece of an organism (stained or unstained).
2. **Sectioning:** Serial sections (at least 10 consecutive sections on a single slide) through an organism (plant or animal), any stain.
3. **Staining, Animal:** Single section of a soft animal organ stained with hematoxylin and eosin.
4. **Decalcification:** Single section of a vertebrate animal containing a decalcified bony structure, any stain.
5. **Staining, Plant:** Single section from a plant stained with saffranin and fast green.
6. **Clearing/Staining:** Cleared and stained (alizarin red/alcian blue) vertebrate in glycerol.

**Specific Techniques:**
7. Whole Mount (slide) of a whole invertebrate animal (stained or unstained).
8. Single section of an organ or structure (plant or animal) stained with a more complex stain than a stain-counterstain pair.
9. Approved group project.
**Wild Cards:**

10. Wild card I: A good animal specimen that you could not use otherwise (repeats of organs are not acceptable).
11. Wild card II: A good plant specimen that you could not use otherwise (repeats of organs are not acceptable).
12. Wild card III: A good specimen that you could not use otherwise (repeats of organs are not acceptable).

**Labeling:** All specimens should be labeled. While being processed, slides are temporarily labeled using a glass scriber. Once coverslipped, a permanent label should be applied containing the following information:

- Scientific name of species
- Name of tissue/organ (if appropriate)
- Name of preparator
- Date
- Section thickness (if appropriate)
- Specimen number/slide number (if appropriate)

The laboratory logbook (your self-critique, in this case) should contain the information above plus:

- Fixative information
- Processing information
- Staining information

**Science and Common Sense:** Although this course is about techniques, you should know enough about the biology of what you are seeing to tell whether the specimen/section is interesting or not. (This is your responsibility, and there are plenty of resources available in the library and online to do it!) For example, when sectioning a kidney, the first few slices will just “graze” the outer surface. If they are flat, contain no artifacts, and are properly labeled, then they will get a good grade, right? Wrong! These are sections of the collagenous capsule surrounding the kidney (and many other organs), and are not good, representative sections of the kidney. (In other words, they are not very interesting.) Use common sense when choosing which specimens to photograph and turn in for a grade. I will deduct points if the specimen is not representative or biologically interesting.

**Photographs** should be made using the digital equipment provided. Each student will take photographs of his or her own specimens, import the images into PowerPoint and label them. These PowerPoint slides will be presented to the class during the final examination period (about 10-15 minutes per student), along with a verbal critique by the presenter.

**Bonus Points:** Individual extra credit is not possible, but extra points are built into all examinations (as extra questions). You may earn an extra 10 points by completing a library/internet assignment. I reserve the right to add additional opportunities for the entire class to earn extra bonus points (e.g., attendance at a special event, written reports, library searches, web searches, quizzes [announced or un-announced]).
opportunities may be offered or announced only once, so be in class, be on time, and stay for the entire period. **Bonus points cannot be made up—period.**

**IMPORTANT MISCELLANEOUS NOTES:**

- Follow instructions! The most common mistakes that cost students points result from failure to follow instructions.
- Bring two #2 pencils to the examination; I neither provide nor sell pencils. (I will provide Scantron sheets for you.)
- Bring a writing implement to each class or laboratory period. Handwritten assignments will be accepted **only** if they are written in *pencil, blue ink, or black ink.* (You will get a permanent “zero” on the assignment if you write with anything else.)
- Grammar counts—period! Poor grammar will cost you points—especially on assignments and presentations.
- Spelling counts—in both lecture and in laboratory! To be considered for partial credit, your answer must phonetically sound like the word that you are trying to spell. Examples of answers that are incorrect:
  - Grossly misspelled words (e.g., “crevurfian pleat” for “cribriform plate”).
  - Ambiguous answers (e.g., “tibula”—could be “tibia,” could be “fibula”).
  - Illegible answers (e.g., “ep-squiggle-squiggle-squiggle” for “epididymis”).
- After an assignment is returned, you have one (1) week to notify me of clerical, mathematical, and/or other errors. I will rectify any such errors, but I will not change a legitimate grade just because you “need” it.
- I only discuss grades in person (i.e., I do not discuss grades or matters relating to grades over the telephone or by e-mail). If you wish to know your final grade before the official grade report is mailed to you, please see me in person or provide me with a self-addressed, stamped envelope.

**ATTENDANCE POLICIES:** Attendance is the student’s responsibility, and students are expected to attend every class and laboratory. In lecture, there is—per se—neither a bonus for attendance, nor a penalty for absence (except for missing an examination, bonus points, or an assignment). I do not take roll, but I may choose to have “pop” quizzes, and/or “attendance” quizzes as part of the bonus points.)

**Absences:** You are responsible for the material covered and assignments made in every lecture and laboratory regardless of whether you attend it. “I came in late and didn’t hear about the assignment,” is never an acceptable excuse. It is always your responsibility to determine what happened in class or laboratory during your absence. If you are absent, tardy, or leave early, I will provide you with copies of assignments (including “bonus point” assignments) and handouts if—and only if—you ask for them. (In other words, I will not, “track down” absentees to make sure that they know about assignments.) You must obtain class or laboratory notes from other students (i.e., I do not “share” my notes).

Points missed because of an unexcused absence (including tardiness and leaving early) cannot be recovered. An excused absence allows us to make alternative arrangements for completing assignments. The documentation required for an absence to be excused must be…

- from an appropriate source (e.g., doctor, dentist, funeral director) who states the nature of the event that caused (or will cause) your absence.
• in writing, on official stationery, and signed. (I do not return excuses to you.) Telephone calls, FAXes, and e-mails are not acceptable.
• presented prior to the absence for a scheduled event (e.g., university-sponsored activity, recognized religious holiday, military service).
• presented no more than one week after the date of an unexpected absence.

There Are NO Make-up Examinations: In extreme cases, Dr. Eliot Chenaux, Vice President for Student Affairs will determine if circumstances warrant giving an individual a make-up test. This make-up test will be all written (i.e., no multiple choice or matching).

Miscellaneous Policies Regarding Attendance:
Unacceptable Excuses: Only unavoidable absences are excused, so you should schedule routine personal events (e.g., vacations, weddings, reunions, non-emergency medical or dental visits, parent-teacher conferences, household or auto repairs) to avoid conflicts with your classes. Oversleeping is never an acceptable excuse. Employment conflicts are not acceptable excuses for absences, tardiness, or leaving class early. (Once enrolled in a class, it is the student’s responsibility to arrange his or her work schedule so that no regularly scheduled class, laboratory, or examination time is missed.) Texas waives jury duty for students, so jury duty is not an acceptable excuse.

Late Assignments: You may always turn in assignments early. Except for excused absences, late assignments will not be accepted. If you know that you will have an excused absence when an assignment is due, you must turn in that assignment before its due date. You should turn in assignments that were missed because of an unexpected, excused absence as soon as possible.

Any situations for which you cannot provide an acceptable excuse as outlined above (e.g., “I have an excuse, but it is too personal to discuss with you”) will be referred to Dr. Eliot Chenaux, Vice President for Student Affairs.

Expectations: You are adult university students. I will treat you as such, and I will expect you to act as such.

You will act with courtesy and common sense. I will not tolerate disruptive, disrespectful, or abusive behavior/language directed toward anyone in this class (i.e., student or instructor). Violations range from talking during class to outright insubordination, and will result in penalties that range from the student being asked to stop to the student being “escorted” from the class—permanently. Cellular phones, pagers, and other “beepers” must be turned off BEFORE you enter the classroom or laboratory. (I will make exceptions for certain “emergency” personnel, but you must see me to obtain this.) Children are not allowed in the rooms during lecture or laboratory periods, or when the child’s guardian is working or studying “after hours.”

You will act like a responsible adult. You are responsible for your own education. You should not expect an instructor to take you by the hand, show you everything you need to know, and then have you regurgitate this information on an examination. This is not an effective way for self-motivated adults to learn. Students are responsible for all class and lecture notes; required assignments; and any additional handouts or reading assignments given by an instructor. This includes (but is not limited to)…
• Knowing and meeting university-imposed deadlines (e.g., withdrawal dates of various types). This information is found in the Summer 2010 Class Schedule.
• Knowing and meeting assignment dates and times—including any changes that may occur during the semester.
• Checking your answers against a key as soon as possible. By all means check for any clerical errors, but a test score is not the end of the learning process. Always review your tests to determine why you missed questions. Making—and correcting—mistakes is an effective, natural way to learn material. Educators have a fancy term, reflective learning, for this simple process.
• Keeping track of your progress (i.e., your grades, points you earn in lecture and laboratory, and averages).
• Asking for help. Instructors are available for consultation and extra help, but it is the student’s responsibility to request help.

Learning is more than just reading, taking notes, and memorizing. Reading and taking notes puts information in short-term memory where it is forgotten quickly unless you do something with it. Memorizing, though important, is but the first step in the learning process. As university students, you should be able to link, combine, and synthesize the bits of data that you memorize into useful concepts.

Scholastic dishonesty will not be tolerated. It will be prosecuted to the full extent of university regulations (see the Student Handbook, and the current Undergraduate Catalog: Texas A&M University-Corpus Christi). Cheating and plagiarism are unacceptable behaviors. The following procedures will be enforced:
• You must be prepared to present a photo ID at all examinations.
• Different test forms may be prepared for a single examination. To ensure that the appropriate key will be used to grade your answer sheet, always follow instructions on the test or answer sheet, or given orally by the instructor.
• If you leave an examination room—for any reason—you must hand in your answer sheet and you will not be allowed to resume the examination. Attend to personal matters (e.g., rest room visits) before the examination.
• Be on time! Anyone arriving after someone has completed an examination and left the room will not be allowed to take that examination.

Grade Appeals: As stated in the Texas A&M University-Corpus Christi University Rules and Procedures (Section B [Academic Program], Part 13 [Students]: 13.02.99.C2 [Student Grade Appeals] and 13.02.99C2.01 [Student Grade Appeal Procedures]), a student who believes that he or she has not been held to appropriate academic standards as outlined in the class syllabus, equitable evaluation procedures, or appropriate grading, may appeal the final grade given in the course. The burden of proof is on the student to demonstrate the appropriateness of the appeal. A student with a complaint about a grade is encouraged to first discuss the matter with the instructor. For complete details, including the responsibilities of the parties involved in the process and the number of days allowed for completing the steps in the process, consult the University Rules and Procedures specified above (accessible through the University Rules and Procedures website at http://www.tamucc.edu/provost/university_rules/index.html). For assistance and/or guidance in the grade appeal process, students may contact the office of Student Affairs.
DISABILITY AND VETERANS’ SERVICES: Texas A&M University-Corpus Christi is committed to providing persons with disabilities an equal opportunity to access campus facilities, resources and programs. The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. Support and accommodations are also available for returning veterans who experience cognitive and/or physical access issues in the classroom or on campus. Our Office of Disability Services arranges such support and academic accommodations. To make a request, or for more information, call (361) 825-5816 or visit Driftwood 101. It is important to contact the Office of Disability Services in a timely fashion as it will take time for them to review requests and prepare accommodations and accommodation letters. Upon receipt of accommodation letters, a student should take them to appropriate instructors as soon as possible. (Instructors are not required to make accommodations prior to receipt of an official accommodation letter.) Should you have mobility problems, please notify your instructors so that they may seek assistance for you in the case of fire drills or emergencies. Also, any student having a medical condition that may fulminate (i.e., “flare-up” without warning such as diabetes, epilepsy, etc.) should notify your instructors.

RELIGIOUS HOLIDAYS: Any student who will miss class and/or test days because of recognized religious holidays should notify me as soon as possible so we can make alternative arrangements. Prior notification is required for such absences to be excused.

GENERAL DISCLAIMER: I reserve the right to modify the information, schedules, assignments, deadlines, and policies in this syllabus if and when necessary. Whenever possible, I will announce such changes in a timely manner during regularly scheduled lecture or laboratory periods. I will not attempt to contact students who were absent when an announcement was made. Nevertheless, all students are responsible for abiding by all announced changes, and it is a student’s responsibility to obtain this information. In rare cases, some modifications may be implemented without prior warning.