Biology 3411-010 - General Microbiology - Fall, 2017

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Text: Required: Benson’s Microbiological Applications (long version) by A. E. Brown; 13th or 14th edition (lab manual).

Lecture absences: Do not negatively affect the final grade but roll is taken daily as required by the university

Course goals: [1] Provide students with factual knowledge about the field of general microbiology  
[2] Introduce fundamental principles of the field.  
(These are progress points #1 & #2 on the IDEA end of semester course evaluation form)

Course format: Classic lecture style supplemented w/ transparencies.

Scope of the course: This course is an intro to microbiology & is intended for upper level science majors. Topics include: microbial anatomy, physiology, identification, classification, growth, genetics & practical applications of microbiology.

Student learning objective: For departmental, university, state & accreditation purposes, this course assesses learning objective BIOLOGY5, which states that the student will be able to demonstrate "communication and critically evaluate information in oral and/or written forms".

Expected Outcome: To demonstrate successful attainment of the learning objective a student completing this course should be able to:  
[1] isolate, maintain in pure culture, & laboratory test an unknown bacterium; [2] critically evaluate the data & use appropriate references to identify the unknown and [3] successfully communicate his/her results in a scientifically appropriate and grammatically correct written form.

Assessment: A term project worth 100 points is a component of the laboratory accompanying this course. This project will culminate in a term paper that will be graded on the basis of how well the student attained & communicated the goals listed above under the "Expected Outcome" heading (Grading criteria are listed elsewhere in this syllabus).

Max. possible points in the course:  
100 = for lab write-ups (10 write-ups X 10 pts each)  
100 = for paper detailing unknown microbe identification  
250 = for 2 exams (2 exams X 125 pts each)  
150 = for the final exam  
600 = Total  

Grade:  
540 or more points = A  
480-539 = B  
420-479 = C  
330-419 = D  
329 or less = F

Bonus Opportunities:  
15-25 pts maximum for an optional lab practical  
5 pts for donating or recruiting a blood donor for the TriBeta blood drive (TBA)

Exam dates: Sept. 25 (M), Oct 20 (F), Nov 13 (M) & Dec 13 (W) (final exam 1-3).

Nature of the hour exams: On exam days, bring blank paper & a pen/ pencil. No electronic devices, including calculators, are permitted on desktops during exams. Three 1-hour exams will be given but only 2 will count towards your final grade. No make up exams are given. A missed exam is a dropped exam score as long as only one is missed. Each exam consists of material introduced in both lecture AND lab. Also, you are responsible for any reading assignments. Only the final exam is comprehensive. All exams will be composed of a mixture of question types (see attached sample exams). An exam key will be posted in the lab after exams are returned.

Nature of the final exam: It is mandatory. The comprehensive portion will emphasize questions from previous exams (but, questions will not be identical to those on previous exams). New information presented since the 3rd hour exam (both lab & lecture) will represent 30-50% of the final exam.

Penalty assessments: After one warning, a maximum of 5 pts may be deducted from your final point total for improper: lab attention, lab punctuality, lab cleanup & proper technique (i.e. discarding materials appropriately, aseptic technique, microscope care).

Hints for doing well in this course:  
• Take good notes & remain attentive (Everything presented in lab and classroom lectures is possible exam material)  
• Seek instructor help through office hour visits and/or by questions during/after class  
• Develop/ demonstrate an interest in this class (acquired knowledge should be as important as the grade)  
• Be complete with answers (you're more likely to lose credit with an incomplete answer than one with extraneous information)  
• Allow sufficient time to compose lab write-ups (i.e. keep up with the write-ups!)  
• Do not arrive late to lab or make quick departures  
• Do not maintain regular absences and borrow notes to compensate  
• Do not underestimate the value of bonus points

Miscellaneous rules: No visitors to lab/lecture; do not infringe on other’s learning environment; turn off cell phones
The following excerpt from *ASM News*, 1999, "The Quest for Darwin's Grail" by Carl Woese serves as a course framework:

"...the earth is a microbial planet. Harvard paleontologist Stephen Jay Gould knew this when he said: '...we live in the Age of Bacteria (as it was in the beginning, is now and ever shall be, until the world ends)....'"

Microorganisms were the first to inhabit the earth. But for bacterial life, multicellular eukaryotic life as we know it would not have arisen: chloroplasts and mitochondria, which define the plants and animals, are both bacterial inventions. The planet's atmosphere bears the imprint of bacterial metabolism, and microbes are the essential, stable underpinnings of the biosphere—without bacteria, other life would not continue to exist. Understanding the (microbiologically based) biosphere is the primary goal, the necessary objective, of biology in [this] century. In this effort, microbiology is destined to emerge as the primary biological discipline.

A scientific understanding of a group of organisms has four components: [1] structure-function—how the organisms are built and how they work; [2] diversity—how many and what kinds of them there are, the ways in which they are similar and different; [3] ecology—how they interact with their environments and with one another; [4] evolution—where they came from and how they are related to one another. These are not four separate ways of knowing a group of organisms. They are facets of the same gem, interwoven threads of a tapestry."

Schedule of Lecture topics:

Weeks 1-3: Important historical events in microbiology and recent updates of each
Weeks 4-5: Microbial taxonomy and classification (features & methods used to place microbes on the "tree of life")
Week 6: Microbial identification and cultivation (lab methods for identifying and growing microorganisms)
Weeks 7-11: Microbial cell anatomy (discussions of cell wall, membrane, pili, spores, flagella, biofilms, genomes)
Week 12: Microbial growth (growth curve; growth rate calculations; factors influencing growth rate)
Week 13-14: Microbial genetics (recombinant DNA technology, operon theory, horizontal gene transfer, antibiotic resistance)
Week 15: Applied & environmental microbiology: (food microbiology, waste/drinking water microbiology, pharmaceutical aspects) & Virology (classification of viruses; differences from bacteria; selected examples)

Lab Schedule:

<table>
<thead>
<tr>
<th>Date</th>
<th>Activity</th>
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<tr>
<td>Aug 29/31</td>
<td>Lab check-in / Exercise #1 - Isolation of bacteria.</td>
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<tr>
<td>Sept 5/7</td>
<td>Read out: Exercise #1 / Unknown ID work: gram stain; streak plate &amp; slants;</td>
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<tr>
<td>Sept 12/14</td>
<td>Unknown ID work: spore stain; enzymes / Write-up #1 due</td>
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<tr>
<td>Sept 19/21</td>
<td>Unknown ID work: wet mount, size measurement; relationship to oxygen, sole carbon sources, temperature &amp; salt tolerance</td>
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<tr>
<td>Sept 26/28</td>
<td>Unknown ID work: capsule stain; read out of O₂, sole carbon source, temperature &amp; salt tolerance tests</td>
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<tr>
<td>Oct 3/5</td>
<td>Exercise #2 - Medium preparation / Exercise #3 - Physical control of microorganisms</td>
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<td>Oct 10/12</td>
<td>Read out: Exercises #2 &amp; #3</td>
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<tr>
<td>Oct 17/19</td>
<td>Free lab (work on unknown identification paper). / Write-ups #2 &amp; #3 due by 5PM</td>
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<td>Oct 24/26</td>
<td>Exercise #4 - Protozoa and Algae / Exercise #5 Bacterial growth rate</td>
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<td>Oct 30/Nov 2</td>
<td>Exercise #6 - Genetic transformation of E. coli / Exercise #7 - Ames test for mutagenicity</td>
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<tr>
<td>Nov 7/9</td>
<td>Read out: Exercises #6 &amp; #7. / Write-ups #4 &amp; #5 due</td>
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<td>Nov 14/16</td>
<td>Exercise #8 - Water analysis for fecal coliforms / Exercise #9 - Virus isolation from sewage / Write-ups #6 &amp; #7 due</td>
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<td>Nov 21/23</td>
<td>No lab: Thanksgiving holiday</td>
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<tr>
<td>Nov 28/30</td>
<td>Read-out: Exercises #8 &amp; 9 (write-ups due in Mon lecture). Exercise #10 - Examination of molds (write-up due at lab departure).</td>
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<tr>
<td>Dec 5/7</td>
<td>Optional lab practical exam</td>
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Unknown paper due: October 23 in lecture (a -5 pt penalty for each day late will be assessed)

Laboratory exercise write-ups (10 experiments each worth 10 points = 100 total)

1. While working in lab groups, it is your responsibility to equally share the work and also to observe & check the results of your group members. Only data can be shared---write-ups must be done individually. (Suggestion: observe other group's results)
2. Late submissions of write-ups will not be accepted.
3. For maximum credit your write-up must include the following (unless otherwise indicated):
   a. A "Title Page" for each exercise including your name & title of exercise. 1 pt will be deducted if this format is not followed.
   b. A section entitled “Results” listing complete results in the following manner: (5 pts max)
      - Include results of every test or observation you made in the lab & anything requested by the instructor/lab handout
      - Results must be presented in the form of properly labeled tables, graphs, figures and/or photos where possible
      - Do not include in this section: descriptions of methods/procedures, explanations for results or excessive narration
   c. A section entitled “Explanations” w/ thorough, well thought-out explanations (reasons): (4pts max)
      - This section should be mainly narrative
      - This section should not be a restatement of results
      - This section should suggest possible reasons/explanations for why the results came out as they did & where possible, refer to the handout, lab manual and/or lecture material to lend support for your explanation
      - In exercises where you record the entire lab results, you must discuss the overall findings--not just your part of the experiment.
   d. A section entitled "Personal Significance" (1 pt max) where you: relate the lab exercise to some aspect of your life. For example, if the results show you have bacteria on your hands, you could say: “because this experiment showed I have bacteria on my hands, perhaps by washing before meals, I might avoid swallowing potential pathogens by doing so"
**LABORATORY CHECK-IN:**

1. Sign the seating chart w/your preferred name & select a microscope from the cabinet to use this semester (write your microscope number on the seating chart)
2. Correct microscope storage includes: first removing slides, cleaning immersion oil from the lens, placing the low power objective down & covering the scope
3. Check your supply drawer for the following items: Immersion oil, inoculating loops & needles, wax pencils, matches, lens paper, spark lighters, bottles of reagents for the gram stain technique (crystal violet, iodine, 95% ethanol and safranin), slide holders, bibulous paper and plastic slide boxes
4. Do not borrow material from other supply drawers (consult the instructor for equipment replacement); do not save extraneous material in the drawer
5. Familiarize yourself with the location in our lab of the following: Incubators, refrigerators, hotbox, coverslips/slides, disinfectant jars, discard bucket for disposables, discard pan for dirty glassware, discard rack for dirty test tubes, discard jar for slides, discard jar for pipets, hand-washing sink, sink for discarding fluids, table/desk storage area and first-aid kit and shower
6. Review the lab safety section of your lab manual with your instructor. This material is extremely important & you need to know & practice everything presented. To insure that this is the case, be prepared to be tested over the information.

**Unknown paper write-up** (100 points total is possible)  Note: A copy of the instructors grading key is found later in this syllabus. You may work with a partner on this exercise in which case only one paper is required but both partners receive the same grade--BE SURE if you choose this option that the two of you are compatible work partners!

1. Word processed; excessive spelling/grammatical errors will be penalized; final length is optional; double space.  
   (5pts max)

2. Data presented must include: exact environmental site from which your unknown was isolated, cell/coloniaal morphological descriptions & sketches, tabulated data of tests performed, incubation lengths & temperatures, results of every test, stain, wet mount & observation you make (but don’t describe how/why you performed each test)  
   (20 pts max)

3. From Bergey’s Manual of Systematic Bacteriology, select and report the genus and species name of a bacterium which yields test results most like those of your unknown and describe in step-by-step detail how you arrived at the genus & the species name including how you decided it was not the other related genera and species listed in Bergey’s.  
   (20 pts max)

4. In a table (it can be the same one that you prepared in point #2 above), list each test you performed and its results. Indicate in this table whether each test result that you obtained “matched”, “did not match”, or was “not mentioned in Bergey’s” for the species name you chose as being your unknown. For tests that matched or did not match, indicate where in Bergey's you obtained this information (i.e. page number or table number).  
   (20 pts max)

5. Select a 2nd species (report the name) that you also considered & tell exactly why it was not your first choice  
   (10 pts max)

6. Cite 3 tests listed in Bergey’s which might have helped you differentiate between your two choices but which you did not perform. Explain why & how they would have been useful  
   (10 pts max)

7. Summarize & make conclusions. Include: your confidence in the correctness of your identification, tests that yielded results not clear-cut along w/ possible explanations; other information listed by Bergey’s relevant to your identification such as habitat.  
   (10 pts max)

8. A culture of your unknown must be turned in to the instructor at the beginning of your work on the unknown. This will be used by the instructor to verify your reported lab tests  
   (5pts)

*We use the microscope extensively in this course and it is important that you become very familiar with your assigned scope. Refer to the following tips when you experience problems in upcoming labs:

1. Too much light on the preparation--use less with oil immersion than you would with the other objectives
2. Baking the objective up with the coarse focus must be done slowly or the image is bypassed
3. Make sure your oil immersion objective enters the oil; if it will not do so, your fine focus has been dialed too far up--dial it down.
4. Take care that you are not working on the wrong side of the slide or using two coverslips
5. It is often best to focus on something using low power objectives before using oil immersion
6. Do not borrow material from other supply drawers (consult the instructor for equipment replacement); do not save extraneous material in the drawer
7. Do not borrow material from other supply drawers (consult the instructor for equipment replacement); do not save extraneous material in the drawer
8. Review the lab safety section of your lab manual with your instructor. This material is extremely important & you need to know & practice everything presented. To insure that this is the case, be prepared to be tested over the information.*

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**Academic Honor Code**

Angelo State University expects its students to maintain complete honesty and integrity in their academic pursuits. Students are responsible for understanding the Academic Honor Code, which is contained in both print and web versions of the Student Handbook.”

**Persons with disabilities** which may warrant academic accommodations must contact the Student Life Office, University Center, in order to request and to implement academic accommodations.”

**RELIGIOUS HOLY DAY:** A student who intends to observe a religious holy day during the semester should make that intention known in writing to the instructor during the first week of the semester and one week prior to the absence. If this submission is completed, a student who is absent from classes for the observance of a religious holy day shall be allowed to take make up missed exams or assignments scheduled for that day in accordance with syllabus policy.”