Biology 3411-010 - General Microbiology – Summer II, 2018

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Text: Benson’s Microbiological Applications (complete version by A. E. Brown; 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.

Course format: Classic lecture style supplemented w/ transparencies.

Student learning objective: For departmental, university, state & accreditation purposes, this course assesses learning objective BIOLG5, 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 learning objective BIOLG5 a student completing this course should be able to:
[1] isolate, maintain in pure culture, & laboratory test unknown bacteria; [2] critically evaluate the data & use appropriate references to identify the bacteria and [3] successfully communicate his/her results in a scientifically appropriate and grammatically correct written form.

Assessment: A term paper worth 125 points is a component of the lab accompanying the course. The project culminates in a term paper that will be graded (see criteria later in the syllabus) as to how well the student achieved the objectives listed above in the "Expected Outcome"

Max. possible points in the course:

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<tr>
<th>Points</th>
<th>Description</th>
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<tr>
<td>75</td>
<td>for assigned lab reports (5 reports X 15 pts each)</td>
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<tr>
<td>125</td>
<td>for paper detailing unknown microbe identification</td>
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<tr>
<td>375</td>
<td>for 3 exams (3 exams X 125 pts each)</td>
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<td>575</td>
<td>Total</td>
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Grade:

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<th>Grade</th>
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<tr>
<td>A</td>
<td>518 or more points</td>
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<td>B</td>
<td>461-517</td>
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<td>C</td>
<td>404-460</td>
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<td>D</td>
<td>347-403</td>
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<td>F</td>
<td>346 or less</td>
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Exam dates: July 17 (Tues), July 27 (Fri), & Aug 8 (Wed) (final exam 10:15-12:15)

Nature of the three exams: On exam days, bring blank paper & a pen/pencil. No electronic devices, including calculators, are permitted on desks during exams. Three exams will be given and each will count an equal amount towards your final grade. None are comprehensive. You will have the entire lecture period to finish the exam. No make up exams are given (see the instructor if an emergency prevents you from taking one of the exams; you must document the emergency). Each exam consists of material introduced in both lecture AND lab. 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.

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).

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.

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 (microbially 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:
Week 1: History, taxonomy and classification of microbial life
Week 2: Bacterial culture, identification and anatomy (part 1)
Week 3: Bacterial anatomy (part 2) and physiology/metabolism
Week 4: Microbial genetics (recombinant DNA technology, operon theory, horizontal gene transfer, antibiotic resistance)
Week 5: Applied & environmental microbiology: (food, waste/drinking water microbiology, pharmaceutical aspects) & Virology
Lab Schedule:

July 10  Intro to laboratory – Aseptic techniques – Isolation of microbes on laboratory media (SDA and MSA)
July 11  Microscopic examination of protozoa and algae
July 12  Microscopic examination of fungi
July 17  Unknown bacteria lab: Preparation of streak plates, gram stains and size measurements
July 18  Unknown bacteria lab: Colony descriptions, capsule stains and spore stains
July 19  Unknown bacteria lab: Susceptibility to antimicrobial conditions and/or chemicals (antibiotics, disinfectants, salt, ultraviolet light, temperature, heavy metals)
July 24  Unknown bacteria lab: Read out and discussion of previous lab’s tests
July 25  Unknown bacteria lab: Biochemical & metabolic testing (oxidase; catalase; fermentation of glucose, sucrose, lactose and mannitol sugars; acetoin production (VP), urease enzyme; indole production; growth anaerobically (Gas-Pak); nitrate reduction; starch hydrolysis; use of Simmons citrate as sole carbon source & use of asparagine as sole carbon source)
July 26  Unknown bacteria lab: Read out and discussion of previous lab’s tests. Discussion of term project paper.
Aug 1  Growth Rate Exercise.
Aug 2  Read out and discussion of week’s exercises (Reports due Monday in lecture, August 6)
Aug 7  No lab.

Unknown identifications: paper is due on August 2 (Thurs) in lab (a -5 pt penalty for each day late will be assessed)

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)
- Do not arrive late to lab or make quick departures
- Do not maintain regular absences and borrow notes to compensate
- Do not bring visitors to lab/lecture; turn off cell phones; do not infringe on the learning environment of others

Laboratory reports (75 points maximum)
1. Group data will be shared but the laboratory reports you turn in must be done individually.
2. Each of 5 lab exercises will be worth 15 points maximum. (These labs can not be made up but if a lab partner will share data, you can use the data and write up the experiment with a -3 point penalty)
3. Late submissions of reports will not be accepted.
4. Lab reports (except for the first) will consist of your answers to a handout set of questions regarding the class results of each exercise. These will test your ability to analyze results, see trends in data, recognize the practical significance of the data, draw appropriate graphs, and/or find relevant references on-line.
5. For lab exercise #1 only, your instructor will have a check-off list of organisms for you to find. As you find each of the required items, you will have the instructor confirm your find. The more you find & show, the more points you earn on this report.

Unknown paper write-up (125 pts maximum). Each group of 2-3 students will be given 4 bacterial cultures to identify using a series of laboratory tests. You are expected to collaborate with each other in setting up all of the tests on these 4 organisms. You will collect the data together. You will then have the option of submitting your own identification paper or alternatively turning in one paper representing a collaborative effort. All names on a collaborative paper will receive the same grade. Hence, it is possible that if separate papers are submitted, different grades may be earned depending upon the quality of the identifications.
Included in your lab handout are reprints of data tables from Bergey’s Manual of Systematic Bacteriology. This reference is one of the most commonly used sources of information for identifying bacteria. You will be given cultures of the following bacteria: *Bacillus, Pseudomonas* & a species from the family of bacteria Enterobacteriaceae. Also, you will isolate a *Staphylococcus* from your nose. Your task is to collect enough data to identify the species of each of these four organisms using the tables and data provided and then submit a paper that includes each of the following components:

a. A complete tabulated list of all tests conducted on the four organisms, the results obtained for each test (reported in correct scientific fashion), and a notation for each test result as to whether it “matched”, “did not match” or was “not reported” in the handout materials you were provided. (55 pts)

b. The species name you chose for the identity of each of the four organisms (the full names for both genus and species must be reported, correctly spelled and in correct scientific notation). Three of the species names are known by the instructor and your accuracy in choosing the correct name will be evaluated while the *Staphylococcus* species will be graded depending upon the quality of your analysis. For each correct name you submit, you will receive 4 points. The other five points will be earned by submitting correct spelling and scientific notation of the names you submit. (20 pts)

c. For each organism you named, provide an alternate name (in case your first choice is incorrect) and explain why you did not choose that name as your first choice. (If your second choice is more correct, you can earn back the relevant points you lost in section b. (10 pts)

d. For each unknown, do an on-line search and report the following things about each: where it got its full name (but do not report who named it); the organism’s normal habitat; what danger (if any) does it pose to humans. Cite your online source for the information you report. (16)

e. Although not as useful in identification, the various inhibitors that we tested ARE an important means of controlling bacteria. We tested UV light, antibiotics, disinfectants, temperature and heavy metals. For each one of these, rank your four organisms in terms of most affected to least affected. Then examine each ranking and report whether there are correlations between gram positive vs gram negative effects and between spore former vs. non-sporeformer effects. Finally, make conclusions as to [1] which individual organism is easiest overall to control and which is the most difficult to control, [2] which inhibitor is best and least effective against gram positives and gram negatives and [3] which inhibitor is best and least effective against spore-formers. (24 pts)

**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.

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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. Backing 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. If the specimen looks blurry, check for oil on the reverse of the slide or on the stage lens
7. When all else fails, ASK the instructor for help

“*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.*”