Laboratory course description

Fundamentals of Microbiology is a microbiology college course for nursing, food and nutrition and physical therapy majors. It is the study of microorganisms of the environment, including disease-producing organisms, their actions and reactions. The goal of the class is to teach basic microbiology techniques for allied health majors and to teach students how important microbes are in our daily lives.

PREREQUISITES: Will be enforced. Completion of, or Concurrent Enrollment in Bio 211. Completed Bio 203 and 203L (Formerly 201A); or Bio 100 and Chem 100 or Chem 102 or Chem 130.

ATTENDANCE: Laboratory attendance is mandatory. If you are absent or late, or leave before the assigned work is completed, you are letting your lab partners down and compromising your own grade, by losing performance evaluation points. You WILL NOT PASS the course if you miss more than 2 lab periods without a valid medical excuse. You will receive a warning after the second absence. Arriving late (more than 15 minutes) consistently (more than 2) or leaving early before the lab work is completed will be counted as an unexcused absence.

COURSE OBJECTIVES: (also see the Lab Learning Objectives on class web site for individual lab exercises 1-30)

Upon Successful completion of this course students will be able to:

1. Demonstrate a working knowledge of all safety equipment and procedures in the microbiology laboratory. This includes Biosafety Levels 1 & 2 rules.
2. Properly use a compound microscope to observe bacteria, fungi, protozoa and algae.
3. Perform Aseptic technique as it is used in a microbiology laboratory.
4. Properly use stains such as the Gram stain for identification of bacteria.
5. Demonstrate proper hand washing.
6. Distinguish between select bacterial groups based on microscopy, physiological and biochemical characteristics.
7. Identify microorganisms in: drinking water, wastewater and sewage treatment, production and spoilage of foods, human disease, the production of antibiotics.
8. Recognize the importance of microbes in nature.
9. Recognize the importance of microorganisms to humans, both beneficial and in disease.
10. Use and apply technical skills necessary for the study of immunology in the laboratory.

SAFETY: The laboratory exercises will use chemicals and living microorganisms, both of which could be harmful or infectious if handled improperly. You will be taught how to work in the laboratory properly. Please follow the instructions that the laboratory instructors provide. If you have an allergy to fungi or certain chemicals, if you are pregnant, or if you have a compromised immune system, you should contact the instructor and discuss such conditions with your personal physician prior to participation in the lab to determine if it is safe to for you to participate in the laboratory class. Before you start any work in this class, you will be required to sign a Safety Acknowledgement sheet that states that you have read the safety instructions and agree to abide by all the laboratory rules.

All students (enrolled and crashers) MUST attend the Safety Presentation and watch the safety video at the beginning of the semester and sign the Safety Acknowledgement form that states the following:

I have read the Safety Instructions for Microbiology Laboratory Classes, San Diego State University, and I understand its content. I agree to abide by all laboratory rules set forth by this document and my instructor. I understand that my safety is entirely my own responsibility and that I may be putting myself and others in danger if I do not abide by all the rules set forth by this document and my instructor.
ETIQUETTE FOR EMAILS AND DISCUSSIONS:
The faculty and staff associated with Biology 211 are your advocates and want you to succeed in this course and beyond. You have every right to ask to review an issue with appropriate faculty or staff. It is not acceptable to write inflammatory emails or use expletives in face-to-face meetings, or in email. An individual who displays disruptive behavior will be asked to leave the class.

LAB ASSIGNMENTS: The lab manual is to be used as a workbook and students are required to complete all of the laboratory exercises in the lab manual. This includes the “Evaluation of Results” section (Purpose, Data, Conclusions and Discussions), and the questions, as well as the Case Histories in the appendix. The student should use lecture notes, lab notes, the textbook, lab manual and other texts to find the answers to the questions and to work on the Case Histories. Additional questions will be added as needed. The lab quizzes will test your knowledge of all of the material. The TA will check the manual periodically. Pop quizzes will be given throughout the semester to assure that students are coming to class prepared. Each student will be required to give an oral presentation (10-15 minutes, with PowerPoint) on a topic in microbiology, to be decided by the student and TA. A general outline of the presentation must be handed in before the day of the oral, and a detailed outline is due on the day of the presentation. Students are required to write two lab reports, following scientific format, on unknown microorganisms. Students are required to turn in both a hard copy and an electronic copy of both lab reports and both outlines for the orals. If plagiarism is discovered, students are liable to be expelled, suspended or placed on probation, according to Section 41301 of the California Code of Regulations.

REPORTS: take home quizzes, written reports, etc. All written reports are due on the dates listed in the syllabus. Written reports need to be submitted to Turnitin along with a hard copy to the instructor. The oral reports are due on the date decided between you and your TA. Points will be lost for handing in late work. The penalty for late work will be 10% per lab day.

LAB PERFORMANCE: This grade is determined by attendance, ability to master the technical skills, preparation before coming to class, professionalism, your ability to accept responsibility and work well with your partners, and your attitude and cooperation in class. Lab checks (pop quizzes) will be instituted to enforce your preparation before lab.

QUIZZES: There will be five lab quizzes, worth 40 points each, spread over the 15 week semester. They might include practical lab questions. These will be given during the laboratory portion of the course to individual sections, on the dates listed in the syllabus. The lowest quiz grade will be discarded and there will be no makeup’s. A missed quiz will count as the lowest grade to be dropped. Please do not discuss the quiz material with other sections of the class, this will only lower your grade. There will not be any extra credit given. There will be no changes to an assignment’s grade later than two periods after it is returned.
TEXTBOOKS:
DeMers; Fundamentals Of Microbiology Lab Manual, 7th Revised or newest Printing Kendall Hunt

*(every student must have a new unused one)*

Tortora
Microbiology An Introduction, 11th edition Pearson, Benjamin Cummings

Leboffe
Photographic Atlas for the Microbiology Laboratory 3rd or 4th Edition Morton
*(students can share)*

Note: Payment of laboratory fees is required

LABORATORY SUPPLIES: Students need to provide the following supplies:

**R means; is Required / O means optional**

- Lab coat, full length (white, with knitted cuffs, preferred) NO Lab Aprons R
- Bibulous Paper #5495 R
- Black Sharpie Marker (for writing on glassware) R
- Lens Paper R
- Microscope Slides - Frosted End (1/2 Gross) (can be shared by pairs) R
- Slide Box = Slide holder box (for saving stained slides) R
- Goggles for eye protection when using stains and chemical R
- Berol China Marker (Red) (glass marking wax pencil) R
- Gram Stain Pen (for marking microscope slides) (can be shared) O
- Dye Sol/Erada Stain Cream (for removing stain from hands) O

LABORATORY SUPPLIES: provided by the Microbiology prep room.

Locker keys will be issued to students at the beginning of the semester during check in.
It is the student’s responsibility to return supplies to the lockers at the end of the semester and return the locker key during check out.

Locker contents per pair of students:
- 2 White TT Racks
- 2 Loops
- 1 Needle
- 1 Immersion Oil
- 2 Clothespins (large & small)
- 4 Plastic Beakers

Non-latex Gloves are provided by the Microbiology prep room:
GRADING: BASED ON A TOTAL OF 300 POINTS: (THERE IS NO EXTRA CREDIT!)

160 Lab quizzes; 5 (40 pt. each), drop one 20 Performance evaluation
5 Unknown take home 20 Lab Manual
15 Lab Report # 1 (First Unknown) 15 Case Histories: (5 x 3 pt each)
30 Lab Report # 2 (Second Unknown) 15 Pop quizzes: (3 X 5 pt each)
20 Oral report

BIO 211 GRADING BREAKDOWN

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<thead>
<tr>
<th>Grade</th>
<th>%</th>
<th>Points</th>
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<tbody>
<tr>
<td>A</td>
<td>93 – 100</td>
<td>279-300</td>
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<tr>
<td>A-</td>
<td>90 – 92.9</td>
<td>270-278.9</td>
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<td>B+</td>
<td>87 - 89.9</td>
<td>261-269.9</td>
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<tr>
<td>B</td>
<td>83 - 86.9</td>
<td>249-260.0</td>
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<tr>
<td>B-</td>
<td>80 – 82.9</td>
<td>240-248.9</td>
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<tr>
<td>C+</td>
<td>77 - 79.9</td>
<td>231-239.9</td>
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<tr>
<td>C</td>
<td>73 - 76.9</td>
<td>219-230.9</td>
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<tr>
<td>C-</td>
<td>70 -72.9</td>
<td>210-218.9</td>
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<td>D</td>
<td>60 - 69.9</td>
<td>180-209.9</td>
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<tr>
<td>F</td>
<td>&lt; 60</td>
<td>&lt;180</td>
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Note: If lab section grades are significantly different, the lab grades will be normalized between lab sections

GRADES: An independent letter grade will be assigned for both lab (Bio 211L) and lecture (Bio 211). Grades for all quizzes, and assignments will be posted on Blackboard.

It is the non-negotiable policy of this class that exam scores and final course grades will not be discussed via email. Grades for exams or the course must be discussed in person. Email discussions about course or assignment grades are prohibited by SDSU’s Information Security Plan in order to assure compliance with federal laws protecting student privacy.

Your grades are based on your attendance, performance in lab and the assignments and quizzes. You may request a change to your exam score or grade based on factors such as exam key errors, potentially incorrect exam key answers, or errors made by the instructor during the entry of scores on Blackboard. There will be no changes to an assignment’s grade later than two periods after it is returned.

The TA will keep a record of the student’s lab participation (total 20 points) as follows.

<table>
<thead>
<tr>
<th>TA evaluation of student for Lab Participation:</th>
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<tr>
<td>Attendance (10 points):</td>
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<tr>
<td># Unexcused Absences</td>
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<tr>
<td>0</td>
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<td>1</td>
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<td>2*</td>
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<td>3</td>
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<td>*(warning sent)</td>
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ACADEMIC HONESTY:
Students are expected to be honest and ethical at all times in their quest of academic goals. There is “zero tolerance” for academic dishonesty. This includes:
- Unauthorized assistance on an examination, quiz, or any other test.
- Plagiarism (to take and pass off as one’s own work, the work or ideas of another).
- Any unauthorized access of an Instructor’s account;
- Any other serious violation of academic integrity identified by the instructor.

Plagiarism is formal work publicly misrepresented as original; it is any activity wherein one person knowingly, directly, and for lucre, status, recognition, or any public gain resorts to the published or unpublished work of another in order to represent it as one’s own (Lindey, Alexander. Plagiarism and Originality, 1952).

Cheating, Copying or Plagiarism will not be tolerated:
If there is evidence of cheating copying or plagiarizing on any test, quiz, report, etc., those involved will receive no credit on the item or receive an F for the course. The lecturer and appropriate lab instructors will meet with those involved and students will not be allowed to sit together during subsequent exams, quizzes (lecture and lab). This will be dealt with on a case by case basis. Further departmental action may be taken, including action resulting in the expulsion of the student who has committed the infraction.

ADD/DROP AND CRASHING PROCEDURES:
Enrolled Students:
- Prerequisites will be enforced for all students. Enrolled students need to be prepared to show proof of meeting the prerequisites if needed.
- Enrolled students missing the first two lab meetings will be dropped.

Crashers:
- Crashers MUST be present at the beginning of the first and second laboratory meetings of the lab section that they are trying to crash, to be considered to get an add code.
- Add codes will be given out to qualified students at the second laboratory meeting after attendance is taken.
- Add codes will be given out to SDSU students first. Previous crashers from past semesters will have first priority.
- Open University students have the lowest priority. Add codes are given to these students after all SDSU students are enrolled.

All students (enrolled and crashers) MUST attend the Safety Presentation and watch the safety video at the beginning of the semester and sign the Safety Acknowledgement form that states the following:

I have read the Safety Instructions for Microbiology Laboratory Classes, San Diego State University, and I understand its content. I agree to abide by all laboratory rules set forth by this document and my instructor. I understand that my safety is entirely my own responsibility and that I may be putting myself and others in danger if I do not abide by all the rules set forth by this document and my instructor.

Students with Disabilities
If you are a student with a disability and believe you will need accommodations for this class, it is your responsibility to contact Student Disability Services at (619) 594-6473. To avoid any delay in the receipt of your accommodations, you should contact Student Disability Services as soon as possible. Please note that accommodations are not retroactive, and that the TA cannot provide accommodations based upon disability until they have received an accommodation letter from Student Disability Services. Your cooperation is appreciated.
BIO 211L Spring 2014
LABORATORY SCHEDULE (Tentative)
Prepared by Marlene DeMers Lab Coordinator (mmdemers@mail.sdsu.edu)
Web Site:  http://www.bio.sdsu.edu/classes/Bio211L/
You are required to read the Assigned Readings listed below in your lab manual and textbook, before coming to each class. Laboratory Manuals (required): Fundamentals of Microbiology, 7th edition, revised by DeMers.  A photographic Atlas for the Microbiology Laboratory; 3rd or 4th edition; Leboffe & Pierce
Please note exercise numbers and Appendices refer to the Laboratory Manual by DeMers. Use the Atlas by Leboffe for images to the lab exercises. Use the Tortora index (and other textbooks) for references to the lab exercises.

**BIO 211L LAB SECTION MEETING TIMES**

| SECTION 1  | 20384 | MW 9:00 – 11:40 am |
| SECTION 2  | 20385 | MW 12:00 – 1:40 pm |
| SECTION 3  | 20386 | MW 3:00 – 5:40 pm |
| SECTION 4  | 20387 | MW 6:00 – 8:40 pm |
| SECTION 5  | 20388 | TTH 8:00 – 10:40 am |
| SECTION 6  | 20389 | TTH 11:00 – 1:40 pm |
| SECTION 7  | 20390 | TTH 2:00 – 4:40 pm |
| SECTION 8  | 20391 | TTH 5:00 – 7:40 pm |
| SECTION 9  | (20392) NLS 420 | TTH 3:00 – 5:40 pm |
| SECTION 10 | (20393) NLS 420 | TTH 6:00 – 8:40 pm |
| SECTION 11 | (23894) NLS 420 | MW 7:00 – 9:40 pm |

<table>
<thead>
<tr>
<th>LAB #</th>
<th>DATE</th>
<th>EXERCISE</th>
<th>READINGS Lab Manual &amp; Requirements</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>W, Th 1/22,23</td>
<td><strong>First Day of classes:</strong> Labs begin: Crash Lists, Introduction, Laboratory description, Overview of course (Includes Microbiology oral topics discussion); Necessary supplies, Lab Safety, Review of calculations</td>
<td>Safety Video &amp; Handouts</td>
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<tr>
<td>2</td>
<td>M, T 1/27,28</td>
<td><strong>Check in (keys, lockers &amp; drawers) for enrolled students and crashers with add codes</strong> Enrollment continued, add codes, etc. Digital Video: Lab Safety &amp; acknowledgment continued 1: Brightfield microscopy (prepared slides) Troubleshooting the microscope Digital Video (lab manual): Using the Microscope 2: Other Microscopes; (darkfield, phase) 3: Observing Protozoa, Hay Infusion, Cyanobacteria Sign safety acknowledgement.</td>
<td>Add codes given out after Attendance DVD &amp; Safety; vi-ix Ex. 1 Microscope DVD Appendix A DVD Ex. 2 Ex. 3 Required: Ink Pen &amp; Sharpie</td>
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<tr>
<td>3</td>
<td>W, Th 1/29,30</td>
<td><strong>Introduction to Case Histories (practice with #1)</strong> 1, con’t: Brightfield microscopy, con’t. 2: Other Microscopes, con’t. (stereo) 4: Observing Fungi and Yeast prepared slides</td>
<td>Ex. 1, con’t. Ex. 2, con’t. Ex. 4 Appendix N: Case History # 1</td>
</tr>
<tr>
<td>4</td>
<td>M, T 2/3.4</td>
<td><strong>Case History # 6 Due</strong> Note: Tues, 2/4/2014 Students Last day to add or drop</td>
<td>Ex. 4, con’t Ex. 5 revised Ex. 6 (DVD) Appendix N Required: Lab Coat, Slides</td>
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<tr>
<td>Day</td>
<td>Days</td>
<td>Quiz</td>
<td>Exercises</td>
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| 5   | W, Th | 2/5, 6 | 6: Aseptic Technique (smears from inoculations)  
7: Smear preparation  
8: Simple staining  
11: Culture media preparation | Ex. 6, con't.  
Ex. 7 (DVD)  
Ex. 8 (DVD)  
Ex. 11, Appendix L  
**Required:** Eye Protection |
| 6   | M, T  | 2/10, 11 | **QUIZ # 1 (Exercises: 1,2,3,4,5,6,7,8,9,10,Safety)**  
9: The Gram Stain (start)  
Appendix B: Troubleshooting the Gram Stain  
11, con’t: Culture media preparation con’t | Ex. 9  
Appendix B  
Ex. 11, con’t |
| 7   | W, Th | 2/12, 13 | 9, con’t: Gram staining, con’t.  
10: Miscellaneous staining: Acid-Fast staining, Capsule  
12: Streak Plate Technique (day 1)  
13: Specimen transport (collection swab only)  
14: Hand Washing | Ex. 9, con’t.  
Ex. 10  
Ex. 12  
Ex. 13  
Ex. 14 |
| 8   | M, T  | 2/17, 18 | 10: Miscellaneous staining, continued, Endospore  
12 con’t: Culture techniques con’t. (day 2)  
13, con’t: Specimen Transport (inoculation)+ RODAC  
14, con’t: Hand Washing  
15: Bacterial plate counts  Appendix C: Dilutions | Ex. 10, con’t  
Ex. 12, con’t  
Ex. 13, con’t  
Ex. 14, con’t  
Ex. 15 App. C |
| 9   | W, Th | 2/19, 20 | 12, con’t: Culture techniques con’t (day 3)  
13, con’t: Specimen transport con’t. (results)  
15, con’t: Bacterial counts con’t. (results)  
Appendix C: Dilution’s  
24: **Unknown #1 – (day 1) (streak plates)** | Ex. 12, con’t  
Ex. 13, con’t  
Ex. 15, con’t  
App. C  
Ex. 16 A - E  
Ex. 24, App. D - I |
| 10  | M, T  | 2/24, 25 | 12, con’t: Culture techniques, con’t. (day 4) only if necessary  
16, con’t: Bacterial Growth Characteristics con’t. (A-E)  
(Results and Interpretations)  
24: **Unk #1, con’t. – (day 2) (Gram stain & inoculation on to TSA slant only)**  
24: **Take home unknown quiz available on line** | Ex. 12, con’t  
Ex. 16, con’t.  
Ex. 24, con’t  
Ex. 24, App. D - I |
| 11  | W, Th | 2/26, 27 | **QUIZ # 2 (Exercises: 9,10,11,12,13,14,15,16)**  
17: Selected Physiological and Biochemical Tests  
Introduction to Gram Negative Rods, (B-E)  
24: **Unk # 1, con’t. – (day 3) Inoculate C, D, E** | Ex. 17 B - E  
24, con’t |
| 12  | M, T  | 3/3, 4 | 17, B-E con’t: Physiological and Biochemical tests  
17, F-K start: Physiological and Biochemical tests  
24, **Unk # 1, con’t. – (day 4) Inoculate F, G, H, I, J, K** | Ex. 17,B-E con’t  
Ex. 17 F-K  
24, con’t |
| 13  | W, Th | 3/5, 6 | 17, con’t: Physiological and Biochemical tests, con’t. B-K  
21: Antiseptics & Disinfectants  
22: Antibiotic sensitivity testing  
24: **Unk #1, con’t. – (day 5)(results)**  
**Unknown take home quiz Due**  
24, con’t: Unknown #1, con’t. How to write the report | Ex. 17, con’t  
Ex. 21  
Ex. 22  
Ex. 24, con’t |
<table>
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<tr>
<th>Date</th>
<th>Days</th>
<th>Topic</th>
<th>Due Information</th>
</tr>
</thead>
</table>
| 14 M, T | 3/10,11 | 21, con't: Antiseptics & Disinfectants, day 2  
22, con't: Antibiotics' days 2  
23: Isolation of Antibiotic Resistant Mutants (day 1)  
24: BEGIN UNKNOWN #2 (day 1)(streak plates) | Ex. 21, con't  
Ex. 22, con't  
Ex. 23  
Ex. 24 Unk. # 2 |
| 15 W, Th | 3/12,13 | 23: Isolation of Antibiotic Resistant Mutants (day 2)  
24, con't: Unknown #2, con't (day 2)(Gram stains)  
Choice of Microbiology oral topic & date DUE | Ex. 23, con't  
Ex. 24 Unk. # 2, con't. |
| 16 M, T | 3/17,18 | 24, con't: Unknown #2, continued (day 3)  
Brief Outline of Oral Due | Ex. 24 Unk. # 2, con't. |
| 17 W, Th | 3/19,20 | QUIZ # 3 (Exercises; 17,21,22,23,24,Safety)  
24, con't: Unknown #2, continued (day 4) | Ex. 24 Unk. # 2, App. D – I |
| 18 M, T | 3/24,25 | 24, con't: Unknown #2, continued (day 5)  
Lab Report # 1 Due (unknown #1)  
Begin Oral presentations  
NOTE: Detailed Outlines Due on the day of oral | Ex. 24 Unk. # 2, App. D – I |
| 19 W, Th | 3/26,27 | 24, con't: Unknown #2, con't (day 6) (if necessary)  
Oral presentations continued | Ex. 24 Unk. # 2, App. D – I |
|         |       | Spring Break  
March 31 – April 4 |                           |
| 20 M, T | 4/7,8 | 27: Spoilage of meat (day 1) (inoculations)  
30: Isolation of antibiotic producer from soil day 1 continued (incubate plates for one week at 30 degrees)  
Oral presentations continued | Ex. 27  
Ex. 30 |
| 21 W, Th | 4/9,10 | 25: Immunology: Slide & Tube Agglutinations Day 1  
26: Water Microbiology -Presumptive test (day 1)  
Oral presentations continued | Ex. 25  
Ex. 26  
Required: BSL2 Rules Compliance |
| 22 M, T | 4/14,15 | 18: Staphylococci (day 1) BSL2  
19: Streptococci (day 1)(throat cultures) BSL2  
25, con't. Immunology: Tube Agglutination only  
26, con't: Water Microbio. Confirmed test (day 2) BSL2  
30, con't: Antibiotic producer from soil, day 2 (incubate one week 30 degrees) BSL2  
Case History # 2 Due  
Oral presentations continued | Ex. 18 BSL2  
Ex. 19 BSL2  
Ex. 25, con’t  
Ex. 26, con’t BSL2  
26, con't: Water Microbio. Confirmed test (day 2) BSL2  
Ex. 30, con't BSL2  
Appendix N |
<table>
<thead>
<tr>
<th>Date</th>
<th>Schedule</th>
<th>Notes</th>
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<tbody>
<tr>
<td>23 W, Th</td>
<td>4/16,17</td>
<td>18, con't: Staphylococci (day 2) <strong>BSL2</strong></td>
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<td>19: Streptococci, con't. (day 2) <strong>BSL2</strong></td>
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<td>20: Urine cultures, day 1 <strong>BSL2</strong></td>
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<td>26, con't: Water Microbiology (day 3) <strong>BSL2</strong></td>
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<td>30, con't: Antibiotic producer from soil, day 3 <strong>BSL2</strong></td>
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<td><strong>Case History # 3 Due</strong></td>
<td><strong>Oral presentations continued</strong></td>
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<td>24 M, T</td>
<td>4/21,22</td>
<td><strong>QUIZ # 4 (Exercises; 20,24,25,26,some 30 Safety)</strong></td>
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<td>18, con't: Staphylococci, con't. (day 3) <strong>BSL2</strong></td>
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<td>19, con't: Streptococci, con't. (day 3) <strong>BSL2</strong></td>
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<td>20, con't: Urine cultures, day 2 <strong>BSL2</strong></td>
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<td>26, con't: Water Microbiology (day 4) <strong>BSL2</strong></td>
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<td>28: Microbiology of Wine Making (day 1) <strong>BSL2</strong></td>
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<td><strong>Case History # 5 Due</strong></td>
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<td><strong>Oral presentations continued</strong></td>
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<td>25 W, Th</td>
<td>4/23,24</td>
<td>18, con't: Staphylococci, con't. (day 4) <strong>BSL2</strong></td>
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<td>19, con't: Streptococci, con't. (day 4) <strong>BSL2</strong></td>
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<td>29: Microbiology of Milk (day 1): Standard plate count of milk, <strong>BSL2</strong> Reductase test demonstration, Fermented milk products (yogurt)</td>
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<td><strong>Case History # 5 Due</strong></td>
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<td><strong>Oral presentations continued</strong></td>
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<tr>
<td>26 M, T</td>
<td>4/28,29</td>
<td>27, con't: Spoilage of Meat, con't. (day 2) <strong>BSL2</strong></td>
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<td>28, con't: Microbiology of Wine Making (day 2) <strong>BSL2</strong></td>
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<td><strong>Unknown #2 Written Lab Report Due</strong></td>
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<td>27 W, Th</td>
<td>4/30, 5/1</td>
<td>29, con't: Fermented Milk Products (day 2) (plate counts &amp; yogurt) <strong>BSL2</strong></td>
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<td><strong>Case History # 4 Due</strong></td>
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<td><strong>Start Cleanup</strong></td>
<td>after all exercises are finished</td>
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<td>28 M, T</td>
<td>5/5, 6</td>
<td><strong>Quiz # 5 (Exercises; 18,19,27,28,29,30,con't.)</strong></td>
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<td><strong>Decontamination of locker contents</strong> <strong>BSL2</strong></td>
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<td><strong>Finish before checkout!</strong></td>
<td><strong>Lab Check Out (No Earlier!)</strong></td>
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<td>**KEYS DUE! **</td>
<td><strong>Follow Check Out Instructions</strong></td>
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<tr>
<td>29 W, Th</td>
<td>5/7,8</td>
<td><strong>LAST DAY OF CLASSES</strong></td>
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**Bio 211 Lecture Final:**
To Be Determined by the instructor

**Please Note:** Lab Coats may be picked up until the end of finals week **only**!
After finals week, they are considered donated,
Thank you! Marlene & Tom, 4th floor prep room

Have a great summer break!  
Spring 2014
Biology 211L Lab Learning Objectives
Exercises 1 - 30

Laboratory Safety

Upon successful completion of the lab introduction, you will be able to
1. define Biosafety levels 1, 2 & 3 procedures.
2. demonstrate a working knowledge of all safety equipment and procedures in the microbiology laboratory, and provide a rationale for each procedure.
3. properly dispose of all contaminated materials and provide a rationale for each disposal method.

Exercise 1–The Brightfield Microscope

Upon successful completion of this exercise, you will be able to
1. identify, describe the function of, and properly operate the parts of the compound microscope.
2. transport and store the microscope safely.
3. properly clean optical and other surfaces.
4. observe various specimens on microscope slides using the low, high, and oil immersion lenses.
5. define the terms listed under “Microscopic Terminology”.
6. calculate total magnification of any microscope, given ocular and objective lens magnifications.

Exercise 2–Other Microscopes

Upon successful completion of this exercise, you will be able to
1. describe the basic differences between brightfield, darkfield, phase and fluorescent microscopy, and state advantages and disadvantages of each.
2. describe the differences between electron (SEM and TEM) and light microscopes, and state the advantages and disadvantages of each.
3. differentiate between the uses of compound microscopes and stereoscopes.
4. properly operate the stereoscope.
5. recognize specimens as being viewed with brightfield, darkfield and phase contrast microscopy.

Exercise 3–Observing Protozoa, Algae, and Cyanobacteria

Upon successful completion of this exercise, you will be able to
1. prepare wet mounts of various organisms.
2. describe the features shared by and unique to algae, protozoans, and cyanobacteria, and provide two examples of each.
3. outline the differences between prokaryotes and eukaryotes.
4. describe how a hay infusion is prepared.
5. relate the disease and source of infection to the protozoan pathogens listed in Conclusions, Discussions and Questions.
6. define the term parasite.
7. compare and contrast bacteria and protozoans, algae and cyanobacteria.
Exercise 4–Observing Fungi and Yeast
Upon successful completion of this exercise, you will be able to
1. describe the features that place the fungi in their own kingdom.
2. outline basic fungal characteristics (as listed in Technical Background) and use these to recognize the five genera studied, both macroscopically and microscopically.
3. compare and contrast, and recognize examples of, zygomycetes, ascomycetes, basidiomycetes, and deuteromycetes.
4. recognize a colony on an agar plate as being either fungal or bacterial.
5. name two media commonly used for growing fungi.
6. define the term compromised host and state its importance.
7. compare and contrast the terms pathogen and opportunistic pathogen.
8. prepare a wet mount of yeast and recognize prepared microscope slides of yeast.

Exercise 5–Observing Bacteria
Upon successful completion of this exercise, you will be able to
1. describe and recognize microscopic differences between bacteria and other organisms studied so far.
2. describe, sketch, and recognize examples of basic bacterial cell morphologies (shapes) and arrangements.

Exercise 6–Aseptic Technique
Upon successful completion of this exercise, you will be able to
1. define and state the importance of aseptic technique.
2. perform aseptic transfers from broth and agar culture tubes to sterile broth and agar tubes
3. properly use a Bunsen burner.
4. define the terms culture, medium, contaminant, and inoculation.

Exercise 7–Smear Preparation
Upon successful completion of this exercise, you will be able to
1. aseptically prepare bacterial smears from broth and agar cultures.
2. describe the importance of the air drying and heat fixing steps in bacterial smear production.
3. outline the differences in smear preparation using broth and agar cultures.
4. describe the uses of agar slants, agar plates, and broths.

Exercise 8–Simple Staining
Upon successful completion of this exercise, you will be able to
1. discuss the importance of bacterial staining.
2. outline and state the importance of the steps in performing a simple stain.
3. perform a simple stain from any bacterial source, including cultures and teeth scrapings.
4. define the terms pleomorphic and palisades arrangement, recognize them on simple stained specimens, and provide an example of a bacterial genus that demonstrates both.
5. provide examples of three genera of commonly encountered oral microbes.
6. describe, sketch, and recognize examples of basic bacterial cell morphologies (shapes) and arrangements.

Exercise 9–The Gram Stain
Upon successful completion of this exercise, you will be able to
1. compare and contrast simple and a differential staining techniques.
2. state the purpose of the Gram stain.
3. describe the function of each step in a Gram stain, and describe how Gram positive and Gram negative cells appear after each step.
4. perform and interpret a Gram stain.
5. discuss the consequences of deviations from proper Gram staining technique.
Exercise 10–Miscellaneous Staining

Upon successful completion of this exercise, you will be able to
1. state purpose of the acid-fast, endospore, and capsule stains.
2. describe the function of each step in a acid-fast, endospore, and capsule stains, and describe how positive and negative cells appear after each step.
3. provide examples of pathogens that are characterized by positive results for the acid-fast, endospore, and capsule stain.
4. perform an acid-fast stain, name the most common genus that is acid-fast, and recognize specimens that have been stained by the acid-fast procedure.
5. perform an endospore stain and interpret slides that have been stained by the endospore procedure.
6. describe the purpose of endospores, and compare and contrast two common genera that produce them.
7. describe the purpose of a capsule.
8. perform a capsule stain and interpret slides that have been stained by the capsule stain procedure.
9. compare and contrast positive and negative stains.

Exercise 11–Culture Media Preparation

Upon successful completion of this exercise, you will be able to
1. compare and contrast the uses of general-purpose, selective and differential media, and provide examples of each.
2. calculate proportions necessary to make different amounts of culture media when given a recipe.
3. discuss the importance of sterilization in medium preparation, state the conditions under which complete sterilization occurs, and name the equipment used to achieve it.
4. prepare nutrient agar and transfer it to Petri plates aseptically to produce nutrient agar plates.
5. state the role of the unopened plate in this exercise.

Exercise 12–The Streak Plate and Colony Morphology

Upon successful completion of this exercise, you will be able to
1. aseptically transfer from broth or agar tubes to Petri dishes.
2. describe the purpose and principle of the streak plate.
3. perform a T-streak to isolate bacteria from a mixed culture.
4. properly label and incubate Petri plates.
5. explain why Petri plates are incubated in an inverted position.
6. describe how colonies form on a Petri plate and explain why isolation is an important procedure in microbiology.
7. visually differentiate bacterial colonies based on color, size, consistency, margin, shape (elevation), and opacity, and properly apply the terms as listed in “Technical Background”.
8. discuss possible problems encountered in performing a streak plate, including recovery of only a single bacterial type from a mixed culture and recognizing likely contaminants.

Exercise 13–Specimen Transport & Ubiquity of Microorganisms

Upon successful completion of this exercise, you will be able to
1. collect a sample with a specimen swab.
2. discuss different transport devices and media used for collected specimens.
3. describe the principle and purpose of RODAC plates, and apply the guidelines for evaluating degree of surface contamination.
4. describe the importance of quality control (QC) in microbiology in general, and the Gram stain in particular.
5. produce a Gram stain QC slide.
Exercise 14–Hand-washing

Upon successful completion of this exercise, you will be able to
1. state the importance of hand washing before and after microbiological procedures, including the use of disinfectant when scrubbing for a medical procedure.
2. list common microorganisms found on the human skin.
3. define the terms nosocomial, contaminant, transient and resident as they apply to microorganisms.
4. provide and recognize examples of likely sources of hand contamination.

Exercise 15–Bacterial Plate Counts

Upon successful completion of this exercise, you will be able to
1. use the plate count technique to calculate bacterial density in a sample.
2. perform serial dilutions using serological and digital pipettors.
3. perform the spread plate technique of inoculation.
4. perform dilution problems.
5. define the terms CFU, aliquot, diluent, dilution factor, TNTC and TFTC.
6. explain why bacterial densities are reported as CFU/mL as opposed to cells/mL.
7. explain the convention of only counting plates that have between 30 and 300 colonies.

Exercise 16 - Bacterial Growth Characteristics

Upon successful completion of this exercise, you will be able to

A - Osmotic Pressure
1. describe osmotic pressure and how it affects a cell.
2. use turbidity measurement aids to compare the growths of bacteria in the different concentrations of salt.
3. recognize salt loving bacteria and know where they are found.

B - Oxygen
1. describe and recognize facultative anaerobe, strict aerobe, aerotolerant anaerobe, obligate anaerobe.
2. name at least one example of a facultative anaerobe, strict aerobe, aerotolerant anaerobe, obligate anaerobe.
3. know the parts an anaerobe jar and how it works.

C - pH
1. determine the different strains of bacteria growing at the different pHs with the turbidity measurement aids.
2. understand why pH is important to know for food preservation methods.
3. know where acid loving and alkaline loving bacteria survive in nature.

D - Temperature
1. determine the optimal growth temperatures for the organisms studied.
2. discuss why it is useful to know the temperatures at which bacteria grow.
3. know the optimum temperature of human pathogens.
4. define the terms thermophile, mesophile, psychrophile.

E - Pigment production
1. describe the different types of pigment production.
2. recognize the different types of pigment production.
3. name some examples of human disease causing bacteria that produce a pigment.
Upon successful completion of this exercise, you will be able to

**B - Catalase**
1. perform a catalase test.
2. recognize a positive and negative result.
3. know the enzyme that is being tested.
4. name the media and the reagents used for this test.
5. know what two Genera of bacteria this tests separates for identification purposes.

**C - Citrate**
1. perform a citrate test.
2. recognize a positive and negative citrate result.
3. know the enzyme that is being tested.
4. name the media and the reagents used for this test.
5. know how to use this test for identification of an unknown.

**D - Carbohydrate fermentation**
1. perform a carbohydrate fermentation test with one sugar for practice.
2. recognize a positive and negative result.
3. name some of the other sugars that bacteria can ferment.
4. know that all members of the Enterobacteriaceae (enteric) family ferment glucose.
5. recognize that lactose fermentation is often used to distinguish certain pathogenic enteric species of bacteria.
6. name the media and the reagents used for this test.
7. know the enzymes that are being tested for the different sugars.

**E - Hydrogen Sulfide Production**
1. perform the hydrogen sulfide test.
2. recognize a positive and negative result.
3. name the media and reagents used for this test.
4. know the enzyme that is being tested.
Upon successful completion of this exercise, you will be able to

F - Indole production
1. perform the indole test.
2. recognize a positive and negative result.
3. name the media and reagents used.
4. know the enzyme responsible for this test.

G - Methyl Red test
1. perform the MR test.
2. recognize a positive and negative result.
3. name the media and reagents used.
4. know the enzyme responsible for this test.

H - Motility
1. inoculate the motility agar with an inoculating loop.
2. know how to determine positive motility and negative motility.
3. know how to double check for motility using a wet mount.

I - Nitrate
1. describe nitrate reduction.
2. recognize a positive and negative result.
3. evaluate the different observations after the addition of the reagents in each step and color change.
4. name the media and reagents used.
5. know the enzymes responsible.

J - Oxidase
1. perform an oxidase test.
2. recognize a positive and negative result.
3. name two groups of bacteria that are separated from each other with the oxidase test.
4. name the enzyme responsible.
5. know the media used.

K. Urease test
1. perform the urease test
2. recognize a positive and negative result.
3. name the enzyme responsible.
4. know the media used.
5. describe how the pathogens Salmonella and Shigella can be differentiated in the Enterobacteriaceae family.
Exercise 18 - Gram Positive Cocci: Staphylococci

Upon successful completion of this exercise, you will be able to
1. describe the Gram reaction and recognize the arrangement of staphylococci cells on a Gram stained slide.
2. list the types of media that the staphylococci grow on and describe their appearance.
3. perform and describe the catalase, coagulase, and DNAse tests.
4. know how the catalase, coagulase and DNase tests are used in studying the staphylococci.
5. define nosocomial infections and give examples of some.
6. list some of the normal flora found on skin and in the nasal area.
7. define carrier, opportunistic pathogen and pathogen.
8. describe the types of hemolysis.
9. identify colonies of staphylococci that are beta hemolytic and non-hemolytic and give examples of each.
10. compare and contrast the terms pathogen and opportunistic pathogen using the staphylococci as examples.

Exercise 19 - Gram Positive Cocci: Streptococci

Upon successful completion of this exercise, you will be able to
1. describe the Gram reaction and recognize the arrangement of streptococci cells on a Gram stained slide.
2. perform the proper technique of obtaining a throat culture on yourself.
3. list some of the normal flora found in the throat and mouth.
4. perform the catalase, 6.5% NaCl, bile esculin tests with the streptococci.
5. recognize positive and negative results for catalase, 6.5% NaCl and bile esculin tests.
6. recognize the types of hemolysis on a blood agar plate.
7. name the types of hemolysis and give examples of streptococci for each.
8. perform the identification tests using Bacitracin, SXT and Optochin discs.
9. list some diseases that Group A streptococci cause in humans.
10. list the different groups of streptococci and give examples of each.
11. list examples of streptococci that cause dental plaque.
12. know how agglutination tests help in identifying the beta hemolytic groups of streptococci.

Exercise 20 - Urine Cultures

Upon successful completion of this exercise, you will be able to
1. know how to collect a clean catch urine.
2. perform universal precautions.
3. describe the criteria used for identifying a UTI (urinary tract infection).
4. know how to perform and interpret the results of a urine dipstick.
5. list what positive tests would indicate a UTI on the urine dipstick.
6. list some examples of Gram negative bacteria that cause UTIs.
7. list some examples of Gram positive bacteria that cause UTIs.
8. describe EMB agar and why it is used.
9. know how to calculate the final number of colonies the diluted urine plates.
Exercise 21 - Antiseptics and Disinfectants
Upon successful completion of this exercise, you will be able to
1. define antiseptic and disinfectant.
2. define bacteriostatic and bactericidal.
3. inoculate a plate using a swab.
4. define zone size.
5. evaluate the relative effectiveness of various chemical with various bacteria.
6. know what type of compound ethanol, chlorine and phenol are and their uses.

Exercise 22 - Antibiotic Sensitivity Testing
Upon successful completion of this exercise, you will be able to
1. perform the Kirby-Bauer method of antibiotic susceptibility.
2. describe the importance of doing antibiotic susceptibility tests on bacteria.
3. define and know how to measure the zone of inhibition.
4. list the factors affecting the zone of inhibition.
5. know the difference between narrow and broad spectrum antibiotics.
6. Define MIC.

Exercise 23 - Isolation of Antibiotic-Resistant Mutants
Upon successful completion of this exercise, you will be able to
1. discuss why spontaneous mutations to antibiotics can occur in some bacteria.
2. define mutation.
3. calculate the ampicillin-resistant spontaneous mutants that occur with *Serratia marcescens*.
4. describe what a negative control is and how it is used.
5. discuss how antibiotic mutations can affect patient treatments.

Exercise 24 - Unknowns
Upon successful completion of this exercise, you will be able to
1. perform the identification of unknown bacteria.
2. use QC slides to aid in the unknown identification.
3. keep stock and working cultures of unknown bacteria for testing.
4. correctly use an identification table for identifying an unknown.
5. make flow charts.
6. write a lab report using scientific format.

Exercise 25 - Immunology
Upon successful completion of this exercise, you will be able to
1. define antigen, antibody, agglutination and titer.
2. read and interpret tube agglutination reactions.
3. perform a slide agglutination test.
4. interpret slide agglutination reactions.
5. describe how positive and negative controls are used with agglutination reactions.
6. list the types of blood cells found in human blood and their function.
7. recognize the difference between a white cell, red blood cell and platelet.
8. list the blood groups found in humans.
9. describe how slide hemagglutinations are used for typing human blood cells.
Exercise 26 - Water microbiology
Upon successful completion of this exercise, you will be able to
1. describe what MPN is.
2. describe the presumptive, confirmed and completed tests of the MPN.
3. define indicator and coliform.
4. describe the characteristics of a good sewage indicator.
5. describe the MUG method.
6. describe the Millipore method for determining bacterial counts in water.
7. name some protozoan diseases that are transmitted in contaminated water.
8. list some bacterial species found in water that can cause diseases.

Exercise 27 - Spoilage of Meat
Upon successful completion of this exercise, you will be able to
1. perform standard plates counts on food samples.
2. list the types of microorganisms that grow at refrigerator temperatures.
3. define; psychrophile, psychrotroph , mesophile, thermophile, hyperthermophile.
4. list some examples of each of the growth temperature groups.
5. discuss what temperature human pathogens grow at and why?
6. list some examples of food borne pathogens.

Exercise 28 - Microbiology of Wine - making
Upon successful completion of this exercise, you will be able to
1. list some foods that microbial fermentations are used to help produce.
2. name the yeast responsible for wine fermentation.
3. describe the purpose of sealing the wine flask with a ballon or gas vent.

Exercise 29 - Microbiology of Milk
Upon successful completion of this exercise, you will be able to
1. describe raw and pasteurized milk.
2. perform the standard plate count of raw and pasteurized milk and determine the amount of bacteria in each.
3. evaluate the quality of the milk samples based on the bacterial plate counts and the reductase test.
4. define the reductase test used for testing milk.
5. compare the reductase test to the standard plate count of milk.
6. describe the type of fermentation used in yogurt production.
7. list the types of microbes used in yogurt production.

Exercise 30 - Isolation of an Antibiotic Producer from Soil
Upon successful completion of this exercise, you will be able to
1. perform dilution plates using the spread plate technique.
2. list some of the bacteria found in soil that produce antibiotics.
3. describe why the soil was diluted.