Microbiology Lab

The University of Toledo
Department of Biological Sciences, College of Natural Sciences and Mathematics

BIOL4040/5040/7040, 1 credit

Spring 2015

Wolfe Hall 1214

Wednesday	9:00-11:50 am (section 003)	CRN: 20443 (for BIOL4040-003)
	2:00-4:50 pm (section 001)	CRN: 12293 (for BIOL4040-001)
	6:30-9:50 pm (section 002)	CRN: 12294 (for BIOL4040-002)
Thursday	9:00-11:50 am (section 005)	CRN: 31295
	1:00-3:50 pm (section 004)	CRN: 22906

INSTRUCTOR:

Dr. Song-Tao Liu
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TEACHING ASSISTANTS:

Tao Yang (section 003)---UT extension 1589, WO4268
Rose Henry (section 001)---UT extension 7882, WO3213
Kyle Snyder (section 002)---UT extension 1991, BO3090
Chris Arnst (section 005)---UT extension 7857,WO4254
Deanna Filppi (section 004)---UT extension 1546, WO3245

OFFICE HOURS

Contact the instructor by email or by appointment. Consult with TAs for their individual office hours.

COURSE/CATALOG DESCRIPTION

Laboratories utilizing basic microbiological techniques and illustrating principles of growth, identification, and genetics of microbes.

COURSE OVERVIEW

This lab course examines basic microbiological techniques. Students will be exposed to different methods to isolate, culture and identify microorganisms, a series of protocols to study basic biochemical

and molecular biological properties of microorganisms, and approaches to control microorganisms. The goal is to provide basic trainings in fundamental microbiological techniques that are useful in clinical and research labs. The course also advocates personalized active learning, and encourages adoption of new digital media in learning key techniques and recording experiment results.

Please note although the hands-on time for each lab is usually less than 1 hr, the students sometimes need arrange time before or after the lab day to do certain preparations or observe results. The instructor and the TAs are making great efforts to reduce these extra visits but some are unavoidable due to the nature of a microbiology lab.

STUDENT LEARNING OUTCOMES

Upon completion of this course, the student will be able to

1. Recognize common tools used in a typical microbiology lab.
2. Master aseptic transfer techniques (or sterile techniques) in isolating and transferring microorganisms.
3. Isolate pure culture of microorganisms from different samples.
4. Understand the importance of different media in culturing and isolating different microorganisms.
5. Master Gram staining techniques and read the results.
6. Utilize biochemical, metabolical and immunological techniques to isolate, identify and characterize different microorganisms.
7. Demonstrate effective understandings about genetic mutations.
8. Master the method to isolate plasmids from bacteria and understand the importance of plasmids in microbial pathogenicity, modern genetic engineering and other natural or artificial applications.
9. Recognize different types of human blood cells and their contribution to immune responses.
10. Identify common ways to control bacteria and other microorganisms.

More detailed learning outcomes are provided at the beginning of each lab in the accompanying lab manual.

PREREQUISITES AND COREQUISITES

Corequisite: BIOL 4030.

REQURIED TEXTS AND ANCILLARY MATERIALS

A lab manual is provided by the instructor. The laboratory manual was reorganized and rewritten based on previous manuals by Drs. Scott Leisner, John Gray and Louis Glatzer at the Department of Biological Sciences of the University of Toledo. Your input for any possible future modifications is welcome.

TECHNICAL RQUIREMENTS

Course materials including the syllabus, lab manual and other supplementary materials will be deposited on the course website hosted at UT BLACKBOARD. Announcements from the instructor and submissions of students works will also be through BLACKBOARD.

UNIVERSITY POLICIES

Policy Statement on Non---Discrimination on the basis of Disability (ADA)

The University is an equal opportunity educational institution. **Please read** The University's Policy Statement on Nondiscrimination on the Basis of Disability Americans with Disability Act Compliance.

Academic Accommodations

The University of Toledo is committed to providing equal access to education for all students. If you have a documented disability or you believe you have a disability and would like information regarding academic accommodations/adjustments in this course please contact the Student Disability Services Office.

GRADING

Grades for this course will be based upon:

Quizzes, twelve worth 10 pts each	100
Lab Notebook, worth 140 pts, 10 points each experiment	140
Lab Performance, worth 140 pts, 10 points each experiment	140
Lab Practical mid-term exam worth 160 points	160
Lab Practical final exam worth 160 points	160
Total points:	700

The total points will be converted into % and letter grades will be given according to the following table.

% of available marks	Grade	Standard
≥93	A	Achievement of outstanding quality
≥90	A-	Achievement of slightly less than outstanding quality
≥87	B+	Achievement of slightly more than high quality
≥83	B	Achievement of high quality
≥80	B-	Achievement of slightly less than high quality
≥77	C+	Work of slightly more than acceptable quality
≥73	C	Work of acceptable quality
≥70	C-	Work of slightly less than acceptable quality
≥67	D+	Work slightly below the quality expected
≥63	D	Work below the quality expected
≥60	D-	Barely above failing
<60	F	Fail

NOTES ON GRADING

I. Quizzes

There will be one quiz each lab week except the first meeting and exam weeks. This is a total of 12 quizzes but your quiz grade will be based on your best 10 scores. In other words, you get to drop your lowest 2 quiz scores. Quizzes will be based on materials from the previous lab and the materials for the lab of that day. Quizzes will be given at the beginning of the class and no make-up quiz will be given if you are more than 5 minutes late for class.

II. Lab Notebook

A notebook with sewn binding is recommended to catalog what you have done in the lab. See Appendix A for assistance with organizing your notebook. Briefly, it should be organized in the following manner:

-Lab title and date

-Subtitles for each specific experiment. List any changes in the protocols for each experiment---You don't have to copy everything in the lab manual but YOU should read the lab manual before starting any experiment. Note down how you exactly did the experiment.

-Data/results for each experiment. Any observations you made during the lab.

-Conclusions for each experiment. Include discussions when necessary (i.e. in case of failed experiments).

The entries for the notebook should be finished in class after each experiment unless your instructor/TA tells you otherwise (Results for some experiments need wait for 24~48 hrs or longer). After each experiment, you should let the TA check your notebook before you leave the lab. No make-up is allowed. **Use of new technology to record your results (digital images, videos etc) is encouraged** but should not interfere with the order in the class. The digital results may be emailed to the TA and/or Dr. Song-Tao Liu for future teaching references (you will be acknowledged but no copyright claims please).

III. Lab Performance

Because this is a laboratory course, you must have a practical working knowledge of various techniques such as proper sterile techniques, the Gram staining, labeling your plates correctly, as well as cleaning up your laboratory area. It is essential that each person pulls his/her own weight even though you will be working in groups of two or four. **Individual performance will be evaluated by your instructor/ TA during every experiment**. For obvious reasons no make-up is allowed if you miss experiments.

IV. Lab Practical Exams

Two lab practical exams will test your understanding of the various techniques and organisms examined during the semester. The mid-term exam will be scheduled in Week 8 (3/4-5, 2015), and the final exam will be in week 16 (4/29-30, 2015). The final exam will be comprehensive. The exams will be based on quizzes and lab practices, so make sure you review the answers to quizzes and get familiar with proper lab techniques.

V. Attendance

Laboratory experiments will begin promptly and most require the full class time. Instructions and advice will be given at the outset of the lab as well as the quizzes. Therefore, it is critical for you to be in class on time. If you have to miss a lab, make sure to notify both your lab instructor/TA and your lab partner prior to the lab. You can get a make-up quiz if you have legitimate excuses for absence. It is normally impossible to make up for the labs themselves, although you might be able to join other sections with the permission of the instructor and TAs. How to deal with the lost points on lab notebook and lab performance will be determined on a case-by-case situation by the instructor/TA.

VI. Preparation

In most experiments you will be working with live bacteria and viruses, and certain organisms can be pathogenic. It is important for you to understand the purpose of the experiments, the sequence of steps and operation of equipment before you begin the experiment. Therefore, it is essential that you read through the lab materials prior to attending the lab. The quizzes will contain questions pertaining to the procedure that you are about to perform in order to encourage you to understand the lab before you begin. There are also a number of basic rules (listed in the next part) that you must follow to allow the course to be run safely and smoothly.

VII. Group work

All experiments are to be done in groups of two unless otherwise specified. Be sure to come prepared for the lab for your own benefit and for that of your partner. Even though the students will be working in groups of two and the results of experiments will be shared, the performance of each student will be evaluated individually. Therefore, it is important to earn your own "hands-on" performance points during each experiment. Specifically, each student must demonstrate their **competence to isolate a pure culture** and **to develop a good Gram stain** and your instructor will note this information in their records. Failure to accomplish this task will cost you a letter grade.

2015 Spring **Laboratory Schedule**

Please note: *this is a tentative syllabus and it may be changed during the course of the semester.*

Week	***Lab No.***	**Date**	**Lab Title**
Part I Basic Techniques			
1	***1***	1/14-15	The rules, the media, the tools, and aseptic techniques
2	***2***	1/21-22	Isolation of A Pure Culture
Part II Microbial Physiology and Characterization of Microorganisms			
3	***3***	1/28-29	Bacterial Growth Curve and liquid culture
4	***4***	2/4-5	Introduction To Staining, basic microscopy
5	***5***	2/11-12	Bacterial Growth On Specialized Media
6	***6***	2/18-19	Bacterial Enzymes
7	***7***	2/25-26	Immunological and Molecular characterization of microorganisms
8		3/4-5	***Mid-term exam***
9		3/11-12	**Spring Break, No Lab**
Part III Bacterial Genetics			
10	***8***	3/18-19	Induction Of Bacterial Mutants
11	***8***	3/25-26	Mutant Characterization
	9		Bacterial Responses To Antibiotics
12	***10***	4/1-2	Molecular Basis Of Antibiotic Resistance
13	***11***	4/8-9	DNA transformation---**Green** Bacteria!
Part IV Control of Microorganisms			
14	***12***	4/15-16	Microbes And Man
	13		Mammalian Defenses Against Microbial Attack
15	***14***	4/22-23	Effects Of Environmental Conditions On Bacterial Growth
16		4/29-30	***Lab Practical Final Exam***

17	5/6-7	**Finals Week, No Lab**

Just for fun:

("Just for Fun" activities are optional experiments to encourage active and personalized learning)
There are two major experiments if any student would like to explore more (sorry, no extra credits!).

1. Fermentation of wine or beer: Volunteers need to bring in grape juice, malt extract and commercial yeast. Utensils, tools and incubators will be provided.
2. Making yogurt: Volunteers need to bring yogurt (the varieties containing live and active cultures) and milk.

Directly contact the instructor so we can make arrangements if there is enough interest. These experiments can be scheduled after week 14. The yeast and yogurt bacteria can also be used for other labs such as lab 2, 4, 5 and 6. They would be perfect for practicing microscopy or isolation of single colonies. Let your TA know if you would like to bring them in for certain explorations.

Microbiology Laboratory Rules

Most of these rules are common sense. Since you are working with microorganisms, and some of which could be pathogenic (i.e., disease causing), it is very important to take precautions. Be careful working with these organisms for both yourself and for others that may have contact with you! How well you follow these rules is an important part of your lab performance scores.

1. Under **NO** circumstances is eating, drinking, or gum chewing allowed in the laboratory.

2. Coats and other clothing accessories should be left on the coat rack or designated area only. Purses, Book bags, textbooks, and notebooks may be placed only in a clean area (under the counters or in your assigned lab drawers) but never on the counter that may be contaminated with bacteria.

3. You are required to have the following lab supplies available for each lab:
   1 "Sharpie" type permanent marking pen.
   1 Lab notebook
   A lab coat is suggested but not mandatory.

4. Lab countertops must be cleaned with disinfectant (Roccal) both before and after lab work. Clean up a working area on the bench before you start working. The area should be away from computers, especially when you use staining solutions or flames.

5. Because this course is MICRObiology, it is essential that proper care of microscopes be adhered to. All microscopes should be cleaned, covered, and placed in the appropriate location. Abuse of microscopes will not be tolerated!

6. Labeling: All labeling is to be done with an organic solvent-based (non-water based) "Sharpie" type permanent marking pen.
   Petri plates: Should be labeled on the bottom of the plate (not on the lid!) with your name, dates, contents and other necessary information.
   Test tubes: May be labeled on the glass surface of the tubes or on a piece of tape put onto the glass surface of the tube but **NEVER** on the cap.
   Test tube racks: Are to be labeled with masking tape but no markings should be made directly on the rack itself with any form of marker.

7. Contaminated material is to be placed in the proper containers at the completion of the experiment: **NEVER** put contaminated material in regular waste baskets or sinks or on the countertop.

   7a. Plastic petri plates inoculated with microbes should be discarded in the **orange biohazard** bags upon completion of experiments.
   7b. Slides containing microbes are to be put into a designated glass container labeled "contaminated" after the experiment is completed.
   7c. Contaminated glass Pasteur pipettes are to be placed tip down in a designated glass container.
   7d. Contaminated/used plastic pipette tips (except Pasteur Pipettes) are to be placed into pipette jars with a small **orange biohazard bag.**

7e. All other contaminated materials---tubes or flasks containing slants or liquid media--- should be discarded on the WASTE metal cart provided for this purpose.

7f. **NEVER** return opened or used materials to the supply bench without telling your lab instructor/TAs.

8. Hands should be washed before and after lab work.

9. You will be using some containers filled with bleach. This chemical kills bacteria very quickly. However, it can also stain your clothes so be careful when using it.

10. For many experiments, you will be using a flame to sterilize materials. NEVER LEAVE A FLAME UNATTENDED!!!!

11. Immediately report any accidents to your TA/lab instructor.

STATEMENT ON ACADEMIC DISHONESTY

Department of Biological Sciences

Academic dishonesty by students enrolled in undergraduate or graduate courses and programs offered by the Department of Biological Sciences will not be tolerated. Academic dishonesty includes but it not limited to:

1. Obtaining assistance from another individual during an examination.

2. Giving assistance to another individual during an examination.

3. The unauthorized use of study material or textbooks during an examination.

4. Changing answers on an examination after it has been returned and then submitting it for re-grading.

5. Plagiarizing written assignments. Plagiarizing includes but is not limited to: a) Copying laboratory reports from previous years, b) copying or paraphrasing reports, term papers, or theses prepared by other students, c) unauthorized collaboration in the preparation of reports, term papers, or theses, and d) use of another author's materials without appropriate acknowledgment through quotation and citation.

6. Attempting to bribe or otherwise induce an instructor to alter either a grade or examination score.

7. Obtaining or attempting to obtain a copy of an examination prior to its administration.

In accordance with policies presented in The Student Handbook and The University Catalog, Instructors have the responsibility and right to report cases of alleged dishonesty to departmental, college, and university administrative units. Students involved in academic dishonesty may expect to receive a grade of F on specific assignments as well as in the course where the assignment was made. In addition, disciplinary action may be recommended through appropriate college and university disciplinary committees. Please consult your instructor for instructions on the implementation of this policy.