

Microbiology 4000: Basic and Practical Microbiology
Spring 2013
The Ohio State University

Lecture meets for 3 classroom hours per week, usually on Monday, Wednesday, and Friday. Attendance in lecture is strongly recommended. Attendance in lab is required for successful completion of the course. We currently use Carmen as a supplement to both the lecture and lab portions of the class. On Carmen you will find the comprehensive syllabus, lecture and lab handouts, study guides, and photos of lab results. You will also use Carmen to complete worksheets prior to each lab period and lab quizzes.

Materials needed for course

Lecture Text: "Microbiology: An Introduction", 10th ed. by Tortora, et al., The Benjamin Cummings Publishing Co.

Laboratory Manual: Available in Barnes and Noble on High Street, in the bookstore of the Central Classroom Building and on Carmen, if you wish to print out the lab manual yourself.

Instructor Information

Course instructor: Dr. Madhura Pradhan
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Phone: 292-1196
Office: 372 Biological Sciences Building, 484 W 12th Ave
Office Hours: MW 2:30-3:30pm, I may also be available after the lecture to answer your questions.

Lab Coordinator: Dr. Mette Ibba
Email: ibba.2@osu.edu
Phone: 292-0509
Office: 374 Biological Sciences Building, 484 W 12th Ave
Office Hours: Email or call for appointment or just drop by.

MICROBIOLOGY 4000: Lecture Schedule, Spring 2013

NOTE: THE FOLLOWING SCHEDULE IS SUBJECT TO CHANGE.

Date	Topic	Chapter(s)
Jan. 7	Introduction/ The Microbial World and You	1
Jan. 9	The Microbial World	1
Jan. 11	Functional Anatomy of Prokaryotic cells	4
Jan. 14	Functional Anatomy of Prokaryotic cells	4
Jan. 16	Functional Anatomy of Prokaryotic cells	4
Jan. 18	Microbial Metabolism: Enzymes Review	5
Jan. 21	Martin Luther King Day: No classes	
Jan. 23	Microbial Metabolism: Carbohydrate Catabolism	5
Jan. 25	Microbial Metabolism	5
Jan. 28	Microbial Metabolism: The Diversity of Prokaryotic Organisms	5
Jan. 30	Microbial Growth	6
Feb. 1	Microbial Growth	6
Feb. 4	Exam I	
Feb. 6	Viruses, viroids and prions	13
Feb. 8	Viruses, viroids and prions	13
Feb. 11	Viruses, viroids and prions / Microbial Genetics	13, 8
Feb. 13	Microbial Genetics	8
Feb. 15	Microbial Genetics	8
Feb. 18	Microbial Genetics	8
Feb. 20	The Control of Microbial Growth	7
Feb. 22	The Control of Microbial Growth	7
Feb. 25	Exam II	
Feb. 27	Antimicrobial Drugs	20
Mar. 1	Antimicrobial Drugs	20
Mar. 4	The Innate Immunity	16
Mar. 6	The Innate Immunity	16
Mar. 8	The Innate Immunity/ The Adaptive Immunity	16, 17
Mar. 11-15	Spring Break	
Mar. 18	The Adaptive Immunity	17
Mar. 20	The Adaptive Immunity: Humoral	17
Mar. 22	Practical applications of Immunology: Vaccines	17, 18
Mar. 25	The Adaptive Immunity: Cell-mediated	17
Mar. 27	Microbial Mechanisms of Pathogenicity	15
Mar. 29	Microbial Mechanisms of Pathogenicity	15
Apr. 1	Exam III	
Apr. 3	Principles of Disease and Epidemiology	14
Apr. 5	Principles of Disease and Epidemiology	14
Apr. 8	Microbial Diseases of Respiratory System	24
Apr. 10	Microbial Diseases of Upper Respiratory System	24
Apr. 12	Microbial Diseases of Lower Respiratory System	24
Apr. 15	Microbial Diseases of Digestive System	25
Apr. 17	Microbial Diseases of Digestive System	25
Apr. 19	Microbial Diseases of Digestive System	25
Apr. 22	Last Day of Classes	
Apr. 26	FINAL EXAM (Friday 12:00-1:45pm) for class meeting MWF at 11:30am	
Apr. 30	FINAL EXAM (Tuesday, 4:00-5:45pm) for class meeting MWF at 4:10pm	

Microbiology 4000 Lab Schedule – Spring 2013

Lab	Date	Laboratory Assignment
1	T - Jan 8 W - Jan 9 R - Jan 10	Exercise 1: The Compound Brightfield Microscope – Period 1 Exercise 2: Other Microscopes and Their Uses – Demonstration/Period 1 Exercise 3: Microbial Ubiquity and Diversity - Period 1 Supplement to Exercise 6: Dilution and Enumeration
2	T - Jan 15 W - Jan 16 R - Jan 17	Exercise 2: Other Microscopes and Their Uses – Discussion/Period 2 Exercise 3: Microbial Ubiquity and Diversity – Period 2 Exercise 6: Introduction to Streak and Spread Plate Techniques- Period 1 Aspetic technique mini quiz – Open on Carmen January 18 (F) to January 21 (M)
3	T - Jan 22 W - Jan 23 R - Jan 24	Exercise 4: Simple and Differential Staining Techniques – Period 1 Exercise 6: Introduction to Streak and Spread Plate Techniques - Discussion/Period 2 Exercise 7: The Acid-Fast Stain – Demonstration/Period 1 Exercise 8: The Capsule Stain – Period 1 Exercise 9: Observations of Endospores – Period 1 Exercise 10: Isolation of Microorganisms from Mixed Cultures- Period 1 Exercise 15: Bacterial Cytochrome Oxidase and Catalase Activity - Period 1 Competency Test 1: Microscope Quiz 1: Exercises 1 - 6 + Lab Safety - Open on Carmen January 25 (F) to January 28 (M)
4	T - Jan 29 W - Jan 30 R - Jan 31	Exercise 10: Isolation of Microorganisms from Mixed Cultures – Discussion/Period 2 Exercise 11: Bacterial Nutritional Requirements and Media Classification - Period 1 Exercise 12: Using Selective, Differential and Selective-Differential Media - Period 1 Exercise 15: Bacterial Cytochrome Oxidase and Catalase Activity - Discussion/Period 2 Competency Test 1: Microscope (continued) Competency Test 2: 3-phase streak plate
5	T - Feb 5 W - Feb 6 R - Feb 7	Exercise 10: Isolation of Microorganisms from Mixed Cultures – Discussion/Period 3 Exercise 11: Bacterial Nutritional Requirements and Media Classification - Period 2 Exercise 12: Using Selective, Differential and Selective-Differential Media - Period 2 Exercise 13: Growth curve Exercise 14: Carbohydrate Utilization in Bacteria - Period 1 Exercise 16: Protein Utilization in Bacteria - Period 1 Exercise 17: Culturing Bacteria Under Anaerobic Conditions - Period 1 Competency Test 3: Inoculation

6	T - Feb 12 W - Feb 13 R - Feb 14	Exercise 14: Carbohydrate Utilization in Bacteria - Discussion/Period 2 Exercise 16: Protein Utilization in Bacteria – Discussion/Period 2 Exercise 17: Culturing Bacteria Under Anaerobic Conditions - Discussion/Period 2 Exercise 18: Nitrate Reduction in Anaerobic Respiration - Period 1 Exercise 20: The Enterotube II and API 20E Systems – Demonstration/Period 1 Exercise 21: The Identification of Unknown Bacteria - Period 1 Quiz 2: Exercises 6 - 12 - Open on Carmen February 15 (F) to February 18 (M)
7	T - Feb 19 W - Feb 20 R - Feb 21	Exercise 18: Nitrate Reduction in Anaerobic Respiration - Discussion/Period 2 Exercise 19: The Effects of pH on Microbial Growth - Period 1 Exercise 21: The Identification of Unknown Bacteria - Period 2 Exercise 23: The Effects of Osmotic Pressure on Microbial Growth – Period 1
8	T - Feb 26 W - Feb 27 R - Feb 28	Exercise 19: The Effects of pH on Microbial Growth - Discussion/Period 2 Exercise 21: The Identification of Unknown Bacteria - Period 3 Exercise 22: The Effects of Temperature on Bacterial Growth - Period 1 Exercise 23: The Effects of Osmotic Pressure on Microbial Growth - Discussion/Period 2 Suppl. to Exercise 23: A Demonstration Exercise 24: Viability of Bacteria Exposed to High Temperature - Period 1 Exercise 25: The Effects of UV Radiation on Bacterial Growth – Period 1 Quiz 3: Exercises 14 - 19 - Open on Carmen March 1 (F) to March 4 (M)
9	T - Mar 5 W - Mar 6 R - Mar 7	Exercise 21: The Identification of Unknown Bacteria - Period 4 Exercise 22: The Effects of Temperature on Bacterial Growth - Discussion/Period 2 Exercise 24: Viability of Bacteria Exposed to High Temperature–Discussion/Period 2 Exercise 25: The Effects of UV Radiation on Bacterial Growth – Discussion/Period 2 Exercise 26: Microbes and Food - Period 1 Suppl. to Exercises 30 and 42: Use of Micropipettors
	T - Mar 12 W - Mar 13 R - Mar 14	Spring Break
10	T - Mar 19 W - Mar 20 R - Mar 21	Exercise 21: The Identification of Unknown Bacteria - Period 5 Exercise 26: Microbes and Food - Discussion/Period 2 Exercise 27: The Effectiveness of Hand Washing - Period 1 Exercise 28: The Effects of Mouthwashes and Rinses on Bacterial Growth –Period 1 Exercise 29: The Effects of Disinfectants and Antiseptics on Bacterial Growth – Period 1 Exercise 30: The Effects of Antibiotics on Bacterial Growth - Period 1 Exercise 31: Observations of Natural Antibiotic Action - Period 1 Case study problem Quiz 4: Exercises 20, 22 - 26 - Open on Carmen March 22 (F) to March 25 (M)

11	T - Mar 26 W - Mar 27 R - Mar 28	Exercise 21: The Identification of Unknown Bacteria – Discussion/Period 6 Exercise 27: The Effectiveness of Hand Washing – Discussion/Period 2 Exercise 28: The Effects of Mouthwashes and Rinses on Bacterial Growth – Dis./Period 2 Exercise 29: The Effects of Disinfectants and Antiseptics on Bacteria – Dis./Period 2 Exercise 30: The Effects of Antibiotics on Bacterial Growth –Discussion/Period 2 Exercise 31: Observations of Natural Antibiotic Action –Discussion/Period 2 Exercise 34: Normal Microbiota of the Nose and Mouth– Period 1 Exercise 35: Microbial Symbiosis: Parasitism -- Period 1 Suppl. Exercise 21: How to prepare your summary Suppl. Exercise 32-35: Microbial Symbiosis Case study problem
12	T - April 2 W - April 3 R - April 4	Exercise 21: The Identification of Unknown Bacteria - Period 7 (ASSIGNMENT DUE!) Exercise 30: The Effects of Antibiotics on Bacterial Growth - Period 3 Exercise 33: Mutualism - Demonstration Exercise 35: Microbial Symbiosis: Parasitism – Period 2 Exercise 37: Phagocytic Activity Associated with the Inflammatory Response: Demo Exercise 38: Virulence Factors in Bacteria - Demo Exercise 39: The Host-Specific Immune Response - Precipitation and Agglutination Exercise 40: The Classical Pathway of Complement fixation – Demo Exercise 41: Epidemiology simulation Exercise 42: Using Elisa to Track an Epidemic Quiz 5: Exercises 21, 30, 31, 34 -35 37, 40-42 Open on Carmen April 5 (F) to April 8 (M)
13	T - April 9 W - April 10 R - April 11	Open
14	T - April 16 W - April 17 R - April 18	Final Lab Exam 60 multiple choice questions and 1 calculation of cfu/ml

Microbiology 4000 Learning Outcomes

Successful students will be able to...

1. Describe the basic morphology of bacteria, their growth requirements, and how they adapt and reproduce.^{1,2}
2. Explain how environmental factors affect the culturing of microbes in a laboratory setting.^{1,2}
3. Understand the diversity of metabolism that exists in bacteria and describe the unique metabolic ways used only in the prokaryotic world.¹
4. Describe bacterial genetics with the emphasis on two main processes responsible for the diversity in the bacterial world: mutations and bacterial gene transfer.¹
5. Describe the basic morphology of viruses, how they reproduce and cause diseases.¹
6. Apply appropriate aseptic techniques when completing any exercise in lab.²
7. Correctly carry out basic microbiology laboratory techniques including: Gram staining, production of pure cultures, production of dilution series and enumeration of microbes, inoculation of various culture media, the filter disk method of testing bacterial susceptibility to various agents, and use of the ELISA test.²
8. Correctly and safely use any equipment needed to carry out exercises in lab.²
9. Demonstrate how to identify unknown bacteria using tests, media, and techniques introduced in lab.²
10. Explain how unknown bacteria are identified through submission of a lab report that includes a flow chart and interpretation of results.²
11. Explain how microbes are involved both constructively and destructively in foods.^{1,2}
12. Explain microbial symbiosis based on observations made in lab.²
13. Describe some of the normal microbiota of the nose, mouth, and skin based on cultured samples from individual students.^{1,2}
14. Understand infection and disease control. Understand the preventative techniques necessary to limit the spread of bacteria and viruses.¹
15. Describe and explain various ways to control the growth of microbes.^{1,2}
16. Describe how to track the spread of a simulated disease, and how to determine the index case.^{1,2}
17. Describe the system of Natural or non-specific immunity.¹
18. Describe Adaptive immunity; understand how it is acquired and how it protects us.¹
19. Describe how microbes overcome the host body's immune mechanisms and how they are transmitted.¹
20. Explain several aspects of immunity based on observations made in lab. Including: phagocytosis, precipitin, agglutination, and complement fixation.^{1,2}
21. Describe the etiological agent, pathogenesis, symptoms and treatment of microbial diseases of the Respiratory system and the Digestive system.¹

¹Lecture goal

²Lab goal

Guidelines for Final Grade

Points Available: The entire course is based on a 400 point system. 250 of the points are from lecture exams and 150 points are from lab assessments.

Lecture Exam I	55 points
Lecture Exam II	55 points
Lecture Exam III	55 points
Final lecture Exam (non-comprehensive)	55 points
Clicker Participation (75%)	30 points
5 Lab Quizzes w/ <u>lowest quiz dropped</u> (18 points each)	72 points (4 quizzes)
Unknown Summary (ID of unknown bacteria)	15 points
Final Lab Exam	45 points
On-line Lab Worksheets	6 points
Lab Competency Tests	9.5 points
Lab Attendance*	1.5 points
Completion of On-line Course Survey	1.0 point
TOTAL POINTS	400 points

*Please see Attendance Policy on p. 8 of this syllabus

Grading Scale (Note: This is a guideline and may be subject to change)

<u>Final total points</u>	<u>Grade</u>	<u>Final total points</u>	<u>Grade</u>
372-400	A	308-319	C+
360-371	A-	292-307	C
348-359	B+	280-291	C-
332-347	B	268-279	D+
320-331	B-	240-267	D

The table below gives additional information concerning the point categories above. Please read the information carefully and ask if you have questions.

Table Concerning Point Categories (Continued on next page)

Lecture Exam Policy: All exams are as scheduled. Students with excusable conflicts need to contact Dr. Pradhan at least one week ahead of the regularly scheduled exams. Should you miss an exam and have a valid excuse, you must contact Dr. Pradhan and provide a written documentation for your absence in order to be eligible to take a make-up exam. Also note that the format of the make-up exam may be different than the regular exams. **All make up exams must be completed within one week of the regularly scheduled exams.**

All make up exams will be administered by the Testing center. Students are responsible for arranging an appointment with the testing center **which needs to be approved by the Instructor.**

Visit <http://registrar.osu.edu/testing/index.asp> for more information.

Lecture assessments based on clicker: We will use clickers from Turning Technologies in this course for the assessment purposes and to encourage student participation in classroom discussions. Students are expected to bring these devices to every lecture starting Jan. 14th, in order to be able to participate.

The extent of clicker usage for each lecture is not fixed since it will vary depending on the depth and complexity of the topics being covered. Clicker-based formative assessments will contribute 30 points towards your final grade. In order to get the full credit of 30 points, you need to cumulatively answer 75% of the total questions asked throughout the semester. There will be approximately 90-100 total clicker based questions throughout the semester.

During the classroom participation, using a clicker or multiple clickers that are not registered under your name, will be considered as an academic misconduct. Refer to Code of Student Conduct (Section 3335-23-04)

Lab Quizzes: Although 5 on-line quizzes will be given, the lowest quiz will be dropped, so only 4 quizzes will be part of the course points. No make-up lab quizzes will be given if a quiz is missed. The missed quiz will be the quiz that will be dropped. If you miss a second quiz, you must contact the Lab Coordinator within 24 hours. The Coordinator will determine if there is a valid reason to allow you to make-up the quiz.

On-Line Pre-lab Worksheets: An on-line pre-lab worksheet has to be complete and submitted prior to each lab period in order to prepare efficiently for each lab. Each worksheet will have approximately 12-16 questions about the material to be covered in the upcoming lab period. To receive full credit (6 points) for this part of the course, you must get at least 80% of the TOTAL questions on the worksheets correct. For example, if there were 10 worksheets of 10 questions each that would equal 100 questions. To get full credit in that situation, you would need to get 80 of the 100 questions correct. If you get less than 80% of the questions correct you will not receive full credit. For example: 79-70%=5 pt., 69-60%=3.5pt., 59-55%=2.5pt, 54-50%=1.5pt., below 50%=0pt. Although the lab worksheets may be available to you AFTER you complete a lab, you are to complete them BEFORE you come to lab. If you complete them after you have attended the lab, you may have those points subtracted from your total.

Lab Competency Tests: Learning basic microbiology laboratory techniques is an important part of your lab experience. During quarter you will be tested on three of these techniques: 3-phase streak-plate, aseptic transfer, and use of the compound light microscope. You will have plenty of opportunities to practice these techniques during lab. Please be sure to ask your lab TA to observe you as you practice and to critique your technique.

Assignment - Identification of Unknown Bacteria: This assignment concerns the identification of two unknown bacterial species. The lab manual contains detailed information about the format to be use for this assignment.

Final Lab Exam: The examination will include questions about the techniques and several different exercises from throughout the quarter. More information concerning specific topics covered in the exam will be given in the lab period before the final lab exam. Additional guidelines will be available a week prior to the exam. The exam consists of 60 multiple choice questions about lab exercise results and techniques, (some referring to photos) and one calculation of cfu/ml.

Lab Attendance: Your will receive 1.5 points if you have attended **all** labs. Besides losing 16 points for each unexcused lab absence, you will also lose points, if you are more than 10 min late for lab. Please, see below the complete attendance policy for more information.

Completion of Course Survey (SEI) and an in-lab TA survey: Near the end of the semester, you will complete course evaluations for each the lab and lecture components (SEI) as well as a short survey about your TAs.

ATTENDANCE POLICY

Lecture attendance

Attendance in lecture is highly recommended. You are responsible for all the material covered in lecture, including all handouts, additional assignments, clicker participation, and announced schedule changes.

Attendance in the laboratory is required for course completion. Due to the nature of this course, there will not be any make-up labs. Missing one lab without a valid written excuse (e.g. doctor's note), results in losing 16 point out of the 400 total course points, which will influence your overall grade. For an excused absence from lab, please bring a valid written excuse within 48 hours of the missed lab. You also lose points for being over 10 minutes late to lab (0.2 points/late lab). If you are over 40 minutes late to lab, it will count as a missed lab and you will lose 16 points. If you have more than 4 unexcused or excused absences you may not be allowed to complete the lab course. Please, contact the lab coordinator and lecture instructor to see if you will be allowed to complete the course. Please, note that if your absences are due to a documented illness or other valid excused reasons, you may be eligible for an incomplete grade. (NOTE: Written records of your reason must be submitted.)

QUESTIONS CONCERNING GRADING OF COURSE MATERIALS

If you have any questions or concerns regarding grading of any of the lecture exams offered in this course, you must submit them in writing to the lecture instructor within one week from the date the grade for the exam is posted on Carmen. You must address all the concerns regarding the final exam before the final grade is posted on Carmen. Once the final grade is posted, no questions from the final will be addressed.

Any questions that you have regarding grading of lab materials must be submitted in writing to your lab TA or the lab coordinator within week of the date the graded material (quiz, etc.) was returned to you.

Disability Statement

Any student who feels s/he may need an accommodation based on the impact of a disability should contact Dr. Pradhan (for lecture accommodations) or Dr. Mette Ibba (for lab accommodations) privately to discuss your specific needs. Please contact the Office for Disability Services at 614-292-3307 in room 150 Pomerene Hall to coordinate reasonable accommodations for students with documented disabilities.

Academic Misconduct Statement

- Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research, and other educational and scholarly activities. Thus, The Ohio State University and the Committee on Academic Misconduct (COAM) expect that all students have read and understand the University's Code of Student Conduct, and that all students will complete all academic and scholarly assignments with fairness and honesty. Students must recognize that failure to follow the rules and guidelines established in the University's Code of Student Conduct and this syllabus may constitute "Academic Misconduct."
- The Ohio State University's Code of Student Conduct (Section 3335-23-04) defines academic misconduct as: "Any activity that tends to compromise the academic integrity of the University, or subvert the educational process." Examples of academic misconduct include (but are not limited to) plagiarism, collusion (unauthorized collaboration), copying the work of another student, and possession of unauthorized materials during an examination. Ignorance of the University's Code of Student Conduct is never considered an "excuse" for academic misconduct, so we recommend that you review the Code of Student Conduct and, specifically, the sections dealing with academic misconduct.
- If we suspect that a student has committed academic misconduct in this course, we are obligated by University Rules to report our suspicions to the Committee on Academic Misconduct. If COAM determines that you have violated the University's Code of Student Conduct (i.e., committed academic misconduct), the sanctions for the misconduct could include a failing grade in this course and suspension or dismissal from the University. If you have any questions about the above policy or what constitutes academic misconduct in this course, please contact Dr. Pradhan or Mrs. Saville-Rath.

General Education Course Information

Microbiology 4000 is a General Education Course (GEC) in Natural Science and as such, is part of the Colleges of Arts and Sciences (ASC) General Education Program.

Goals of ASC Natural Sciences Courses:

Natural science coursework fosters students' understanding of the principles, theories and methods of modern science, the relationship between science and technology, and the effects of science and technology on the environment.

Learning Objectives of ASC Natural Sciences Courses:

1. Students understand the basic facts, principles, theories, and methods of modern science.
2. Students learn key events in the history of science.
3. Students provide examples of the inter-dependence of scientific and technological developments.
4. Students discuss social and philosophical implications of scientific discoveries and understand the potential of science and technology to address problems of the contemporary world.

Microbiology 4000 meets the GEC Natural Science Learning Objectives in multiple ways. The course includes an overview of the basic biology, structure, and function of microorganisms with a concentration on bacteria and viruses. Principles and theories related to microbial growth, metabolism, genetics, and the human immune system are included. Students study modern scientific methods of culturing and identifying microbes in the laboratory part of the course. The lecture part of the course also explains how scientific methods are used in the field of microbiology and how these methods have been used historically in key discoveries such as pasteurization, vaccination and antibiotic therapy. Both lecture and lab provide opportunities for students to learn and experience how technological advances in microscopy, genetic engineering, and biochemical techniques have contributed to understandings of scientific principles of microbiology and vice versa. In lecture, current events from news media and recent scientific publications are used to help students appreciate the positive and negative roles of microorganisms in fields such as health and disease, the environment, industry, and food sciences. By the end of the course, students will have developed an understanding of how microorganisms are involved in nearly every aspect of their everyday life.