

## Course Syllabus: Bacteriology

### General Information:

<b>Course Meetings:</b>	TR (11:00 am – 12:20 pm) Bolin Hall 209
<b>Instructor:</b>	James Masuoka, Ph.D.
<b>Office:</b>	Pierce Hall 150
<b>Telephone:</b>	397-4181
<b>E-mail:</b>	<a href="mailto:james.masuoka@msutexas.edu">james.masuoka@msutexas.edu</a>
<b>Office Hours:</b>	MWF 10:00 – 11:00 am M 12:00 – 1:00 pm TR 1:00 – 2:00 pm (Other times by appointment)

### Course Description (from the catalog):

Study of bacteria and archaea cell structure and function, bioenergetics, and regulation of cellular functions; survey of adaptations to diverse environments.

**For fall semester 2024:** Emphasis will be placed on mechanisms of bacterial pathogenesis as it pertains to the human host. Topics will include: the relationship between bacteria and the host generally; cellular structures and products that directly or indirectly impair host function; mechanisms by which bacteria acquire virulence genes; mechanisms by which bacteria evade the immune response, antibiotics, and viral attack; how pathogenicity and virulence are studied experimentally

### Required Materials:

**Bacterial Pathogenesis: A Molecular Approach** (Wilson, Winkler, Ho), 4<sup>th</sup> Edition (2019).ASM Press. ISBN 9781683672883 (eBook), 9781555819408 (pbk.)

**For fall 2024, the textbook is integrated into D2L.**

**Lab:** This semester, all labs will be carried out virtually using simulations. An access code must be purchased from the MSU Bookstore. Simulations are accessed in D2L in your lab section page. Starting the first simulation with start the access process, during which you will need to enter your code. This process needs to be done only once.

### **Course Objectives (Lecture):**

- Define microbiota/microbiome. Explain how the human microbiome composition is characterized.
- Explain how Koch's Postulates help us understand infectious disease. Describes cases in which Koch's Postulates cannot be satisfied.
- Describe experimental approaches to defining and characterizing virulence factors of bacteria.
- Describe bacterial cell structures and relate these structures to function, particularly those related to pathogenesis.
- Describe the mechanisms by which bacteria can acquire virulence traits through genetic modification and exchange and how expression of these traits is regulated.
- Explain how these virulence factors cause disease (damage to the host).
- Describe mechanisms by which antibacterial agents (chemicals, viruses) act and how bacteria protect themselves from these agents
- Describe strategies used by bacteria to colonize and survive within the host, including ways they evade the host immune response.
- Research and critically evaluate scientific literature to answer or address a question
- Communicate fundamental concepts of microbiology, both in written and in oral formats

### **Classroom Expectations and Policies:**

- Students are expected to be prepared for lecture and lab by 1) reading the text, lab manual and handouts prior to coming to class; 2) having paper and pen at hand
- Students are expected to arrive a few minutes early to mentally prepare. If late arrival is unavoidable, the student should enter the class in a manner that creates as little disruption as possible.
- Points will be deducted from assignments turned in late.
- Student Conduct: Please refer to the MSU Student Handbook: (<https://mwsu.edu/Assets/documents/student-life/student-handbook-2017-18.pdf>) for university policies related to student responsibilities, rights, and activities. For example, see page 73 for valid grounds for an instructor drop (excessive absence, indifferent attitude, disruptive conduct, failure to meet class assignments), page 13 for the university's code of student conduct and page 55 for definitions of academic dishonesty that may be subject to disciplinary action (cheating, plagiarism, and collusion). In this class, academic dishonesty on an assignment or exam will minimally result in a score of 0 for that assignment or exam. Depending on the magnitude or frequency of these types of infractions, more severe sanctions – including being dropped from the course – will be imposed.

- **CELL PHONES (and other electronic devices): (READ THIS TWICE, PLEASE)** This class, as well as your other classes, requires your engagement, and typical cell phone use serves to detract from that engagement. While in class, your phone should be on “silent” (NOTE: vibrate is NOT silent).
- **Other electronic devices: laptops, tablets and similar devices will no longer be permitted to be used during lectures.** The ability to take good notes is a skill that university students must be able to master. Further, classroom studies have shown that taking notes by hand increases engagement in the material. Simply transcribing the lecture word-for-word is not helpful.
- **Students with disabilities:** It is the responsibility of the student to first contact Disability Support Services and then the instructor to determine what accommodations might be made for a disability. It will be the responsibility of the student to plan to acquire notes. Any requests for accommodation must be made 2 weeks prior to the first exam.
- The professor considers this classroom to be a place where you will be treated with respect as a human being - regardless of gender, race, ethnicity, national origin, religious affiliation, sexual orientation, political beliefs, age, or ability. Additionally, diversity of thought is appreciated and encouraged, provided you can agree to disagree. Furthermore, guns or other weapons create a coercive environment that is neither safe nor conducive to learning. Therefore, weapons of any kind will not be permitted in my classroom. This includes guns, concealed or otherwise, regardless of licensure. Any student bringing a weapon to class or to lab will be immediately dropped from the course. It is the professor's expectation that ALL students consider the classroom a safe environment.
- The instructor reserves the right to amend these rules as needed throughout the term.

### **E-mail Policy:**

I will respond to e-mail during regular school hours (8:30 am – 5:00 pm M-F). I will make every effort to respond to e-mail sent during the week within 24 hours. Those sent over the weekend will be attended to on Monday. Always include a subject line in your e-mail messages. It would be particularly helpful to include in the subject line the course number & section (*i.e.*, BIOL 3044). Questions regarding simple matters of class schedule or those that can otherwise be answered from information in this syllabus will be given low priority.

### **Attendance Policy:**

Students are expected to attend all meetings of the classes in which they are enrolled. Although in general students are graded on intellectual effort and performance rather than attendance, absences may lower the student's grade where class attendance and class participation are deemed essential by the faculty member. In those classes where attendance is considered as part of the grade, the instructor should

inform students of the specifics in writing at the beginning of the semester in a syllabus or separate attendance policy statement. An instructor who has an attendance policy must keep records daily. The instructor must give the student a verbal or written warning prior to being dropped from the class. Instructor's records will stand as evidence of absences. A student with excessive absences may be dropped from a course by the instructor. Any individual faculty member or college has the authority to establish an attendance policy, providing the policy is in accordance with the General University Policies. [MSU Student Handbook, p. 61]

Absences will be excused for:

- a. **Death of an immediate family member.** An immediate family member is a grandparent, parent, sibling, spouse, in-law, aunt, uncle, or child.
- b. **Summons to appear in court or jury duty.** A copy of the summons is required.
- c. **Call to military service.** A copy of your orders to report is required.
- d. **University sponsored event.** Members of athletic teams, college bowl participants, etc. will be excused with proper notification.
- e. **Debilitating illness or disability.** Illnesses will be addressed on an individual basis. If a student is affected by an illness that is not debilitating, (*i.e.*, flu, virus infection) which may result in the student missing one or more consecutive class sessions, that student will be marked as unexcused for the number of days missed **unless a doctor's note is provided.**

ROUTINE APPOINTMENTS, medical or otherwise, AND VACATION TRAVEL ARE NOT ACCEPTABLE reasons for excused absences.

**Students who feel ill** (esp. with fever or symptoms of COVID-19) should stay home and isolate themselves. Notify the instructor immediately.

It is the responsibility of the student to obtain notes or other information covered in class during an absence.

### **Exam Policies:**

- No make-up exams will be given in this course. If you must miss class during a midterm exam period, and it is an excusable absence (see above), then the cumulative portion of the final exam will be used to determine the missed midterm score. You must notify the instructor of problems **prior to** the start of the exam and provide the appropriate documentation as soon as possible. Only one midterm exam will be substituted for in this manner.
- Exams are not moved for congested midterm or finals schedules.

- **All electronic devices**, including cell phones, **must be completely turned off** during exam periods. I will keep track of time and relay the information to the class. If you must keep track of time yourself, invest in a wristwatch.

### **Grading:**

All exams and assignments count toward your final grade in the course and so it is important to do the best that you can on everything you turn in. If you find yourself having difficulties, please come to me for help early in the semester so that you give yourself time to improve.

Attendance is not a direct component of your course score. However, continual tardiness – and the subsequent class disruption due to coming in late – will be considered and may influence your final points awarded. As stated above, cell phone use distracts from attention in class. Therefore, students who persist in using their mobile devices during class, except for designated classroom activities, will be marked as absent.

This course is not graded on a traditional curve. The course is worth 1000 points. Grade categories and equivalent percentages are as indicated: A (90-100%); B (80-89%); C (70-79%); D (60-69%); F (59% and below). Passing requires 60% of the points (unadjusted) for the course, or 600. Fractional percentages will be rounded at the end of the semester.

Lectures constitute approximately 60% of the BIOL 3044 grade. There will be **two midterm exams**, each worth 100 points. The **final exam** will be worth 200 points. Each exam, including the final, will focus on what was covered since the previous exam. However, each exam will also be cumulative in that each section of the course builds on what came before. The final will be effectively two exams. The first section will act as midterm 3 and cover the material from the final third of the semester. The second section will be cumulative in that it will cover the entire semester, focusing on material that needs to be reviewed (*i.e.*, most of the class got it wrong the first time around).

Lecture assignments:

Throughout the semester, we will read and evaluate several (4) **research papers** taken from the primary literature. The first three will be discussed in class, with the initial paper being an unassessed introduction to the primary literature. The final three will be assessed as part of your course grade (**40 points each**). Assignment specifics will be provided in class and on the D2L webpage.

In addition, several (4) **video-based homeworks** will be assigned (**20 points each**). The purpose of the assignments is to reinforce course concepts and highlight the diversity of the science and scientists in microbiology.

Lab constitutes approximately 40% (**400 points**) of the BIOL 2144 grade. The bulk of the laboratory assessment will be from lab simulations. Each simulation is weighted

equally. Simulations are assigned based on the week (see table below), and should be completed by the end of the week.

Each semester, the University sponsors the Undergraduate Research and Creative Activity Forum. In this Forum, students present their research findings or creative works. For this assignment, students will critically evaluate **(30 of 400 points)** three (3) poster presentations or three (3) oral presentations (or combination thereof). This will provide experience in both how to present results and how to critically evaluate data presented by others.

**Note:**

- 1) No regrades will be provided for exams done in pencil.
- 2) Misspelled words (esp. organism names) and incorrect taxonomic nomenclature will result in  $\frac{1}{4}$  point deductions for each instance.

**Assignment Summary:**

Midterm exams:	200 points (2 x 100 points)
Research Paper Assignments:	120 points (3 x 40 points)
Video Homework Assignments:	80 points (4 x 20 points)
Final Exam:	200 points
Laboratory:	400 points
Total:	1000 points

**Important Dates (Fall 2024):**

Classes begin:	August 26
Labor Day (no classes):	September 2
<b>Midterm Exam 1:</b>	<b>October 1</b>
<b>Midterm Exam 2:</b>	<b>October 29</b>
Last day to drop with a "W":	November 25 (4:00 pm)
Thanksgiving Break (no classes):	November 27 – 29
Classes end:	December 6
<b>Final Exam*:</b>	<b>December 10 (Tuesday) (1:00 – 3:00 pm)</b>

**Tentative Lecture Schedule**

<b>Date</b>	<b>Week</b>	<b>Topic</b>	<b>Reading</b>	<b>Assignments</b>
Aug 27 & 29	1	Intro; Bacteria	Ch1	
Sept 3 & 5	2	Microbiota; Bacteria & Disease	Ch5, Ch6	
Sept 10 & 12	3	Bacteria & Disease Methods: Measuring Infectivity	Ch6, Ch8	Paper (Intro) (T); <b>Homework 1 Due (R)</b>
Sept 17 & 19	4	Methods: Measuring Infectivity, Bacterial Factors; Host Factors	Ch9, Ch10	
Sept 24 & 26	5	Methods: Host Factors	Ch10	<b>Paper 1 (R)</b>
Oct 1 & 3	6	<b>[Exam 1] (T);</b> Gene Exchange	Ch7	
Oct 8 & 10	7	Gene Exchange; Colonization	Ch7, Ch11	<b>Homework 2 Due (R)</b>
Oct 15 & 17	8	Toxins	Ch12	
Oct 22 & 24	9	Delivery Systems	Ch13	<b>Paper 2 (R)</b>
Oct 29 & 31	10	<b>[Exam 2] (T);</b> Virulence Regulation	Ch14	
Nov 5 & 7	11	Virulence Regulation; Antimicrobials	Ch14, Ch15	<b>Homework 3 Due (R)</b>
Nov 12 & 14	12	Antimicrobials; Antibiotic Resistance	Ch15, Ch16	
Nov 19 & 21	13	Antibiotic Resistance; Research Forum	Ch16	<b>Research Forum (R)</b> <b>Paper 3 Due (R)</b>
Nov 26	14	CRISPR, Restriction Enzymes		
Nov 28	14	<b>No Classes – Thanksgiving Break</b>		
Dec 3 & 5	15	Examples: Gram-positives (T); Gram-negatives (R)	Ch18, Ch19	<b>Homework 4 Due (R)</b>
Dec. 10	<b>Final Exam (Tuesday) 1:00 – 3:00 pm</b>			

**Tentative Schedule of Laboratory Exercises**  
**Lab simulations are due at the end of the week (Friday before 11:30 pm)**

<b>Week</b>	<b>Date</b>	<b>Topic</b>
1	Aug 26	<b>Virtual Labs Tutorial (due 9/6/24)</b>
2	Sept 2	Lab Safety (Personal), Lab Safety (Hand washing), Aseptic Technique (Broth to Plate, Broth to Broth, Slant to Slant)
3	Sept 9	Isolation (Subculture, Streak plate, Dilution, Colony Count, Optical Density)
4	Sept 16	Microscopy (Brightfield, Oil Immersion), Preparing Smears, Gram Stain, Ubiquity of Microorganisms
5	Sept 23	DNA (Isolation, Gel electrophoresis), Bacterial Genetics (DNA Profiling, PCR)
6	Sept 30	Bacterial Genetics (Transformation), DNA (Transcription, Translation, Mutation)
7	Oct 7	Gram-Positive Cocci Tests: Catalase, Coagulase, Mannitol Salt Agar, CAMP, Blood Agar Hemolysis, Antimicrobial Testing
8	Oct 14	Unknowns (3)
9	Oct 21	Gram-Positive Rod Tests: Spore stain, Acid-fast stain, Triple Sugar Iron, Urease, Nitrate reduction, Phenol Red
10	Oct 28	Gram-Negative Rod Tests: Indole, Methyl Red, Voges-Proskauer, Citrate, MacConkey's Agar, SIM, Oxidase
11	Nov 4	Unknowns (3)
12	Nov 11	Control of Microbial Growth (Antiseptics & Disinfectants, Ultraviolet Light), Natural Selection – Antibiotic Resistance
13	Nov 18	Control of Microbial Growth (Kirby-Bauer), Unknowns (4)
14	Nov 25	ELISA, Rapid Diagnostic Testing
15	Dec 2	<b>No Labs Scheduled: Prepare for Finals</b>



### **Laboratory Safety:**

Microbes are found everywhere within the environment – in the air, on surfaces, on your body. In the Bacteriology Laboratory, we deal with microbes at higher concentrations than those found in the environment. We will also be dealing with organisms that are potentially pathogenic to humans – thus we treat EVERY organism as if it were pathogenic.

1. No food or drinks are to be taken into or consumed in the laboratory. Further, ANY activity that involves hand-to-face contact (applying cosmetics, handling contact lenses, etc.) should be avoided.
2. Disinfect the work area before starting lab, after completing lab, and after any spills that occur. Do not assume that the lab members in the previous class cleaned up after themselves.
3. Wash your hands thoroughly with soap and water before leaving the laboratory – even if you need to leave only for a brief time.
4. Open-toed shoes, sandals or similar footwear are not appropriate and should not be worn in the laboratory. Shorts and short skirts are also inappropriate in terms of laboratory safety. These regulations are for your personal safety. Students wearing inappropriate dress will not be permitted to enter the laboratory.
5. Long hair must be tied back as it is not only a potential source of contamination, but also a fire hazard.
6. Proper personal protective equipment (PPE) must be used in the lab whenever work is being done. For this laboratory, PPE includes a lab coat, safety glasses and laboratory gloves.
7. Be aware of the location of safety equipment such as fire extinguishers, eyewashes, showers, First Aid kits, etc.
8. Follow all waste disposal guidelines. (See below)
9. Refer to the Introduction section of your lab manual for additional discussion of laboratory safety issues.
10. When in doubt, ASK!

### **Waste Disposal and Cleanup:**

Proper cleanup of the laboratory is essential to reduce contamination and to ensure that subsequent lab sections have a clean and organized work area. The following guidelines must be observed during each lab session. Each student must take an active role in proper cleanup and waste disposal. Do not leave it for someone else.

**Lab benches:** There are wash bottles of disinfectant (Cidecon) located on the lab benches. You must clean the lab bench before AND after each lab. If you run out of disinfectant, refill the bottle from the large carboy next to the microscope cabinet. The best technique for disinfection is to stream disinfectant over the surface, then use a paper towel to even the fluid over the surface so that a light film remains. Do not wipe to dryness but allow the disinfectant to air dry. The extended contact of the fluid to the surface increases effectiveness.

**Paper towels** and **soap** are located next to the sink.

**Waste material:** Bacterial cultures must be killed prior to disposal. Each group must dispose of their cultures once they have obtained and recorded their results. Dispose of each type of waste according to the following guidelines.

- **Liquid cultures:** add bleach to the tube. Squirt bottles containing bleach (1:2 dilution of household bleach in water, 2.5% final) are kept next to the sink. Add 1/5 the culture volume (usually about 1 cm) and place the tube into the holding racks next to the sink. The tube cap should go into the appropriately marked basket. **NEVER** pour your cultures down the drain or into the trash.
- **Solid cultures (plates):** All cultures on plastic Petri plates are disposed of in the Contaminated Material Container (CMC, large box with the red plastic bag) next to the sink.
- **Solid cultures (slants):** For cultures on agar slants – remove the cap and place the cap in the appropriate basket. The tube is disposed of in the CMC. **DO NOT** bleach your slants.
- **Semi-solid cultures:** Some growth media are termed semi-solid because they do not contain enough agar to completely solidify. These media are treated like agar slants.
- **Additional note on CMCs:** Only materials that are visibly contaminated are to be put into CMCs. Paper towels used for washing hands go into the trash, as do transfer pipette wrappers, sterile swab wrappers and the like. If the organisms are dead/killed – as with paper towels used to wipe up Cidecon from the benches – the material still goes into the trash.