

Honors Microbiology Syllabus



Instructor: Mr. Guilfoyle (Western Michigan University c/o forever ago)

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Room: 811

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Office Hours: MTRF 2:30-3:15

Course Description: This semester-long course is lab and skills based course focusing on a general study of the fundamental concepts of Microbiology and epidemiology. Lab activities will involve the collection, cultivation, examination, identification, and control of various microbes.

Main Course Objectives:

1. To acquaint students with the basic laboratory techniques and tools of microbiology and epidemiology.
2. To introduce the fundamental characteristics of various microorganisms.
3. To develop lab skills, including collection and analysis of data, the ability to draw valid conclusions and apply these conclusions within a larger framework.
4. To develop a heightened sense of understanding in students about the microscopic world around them.

Materials Needed for Class:

3-ring notebook/binder (1" or 2")

Pencil

Colored pencils and sharpie marker would be helpful

Text: Fundamentals of Microbiology (class set only)

Labs: Labs will constitute a majority of the course work. In order to have as authentic a lab experience as possible, you will keep a **lab composition notebook** to record procedures and observations during labs. In the scientific work, lab notebooks are considered legal documents and all information must be accessible. Formal lab write ups will be completed for each lab.

- You will be responsible for maintaining the inventory in your assigned lab tote and tray
- All labs will be written in pen
- All lab instructions; notes; data; etc will be recorded in the composition book and left in the classroom (use black pen with the exception of drawings)
- Drawings will be completed professionally (format will be explained separately), cut n pasted into the lab notebook and initialed
- If you make a mistake, cross out (do not scribble out) the information and rewrite. White out cannot be used in the lab notebook (all mistakes will be crossed out neatly)
- Record ALL observations while in the lab and DO NOT re-draw sketches later (copies will be less accurate even if they are "neater")
- Each day a reflection will be dated and written in the notebook as a ticket out the door

Lab Safety: Lab safety is of extreme importance and will be handled vigilantly with very strict rules regarding food, drinks and personal belongings. We will be working with a variety of potentially dangerous lab equipment, chemicals, and specimen, therefore students MUST conduct themselves in a responsible manner at all times, pay close attention during lab briefings, and follow ALL lab safety rules. As a safety precaution, any misbehavior in the lab will result in immediate removal from the lab and future lab work. Students and parents who are concerned may wish to contact me through e-mail.

- Each student is responsible for washing their hands and lab table and area with a disinfectant before AND after each lab activity
- To prevent possible ingestion of microorganisms, eating and drinking are prohibited in the lab.
- For safety reasons, all bookbags and personal belongings MUST be kept in the designated location (the only personal items needed during class are the notebook; lab book; writing materials)
- If anything spills – clean it immediately!
- Most bacteria collected in the environment will not be harmful. However, once they multiply into millions of colonies they become more of a hazard.
- Be sure to protect open cuts with rubber gloves and never breathe in growing bacteria (Keep growing petri dishes closed until it is necessary to open them.
- All cultures must be safely destroyed using the biohazard bucket at the conclusion of their use.
- Cultures are not to leave the classroom

Note Taking : You will need a loose leaf binder for the notes and handouts you will receive. Bring this to class every day. It is wise to take detailed notes during lecture and class discussions. Reviewing and rewriting your notes on a regular basis is an excellent way to study.

Grading : Formal Assessments (Labs, Quizzes, Exams) → 70% Informal Assessments (Lab Techniques and classwork) → 30%
Cumulative final exam → 25% of the total grade for the course.

Class Expectations and Policies:

▶ Come to class prepared - in order to facilitate class discussions you must complete all required assignments; assignments are not 'busy work'; they are designed to help you learn difficult material.

▶ Come to class! The work we will be doing during class cannot be replicated at home.

▶ No whining! This is a college level course. It will be challenging. If you don't like biology, this is not the class for you!

▶ Yes, you have to write in complete sentences. Yes, you have to show your work. Yes, you have to write out procedures, data tables, and label graphs. Yes, you are expected to show a higher level of understanding on ALL of your assignments. No, you may not write in 'text-speak'

▶ Do not throw any classwork away. You will need it to review for tests and mistakes do happen occasionally with grade recording.

▶ Cheating is unacceptable in any form. Cheating includes, but is not limited to: copying homework, copying lab analysis answers, plagiarizing written assignments, copying test answers, use of electronics to find test answers. If copying occurs then all people involved will receive a zero on the assignment. You are in class to learn and succeed on the spring exam. Cheating DOES NOT help you learn.

▶ You are responsible for your lab station. Keep it clean and organized to make lab breakdown easier at the end of class.

* All rules and school procedures set forth by the administration will be upheld in this class.

Attendance: Attendance is very important for passing this class. If an excused absence is necessary, it is the student's responsibility to find out what work has been missed and to make arrangements with the teacher to make it up within 5 days. Missed work can be found in a box accessible to students in class. Only make-up work from excused absences will be recorded for a grade. Due to the emphasis on laboratory work in this class, students may be required to complete an alternate paper assignment in place of lab work. Students are allowed to make up missing work. Ten percent of the grade will be subtracted for every day the assignment is late with a maximum of 50% credit. If the student has not made up the work within the designated time, the student will receive a zero for the work. In the event that you are absent from school it is **your** responsibility to get the information presented during class as well as any assignments, labs, activities, quizzes etc. given. Students that are absent from class will be given 5 class days/periods to make up the work after which time the late policy takes effect. Lab Activities and other activities that have a time limit – possible alternate arrangements will be made and/or alternate assignments. If you are absent on the day a lab or assignment is due then you are required to turn it in upon your return to class.

Honor System : Any work, unless specified by me, will be on your honor that it is your work. Learn, understand and be able to differentiate the following definitions.

Collaboration - getting together to exchange ideas.

Cheating - getting together to exchange answers and/or using another person's answers.

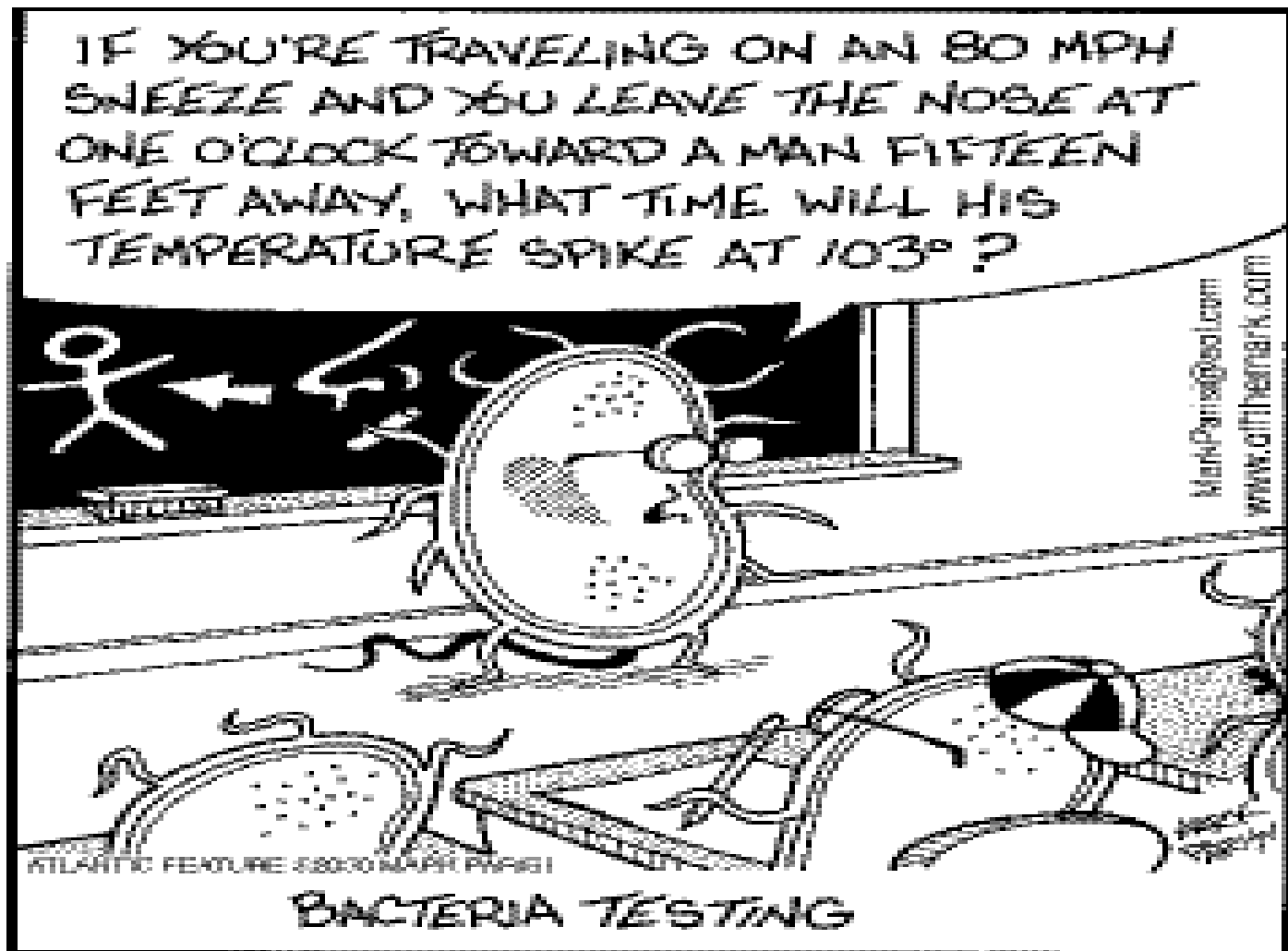
*"Hold yourself responsible for a higher standard than anyone else expects of you."
- Henry Ward Beecher*

I believe that you will find this class to be both difficult and rewarding and look forward to working with all of you throughout the coming semester. Please do not ever hesitate to come to me if you need help. I arrive on campus early and will stay after school as needed. Students may come in individually or in groups any morning or afternoon for help. Students can also make arrangements to stay after school for a longer period of time as the need arises.

Tim Guilfoyle

Tim Guilfoyle

*"We are what we repeatedly do. Excellence, then, is not an act, but a habit."
- Aristotle*



Microbiology Safety Contract: This is a lab based course so there will be some very specific, strict procedures and rules in place.

Lab Safety: Lab safety is of extreme importance and will be handled vigilantly with very strict rules regarding food, drinks and personal belongings. We will be working with a variety of potentially dangerous lab equipment, chemicals, and specimen, therefore students **MUST** conduct themselves in a responsible manner at all times, pay close attention during lab briefings, and follow **ALL** lab safety rules. I refer to them as potentially hazardous because they are only hazardous if used inappropriately. There is no place in my class for unsafe use of materials. Students and parents who are concerned may wish to contact me through e-mail.

- Conduct yourself responsibly at all times.
- Stay at your lab bench or lab table with your lab group during labs.
- Unnecessary socializing leads to carelessness and catastrophe and will not be tolerated.
- Each student is responsible for washing their hands and lab table and area with a disinfectant before AND after each lab activity
- To prevent possible ingestion of microorganisms, eating and drinking are prohibited in the lab.
- For safety reasons, all bookbags and personal belongings **MUST** be kept in the designated location
- Improper use of a cell phone or tech device leads to carelessness and catastrophe and will not be tolerated.
- If anything spills – clean it immediately!
- Most bacteria collected in the environment will not be harmful. However, once they multiply into millions of colonies they become more of a hazard.
- Be sure to protect open cuts with rubber gloves and never breathe in growing bacteria
- Keep growing petri dishes closed until it is necessary to open them.
- All cultures must be safely destroyed using the biohazard bucket at the conclusion of their use.
- Cultures are not to leave the classroom
- Dispose of all chemicals and cultures properly. I will instruct you about how to dispose of specific chemicals.
- Follow all written and verbal instructions carefully. Ask questions if you do not understand.
- Keep your work area neat and clean at all times!
- Know the location and operation of all safety equipment.
- Do not run, shout, or throw things in the lab.
- Keep your hands away from your face while doing labs. Also, always wash your hands after the clean-up is complete.
- Rinse out all glassware and leave it to dry in the designated locations.
- Use caution when using the hot plates; remember they are hot even though the top is white.
- Never leave a hot plate unattended.
- Never look directly into a container that is being heated, observe from the side
- Goggles and aprons must be worn when instructed
- Tie long hair behind your head.
- Consider all lab chemicals to be hazardous.
- Take only the amount of chemical you will use.
- Never let a chemical near your mouth.
- Never remove chemicals or other materials from the lab.
- Always hold chemical bottles with two hands when transporting them.
- Never pick up a chemical from the lid (it may not be secure).
- Never handle broken glass. If a piece of glassware breaks, notify me immediately and I will dispose of it.
- Immediately report **ALL** injuries, no matter how minor, to me.
- Notify me if an unsafe condition exists in the classroom.

I have read, understand, and **will abide** by the student expectations and the lab safety contract.

Student name _____ (printed)

Student signature _____ Date: _____

I have read, understand, and choose to **not participate** in the laboratory assignments associated with this class. I understand that alternate assignments will be provided and used in place of any lab associated assignment. I am still responsible for the content of the curriculum and will abide by the safety rules and standards listed above

Student name _____ (printed)

Student signature _____ Date: _____

Microbiology Course Objectives:

Main Course Objectives (skills):

The student conducts and understands the purpose for laboratory experimentation using safe, appropriate, ethical practices. The student is expected to:

- S.1 To acquaint students with the basic laboratory techniques and tools of microbiology.
To develop lab skills, including collection and analysis of data, the ability to draw valid conclusions and apply these conclusions within a larger framework.
- S.2
- S.3 To develop a heightened sense of understanding in students about the microscopic world around them.
- S.4 Understand and demonstrate proper handling and use of laboratory materials while undertaking a laboratory investigation;
- S.5 Dispose of any waste and unused materials using proper laboratory and environmentally sound techniques for removal;
- S.6 Define laboratory procedures and performing laboratory set-up with proper materials and equipment;
- S.7 Formulate questions and use appropriate concepts to guide scientific investigations and to solve real world problems.
- S.8 Design and conduct a controlled scientific investigation.
- S.9 Collect, organize, analyze, evaluate data to compose a valid conclusion.
- S.10 Use technologies as tools in conducting investigations, e.g. microscopes, computer, calculator.

Objective 1

Students explore the development of microbiology and investigate the early history of microbiology, noting especially the development of the microscope and develop an understanding and appreciation for the historical background of microbiology. The student will:

- 1.1 Describe the scope of microbiology, focusing on a variety of microbes and the variety of work that microbiologists conduct
- 1.2 To introduce the fundamental characteristics of various microorganisms.
- 1.3 Name the significant contributions of noted microbe hunters
- 1.4 Utilize Koch's postulates explain how evidence links etiologic agent and to a disease

Objective 2

The student will demonstrate an understanding of microscopy. The student will:

- 2.1 List the appropriate metric units that are used to measure bacteria, viruses, and fungi
- 2.2 Contrast the differences and relationships among the following: resolution, field of view measurement and total magnification
- 2.3 Locate and describe the functions of each major part of a compound light microscope
- 2.4 Outline the principles of transmission and scanning electron microscopy,
- 2.5 Compare the advantages and limitations of electron microscopy with those of light microscopy

Objective 3

Students investigate and analyze the growth and culture of bacteria. Students will develop the ability to work both independently and with others in the laboratory and draw appropriate conclusions from laboratory results. The student will:

- 3.1 Culture bacteria in the laboratory
- 3.2 Produce a streak plate for isolation and critique plates for technique and purity.
- 3.3 Describe a culture using microbial terminology

Objective 4

Students develop the basic knowledge of bacteria types and classifications and investigate specific examples of and explain the chemical basis for biochemical tests to identify bacteria. The student will:

- 4.1 Differentiate between the main components and resulting characteristics attributed to bacteria displaying Gram negative and Gram positive cell walls
- 4.2 Correctly prepare a Gram stain and use the microscope identify the Gram reaction, cell shape, and cell arrangement
- 4.3 Differentiate and describe bacteria based on their cell shape and groupings.
- 4.4 Describe binomial nomenclature, use it correctly and relate it to bacterial names
- 4.5 Define and explain gram staining and describe the features of the more common types of staining methods used in microbiology
- 4.6 Investigate structural properties of microbial membranes and functions associated with these membranes.

Objective 5

Students will compare and contrast parameters affecting microbial growth, ways of controlling growth of microorganisms, and examine the effects that physicochemical factors can have on microbes. The student will:

- 5.1 Explain different growth phases of microbial in a batch cultures and the factors that influence these phases.
- 5.2 Describe environmental factors that influence microbial growth and how these factors vary for different species.
- 5.3 Compare various physical and chemical methods used to control or prevent microbial growth.
- 5.4 Explain the various modes of action of specific antibiotics in preventing the growth of microorganisms.
- 5.5 Demonstrate an understanding of how bacteria divide, what a growth curve is, and how accurate measurements of growth are obtained
- 5.6 Define autotrophs, heterotrophs, saprophytes, and chemoautotrophs
- 5.7 Compare and contrast the various oxygen requirements of bacteria and given data interpret the whether a bacteria is aerobic, facultative anaerobic, anaerobic or microaerophilic

Objective 6

Students will demonstrate an understanding of the host-microbe relationships with humans. Students explain principles of physical and chemical methods used in the control of microorganisms and apply this understanding to the prevention and control of infectious disease. They develop an information base for making personal health decisions in regard to infectious diseases. The student will:

- 6.1 Relate Koch's postulates to identifying disease-causing microbes.
Describe examples of pathogenic microorganisms (bacteria, protists, fungi, viruses and parasites) and how they cause disease in plants and animals.
- 6.2 Compare mechanisms of how communicable diseases are spread among individuals within a population and how genetic changes in pathogenic microbes (such as influenza virus) result in new outbreaks of disease.
- 6.3 Demonstrate an understanding of the development of a harmful disease-causing relationship of some bacteria and the human
- 6.4 Compare the meanings of the terms disinfectant and antiseptic, bactericidal agent and bacteriostatic agent, virucidal, fungicidal
- 6.5 Define, compare and contrast the terms: sterile, aseptic, disinfect, decontaminate
- 6.6 Define epidemiology
- 6.7 Explain the use of the term "patient zero" with examples
- 6.8 Differentiate between epidemic and pandemic with an example
- 6.9 Describe methods for the transmission of pathogens

Objective 7

Students will analyze different types of microorganisms and their defining characteristics.

- 7.1 Distinguish between different kinds of microorganisms based on cellular structure, molecular biology and biochemical composition.
- 7.2 Describe how viruses differ from other parasitic microorganisms.
- 7.3 Compare relative sizes of microorganisms, different types of cell shapes, and various methods used to visualize microorganisms.

Objective 8

Students will analyze historical and modern day uses of bioterrorism and the methods to contain and study microorganisms based on the BSL categories.

- 8.1 Identify and describe the four BSL categories
- 8.2 Describe historical evidence of bioterrorism