BIOL 2420.02 wmccowan
Microbiology

Course Syllabus: Fall 2018

"Northeast Texas Community College exists to provide responsible, exemplary learning opportunities."

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Office Hours	Monday	Tuesday	Wednesday	Thursday	Friday	Online
	11:00am-12:20pm	11:00am-12:20pm	11:00am-12:20pm	11:00am-12:20pm		

The information contained in this syllabus is subject to change without notice. Students are expected to be aware of any additional course policies presented by the instructor during the course.

Course Description: A survey of microbiological concepts, methods, and techniques teaching students the importance of microbes in our daily lives and their central roles in nature.. Prerequisite: The success of this course is mandated through recommendations of the following prerequisite courses: General Biology (min. 4 hours), Anatomy and Physiology (min. 4 hours), and Chemistry (min. 4 hours). Note: Placement in this course by any other means than what is recommended, will first have to meet teacher approval.

Required Textbook(s):
Lansing Prescott, John Harley and Donald Klein, 10th Edt.
Microbiology McGraw-Hill, Inc.
Michael Leboffe, Burton Pierce , Photographic Atlas For Microbiology
Laboratory: Morton Publishing Company

Publisher: McGraw-Hill Publishers

ISBN Number: , ISBN-13 9780077993122
MHID 0077993128

Recommended Reading(s): Text Book

Student Learning Outcomes: Upon successful completion of this course the student will:

1. Have a basic knowledge of non-pathogenic and pathogenic microorganisms. This will enable students to make responsible decisions and conclusions as they relate to microorganisms and as a result be a better citizen.

2. Demonstrate basic skills and knowledge which may be used immediately if entering allied health science fields, or upper level courses preparing a person in food science, biology, medicine, veterinary science, or health education.

3. Demonstrate a respect for lab safety and develop useable aseptic skills and techniques for future laboratory use or home use.

4. Discover the enormous impact microorganisms have on human life.

College Student Learning Outcomes:

Critical Thinking Skills
CT.1
Students will demonstrate the ability to 1) analyze complex issues, 2) synthesize information, and 3) evaluate the logic, validity, and relevance of data.

Communication Skills
CS.1
Students will effectively develop, interpret and express ideas through written communication.

Empirical and Quantitative Skills
EQS.1
Students will manipulate numerical data or observable facts by organizing and converting relevant information into mathematical or empirical form.
EQS.2
Students will analyze numerical data or observable facts by processing information with correct calculations, explicit notations, and appropriate technology.

Team Work
TW2. Students will work with others to support and accomplish a shared goal.

Lectures & Discussions:

1. The History and Scope of Microbiology

CHAPTER OVERVIEW

This chapter introduces the field of microbiology and discusses the importance of microorganisms not only as causative agents of disease but also as important contributors to food production, antibiotic manufacture, vaccine development, and environmental management. It presents a brief history of the science of microbiology, an overview of the microbial world, and a discussion of the scope and relevance of microbiology in today's society.

Learning Objectives:

After reading this chapter you should be able to:

! define the science of microbiology and describe some of the general methods used in the study of microorganisms

! discuss the historical concept of spontaneous generation and the experiments that were performed to disprove this erroneous idea

! discuss Koch=s postulates, which are used to establish the causal link between a suspected microorganism and a disease

! describe some of the various nonpathological activities of microorganisms

! describe procaryotic and eucaryotic morphology, the two types of cellular anatomy, and also the distribution of microorganisms among the various
kingdoms or domains in which living organisms are categorized

! discuss the importance of the field of microbiology to other areas of biology and to general human welfare

2.The Study of Microbial Structure: Microscopy and Specimen Preparation

CHAPTER OVERVIEW

This chapter provides a relatively detailed description and operation principles of the bright-field microscope. Other common types of light microscopes are also described. Following this the students are introduced to various procedures for the preparation and staining of specimens in order to observe general features and/or specific structures. The chapter concludes with a description of the two major types of electron microscopes and the procedures associated with their use.

CHAPTER OBJECTIVES

After reading this chapter you should be able to:

! describe how lenses bend light rays to produce enlarged images of small objects

! describe the various parts of the light microscope and how each part contributes to the functioning of the microscope

 ! compare the images obtained by the different types of light microscope

 ! describe the preparation and simple staining of specimens for observation with the light microscope

 ! describe the Gram-staining procedure and how it is used to categorize bacteria

 ! describe the basis for the various staining procedures used to visualize specific structures associated with microorganisms

 ! compare the operation of the transmission and scanning electron microscopes with each other and with light microscopes

3.Procaryotic Cell Structure and Function

 CHAPTER OVERVIEW

 This chapter provides a description of the procaryotic cell, beginning with the general features of size, shape, and arrangement. Then the general features of biological membranes and the specific features of procaryotic membranes are given. Important internal structures of procaryotes, such as the cytoplasmic matrix,the ribosomes, the inclusion bodies, and the nucleoid are described, in addition to structures external to the cell, such as the cell wall, capsule, pili, and flagella. The
 differences between the cell walls of gram-positive organisms and gram-negative organisms are discussed and the mechanism of this differential staining reaction is explained. The chapter concludes with a discussion of bacterial chemotaxis and bacterial endospores.

 CHAPTER OBJECTIVES

 After reading this chapter you should be able to:

 ! describe the various sizes, shapes, and cellular arrangements exhibited by bacteria

 ! describe the bacterial plasma membrane and the limited internal membrane structures found in procaryotes

 ! describe the appearance, composition, and function of the various internal structures found in procaryotic organisms (such as inclusion bodies, ribosomes,
 and the nucleoid)

 ! define the composition of gram-positive and gram-negative cell walls and explain how these differences contribute to the differential reaction to the
 Gram-staining procedure

 ! describe external structures such as capsules, fimbriae and flagella
 ! diagram and describe the various arrangements of bacterial flagella
 ! describe how bacteria use their locomotive ability to swim toward chemical attractants and away from chemical repellents
 ! describe the production of the bacterial endospore and how it enables spore-forming bacteria to survive harsh environmental conditions and renew growth
 when the environment becomes conducive to growth

4 Eucaryotic Cell Structure and Function

CHAPTER OVERVIEW

This chapter focuses on eucaryotic cell structure and function. Although procaryotic organisms are immensely important in microbiology, eucaryotic microorganisms-such as fungi, algae, and protozoa-are also prominent members of many ecosystems, and some have medical significance as etiological agents of disease as well. The chapter concludes with a comparison of eucaryotic and procaryotic cells.

CHAPTER OBJECTIVES

After reading this chapter you should be able to:

- o discuss the various elements of the cytoskeleton (microfilaments, intermediate filaments, microtubules) with regard to their structure and various functions within the cell
- o discuss the composition, structure, and function of each of the internal organelles, such as the endoplasmic reticulum, Golgi apparatus, lysosomes, ribosomes, mitochondria, chloroplasts, nucleus, and nucleolus
- o discuss the mechanism of endocytosis and the difference between phagocytosis and pinocytosis
- o compare mitosis and meiosis
- o compare and contrast procaryotes and eucaryotes

5 Microbial Nutrition

CHAPTER OVERVIEW

This chapter describes the basic nutritional requirements of microorganisms. Cells must have a supply of raw materials and energy in order to construct new
cellular components. This chapter also describes the processes by which microorganisms acquire nutrients and provides information about the cultivation of
microorganisms.

CHAPTER OBJECTIVES

After reading this chapter you should be able to:

- list the ten elements that microorganisms require in large amounts (macronutrients/macroelements) and the six elements that they require in trace amounts (micronutrients)

- list the major nutritional categories and give the source of carbon, energy, and hydrogen/electrons for each of the categories

- compare the various processes (passive diffusion, facilitated diffusion, active transport, group translocation) by which cells can obtain nutrients from the environment

- describe the various types of culture media for microorganisms (synthetic, defined, selective, differential) and tell how each is normally used in the study of microorganisms

- describe the techniques used to obtain pure cultures (spread plate, streak plate, pour plate)

6 Microbial Growth

CHAPTER OVERVIEW

This chapter describes the basic nature of microbial growth in the presence of an adequate nutrient supply. Several methods for the measurement of microbial

growth are described and different systems used for microbial growth are also described. The chapter finishes with a discussion of the influence of various
environmental factors on the growth of microorganisms.

CHAPTER OBJECTIVES

After reading this chapter you should be able to:

- name the various phases of growth that occur in closed culture systems and describe what is occurring in each phase

- determine from experimental data the various parameters (number of generations, specific growth rate constant, mean generation time) that describe
  microbial growth in mathematical terms

- explain the concept of growth yield and molar growth yield

- describe the various types of continuous culture systems and explain the differences in their function

- describe the influence of various environmental factors (water availability, pH, temperature, oxygen concentration, pressure, radiation) on the growth of
  microorganisms

- categorize microorganisms according to the environmental factors that are conducive to optimal growth of the organism

8 Metabolism: Energy and Enzymes

CHAPTER OVERVIEW

This chapter discusses energy and the laws of thermodynamics. The participation of energy in cellular metabolic processes and the role of
adenosine-5'-triphosphate (ATP) as the energy currency of cells is examined. The chapter concludes with a discussion of enzymes as biological catalysts and the
ways in which enzymes work and are affected by their environment.

CHAPTER OBJECTIVES

After reading this chapter you should be able to:

- discuss the first and second laws of thermodynamics and show how they apply to biological systems

o discuss enthalpy, entropy, and free energy and their application to biological reactions

o discuss the use of ATP as the energy currency of the cell and show how it is used to couple energy-yielding exergonic reactions with energy-requiring
endergonic reactions

o discuss reduction potential and its relationship to exergonic and endergonic processes

o describe the role of enzymes in the catalysis of biological reactions, and discuss the ways in which enzymes are influenced by their environment

9 Metabolism: The Generation of Energy

CHAPTER OVERVIEW

This chapter presents an overview of metabolism beginning with carbohydrate degradation and the aerobic generation of ATP through electron transport. Fermentation and anaerobic respiration are examined, followed by the catabolism of lipids, proteins, and amino acids. The chapter concludes with discussions of the function of inorganic molecules as electron acceptors and the trapping of energy by photosynthesis.

CHAPTER OBJECTIVES

After reading this chapter you should be able to:

o discuss the difference between catabolism and anabolism

o describe the various pathways for the catabolism of glucose to pyruvate

o discuss the tricarboxylic acid (TCA) cycle and its central role in aerobic metabolism

o describe the electron transport process, and compare and contrast the electron transport system of eucaryotes with that of procaryotes

o contrast the two major proposed mechanisms for oxidative phosphorylation (i.e., the chemiosmotic hypothesis and the conformational change hypothesis)

o discuss the different electron acceptors used during aerobic respiration, fermentation, and anaerobic respiration

o describe in general terms the catabolism of molecules other than carbohydrates

o discuss the photosynthetic light reactions, and compare and contrast the light reactions of eucaryotes (and cyanobacteria) with those of green (or purple)photosynthetic bacteria

16 The Viruses: Introduction and General Characteristics

CHAPTER OVERVIEW

Viruses are generally small, acellular entities that possess only a single type of nucleic acid and that must use the metabolic machinery of a living host in order to reproduce. Viruses have been and continue to be of tremendous importance for a variety of reasons: many human diseases have a viral etiology; the study of viruses has contributed greatly to our knowledge of molecular biology; and the blossoming field of genetic engineering is largely based on discoveries in the field of virology. This chapter focuses on the general properties of viruses, the development of the science of virology, and the methodology used in the study of virology.

CHAPTER OBJECTIVES

After reading this chapter you should be able to:

- o define viruses and discuss the implications of the concepts embodied in the definition
- o discuss the various requirements for culturing viruses
- o discuss the methodology employed for virus purification and enumeration
- o discuss the composition and arrangement(s) of viral capsids
- o discuss the variety found in viral genomes (DNA or RNA, single or double stranded, linear or circular, etc.)
- o describe the way in which viruses are classified

19 Microbial Taxonomy

CHAPTER OVERVIEW

Microorganisms are tremendously diverse in size, shape, physiology and lifestyle. This chapter introduces general principles of microbial taxonomy and presents an overview of the current classification scheme. Subsequent chapters will examine the various groups of microorganisms in greater detail. Chapters:20, 21, 22, 23, and 24

Evaluation/Grading Policy:

Lecture will meet twice a week; meeting for one hour and twenty minutes per lecture.

a.	Four major tests will be given	50% of grade
b.	One comprehensive final	5% of grade
c.	Special assignments and reports	5% of grade
		60%

2. Lab

Lab will meet twice a week; meeting for one hour and twenty minutes per lab. However, lab time will be increased occasionally as time is needed to complete necessary lab assignments or procedures.

a.	Daily work	5% of grade
b.	Lab evaluations/tests	10% of grade
c.	Lab research (unknowns)	25% of grade
		40%

3. Final Evaluation

Lecture	60%
Lab	40%
Course Total -	100%

Tests/Exams:

Lecture will meet twice a week; meeting for one hour and twenty minutes per lecture.

a.	Four major tests will be given	50% of grade
b.	One comprehensive final	5% of grade
c.	Special assignments and reports	5% of grade
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Lab will meet twice a week; meeting for one hour and twenty minutes per lab. However, lab time will be increased occasionally as time is needed to complete necessary lab assignments or procedures.

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		40%

3. Final Evaluation

Lecture	60%
Lab	40%
Course Total -	100%

Assignments:

MICROBIOLOGY LABORATORY SCHEDULE

LAB BOOKS WILL BE CHECKED ON A WEEKLY BASIS. ALL QUESTIONS FOR THE EXERCISE COMPLETED MUST BE ANSWERED.

WEEK LABORATORY ASSIGNMENTS
Aug 28 Training Sessions on Lab Safety
Aug 30 Training Session on Lab Safety
Sept 4 Exercise #1: The Microscope
Sept 6 Exercise #2: Handling and Examining Cultures Microbes in the Environment
Sept 11 Completion of exercise #2
Sept 13 Exercise #3: Hanging-Drop and Wet-Mount Preparations
Sept 18 Exercise #4 Simple Stains
Sept 20 Exercise #5 Negative Stains
Sept 25 Exercise #6 Gram Stains
Sept 27 Exercise #7 Acid Fast Stains (hot method)
Oct 2 Exercise #8: Acid Fast Stain (cold method)
Oct 4-9 Exercise #9: Spore Stain
Oct 11 Exercise #10: Capsule Stain, Flagella Stain
Oct 16-19 Completion of lab. test
Oct 23-25 Lab Exercise- Preparation of Media
Oct 30 Lab Exercise- Evaluation of Media Microbial Growth
Nov 1 Lab Exercise- Streak Plate Technique
Nov 6 Lab Exercise- Completion of Streak Plate Technique
Nov 8 Lab Exercise- Differential and Selective media
Nov 13 Fermentation,
Nov 15 Continuation of Exercise
Nov 20 Rapid Identification:Enterotubes BBL crystal systems
Nov 26 Continuation of Exercise
Nov 38 Unknown Bacteria Final Week
Each Student will take a safety test and sign a release before continuing in lab.
Unknowns Presented in Proper Manner
* All unknowns will be typed showing procedual data, summary data, bibliography, and any other material that will support your results. All unknowns will be turned in before scheduled date of your finals.

Lecture Schedule and Exams:

Aug 28 Training Sessions on Lab Safety
Aug 30 Training Session on Lab Safety
Sept 4 1. The History and Scope of Microbiology
Sept 6 1. The History and Scope of Microbiology
Sept 11 1. The History and Scope of Microbiology
Sept 13 2.The Study of Microbial Structure: Microscopy and Specimen Preparation
Sept 18 2.The Study of Microbial Structure: Microscopy and Specimen Preparation
Sept 20 Lecture Test # 1 Chapters 1 & 2
Sept 25 3.Procaryotic Cell Structure and Function
Sept 27 3.Procaryotic Cell Structure and Function
Oct 2.Procaryotic Cell Structure and Function

Oct 4 4 Eucaryotic Cell Structure and Function
Oct 9 4 Eucaryotic Cell Structure and Function
Oct 11 Lecture test # 2 Chapters 3 & 4
Oct 16-18 5 Microbial Nutrition
Oct 23-25 6 Microbial Growth
Oct 30 6 Microbial Growth
Nov 1 6 Microbial Growth
Nov 6 Lecture Test # 3
Nov 8 Chapter 8-Control of Microorganisms by Physical and Chemical Agents
Nov 13 Chapter 8-Control of Microorganisms by Physical and Chemical Agents
Nov 15 Chapter 8-Control of Microorganisms by Physical and Chemical Agents
Nov 20 Chapter 35-Clinical Microbiology
Nov 27 Chapter 35-Clinical Microbiology
Nov 29 Chapter 35-Clinical Microbiology
Dec 3 Chapter 7 The Viruses: Introduction and General Characteristics
Dec 5Chapter 7 The Viruses: Introduction and General Characteristics
Dec 10 - Lecture Test #4

LAB SUPPLIES CHECKLIST

1. Lab Book 0

2. Lab Coat, Apron, or Acceptable Tunic 0

3. Container of Matches 0

4. One Box of Microscope Slides 0

5. Two Rolls of Paper Towels 0

6. One Package of Index Cards 0

7. Labels 0

8. Expo Marker Fine Point 0

Go to http://wmccowan.pageo

Student Responsibilities/Expectations:

Attendance Policy

Regular and punctual attendance at all scheduled classes is required by every student. Students absent, for any reason, are still responsible for lecture materials and any required assignments. There are no excused absences. Excessive absences will ultimately hinder your success in this course. Therefore, it is the responsibility of the student to withdraw from this course before the final withdrawal date to receive a "W". However, your failure to abide by this institutional rule will result in you receiving an "F" for this course.

NTCC Academic Honesty Statement:
"Students are expected to complete course work in an honest manner, using their intellects and resources designated as allowable by the course instructor. Students are responsible for addressing questions about allowable resources with the course instructor. NTCC upholds the highest standards of academic integrity. This course will follow the NTCC Academic Honesty policy stated in the Student Handbook."

Academic Ethics
The college expects all students to engage in academic pursuits in a manner that is beyond reproach. Students are expected to maintain complete honesty and integrity in their academic pursuit. Academic dishonesty such as cheating, plagiarism, and collusion is unacceptable and may result in disciplinary action. Refer to the student handbook for more information on this subject.

ADA Statement:
It is the policy of NTCC to provide reasonable accommodations for qualified individuals who are students with disabilities. This College will adhere to all applicable federal, state, and local laws, regulations, and guidelines with respect to providing reasonable accommodations as required to afford equal educational opportunity. It is the student's responsibility to request accommodations. An appointment can be made with Shannin Garrett, Academic Advisor/Coordinator of Special Populations located in the College Connection. She can be reached at 903-434-8218. For more information and to obtain a copy of the Request for Accommodations, please refer to the NTCC website - Special Populations.

Family Educational Rights And Privacy Act (Ferpa):
The Family Educational Rights and Privacy Act (FERPA) is a federal law that protects the privacy of student education records. The law applies to all schools that receive funds under an applicable program of the U.S. Department of Education. FERPA gives parents certain rights with respect to their children's educational records. These rights transfer to the student when he or she attends a school beyond the high school level. Students to whom the rights have transferred are considered "eligible students." In essence, a parent has no legal right to obtain information concerning the child's college records without the written consent of the student. In compliance with FERPA, information classified as "directory information" may be released to the general public without the written consent of the student unless the student makes a request in writing. Directory information is defined as: the student's name, permanent address and/or local address, telephone listing, dates of attendance, most recent previous education institution attended, other information including major, field of study, degrees, awards received, and participation in officially recognized activities/sports.