

Syllabus for  
**BIO 310—Microbiology Lecture**  
3.0 Credit Hours  
Fall 2012

I. COURSE DESCRIPTION

A study of classification, cultivation, physiology, growth, morphology, pathogenicity, and economic importance of micro-organisms, with emphasis on the bacteria.

Prerequisites: One semester each of general biology and chemistry, both with labs; BIO 370.

Corequisite: BIO 310 Lab.

II. COURSE GOALS

This course is designed to enable the student to study the basic concepts in microbiology, which include an introduction to bacteriology, virology, immunology, mycology, the practical applications of microbiology, and microorganisms in the disease process. Mastery of selected details illustrating these concepts is expected; the ability to read critically, with comprehension, is a useful skill for successful completion of this course.

III. STUDENT LEARNING OUTCOMES FOR THIS COURSE

A. Terminal Objectives

As a result of successfully completing this course, the student will be able to do the following:

1. Describe and discuss the significance of microbiology to our lives.
2. List some milestones in microbiological history.
3. Describe some basic techniques for the study of microorganisms.
4. Describe the diversity of the microbial world.
5. Describe general principles of microbial metabolism, biosynthesis, regulation, and growth.
6. Identify the factors affecting microbial growth.
7. Identify subcellular structures and functions of microbial cells.
8. Describe the important processes of molecular genetics.
9. Describe the characteristics of viruses.
10. Identify and classify the important subgroups of bacteria, fungi, and protozoa.
11. Describe the causes and symptoms of several microbial diseases and their treatment.
12. List important applications of microorganisms.
13. Discuss the components and the role of immunology in prevention of disease.

B. Unit Objectives

1. Unit One: Fundamentals of Microbiology

As a result of successfully completing this unit, the student will be able to do the following:

- a. Identify the contribution made to the development of microbiology by certain outstanding research workers of the past.
- b. Identify chemical functional groups by name and identify which functional groups are present in each of the 20 amino acids.

- c. Draw structures of prokaryotic and eukaryotic cells and explain their function.
  - d. List and explain the factors that affect the growth of microorganisms.
  - e. Identify agents that limit the growth of microorganisms and their general mode of action.
  - f. Discuss the role of enzymes in metabolism and physiology.
  - g. Explain the major biochemical features of the tricarboxylic acid cycle, electron transport system, and glycolysis; identify all sites of ATP synthesis.
  - h. Explain the differences between the metabolic pathways of respiration and fermentation.
2. Unit Two: Genetics and A Survey of the Microbial World  
As a result of successfully completing this unit, the student will be able to do the following:
- a. Describe the activity of the enzymes involved in DNA synthesis and the direction of growth of newly synthesized chains.
  - b. Describe the enzymes involved in the synthesis of RNA and the details of how ribosomes translate the genetic code in RNA into protein.
  - c. Explain how lactose in the medium induces the synthesis of galactosidase and how tryptophan in the medium represses the synthesis of enzymes for the synthesis of tryptophan.
  - d. Classify viruses by name according to the type of nucleic acid present, capsid symmetry, and presence of envelope.
  - e. Describe the steps involved in virus replication: adsorption, penetration, early protein synthesis, DNA replication, late protein synthesis, assembly, and release.
  - f. Explain the differences and similarities between conjugation, transformation, and transduction, and the role that recombination plays in these processes.
  - g. Explain cloning and use of restriction enzymes.
3. Unit Three: Microbes and Their Hosts  
As a result of successfully completing this unit, the student will be able to do the following:
- a. Identify the different criteria for classification used by Bergey, numerical taxonomy, DNA-DNA hybridization, and Numerical Profile Number.
  - b. Differentiate between Bergey's 8th and 9th editions.
  - c. Explain how the study of environmental factors accompanying the occurrence of disease can be used to determine the cause of disease.
  - d. Discuss antigens, antibody-mediated and cell-mediated immunity.
  - e. Describe antibody structure and function.
  - f. Discuss phagocytosis.
  - g. Explain the complement system.
  - h. Compare and contrast humoral and cellular immunity.
  - i. Explain causes, symptoms, and diagnosis of meningitis and encephalomyelitis.
  - j. Identify certain antibiotics with respect to the type of cells inhibited and their molecular mechanism.

4. Unit Four: Microbes and Human Disease  
As a result of successfully completing this unit, the student will be able to do the following:
  - a. Discuss the viral and bacterial infections acquired through injury to the skin.
  - b. Describe the gastrointestinal diseases caused by virus, bacteria, and protozoa.
  - c. Discuss the infectious agents that cause genitourinary tract infections.
  - d. Describe the characteristics used to classify fungi and the disease conditions caused by specific fungi.
  - e. Discuss viral and bacterial respiratory infections.
  - f. Identify the major groups of parasites and discuss malaria and schistosomiasis.
5. Unit Five: Environmental, Industrial, and Applied Microbiology  
As a result of successfully completing this unit, the student will be able to do the following:
  - a. Name the bacteria present at various levels of fresh water; name bacteria and algae present in sea water.
  - b. Define eutrophication; identify nutrients in water that are growth limiting to microorganisms.
  - c. Describe how algae differ from bacteria.
  - d. List the goals of sewage treatment and describe the three treatment systems.
  - e. Identify the various fields of microbiology and give examples for each.
  - f. List areas of biotechnology and identify applications.
  - g. Name the bacteria involved in each step of nitrification; define the processes of ammonification, nitrification, denitrification and nitrogen fixation.
  - h. Describe each step of the nitrogen cycle.
  - i. Describe how carbon is cycled between soil, air, and water.
  - j. Name the important soil bacteria.
  - k. Classify foods as to source and ease of spoilage
  - l. Define spoilage biologically and chemically
  - m. Identify principles and methods of food preservation.
  - n. Identify causes of spoilage.
  - o. Select factors affecting the kinds and number of microorganisms associated with foods.
  - p. Identify microorganisms of industrial importance.
  - q. Identify principles and methods of food preservation.
  - r. Define food infection and food poisoning.

#### IV. TEXTBOOKS AND OTHER LEARNING RESOURCES

##### Required Textbooks:

Tortora, G.B., Funke and Case, C. 2010. Microbiology, 10th edition, Reading: Addison Wesley. 885 p. ISBN: 978-0-321-55007-1.

## V. POLICIES AND PROCEDURES

### A. University Policies and Procedures

1. Attendance at each class or laboratory is mandatory at Oral Roberts University. Excessive absences can reduce a student's grade or deny credit for the course.
2. Students taking a late exam because of an unauthorized absence are charged a late exam fee.
3. Students and faculty at Oral Roberts University must adhere to all laws addressing the ethical use of others' materials, whether it is in the form of print, electronic, video, multimedia, or computer software. Plagiarism and other forms of cheating involve both lying and stealing and are violations of ORU's Honor Code: "I will not cheat or plagiarize; I will do my own academic work and will not inappropriately collaborate with other students on assignments." Plagiarism is usually defined as copying someone else's ideas, words, or sentence structure and submitting them as one's own. Other forms of academic dishonesty include (but are not limited to) the following:
  - a. Submitting another's work as one's own or colluding with someone else and submitting that work as though it were his or hers;
  - b. Failing to meet group assignment or project requirements while claiming to have done so;
  - c. Failing to cite sources used in a paper;
  - d. Creating results for experiments, observations, interviews, or projects that were not done;
  - e. Receiving or giving unauthorized help on assignments.By submitting an assignment in any form, the student gives permission for the assignment to be checked for plagiarism, either by submitting the work for electronic verification or by other means. Penalties for any of the above infractions may result in disciplinary action including failing the assignment or failing the course or expulsion from the University, as determined by department and University guidelines.
4. Final exams cannot be given before their scheduled times. Students need to check the final exam schedule before planning return flights or other events at the end of the semester.
5. Students are to be in compliance with University, school, and departmental policies regarding the Whole Person Assessment requirements. Students should consult the Whole Person Assessment handbooks for requirements regarding general education and the students' majors.
  - a. The penalty for not submitting electronically or for incorrectly submitting an artifact is a zero for that assignment.
  - b. By submitting an assignment, the student gives permission for the assignment to be assessed electronically.

### B. Course Policies and Procedures

1. Attendance  
Oral Roberts University tries to educate and train you to succeed in a wide variety of situations, which usually require that you be present, punctual and prepared to do your job well. The attendance policy of this course is to prepare you for a responsible, successful post-ORU reality. Your sick or other emergency leaves equal the number of times you meet in a week, i.e., three days. Any additional absences will cost you. One absence 1%, two absences 2% and

three absences 3%. **There are no exceptions to this policy except for an official University activity.** Absence on exam days will cost you 20 points.

2. Grading

All earned points are added together from all the exams, quizzes, and the final exam.

The following criteria are used to assign grades at the end of the semester:

<u>Letter</u>	<u>Grade</u>	<u>Course Average</u>
A	90	100%
B	80	89%
C	70	79%
D	60	69%
F	59% and below	

3. Examinations

- a. Students are evaluated by his or her performance on a daily quiz, three, one-hour examinations (100 points each), and a comprehensive final examination at the end of the course (200 points). A quiz over the previous lecture is given at the beginning of each class. **THE STUDENT MUST BE ON TIME TO TAKE THE QUIZ. There are NO makeup quizzes.** Quizzes count 10 points each and are also included in the total points (300) for the course. The total points in the course are 900.
- b. The examinations will consist of short answer questions and definitions in any combination. Questions will be based on material from the text, study guide, handouts and material presented in the class.
- c. Successful performance on these examinations requires mastery of the subject material presented. The student should study the questions in the study guide and text as a guide to the depth of knowledge required from each lecture.
- d. Makeup examinations are given within one week after the regular examination to students who have an excused absence. **Taking a make-up exam for an unexcused absence will result in the loss of 20 points plus the charging of a \$15 late fee.**

4. Whole Person Assessment Requirements  
None

VI. COURSE CALENDAR

<b>Week</b>	<b>Topic</b>	<b>Chapter</b>
1	An introduction to the microscopic world and history of microbiology. Important biological molecules in cells.	1, 2
2-3	How to observe microorganisms through a microscope. Structure and function of prokaryotic cell.	3, 4

<b>Week</b>	<b>Topic</b>	<b>Chapter</b>
4	Characteristics of fungi, protozoa and helminthes. Medically important fungi, protozoa and helminthes. General features of viruses, viroids and prions. Isolation, cultivation and identification of viruses.	12 13
5	Microbial diseases of the skin, nervous, respiratory, urinary and reproductive system.	21, 22, 24, 25
6	The role of viruses in cancer. Role of enzymes in metabolism	13, 5
7-9	Glycolysis, fermentation, respiration. Bacterial growth requirements, pure culture, phases of growth and estimating bacterial growth and numbers.	5, 6
10	Physical and chemical methods to control bacterial growth. Structure and function of bacterial nuclear material.	7, 8
11	Transfer of genetic material in microbes- transformation, conjugation and transduction. Biotechnology and Recombinant DNA methodology and its application in medicine.	8, 9
12	Principles of disease and epidemiology. Microbial mechanisms of pathogenicity. On overview of the MMWR.	14, 15
13	Non-specific defenses of the host. Specific defenses of the host.	16, 17
14	Practical applications of immunology.	18
15	The action of antimicrobial drugs. Applied microbiology	20, 28

## Course Inventory for ORU's Student Learning Outcomes

### Microbiology Lecture – BIO 310 Fall 2012

This course contributes to the ORU student learning outcomes as indicated below:

**Significant Contribution** – Addresses the outcome directly and includes targeted assessment.

**Moderate Contribution** – Addresses the outcome directly or indirectly and includes some assessment.

**Minimal Contribution** – Addresses the outcome indirectly and includes little or no assessment.

**No Contribution** – Does not address the outcome.

The Student Learning Glossary at <http://ir.oru.edu/doc/glossary.pdf> defines each outcome and each of the proficiencies/capacities.

OUTCOMES & Proficiencies/Capacities		Significant Contribution	Moderate Contribution	Minimal Contribution	No Contribution
<b>1</b>	<b>Outcome #1 – Spiritually Alive</b> Proficiencies/Capacities				
1A	Biblical knowledge			X	
1B	Sensitivity to the Holy Spirit				X
1C	Evangelistic capability				X
1D	Ethical behavior				X
<b>2</b>	<b>Outcome #2 – Intellectually Alert</b> Proficiencies/Capacities				
2A	Critical thinking	X			
2B	Information literacy			X	
2C	Global & historical perspectives				X
2D	Aesthetic appreciation				X
2E	Intellectual creativity			X	
<b>3</b>	<b>Outcome #3 – Physically Disciplined</b> Proficiencies/Capacities				
3A	Healthy lifestyle				X
3B	Physically disciplined lifestyle				X
<b>4</b>	<b>Outcome #4 – Socially Adept</b> Proficiencies/Capacities				
4A	Communication skills				X
4B	Interpersonal skills				X
4C	Appreciation of cultural & linguistic differences				X
4D	Responsible citizenship				X
4E	Leadership capacity				X