

**BIOL 15 - Introduction to Microbiology****Catalog Description****Transfer Status:** CSU/UC**Prerequisite:** CHEM 1 or CHEM 51 and One year high school biology or BIOL C1000 or BIOL 2 or BIOL 20 or BIOL 21**Unit(s):** 4.00**Lecture:** 34.00 Contact hours/68.00 Out of class hours/102.00 Total hours/2.00 Unit(s)**Activity:** 34.00 Contact hours/17.00 Out of class hours/51.00 Total hours/1.00 Unit(s)**Lab:** 51.00 Contact hours/0.00 Out of class hours/51.00 Total hours/1.00 Unit(s)**Total:** 119.00 Contact hours/85.00 Out of class hours/204.00 Total hours/4.00 Unit(s)

**Course Description:** This course includes the study of the structure and function of viruses, bacteria, fungi and protists, with emphasis on the predominant pathogenic members of those groups. Study of basic organic chemistry, genetics, metabolism, microbe-host interactions, the immune response and etiological factors involved in disease are also included. Methods of detection, identification, isolation, culture, enumeration, and control of microbes are provided. Graded only.

**Objectives**

Upon successful completion of this course, the student should be able to:

1. Describe the structures of viruses, bacteria, fungi and protists and the function of these structures.
2. Employ basic microbiological equipment and methods for the study, identification and quantification of microbes.
3. Describe the basic metabolic pathways of microbes (energetics) and how metabolism relates to both the establishment of microbial infection and to the biochemical tests used in microbial identification.
4. Explain the role of microbes in infectious disease, including the features of the microbes that contribute to the establishment of infection.
5. Identify key microbial pathogens, how they are transmitted and the major symptoms of the diseases they cause.
6. Explain how the human immune system functions to prevent and control infectious disease.
7. Explain the central dogma of molecular biology and how mutations can lead to changes in protein function.
8. Describe the methods used to identify and or quantify microbes and microbial infections (biochemical tests, DNA based test and serological tests); explain the advantages and disadvantages of these methods.
9. Perform calculations to determine unit conversions, dilution factors, microbial population size and generation time.
10. Describe how microbes are controlled by use of chemical and physical means and through the use of antimicrobial compounds; explain the limitations of these methods.
11. Apply the scientific method to evaluate experiments accurately and communicate conclusions effectively.

**Course Content****Topic Titles / Suggested Time Topic****Lecture/Activity**

<b><u>Topics</u></b>	<b><u>Lec Hrs</u></b>	<b><u>Act Hrs</u></b>
Overview of microbes and microbial taxonomy	2.50	1.50
Scientific method, chemistry of Life and microbial nutritional requirements	1.00	6.00
Structure and functions of the features of a bacterial and eukaryotic cells	2.00	3.50
Basic microbial metabolic processes and how these relate to the establishment of infection and to biochemical tests used to identify microbes	2.50	3.00
DNA replication and microbial population growth	2.50	4.00
Control of microbes by chemical and physical means.	2.50	1.50
Expression of the genetic code, types of mutations and their effect on protein function and horizontal gene transfer	3.00	1.25
Overview of viruses, viral lifecycles, identification and growth of viruses	2.50	1.50
Innate immune system	2.50	1.50
Adaptive immune systems	2.50	2.50
Infection, disease and mechanisms of pathogenicity	2.50	1.50
Example pathogenic microbes, the diseases they cause, their symptoms, their virulence factors and how they evade the immune system	5.00	3.25
Basic properties of enzymes and redox reactions and how it relates to growth	1.50	1.00
Methods of detection and quantification of microbes	1.50	2.00
<b>Total Hours:</b>	<b>34.00</b>	<b>34.00</b>

## Lab

<u>Topics</u>	<u>Lab Hrs</u>
Introduction to the microbiology lab; lab safety	1.50
Introduction to microbiological growth media, culturing techniques and the scientific method	5.00
Use of the microscope for viewing and measuring cells; ocular micrometer calibration; preparation of a heat fixed smear	4.75
Bacterial morphology and arrangement, gram stain and acid-fast stain	3.25
Biochemical tests used to identify Gram positive cocci	4.00
Biochemical tests used to identify Gram negative rods	4.00
Counting microbial populations using direct microscopy and plate counts and coulter counts	3.25
Determination of bacterial population growth and generation time using spectrophotometry	4.00
Identification of an unknown bacterium using PCR and gel electrophoresis	4.00
Control of bacterial growth with UV light, salt, temperature and anoxic conditions	4.00
Determination of antimicrobial susceptibility profiles and minimum inhibitory concentrations; mechanisms of action of commonly used antibiotics and resistance mechanisms in bacteria	4.50
Laboratory tests involving immunological components: leukocyte differential count, ELISA test (as part of an epidemiological activity) and agglutination	4.25
Motility determination, capsule stain and endospore stain	4.50
<b>Total Hours:</b>	<b>51.00</b>

### **Methods of Instruction**

- A. Class Activities
- B. Homework: Students are required to complete one hour of outside-of-class homework for every two hours of activity
- C. Homework: Students are required to complete two hours of outside-of-class homework for each hour of lecture
- D. Laboratory Experiments
- E. Lecture
- F. Reading Assignments

### **Methods of Evaluation**

- A. Quizzes
- B. Homework
- C. Written Assignments
- D. Practical Evaluations
- E. Mid-term and final examinations
- F. Class Discussion

### **Examples of Assignments**

#### **Reading Assignments**

1. Read through the information in your text book and lab manual on 11 antibiotics and be prepared to answer questions on each antibiotic's mechanism of activity.
2. Read through the information provided on a biochemical test. Be prepared to present to the class the goal of the test and how it works including the differential and selective ingredients.

#### **Writing Assignments**

1. Explain why gram negative organisms are resistant to many more antibiotics than gram positive organisms.
2. Read Lab 1 in the Introduction to Microbiology Lab Manual and prepare 0.5-1 page outline of the activities you will perform during Lab 1.

#### **Out-of-Class Assignments**

1. Students should be able to describe and identify the 4 different types of chemical interactions. Read the Chemistry Primer that describes the four interactions and then complete the questions on the worksheet.
2. Students should be able to explain the differences between aerobic respiration, anaerobic respiration and fermentation. Watch the videos on each of these processes and then complete the quiz on Canvas.

### **Recommended Materials of Instruction**

Parker, N., Schneegurt, M., Thi Tu, A., Lister, P. & Forster, B. (2016). Microbiology. *OpenStax*, 1st. 0805376798.

Matiasek, M., White, A., Terra, J., Schmid, M., Grewal, M. (2020). Introduction To Microbiology Lab Manual. *Butte College Press, Current*.

### **Other Learning Materials**

Students must provide their own scientific calculator, lab coat, disposable gloves and goggles.

## Minimum Qualifications

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Biological Sciences (Masters Required)

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**Date:** 05/11/2020