

Virginia Western Community College

BIO 150

Introductory Microbiology

Prerequisites

BIO 101 or 141; ENG 111 placement recommendation, co-enrollment in ENF 3/ENG 111, or successful completion of all developmental English requirements.

Course Description

Examines the general characteristics of microbes including cell morphology and physiology, with an emphasis on human pathogens and methods of microbial control. Studies the relationship of microbes to individual and community health. In this survey course, students will begin with a brief history of microbiology, followed by an exploration of the basic concepts of microbial classification, cellular structure, metabolism and genetics. Following this unit, the students begin to explore infectious diseases caused by bacteria and viruses with an emphasis on diseases of skin, genitourinary tract, respiratory system, digestive system, nervous system, and blood. The course concludes with an overview of microbial control (with a focus on antibiotic resistance), epidemiology and the human immune system. Students learn how the human body remains healthy in the face of numerous microbial invaders. Throughout the course, realistic examples from current events are presented and discussed in the context of the course material, and laboratory exercises are conducted to complement the lecture material.

Semester Credits: 4 Lecture Hours: 3 Lab/Clinical/Internship Hours: 3

Required Materials

Textbook:

Microbiology: The Human Experience. Foster, Aliabadi, and Slonczewski. 1st edition. Norton Publishing. Paperback bundle ISBN: 978-0-393-97858-2

Other Required Materials:

Lab manual: Microbiology Laboratory Theory and Application – Brief Edition. Leboffe and Pierce. 3rd edition. Morton Publishing Company. ISBN: 9781617314773

Lab Coat

Course Outcomes

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

- List, compare and contrast the major categories of microbes
- Understand the basic functions of the different components of a prokaryotic cell
- Compare and contrast prokaryotes and eukaryotes
- Describe the bacterial growth curve, and how it is affected by environmental conditions
- Describe the fundamental processes of horizontal gene transfer

- Describe aerobic and anaerobic metabolism, and fermentation
- For common infectious diseases affecting human skin, genitourinary tract, respiratory system, digestive system, nervous system, and blood, students will be able to identify:
 - Etiologic agent
 - Means of transmission
 - Symptoms
 - Treatment
 - Incubation period
 - Basic epidemiology
 - Method of control/treatment
- Outline the basic immune defenses of the human body
- Understand means of microbial control, including antibiotics and antibiotic resistance

Laboratory Objectives:

Upon completion of the laboratory section of this course, students should be able to:

- Use aseptic techniques to handle microorganisms
- Understand the basics of laboratory safety, and use of proper personal protective equipment
- Understand proper hand washing technique
- Use a compound light microscope and oil immersion lenses
- Prepare specimens for Gram stains, and other differential and special stains
- Isolate, culture, and identify unknown microorganisms
- Understand methods used to quantitate microorganisms
- Isolate bacterial DNA for sequencing and identification of unknown bacterial species
- Perform a Kirby-Bauer antibiotic susceptibility test
- Test water for presence of fecal coliform bacteria
- Perform biochemical and aerotolerance testing on unknown bacterial species

Topical Description

1. Introduction to Microbiology
 - a. Survey of microbes
 - b. History of microbiology
2. Basic concepts of infectious disease
 - a. Microbiota vs. pathogens
 - b. Host-pathogen interactions
 - c. Mechanisms of disease transmission
 - d. Host factors
3. Chemistry of cells
 - a. Elements, bonding and water
 - b. Macromolecules: Lipids, sugars, proteins and nucleic acids
 - c. Membranes and transport
4. Cell Biology of Bacteria
 - a. Cell wall architecture
 - b. Membrane transport

- c. Gram negative and Gram positive bacteria
- d. Specialized bacterial structures
- 5. Bacterial Growth and nutrition
 - a. Growth cycle
 - b. Environmental factors that influence growth: temperature, pH, water, oxygen
- 6. Bacterial Metabolism
 - a. Catabolism: Glycolysis, fermentation pathways, respiration pathways
 - b. Biosynthesis and nitrogen fixation
- 7. Bacterial genetics
 - a. Bacterial genomes
 - b. DNA replication
 - c. Transcription and translation
 - d. Regulation of gene expression: operons
 - e. Horizontal gene transfer: transformation, transduction, conjugation
- 8. Viruses
 - a. Viral structure
 - b. Viral replication strategies
 - c. DNA viruses
 - d. RNA viruses
 - e. Retroviruses
- 9. Microbial pathogenesis
 - a. Attachment to host cells
 - b. Toxins
 - c. Secretion of virulence proteins
 - d. Surviving within the host
- 10. Skin infections
 - a. Basic anatomy
 - b. Viral infections
 - c. Bacterial infections
 - d. Fungal infections
- 11. Infections of respiratory tract
 - a. Basic anatomy
 - b. Viral infections
 - c. Bacterial infections
 - d. Fungal and parasitic infections
- 12. Infections of digestive system
 - a. Basic anatomy
 - b. Viral infections
 - c. Bacterial infections
 - d. Parasitic infections
- 13. Infections of the genitourinary system
 - a. Basic anatomy
 - b. Viral infections
 - c. Bacterial infections

- d. Fungal infections
- 14. Infections of the central nervous system
 - a. Basic anatomy
 - b. Viral infections
 - c. Bacterial infections
 - d. Fungal infections
- 15. The innate immune system
 - a. Cell types
 - b. Physical barriers
 - c. Inflammation
 - d. Innate immunity
 - e. Phagocytosis
- 16. Adaptive immune system
 - a. Cell types
 - b. Humoral vs. cell mediated immunity
 - c. Role of antibodies
 - d. Mechanism of vaccines
- 17. Microbial control
 - a. Sterilization
 - b. Disinfection
 - c. Antibiotic therapy

If time permits:

- A. Epidemiology
- B. Microbiome

Notes to Instructors

Teaching Methods

The amount of instructional time allocated to each topic can vary from instructor to instructor, according to their expertise and interest, but all points are covered.

Evaluation Criteria and Procedures

This will vary slightly from instructor to instructor. Normally it entails four or more written lecture exams with practical testing given to cover laboratory materials. Lecture and laboratory information is covered on the same assessment tools. Course may also include reading assignments, oral presentations and case studies.