Virginia Western Community College
BIO 205
General Microbiology

Prerequisites

One year of college biology and one year of college chemistry or divisional approval; an ENG 111 placement recommendation, co-enrollment in ENF 3/ENG 111, or successful completion of all developmental English requirements.

Course Description

Examines morphology, genetics, physiology, ecology, and control of microorganisms. Emphasizes application of microbiological techniques to selected fields. Focuses on human pathogens and the process of pathogenicity.

In this survey course, students explore the vast world of microbiology and the myriad ways microorganisms influence everyday life, with an emphasis on human health and disease. Initially, students study the history of microbiology and the classification and structure of microorganisms. After a basic introduction, students begin an in-depth look at microbial metabolism and genetics. The latest technologies are discussed, and the impact that genetics of the microbial organisms have on humans is emphasized. Following this unit, the students begin to explore the individual categories of microorganisms and individual representatives of each type of microbe are studied in detail. 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, with the overall goal of improving their own personal health. 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** **Laboratory Hours: 3**

Required Materials

Textbook:

Microbiology: The Human Experience. Foster, Aliabadi, and Slonczewski. 2nd edition. Norton Publishing. Paperback ISBN: 9780393533248

Lab Manual: Exercises in General Microbiology. Biscardi, Juneau, and Ojeda; printed in-house.
For virtual sections: Microbiology: The Human Experience with Access code (eText) + Digital Microbiology Laboratory Exercises

Other Required Materials:

Lab Coat
Goggles

Course Outcomes

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

- Practice safe microbiology, using appropriate protective and emergency procedures.
- Apply aseptic technique to safely handle BSL-1 and BSL2 microbes
- Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
- Use pure culture and selective techniques to enrich for and isolate microorganisms.
- Use appropriate media and biochemical based methods to identify microorganisms
- Estimate the number of microorganisms in a sample using viable plate count
- Set up and perform calculations using a serial dilution
- Use various DNA technology applications to identify unknown bacterial species; and to understand the principle of bacterial gene transfer
- Use appropriate microbiological and molecular lab equipment and methods.
- Document and report on experimental protocols, results and conclusions

Topical Description Listed in the Order Taught

Chapter 1: Introduction to Microbiology

- Types of Microorganisms
  - Bacteria
  - Fungi
  - Viruses
- History of Microbiology
  - Germ Theory of Disease vs. Spontaneous Generation
  - Founders of Microbiology (Ex. Van Leeuwenhoek, Pasteur, Koch)

Chapter 5: Prokaryotic Cell Biology:

- Outer structures; flagella, cilia, capsules, and pili ○ Cell wall
- Plasma membrane (hypotonic, isotonic, and hypertonic solutions)
- Cell organelles

Chapter 6: Prokaryotic Cell Growth:

- Understanding the bacterial growth curve; how factors such as temperature, pH, oxygen, and osmotic pressure influence bacterial growth

Chapter 3: Microscopy and Cell Structure

- Light, dark field, and electron microscopy
- Anatomy and physiology of Prokaryotic and Eukaryotic Cells; size, shape, and types

Chapter 7: Microbial Metabolism

- The role of enzymes
- Central metabolic pathways
- Glycolysis
- Fermentation pathways
- Citric acid Cycle
- Oxidative Phosphorylation and electron transport chain
- Structure & Function of ATP synthase
- Catabolism of non-carbohydrate macromolecules
- Anabolic pathways

Chapter 27: Food/Environmental Microbiology

- Microbes in food and beverage production
- Food spoilage
- Foodborne illnesses

Chapter 8: From DNA to Protein/Biotechnology

- DNA replication
- Gene expression
- Regulation of gene expression – the lac operon
- DNA technology methods

Chapter 9: Microbial Genetics

- Mutations
- Transfer of genetic material
  - Transformation
  - Transduction
  - Conjugation
- Mobile genetic elements

Chapter 18: Host Microbe Interactions/Microbial pathogenesis

- Principles and causes of infectious disease
- Mechanisms of pathogenicity

Chapter 12: Viruses, Viroids, and Prions

- Structure and classification
- General infectious cycles of example bacterial and animal viruses
- Cultivation in the laboratory
- Viruses and cancer – oncogenic viruses

Chapter 11: Eukaryotic Microbes

- Fungi
- Protozoa
- Helminthes

Control of Microorganisms Chapter 13: Sterilization, Disinfection, and Antibiotic therapy

- Heat
- Filtration
- Refrigeration
- Radiation
- Desiccation
- Osmotic pressure
- Antiseptics and disinfectants
- Antibiotics and their modes of action, selective toxicity, mechanisms of action, determining susceptibility, antibiotic resistance

Host Resistance Chapter 15: The Innate Immune Response

- Intact skin
- Inflammatory response and phagocytosis
- Fever
- Antimicrobial substances (Lysozyme, Complement, Interferon)

Chapter 16: The Adaptive Immune Response

- Antigens and antibodies
- Humoral and cell-mediate immune systems
- Active and passive immunity
- Immunological memory
- Monoclonal antibodies (if time permits)

If time permits, the following chapters will be taught:

Chapter 26: Principles of Epidemiology

- Epidemiological studies
- Portals of entry and means of transmission
- Surveillance
- Trends in disease
- Healthcare associated infections

Sexually Transmitted Infections

Laboratory Topics

- Use of the Compound Light Microscope and Dissecting Microscope
- Bacteriological Media and Aseptic Techniques
- Differential staining (Gram Stain Technique)
- Special staining techniques (acid fast stains and spore stains)
- Effects of environmental conditions on growth (aerobic vs. anaerobic)
- Bacterial enumeration by serial dilution and plate counting
- DNA Technology *(May include PCR, DNA fingerprinting, transformation and/or microarray technology)*
- Antibiotic Sensitivity Testing (Disc Diffusion Method)
- Biochemical Testing and Selective and Differential Media
- Unknown identification with multi-test identification systems
- Eukaryotic Microorganisms – Yeast, Molds, and Protozoans (Slide identification)
- Coliform testing of water
- Antibiotic resistance assay of soil bacterial
- Winogradsky column

Notes to Instructors

1. Departmental policy dictates that instructors do not allow students to keep tests.
2. A comprehensive final exam counting 15%-20% of the total grade will be given at the end of the semester.
3. The syllabus should state what the course grade will be based on, such as tests, quizzes, a comprehensive final exam, and any other assignments made by the instructor.
4. The VWCC Biology Department uses a 10-point grading scale.
5. Comprehensive study of the listed topics is beyond the reasonable expectations of a 16-week Microbiology course. It is up to the discretion of the instructor to choose which topics are more detailed but each topic should be adequately covered.