

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: A Human Perspective. Nester, Anderson, Roberts. 8th edition. McGraw Hill Publishing. Hardback bundle ISBN: 9781259621871. Loose-leaf bundle ISBN: 9781259390586

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

Other Required Materials:

Lab Coat

Course Outcomes

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

- Practice safe microbiology, using appropriate protective and emergency procedures.
- 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 based methods to identify microorganisms
- Estimate the number of microorganisms in a sample using viable plate count
- Use appropriate microbiological and molecular lab equipment and methods.
- Document and report on experimental protocols, results and conclusions

Topical Description

Chapter 1: Introduction to Microbiology

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

Chapter 4: Prokaryotic Cell 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
 - Outer structures; flagella, cilia, capsules, and pili
 - Cell wall
 - Plasma membrane (hypotonic, isotonic, and hypertonic solutions)
 - Cell organelles

Chapter 6: Microbial Metabolism

- The role of enzymes
- Central metabolic pathways
 - Glycolysis
 - Pentose phosphate pathways
 - TCA cycle
- Respiration
 - ETC
 - ATP Synthase
- Catabolism of non-CHO macromolecules

- Anabolic pathways

Chapter 31: Food Microbiology

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

Chapter 7: From DNA to Protein

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

Chapter 8: Microbial Genetics

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

Chapter 9: Biotechnology and Recombinant DNA

- Tools of biotechnology
- Applications
- Techniques
 - DNA sequencing
 - Polymerase chain reaction
- The ethics of genetic engineering

Chapter 16: Host Microbe Interactions

- Principles and causes of infectious disease
- Mechanisms of pathogenicity

Microbial Diversity

Chapter 13: Viruses, Viroids, and Prions

- Structure and classification
- General life cycle of bacterial and animal viruses
- Cultivation in the laboratory
- Viruses and cancer – oncogenic viruses
- Infection protein and RNA

Chapter 12: Eukaryotes

- Fungi
- Protozoa
- Helminthes

If time permits, the following chapters will be taught:

Chapter 19: Principles of Epidemiology

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

Control of Microorganisms

Chapter 5: Physical Methods of Microbial Control

- Heat
- Filtration
- Refrigeration
- Radiation
- Desiccation
- Osmotic pressure

Chapter 20: Chemical Methods of Microbial Control

- Antiseptics and disinfectants
- Antibiotics and their modes of action
 - Selective toxicity
 - Mechanisms of action
 - Determining susceptibility
 - Antibiotic resistance

Host Resistance

Chapter 14: The Innate Immune Response

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

Chapter 15: The Adaptive Immune Response

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

Chapter 19: Practical Applications of Immunology

- Immunizations
- Immunologic Testing

Emerging Diseases

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
- Bacteriophage infection of *E. coli* and/or phage discovery using *Bacillus* bacteria as hosts.
- DNA Technology (*May include PCR, DNA fingerprinting, transformation and/or microarray technology*)
- Use of disinfectants and U.V. Irradiation
- 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)
- Immunology Techniques (Ex. ELISA)

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 15-week Biology 101 course. It is up to the discretion of the instructor to choose which topics are more detailed but each topic should be adequately covered.