DEPARTMENT OF BIOLOGICAL SCIENCES

BIOLOGY 51: MICROBIOLOGY OF HEALTH & DISEASE

SYLLABUS & COURSE OUTLINE

COURSE COORDINATORS:
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Course Information
Bio 51 is a one semester 4 credit, 6 hour course required for nursing students and students enrolled in the pre-physician assistant concentration. This course does not fulfill the requirements for Biology majors.

Prerequisites: successful completion of Bio 12
Science 25 (required for nursing students only)

Corequisites: For nursing students only, Bio 51 must be taken before or with Nursing 21. Nursing students cannot continue in Nursing 21 if they withdraw from Bio 51.
Course Overview

- Major diseases caused by microorganisms are considered. These include: HIV opportunistic and nosocomial infections, tuberculosis, hepatitis, pneumonia, sexually transmitted diseases, and water and foodborne diseases.
- The course has direct application to medical surgical nursing.
- Universal precautions, asepsis, and control of microbial growth are emphasized.
- Immune responses to infections are discussed.
- Your knowledge of anatomy and physiology will be applied to understand the effects of microbial infections on various organs systems. If you are unsure of any of the anatomy and physiology principles being discussed, please review them or meet with your instructor.

Course Goals for Student Outcomes
1. Apply the concept of asepsis and its applications to laboratory procedures, hospitals, & medical practices.
2. Employ basic principles of microbial anatomy and physiology to microbial virulence, pathogenicity, and disease establishment.
3. Identify the factors affecting microbial virulence and the responses by the host’s defense mechanisms.
4. Determine properties of microorganisms through staining and biochemical testing that can be used for diagnostic microbial identification.
5. Recognize the signs and symptoms of particular disease and decisions involved in determining antibiotic therapy.

Recommendations to Students
- Read assigned lecture and laboratory material before coming to class.
- Ask questions and meet your instructor during office hours to clarify any questions you may have.
- Attendance to class is essential. If you do miss class you are responsible for making up the missed work.
- Plan your work and study time. Read over or perhaps rewrite your notes after class. Read the text to supplement your notes. Discuss the material with your classmates. Form study groups.
- Best wishes for your success in the course. If you have any questions, please feel free to meet with your instructor.

Grade computation: Lecture and laboratory are each 50% of the final grade.

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Required Textbook and Laboratory Manual


**OR**


**Special requirements:**

a) **Knee length laboratory coat:** This requirement conforms to OSHA safety regulations. It must be worn at all times in the microbiology laboratory. You will not be able to remain in the laboratory without a lab coat. After each week’s lab, the lab coat should be washed.

b) **Safety goggles:** eye protection needs to be worn when you are working with your transferring cultures using your Bunsen burners and inoculating loops. Eyeglasses cannot be used in lieu of safety goggles.

**BIO 51 LECTURE OUTLINE**

**WEEK 1: INTRODUCTION AND HISTORY OF MICROBIOLOGY**
Organisms studied in microbiology (prokaryotic and eukaryotic)
The nature microbiological problems
The history of microbiology
Reading Assignment - Chapter 1 p. 1-26; Chapter 10 p. 271-278, p. 286-302;
Chapter 11 p. 312-326

**WEEK 2: BACTERIAL ANATOMY**
Bacterial shapes and arrangements
Cell wall
Cell membrane
Glycocalyx
Endospores
Flagella
Cytoplasmic inclusions
Cytoplasmic structures/organelles
Reading Assignment - Chapter 3 p. 69-73; Chapter 4 p. 79-98; Chapter 6 163-164; (Review of eukaryotic organelles Chapter 4 p. 98-104)

**WEEK 3: BACTERIAL GENETIC TRANSFER & GROWTH**
3 major modes of bacterial genetic transfer: transformation, conjugation, & transduction
Significance of genetic transfer
Bacterial cell division
Bacterial growth curve
Reading Assignment - Chapter 8 p. 211-222; Chapter 6 p. 147-160, 160-171

**WEEKS 4 & 5: BACTERIAL METABOLISM**
Aerobic respiration
Anaerobic respiration
Fermentation and types of fermentation
Use of metabolic properties to identify microorganisms
Industrial uses for microbial metabolism- food, antibiotic, and enzyme production
Antibiotic therapy

Reading Assignment - Chapter 5 p. 116 – 136; Chapter 1: p. 366 - 399

WEEKS 5 & 6: IMMUNOLOGY
Normal flora, transient flora opportunistic microbes
Pathogenicity, virulence, and factors that increase virulence (enzymes, toxins)
Factors that affect the spread of disease
Nonspecific immune responses
Specific immune responses: humoral and cell mediated immunity
Vaccines
HIV/AIDS

Reading Assignment - Chapter 14: p. 400 – 425; Chapter 15: p. 426 – 463;
Chapter 16: p. 463 – 487; Chapter 17: p. 488 – 531; Chapter 18: p. 555 – 560

WEEKS 7 & 8: MICROBIAL DISEASES OF THE SKIN AND EYES
Bacterial diseases of the skin
Acne, folliculitis, boils, furuncles, carbuncles, impetigo, cellulitis, & osteomyelitis
Infections of burns and surgical wounds, gangrene
Leprosy

Viral Diseases of the Skin
Warts
Chicken pox and shingles
Herpes (HSV I)
Measles
German measles (Rubella)
Smallpox

Fungal Diseases of the Skin
Dermatophyte infection (Tinea infections)
Candidiasis

Bacterial diseases of the Eyes
Conjunctivitis
Atypical bacterial diseases of the Eyes
Inclusion conjunctivitis
Trachoma

WEEKS 7 & 8: MICROBIAL DISEASES OF THE SKIN AND EYES (continued)
Viral Diseases of the Eyes
Herpetic Keratitis


WEEKS 8 & 9: MICROBIAL DISEASES OF THE RESPIRATORY SYSTEM
Bacterial diseases
Group A streptococci, its complications (rheumatic fever, glomerulonephritis) & scarlet fever
Diptheria
Otitis media
Laryngitis, sinusitis & bronchitis
Bacterial pneumonia
Pertussis
Tuberculosis
Legionnaire's disease
**Atypical bacterial diseases**
Ornithosis
Mycoplasmal pneumonia
**Viral diseases**
Common cold
Influenza
Viral pneumonia (Respiratory Syncytial Infection)
Hanta virus pulmonary syndrome
**Fungal diseases**
Histoplasmosis
Cryptococcosis
Pneumocystis carinii pneumonia

**Reading Assignment:**  Chapter 19 p. 579;  Chapter 20 p. 612;  Chapter 21 p. 639 – 669;  Chapter 23 p. 720

**WEEK 10: MICROBIAL DISEASES OF THE CARDIOVASCULAR & LYMPHATIC SYSTEMS**
**Bacterial diseases**
Bacteremia and septicemia
Acute and subacute bacterial endocarditis
Plague (pneumonic)
Lyme disease
Anthrax
**Atypical bacterial diseases**
Rocky mountain spotted fever
**Viral diseases**
Epstein Barr Virus: Infectious mononucleosis/ Burkitt’s lymphoma
Ebola virus hemorrhagic fever
West Nile Fever

**WEEK 10: MICROBIAL DISEASES OF THE CARDIOVASCULAR & LYMPHATIC SYSTEMS (continued)**
**Protozoan diseases**
Malaria
Toxoplasmosis

WEEKS 10 & 11: MICROBIAL DISEASES OF THE NERVOUS SYSTEM

Bacterial diseases
Meningitis
Tetanus
Botulism

Viral diseases
Polio
Rabies
Encephalitis
West Nile Fever
Cytomegalovirus infection
Creutzfeldt-Jakob disease (CJD)

Protozoan diseases
Trypanosomiasis/ Chagas' Disease

Reading Assignment: Chapter 20 p. 632 – 634, Chapter 24 p. 754 – 763, p. 765 – 777

WEEKS 11 & 12: MICROBIAL DISEASES OF THE DIGESTIVE SYSTEM

Bacterial diseases
Dental caries
Food poisonings
Cholera
Gastroenteritis
Bacterial Dysentery
Peptic Ulcers

Fungal diseases
Thrush
Aflatoxin poisoning
Ergot poisoning

Viral diseases
Mumps
Hepatitis A-E

Protozoan diseases
Amebic dysentery
Giardiasis
Cryptosporidiosis

Reading Assignment: Chapter 22 p. 676 – 703

WEEK 12: MICROBIAL DISEASES OF THE URINARY/ REPRODUCTIVE SYSTEMS

Bacterial diseases
Urinary tract infections
Vaginitis
Toxic Shock Syndrome
Syphilis
Gonorrhea

Atypical bacterial diseases
Nongonoccal urethritis

Viral diseases
Genital herpes
Genital warts

Protozoan diseases
Trichomoniasis

Fungal diseases
Vaginitis

Reading Assignment: Chapter 20 p. 606 – 611, 613 – 635
OBJECTIVES
The objectives listed can be used as guidelines for studying each topic discussed in the course.

Introduction and History of Microbiology
1. Describe in one or two sentences the significance of the contributions of the following scientists to the field of microbiology: (a) van Leeuwenhoek; (b) Pasteur; (c) Semmelweis; (d) Lister; (e) Koch; (f) Ehrlich; & (g) Fleming.
2. Define spontaneous generation.
3. In a brief statement, describe the series of experiments disproving spontaneous generation.
4. List 3 major concerns regarding the spread and treatment of diseases caused by microorganisms.

Bacterial Anatomy
1. Draw and describe common bacterial shapes and their arrangements.
2. Describe the structure and function of the following: (a) cell wall; (b) cell membrane; (c) glycocalyx; (d) endospores; (e) flagella; (f) inclusion bodies
3. For each of the structures mentioned in objective 2, describe how each is involved in disease processes.

Genetic Transfer
1. Distinguish between transformation, transduction and conjugation.
2. Explain the medical significance of the 3 modes of genetic transfer mentioned in objective 1.

Growth and Factors Affecting Growth
1. Draw and label the four phases of a typical bacterial growth curve.
2. Describe the phases of a typical bacterial growth curve.
3. List and describe four physical factors affecting microbial growth.
4. Explain why physical factors affecting growth can be used to demonstrate the human body is an excellent environment for growth of a variety of microorganisms.

Microbial Metabolism
1. Define the following terms: (a) fermentation; (b) aerobic respiration; & (c) anaerobic respiration.
2. List the end products of (a) glycolysis; (b) Krebs cycle; (c) electron transport/oxidative phosphorylation.
3. Explain how proteins and lipids are metabolized to generate ATP.
4. Explain the significance of microbial metabolism in the identification of microorganisms.
5. List three organisms and their fermentation products used in food production.

Immunology
1. Distinguish between contamination, infection and disease.
2. Define each of the following terms: (a) normal flora; (b) transient flora & (c) opportunistic organisms.
3. Describe the stages and infectious disease establishment.
4. The list and describe the significance of three virulence factors.
5. List and describe the significance of five bacterial enzymes serving as virulence factors.
6. Distinguish between exotoxins and endotoxins.
7. Distinguish between nonspecific resistance and specific resistance.
8. Distinguish between portal of entry and portal of exit.
9. List and describe three examples of nonspecific resistance.
10. Describe the stages of inflammation.
11. Describe the classical and alternate pathway of the complement system.
12. Distinguish between humoral immunity and cell mediated immunity.
13. Distinguish between passive immunity and active immunity.
15. Distinguish between an antibody and an antigen.
17. Explain the immunological basis of vaccination against diseases such as smallpox.

**Microbial Diseases of the Skin and Eyes**
1. List and describe three examples of staphylococcal infections.
2. List and describe two eye infections caused by bacteria.
3. List two organisms found infecting skin burns.
4. List three major causes of wound infections.
5. Distinguish between superficial mycoses, subcutaneous mycoses, & cutaneous mycoses.
6. Distinguish between herpes simplex virus I (HSV I) & herpes simplex virus II (HSV II).
7. Describe the effects resulting from herpes simplex I and herpes simplex II infection.
8. Describe three childhood viral diseases including the name of the causative agent, signs & symptoms, treatment, & prevention.

**Microbial Diseases of the Respiratory System**
1. List and describe three streptococcal infections.
2. Describe three complications of streptococcal infections.
3. Describe upper respiratory infections caused by *Haemophilus influenzae* & *Streptococcus pneumoniae*.
4. Name of causative agent, transmission, signs and symptoms, and treatment of the following: (a) whooping cough; (b) bacterial pneumonia; (c) tuberculosis; and (d) Legionnaire’s disease.
5. Describe the effects resulting from rhinovirus infection.

**Microbial Diseases of the Cardiovascular and Lymphatic Systems**
1. Describe three bacterial systemic infections including the name of the causative agent, signs and symptoms, and treatment.
2. Distinguish between bacteremia and septicemia.
3. Distinguish between acute endocarditis and subacute endocarditis.
4. Describe the following diseases including the name of the causative agent, signs and symptoms, and treatment (if any): (a) Ebola virus (b) Hanta virus and (c) West Nile virus.

**Microbial Diseases of the Nervous System**
1. Describe three bacterial nervous system infections including the name of the causative agent, signs and symptoms, and treatment.
2. List five effects of (a) botulism and (b) tetanus on the nervous system.
3. List three bacteria causing meningitis.
4. List three properties of parasitic protozoa.
5. Describe the mode of action of three drugs used to treat protozoan infections.
6. Describe the worldwide significance of malaria.
7. Explain how toxoplasmosis can lead to congenital defects.
8. Describe the following diseases including the name of the causative agent, signs and symptoms, and treatment: (a) rabies; (b) polio; and (c) encephalitis.
9. Distinguish between prions and viroids.
Microbial Diseases of the Digestive System
1. List five bacteria that can cause gastrointestinal infections.
2. Distinguish between an intoxication and an infestation.
3. In a brief statement, describe the signs, symptoms and treatment of *Salmonella* gastroenteritis.
4. Distinguish between hepatitis A, hepatitis B, hepatitis C, hepatitis D, and hepatitis E with regard to incubation time, transmission, and groups at greatest risk of infection.

Microbial Diseases of the Urinary/Reproductive System
1. List three bacteria causing urinary tract infections.
2. List three reasons for urinary tract infections.
3. Define the term nongonococcal urethritis.
4. Describe the effects resulting from human papilloma virus infection.
5. Describe the progression of syphilis (primary, secondary, and tertiary)
6. Describe the signs/symptoms of gonorrhea.
7. Describe the effects of 2 sexually transmitted diseases on an unborn fetus.
BIOLOGY 51 LABORATORY

Recommendations to the student:

- Observe all safety precautions in the laboratory. They are for your protection.
- Each student is responsible for the proper safety and maintenance of their work area. Bench tops and microscopes must be properly cleaned before and after use. Microquat disinfectant is used on bench tops.
- Wear your laboratory coat at all times while in the microbiology laboratory.
- Use the additional hours scheduled to practice skills, reinforce concepts, and analyze results.
- Read the laboratory exercises before class and the textbook pages corresponding to the laboratory activities.
- If you are unsure of any of the work you are required to perform during the lab, ask your instructor.
- If you spill any bacterial cultures or make a mistake you think might be a potential health hazard, inform your instructor.
- Wash your hands with betadine before, during and after lab work.