



DEPARTMENT OF BIOLOGICAL SCIENCES

BIOLOGY 51: MICROBIOLOGY OF HEALTH & DISEASE

SYLLABUS & COURSE OUTLINE

FALL 2017 - SUMMER 2018

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Course Information

Bio 51 is a one semester 4 credit, 6 hour course required for preparing for Nursing, Physician's Assistant and other allied health sciences only. This course examines the role of microbes as infectious agents responsible for a wide variety of diseases and medical conditions. Disease transmission, treatment, and prevent are considered. The laboratory focuses on the basic methods to cultivate, identify and control microbial growth. **This course does not satisfy the Biology major elective requirement.**

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. A student in any course who has been absent 15% of the total number of instructional hours that a class meets during a semester is deemed excessively absent. Excessive absences may result in the instructor assigning either a lower grade or “WU” grade for the course. For Bio 51, this policy is brought into effect when a student exceeds approximately 11 hours of class time.
- 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.

Access-Ability Services (AAS) serves as a liaison and resource to the KCC community regarding disability issues, promotes equal access to all KCC programs and activities, and makes every reasonable effort to provide appropriate accommodations and assistance to students with disabilities. Please contact this office if you require such accommodations and assistance. Your instructor will be glad to make the accommodations you need, but you must have documentation from the Access-Ability office for any accommodations.

Academic Integrity

Your instructor upholds the KCC policy on academic honesty (see Student Handbook online). There are serious consequences for cheating on exams or plagiarizing someone else’s work (i.e., turning in work that is copied from another source). These include a reduced grade or zero, suspension, or dismissal. If you are not sure what constitutes academic dishonesty, please check with the instructor.

Plagiarism is the use of others’ words and/or ideas without clearly acknowledging their source. As students, you are learning about other people’s ideas in your course texts, your instructors’ lectures, in-class discussions, and when doing your own research. When you incorporate those words and ideas into your own work, it is of the utmost importance that you give credit where it is due. Plagiarism, intentional or unintentional, is considered academic dishonesty and all instances will be reported to the Academic Judiciary. To avoid plagiarism, you must give the original author credit whenever you use another person’s ideas, opinions, drawings, or theories as well as any facts or any other pieces of information that are not common knowledge. Additionally, quotations of another person’s actual spoken or written words, or a close paraphrasing of another person’s spoken or written words, must also be referenced. Accurately citing all sources and putting direct quotations – of even a few key words – in quotation marks are required.

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

<u>Lecture</u>		<u>Laboratory</u>	
Examinations-	20%	Examinations-	20%
Writing assignment-	10%	Clinical unknowns-	15%
Final examination-	20%	Practicals-	10 %
		Technique/classwork	5%

**Writing assignment may vary at the discretion of the Instructor.*

Required Textbook and Laboratory Manual

Black, J.G. Microbiology: Principles and Explorations. 9th edition (2008) John Wiley & Sons

Brancaccio-Taras, L. Laboratory Exercises in Microbiology. 2nd edition (2007) Whitter Publications: New York.

****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 handling cultures. 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

WEEK 2: BACTERIAL ANATOMY

Bacterial shapes and arrangements

Cell wall

Cell membrane

Glycocalyx

Endospores

Flagella

Cytoplasmic inclusions

Cytoplasmic structures/organelles

Reading Assignment- Chapter 4 p. 77-96; Chapter 6 165-166; (Review of eukaryotic organelles Chapter 4 p. 97-104)

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. 213-224; Chapter 6 p. 146-150

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. 115 – 135; Chapter 13 p. 371-400

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. 405 – 425; Chapter 15: p. 433 – 462;

Chapter 16: p. 472 – 493; Chapter 17: p. 498 – 533; Chapter 18: p. 564 – 571

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

Viral Diseases of the Eyes

Herpetic Keratitis

Reading Assignment: Chapter 19: p. 585 – 606

WEEKS 8 & 9: MICROBIAL DISEASES OF THE RESPIRATORY SYSTEM**Bacterial diseases**

Group A streptococci, its complications (rheumatic fever, glomerulonephritis) & scarlet fever

Diphtheria

Otitis media

Laryngitis, sinusitis & bronchitis

Bacterial pneumonia

Pertussis

Tuberculosis

Legionnaire's disease

Atypical bacterial diseases

Ornithosis

Mycoplasmal pneumonia

Reading Assignment: Chapter 21: p 650-684

WEEKS 8 & 9: MICROBIAL DISEASES OF THE RESPIRATORY SYSTEM**Bacterial diseases (Continued)****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. 650-684

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

Protozoan diseases

Malaria

Toxoplasmosis

Reading Assignment: Chapter 23 p. 733 – 738, 740 – 746, 748 – 751, 753 – 754, 757- 759
762 – 765, 740: Chapter 24; 779-781

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. 644-646 Chapter 24 p. 772 –796, p. 765 – 781**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. 690 –726

WEEK 12: MICROBIAL DISEASES OF THE URINARY/REPRODUCTIVE SYSTEMS**Bacterial diseases**

Urinary tract infections

Vaginitis

Toxic Shock Syndrome

Syphilis

Gonorrhea

Atypical bacterial diseases

Nongonococcal urethritis

Viral diseases

Genital herpes

Genital warts

Protozoan diseases

Trichomoniasis

Fungal diseases

Vaginitis

Reading Assignment: Chapter 20 p. 606 – 611, 613 – 638

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 Leewenhoek; (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. 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.

14. Distinguish between naturally acquired immunity and artificially acquired community.
15. Distinguish between an antibody and an antigen.
16. Describe in a series of steps antibody production.
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 viroid's.

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.

LABORATORY OUTLINE

NOTE: Due to the live cultures and complicated media preparation required for each lab, labs cannot be made up if missed. A knee length lab coat & safety goggles must be brought to each week's lab session. Lab coats and safety goggles cannot be left in the lab. It is recommended that you wash your lab coat after each lab.

<u>WEEK #</u>	<u>ACTIVITIES</u>	<u>Exercise # (page)</u> <u>Brancaccio Taras</u>
1	Introduction, Safety Guidelines, Check-in Culture Transfer Instruments, Techniques & Isolation & Maintenance of Pure Cultures (Aseptic Technique only) MICROBIAL MORPHOLOGY Smear Preparation and Simple Staining Gram Stain Bright Field Light Microscope	v- vii 10 (p. 61) 2 (p. 12) 4 (p. 25) 1 (p. 3)
2	Acid-fast Staining (demonstration or class activity) BACTERIAL ANATOMY Endospore Staining Capsule Staining (Graham & Evans procedure) Bacterial Motility (demonstration or class activity) The Effectiveness of Handwashing	5 (p. 32) 7 (p. 43) 6 (p. 38) 8 (p. 49) 22 (p. 131)
3	Gram Stain Practical MICROBIAL GROWTH Environmental Factors Affecting Growth of Microorganisms: Temperature, pH, & Osmotic Pressure Cultivation of Anaerobic Bacteria (Broth & Plate cultures- demonstration or class activity)	15-17 (p. 97) 18 (p. 110)

<u>WEEK #</u>	<u>ACTIVITIES</u>	<u>Exercise # (page)</u> <u>Brancaccio Taras</u>
4	ISOLATION AND ENUMERATION OF MICROORGANISMS Spread Plate Technique Streak Plate Technique Determination of Bacterial Numbers Bacterial Count of a Food Product	11 (p. 72) 11 (p. 70) 12 (p. 75) 42 (p. 327)
5	CONTROL OF MICROBIAL GROWTH Radiation (Ultraviolet Light) The Effects of Chemical Agents on Bacteria I: Disinfectants The Effects of Chemical Agents on Bacteria I: Antimicrobial Agents (Kirby-Bauer method)	21 (p. 126) 19 (p. 115) 20 (p. 120)
6	NORMAL FLORA, HOST DEFENSES, AND UNKNOWN IDENTIFICATION Nonspecific Host Defenses: Lysozyme (demonstration) Isolation of Normal Microbiota from the Human Body (Nose, Throat, or Skin) Throat Culture Unknown Activity - Control and unknown specimens inoculated Proteins, Amino Acid & Enzymes V: catalase activity Proteins, Amino Acid & Enzymes VI: coagulase & DNase activity Selective and Differential Media (blood agar& mannitol salt agar only)	44 (p. 344) 37 (p. 289) 25 (p. 170) 25 (p. 169, 167) 14 (p. 87)
7	TECHNIQUES TO ISOLATE AND IDENTIFY BACTERIA Throat Culture Unknown Activity- Observe & Record results	25 (p. 169, 167) & 14 (p. 87)

<u>WEEK #</u>	<u>ACTIVITIES</u>	<u>Exercise # (page)</u> <u>Brancaccio Taras</u>
8	UNKNOWN IDENTIFICATION Gastrointestinal (GI) Unknown Activity- Control & Unknown specimens inoculated Carbohydrate Fermentation The Hydrogen Sulfide Production using	IMViC Tests 23,24 (p. 144-148; 152-153) Kligler's Iron Agar 24 (p. 159) 23 (p. 139)
9	GI Unknown Activity- Observe & Record results	23, (p. 139-142; 144-148) 24 (p. 152-153; 159-160)
10	Urinary Tract (UT) Unknown Activity- Control and Unknown specimens inoculated Selective & Differential Media (EMB & MacConkey only) Tryptophan Hydrolysis Oxidase Test Urease Activity Phenylalanine Deamination Nitrate Reduction	14 (p. 87) 24 (p. 152) 25 (p. 171) 24 (p. 156) 24 (p. 153) 25 (p. 172)
11	UT Unknown Activity- Observe & Record results	14 (p. 87) 24 (p. 152; 153; 156) 25 (p. 171, 172)
12	Final Laboratory Practical* Check out**	

*The final laboratory practical cannot be made up if missed. The point value for this practical (5%) will be deducted from your final grade.

**For check out, empty your drawer of all slides and media and place them in the discard bin. Clean empty drawer with microquat. Once the drawer has been cleaned, reusable materials can be returned to the drawer. Material in the slide discard bowls is placed in the discard bin. All paper trash is placed in the proper receptacle. Lastly, wash the laboratory bench top with microquat.