



BAKER COLLEGE
STUDENT LEARNING OUTCOMES

BIO2410 Microbiology
3 Semester Hours

Student Learning Outcomes & Enabling Objectives

1. Evaluate the important historical events which led to the development of the field of microbiology, including:
 - a. Pioneers and their contributions to microbiology.
 - b. Development of the microscope.
 - c. Application of the scientific method to the field microbiology.
 - d. The germ theory of disease.
 - e. Application of microbiology in medical settings.
2. Analyze the basic steps of the scientific method.
 - a. Identify the following steps in the scientific method: Observation, question, hypothesis, testing of hypothesis, analysis, and conclusion.
 - b. Compare the level of support needed for hypotheses, theories, and laws.
 - c. Identify control and experimental groups.
 - d. Discuss these concepts and how they can be used in problem solving.
3. Differentiate between various methods of visualizing microscopic organisms, including:
 - Light microscopy
 - Phase contrast microscopy
 - Scanning and transmission electron microscope
4. Differentiate between the major biological macromolecules.
 - a. Describe carbohydrates (simple sugars, disaccharides, cellulose and starch).
 - b. Describe lipids (fats and phospholipids).
 - c. Describe proteins.
 - d. Describe nucleic acids (DNA and RNA).
5. Differentiate the structure and functions of the prokaryotic and eukaryotic cell.
 - a. Compare the structure and functions of the prokaryotic cell including fimbriae, flagella, cell wall, ribosomes, DNA, and endospores.
 - b. Discuss the basic structures of the eukaryotic cell including organelles.
 - c. Compare and contrast the prokaryotic and eukaryotic cell.
 - d. Discuss biofilms and the endosymbiotic theory.
6. Differentiate between the various staining and techniques used in microbiology.
 - a. Define biochemical testing and how it is applied to bacterial identification including the following:
 - Basic cell culture techniques
 - Enriched, selective, and differential media

- The cellular basis and process of gram staining
 - Importance of specimen collection and transport
7. Evaluate the factors that influence microbial growth.
 - a. Explain the process of microbial growth in terms of an exponential growth curve.
 - b. Distinguish the important nutrients needed for microbial growth.
 - c. Describe the different environmental factors and explain how they affect microbial growth.
 - d. Discuss the range of ecological associations among microorganisms.
 - e. Discuss how resistance develops in microorganisms and the role of natural selection in this process.
 - f. Compare different methods of evaluating microbial growth.
 8. Examine the multiple cellular mechanisms of energy metabolism.
 - a. Examine enzyme structure and function.
 - b. Relate the main points of bioenergetics and energy strategies in microorganisms.
 - c. Explain the process and importance of aerobic respiration
 - d. Compare and contrast the processes of aerobic and anaerobic respiration.
 - e. Explain the process and importance of anaerobic fermentation.
 9. Examine the taxonomic relationship and the major infectious diseases caused by the organisms traditionally studied by microbiologists.
 - a. Review the binomial nomenclature, basic cell structure, growth requirements, and reproductive methods of the following organisms:
 - b. bacteria
 - c. viruses
 - d. fungi
 - e. protozoan
 - f. multicellular parasites
 10. Summarize basic genetic principles and analyze implications of genetic mutations, recombination, and genetic engineering.
 - a. Discuss the basic nature of genetic material and how it is replicated.
 - b. Explain how genetic material is used in a cell.
 - c. Explain the relationship between DNA and the structure of protein.
 - d. Outline the general reactions of protein synthesis.
 - e. Compare and contrast protein synthesis in prokaryotic and eukaryotic microorganism.
 - f. Define mutation and explain the cause and effect on cells.
 - g. Compare the different methods for bacterial recombination including transduction, transformation, conjugation, and transposons.
 - h. Discuss the use of restriction enzymes and vectors in the process of genetic transformation.
 - i. Describe the process of creating and uses of genetically modified organisms.
 11. Identify the physical methods for prevention of microbial growth and describe their correct use and effectiveness.

- a. Discuss microbial control terminology including: sterilization, disinfection, degermenation, and antisepsis.
 - b. Discuss the mode of action and use of these physical agents: dry and moist heat including autoclaving, radiation, filtering.
12. Identify the chemical methods for prevention of microbial growth and describe their correct use and effectiveness.
 - a. Discuss the mode of action and use of chemical agents including: alcohol, soaps, halogen compounds, phenols, hydrogen peroxide, formaldehyde, glutaraldehyde, heavy metals, dyes and acids.
 - b. Discuss factors that affect the germicidal activity of these control agents.
13. Identify the functional processes of basic antimicrobial agents and development of microbial resistance.
 - a. Discuss the major modes of action of antimicrobial agents in controlling microbial growth and give examples of antimicrobials for each mode of action.
 - b. Explain how the appropriate antimicrobials are chosen for specific diseases including the Kirby-Bauer and MIC tests.
14. Analyze human and microbe interactions including the infection and disease processes.
 - a. Define microflora and distinguish between pathogenic and normal flora.
 - b. Differentiate between the regions of the body that typically harbor microflora and those that are normally sterile
 - c. Describe the pathogenesis process including the portals of entry, attachment, and ways of establishment, virulence factors and portals of exit.
 - d. Differentiate the stages of infection, patterns of infection, and signs and symptoms of infection.
 - e. Differentiate between infection and disease.
 - f. Describe the reservoirs and transmission of infectious agents.
 - g. Discuss how deviations from the normal community can contribute to disease.
15. Analyze the types of nonspecific resistance related to immunity.
 - a. Discuss physical and anatomical barriers to infection.
 - b. Discuss the chemical barriers to infection.
 - c. Describe the organs of defense and immunity including the lymphatic and reticuloendothelial system and the role of white blood cells in immunity.
 - d. Describe the inflammatory response and stages of inflammation.
 - e. Analyze the importance of cytokines, phagocytosis, interferon, complement, and fever in the immune response.
16. Analyze the types of specific resistance related to adaptive immunity.
 - a. Compare and contrast between humoral (antibody) immunity and cell mediated immunity.
 - b. Discuss the importance and role of the different types of T cells and how they are activated.
 - c. Describe the development process of antibody mediated immunity including the process of clonal selection, role of plasma cells, and memory cells.
 - d. Describe antigen structure, functional categories, and roles in immunity.

- e. Describe how antibodies function including opsonization, agglutination, complement, and neutralization.
17. Compare and contrast the four types of immunity to disease.
- a. Differentiate between acquired and natural immunity and provide examples.
 - b. Differentiate between active and passive immunity and provide examples.
 - c. Discuss the role of vaccinations in public health and herd immunity.
18. Relate epidemiology to the study of microbiology.
- a. Compare the prevalence and incidence of a disease.
 - b. Differentiate between sporadic, endemic, epidemic, and pandemic patterns of occurrence.
 - c. Discuss hospital acquired infections (HAI's or nosocomial infections) including common types of diseases and universal precautions.
-

These SLOs are not approved for experiential credit.

Effective: Fall 2017