



## Wisconsin Indianhead Technical College

# 10806197 Microbiology

## Course Outcome Summary

### Course Information

<b>Description</b>	Examines microbial structure, metabolism, genetics, growth and the relationship between humans and microbes. Addresses disease production, epidemiology, host defense mechanisms and the medical impact of microbes. Presents the role of microbes in the environment, industry, and biotechnology.
<b>Instructional Level</b>	Associate Degree
<b>Total Credits</b>	4.00
<b>Total Hours</b>	80.00

### Types of Instruction

Instruction Type	Credits/Hours
Presentation (Lecture/Demonstration/Discussion)	3/48
Lab and/or Shop Experience	1/32

### Course History

<b>Revised By</b>	Andrea Schullo (andrea.schullo)
<b>Last Approval Date</b>	1/14/2014

### Purpose/Goals

This course outcome summary includes the competencies and criteria for Microbiology (10-806-197). This course is part of the General Studies Core offered throughout the Wisconsin Technical College System (WTCS). The course competencies are consistent among the colleges and are at baccalaureate level to accommodate student success in transfer to four-year colleges.

### Target Population

This course is designed for Associated Degree and Technical Diploma students in Allied Health Programs requiring four credits of Microbiology.

## Pre/Corequisites

Prerequisite 10806177 General Anatomy and Physiology, preferably within the last five years

## Course Competencies

### 1. Explore the history and scope of the field of microbiology

*Domain Cognitive Level Analysis Status Active*

#### Assessment Strategies

- 1.1. through a written, graphic or oral assessment strategy, including at least one or more instructor-provided written exams at various points throughout the course
- 1.2. in a laboratory or classroom setting

#### Criteria

*Performance will be successful when:*

- 1.1. written, graphic or oral assessment strategy describes the range of organisms studied by microbiologists
- 1.2. written, graphic or oral assessment strategy relates historical events to the current understanding of microbiology
- 1.3. written, graphic or oral assessment strategy evaluates the relationship between humans and microbes
- 1.4. written, graphic or oral assessment strategy describes the scope of microbes within industrial and environmental applications
- 1.5. written, graphic or oral assessment strategy uses correct writing conventions of binomial nomenclature
- 1.6. written, graphic or oral assessment strategy describes classification methods used for grouping organisms
- 1.7. written, graphic or oral assessment strategy recognizes the role of microbes in nutrient cycling
- 1.8. written, graphic or oral assessment strategy associates laboratory tools and techniques of microbiology with their use in studying microbes

#### Learning Objectives

- 1.a. Identify everyday uses of and interactions with microbes
- 1.b. List types of microorganisms
- 1.c. Summarize historical events that advanced understanding of microbes
- 1.d. Identify current events that relate to microbiology
- 1.e. Identify genus and species names of microbes
- 1.f. Classify organisms into large groups using methods for grouping organisms including the five-kingdom approach

### 2. Use safe laboratory practices

*Domain Psychomotor Level Adaptation Status Active*

#### Assessment Strategies

- 2.1. in the laboratory

#### Criteria

*Performance will be successful when:*

- 2.1. you identify hazards and safety equipment in the microbiology lab
- 2.2. you select personal protective equipment appropriate to the hazard
- 2.3. you follow all laboratory practice expectations of the college
- 2.4. you abide by the O.S.H.A. Guidelines, including Blood-Borne Pathogens Standards

#### Learning Objectives

- 2.a. Perform handwashing before, after, and between (when applicable) lab activities
- 2.b. Disinfect the lab bench and work surfaces before and after working in the laboratory
- 2.c. Dispose of wastes in the assigned containers
- 2.d. Use approved techniques for cleaning up spills
- 2.e. Report or correct unsafe behaviors observed during lab periods
- 2.f. Report or correct unsafe conditions observed in the laboratory proper
- 2.g. Follow laboratory rules
- 2.h. Use appropriate strategies for personal protection

- 2.i. Handle cultures as demonstrated/directed
- 2.j. Employ actions that prevent contamination of samples
- 2.k. Explain the purpose of safety practices employed in the laboratory

### 3. Perform microbiological laboratory procedures according to appropriate safety standards

*Domain Psychomotor Level Adaptation Status Active*

#### Assessment Strategies

- 3.1. in the laboratory

#### Criteria

*Performance will be successful when:*

- 3.1. you perform wet-mount and/or hanging-drop slide preparations
- 3.2. you perform Gram stains
- 3.3. you perform aseptic transfers
- 3.4. you obtain microbial samples for culture
- 3.5. you isolate colonies and/or plaques
- 3.6. you recognize pure and mixed cultures
- 3.7. you use biochemical test media or other means of organism identification
- 3.8. you accurately record observations and test results
- 3.9. you correctly use appropriate laboratory equipment
- 3.10. you use enumeration methods to calculate population density

#### Learning Objectives

- 3.a. Transfer cultures without contaminating media or work surface
- 3.b. Use laboratory equipment and supplies including Bunsen burners, inoculating loops, staining kits, microscopes and culture media
- 3.c. Inoculate bacterial cultures
- 3.d. Dispose of contaminated materials according to instructions
- 3.e. Follow decontamination procedures in the event of a spill
- 3.f. Obtain isolated colonies on plates streaked for isolation
- 3.g. Follow general lab safety guidelines

### 4. Use a bright-field microscope to examine microbial cells

*Domain Psychomotor Level Adaptation Status Active*

#### Assessment Strategies

- 4.1. in the laboratory

#### Criteria

*Performance will be successful when:*

- 4.1. you identify parts of the microscope and their functions
- 4.2. you adjust microscope for optimal viewing
- 4.3. you focus on a prepared slide sample using the low, high, and oil immersion lenses
- 4.4. you interpret microscopic observations
- 4.5. you demonstrate care and clean-up of microscopes
- 4.6. you contrast other types of microscopy with bright-field microscopy
- 4.7. you use safe laboratory practices
- 4.8. you perform microbiological laboratory procedures and techniques according to appropriate safety standards

#### Learning Objectives

- 4.a. Identify the parts of a microscope and their functions
- 4.b. Adjust microscope for optimal viewing
- 4.c. Focus on a prepared slide sample using low, high, and oil immersion lenses
- 4.d. Clean microscope after use
- 4.e. Discuss the uses of bright-field and other types of microscopy

### 5. Compare prokaryotic and eukaryotic cell structures and their functions

*Domain Cognitive Level Analysis Status Active*

### Assessment Strategies

- 5.1. through a written, graphic or oral assessment strategy, including at least one or more instructor-provided written exams at various points throughout the course
- 5.2. in a laboratory or classroom setting

### Criteria

*Performance will be successful when:*

- 5.1. written, graphic or oral assessment strategy identifies components of prokaryotic cells
- 5.2. written, graphic or oral assessment strategy identifies components of eukaryotic cells
- 5.3. written, graphic or oral assessment strategy describes the functions of cellular components
- 5.4. written, graphic or oral assessment strategy contrasts cellular structure and functions of prokaryotic and eukaryotic cells
- 5.5. written, graphic or oral assessment strategy contrasts the size and morphology of prokaryotic and eukaryotic cells

### Learning Objectives

- 5.a. Diagram a simple prokaryotic cell
- 5.b. Label components of a prokaryotic cell
- 5.c. Identify parts of a simple eukaryotic cell
- 5.d. List components that are common to all cells
- 5.e. Describe the function of cellular components
- 5.f. Describe the function of specialized structures including capsules, walls, flagella, pili, and cilia
- 5.g. Identify cells as prokaryotic or eukaryotic based on structure

## 6. Explain microbial growth requirements and key microbial metabolic processes

*Domain Cognitive Level Analysis Status Active*

### Assessment Strategies

- 6.1. through a written, graphic or oral assessment strategy, including at least one or more instructor-provided written exams at various points throughout the course
- 6.2. in a laboratory or classroom setting

### Criteria

*Performance will be successful when:*

- 6.1. written, graphic or oral assessment strategy describes the phases of microbial growth
- 6.2. written, graphic or oral assessment strategy describes factors which affect microbial growth
- 6.3. written, graphic or oral assessment strategy describes microbial growth characteristics on various media including enriched, selective, and differential media
- 6.4. written, graphic or oral assessment strategy describes the role of enzymes in living organisms
- 6.5. written, graphic or oral assessment strategy differentiates among organisms on the basis of their ability to metabolize different substances
- 6.6. written, graphic or oral assessment strategy defines the role and output of glycolysis, fermentation, aerobic and anaerobic respiration in organism metabolism
- 6.7. written, graphic or oral assessment strategy defines aerobic, anaerobic, capnophilic, microaerophilic and facultatively anaerobic

### Learning Objectives

- 6.a. Describe the phases of microbial growth
- 6.b. Estimate culture density using serial dilution
- 6.c. Describe factors that affect microbial growth, including gas requirements
- 6.d. Compare microbial growth on different types of media
- 6.e. Explain how enzymes catalyze reactions in living cells
- 6.f. Summarize the processes of glycolysis, fermentation, aerobic and anaerobic respiration

## 7. Classify bacteria based on differentiating characteristics

*Domain Cognitive Level Application Status Active*

### Assessment Strategies

- 7.1. through a written, graphic or oral assessment strategy, including at least one or more instructor-provided written exams at various points throughout the course

7.2. in a laboratory or classroom setting

### Criteria

*Performance will be successful when:*

- 7.1. written, graphic or oral assessment strategy evaluates the results of differential stain techniques
- 7.2. written, graphic or oral assessment strategy describes bacteria based on microscopic and macroscopic morphology
- 7.3. written, graphic or oral assessment strategy evaluates the growth of organisms on enriched, selective and differential media
- 7.4. written, graphic or oral assessment strategy recognizes environments necessary for growth
- 7.5. written, graphic or oral assessment strategy describes the use of differential tests in identifying bacteria
- 7.6. written, graphic or oral assessment strategy assigns bacteria to taxonomic groups based on characteristics

### Learning Objectives

- 7.a. Identify genus and species names of bacteria
- 7.b. Classify objects using dichotomous keys
- 7.c. List microbial characteristics that can be used in classification
- 7.d. Differentiate between prokaryotic and eukaryotic microbes based on cell characteristics
- 7.e. Classify bacteria based on cell shape
- 7.f. Perform Gram stains of bacteria
- 7.g. Evaluate the results of Gram stains
- 7.h. Describe the uses of differential and selective media
- 7.i. Interpret growth patterns of different strains on differential and selective media
- 7.j. Identify organisms in the lab using differential tests

## 8. Assess the impact of microbial genetics on humans and the environment

*Domain Cognitive Level Application Status Active*

### Assessment Strategies

- 8.1. through a written, graphic or oral assessment strategy, including at least one or more instructor-provided written exams at various points throughout the course
- 8.2. in a laboratory or classroom setting

### Criteria

*Performance will be successful when:*

- 8.1. written, graphic or oral assessment strategy outlines the processes of DNA replication, transcription and translation
- 8.2. written, graphic or oral assessment strategy differentiates among types of mutation and their impact
- 8.3. written, graphic or oral assessment strategy describes how bacteria can acquire new genetic information
- 8.4. written, graphic or oral assessment strategy describes the role of microbial genetics in biotechnology and molecular diagnostics
- 8.5. written, graphic or oral assessment strategy explains the impact of gene transfer on the spread of antibiotic resistance

### Learning Objectives

- 8.a. Review the structure of DNA
- 8.b. Outline the process of DNA replication
- 8.c. Illustrate the process of transcription
- 8.d. Illustrate the process of translation
- 8.e. Relate DNA sequence to protein sequence
- 8.f. Relate changes in nucleotide sequence to changes in proteins
- 8.g. Assess the relative impact of different mutations on a hypothetical organism
- 8.h. Describe the structure and function of plasmids
- 8.i. Examine the process of transformation, conjugation, and transduction
- 8.j. Assess the impact of gene transfer on microbial evolution
- 8.k. Describe the role of microbial genetics in biotechnology and diagnostics

## 9. Evaluate processes to control the growth of microbes in the body and in the environment

*Domain Cognitive Level Evaluation Status Active*

### **Assessment Strategies**

- 9.1. through a written, graphic or oral assessment strategy, including at least one or more instructor-provided written exams at various points throughout the course
- 9.2. in a laboratory or classroom setting

### **Criteria**

*Performance will be successful when:*

- 9.1. written, graphic or oral assessment strategy differentiates between disinfection and sterilization
- 9.2. written, graphic or oral assessment strategy compares methods of disinfection and sterilization
- 9.3. written, graphic or oral assessment strategy describes modes of action of antibacterial agents
- 9.4. written, graphic or oral assessment strategy differentiates between broad-spectrum and narrow-spectrum agents
- 9.5. written, graphic or oral assessment strategy describes mechanisms of antibiotic resistance
- 9.6. written, graphic or oral assessment strategy identifies issues to consider in administering antimicrobial therapies
- 9.7. written, graphic or oral assessment strategy interprets the results of susceptibility testing procedures

### **Learning Objectives**

- 9.a. Compare disinfection and sterilization
- 9.b. Compare disinfectants, antiseptics, and antimicrobial therapies
- 9.c. Describe the mode of action of various antibacterial agents
- 9.d. Explain the significance of spectrum of activity
- 9.e. Explain the significance of selective toxicity
- 9.f. Differentiate between antibiotic susceptibility and resistance
- 9.g. Examine mechanisms of antibiotic resistance

## **10. Summarize pathogenic and non-pathogenic host-microbe interactions**

*Domain Cognitive Level Application Status Active*

### **Assessment Strategies**

- 10.1. through a written, graphic or oral assessment strategy, including at least one or more instructor-provided written exams at various points throughout the course
- 10.2. in a laboratory or classroom setting

### **Criteria**

*Performance will be successful when:*

- 10.1. written, graphic or oral assessment strategy examines symbiotic relationships between humans and microbes
- 10.2. written, graphic or oral assessment strategy identifies mechanisms by which microbes cause disease
- 10.3. written, graphic or oral assessment strategy identifies the stages of an infectious disease
- 10.4. written, graphic or oral assessment strategy identifies the causes of hospital-acquired infections
- 10.5. written, graphic or oral assessment strategy describes the methods of infection control in clinical settings
- 10.6. written, graphic or oral assessment strategy describes the ubiquity of microbes
- 10.7. written, graphic or oral assessment strategy examines the role of opportunists in human disease
- 10.8. written, graphic or oral assessment strategy differentiates among terms used to explain characteristics of infectious disease

### **Learning Objectives**

- 10.a. Discuss symbiotic relationships between humans and microbes
- 10.b. List mechanisms by which organisms cause disease
- 10.c. Describe the stages of infectious disease
- 10.d. Identify the causes of nosocomial infection
- 10.e. Describe methods of infection control used in clinical settings
- 10.f. Describe ubiquity of microorganisms
- 10.g. Discuss the characteristics of opportunistic human disease
- 10.h. Define terms describing the characteristics of human disease
- 10.i. Employ methods of disinfection/infection control in the laboratory
- 10.j. Perform environmental cultures

## **11. Analyze patterns of microbial disease transmission using principles of epidemiology**

*Domain Cognitive Level Analysis Status Active*

### **Assessment Strategies**

- 11.1. through a written, graphic or oral assessment strategy, including at least one or more instructor-provided written exams at various points throughout the course
- 11.2. in a laboratory or classroom setting

### **Criteria**

*Performance will be successful when:*

- 11.1. written, graphic or oral assessment strategy compares communicable and noncommunicable diseases
- 11.2. written, graphic or oral assessment strategy identifies possible reservoirs of infection
- 11.3. written, graphic or oral assessment strategy examines various modes of disease transmission
- 11.4. written, graphic or oral assessment strategy differentiates between sporadic, endemic, epidemic, and pandemic conditions
- 11.5. written, graphic or oral assessment strategy evaluates the effect of herd immunity on disease transmission
- 11.6. written, graphic or oral assessment strategy describes methods of controlling disease outbreaks
- 11.7. written, graphic or oral assessment strategy explores new and re-emerging infectious disease agents

### **Learning Objectives**

- 11.a. Examine the scope and applications of the field of epidemiology
- 11.b. Analyze patterns of disease outbreaks
- 11.c. Differentiate between communicable and noncommunicable diseases
- 11.d. Examine modes of disease transmission
- 11.e. Describe herd immunity
- 11.f. Identify methods of controlling disease outbreaks
- 11.g. Interpret epidemiology case studies

## **12. Summarize host defense mechanisms**

*Domain Cognitive Level Application Status Active*

### **Assessment Strategies**

- 12.1. through a written, graphic or oral assessment strategy, including at least one or more instructor-provided written exams at various points throughout the course
- 12.2. in a laboratory or classroom setting

### **Criteria**

*Performance will be successful when:*

- 12.1. written, graphic or oral assessment strategy distinguishes between specific and non-specific host defenses
- 12.2. written, graphic or oral assessment strategy identifies non-specific host defense mechanisms
- 12.3. written, graphic or oral assessment strategy identifies the processes of natural, artificial, passive, and active immunity
- 12.4. written, graphic or oral assessment strategy describes antigen-antibody interactions
- 12.5. written, graphic or oral assessment strategy differentiates between humoral and cell-mediated immunity
- 12.6. written, graphic or oral assessment strategy explains the role of memory cells in lasting immunity

### **Learning Objectives**

- 12.a. Describe non-specific host defenses
- 12.b. Describe specific host defenses
- 12.c. Differentiate between acquired, innate and temporary immunity
- 12.d. Summarize the process of acquiring immunity
- 12.e. Describe the role of memory cells in lasting immunity

## **13. Evaluate immunopathology and immunological applications**

*Domain Cognitive Level Application Status Active*

### **Assessment Strategies**

- 13.1. through a written, graphic or oral assessment strategy, including at least one or more instructor-provided written exams at various points throughout the course

13.2. in the laboratory or classroom setting

### Criteria

*Performance will be successful when:*

- 13.1. written, graphic or oral assessment strategy describes use of vaccines and immune globulins to confer specific immunity
- 13.2. written, graphic or oral assessment strategy differentiates among the types of hypersensitivity
- 13.3. written, graphic or oral assessment strategy explains the health consequences of immune hypersensitivity
- 13.4. written, graphic or oral assessment strategy describes the consequences of immune system dysfunction
- 13.5. written, graphic or oral assessment strategy identifies immunological methods of diagnosing infectious disease

### Learning Objectives

- 13.a. Differentiate between humoral and cell-mediated immunity
- 13.b. Describe antigen-antibody and antigen-receptor interactions
- 13.c. Describe the use of vaccines to confer specific immunity
- 13.d. Compare mechanisms of hypersensitivity
- 13.e. Summarize types of immune hypersensitivity
- 13.f. Explain the health consequences of immune hypersensitivities
- 13.g. Examine the consequences of immune system dysfunction
- 13.h. Describe immunological methods of diagnosing infectious disease

## 14. Correlate select bacteria with human infectious disease

*Domain Cognitive Level Application Status Active*

### Assessment Strategies

- 14.1. through a written, graphic or oral assessment strategy, including at least one or more instructor-provided written exams at various points throughout the course
- 14.2. in a laboratory or classroom setting

### Criteria

*Performance will be successful when:*

- 14.1. written, graphic or oral assessment strategy describes microbial characteristics for select organisms
- 14.2. written, graphic or oral assessment strategy describes disease signs and symptoms for select organisms
- 14.3. written, graphic or oral assessment strategy describes disease transmission, diagnosis, treatment, and prevention for select organisms

### Learning Objectives

- 14.a. Discuss morphological and clinical characteristics of medically important Gram positive cocci, including Staphylococcus species and Streptococcus species
- 14.b. Discuss morphological and clinical characteristics of medically important Gram negative cocci, including Neisseria species
- 14.c. Discuss morphological and clinical characteristics of medically important Gram positive bacilli, including Bacillus, Clostridium, Listeria, Mycobacteria, and Corynebacteria
- 14.d. Discuss morphological and clinical characteristics of medically important Gram negative bacilli, including Pseudomonas, Brucella, Francisella, Bordetella, Haemophilus, Legionella, Gardnerella, and Bacteroides (Prevotella)
- 14.e. Discuss the morphological and clinical characteristics of the Enterobacteriaceae
- 14.f. Discuss the morphological and clinical characteristics of the spirochetes, vibrios, Campylobacter, and Helicobacter
- 14.g. Discuss the morphological and clinical characteristics of Rickettsia, Chlamydia, and Mycoplasma
- 14.h. Describe disease transmission, pathogenicity, treatment, and prevention for select bacterial diseases
- 14.i. Give examples of polymicrobial infections

## 15. Correlate select fungi and parasites with human infectious disease

*Domain Cognitive Level Application Status Active*

### Assessment Strategies

- 15.1. through a written, graphic or oral assessment strategy, including at least one or more instructor-provided written exams at various points throughout the course



15.2. in a laboratory or classroom setting

### Criteria

*Performance will be successful when:*

- 15.1. written, graphic or oral assessment strategy defines eukaryotic parasites
- 15.2. written, graphic or oral assessment strategy describes characteristics of select fungi
- 15.3. written, graphic or oral assessment strategy describes characteristics of select protists and helminths
- 15.4. written, graphic or oral assessment strategy describes disease signs and symptoms for select organisms
- 15.5. written, graphic or oral assessment strategy describes disease transmission, diagnosis, treatment and prevention of select organisms

### Learning Objectives

- 15.a. Discuss the characteristics of different groups of parasitic protists
- 15.b. Summarize the lifecycles of select parasites
- 15.c. Discuss the characteristics of different groups of parasitic helminths
- 15.d. Summarize the lifecycles of select helminths
- 15.e. Examine samples of parasitic protists and helminths
- 15.f. Describe disease transmission pathogenicity, diagnosis, treatment, and prevention of select organisms

## 16. Correlate select viruses and prions with human infectious disease

*Domain Cognitive Level Application Status Active*

### Assessment Strategies

- 16.1. through a written, graphic or oral assessment strategy, including at least one or more instructor-provided written exams at various points throughout the course

### Criteria

*Performance will be successful when:*

- 16.1. written, graphic or oral assessment strategy describes viral morphology and the processes of viral replication
- 16.2. written, graphic or oral assessment strategy analyzes the impact of viruses on a host organism
- 16.3. written, graphic or oral assessment strategy describes disease signs and symptoms for select viruses
- 16.4. written, graphic or oral assessment strategy describes disease transmission, diagnosis, treatment and prevention for select viruses
- 16.5. written, graphic or oral assessment strategy describes prions and associated diseases

### Learning Objectives

- 16.a. Describe viral morphology and the processes of viral replication
- 16.b. Analyze the impact of viruses on a host organism
- 16.c. Discuss clinical characteristics of medically important DNA viruses including herpes viruses, hepatitis B, and pox viruses
- 16.d. Discuss clinical characteristics of medically important RNA viruses including retroviruses, influenza, rabies, hepatitis viruses, measles, mumps, rubella, polio, and common cold viruses
- 16.e. Describe disease transmission, pathogenicity, diagnosis, treatment, and prevention for select viruses
- 16.f. Describe prions and associated diseases