BIOL 41: MICROBIOLOGY

Foothill College Course Outline of Record

Heading	Value
Effective Term:	Summer 2022
Units:	6
Hours:	4 lecture, 6 laboratory per week (120 total per quarter)
Prerequisite:	CHEM 1A or CHEM 25 or CHEM 30A or equivalent.
Advisory:	Demonstrated proficiency in English by placement via multiple measures OR through an equivalent placement process OR completion of ESLL 125 & ESLL 249.
Degree & Credit Status:	Degree-Applicable Credit Course
Foothill GE:	Area III: Natural Sciences
Transferable:	CSU/UC
Grade Type:	Letter Grade (Request for Pass/No Pass)
Repeatability:	Not Repeatable

Student Learning Outcomes

- Students will compare and contrast the role of normal flora, opportunistic and obligate pathogens in both health and disease states
- Distinguish between bacterial, viral and eukaryotic pathogens in terms of structure and chemotherapeutic interventions.

Description

Morphology and physiology of microorganisms with emphasis on the important roles that microbes play in human life. Mechanisms of pathogenicity, host-parasite relationships, the immune response and principles of disease transmission. Techniques of microbial control including sterilization, aseptic procedures, use of disinfectants, antiseptics and chemotherapy. Basic laboratory skills of microbiology.

Course Objectives

The student will be able to:

1. Compare and contrast eukaryotic, bacterial and viral organisms
2. Describe basic microbial metabolic processes and discuss their significance
3. Discuss basic genetic principles and their potential applications
4. Discuss the role of the human microbiome in healthy and disease states
5. Examine common human and animal diseases
6. Discuss health disparities and the social determinants of health in the U.S. and worldwide as related to infectious disease
7. Consider the role of microorganisms in the disease process
8. Compare and contrast antimicrobial drugs used to treat bacterial, viral, protozoan and helminthic diseases
9. Identify the role of the host organism in resisting infectious diseases
10. Discuss the importance of vaccines as a public health tool
11. Evaluate the reliability of scientific information
12. Exhibit understanding of the scientific method
13. Use appropriate lab safety practices
14. Use light microscopy to examine and identify microorganisms
15. Use basic microbiology laboratory techniques to isolate and cultivate microbes in various media and growing conditions
16. Investigate methods of microbial control
17. Explore and use biotechnology techniques common in microbiology laboratories

Course Content

1. Introduction to microbiology
    a. History of microbiology, acknowledging that the recorded history of microbiology is biased toward Eurocentric contributions
    b. Basic taxonomy
    c. Importance of microbes to humans and society, including beyond disease states
2. Basic cell anatomy and physiology
    a. Eukaryotic cells
    b. Bacterial cells
    c. Viruses
        i. Bacteriophage vs. mammalian viruses
        ii. Structure and replication of DNA and RNA viruses
3. Microbial metabolism
    a. Enzyme structure and function
    b. Anaerobic and aerobic respiration, fermentation
4. Bacterial genetics
    a. Genes vs. genome (chromosomes and plasmids)
    b. DNA replication, transcription, and translation
    c. Mutations
    d. Plasmids and horizontal gene transfer
    e. Basic applications of microbes in biotechnology
5. Microbiome
    a. Composition of a healthy microbiome and its role in human health
    b. Impacts of dysbiosis
6. Common human and animal diseases
    a. Common bacterial pathogens
    b. Eukaryotic pathogens: fungi, protozoa, helminths
    c. Representative viral diseases
7. Health disparities
    a. Social determinants of health
    b. Disproportionate impact of infectious disease and the impact on the physical, mental, and economic health of communities
    c. Neglected tropical diseases
8. Microbes and disease
    a. Host-parasite relationships
    b. Epidemiology of disease
    c. Pathogenicity and virulence
9. Control of microorganisms
    a. Antimicrobial drugs that target each pathogen group
    b. Selective toxicity
    c. Antibiotic resistance
        i. Mechanisms of resistance
        ii. Development of resistance
        iii. Impact of antibiotic resistance on human health
10. Immunology

a. Nonspecific and specific host resistance
b. Humoral and cellular immune responses
c. Active and passive immunity
d. Dysfunctional immune responses

11. Vaccines
a. Common vaccine types and their mechanisms of action
b. Principles of protection to the individual
c. Herd immunity as a public health protection

Lab Content

1. Scientific method
a. Experimental design
b. Importance of peer review
c. Evaluating sources of information
d. Perform common laboratory calculations
2. Laboratory safety and aseptic technique
a. Universal precautions
b. Aseptic transfer techniques
c. Labeling of cultures and specimens
3. Microscopy
a. Use and care of microscopes
b. Basic microscopic techniques to visualize microbes and immune cells
c. Simple and differential staining techniques
i. Wet mounts
ii. Gram staining
iii. Capsule stains
iv. Simple stains
v. Negative staining
vi. Endospore stains
4. Isolation and cultivation of microbes
a. Aerobic and anaerobic culture techniques
b. Selective and differential media
c. Common biochemical tests
d. Differentiation/identification of pathogenic bacteria
i. Common pathogenic cocci
ii. Common enteric pathogens
e. Identification of an unknown bacterium
5. Control of microorganisms
a. Physical methods of control using UV radiation
b. Chemical control using disinfectants and antiseptics
c. Antibiotics and antibiotic resistance using disc diffusion
6. Biotechnology
a. Tools of microbial genetics
b. ELISA

Special Facilities and/or Equipment

1. Laboratory coats, disposable gloves, texts, and lab manual.
2. Laboratory equipped with microscopes (oil immersion capacity), gas outlets at each station, autoclave, hot-air sterilizer, two incubators, refrigerator, media preparation area with glass washing facilities.
3. Students need internet access.

Method(s) of Evaluation

Methods of Evaluation may include but are not limited to the following:

Demonstration of mastery of lecture material and critical thinking ability by written quizzes, in-class activities, midterm exams, and a comprehensive final
Demonstration of mastery of laboratory material and critical thinking ability by skills assessment, practical exams, and/or written exam
Demonstration of mastery of the scientific technique by participation in lab activities and classroom discussions, and written and practical lab exams
Evaluation of written lab reports, including data presentation, critical analysis of results and discussion of appropriate conclusions

Method(s) of Instruction

Methods of Instruction may include but are not limited to the following:

Lecture
Discussion
Cooperative learning exercises
Electronic discussions/chat
Laboratory
Demonstration

Representative Text(s) and Other Materials

Bauman, R.W.. Microbiology with Diseases by Taxonomy, 6th ed.. 2019.

OpenStax. Todar's Online Textbook of Bacteriology. 2020.

Leboffe, M.J., and B.E. Pierce. Laboratory Theory and Application, 4th ed.. 2015.

This is the most recent edition of the Leboffe and Pierce text.

Types and/or Examples of Required Reading, Writing, and Outside of Class Assignments

1. Pathogen Research Assignment: student chooses a pathogen and turns in a short research paper and presents their findings to the class. This includes proper citation of sources.
2. Reading of the lab manual and teacher materials in preparation of each week's lab.
3. Homework assignments that require textbook reading and analysis.

Discipline(s)

Biological Sciences