BIOL C210: GENERAL MICROBIOLOGY

Item	Value
Curriculum Committee Approval Date	02/23/2007
Top Code	040300 - MicroBiology
Units	5 Total Units
Hours	162 Total Hours (Lecture Hours 54; Lab Hours 108)
Total Outside of Class Hours	0
Course Credit Status	Credit: Degree Applicable (D)
Material Fee	No
Basic Skills	Not Basic Skills (N)
Repeatable	No
Open Entry/Open Exit	No
Grading Policy	Standard Letter (S), • Pass/No Pass (B)
Local General Education (GE)	• Area 5B Life Sciences (CB2)
California General Education Transfer Curriculum (Cal-GETC)	• Cal-GETC 5B Biological Sciences (5B) • Cal-GETC 5C Laboratory Activity (5C)
Intersegmental General Education Transfer Curriculum (IGETC)	• IGETC 5B Biological Sciences (5B) • IGETC 5C Laboratory Activity (5C)
California State University General Education Breadth (CSU GE-Breadth)	• CSU B2 Life Science (B2) • CSU B3 Laboratory Activity (B3)

Course Description

Major concepts of microbiology are discussed as they relate to the principal classes of microorganisms: bacteria, fungi, algae, protozoa, and viruses. Topics covered include 1) functional anatomy of prokaryotes and eukaryotes 2) microbial metabolism and genetics 3) characteristics and control of microbial growth 4) microbial taxonomy and methods of microbial classification 5) host-microbe interactions 6) mechanisms of microbial pathogenicity 7) immunology 8) biotechnology and human infectious diseases. The laboratory focuses on methods for identifying and characterizing microbes, including aseptic technique, microscopy, staining, cultivation, molecular biology, and bioinformatics. Both lecture and laboratory content relate to general and clinical applications. ADVISORY: CHEM C110, BIOL C100 or BIOL C180, and eligibility for ENGL C1000. Transfer Credit: CSU; UC: Credit Limitation: BIOL C211, BIOL C211L, BIOL C210 combined: maximum credit, 5 units.

Course Level Student Learning Outcome(s)

1. Present current knowledge on a reportable communicable disease in the U.S.
2. Demonstrate fundamental understanding of microbial characteristics, metabolism and genetics.
3. Describe microbe-human interactions and explain how these interactions can be either beneficial or detrimental.
4. Explain how microbial growth can be controlled.
5. Effectively apply the scientific method to successfully identify bacterial cultures using morphological and metabolic tests, given the appropriate lab setting.

Course Objectives

- 1. Compare and contrast the characteristics of bacteria, fungi, algae, viruses, and helminths, with an emphasis on organisms causing human disease and those of special benefit to man.
- 2. Describe the evidence that supports the theory that mitochondria and chloroplasts evolved from bacteria.
- 3. Give an example of a disease that has emerged due to human activities and state what those human activities were.
- 4. Explain how not completing a full treatment of antibiotics can lead to an increase in resistance in a bacterial population.
- 5. Describe how mutations and horizontal gene transfer, together with selective pressure, can lead to a rise in antibiotic resistance.
- 6. Explain how specialized structures (e.g., pili/fimbriae, capsules, lipopolysaccharides, spores, or flagella) enable a microbe to survive in a given environment.
- 7. Predict whether a given antibiotic would affect a Gram-positive and/or Gram-negative bacterial cell based in their mechanism of action.
- 8. Compare and contrast the differences between lytic and lysogenic viral infection.
- 9. Compare and contrast transcription and translation in Eukaryotes vs. Bacteria.
- 10. Analyze the symbiotic relationship that some Nitrogen-fixing bacteria have with plants. Identify what the bacteria contribute and what the plant contributes.
- 11. Give an example of how quorum sensing is advantageous to bacterial cells in a given environment.
- 12. Describe how extreme levels of temperature, pH, or salt concentrations inhibit growth (e.g., membrane stability, enzyme activity, proton motive force, etc.).
- 13. Given a particular situation, present an argument for the best method for controlling bacterial growth (e.g., physical, chemical, biological, etc.).
- 14. For a given point mutation, genetic insertion, or genetic deletion, describe a situation that would result in a non-functioning protein and one that would not.
- 15. Describe how bacteria can regulate gene expression at the level of transcription and translation.
- 16. Compare and contrast the multiplication of animal viruses and bacteriophages.
- 17. List the similarities and differences in transcription initiation and termination between Bacteria and Eukaryotes.
- 18. Compare and contrast commensal, symbiotic, and pathogenic relationships.
- 19. Given a human defense, describe a mechanism that would allow a bacterial pathogen to evade it.
- 20. Explain how the presence of a microorganism elicits a cellular or humoral immune response.
- 21. Predict conditions that would favor biofilm formation and explain where they might be found.

- 22. Explain the importance of microbial fermentation products to food/beverage production (e.g., bread, cheese, yogurt, wine, beer, etc.).
- 23. Predict the effect on a host organism if the normal flora were removed.
- 24. Apply the process of science by demonstrating an ability to formulate hypotheses and design experiments based on the scientific method.
- 25. Properly prepare and view specimens for examination using bright field microscopy.
- 26. Use pure culture and selective techniques to enrich for and isolate microorganisms.
- 27. Use media-based, biochemical, and molecular methods to identify microorganisms.
- 28. Estimate the number of microorganisms in a sample (e.g., via direct count, viable plate count, and spectrophotometric methods).
- 29. Use appropriate microbiological and molecular lab equipment and methods.
- 30. Practice safe microbiology, using appropriate protective and emergency procedures.
- 31. Document and report on experimental protocols, results, and conclusions.
- 32. Analyze and interpret results from a variety of microbiological methods and apply these methods to analogous situations.
- 33. Identify credible scientific sources and interpret and evaluate the information therein.

Lecture Content

History of Microbiology Overview of field Contributions of pioneers in microbiology Microscopy Types of Microscopes Staining Techniques Microbial Structure and Function Prokaryotic Cells Eukaryotic Cells Cultivation of Bacteria Physical and nutritional requirements Types of lab Media Growth curve Generation time Microbial Control Methods Physical agents Chemical agents Antimicrobial drugs Microbial Metabolism Metabolic pathways Protein Synthesis Bacteria Taxonomy Fungi Yeast vs Molds Cell structure and function Mycoses Algae Protozoa Structure and function of common protozoans General lifecycle Protozoan diseases Multicellular Parasites Viruses Unique features Replication cycles Growth and cultivation Microbial genetics DNA replication Protein synthesis Bacterial recombination Biotechnology Soil and aquatic microbes Industrial microbiology Epidemiology Normal flora Endogenous infections Host and parasite Nonspecific host defenses Immunology Host defenses Vaccines and diagnosis Hypersensitivity Diseases Tropical Of skin, eyes, and nervous system Of cardiovascular and respiratory systems Of digestive and urogenital systems

Lab Content

Introduction to Microscopy Aseptic Techniques Microbial Survey Bacterial prepared slides Fungi: molds and yeasts Protozoan slides Pond life Helminths Bacteriophages Normal microbiota Handwashing Predisposition to dental caries Throat and nasal culture Bacterial stains Simple and negative stains Differential stains Gram Stain Acid Fast Stain Endospore Stain Capsule Stain Flagella Stain Microbial Media Preparation Complex Selective Differential Quadrant streak plate Motility media Metabolic tests Oxidation/Fermentation Carbohydrate fermentation Exoenzyme analysis IMViC tests Microbial growth Growth curves Oxygen requirements pH Osmotic pressure Temperature Control of Microbial Growth Sterilization/Disinfection methods Antibiotic sensitivity Sensitivity to disinfectants/antiseptics UV radiation Biotechnology Transformation Plasmid DNA isolation Restriction analysis PCR Environmental Microbiology Water quality Standard plate count Epidemiology

Method(s) of Instruction

- Lecture (02)
- DE Live Online Lecture (02S)
- DE Online Lecture (02X)
- Lab (04)
- DE Live Online Lab (04S)
- DE Online Lab (04X)

Instructional Techniques

This course is presented through lecture material supplemented with visual materials, such as PowerPoint slides, movies, podcasts, and demonstrations. All of the course materials are also provided to the students in the learning management system. In addition, lectures will incorporate case studies, small-group discussions, and active-learning techniques such as personal response systems or think-pair-share to engage students. There may also be opportunities to invite guest lecturers. Students will read the text, listen to podcasts, read and evaluate primary scientific research articles, carry out small-group discussions, and give oral presentations. Students read and follow instructions in the lab manual, execute experiments, take pre-lab quizzes, read and evaluate primary scientific research articles, carry out small-group work, and give oral presentations.

Reading Assignments

Examples of Reading assignments may include: Readings from text Reading microbiology-related articles from science websites Reading journal articles for capstone projects Reading Bergey's manual for constructing bacterial identification keys

Writing Assignments

Examples of writing assignments for this course are: Summary report on recent Microbiology-related news article Field trip report Summary report of scientific seminar Proposal for isolating a particular bacterial strain Construction of a dichotomous key

Out-of-class Assignments

Examples of out of class assignments for this course are: Online quizzes Participation Forums Oral presentation on notifiable disease Attending off-campus seminar Reviewing vocabulary terms Homework Problems from text Field trip to a location relevant to microbiology (e.g., winery, cheese factory, water treatment plant)

Demonstration of Critical Thinking

Critical evaluation of new developments related to a notifiable disease given in an oral presentation Construction of a dichotomous key for bacterial identification Case-based quizzes Proposing a strategy for isolating and purifying a given bacterial strain Report on a Microbiology-related news article that deduces each step of the Scientific Method

Required Writing, Problem Solving, Skills Demonstration

Short answer and essays are included in exams Microbiology problems are included on exams and quizzes Case study questions given in quizzes and exams Optional oral exams may be given Summary report on a Microbiology-related news article that deduces each step of the Scientific

Method Oral presentation skills demonstrated through oral presentation of new developments related to a notifiable disease

Eligible Disciplines

Biological sciences: Master's degree in any biological science OR bachelor's degree in any biological science AND master's degree in biochemistry, biophysics, or marine science OR the equivalent. Master's degree required.

Textbooks Resources

1. Required Tortora, Gerard J.; Funke, Berdell R.; Case, Christine L. Microbiology: An Introduction, 12th ed. Pearson Benjamin/Cummings, 2015 Rationale: - Legacy Textbook Transfer Data: Legacy text 2. Required Pommerville, Jeffery C. Alcamo?s Fundamentals of Microbiology, 9th ed. Jones and Bartlett, 2010 Rationale: - Legacy Textbook Transfer Data: Legacy text 3. Required Talaro, Kathleen. Foundations in Microbiology, 9th ed. McGraw Hill, 2015 Rationale: - Legacy Textbook Transfer Data: Legacy text

Manuals Resources

1. Gutierrez, P. J. A. General Microbiology - Microbiology Exercises, Coastline Graphics and Publications , 08-15-2011

Other Resources

1. Coastline Library