



C-ID Descriptor

Introductory Biotechnology with Laboratory

Descriptor Details

- **Descriptor Title:** Introductory Biotechnology with Laboratory
- **C-ID Number:** 101
- **Suffix:**
 - Lab and Lecture (B)
 - Community College Use Only (X)
- **Units:** 4
- **Hours:** 0000
- **Date of Last Revision:** 10/12/2017 11:44:12 PM GMT+0000

General Description

This course is a general examination of biology as it relates to the field of biotechnology. Topics include the fundamental chemical processes common in prokaryotic and eukaryotic biology, chemistry of bio-molecules (proteins, enzymes, nucleic acids and lipids), cellular and molecular biology, basic immunology, and classical and molecular genetics with an emphasis on gene expression and genetic engineering. The laboratory addresses basic skills and techniques common to the biotechnology industry. Topics include the measurement of activity and quantity of proteins, growth and manipulation of bacteria, genetic engineering and antibody methods. This course is intended for students majoring in applied biology and as a general education option for all students.

Prerequisites

None

Corequisites

None

Advisories

Algebra (C-ID MATH 150 or C-ID MATH 151), English (C-ID ENGL 100),
Introductory Biology, Introduction to Chemistry (C-ID CHEM 101)

Content

The following topics are included in the framework of the course but are not intended as limits on content. The order of presentation and relative emphasis will vary with each instructor.

Lecture Portion of Class

1. Overview of biotechnology
 - A. Applications
 - i. Medicine
 - ii. Agriculture
 - iii. Diagnostics
 - iv. Environment/Energy
 - v. Fuels
 - B. Careers
2. Cell biology (prokaryotic/eukaryotic)
 - A. Morphologic differences
 - B. Differences in DNA
 - C. Differences in gene expression.
3. Bio-molecules and atomic structure
 - A. Atoms
 - B. Molecules
 - C. Compounds
 - D. Mechanisms of chemical bond formation
 - E. Bio-molecule structures and features
4. Double-stranded DNA molecule
 1. Alpha-helix

2. DNA replication
3. Meiosis and mitosis.
5. Gene expression and the genetic code
 - A. Transcription from DNA to mRNA
 - B. Translation from mRNA to a protein.
6. Basic Mendelian genetics including inheritance of traits
7. Evolution from the genetic perspective
8. Ethical aspects of biotechnology
9. Basic physiology such as
 - A. Homeostasis
 - B. The immune system
10. Introduction to Energy/Metabolism
 - A. Photosynthesis
 - B. Cellular respiration

Lab Activities

Lab Portion of Class

1. Basic lab skills
 - a. The metric system
 - b. Lab safety guidelines
 - c. Good Laboratory Practices (record keeping, following protocols)
 - d. Laboratory measurements (including accuracy versus precision)
 - e. The pH meter
 - f. Graphs
 - g. Microscope use
 - h. Pipetting skills
2. Perform 1 lab activity from at least three of the topics (ie. Proteins, DNA, Antibodies, Culturing Cells or Organisms)
 - a. Protein
 - i. Protein assays
 - ii. Introduction to enzymes
 - iii. Protein electrophoresis
 - b. DNA
 - i. DNA electrophoresis

- ii. Bacterial transformation
 - iii. Isolation of plasmid DNA/restriction digestion.
- c. Antibody
 - a. ELISA assay
 - b. Home pregnancy test.
- d. Culturing Cells or Organisms
 - i. Unicellular prokaryotic or eukaryotic culture with growth curve
 - ii. Mammalian cell culture and analysis
 - iii. Multicellular organism growth and analysis

Objectives

At the conclusion of this course, the student should be able to:

1. List the morphologic and chemical differences between prokaryotic and eukaryotic cells
2. Define and distinguish among atoms, molecules, compounds, chemical bonds, mechanisms of chemical bond formation, and components of biological molecules
3. Construct the flow diagram of gene expression from DNA to protein
4. Translate the triplet code of DNA into primary protein structure
5. Assess the role of basic Mendelian genetics
6. Compare and contrast current applications of biotechnology to the areas of medicine, agriculture, diagnostics, and the environment
7. Explain evolution from a genetic perspective
8. Evaluate a recent development in the field of biotechnology from an ethical perspective
9. Demonstrate pipetting skills
10. Explain the importance of Good Laboratory Practices and record keeping
11. Prepare and analyze graphs
12. Explain how an antibody based assay works
13. Use a microscope to view specimens
14. Employ a lab protocol

Evaluation Methods

A variety of assessment techniques that may include midterm exam, term paper, projects, homework problems. Below are some specific examples:

- I. In class objective examinations and quizzes that test for definitions and major biological concepts
- II. Performance on out of class assignments such as written reports
- III. Laboratory practicals that assess the ability to prepare and analyze graphs, follow a protocol, and explain deviations from the protocol
- IV. Class participation in discussions on biotechnology
- V. Regular class and laboratory participation in discussion related to course topics

Textbooks

Lecture

Introduction to Biotechnology (3rd Edition) by William J. Thieman and Michael A. Palladino (Jan 23, 2012) ISBN 978-0321766113

Campbell Essential Biology (5th Edition) by Eric J. Simon, Jean L. Dickey and Jane B. Reece (Feb 19, 2012) ISBN 978-0321772596

Campbell Essential Biology with Physiology, Simon, Eric J., Reece, Jane B. and Dickey, Jean L. Campbell Essential Biology with Physiology, 3rd ed. Benjamin Cummings, 2010, ISBN: 0321602072

Biology by Sylvia Mader and Michael Windelspecht (Jan 3, 2012) ISBN 978-0073525501

Nature Publishing Group's "Principles of Biology" (online text with lifetime access): www.nature.com/principles