

Contra Costa College

Course Outline

Department & Number: BIOSC 172

Course Title: Introduction to Biotechnology

Pre-requisite: None

Corequisite: None

Advisory: None

Entry Skill: None

Lecture Hours: 54.00 - 54.00

Lab Hours: 0.00

Composition Hours: 0.00

Activity Hours: 0.00

Lecture Hours By Arrangement: 0.00

Lab Hours By Arrangement: 0.00

Units: 3.00 - 3.00

Course/Catalog Description:

This course will teach students about all aspects of the biotechnology field, with content appropriate for a wide range of students and professionals. Topics will include the biology, business, and legal/ethical issues surrounding biotechnology; cells, genes, DNA, proteins, genetic engineering, drug development, biofuels, agriculture, bioremediation, biotechnology company structure, and the regulations affecting the field.

Requisites

There are no requisites to display.

Course Objectives:

At the completion of the course the student will be able to:

1. Demonstrate understanding of basic biological and chemical principles underlying biotechnology.
2. Define, explain, and interpret characteristics of life. Define and give examples of the kingdoms of life; know the major phyla in the living world.
3. Explain the structure of atoms, ions, and isotopes. Describe and distinguish between ionic bonds, covalent bonds, and hydrogen bonds. Understand empirical and structural formulae for basic biological molecules. Identify, and discuss the structures and functions of the four major classes of biological molecules: carbohydrates, lipids, proteins, and nucleic acids.
4. Demonstrate knowledge of the Cell Theory. Identify, explain, and interpret the distribution, structure, and function of the organelles found in eukaryotic cells (including animals and plants). Compare and contrast the distribution, structure, and functions of eukaryotic and prokaryotic cells. Diagram and discuss the macromolecular structure of cell membranes. Define, and interpret the various kinds of transport and signaling across cell membranes.
5. Compare and contrast metabolic processes and activities in animal, plant, and fungal cells, including fermentation.
6. Define and explain cellular reproduction in prokaryotes and eukaryotes. Understand the structure of chromosomes.
7. Interpret the life-cycles of various eukaryotes. Explain and interpret, compare and contrast diverse eukaryotic life cycles.
8. Explain and discuss how genetic material is encoded in molecules of DNA and expressed through the processes of transcription and translation. Explain and interpret those factors regulating the expression of genes in prokaryotic and eukaryotic cells. Demonstrate knowledge of and interpret the process of DNA replication. Explain how these events relate to the cell cycle cell cycle.
9. Define and apply the basic vocabulary of genetics. Explain the molecular aspects of genes and mutations.
10. Define, explain, and interpret evolution and natural selection. Explain and interpret the action of natural selection.
11. Discuss the location and significant characteristics of the major global ecosystems, both terrestrial and aquatic. Evaluate and understand diverse ecological phenomena, including interspecific interactions, succession, and niches. Interpret how these factors lend structure to nature.
12. Differentiate between functional activities of different biological macromolecules.

13. Explain and apply knowledge of protein structure and function, with emphasis on enzymes and signaling proteins.
 14. Demonstrate understanding of common biological techniques used in biotechnology. Know and explain recent advances in genetic engineering and biotechnology involving the introduction of new or modified genetic material into the organismal genome and the cloning of organisms.
 15. Discuss the theory behind and applications of the Polymerase Chain Reaction.
 16. Explain overall process of protein production and purification and describe its applications.
 17. Demonstrate understanding of construction and uses of recombinant DNA, including the use of plasmids and restriction enzymes.
 18. Demonstrate understanding of the principles underlying plant, animal, and prokaryotic cell culture. Describe applications of this technique, including stem cells.
 19. Demonstrate knowledge of a wide variety of biotechnology applications; including producing a protein product, forensics, blocking harmful protein interactions, cancer treatments, GMO crops, vaccines, human disease study and treatment, drug testing, aquaculture, bioremediation, medical diagnostics and biomarkers, pharmacogenomics, gene therapy, regenerative medicine, stem cells, cloning, and biofuels.
 20. Demonstrate knowledge of legal and ethical concerns surrounding biotechnology.
 21. Demonstrate knowledge of the structure, function, and processes of biotechnology companies.
 22. Explain the importance of Quality Control (documentation, Standard Operating Procedures, Lab notebooks) and regulatory agencies in the biotechnology industry.
-

Student Learning Outcomes

1. Students will increase understanding and knowledge of basic biological concepts of biotechnology including; molecular biology/genetic engineering, applications of biotechnology, central dogma, recombinant DNA, transgenic organisms, what is a protein.
2. Students will increase understanding and knowledge of the biotechnology field, including the fact of continued innovation (Research and Development) going on, awareness of ethical questions (innovation vs. social concerns), structure of biotechnology companies, and regulatory structure.
3. Students will be able to access online information and perform basic word processing tasks.

Course Content

Course Content (Lecture):

Characterizing life

Diversity and classification

Ecosystem function and diversity

Basic chemistry, pH, chemical bonding

Cells, organelles, membrane structure, function, and mechanisms of transport and signaling

Cellular reproduction: mitosis, DNA replication

Organismal reproduction and life cycles

DNA structure, replication, transcription, and translation

Structure and function of viruses

Evolution, natural selection, and population genetics

Physiology and metabolism

Structure and function of biological macromolecules in living systems; including proteins, nucleic acids, lipids, and carbohydrates

Cell signaling, with emphasis on cancer

Molecular biology and genetic engineering

Recombinant DNA, restriction enzymes, cloning enzymes, plasmids

Polymerase Chain reaction

Transformation, marker selection, gene expression

DNA sequencing, genome comparisons, gene isolation

Genotyping

Cell culture and stem cells

Protein production, purification, and structural analysis

History of biotechnology industry

Applications of biotechnology (pharmaceutical, agricultural, bioremediation, microbial, forensics, medical, industrial)

Legal issues, ethical concerns

Regulation of biotechnology products, including Quality Control and documentation

Biotechnology product development, structure of biotechnology companies

Scientific method

Written communication, appropriate use of online resources, teamwork

Methods Of Instruction:

1. Lecture
 2. Activity
 3. Computer Assisted Instruction
 4. Discussion
 5. Demonstration/Modeling
-

Instructional Materials

Note: To be UC/CSU transferable, the text must be dated within the last 7 years OR a statement of justification for a text beyond the last 7 years must be included

Textbooks

Title: Introduction to Biotechnology

Author: Thieman, William J. and Palladino, Michael A.

Publisher: Pearson Benjamin Cummings

Edition: 3rd

Date: 2012

Justification Statement:

Needs to be updated

Outside of Class Weekly Assignments

Title 5, section 55002.5 establishes that a range of 48 -54hours of lecture, study, or lab work is required for one

unit of credit. For each hour of lecture, students should be required to spend an additional two hours of study outside of class to earn one unit of credit.

- State Mandates that sample assignments must be included on the Course Outline of Record

Outside of Class Weekly Assignments

Hours Per Week

Weekly Reading (*Include detailed assignment below, if applicable*)

3.00

Read Chapter 2 (p28-40) in Introduction to Biotechnology (Thieman and Palladino). Section 2.1 is very important, and section 2.3 will be re-visited throughout the course, so give it a good shot this first time. Section 2.2 will be discussed in lecture, so don't get bogged down in the details.

Weekly Writing (*Include detailed assignment below, if applicable*)

3.00

Discussion prompt #4: (only one this module) What is the value of Biotech products? First, think in terms of time spent in development, patient health, environmental effects, and ethical concerns etc. Then consider the amounts of money invested in development and the costs of this kind of therapy. Written submission of Discussion Prompts #1-3 They must be submitted via the assignment drop box on D2L A reminder on how to prepare and submit your assignment: Respond with a typewritten page (a half to a full page is appropriate for each prompt) In your response include: 1. Your initial thoughts and a discussion of the evidence you used to answer question before you participated in the discussion 2. How 2-3 specific points from others in online discussion helped change your ideas or helped support your initial idea. a. Name each of the people you discuss clearly. Write 2-3 sentences about each classmates' ideas. 3. Your final response to the question. 4. For each prompt, I expect about 1/2 - 2/3 page of well-written work. Assignments are submitted via the "drop box" on D2L as an .doc or .docx file Open a word document, and save it on your computer or portable storage Save as a .doc or .docx file with file name: "YourLastNameQuestions1-3.docx" Examples: Krolikowski Questions1-3.doc or Smith Questions1-3.docx Type your discussion responses for each question in your document: Save your document as an .rtf file and "turn it in" Note: don't turn in the assignment until you've documented responses for all 3 discussion prompts! Click on "Module 4 Assignment" in graded things menu Double-check instructions, scroll to the bottom Click on "add a file" Click on "choose file" Browse to find the file that you named: "YourLastNameQuestions1-3.rtf" Click on your file, Click "open" or "choose" Click "upload" to upload file Make any comments you want to, and BE SURE TO Click on "submit" Make sure you get a message that your file has been successfully submitted.

Student Evaluation

Quizzes, exams

Discussion participation

Written assignments

Reports

Grading Policy

Letter Grade

90% - 100% = A

80% - 89% = B

70% - 79% = C

60% - 69% = D

Below 59% = F

