Contra Costa College

Course Outline

Department & Number: BIOSC 172L
Course Title: Introduction to Biotechnology Lab
Pre-requisite: BIOSC 172
Corequisite: None
Advisory: MATH 118, ENGL 142B, COUNS 103A
Entry Skill: None

Lecture Hours: 0.00 - 0.00
Lab Hours: 54.00 - 54.00
Composition Hours: 0.00
Activity Hours: 0.00
Lecture Hours By Arrangement: 0.00
Lab Hours By Arrangement: 0.00
Units: 1.00 - 1.00

Course/Catalog Description:

This is an introductory laboratory course in which scientific and biotechnology methodology is taught and used to explore and experiment with topics found in the Introduction to Biotechnology course (BIOSC 172). It is a brief introduction to the skills and concepts necessary to work in the biotechnology industry, allied health, or related fields. Topics 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, and a survey of general methodologies utilized in biotechnology research and manufacturing. Field trips may be included.

Requisites

1. Advisory: MATH 118
2. Advisory: ENGL 142B
3. Advisory: COUNS 103A
4. Pre-requisite: BIOSC 172
   Comment or Non Course Requisite: May be taken concurrently

Course Objectives:

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

1. Formulate and write out appropriate research questions and hypothesis when presented with observation phenomena
2. List the major steps in the scientific method of investigation
3. Collect and evaluate experimental data to accept or reject hypotheses
4. Prepare appropriate data tables and graphs from data collected
5. Demonstrate the use of general math skills in the application of the scientific method (i.e. computations, ratios, calculations, conversions, logarithms)
6. Describe, explain and apply the metric system of measurement, including converting between metric units
7. Perform calculations and manipulations relating to solutions and dilutions (e.g., ability to make a solution based on a target volume and concentration provided in molar or g/L units, ability to calculate dilution factors and the concentrations of a diluted solution)
8. Explain the theory of spectrophotometry and demonstrate the proper care and use of the spectrophotometer
9. Create a standard curve and read the concentration of an unknown using it
10. Demonstrate appropriate teamwork skills in the laboratory
11. Demonstrate the proper use of pH meters and computer-based pH probes to collect and analyze data collected under varying conditions
12. List potential chemical and biological hazards in the laboratory and take proper precautions against them.
13. Demonstrate the proper use of micropipettes to measure small quantities of fluids
14. Demonstrate the proper use of common laboratory equipment (e.g., balance, graduated cylinder, pipette,

centrifuge, etc.)
15. Demonstrate the proper technique in using microscopes
16. Define pH, acids, bases, and buffers and describe their role in living systems
17. Calculate Mendelian probabilities when given the appropriate pedigree information
18. Describe the structure and function of enzymes
19. Evaluate the effect of different environmental factors on the rate of enzyme catalysis
20. Demonstrate appropriate skills in the aseptic culturing of cells
21. Demonstrate Good Laboratory Practices and record keeping in a laboratory notebook

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Student Learning Outcomes

1. Students will make lab notebook entries correctly according to a standard operating procedure (SOP)
2. Students will improve their understanding and knowledge of basic scientific and biological concepts, including cell theory, cellular reproduction and enzyme activity.
3. Students will be able to accurately prepare laboratory solutions. Recipe preparation will include application of ratios and proportions and various methods of expressing concentration. Preparation of solutions will include proper use of equipment to measure volume and mass.
4. Students will be able to correctly prepare, focus, view, and interpret a sample using a microscope.

Course Content

Course Content (Lecture):

Course Content (Lab):

Data evaluation, collection and presentation (tables and graphs, raw/tabulated data, types of graphs, interpreting graphs, Excel spreadsheet program to present and graph data)

The metric system and its application (calculations for making buffers and media, dilution math and serial dilutions). This includes general math, computation, ratios, calculations, conversions, logarithms, metric units, scientific notation)

Using standard metrology instruments (including; pH meter, balance, pipettes, micropipettes, and spectrophotometry) to prepare media, buffers, and assay reagents.

Solution and dilution mathematic calculations and documentation (molar units, g/L, dilution factors, concentrations)

Cells and microscopy (prokaryote/eukaryote cells and characteristics, plant/animal cells, microscopic observation, types ofmicroscopes/uses, light microscope use and care)

Cell and tissue culture (including growth requirements, aseptic technique, streak isolation, inoculation, monitoring growth, liquid/broth and agar techniques)

Genetic inheritance, chromosomes

Introduction to biological chemistry principles (Monitoring chemical reactions, using pH meters, preparation and use of buffersystems)

Monitoring growth of cells in a bioreactor (measurement of population size in response to experimental manipulation of growth conditions such as pH, osmolarity, temperature, etc.)

Enzymes: Their chemical nature and role in biological systems (effects of various environmental factors on enzyme activity, control of enzyme activity, enzyme inhibition, using a spectrophotometer to measure enzyme activity)

Extraction, separation, and measurement of macromolecules from cell culture using centrifugation and other techniques

Monitoring metabolism in biological systems (use of a CO2 meter to measure cellular respiration and photosynthesis)

Modeling the movement and assortment of chromosomes, genes and DNA during modeling of cell division, asexual and sexualreproduction. Modeling of gene expression and molecular models of biological molecules

Spectrophotometry: Principles and practice, including preparing a standard curve using dilutions of known standards and using it to calculate the concentration of an unknown sample

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Methods Of Instruction:

1. Lab
2. Discussion

Other Method:
Written assignments (laboratory notebook entries) Lab participation: critical thinking, hypothesis development, experimental design/setup, data collection/analysis, development of conclusion

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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

Manuals
Title: Introduction to Biotechnology Laboratory
Author: E. Kaeuper, C. Zimmerman, P. Jardim, L. Clement, and K. Krolikowski
Date: 1/12/2016 12:00:00 AM
Publisher: Contra Costa College Bookstore

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 Writing *(Include detailed assignment below, if applicable)*	1.00

Background reading in text and lab manual as part of pre-lab assignment: Pre-lab Lab 14: Enzymes III 1. Lab notebook entry: We will be performing the BIOREACTOR GROWTH TESTS and METABOLITE EXTRACTION on the samples we started growing last week. BACKGROUND for METABOLITE EXTRACTION: This should include the reason(s) for choosing the variables (pH, NaCl) we did for the experiment. Be sure to list all 8 growth conditions our class is testing, and note the reasons for choosing each condition. PROCEDURE: Review the mini-extraction procedures for algae and make any clarifications needed in the procedure. We will finish the procedure from last week's preparation (starch), and do up through step 19 of this week's samples. We will be monitoring photosynthesis and respiration in algae samples we started growing last week BACKGROUND for BIOREACTOR GROWTH TESTS should include a summary of photosynthesis and cellular respiration. Be sure to note the inputs and outputs to each process. Which samples do you think will have the greatest amount of photosynthesis?

Respiration? Explain why. Summarize data from previous algae growth experiments, discuss new possible questions. We will be measuring CO2 released from the cells and recording the data in our lab notebooks. What will the CO2 data be like in a sample with high rates of photosynthesis? Respiration? METHODS: Think about interesting variables to test. These could include NaCl concentration (seawater?), pH (now that you know more from enzyme experiment), Temperature (now that you know more from enzyme experiment), Glucose concentration, bubble rate. Have TAP media recipes and procedures ready for preparing a 250mL final volume of growth media.

Student Evaluation

Lab Notebook

Computation or non-computational problem solving skills

Skills demonstration

Grading Policy

Letter Grade

90% - 100% = A
80% - 89% = B
70% - 79% = C
60% - 69% = D
Below 59% = F

Prepared by Katherine Krolikowski
Date 1/1/0001
