GROSSMONT COLLEGE

COURSE OUTLINE OF RECORD

Curriculum Committee Approval: 05/18/2021

GCCCD Governing Board Approval: 06/15/2021

BIOLOGY 230 - PRINCIPLES OF CELLULAR, MOLECULAR AND EVOLUTIONARY BIOLOGY

1. Course Number Course Title Semester Units

BIO 230 Principles of Cellular, Molecular and 4

Evolutionary Biology

Semester Hours

3 hours lecture 48-54 hours 96-108 outside of class hours 3 hours laboratory 48-54 lab hours

192-216 total hours

2. Course Prerequisites

A “C” grade or higher or “Pass” in Chemistry 141 or equivalent.

Corequisite

None

Recommended Preparation

A “C” grade or higher or “Pass” in Biology 120 and English 120 or equivalents.

3. Catalog Description

This course surveys the general principles of biology at an advanced level. Emphasis is placed on the following topics: prokaryotic and eukaryoticcellular processes including energy metabolism,membrane transportandcell cycle/cell divisionandmolecular genetics along withrecombinant DNA; Mendelian and Non-Mendelian genetics; communication between cells; and the current models for cellular evolution. The course also includes laboratory exercises emphasizing the topics listed and the application of those topics to biotechnology. This course along with Biology 240 is the recommended biology sequence for life science majors. It is suggested that students contact the anticipated transfer institution to ascertain specific transfer requirements for their major.

4. Course Objectives

The student will

a. Define the scientific terms used in written materials and discussions of modern biology covered in the lectures and readings for this course.

b. List, organize and differentiate between prokaryotic and eukaryotic cellular and molecular biological processes and explain each process.

c. For selected examples of biological processes, analyze and predict outcomes based on experimental data in areas such as energy metabolism, cell division, cell communication and expression of genes.

d. Read and analyze selected current papers from the primary biology literature as published in established scientific journals such as Science, Nature and Proceedings of the National Academy of Sciences (PNAS).

e. Use the scientific method of hypothesis testing to analyze experiments that determined the basis of current cellular and molecular models and theories (i.e., Establishment of DNA as the Genetic Material; Current Models of Cell Cycle control).

d. Demonstrate standard methods for presentation and analysis of data, including graphing and simple statistics, using both a calculator and computer software.

f. Identify the steps of mitosis, meiosis & recombination in plants and animals. Relate these processes to the cell cycle.

g. Know the Principles of Mendelian Genetics and utilize those principles to solve problems in Mono- & Dihybrid crosses and analyze data using the chi-square analysis.

h. Conduct experiments on selected membrane transport processes in the laboratory and use data to formulate hypotheses regarding membrane characteristics.

i. Measure the activity of a selected enzyme under different conditions, and develop and analyze appropriate tabular and graphical presentations of the data.

j. Perform exercises and analyze resulting data, to investigate major pathways of cellular energy metabolism.

k. Solve problems involving Incomplete Dominance, Multiple Alleles, Sex-Linked traits, Crossing-Over, basic Locus Mapping.

l. Use basic biotechnology equipment and methodologies.

m. Perform exercises and analyze resulting data of Bacterial transformations, agarose gel electrophoresis, construction and cloning a DNA molecule, PCR and other biotechnology topics.

n. Use and analyze the data from online DNA sequence databases (Bioinformatics)

o. Analysis of issues in BioScience.

5. Instructional Facilities

1. Standard Classroom.
2. Laboratory classroom, with data projector, overhead projector, screen, black or white board, sink, hood, gas, glassware (beakers, flasks, graduated cylinders) proximity to biology laboratory prep room, computers with data analysis, graphics, web browsing software
3. Special requirements: compound and dissecting microscopes, student spectrophotometers, refrigerator, water baths, incubators, electrophoresis equipment, and other related biotechnology equipment

6. Special Materials Required of Student

1. Hand calculator
2. Access to Internet-connected computer with printing facilities

7. Course Content

LECTURE and LAB

a. What science is: hypothesis testing, graphing data, use of the calculator and computer software in data analysis.

b. Cellular processes including basic biochemistry, energy metabolism, membrane transport, and cell cycle in both prokaryotic and eukaryotic cells.

c. Compare and contract internal organization of prokaryotic and eukaryotic cells including differences in organelle structure and function.

d. Molecular genetics including the genetic code and protein synthesis.

e. Orientation to the tools and techniques in modern biology and biotechnology.

f. Principles of cellular membrane transport.

g. Enzyme activity: qualitative and quantitative analysis, computer-assisted data analysis.

h. Cellular respiration.

i. Photosynthesis.

j. Cell cycle, mitosis & meiosis

k. Bacterial transformation

l. Principles of Mendelian genetics as it applies solving mono- & dihybrid crosses and segregation analysis using model organisms.

m. Non-Mendelian genetics as it applies to solving problems involving Incomplete Dominance, Multiple Alleles, Sex-Linked traits, Crossing-Over, basic Locus Mapping

n. Electrophoresis: its use in DNA, RNA and protein isolation and characterization and the basic principles of Northern, Southern and Western blot Hybridization.

o. Other topics in Biotechnology

LECTURE

a. RNA and Proteins of gene products**.**

b. Control of gene expression.

c. Communication between cells: cellular receptors, chemical messengers, with implications for disease.

d. Current models on the origin and evolution of cellular life.

e. Examples of current primary literature.

f. Web-based readings in Bioethics and analysis of same.

LAB

a. Recombinant DNA technology.

b. Chi-Square analysis of segregation data.

c. Basic topics in Bioinformatics using web-based search engines such as BLAST.

8. Method of Instruction

a. Lecture

b. Laboratory experiments

c. Laboratory exercises

d. Computer-based investigations

e. Film/video presentations

g. Study questions

9. Methods of Evaluating Student Performance

1. Essay, objective and practical examinations including a final exam
2. Written papers, using correct English grammar and paragraph organization**,** including expository essays on topics from recent scientific literature such as gene editing or viral evolution.
3. Lab reports based on experiments completed during laboratory class time, with students working in groups in the lab but independently on the lab reports.

10. Outside Class Assignments

1. Textbook reading at the Grade 14 level or above.
2. Homework assignments including problem-solving and diagramming complex processes.
3. Read and interpret excerpts from the Primary Scientific Literature in a homework assignment or discussion format

c. Career investigations assignment where students interview a person in their prospective career field and write up the interview, explore career options using resources from the Career Center and report on their findings in writing, or prepare a resume and cover letter for an application to an entry level job in science.

1. Preparation of written lab reports according to standard scientific conventions (Methods, Discussion etc.) including data analysis and graphing.

11. Representative Texts

1. Representative Text(s):

1) Alberts, Bruce, et. al., *Essential Cell Biology*. (5th Edition). New York: Garland Publishing, Inc., 2018

2) OpenStax, Biology. OpenStax CNX. Mar 28, 2019

https://openstax.org/details/books/biology-2e. Licensed under a Creative Commons Attribution 4.0.

1. Supplementary texts and workbooks:

Milgrim, Craig*. Laboratory Manual for Bio 230.* 34th Edition, El Cajon, California: Grossmont College, Spring 2014.

Addendum: Student Learning Outcomes

Upon completion of this course, our students will be able to do the following:

1. Describe and diagram the process of Iron uptake in Eukaryotic Cells.
2. Analyze an article from the Primary Literature and participate in a direct-discussion the data presented in the article.

Enzyme Activity Lab Exercise

c. Analyze and explain how pH and temperature affect enzyme activity

Construction and Cloning of a Recombinant DNA Laboratory

1. Analyze plasmid vector and insert sequence size and restriction data and produce a composite map of the ligated construct.
2. Create a flowchart of a written Transformation protocol and apply that protocol in Module 2.