GROSSMONT COLLEGE

COURSE OUTLINE OF RECORD

Curriculum Committee Approval: 05/18/2021

GCCCD Governing Board Approval: 06/15/2021

BIOLOGY 120 – PRINCIPLES OF BIOLOGY

1. Course Number Course Title Semester Units

BIO 120 Principles of Biology 4

Semester Hours

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

192-216 total hours

2. Course Prerequisites

None

Corequisite

None

Recommended Preparation

A “Pass” grade in Math 090 or equivalent and a “C” grade or higher or Pass in English 120or equivalent.

3. Catalog Description

This course uses Evolutionary Theory to discuss and explain the major principles in Biology. These areas include natural selection, general and biochemistry, cell biology, homeostasis & metabolism, classical and molecular genetics, systematics, animal and plant structure and function, and ecology. The laboratory component extends and complements that lecture with hands-on experiences that include experimental design, light microscopy, cellular biology, enzymes, data analysis and interpretation, organismal biology, genetics, systematics, and ecology.

4. Course Objectives

The student will:

1. List and describe the steps comprising the scientific method and apply the scientific method to understanding experimental design and the analysis of experimental data.
2. Differentiate between the primary scientific literature and generic presentations of scientific knowledge and be able use the primary literature in conjunction with understanding selected biological principles.
3. Define and explain the basic mechanisms of cellular reproduction, the molecular biology of inheritance, and the fundamental patterns of genetic inheritance.
4. Connect the process of evolution by natural selection to the processes of cellular and molecular reproduction.
5. List and describe the major steps in evolution by natural selection, explain how these steps account for the observed diversity of life on earth.
6. Describe and explain the general characteristics of life.
7. List the criteria that define the major domains & kingdoms of life on earth.
8. Explain the basis of evolution-based classification of life on earth (systematics).
9. Differentiate between homologous and analogous structures and provide at least one example of each.
10. Differentiate the structural differences between typical prokaryotic and eukaryotic cells as well as between typical plant and animal cells.
11. Explain and provide examples of the concept of homeostasis, the self-regulation that maintains the optimal internal conditions for survival in changing environmental conditions.
12. Explain the interrelationships within living systems as well as between living systems and their physical, chemical, and energy environments.
13. Analyze, explain and apply the data collected from laboratory experiments performed in class.
14. Prepare specimens for examination using a compound microscope.
15. Use self-prepared and prepared materials for examination and analysis using laboratory equipment.
16. Read and analyze college-level materials that elaborate and expand on the understanding of biological topics.

5. Instructional Facilities

1. Standard Classroom
2. Biological teaching laboratory equipped with running water, gas, vacuum, air, and electrical outlets; with storage space for plant and animal specimens.
3. Special requirements:
   1. Compound and dissecting microscopes.
   2. Selected charts and models.
   3. Preserved and living specimens for dissection and observation.
   4. Selected prepared microscopic slides.
   5. Chemicals as requested.
   6. Facilities for multimedia presentations, including a computer at the instructor’s station.
   7. Classroom computers in laboratory for student use during laboratory exercises.

6. Special Materials Required of Student

None

7. Course Content

LECTURE AND LAB

a. Introduction.

1) Characteristics of life.

2) Scientific method.

b. The living cell.

1) Relationship between structure and function.

2) Cell membrane characteristics and its role in transport (diffusion, osmosis, protein-assisted transport)

3) Enzyme structure, function and control.

4) The flow of matter and energy through living systems: cellular respiration, photosynthesis, and the laws of thermodynamics.

5) Cellular reproduction: the cell cycle, mitosis and meiosis.

c. The diversity of life.

1) Levels of organization of ecosystems: unicellular, colonial, multicellular, tissues, organs, abiotic components.

2) An introduction to evolutionary classification (systematics) including all domains and kingdoms

3) Homologous structures vs. analogous structures.

4) Animal vs. plant life cycles including alternation of generations

5) Examples of evolutionary adaptations in various environments.

6) Natural selection as a mechanism for evolution.

7) DNA, genes, and patterns of inheritance.

d. Multicellular organisms (plants, animals, fungi and protists)

1) Selected examples used to illustrate the functions and evolution of major physiological systems: (e.g., transpiration, circulation, osmoregulation)

2) Homeostasis: mechanisms of coordination and control in living systems; response to environmental stimuli.

3) Biology of reproduction in selected forms

e. Unifying concepts.

1) The flow of matter and energy through living systems

2) Evolution as the basis for understanding variation & diversity in living populations.

3) Molecular basis of heredity

4) Homeostasis in cells, organisms and ecosystems

LECTURE

a. Chemistry of life.

1) Introduction to general chemistry principles

2) Introduction to basic organic and biochemical principles

3) Roles of proteins, carbohydrates, lipids and nucleic acids in living systems

LAB

a. Introduction.

1) Scientific method.

(i) Identify Expected vs. Observed data

(ii) Connect hypothesis generation to experimental design.

b. The living cell.

1) Relationship between structure and function.

2) Cell membrane characteristics and its role in transport (diffusion, osmosis, protein-assisted transport)

3) Enzyme structure, function and control.

4) Cellular Reproduction: the cell cycle, mitosis and meiosis

c. Laboratory Skills

1) Utilize compound light microscopes for analysis of specimens

2) Follow written protocols for experiments in order to produce accurate data.

3) Collect, organize using graphs and tables, and analyze experimental data collected in class

8. Method of Instruction

a. Lecture and discussion.

b. Multimedia presentations.

c. Laboratory demonstrations and investigations using small groups of students.

d. Some classes may include field work.

9. Methods of Evaluating Student Performance

1. Written quizzes, tests and examinations (including a final).
2. Practical laboratory questions including demonstrations of lab skills or identification of specimens
3. Laboratory assignments requiring data analysis, interpretation of data, graphs and tables and mathematical calculations.
4. Writing assignments and/or projects (individual and/or group) utilizing proper English grammar and spelling, such as a research poster or PowerPoint presentation on a disease, a report on participation in a volunteer activity or citizen science project, an opinion paper on a controversial topic in modern biology (stem cell research, GMO foods, gene editing), or discussion of a primary literature article.

10. Outside Class Assignments

1. Textbook reading assignments.
2. Written lab reports covering laboratory activities
3. Related reading assignments outside the textbooks (e.g. primary literature).
4. Reports and/or projects covering recent biological research such as epidemiology, virology, systematics, biotechnology, and genetics.
5. Student use of online resources, such as Google Scholar, science-in-the-news sites, or web sites of scientific institutions such as universities, zoos and museums.

11. Representative Text(s)

1. Representative Text(s):

1) Botten, Ruth, Dick Vessel, Ernie Nevue, Dave Wertlieb, Dick Lantz, Bill Carden, Diane Merlos, Gordon Dudley, and Jim Sumich. *Biology 120 Laboratory Manual*. El Cajon: Grossmont College Printing Department. 2019.

2) Taylor, M.R. E.J. Simon, and J.L. Dickey, K.A. Hogan, and J.B. Reece, 2018. Concepts and Connections, 9th Edition, Benjamin Cummings Publishers, San Francisco.

3) Fowler et al. *Concepts of Biology.*1st Edition, OpenStax College, 2013

b. Supplementary texts and workbooks:

None

Addendum: Selected Student Learning Outcomes

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

a. Explain the relationship between variations within populations and Natural Selection

b. Learn the Scientific Method and apply this knowledge to investigate a scientific problem.

c. Use algebraic skills to interpret scientific data.

d. Learn the parts and operation of a compound microscope and apply that knowledge to investigating biological specimens.

e. Explain the relationship between genotype and phenotype