

COURSE OUTLINE

General Biology

Course Description

BI 110. General Biology. 5 hours credit. This course will enable the student to apply basic biological principles to relevant situations in his/her daily life. The student will apply the scientific process to problem solving and deductive reasoning to analyze and interpret observations. This course is not intended for biology majors.

Course Relevance

This general biology course will provide the student with the basic fundamentals about how the scientific process operates and a fundamental understanding of basic concepts of biology. Understanding concepts will help the student make informed political or ethical decisions in which a biological understanding plays an important role.

Required Materials

Mader, S.S. (2006). *Essentials of biology* (1st ed.). Dubuque, IA: McGraw-Hill.

Staff of BCC Biology Department. *Student study guide* (8th ed.) El Dorado, KS: L, K & G Press

Staff of BCC Biology Department. *General biology lab manual* (8th ed.) El Dorado, KS: L, K & G Press.

Learning Outcomes

The intention is for the student to be able to:

1. Apply basic biological concepts to understand the causes and treatments of genetic disorders, diseases and cancer
2. Apply the scientific process when describing the results of an experiment done during lab
3. Evaluate his/her current behavior as it applies to maintaining a positive healthy life style

Learning PACT Skills that will be developed and documented in this course

Through the student's involvement in this course, he/she will develop his/ her ability in the following PACT Skills areas:

Analytical Thinking Skills

1. Critical thinking
 - Through a written paper, the student will demonstrate analysis of causal situation of a particular disease or cancer and evaluate the associated risks and treatments
 - Through a written report, the student will apply the scientific process to a problem solving situation.

Communication Skills

2. Creation and delivery of messages
 - Through an oral presentation to the class, the student will present a summary of research on a particular disease or cancer

Personal Development Skills

3. Personal management
 - Through a series of self-assessment surveys, the student will evaluate his/her ability to maintain a positive personal health

Major Summative Assessment Task(s)

These learning outcomes and the Learning Pact skills will be demonstrated by

1. Writing a critical analysis of the cause and treatment of a specific disease or cancer (A outcome) shared with the class through an oral presentation (C outcome)
2. Writing a critique that explains and projects the worth of the series of self-assessments of personal health practices (P outcome)

Course Content

- I. Themes – Key recurring concepts that run throughout the course:
 - A. Scientific Process
 - B. Molecular and cellular basis of life
 - C. Connection between structure and function
 - D. Basis of diseases and medical disorders
 - E. Genetic basis of life
 - F. Evolutionary basis of all living organisms
 - G. Inter-relationship of all living organisms to one another
- II. Issues – Key areas of conflict that must be understood in order to achieve the intended outcomes:
 - A. Balance between the reductionism (molecular/cellular/mechanical) view point and emergent properties as the level of complexity increases
 - B. Balance between the environmental needs of the individual and of the community
 - C. Relationship between proximate and ultimate explanations or causes of biological processes
- III. Concepts – Key concepts that must be understood to address the issues:
 - A. The relationship structure and function at the cellular, individual and population levels
 - B. The scientific process applied to the acquisition, analysis and interpretation of data and general concepts
 - C. The underlying chemical basis of metabolism, physiological processes, cell respiration and photosynthesis and protein synthesis
 - D. The connection between normal and abnormal functioning in role of disorders, cancer and diseases
 - E. The application of evolutionary and ecological concepts to understand inter-relationship between man, other species and the physical environment
- IV. Skills/Competencies – Actions that are essential to achieve the course outcomes:
 - A. Explain scientific process and general principles of biology

- B. Examine cell structure and function
- C. Explain basic chemistry principles
- D. Explore principles of genetics
- E. Maintenance systems
- F. Explore principles of ecology
- G. Describe the process of evolution

Learning Units

- I. Scientific process
 - A. Describe the traits/characteristics of all living organisms
 - B. List Identify levels of biological organization
 - C. Identify levels of classification: Domain and Kingdom levels, the taxonomy hierarchy of living organisms
 - D. Examine the species level of classification
 - E. Describe the steps of the scientific process and the purpose of each
 - F. Identify the control, independent, and dependent variables in an experiment along with the control group, experimental group and the mean.
 - G. Apply the scientific method to a lab and various theoretical situations
 - H. Write a lab report which includes a graph, mean, standard deviation, and that follows the scientific process
 - I. Describe the role of antibodies, antibiotics and vaccinations

- II. Cells
 - A. Describe the major components of the cell theory (structural, functional, and developmental)
 - B. Compare prokaryotic and eukaryotic cells and eukaryotic plant and animal cells
 - C. Identify the following cellular parts: cell wall, cell membrane, nucleus, nucleolus, centriole, ribosome, endoplasmic (smooth and rough), Golgi body, mitochondrion, chloroplast (thylakoid and stroma), flagella, cilia and describe the major function of each
 - D. Describe the difference between diffusion and active transport using various solutions where differences in concentrations affect the direction of movement
 - E. Diagram and label the double phospholipid structure of the cell membrane
 - F. Compare polar versus non-polar molecules
 - G. Describe the roles of the double phospholipid membrane and of certain protein molecules in transporting substances into and out of the cell
 - H. Compare diffusion, active transport, endocytosis, phagocytosis, pinocytosis, exocytosis as they relate to cellular secretion
 - I. Identify components of various types of cells: prokaryotic bacteria, viral, eukaryotic animal and eukaryotic plant
 - J. Compare antibody, antibiotic, and vaccination
 - K. Contrast viral and bacterial microorganisms
 - L. Describe the roles of cell division in life cycle of organisms
 - M. Properly focus a microscope on a high power using a prepared slide
 - N. Prepare a wet mount slide
 - O. Estimate the size of a cell using the field of view

III. Introduction to chemistry

- A. Define these basic terms: atom, atomic number, atomic mass, element, ion, isotope, and molecule
- B. Use the periodic table to identify the elements found in a living system
- C. Recognize energy levels, electron capacities of an energy level and how stability of atoms is determined
- D. Define and recognize examples of different types of bonds: ionic, covalent, polar covalent and hydrogen
- E. Describe the structure of water molecule, list properties of water and discuss pH, acids and bases
- F. Compare organic and inorganic compounds
- G. Recognize the following functional groups: hydroxyl, methyl, ketone, aldehyde, carboxyl, amino, and phosphate
- H. Examine and recognize organic molecules found in living systems and the function of such molecules: carbohydrates, proteins and fats
- I. Calculate the energy from food
- J. Identify sugars, fats and proteins using standard chemical test
- K. Discuss the importance of enzymes in cellular activities
- L. Describe the digestive system in terms of organs involved with functions and the effects of chemical enzyme digestion on foods
- M. Compare the nutritional and caloric values of various foods: sugars, fats and proteins
- N. Properly focus a microscope on a high power using a prepared slide
- O. Prepare a wet mount slide
- P. Estimate the size of a cell using the field of view

IV. Genetics

- A. Describe the major events that occur during the stages of the cell cycle mitosis: G1, G2, S, Mitosis, and Cytokinesis
- B. Describe the roles of mitosis and meiosis to the life cycle
- C. Compare genotype, phenotype, homozygous, heterozygous, dominant, recessive, allele, gene and codominant
- D. Describe the evidence that Mendel used to prove his idea that genes behave as particles; specifically explain how the Principles of Dominance, Principles of Segregation and Principle of Independent Assortment show genes behave as particles
- E. Solve genetic problems involving individuals that are heterozygous for one and two traits
- F. Describe the structure and activities of chromosomes
- G. Recognize components of a karyotype: sex and the presence of Down's syndrome
- H. Compare the structure of nucleotides in RNA and DNA
- I. Define the roles of nucleolus, ribosomes, codon, anticodon, amino acid, protein, messenger RNA, transfer RNA, and ribosome
- J. Describe the major events that occur during transcription and translation of

protein synthesis

V. Maintenance

- A. Describe oxidation-reduction reactions
- B. Describe the ATP-ADP cycle
- C. Discuss the importance of enzymes in cellular activities
- D. Describe the overall chemical reaction for cellular respiration: outline the major events of glycolysis, Krebs's cycle, and electron transport system
- E. Describe the events of anaerobic and aerobic cellular respiration
- F. Recognize the following: lungs, trachea, larynx, pharynx, and alveolus
- G. Describe the general functions of the respiratory system
- H. Describe the location, structure, and function of the heart's four chambers, valves, and major blood vessels
- I. Describe the parts of the heart, the pathway of blood through the heart and the body
- J. Describe the structure and function of blood vessels
- K. Describe the relationship between heart action and blood pressure
- L. Describe the effect of the autonomic system on the heart
- M. Describe how cardiovascular disease develops
- N. Describe how exercise may affect the five leading risk factors
- O. Explain the function of the immune system: lymphoid organs, inflammatory reaction, specific diseases, vaccines, active immunity and passive immunity
- P. Describe the basis of blood types
- Q. Describe the role of white blood cells, HIV, and AIDS

VI. Ecology

- A. Describe the importance of the laws of thermodynamics to energy flow in living cells
- B. Understand the flow of energy through an ecosystem; pathway of energy flow, energy utilization by living systems and energy loss in an ecosystem
- C. Describe the overall chemical reaction for photosynthesis: visible light, structure of chloroplast, light-dependent reactions and light-independent reactions, products of PGAL
- D. Compare photosynthesis and cellular respiration in terms of reactants, products, processes and relationship to the ecosystem
- E. Compare population, community, ecosystem, biosphere, producer, consumer, decomposer, and habitat
- F. Interpret population growth curves, survivorship curves, fertility curve, and age structure diagrams with emphasis on humans
- G. Describe components and interactions of an ecosystem: biotic and abiotic
- H. Describe ecological interactions: food chains, food webs, types of competition, and symbiotic relationships
- I. Outline the following biogeochemical cycles and identify human influence on the cycle: water, carbon, nitrogen, and phosphorous
- J. Distinguish biomes on the basis of rainfall, temperature, organisms and productivity

- K. Outline the causes of global warming, depletion of forest, ozone depletion, air pollution, water pollution, solid waste and resources
- L. Recognize the environmental impact humans have on planet Earth
- M. Identify pond water organisms and the role that they play within the pond ecosystem

VII. Evolution

- A. Describe and apply the concept of adaptation
- B. Identify the following: skull, vertebral column, pectoral and pelvic girdles, limbs, pectoralis major, quadriceps femoris, external oblique, rectus abdominus, biceps brachii, triceps brachii, rectus femoris, gastrocnemius, and deltoid
- C. Compare the fixed and evolving species models
- D. Identify the major requirements for natural selection process to occur
- E. Define an adaptation and how it evolves
- F. Describe how changes in gene frequencies at the population level can lead to evolution
- G. Describe what a species represents in terms of population genetics and how speciation occurs

Learning Activities

Learning activities will be assigned to assist the student to achieve the course concepts, practice of critical thinking skills applied to lab experiments and study guide exercises, and application of scientific process.

Grade Determination

The student will be graded on learning activities and assessment tasks. Grade determinants may include the following: quizzes, exams, lab reports, lab exercises, written and oral reports and other methods of evaluation employed at the discretion of the instructor.