

SWEETWATER UNION HIGH SCHOOL DISTRICT

DIVISION OF ADULT EDUCATION

High School Subjects

<u>VI</u>	<u>Biology 1, 2</u>	<u>9049</u>
Level	2012	<u>9040</u>
		Code

DURATION: Satisfactory completion of all required work and a minimum of 60 hours.

GRADE LEVEL: Adult/9-12

PREREQUISITES: A minimum of one year of Algebra is recommended.

CREDIT: One (1) semester credit toward the life science requirement for each semester towards high school graduation may be earned.

PROGRAM DESCRIPTION:

This two semester course focuses on experimental science with a focus on molecular, cellular and body system interactions. This course includes laboratory work which is a vital component of the course. Students will also focus on acquisition of quantifiable data, manipulation of data and formulation of conclusions based on the results as well as vocabulary development.

GOALS:

Through the principles and practice presented in this course, students will

- 1.0 Ask meaningful questions and conduct careful investigations.
- 2.0 Demonstrate knowledge of the structure and function of macromolecules which is necessary for an understanding of the biochemistry of cells.
- 3.0 Understand that the fundamental life processes of plants and animals depend on a variety of chemical reactions that occur in specialized areas of the organism's cells.
- 4.0 Analyze photosynthesis and chlorophyll containing cells convert light energy into the chemical energy of ATP, which is used to produce glucose. In cell respiration, glucose is oxidized to carbon dioxide and water, and ATP is produced.
- 5.0 Know how stability in an ecosystem is a balance between competing effects such as nutrient recycling, food webs, and composition of producers and decomposers.

- 6.0 Understand genes are a set of instructions encoded in the DNA sequence of each organism that specify the sequence of amino acids in proteins characteristic of that organism.
- 7.0 Know mutation and sexual reproduction lead to genetic variation in a population.
- 8.0 Understand that a multicellular organism develops from a single zygote, and its phenotype depends on the genotype, which is established at fertilization.
- 9.0 Analyze how evolution is the change of one species into different species through time. Changes in the DNA of an organism lead to phenotypic variation, and through the process of natural selection in changing environments, ultimately result in speciation.
- 10.0 Understand how coordinated structures and functions of organ systems maintain a relatively stable, healthy internal environment in the human body (homeostasis) despite changes in the outside environment.
- 11.0 Comprehend the genetic composition of cells can be altered by incorporation of exogenous DNA into cells to form novel combinations.

OBJECTIVES:

Students who successfully complete this course will be able to:

- 1. Ask meaningful questions and conduct careful investigations. Students will:
 - 1.1. Select and use appropriate tools and technology (such as computer-linked probes, spreadsheets, and graphing calculators) perform tests, collect data, analyze relationships, and display data (IAE 1a).
 - 1.2. Identify and communicate sources of unavoidable experimental error and identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions (IAE 1j).
 - 1.3. Formulate explanations by using logic and evidence and recognize the cumulative nature of scientific evidence (IAE 1d & 1k).
 - 1.4. Distinguish between hypothesis and theory as scientific terms and recognize the usefulness and limitations of models and theories as scientific representations of reality (IAE 1f, & 1g).
 - 1.5. Know that when an observation does not agree with an accepted scientific theory, the observation is sometimes mistaken or fraudulent (e.g., the Piltdown Man fossil or unidentified flying objects) and that the theory is sometimes wrong (e.g., the Ptolemaic model of the movement of the Sun, Moon, and planets) (IAE 1n).

2. Demonstrate knowledge of the structure and function of macromolecules which is necessary for an understanding of the biochemistry of cells. Students will:
 - 2.1. Know most macromolecules (polysaccharides, nucleic acids, proteins, lipids) in cells and organisms are synthesized from a small collection of simple precursors (Bio 1h).
 - 2.2. Know proteins can differ from one another in the number and sequence of amino acids and know enzymes are proteins that catalyze biochemical reactions without altering the reaction equilibrium and the activities of enzymes depend on the temperature, ionic conditions, and the pH of the surroundings (Bio 4e & 1b).
 - 2.3. Know why proteins having different amino acid sequences typically have different shapes and chemical properties (Bio 4f).
3. Understand that the fundamental life processes of plants and animals depend on a variety of chemical reactions that occur in specialized areas of the organism's cells. Students will:
 - 3.1. Understand how prokaryotic cells, eukaryotic cells (including those from plants and animals), and viruses differ in complexity and general structure (Bio 1c).
 - 3.2. Know the central dogma of molecular biology outlines the flow of information from transcription of ribonucleic acid (RNA) in the nucleus to translation of proteins on ribosomes in the cytoplasm and understand the role of the endoplasmic reticulum and Golgi apparatus in the secretion of proteins (Bio 1d & 1e).
 - 3.3. Describe how cells are enclosed within semipermeable membranes that regulate their interaction with their surroundings (Bio 1a).
4. Analyze photosynthesis and chlorophyll containing cells convert light energy into the chemical energy of ATP, which is used to produce glucose. In cell respiration, glucose is oxidized to carbon dioxide and water, and ATP is produced. Students will:
 - 4.1. Understand usable energy is captured from sunlight by chloroplasts and is stored through the synthesis of sugar from carbon dioxide (Bio 1f).
 - 4.2. Know the role of mitochondria in releasing stored chemical-bond energy available to cells by completing the breakdown of glucose to carbon dioxide (Bio 1g).
5. Know how stability in an ecosystem is a balance between competing effects such as nutrient recycling, food webs, and composition of producers and decomposers. Students will:

- 5.1. Analyze how water, carbon, and nitrogen cycle between abiotic resources and organic matter in the ecosystem and how oxygen cycles via photosynthesis and respiration (Bio 6d).
- 5.2. Understand vital part of an ecosystem is the stability of its producers and consumers and know at each link in a food web some energy is stored in newly made structures but much energy is dissipated into the environment as heat. This can be represented in an energy pyramid (Bio 6e & 6f).
- 5.3. Know how fluctuations in population size in an ecosystem are determined by the relative rates of birth, immigration, emigration, and death (Bio 3d).
- 5.4. Demonstrate biodiversity is the sum total of different kinds of organisms and is affected by alterations of habitats and know how to analyze changes in an ecosystem resulting from changes in climate, human activity, introduction of non-native species or changes in population size (Bio 6a & 6b).
6. Understand genes are a set of instructions encoded in the DNA sequence of each organism that specify the sequence of amino acids in proteins characteristic of that organism. Students will:
 - 6.1. Describe the general structures and functions of DNA, RNA and protein (Bio 5a).
 - 6.2. Describe how to apply base-pairing rules to explain precise copying of DNA during semi-conservative replication and transcription of information from DNA into mRNA (Bio 5b).
 - 6.3. Understand the general pathway by which ribosomes synthesize proteins, using tRNAs to translate genetic information in mRNA (Bio 4a).
 - 6.4. Apply genetic coding rules to predict the sequence of amino acids from a sequence of codons in mRNA (Bio 4b).
 - 6.5. Describe how mutations in the DNA sequence of a gene may or may not affect the expression of the gene or the sequence of amino acids in an encoded protein (Bio 4c).
 - 6.6. Understand specialization of cells in multicellular organisms is usually due to different patterns of gene expression rather than to differences of the genes themselves (Bio 4d).
 - 6.7. Describe how genetic engineering (biotechnology) is used to produce novel biomedical and agricultural products (Bio 5c).
7. Know mutation and sexual reproduction lead to genetic variation in a population. Students will:

- 7.1 Understand meiosis is an early step in sexual reproduction in which the pairs of chromosomes separate and segregate randomly during cell division to produce gametes containing one chromosome of each type (Bio 2a).
- 7.2 Analyze how only certain cells in a multi cellular organism undergo meiosis and why approximately half of an individual's DNA sequence come from each parent (Bio 2b & 2e).
- 7.3 Understand how random chromosome segregation explains the probability that a particular allele will be in a gamete and know the genetic basis for Mendel's laws of segregation and independent assortment (Bio 2c & 3b).
- 7.4 Describe how new combinations of alleles may be generated in a zygote through the fusion of male and female gametes (fertilization) and know the role of chromosomes in determining an individual's sex (Bio 2d & 2f).
8. Understand that a multicellular organism develops from a single zygote, and its phenotype depends on the genotype, which is established at fertilization. Students will:
 - 8.1 Demonstrate how to predict the probable outcome of phenotypes in a genetic cross from the genotypes of the parents and mode of inheritance (autosomal or X-linked, dominant or recessive) (Bio 3a).
 - 8.2 Know how to predict the probable mode of inheritance from a pedigree diagram showing phenotypes (Bio 3c).
9. Analyze how evolution is the change of one species into different species through time. Changes in the DNA of an organism lead to phenotypic variation, and through the process of natural selection in changing environments, ultimately result in speciation. Students will:
 - 9.1 Understand how natural selection determines the differential survival of groups of organisms and know how a great diversity of species increase the change that some organisms will survive major changes in the environment (Bio 8a & 8b).
 - 9.2 Know how to analyze fossil evidence with regard to biological diversity, episodic speciation, and mass extinction (Bio 8e).
 - 9.3 Explain how variation in a species increases the likelihood that at least some members of a species will survive under changed environmental conditions (Bio 7d).
 - 9.4 Understand why alleles that are lethal in a homozygous individual may be carried in a heterozygote and thus maintained in a gene pool and why know mutations

are constantly being generated in a gene pool (Bio 7b & 7c).

- 9.5 Understand why natural selection acts on the phenotype rather than the genotype of an organism (Bio 7a).
- 9.6 Analyze the effects of genetic drift on the diversity of organisms in population (Bio 8c).
- 9.7 Know reproductive or geographic isolation affects speciation (Bio 8d).
10. Understand how coordinated structures and functions of organ systems maintain a relatively stable, healthy internal environment in the human body (homeostasis) despite changes in the outside environment. Students will:
 - 10.1 Understand how the nervous system mediates communication between different parts of the body and the body's interactions with the environment, the functions of the nervous system and the roll of neurons in transmitting electrochemical impulses, and the roles of sensory neurons, interneurons and motor neurons in sensation, thought and response (Bio 9b, 9d & 9e).
 - 10.2 Understand how the complementary activity of major body systems provides cells with oxygen and nutrients and removes toxic waste products such as carbon dioxide (Bio 9a).
 - 10.3 Analyze how feedback loops in the nervous and endocrine systems regulate conditions in the body (Bio 9c).
 - 10.4 Identify the important differences between bacteria and viruses with respect to their requirements for growth and replication, the body's primary defenses against bacterial and viral infections, and effective treatments of these infections (Bio 10d).
 - 10.5 Describe the roll of the skin in providing nonspecific defenses against infection, the role of antibodies in the body's response to infection, how vaccination protects an individual from infectious diseases and why an individual with a compromised immune system may be unable to fight off and survive infections by microorganisms that are usually benign (Bio 10a, 10b, 10c, and 10e).
 - 10.6 Describe the cellular and molecular basis of muscle contraction, including the roles of actin, myosin, Ca^{2+} , and ATP (Bio 9h).
11. Comprehend the genetic composition of cells can be altered by incorporation of exogenous DNA into cells to form novel combinations. Students will:
 - 11.1 Demonstrate how basic CAN technology (restriction digestion by endonucleases,

gel electrophoresis, ligation, and transformation) is used to construct recombinant DNA molecules (Bio 5D).

11.2 Analyze how exogenous DNA can be inserted into bacterial cells in order to alter their genetic makeup and support expression of new protein products (Bio 5e).

INSTRUCTIONAL STRATEGIES AND TIMES:

Individual work on assignments	50%
Teacher/student evaluation of student practice	15%
Computer assisted learning	15%
Assessment	20%

EVALUATION:

1. Satisfactory completion of research, Internet, lab and written assignments as evaluated by the instructor.
2. Satisfactory completion of teacher-made and/or standardized test as evaluated by the instructor.
3. Satisfactory progress and participation in classroom activities as evaluated by the instructor.

CONDITIONS FOR REPETITION:

Students who have failed to meet the objectives because of insufficient attendance or inability to master content may repeat the course.

Approved:
July 23, 2012