Course Description for **P-Biology (SCI161/162)**

DEPARTMENT: Science

GRADE: 10

LENGTH: One Year

CREDITS: 10 (Ten)

PREREQUISITE: Passing grade in Integrated Physical Science. Students who plan a career pathway in science and who have achieved a 3.0 or higher in 8th grade advanced science or an A in 8th grade science with teacher recommendation, may enroll in Biology in grade nine.

COURSE DESCRIPTION: This biological science course introduces students to the natural world at a conceptual level with an emphasis on the boitic world. At the same time the course will extensively integrate characteristics of the abiotic world into the curriculum. Students learn that all life is composed of a web of interdependence with both the biotic and the abiotic world; that all life has developed through a continuous and unbroken pattern that is both stable and random, and that physical events have influenced the speed and direction of this development, and continue to do so today. This class is aligned to the biology content standards and meets one year of the "d" requirement for the UC and CSU admission. The class is aligned to the California Science Content Standards.

EXIT CRITERIA: **Investigation and Experimentation**

Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept, and to address the content the other four strands, students should develop their own questions and perform investigations. Students will:

- Select and use appropriate tools and technology (such as computer-linked probes and spreadsheets) to perform tests, collect data, analyze relationships, and display data.
- Identify and communicate sources of unavoidable experimental error.
- Identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions.
- Formulate explanations using logic and evidence.
- Solve scientific problems using quadratic equations, and simple trigonometric, exponential, and logarithmic functions.

- Distinguish between hypothesis and theory as science terms.

- Recognize the use and limitations of models and theories as scientific representations of reality.

- Recognize the issues of statistical variability and the need for controlled tests.

- Recognize the cumulative nature of scientific evidence.

- Analyze situations and solve problems that require combining and applying concepts from more than one area of science.

- Investigate a science-based societal issue by researching the literature, analyzing data, and communicating the findings. Examples include irradiation of food, cloning of animals by somatic cell nuclear transfer, choice of energy sources, and land and water use decisions in California.

- Know that when an observation does not agree with an accepted scientific theory, sometimes the observation is mistaken or fraudulent (e.g., Piltdown Man fossil or unidentified flying objects), and sometimes the theory is wrong (e.g., Ptolemaic model of the movement of the sun, moon and planets).

Cell Biology

Fundamental life processes of plants and animals depend on a variety of chemical reactions that are carried out in specialized areas of the organism's cells. As a basis for understanding this concept, students know:

- Cells are enclosed within semi-permeable membranes that regulate their interaction with their surroundings.

- Enzymes are proteins and catalyze biochemical reactions without altering the reaction equilibrium. The activity of enzymes depends on the temperature, ionic conditions and pH of the surroundings.

- How prokaryotic cells, eukaryotic cells (including those from plants and animals), and viruses differ in complexity and general structure.

- The Central Dogma of molecular biology outlines the flow of information from transcription of RNA in the nucleus to translation of proteins on ribosomes in the cytoplasm.

- The role of the endoplasmic reticulum and Golgi apparatus in secretion of proteins.

- Usable energy is captured from sunlight by chloroplasts, and stored via the synthesis of sugar from carbon dioxide.

- The role of the mitochondria in making stored chemical bond energy available to cells by completing the breakdown of glucose to carbon dioxide.

- Most macromolecules (polysaccharides, nucleic acids, proteins, lipids) in cells and organisms are synthesized from a small collection of simple precursors.

Genetics

Mutation and sexual reproduction lead to genetic variation in a population. As a basis for understanding this concept, students know:

- 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.

- Only certain cells in a multicellular organism undergo meiosis.

- How random chromosome segregation explains the probability that a particular allele will be in a gamete.

- New combinations of alleles may be generated in a zygote through fusion of male and female gametes (fertilization).

- Why approximately half of an individual's DNA sequence comes from each parent.

- The role of chromosomes in determining an individual's sex.

- How to predict possible combinations of alleles in a zygote from the genetic makeup of the parents.

A multicellular organism develops from a single zygote, and its phenotype depends on its genotype, which is established at fertilization. As a basis for understanding this concept, students know:

- 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).

- The genetic basis for Mendel's laws of segregation and independent assortment.

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. As a basis for understanding this concept, students know:

- The general pathway by which ribosomes synthesize proteins, using tRNAs to translate genetic information in mRNA.

- How to apply the genetic coding rules to predict the sequence of amino acids from a sequence of codons in RNA.

- 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.

- Specialization of cells in multicellular organisms is usually due to different patterns of gene expression rather than to differences of the genes themselves.

- Proteins can differ from one another in the number and sequence of amino acids.

The genetic composition of cells can be altered by incorporation of exogenous DNA into the cells. As a basis for understanding this concept, students know:

- The general structures and functions of DNA, RNA, and protein.

- How to apply base-pairing rules to explain precise copying of DNA during semi-conservative replication, and transcription of information from DNA into mRNA.

Ecology

Stability in an ecosystem is a balance between competing effects. As a basis for understanding this concept, students know:

- biodiversity is the sum total of different kinds of organisms, and is affected by alterations of habitats.

- How to analyze changes in an ecosystem resulting from changes in climate, human activity, introduction of non-native species, or changes in population size.

- How fluctuations in population size in an ecosystem are determined by the relative rates of birth, immigration, emigration, and death.

- How water, carbon, and nitrogen cycle between abiotic resources and organic matter in the ecosystem and how oxygen cycles via photosynthesis and respiration.

- A vital part of an ecosystem is the stability of its producers and decomposers.

- At each link in a food web, some energy is stored in newly-made structures but much is dissipated into the environment as heat and this can be represented in a food pyramid.

Evolution

The frequency of an allele in a gene pool of a population depends on many factors, and may be stable or unstable over time. As a basis for understanding this concept, students know:

- Why natural selection acts on the phenotype rather than the genotype of an organism.

- Why alleles that are lethal in a homozygous individual may be carried in a heterozygote, and thus maintained in a gene pool.

- New mutations are constantly being generated in a gene pool.

- Variation within a species increases the likelihood that at least some members of a species will survive under changed environmental conditions.

Evolution is the result of genetic changes that occur in constantly changing environments. As a basis for understanding this concept, students know:

- How natural selection determines the differential survival of groups of organisms.

- A great diversity of species increases the chance that at least some organisms survive large changes in the environment.

- The effects of genetic drift on the diversity of organisms in a population.

- Reproductive or geographic isolation affects speciation.

- How to analyze fossil evidence with regard to biological diversity, episodic speciation, and mass extinction.

Physiology

As a result of the coordinated structures and functions of organ systems, the internal environment of the human body remains relatively stable (homeostatic), despite changes in the outside environment. As a basis for understanding this concept, students know:

- How the complementary activity of major body systems provides cells with oxygen and nutrients, and removes toxic waste products such as carbon dioxide.

- How the nervous system mediates communication between different parts of the body and interactions with the environment.

- How feedback loops in the nervous and endocrine systems regulate conditions within the body.

- The functions of the nervous system, and the role of neurons in transmitting electrochemical impulses.

- The roles of sensory neurons, interneurons, and motor neurons in sensation, thought, and response.

Organisms have a variety of mechanisms to combat disease. As a basis for understanding the human immune response, students know:

- The role 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.

- There are important differences between bacteria and viruses, with respect to their requirements for growth and replication, the primary

- defense of the body against them, and effective treatment of infections they cause.

- Why an individual with a compromised immune system (for example, a person with AIDS) may be unable to fight off and survive infections of microorganisms that are usually benign.

GRADING CRITERIA:	**Activity**	**Percentages**
	Laboratory/Class Activities	40%
	Assessment	40%
	Homework	20%

TEXTBOOK: **Biology: Principles & Explorations**
Publisher: Holt, Reinhart, and Winston
Author: George B. Johnson, Peter H. Raven
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Revised: 4/20/00