

Science Department Guide College Prep Biology

Course Description: College Prep Biology

College Prep Biology, one of the laboratory science courses, is offered primarily to sophomores who have completed Introduction to Physical Science as freshmen. Some freshmen take this course if they completed physical science in the eighth grade. This course fulfills four credits of the twelve credits in science necessary for graduation from high school. The class meets for 56 minutes in a rotating schedule of 6 classes in 7 school days of a 180 day school year. The final grade is determined by four terms, each worth 20% and two end of semester exams, each worth 10%.

This is a college preparatory course based on the biological concepts, principles, and interrelationships between organisms and their environment, with special emphasis on systems of the human body. Mankind's place in the living world is emphasized through better understanding of the individual and his or her environment, including social implications of major biological problems. Outside written and reading assignments augment the classroom and laboratory work. Laboratory activities include the study of cells, tissues, plants and a variety of organisms. The students will also carry out dissection of various organisms. Student evaluation is by chapter tests, quizzes, semester exams laboratory reports, special reports where appropriate, and class participation.

Science is a basic ingredient of our culture. Its study prepares one to understand natural phenomenon, to weigh evidence, to develop a system of prediction, and to make decisions in an objective manner. This preparation can be best accomplished through activities, experiences, and problems that are inquiry oriented. Prerequisite: It is recommended that the student have a minimum "C" average in Physical Science and Algebra I and be enrolled in Geometry.

Successful completion of C.P. Biology with a C or better is required for the student to enroll next year in College Preparatory Chemistry.

Major Course Objectives

When students have completed College Prep Biology they will know and be able to:

1. Demonstrate the makeup of atoms and molecules with emphasis on chemical reactions that produce organic molecules.
2. Explain that all living things are composed of cells and life processes in the cell are based on molecular interactions.
3. Describe how heredity is based on genes that are a set of instructions that determine the makeup of proteins in an organism.
4. Demonstrate patterns of heredity as genes are carried on to successive generations.
5. Identify the major systems in the human body (e.g. respiratory system), the organs (e.g. lung), the functional units (e.g. alveoli) and describe the functions (e.g. exchange of oxygen and carbon dioxide with the blood) of the various parts.
6. Describe how an organism is a sum of many parts which are integrated to maintain homeostasis balance in the organism.
7. Explain evolution and biodiversity in conjunction with genetic changes that occur in constantly changing environments.
8. Describe interactions between organisms and their environments, demonstrate understanding of food webs, and explain how changing environments cause changes in ecosystems.

9. Become proficient in dissection of animals and finding and identifying structures by following written procedures.

**Learning Standards that are met in the Massachusetts Science and Technology/
Engineering Frameworks (May 2001)**

1. The Chemistry of Life

- 1.1 Explain the significance of carbon in organic molecules.
- 1.2 Recognize the six most common elements in organic molecules (C, H, N, O, P, S)
- 1.3 Describe the composition and functions of the four major categories of organic molecules (carbohydrates, lipids, proteins, and nucleic acids)
- 1.4 Describe how dehydration synthesis and hydrolysis relate to organic molecules.
- 1.5 Explain the role of enzymes in biochemical reactions.

2. Structure and function of cells

- 2.1 Relate cell parts/organelles to their function.
- 2.2 Differentiate between prokaryotic cells and eukaryotic cells, in terms of their general structures and degrees of complexity.
- 2.3 Distinguish between plant and animal cells.
- 2.4 Explain the role of cell membranes as a highly selective barrier (diffusion, osmosis, and active transport)
- 2.5 Identify the reactants and the products in the general reaction of photosynthesis. Describe the use of isotopes in this identification.
- 2.6 Provide evidence the organic compounds produced by plants are the primary source of energy and nutrients for most living things.
- 2.7 Identify how cellular respiration is important for the production of ATP.
- 2.8 Explain the interrelated nature of photosynthesis and cellular respiration.
- 2.9 Describe the processes of mitosis and meiosis, and their role in the cell cycle.

3. Genetics

- 3.1 Describe the structure and function of the nucleic acids, DNA and RNA, and distinguish among replication, transcription, and translation.
- 3.2 Describe the process of replication, transcription, and translation and how they relate to each other in molecular biology.
- 3.3 Describe the general pathway by which ribosomes synthesize proteins by using tRNAs to translate genetic information encoded in mRNAs.
- 3.4 Explain how mutations in the DNA sequence of a gene may be silent or result in phenotypic changes in an organism and in its offspring.
- 3.5 Differentiate between dominant, recessive, codominant, polygenic, and sex-linked traits.
- 3.6 State Mendel's laws of segregation and independent assortment.
- 3.7 Use a Punnett Square to determine the genotype and phenotype of monohybrid crosses.
- 3.8 Explain how zygotes are produced in the fertilization process.
- 3.9 Recognize that while viruses lack cell structure, they have the genetic material to invade living cells.

4. Human Anatomy and Physiology

- 4.1 Explain major organ systems in humans (e.g. kidney, muscle, lung) have functional units (nephron, sarcomere, alveoli) with specific anatomy that perform the function of that organ.
- 4.2 Describe how the function of individual systems within humans are integrated to maintain a homeostatic balance in the body

5. Evolution and Biodiversity

- 5.1 Explain how the fossil record, comparative anatomy, and other evidence support the theory of evolution.
- 5.2 Illustrate how genetic variation is preserved or eliminated from a population through Darwinian natural selection (evolution) resulting in biodiversity.

5.3 Describe how the taxonomic system classifies living things into domains (eubacteria, archaebacteria, and eukaryotes) and kingdoms.

6. Ecology

- 6.1 Explain how biotic and abiotic factors cycle in the ecosystem.
- 6.2 Use a food web to identify and distinguish producers, consumers and decomposers, and explain the transfer of energy through trophic levels.
- 6.3 Identify the factors in an ecosystem that influence fluctuations in population size.
- 6.4 Analyze changes in an ecosystem resulting from natural causes, changes in climate, human activity, or introduction of non-native species.
- 6.5 Explain how symbiotic behavior produces interactions within ecosystems.

Assessment Tools

Success in Biology will be assessed by the following criteria:

1. Homework will be checked for completeness, neatness and done on time.
2. Class work will be evaluated for completeness, neatness, staying on task, cooperation and done on time.
3. Lab work will be evaluated for completeness, neatness, staying on task, cooperation and done on time.
4. Tests and quizzes will be evaluated based on understanding of concepts and knowledge of material developed from textbook, homework, class work and lab work.
5. An exam at the end of each semester will be given based on the cumulative work of the semester.

Textbook

Towle, Albert, Modern Biology. Orlando, Florida: Holt, Rinehart and Winston Inc. 1993

Relationship to the Scituate High School Mission Statement

- Focus on cognitive, emotional, physical and social development.
- Foster students' reading, writing, calculating, problem solving , critical thinking skills and creative expression.
- Nurture self-confidence, independence, cooperation, and physical well being.
- Encourage students to develop a sense of values and responsibilities.
- Encourage students to become contributing members of their community and of global society.
- Guide students toward becoming lifetime learners with a positive outlook on the world.