STAFFORD COUNTY PUBLIC SCHOOLS

Curriculum Overview
Biology

Course Description:
This course provides a program in biology which is both laboratory and lecture-oriented. Included are the studies of cell structure and function, genetics, and the diversity of life. There is a strong emphasis on lab work. This course is designed to establish a firm foundation for the biological sciences. Students will take the Standards of Learning test during this course.

Essential Skills/Processes:
The goals of the course are to educate the student in the material content of Biology, to increase science inquiry skills and logical thinking, and foster positive attitudes for further science study. There will be preparation for the Biology Standards of Learning Test.

- The student will investigate and understand the history of biological concepts
- The student will investigate and understand the chemical and biochemical principles essential for life
- The student will investigate and understand relationships between cell structure and function
- The student will investigate and understand life functions of archaebacteria, monerans (eubacteria), protists, fungi, plants, and animals including humans
- The student will investigate and understand common mechanisms of inheritance and protein synthesis
- The student will investigate and understand bases for modern classification systems
- The student will investigate and understand how populations change through time
- The student will investigate and understand dynamic equilibria within populations, communities, and ecosystems

Essential Knowledge:
Essential knowledge and skills is categorized into six strands.

Science as Process:

- Hypotheses based on direct observations and information from the scientific literature.
- Differentiation is made between a scientific hypothesis and theory.
- Data gathered and recorded including the construction and analysis of graphs, charts, and diagrams with conclusions based on quantitative and qualitative data.
- Using appropriate equipment and technology for measurements and analysis including computers, graphing calculators, and probeware.
- History of biological concepts including cell theory, scientific explanations of the development of organisms through time, germ theory of infectious disease, development of the structural model of DNA, and collaborative efforts of scientists.
- A scientific viewpoint is constructed and defended.
- An emphasis on laboratory safety.

Chemistry and Life:

- Basic chemistry including the structure of atoms, molecules, the nature of elements, compounds, and bonding types.
- Water chemistry including polarity, hydrogen bonds, and the impact of water chemistry on life.

- The structure and function of organic compounds including carbohydrates lipids, proteins, and nucleic acids.
- The nature of enzymes.
- The process of photosynthesis including light and dark reactions, overall equation, and the role of chlorophyll.
- The process of respiration including glycolysis, fermentation, aerobic respiration, overall equation, and the role of mitochondria.
- The capture, storage, transformation, and flow of energy through the processes of photosynthesis and respiration.

Cells:

- Structure and function of cell organelles.
- The cell membrane model and the processes of diffusion, osmosis, and active transport.
- Characteristics of cells including procaryotic, eukaryotic, plant, and animal.
- Levels of organization; homeostasis.

Diversity of Life:

- History of taxonomy; classification hierarchies.
- Criteria for classification including structural similarities, the fossil record, comparison of developmental stages, biochemical similarities.
- Systems that are adaptable to new scientific discoveries.
- The five-kingdom system of classification.
- Structure and characteristics of viruses.
- Monerans including the structure and shapes of bacteria, the role of free living bacteria and organisms of disease.
- Life functions of archaebacteria and eubacteria.
- Types of algae and fungi including examples and their life cycles.
- Protists including flagellates, sarcodines, ciliates, and sporozoans.
- Vascular and nonvascular plants, their major structures, the process of photosynthesis, and plant reproduction.
- A survey of animals both vertebrate and invertebrate, characteristics and examples of each group.
- Human anatomy and body systems; human health issues.

Genetics and Evolution:

- Process and stages of cell division including mitosis and meiosis; gamete formation.
- Structure, function, and replication of nucleic acids (DNA and RNA).
- DNA and the process of protein synthesis.
- Genetic variation (mutation, recombination, deletions, additions to DNA).
- Use, limitations, and misuse of genetic information and the impact of DNA technologies.
- Prediction of inheritance of traits based on Mendelian laws of heredity.
- How populations change through time, how adaptations lead to natural selection, how new species emerge, and evidence found in fossils.
- Scientific explanations for biological evolution.

Ecology:

- Nutrient cycles and energy flow through ecosystems.
- Interactions within ecosystems including biotic and abiotic factors.
- The concepts of niche, succession, carrying capacity, and growth curves; human influences.
- Analysis of the flora, fauna, and microorganisms of Virginia ecosystems including the Chesapeake Bay and its tributaries.