**MICROBIOLOGY**

COURSE OF STUDY

I. **Academic Content Standard**

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| **Life Science** Students demonstrate an understanding of how living systems function and how they interact with the physical environment. This includes an understanding of the cycling of matter and flow of energy in living systems. An understanding of the characteristics, structure and function of cells, organisms and living systems will be developed. Students will also develop a deeper understanding of the principles of heredity, biological evolution, and the diversity and interdependence of life. Students demonstrate an understanding of different historical perspectives, scientific approaches and emerging scientific issues. |

**Benchmarks**

 **A**. Explain how processes at the cellular level affect the functions and characteristics of an organism.

 1. Describe how the maintenance of a relatively stable internal environment is required for the continuation of life, and explain how stability is challenged by changing physical, chemical, and environmental conditions.

* Membrane Transports processes, Bacterial growth / control.

 2. Explain that carbon-containing molecules can be used to assemble larger molecules with biological activity (including proteins, DNA, sugars, and fats).

* Biochemistry, Organic molecules.

3. Recognize that information stored in DNA provides instructions for assembling proteins used by cells that determine the characteristics of the organism.

* DNA replication, transcription, translation, Biochemistry.

4. Explain why specialized cells / structures are useful to plants and animals (e.g., stoma, phloem, xylem, blood, nerve, muscle, egg, and sperm).

* Identify and describe the functions of the structures within prokaryotic and eukaryotic cells / organisms.

 **B.** Explain that living things are classified by scientists based on similarities and differences that reflect their evolutionary relationships.

1. Describe the major characteristics of bacteria, including morphology, metabolism, and growth characteristics.

* Basic groups, shape, and arrangements of bacteria, Common bacterial structures and composition, Bacterial life functions / reproductive methods.

2. Describe the major characteristics of non-bacterial microbes (e.g., fungi, algae, protozoans, viruses).

* Identify and describe the functions of the structures within prokaryotic and eukaryotic cells / organisms, Protozoan laboratory, Independent studies.

 3. Identify the structure and reproductive cycles of viruses.

* Viral composition, genetic variation, Lytic and lysogenic cycles, Viral mutation.

 **C**. Explain how humans are connected to and impact natural systems.

 1. Investigate the impact on organisms due to changes in the abiotic and biotic components due to human activity.

* Bacterial growth / control mechanisms, Medical / Sanitation methods, Beneficial aspects of microbial growth.

2. Describe the physical and chemical control methods for microorganisms.

* Bacterial growth / control mechanisms, Bacterial growth / control laboratory.

 3. Identify common pathogens that cause disease in humans and describe some of the characteristics, treatments, and preventive measures of the disease.

* Independent study activities.

 4. Give examples of how human activity can accelerate rates of natural change and can have unforeseen consequences.

* Viral / Microbial resistance, Bacterial growth / control mechanisms, Bacterial growth / control laboratory.

 **D**. Explain the interconnectedness of the components of a natural system.

 1. Show how populations can increase / decrease through linear or exponential growth with changing environmental conditions.

* Bacterial growth / control mechanisms, Bacterial growth / control laboratory.

2. Relate diversity and adaptation to structures and functions of living organisms at different levels of organization.

* Common bacterial structures and composition, Bacterial life functions / reproductive methods.

 3. Relate how survival and reproductive rates of an organism are affected by various environmental factors.

* Bacterial growth / control mechanisms, Bacterial growth / control laboratory.

 **E**. Summarize the historical development of scientific theories and ideas within the study of life sciences.

 1. Use historical examples to explain how new ideas are limited by the context in which they are conceived; are often initially rejected by the scientific establishment; sometimes spring from unexpected findings; and usually grow slowly through contributions from many different investigators (e.g., nuclear energy, quantum theory, theory of relativity).

* Cell Theory, Spontaneous Generation, Disease Theory, etc.

2. Describe advances in life sciences that have important, long-lasting effects on science and society (e.g., biotechnology).

* Vaccination, Food Preservation / Preparation, Bioremediation, etc.

3. Identify the major historical figures and describe their contribution to the development of modern microbiology.

* Hooke, van Leeuwenhoek, Redi, Spallanzani, Pasteur, Koch, Jenner, etc.

II. **Academic Content Standard**

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| **Scientific Inquiry** Students develop scientific habits of mind as they use the processes of scientific inquiry to ask valid questions and to gather and analyze information. They understand how to develop hypotheses and make predictions. They are able to reflect on scientific practices as they develop plans of action to create and evaluate a variety of conclusions. Students are also able to demonstrate the ability to communicate their findings to others. |

**Benchmarks**

 **A**. Make appropriate choices when designing and participating in scientific investigations by using cognitive and manipulative skills when collecting data and formulating conclusions from the data.

 1. Become acquainted with and demonstrate common procedures and methods of microscope use, staining techniques, and culturing processes used to study microorganisms in the laboratory.

* Identify and describe the functions of the parts of a microscope. Demonstrate proper handling and use of the microscope.
* Describe the purpose and use of various staining techniques (e.g., Simple, Gram) and produce usable slides using each technique.
* Prepare and inoculate sample cultures using appropriate aseptic techniques.

 2. Formulate testable hypotheses. Develop and explain the appropriate procedures, controls and variables in scientific experimentation.

* Various lab activities.

 3. Create and clarify the method, procedure, controls, and variables in complex scientific investigations.

* Various lab activities.

 4. Summarize data and construct a reasonable argument based on those data and other known information.

* Various lab activities, Independent study projects.

 5. Design and carry out scientific inquiry (investigation), communicate and critique results through written and oral practices.

* Various lab activities, Independent study projects

 6. Apply appropriate safety precautions when designing and conducting scientific investigations (e.g., OSHA, MSDS, eyewash, goggle, ventilation).

* Various lab activities.