Thomaston Public Schools - Curriculum Overview and Pacing Guide

Course Title: Biology (College and Honors)		
School: THS	**Grade: Nine**	**Curriculum Pacing: 36 weeks**
Unit One: Chemistry of Life	**Unit Two: Cells Organs and Organs Systems**	**Unit Three: Energy Transfer and Use**
Unit Pacing: 6 weeks	**Unit Pacing: 6 weeks**	**Unit Pacing: 6 weeks**
Unit Overview:The performance expectations in the topic "Chemistry of Life" help students formulate an answer to the question: "How do the structures of organisms enable life's functions?" High school students are able to investigate explanations for the structure and function of cells as the basic units of life, the hierarchical systems of organisms, and the role of specialized cells for maintenance and growth and the role of water in the development of life on planet earth. Students demonstrate understanding of how systems of cells function together to support the life processes. Students demonstrate their understanding through critical reading, using models, and conducting investigations. The crosscutting concepts of structure and function, matter and energy, and systems and system models in organisms are called out as organizing concepts.	**Unit Overview:** The performance expectations in the topic "Cells Organ Systems and Homeostasis" help students formulate an answer to the question: Students formulate an answer to the question "*How do cells and organs work together to maintain homeostasis?" S*tudents investigate explanations for the structure and functions of cells as the basic unit of life, of hierarchical organization of interacting organ systems, and of the role of specialized cells for maintenance and growth. The crosscutting concepts of *structure and function*, *matter and energy*, and *systems and system models* are called out as organizing concepts for the disciplinary core ideas. Students use *critical reading*, *modeling*, and *conducting investigations*. Students also use the science and engineering practices to demonstrate understanding of the disciplinary core ideas.	**Unit Overview**: In most cases, the energy needed for life is ultimately derived from the sun through photosynthesis (although in some ecologically important cases, energy is derived from reactions involving inorganic chemicals in the absence of sunlight— e.g., chemosynthesis). Plants, algae (including phytoplankton), and other energy fixing microorganisms use sunlight, water, and carbon dioxide to facilitate photosynthesis, which stores energy, forms plant matter, releases oxygen, and maintains plants' activities. Plants and algae—being the resource base for animals, the animals that feed on animals, and the decomposers—are energy-fixing organisms that sustain the rest of the food web. The crosscutting concepts of *Systems and System Models* and *Matter and Energy* are called out as organizing concepts for the disciplinary core ideas. Students use *critical reading*, *modeling*, and *conducting investigations*. Students also use the science and engineering practices to demonstrate understanding of the disciplinary core ideas.

Compelling Questions	**Compelling Questions**	**Compelling Questions**
1) What role do chemicals and water play in my life? 2) How do organisms live and grow ? 3) How do living systems response chemically and physically to their environment?	1) How do organisms live and grow? 2) How do our systems work together to maintain homeostasis and adjust to each others responses?	1) How do organisms use chemical energy to do work? 2) How is energy created and transferred in living organisms? 3) How is energy shared between the processes of photosynthesis and cellular respiration and why is this important to me?
Priority Learning Targets	**Priority Learning Targets**	**Priority Learning Targets**
1) I can explain the connection between the sequence and the subcomponents of a biomolecule, their properties and where they are utilized by living systems. (NGSS LS1.6; DCI LS1.A: HS-LS1-1) 2) I can design a model to illustrate the structure and function of enzymes. (NGSS LS1.3, DCI LS1.A) 3) I can design and conduct an experiment to evaluate the effects of environmental factors on enzyme function and deduce the fundamental relationship between two variables. (NGSS LS1.3, DCI LS1.A: HS-LS1-3)	1) I can create a model/ diagram and explain cell structure and function in unicellular and multicellular organisms. (NGSS LS1.2; NGSS LS1.3; DCI LS1.A: HS-LS1-2, HS-LS1-3) 2) I can assess and develop a scientific explanation on how communication and cell regulation are accomplished within multicellular organisms and their supporting systems. (NGSS LS1.3; DCI LS1.A: HS-LS1-2) 3) I can assess and develop a scientific explanation on how communication and cell regulation are accomplished within multicellular organisms and their supporting systems. (NGSS LS1.3; DCI LS1.A: HS-LS1-3)	1) I can create research questions and model the transfer and use of matter and energy in photosynthesis. (NGSS LS1.5; NGSS LS1.7; DSI LS1.C) 2) I can perform independent research to model the transfer and use of matter and energy in photosynthesis.(NGSS LS1.6; NGSS LS2.3; DCI LS1.A: HS-LS1-2) 3) I can use a model to describe the transfer of energy from one trophic level to another and show how matter and energy are conserved as matter cycles and energy flows through ecosystems. (NGSS LS2.4; NGSS LS2.5; DCI LS2.BS2.B)

Unit Four: Mitosis, Meiosis and Genetics	**Unit Five: Nucleic Acids and Protein Synthesis**	**Unit Six: Evolution and BioDiversity**
Unit Pacing: 6 weeks	**Unit Pacing: 6 weeks**	**Unit Pacing: 6 weeks**
Unit Overview: In Unit 4- Mitosis, Meiosis and Genetics, students analyze data develop models to make sense of the relationship between DNA and chromosomes in the process of cellular division, which passes traits from one generation to the next. Students determine why individuals of the same species vary in how they look, function, and behave. Students develop *conceptual models* of the role of DNA in the unity of life on Earth and *use statistical models* to explain the importance of variation within populations for the survival and evolution of species. Ethical issues related to genetic modification of organisms and the nature of science are described. Students explain the mechanisms of genetic inheritance and describe the environmental and genetic causes of gene mutation and the alteration of gene expressions. The crosscutting concepts of *structure and function*, *patterns*, and *cause and effect* are used as organizing concepts for the disciplinary core ideas. Students also use the science and engineering practices to demonstrate understanding of the disciplinary core ideas.	**Unit Overview**:In Unit 5 - Nucleic Acid and Protein Synthesis, students analyze data develop models to make sense of the relationship between DNA and chromosomes in the process of protein synthesis, which allows for organisms to function and grow. Students determine why individuals of the same species vary in how they look, function, and behave. Students develop *conceptual models* of the role of DNA in the unity of life on Earth. Ethical issues related to genetic modification of organisms and the nature of science are described. Students explain the mechanisms of genetic inheritance and describe the environmental and genetic causes of gene mutation and the alteration of gene expressions. The crosscutting concepts of *structure and function*, *patterns*, and *cause and effect* are used as organizing concepts for the disciplinary core ideas. Students also use the science and engineering practices to demonstrate understanding of the disciplinary core ideas.	**Unit Overview:** In Unit 6 -Evolution, Diversity and Classification, students analyze data develop models to make sense of the relationship between natural selection and evolution and how the environment causes populations to change to meet their needs. Students determine why individuals of the same species vary in how they look, function, and behave. Students develop *conceptual models* of evolution and is role in the origin of the species(es). Students explain the mechanisms of evolution and describe the environmental and how this “selects” for certain genetic traits. The crosscutting concepts of *structure and function*, *patterns*, and *cause and effect* are used as organizing concepts for the disciplinary core ideas. Students also use the science and engineering practices to demonstrate understanding of the disciplinary core ideas.
Compelling Questions 1) What is the significance of mitosis as it relates to growth, development and repair of cells and tissues and why is this important to me?	**Compelling Questions** 1) What is the relationship between the processes of replication, transcription and translation and how are they regulated?	**Compelling Questions** 1) What is a species? 2) How do chemical and structural relationships indicate related ancestry?

2) Why is regulation of the cell cycle important? 3) What are the similarities between mitosis and meiosis? 4) How does meiosis lead to genetic variability in population?	2) How does the structure of nucleic acids, genes and chromosomes relate to their function? 3) What is the importance of DNA in future biotechnological advances and why is it relevant to my life? 4) What legal and ethical problems have arisen from new DNA technologies?	3) Is evolution a long process or punctuated? 4) Why do species go extinct and why is this relevant to me?
Priority Learning Targets 1) I can compile information from various sources to explain the sequence of events for the cell cycle. (NGSS LS1-4; DCI LS1.B) 2) I can compare/ contrast mitosis and meiosis, and create a model which illustrates how the sorting and recombination of genes during meiosis yields effects.(NGSS LS3-1; NGSS LS3-3; DCI LS3.A) 3) I can synthesize/ model and explain the relationship among genes, chromosomes, and DNA. (NGSS LS3-2; DCI LS3.B: HS-LS3-2, HS-LS3-3)	**Priority Learning Targets** 1) I can investigate through various sources how the processes of transcription, translation and replication are regulated by the nucleus. (NGSS LS1.1; DCI LS1.A; DCI LS1.B) 2) .I can examine the genetic modifications in an organism using modern recombinant genetic techniques. (NGSS LS3.1; DCI LS3.A) 3) I can assess the role(s) of genetic counseling and the role of biotechnology in society (drug development, GMO, GMF, CRISPR (Clustered Regularly, Interspaced Short Palindromic Repeats.(NGSS LS4.4; DCI LS3.B)	**Priority Learning Targets** 1) I can compile evidence and explain how living things originated from previous ancestors. (NGSS LS4.1; DCI LS4.A) 2) I can investigate and explain the mechanisms which result in evolutionary changes in a population (i.e., genetic variation, environmental changes, and natural selection.) (NGSS LS4.2; DCI LS4.B; DCI LS4.C) 3) I can conduct research in order to develop explanations for how past species have gone extinct and what can be done to prevent extinction of modern day species. (NGSS LS4.3; NGSS LS4.5; DCI LS4.B; DCI LS4.C)