The academic standards for High School Biology I establish the content knowledge and skills for Tennessee students in order to prepare them for the rigorous levels of higher education and future job markets. The course provides students with a wealth of experiences for both science practices and content knowledge needed in an ever changing world. The academic standards for Biology I are research-based, supported by the National Research Council’s Framework for K-12 Science Education, and establish the core ideas and practices of science and engineering that will prepare students to use scientific thinking to examine and evaluate knowledge encountered throughout their lives.

The major disciplinary core ideas utilized for Biology I include:

Biology I (BIO1)

From Molecules to Organisms: Structure and Process

• Organic molecules
• DNA structure and function
• Protein synthesis
• Protein structure and function
• Cellular differentiation and coordinated functions
• Eukaryotic cell cycle
• Membrane transport
• Photosynthesis and respiration

Engineering Design

Ecosystems: Interactions, Energy, and Dynamics

• Population dynamics
• Carbon cycle
• Energy transfer
• Succession
• Biodiversity and ecosystem stability

Links Among Engineering, Technology, Science, and Society

• Molecular biotechnology applications
• Ethical debates of biotechnology use

Heredity: Inheritance and Variation of Traits
• Sexual reproduction
• Phenotype determining factors
• Pedigree analysis and predictions

Biological Change: Unity and Diversity
• Evidence for evolution
• Natural selection
• Evolutionary processes
• Speciation
• Global biodiversity patterns
• Human activities that impact biodiversity

Although science is a body of knowledge consisting of theories that explain data, science is also a set of practices that use analysis and argumentation to establish, extend, and refine knowledge. The steps are intended to be a sequence of steps nor are they intended to be taught as a separate, introductory unit.

These practices are not for the course.

and engineering practices are used as a means to learn science by doing science.

By combining content knowledge with skill, students discover how scientific knowledge is acquired and applied to solve problems or advance scientific knowledge further. In addition, there are seven crosscutting concepts that and crosscutting concepts, within each core idea to provide students with a well-rounded education in science.

Tennessee's state mathematics standards are integrated into the science standards, specifically LS3.3. Special attention is given to science literacy through the use of the science and engineering practices. Students are required to gather information from reliable sources to construct evidenced-based arguments. Finally, STEM integration is supported both as a stand-
alone disciplinary core idea as well as integrated into the life science core ideas. By the end of high school, it is expected that all students should be able to demonstrate the skills and content knowledge emphasized in the following standards.

Science are fundamental to the nature of science and thus stretch across all science disciplines. The Biology I standards have been constructed by explicitly integrating practices iteratively and in combination,

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BIOLOGY I: ACADEMIC STANDARDS

BIO1.LS1: From Molecules to Organisms: Structures and Processes

1) Compare and contrast existing models, identify patterns, and use structural and functional evidence to analyze the characteristics of life. Engage in argument about the designation of viruses as non-living based on these characteristics.

2) Evaluate comparative models of various cell types with a focus on organic molecules that make up cellular structures.

3) Integrate evidence to develop a structural model of a DNA molecule. Using the model, develop and communicate an explanation for how DNA serves as a template for self-replication and encodes biological information.

4) Demonstrate how DNA sequence information is decoded through transcriptional and translational processes within the cell in order to synthesize proteins. Examine the relationship of structure and function of various types of RNA and the importance of this relationship in these processes.

5) Research examples that demonstrate the functional variety of proteins and construct an argument based on evidence for the importance of the molecular structure to its function. Plan and carry out a controlled investigation to test predictions about factors, which should cause an effect on the structure and function of a protein.

6) Create a model for the major events of the eukaryotic cell cycle, including mitosis. Compare and contrast the rates of cell division in various eukaryotic cell types in multicellular organisms.
7) Utilize a model of a cell plasma membrane to compare the various types of cellular transport and test predictions about the movement of molecules into or out of a cell based on the homeostasis of energy and matter in cells.

8) Create a model of photosynthesis demonstrating the net flow of matter and energy into a cell. Use the model to explain energy transfer from light energy into stored chemical energy in the product.

9) Create a model of aerobic respiration demonstrating flow of matter and energy out of a cell. Use the model to explain energy transfer mechanisms. Compare aerobic respiration to alternative processes of glucose metabolism.

BIO1.LS2: Ecosystems: Interactions, Energy, and Dynamics

1) Analyze mathematical and/or computational representations of population data that support explanations of factors that affect population size and carrying capacities of populations within an ecosystem. Examine a representative ecosystem and, based on interdependent relationships present, predict population size effects due to a given disturbance.

2) Create a model tracking carbon atoms between inorganic and organic molecules in an ecosystem. Explain human impacts on climate based on this model.

3) Analyze through research the cycling of matter in our biosphere and explain how biogeochemical cycles are critical for ecosystem function.

4) Analyze data demonstrating the decrease in biomass observed in each successive trophic level. Construct an explanation considering the laws of conservation of energy and matter and represent this phenomenon in a mathematical model to describe the transfer of energy and matter between trophic levels.

5) Analyze examples of ecological succession, identifying and explaining the order of events responsible for the formation of a new ecosystem in response to extreme fluctuations in environmental conditions or catastrophic events.

BIO1.LS3: Heredity: Inheritance and Variation of Traits

1) Model chromosome progression through meiosis and fertilization in order to argue how the processes of sexual reproduction lead to both genetic similarities and variation in diploid organisms. Compare and contrast the processes of sexual and asexual reproduction, identifying the advantages and disadvantages of each.

2) Explain how protein formation results in phenotypic variation and discuss how changes in DNA can lead to somatic or germ line mutations.
3) Through pedigree analysis, identify patterns of trait inheritance to predict family member genotypes. Use mathematical thinking to predict the likelihood of various types of trait transmission.

BIO1.LS4: Biological Change: Unity and Diversity

1) Evaluate scientific data collected from analysis of molecular sequences, fossil records, biogeography, and embryology. Identify chronological patterns of change and communicate that biological evolution is supported by multiple lines of empirical evidence that identify similarities inherited from a common ancestor (homologies).

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2) Using a model that demonstrates the change in allele frequencies resulting in evolution of a population over many generations, identify causative agents of change.

3) Identify ecosystem services and assess the role of biodiversity in support of these services. Analyze the role human activities have on disruption of these services.

BIO1.ETS2: Links Among Engineering, Technology, Science, and Society

1) Obtain, evaluate, and communicate information on how molecular biotechnology may be used in a variety of fields.

2) Investigate the means by which karyotypes are utilized in diagnostic medicine.

3) Analyze scientific and ethical arguments to support the pros and cons of application of a specific biotechnology technique such as stem cell usage, in vitro fertilization, or genetically modified organisms.