Tennessee Tutorials are designed specifically for the Tennessee Academic Standards to prepare students for the Tennessee Comprehensive Assessment Program (TCAP) and the TNReady assessments.

Biology Tutorials offer targeted instruction, practice, and review designed to help students develop fluency, deepen conceptual understanding, and apply scientific thinking skills. Students engage with the content in an interactive, feedback-rich environment as they progress through standards-aligned modules. By constantly honing their ability to explain and analyze biological scenarios, students build the depth of knowledge and higher-order skills required to demonstrate their mastery when put to the test.

In each module, the Learn It and Try It make complex ideas accessible through focused content, guided analysis, multi-modal representations, and personalized feedback as students reason through increasingly challenging problems. The Review It offers a high impact summary of key concepts and relates those concepts to students' lives. The Test It assesses students' mastery of the module's concepts, providing granular performance data to students and teachers after each attempt. To help students concentrate on the content most relevant to them, unit-level pretests and posttests can quickly identify where students are strong and where they're still learning.

Unit 1: Nature of Life

- **CHARACTERISTICS OF LIFE**
  - BIO1.LS4.4: Construct an explanation based on evidence for how natural selection leads to adaptation in populations.
  - BIO1.LS1.4: Create, or use, a model to describe how the process of photosynthesis converts light energy into the stored chemical energy of bonds created by converting CO2 and H2O into sugar and other organic molecules.
  - BIO1.LS1.2: Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.
  - BIO1.LS1.3: Use a model to describe how differentiation in a multicellular organism creates specialized cells that perform diverse functions to work together to meet the needs of the entire organism, including human development.
- **COMPONENTS OF DNA**
  - BIO1.LS1.1: Construct an explanation based on evidence that the essential functions of life are primarily carried out through the work of proteins that are coded for by genes in DNA, as described by the Central Dogma (i.e., transcription, translation).

Unit 2: From Genes to Proteins

- **THE GENETIC CODE**
  - BIO1.LS1.1: Construct an explanation based on evidence that the essential functions of life are primarily carried out through the work of proteins that are coded for by genes in DNA, as described by the Central Dogma (i.e., transcription, translation).
  - BIO1.LS3.3: Ask questions to clarify that variation of traits arises from differences in genes (alleles) and how cells regulate gene expression.
- **DNA REPLICATION**
  - BIO1.LS1.1: Construct an explanation based on evidence that the essential functions of life are primarily carried out through the work of proteins that are coded for by genes in DNA, as described by the Central Dogma (i.e., transcription, translation).
- **TRANSCRIPTION**
  - BIO1.LS1.1: Construct an explanation based on evidence that the essential functions of life are primarily carried out through the work of proteins that are coded for by genes in DNA, as described by the Central Dogma (i.e., transcription, translation).
- **TRANSLATION**
  - BIO1.LS1.1: Construct an explanation based on evidence that the essential functions of life are primarily carried out through the work of proteins that are coded for by genes in DNA, as described by the Central Dogma (i.e., transcription, translation).

Unit 3: Cellular Homeostasis

- **PASSIVE TRANSPORT**
  - BIO1.LS1.2: Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.
- **ACTIVE TRANSPORT**
  - BIO1.LS1.2: Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

Unit 4: Cellular Energetics

- **PHOTOSYNTHESIS**
  - BIO1.LS1.4: Create, or use, a model to describe how the process of photosynthesis converts light energy into the stored chemical energy of bonds created by converting CO2 and H2O into sugar and other organic molecules.
- **CELLULAR RESPIRATION**
  - BIO1.LS1.6: Create, or use, a model to describe how cellular respiration transforms stored chemical energy of food resulting in a net transfer of energy. Compare aerobic respiration to alternative processes of glucose metabolism.

Unit 5: Ecosystem Dynamics

- **PYRAMIDS OF ENERGY, NUMBERS, AND BIOMASS**

- BIO1.LS2.2: Create, or use, a mathematical model to describe the transfer of energy from one trophic level to another. Explain how the inefficiency of energy transfer between trophic levels affects the relative number of organisms that can be supported at each trophic level and necessitates a constant input of energy from sunlight and inorganic compounds from the environment.

- **NATURAL IMPACT OF ECOSYSTEMS**
  - BIO1.LS4.5: Obtain, evaluate, and communicate information about how changes in environmental conditions may result in (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.
  - BIO1.LS2.3: Obtain, evaluate, and communicate information based on evidence to describe how the impact of varying levels of disturbance is related to the resilience of an ecosystem.

Unit 6: Cycles and Human Impacts

- **CARBON?CYCLE**
  - BIO1.LS2.4: Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
- **IMPACTS OF HUMANS**
  - BIO1.LS2.4: Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

Unit 7: Cell Division

- **MITOSIS**
  - BIO1.LS3.1: Engage in an argument from evidence that the process of cellular division (mitosis) creates diploid daughter cells that are genetically identical to the diploid parent cells.
- **MEIOSIS**
  - BIO1.LS3.2: Engage in an argument from evidence that the process of meiosis exists to create genetic variation in a population from the creation of new combinations of genetic material in each of the haploid gametes.

Unit 8: Genetic Variation

- **GENETIC CHANGES IN DNA**
  - BIO1.LS3.4: Construct an explanation based on evidence that genetic variations may result from (a) new genetic combinations via the processes of crossing over and random segregation of chromosomes during meiosis, (b) mutations that occur during replication, and/or (c) mutations caused by environmental factors. Evidence should include that mutations that occur in gametes can be passed to offspring.
- **GENETIC CHANGES IN CHROMOSOMES**
  - BIO1.LS3.4: Construct an explanation based on evidence that genetic variations may result from (a) new genetic combinations via the processes of crossing over and random segregation of chromosomes during meiosis, (b) mutations that occur during replication, and/or (c) mutations

caused by environmental factors. Evidence should include that mutations that occur in gametes can be passed to offspring.

Unit 9: Biological Evolution

- **MULTIPLE LINES OF EVIDENCE**
  - BIO1.LS4.1: Analyze and interpret scientific data that common ancestry and biological evolution are supported by multiple lines of empirical evidence (e.g., DNA sequences, amino acid sequences, anatomical structures, the fossil record, biogeography, or order of appearance of structures during embryological development).
- **NATURAL SELECTION**
  - BIO1.LS2.1: Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.
  - BIO1.LS2.5: Analyze data about the role of group behavior on individual and species' chances to survive and reproduce.
  - BIO1.LS4.2: Apply concepts of statistics (i.e., probability) to support explanations that organisms in a population with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.
  - BIO1.LS4.3: Analyze and interpret data that natural selection is influenced by (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.
  - BIO1.LS4.4: Construct an explanation based on evidence for how natural selection leads to adaptation in populations.
- **EVOLUTION OF SPECIES**
  - BIO1.LS4.5: Obtain, evaluate, and communicate information about how changes in environmental conditions may result in (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.