Alabama Science

Biology

From Molecules to Organisms: Structures and Processes

Cells

Structure and Function

1 Engage in evidence-based argument to relate a cell's function to the structure, function, and diversity of its components. BIO.1

DNA and Protein Synthesis

Structure and Function

2 Obtain and evaluate information to explain the role of DNA and RNA in transcription and translation leading to protein synthesis and cellular function. BIO.2

- a Use a model to describe the structure and sequence of DNA, including nucleotide structure, base pairing, and the structure of the helix. BIO.2.A
- b Obtain and evaluate information to explore additional functions and regulatory roles of RNA, DNA, and protein, including their roles in gene expression and cellular differentiation. BIO.2.B
- c Obtain, evaluate, and communicate information regarding how DNA and genetic technology apply to daily life. BIO.2.C

Growth and Development

Systems and System Models

3 Develop and use models to explain how events during the cell cycle lead to the formation of new cells and repair of multicellular organisms, including cell growth, DNA replication, separation of chromosomes, and separation of cell contents. BIO.3

- a Construct an explanation of the process of DNA replication during cellular division (S-phase). BIO.3.A
- b Using observations of cell growth, construct an explanation of how the cell cycle leads to differentiation in tissue development. BIO.3.B

Cellular Homeostasis

Structure and Function

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4 Engage in argument from evidence to explain the regulation of cellular processes that maintain homeostasis, including active and passive transport. BIO.4

a Use models to illustrate how the structural characteristics of lipids and proteins in the cell membrane regulate cellular processes. BIO.4.A

b Construct an explanation of how the unique properties of water are vital to maintaining homeostasis in organisms. BIO.4.B

Photosynthesis and Respiration

Energy and Matter

5 Plan and carry out investigations and utilize results to explain the role and cycling of products and reactants involved in the cellular conversion of energy. BIO.5

a Construct an explanation of how the structural characteristics of carbohydrates and lipids store energy. BIO.5.A

b Use models of the reactants and products of photosynthesis to illustrate the conversion of light energy into stored chemical energy within cells. BIO.5.B

c Use models of the reactants and products of cellular respiration (both aerobic and anaerobic) to illustrate how chemical energy is stored in the bonds of carbohydrates and lipids and converted to ATP and heat when the bonds are broken. BIO.5.C

Ecosystems: Interactions, Energy, and Dynamics

Interdependent Relationships

Systems and System Models

6 Develop and use models to illustrate interactions between ecological hierarchy levels, including biosphere, biome, ecosystem, community, population, and organism. BIO.6

Matter and Energy Flow

Systems and System Models

7 Develop and use models to illustrate the flow of matter and energy between abiotic and biotic factors in ecosystems, including loss of heat, 10% rule, and the conservation of matter. BIO.7

Population Dynamics

Scale, Proportion, and Quantity

8 Construct an evidence-based explanation of how density-dependent and density-independent factors affect population growth. BIO.8

Biodiversity

:ale, Proportion, and Quantity

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9 Obtain, evaluate, and communicate data to explain how the biodiversity of Alabama contributes to ecosystem services in the state. BIO.9

Biodiversity

Stability and Change

10 Engage in argument from evidence to support the claim that characteristics of an ecosystem contribute to its resilience and stability, including ecological succession and recovery from disturbance. BIO.10

Heredity: Inheritance and Variation of Traits

Inherited Traits and Environmental Impact

Patterns

11 Use probability and statistical models to explain the variation of expressed traits within a population. BIO.11

Inherited Traits and Environmental Impact

Systems and System Models

Heredity and Meiosis

Systems and System Models

12 Develop and use an evidence-based model to illustrate the formation of reproductive cells through the process of meiosis. BIO.12

Heredity and Meiosis

Cause and Effect

Use mathematics and computational thinking to predict patterns of inheritance, including dominance, recessiveness, codominance, and incomplete dominance. BIO.11.A

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Obtain, evaluate, and communicate information about how the interplay of heritable risk factors, somatic mutations, and en

b **Obtain, evaluate, and communicate information about how the interplay of heritable risk factors, somatic mutations, and environment influences human disease.** BIO.11.B

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human disease. BIO.11.B

Construct an explanation of how new genetic combinations and variations occur during crossover. BIO.12.A

a **Construct an explanation of how new genetic combinations and variations occur during crossover.** BIO.12.A

Obtain, evaluate, and communicate information about how errors during meiosis and environmental factors affect the expression of traits. BIO.12.B

b **Obtain, evaluate, and communicate information about how errors during meiosis and environmental factors affect the expression of traits.** BIO.12.B

Unity and Diversity

Phylogenetics

Patterns

13 Analyze and interpret data to support hypotheses of common ancestry and biological evolution illustrated by cladograms and phylogenetic trees. BIO.13

a Evaluate evidence supporting claims that viruses should be placed in a separate category from living things. BIO.13.A

Natural Selection

Stability and Change

14 Analyze and interpret data pertaining to adaptations resulting from natural and artificial selection to explain the evolution of populations. BIO.14

Natural Selection

Cause and Effect

15 Engage in argument from evidence to explain how populations respond to changes in the environment that can lead to speciation or extinction. BIO.15