HUDSONALPHA INSTITUTE FOR BIOTECHNOLOGY

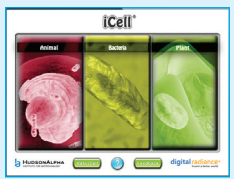
GEORGIA BIOLOGY RESOURCES

■ **Text Resources** ■ **Digital Resources** ■ **Classroom Kits** (Available from Carolina Biological)

SB1. Obtain, evaluate, and communicate information to analyze the nature of the relationships between structures and functions in living cells.

SB1.a. Construct an explanation of how cell structures and organelles (including nucleus, cytoplasm, cell membrane, cell wall, chloroplasts, lysosome, Golgi, endoplasmic reticulum, vacuoles, ribosomes, and mitochondria) interact as a system to maintain homeostasis.

- **Guidebook: Foundational Concepts and Applications:** RNA and Protein Analyses, Gene Therapy and RNAi, Stem Cells
- **iCell®**



SB1.b. Develop and use models to explain the role of cellular reproduction (including binary fission, mitosis, and meiosis) in maintaining genetic continuity.

- **Chromosocks®**
- **Chromosock® Mitosis Protocol** https://hudsonalpha.org/compendium-resources/

SB1.c. Construct arguments supported by evidence to relate the structure of macromolecules (carbohydrates, proteins, lipids, and nucleic acids) to their interactions in carrying out cellular processes. (Clarification statement: The function of proteins as enzymes is limited to a conceptual understanding.)

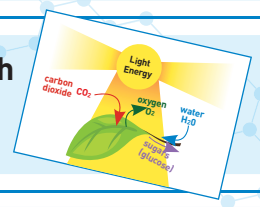
- **Guidebook: Foundational Concepts and Applications:** DNA Sequencing, RNA and Protein Analyses, Recombinant DNA and Genetic Engineering, Synthetic Biology, Pharmacogenomics
- **Enzymes to Go!™** *(to purchase, contact edoutreach@hudsonalpha.org)*

SB1.d. Plan and carry out investigations to determine the role of cellular transport (e.g., active, passive, and osmosis) in maintaining homeostasis.

- **BioBeads: Modeling Cell Processes** https://hudsonalpha.org/compendium-resources/

SB1.e. Ask questions to investigate and provide explanations about the roles of photosynthesis and respiration in the cycling of matter and flow of energy within the cell (e.g., single-celled alga). (Clarification statement: Instruction should focus on understanding the inputs, outputs, and functions of photosynthesis and respiration and the functions of the major sub-processes of each including glycolysis, Krebs cycle, electron transport chain, light reactions, and Calvin cycle.)

- **2018/19 Guidebook: Genetics, Plant Growth and Photosynthesis** *(p. 20-21)*



- **Guidebook: Foundational Concepts and Applications:** DNA Sequencing, RNA and Protein Analyses, Bioinformatics, Recombinant DNA and Genetic Engineering, Synthetic Biology, Therapeutic Approaches: Gene Therapy, Copy Number Variation, Personal Genome Analysis, Genome Editing
- **HNPCC®** ■ **Genes & ConSEQUENCES®**
- **Enzymes to Go!™** *(to purchase, contact edoutreach@hudsonalpha.org)*
- **Progress of Science: Biotechnology Timeline™**

SB2. Obtain, evaluate, and communicate information to analyze how genetic information is expressed in cells.

SB2.a. Construct an explanation of how the structures of DNA and RNA lead to the expression of information within the cell via the processes of replication, transcription, and translation.

SB2.b. Construct an argument based on evidence to support the claim that inheritable genetic variations may result from new genetic combinations through meiosis (crossing over, nondisjunction); non-lethal errors occurring during replication (insertions, deletions, substitutions); and/or heritable mutations caused by environmental factors (radiation, chemicals, and viruses).

- **Guidebook: Foundational Concepts and Applications:** Diagnosing Chromosome Disorders, Personal Genome Analysis, Noninvasive Prenatal Testing
- **Chromosocks®**
- **Modeling Mendel's Laws®**
- **Collecting Cancer-Causing Changes®**
- **Making Sense of Uncertainty®**
- **Touching Triton®**
- **HG Helix®**

SB2.c. Ask questions to gather and communicate information about the use and ethical considerations of biotechnology in forensics, medicine, and agriculture. (Clarification statement: The element is intended to include advancements in technology relating to economics and society such as advancements may include Genetically Modified Organisms.)

- **Guidebook: Foundational Concepts and Applications:** Recombinant DNA and Genetic Engineering, Studying the Genome to Understand the Sequence, Therapeutic Approaches: Gene Therapy and RNAi, Stem Cells, Synthetic Biology, Genome Editing, Criminal Justice and Forensics
- **Shareable Science Blog:**
  "The Ethics of DNA Testing: Ancestry and Crime"
  "Understanding RNAi: First-of-its-kind Genetic Treatment Approved"
  "Gene Therapies bring Genomic Research to Patients in Life-Changing Ways" and more

SB3. Obtain, evaluate, and communicate information to analyze how biological traits are passed on to successive generations.

- **Progress of Science: Biotechnology Timeline™**
- **Guidebook: Foundational Concepts and Applications:** Copy Number Variation, Identifying Genetic Influence on Disease, Infectious Disease, Personal Genome Analysis, Genetics of Eye Color, Studying the Genome to Understand the Sequence

HudsonAlpha Institute for Biotechnology

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SB3.a. Use Mendel's laws (segregation and independent assortment) to ask questions and define problems that explain the role of meiosis in reproductive variability.

- **Guidebook: Foundational Concepts and Applications:** Genetics of Eye Color
- **Modeling Mendel's Laws®**

SB3.b. Use mathematical models to predict and explain patterns of inheritance. (Clarification statement: Students should be able to use Punnett squares (monohybrid and dihybrid crosses) and/or rules of probability, to analyze the following inheritance patterns: dominance, codominance, incomplete dominance.)

- **Guidebook: Foundational Concepts and Applications:** Genetics of Eye Color, Diagnosing Chromosome Disorders
- **Collecting Cancer-Causing Changes®**
- **Making Sense of Uncertainty®**
- **Modeling Mendel's Laws®**

SB3.c. Construct an argument to support a claim about the relative advantages and disadvantages of sexual and asexual reproduction.

- **Guidebook: Foundational Concepts and Applications:** Diagnosing Chromosome Disorders, Epigenetics, Noninvasive Prenatal Diagnosis

SB4. Obtain, evaluate, and communicate information to illustrate the organization of interacting systems within single-celled and multi-celled organisms.

- **Guidebook: Foundational Concepts and Applications:** Comparative Genomics

SB4.a. Construct an argument supported by scientific information to explain patterns in structures and function among clades of organisms, including the origin of eukaryotes by endosymbiosis. Clades should include: archaea, bacteria, eukaryotes, fungi, plants, animals (Clarification statement: This is reflective of 21st century classification schemes and nested hierarchy of clades and is intended to develop a foundation for comparing major groups of organisms. The term 'protist' is useful in describing those eukaryotes that are not within the animal, fungal or plant clades but the term does not describe a well-defined clade or a natural taxonomic group.)

- **Progress of Science: Biotechnology Timeline™**

SB4.b. Analyze and interpret data to develop models (i.e., cladograms and phylogenetic trees) based on patterns of common ancestry and the theory of evolution to determine relationships among major groups of organisms.

- **Guidebook: Foundational Concepts and Applications:** Comparative Genomics

SB4.c. Construct an argument supported by empirical evidence to compare and contrast the characteristics of viruses and organisms.

- **Guidebook: Foundational Concepts and Applications:** Infectious Disease

SB5. Obtain, evaluate, and communicate information to assess the interdependence of all organisms on one another and their environment.

- **Guidebook: Foundational Concepts and Applications:** Comparative Genomics, Infectious Disease

SB5.a. Plan and carry out investigations and analyze data to support explanations about factors affecting biodiversity and populations in ecosystems. (Clarification statement: Factors include population size, carrying capacity, response to limiting factors, and keystone species.)

- **Guidebook: Foundational Concepts and Applications:** Comparative Genomics

SB6. Obtain, evaluate, and communicate information to assess the theory of evolution.

- **Guidebook: Foundational Concepts and Applications:** Comparative Genomics

SB6.a. Construct an explanation of how new understandings of Earth's history, the emergence of new species from pre-existing species, and our understanding of genetics have influenced our understanding of biology.

- **Guidebook: Foundational Concepts and Applications:** Comparative Genomics, Studying the Genome to Understand the Sequence

SB6.c. Construct an argument using valid and reliable sources to support the claim that evidence from comparative morphology (analogous vs. homologous structures), embryology, biochemistry (protein sequence) and genetics support the theory that all living organisms are related by way of common descent.

- **Guidebook: Foundational Concepts and Applications:** Comparative Genomics, Studying the Genome to Understand the Sequence

SB6.d. Develop and use mathematical models to support explanations of how undirected genetic changes in natural selection and genetic drift have led to changes in populations of organisms. (Clarification statement: Element is intended to focus on basic statistical and graphic analysis. Hardy Weinberg would be an optional application to address this element.)

- **Shareable Science Blog: "Human Genome Diversity Project" www.shareable-science.org**

SB6.e. Develop a model to explain the role natural selection plays in causing biological resistance (e.g., pesticides, antibiotic resistance, and influenza vaccines).

- **Guidebook: Foundational Concepts and Applications:** Comparative Genomics, Infectious Disease, Studying the Genome to Understand the Sequence

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