

Life Science (Biology) Strand Map

MA Department of Elementary & Secondary Education
2009

TOPIC

PreK-2

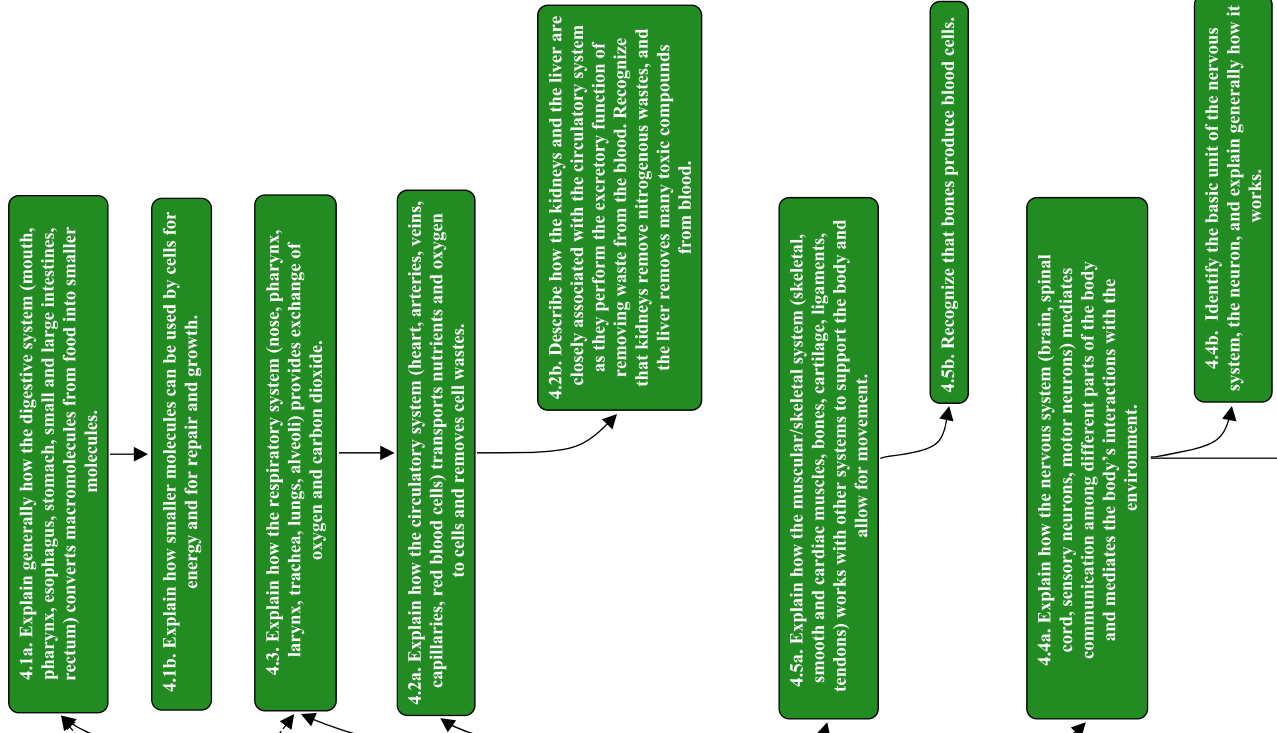
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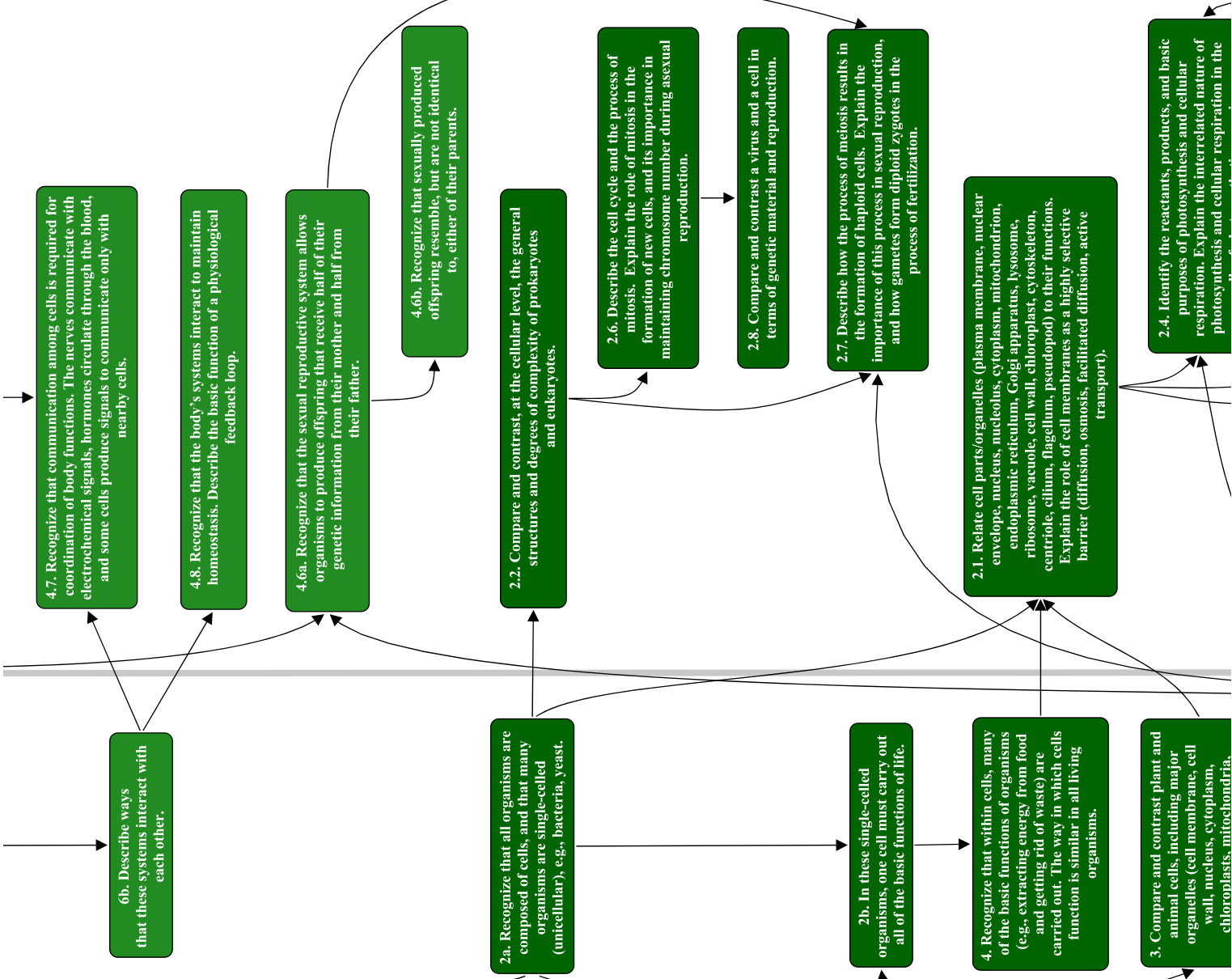
High School

iv:
Anatomy
and
Physiology

PS-Chem 6. Differentiate between an atom (the smallest unit of an element that maintains the characteristics of that element) and a molecule (the smallest unit of a compound that maintains the characteristics of that compound).



ii: Cells and Bio-chemistry



6b. Describe ways that these systems interact with each other.

4.7. Recognize that communication among cells is required for coordination of body functions. The nerves communicate with electrochemical signals, hormones circulate through the blood, and some cells produce signals to communicate only with nearby cells.

4.8. Recognize that the body's systems interact to maintain homeostasis. Describe the basic function of a physiological feedback loop.

4.6a. Recognize that the sexual reproductive system allows organisms to produce offspring that receive half of their genetic information from their mother and half from their father.

4.6b. Recognize that sexually produced offspring resemble, but are not identical to, either of their parents.

2.2. Compare and contrast, at the cellular level, the general structures and degrees of complexity of prokaryotes and eukaryotes.

2.6. Describe the cell cycle and the process of mitosis. Explain the role of mitosis in the formation of new cells, and its importance in maintaining chromosome number during asexual reproduction.

2.8. Compare and contrast a virus and a cell in terms of genetic material and reproduction.

2.7. Describe how the process of meiosis results in the formation of haploid cells. Explain the importance of this process in sexual reproduction, and how gametes form diploid zygotes in the process of fertilization.

2.1. Relate cell parts/organelles (plasma membrane, nuclear envelope, nucleus, nucleolus, cytoplasm, mitochondrion, endoplasmic reticulum, Golgi apparatus, lysosome, ribosome, vacuole, cell wall, chloroplast, cytoskeleton, centriole, cilium, flagellum, pseudopod) to their functions. Explain the role of cell membranes as a highly selective barrier (diffusion, osmosis, facilitated diffusion, active transport).

2.4. Identify the reactants, products, and basic purposes of photosynthesis and cellular respiration. Explain the interrelated nature of photosynthesis and cellular respiration in the

2a. Recognize that all organisms are composed of cells, and that many organisms are single-celled (unicellular), e.g., bacteria, yeast.

2b. In these single-celled organisms, one cell must carry out all of the basic functions of life.

4. Recognize that within cells, many of the basic functions of organisms (e.g., extracting energy from food and getting rid of waste) are carried out. The way in which cells function is similar in all living organisms.

3. Compare and contrast plant and animal cells, including major organelles (cell membrane, cell wall, nucleus, cytoplasm, chloroplasts, mitochondria, ...)

iii: Heredity and Genetics

1. Recognize that animals (including humans) and plants are living things. Living things grow, reproduce, and respond to their environment.

1. Recognize that animals (including humans) and plants are living things. Living things grow, reproduce, and respond to their environment.

4. Describe ways in which many plants and animals closely resemble their parents in observed appearance.

5a. (Differentiate between) observed characteristics of plants and animals that are fully inherited (e.g., color of flower, shape of leaves, color of eyes, number of appendages)

5b. (Differentiate between) characteristics that are affected by the climate or environment (e.g., browning of leaves due to too much sun, language spoken).

2. Identify the structures in plants (leaves, roots, flowers, stem, bark, wood) that are responsible for food production, support, water transport, reproduction, growth, and protection.

vacuoles).

PS-Chem 6. Differentiate between an atom (the smallest unit of an element that maintains the characteristics of that element) and a molecule (the smallest unit of a compound that maintains the characteristics of that compound).

PS-Chem 5. Recognize that there are more than 100 elements that combine in a multitude of ways to produce compounds that make up all of the living and nonliving things that we encounter.

9. Compare sexual reproduction (offspring inherit half of their genes from each parent) with asexual reproduction (offspring is an identical copy of the parent's cell).

7. Recognize that every organism requires a set of instructions that specifies its traits. These instructions are stored in the organism's chromosomes. Heredity is the passage of these instructions from one generation to another.

8a. Recognize that hereditary information is contained in genes located in the chromosomes of each cell.

8b. A human cell contains about 30,000 different genes on 23 different chromosomes.

1a. Classify organisms into the

cells of photosynthetic organisms.

2.5. Explain the important role that ATP serves in metabolism.

1.2. Describe the basic molecular structures and primary functions of the four major categories of organic molecules (carbohydrates, lipids, proteins, nucleic acids).

1.3. Explain the role of enzymes as catalysts that lower the activation energy of biochemical reactions. Identify factors, such as pH and temperature, that have an effect on enzymes.

1.1. Recognize that biological organisms are composed primarily of very few elements. The six most common are C, H, N, O, P, and S.

3.1. Describe the basic structure (double helix, sugar/phosphate backbone, linked by complementary nucleotide pairs) of DNA, and describe its function in genetic inheritance.

3.2. Describe the basic process of DNA replication and how it relates to the transmission and conservation of the genetic code. Explain the basic processes of transcription and translation, and how they result in the expression of genes. Distinguish among the end products of replication, transcription, and translation.

3.3. Explain how mutations in the DNA sequence of a gene may or may not result in phenotypic change in an organism. Explain how mutations in gametes may result in phenotypic changes in offspring.

3.4. Distinguish among observed inheritance patterns caused by several types of genetic traits (dominant, recessive, codominant, sex-linked, polygenic, incomplete dominance, multiple alleles).

3.5. Describe how Mendel's laws of segregation and independent assortment can be observed through patterns of inheritance (e.g., dihybrid crosses).

3.6. Use a Punnett Square to determine the probabilities for genotype and phenotype combinations in monohybrid crosses.

5.2b. Recognize that species are further classified into a

i: Characteristics of Living Things

reproduce, and need food, air, and water.

2. Differentiate between living and nonliving things. Group both living and nonliving things according to the characteristics that they share.

ESS 1

1. Classify plants and animals according to the physical characteristics that they share.

6. Give examples of how inherited characteristics may change over time as adaptations to changes in the environment that enable organisms to survive, e.g., shape of beak or feet, placement of eyes on head, length of neck, shape of teeth, color.

currently recognized kingdoms according to characteristics that they share.

1b. Be familiar with organisms from each kingdom.

18. Recognize that biological evolution accounts for the diversity of species developed through gradual processes over many generations.

10. Give examples of ways in which genetic variation and environmental factors are causes of evolution and the diversity of organisms.

ESS 7

11. Recognize that evidence drawn from geology, fossils, and comparative anatomy provides the basis of the theory of evolution.

7. Give examples of how changes in the environment (drought, cold) have caused some plants and animals to die or move to new locations (migration).

ESS 6a/b. Describe and give examples of ways in which the earth's surface is built up and torn down by natural processes, including deposition of sediments, rock formation, erosion, and weathering.

3. Recognize that plants and animals go through predictable life cycles that include birth, growth, development, reproduction, and death.

4. Describe the major stages that characterize the life cycle of the frog and butterfly as they go through metamorphosis.

8a. Describe how organisms meet some of their needs in an environment by using behaviors (patterns of activities) in response to information (stimuli) received from the environment.

hierarchical taxonomic system (kingdom, phylum, class, order, family, genus, species) based on morphological, behavioral, and molecular similarities.

2.3. Use cellular evidence (e.g., cell structure, cell number, cell reproduction) and modes of nutrition to describe the six kingdoms (Archaea, Bacteria, Eubacteria, Protista, Fungi, Plantae, Animalia).

5.2a. Describe species as reproductively distinct groups of organisms.

5.2c. Describe the role that geographic isolation can play in speciation.

5.3. Explain how evolution through natural selection can result in changes in biodiversity through the increase or decrease of genetic diversity within a population.

5.1. Explain how evolution is demonstrated by evidence from the fossil record, comparative anatomy, genetics, molecular biology, and examples of natural selection.

6.2. Analyze changes in population size and biodiversity (speciation and extinction) that result from the following: natural causes, changes in climate, human activity, and the introduction of invasive, non-native species.

6.1. Explain how birth, death, immigration, and emigration

v: Evolution and Biodiversity

6. Recognize that people and other animals interact with the environment through their senses of sight, hearing, touch, smell, and taste.

