

## MS-LSI-1 MOLECULE TO ORGANISM: STRUCTURES & PROCESSES

CONDUCT AN INVESTIGATION TO PROVIDE EVIDENCE THAT LIVING THINGS ARE MADE OF CELLS; EITHER ONE CELL OR MANY DIFFERENT NUMBERS AND TYPES OF CELLS.



"All living things are made up of cells, which is the smallest unit that can be said to be alive. An organism may consist of one single cell (unicellular) or many different numbers and types of cells (multicellular)."

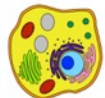


## MS-LSI-2 MOLECULE TO ORGANISM: STRUCTURES & PROCESSES

DEVELOP AND USE A MODEL TO DESCRIBE THE FUNCTION OF A CELL AS A WHOLE AND WAYS PARTS OF CELLS CONTRIBUTE TO THE FUNCTION.



"Structures within cells are responsible for particular functions. The cell membrane forms the boundary that controls what enters and leaves the cell."



## MS-LSI-3 MOLECULE TO ORGANISM: STRUCTURES & PROCESSES

USE ARGUMENT SUPPORTED BY EVIDENCE FOR HOW THE BODY IS A SYSTEM OF INTERACTING SUBSYSTEMS COMPOSED OF GROUPS OF CELLS.



"In multicellular organisms, the body is made of multiple interacting organ systems. These systems are groups of cells that work together to form tissues and organs that are specialized for particular body functions."



## MS-LSI-4 MOLECULE TO ORGANISM: STRUCTURES & PROCESSES

USE ARGUMENT BASED ON EMPIRICAL EVIDENCE AND SCIENTIFIC REASONING TO SUPPORT AN EXPLANATION FOR HOW CHARACTERISTIC ANIMAL BEHAVIORS AND SPECIALIZED PLANT STRUCTURES AFFECT THE PROBABILITY OF SUCCESSFUL REPRODUCTION OF ANIMALS AND PLANTS RESPECTIVELY.



"Animals engage in behaviors that increase the odds of reproduction. Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction."

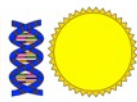


## MS-LSI-5 MOLECULE TO ORGANISM: STRUCTURES & PROCESSES

CONSTRUCT A SCIENTIFIC EXPLANATION BASED ON EVIDENCE FOR HOW ENVIRONMENTAL AND GENETIC FACTORS INFLUENCE THE GROWTH OF ORGANISMS.



"Genetic factors as well as local conditions affect the growth and development of plants and animals."



## MS-LSI-6 MOLECULE TO ORGANISM: STRUCTURES & PROCESSES

CONSTRUCT A SCIENTIFIC EXPLANATION BASED ON EVIDENCE FOR THE ROLE OF PHOTOSYNTHESIS IN THE CYCLING OF MATTER AND FLOW OF ENERGY INTO AND OUT OF ORGANISMS.



"Plants, algae and many microorganisms use the energy from light to make sugars (food) from carbon dioxide and water through the process of photosynthesis, which also releases oxygen. Sugars can be used immediately or stored for growth or later use."



## MS-LSI-7 MOLECULE TO ORGANISM: STRUCTURES & PROCESSES

DEVELOP A MODEL TO DESCRIBE HOW FOOD IS REARRANGED THROUGH CHEMICAL REACTIONS FORMING NEW MOLECULES THAT SUPPORT GROWTH AND/OR RELEASE ENERGY AS THIS MATTER MOVES THROUGH AN ORGANISM.



"Within individual organisms, food moves through a series of chemical reactions in which it is broken down and rearranged to form new molecules, to support growth, or to release energy."



## MS-LSI-8 MOLECULE TO ORGANISM: STRUCTURES & PROCESSES

GATHER AND SYNTHESIZE INFORMATION THAT SENSORY RECEPTORS RESPOND TO STIMULI BY SENDING MESSAGES TO THE BRAIN FOR IMMEDIATE BEHAVIOR OR STORAGE AS MEMORIES.



"Each sense receptor responds to different inputs, transmitting them as signals that 'travel' along nerve cells to the brain. The signals are then processed in the brain, resulting in immediate behaviors or memories."



## MS-LS2-1 ECOSYSTEMS: INTERACTIONS, ENERGY & DYNAMICS

ANALYZE AND INTERPRET DATA TO PROVIDE EVIDENCE FOR THE EFFECTS OF RESOURCE AVAILABILITY ON ORGANISMS AND POPULATIONS OF ORGANISMS IN AN ECOSYSTEM.



"Organisms are dependent on their environmental interactions both with other living things and with nonliving factors. Organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources."



## MS-LS2-2 ECOSYSTEMS: INTERACTIONS, ENERGY & DYNAMICS

CONSTRUCT AN EXPLANATION THAT PREDICTS PATTERNS OF INTERACTIONS AMONG ORGANISMS ACROSS MULTIPLE ECOSYSTEMS.



"Although the species involved in a competitive, predatory and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared."



## MS-LS2-3 ECOSYSTEMS: INTERACTIONS, ENERGY & DYNAMICS

DEVELOP A MODEL TO DESCRIBE THE CYCLING OF MATTER AND FLOW OF ENERGY AMONG LIVING AND NONLIVING PARTS OF AN ECOSYSTEM.



"Food chains and webs demonstrate how matter and energy is transferred between producers, consumers, and decomposers within an ecosystem. Decomposers recycle nutrients from dead plant or animal matter back to the environment."



## MS-LS2-4 ECOSYSTEMS: INTERACTIONS, ENERGY & DYNAMICS

CONSTRUCT AN ARGUMENT SUPPORTED BY EMPIRICAL EVIDENCE THAT CHANGES TO PHYSICAL OR BIOLOGICAL COMPONENTS OF AN ECOSYSTEM AFFECT POPULATIONS.



"Ecosystems are dynamic in nature. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations."



## MS-LS2-5 ECOSYSTEMS: INTERACTIONS, ENERGY & DYNAMICS

EVALUATE COMPETING DESIGN SOLUTIONS FOR MAINTAINING BIODIVERSITY AND ECOSYSTEM SERVICES.



"Biodiversity describes the variety of species found in an ecosystem. The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health."

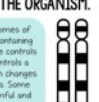


## MS-LS3-1 HEREDITY: INHERITANCE & VARIATION

DEVELOP AND USE A MODEL TO DESCRIBE WHY STRUCTURAL CHANGES TO GENES (MUTATIONS) LOCATED ON CHROMOSOMES MAY AFFECT PROTEINS AND MAY RESULT IN HARMFUL, BENEFICIAL, OR NEUTRAL EFFECTS TO THE STRUCTURE AND FUNCTION OF THE ORGANISM.



"Genes are located in the chromosomes of cells, with each chromosome pair containing two variants of each gene. Each gene controls a specific protein, which in turn controls a trait. Mutations to genes can result in changes to proteins, which can change traits. Some changes are beneficial, others harmful and some neutral to the organism."



## MS-LS3-2 HEREDITY: INHERITANCE & VARIATION

DEVELOP AND USE A MODEL TO DESCRIBE WHY ASEQUAL REPRODUCTION RESULTS IN OFFSPRING WITH IDENTICAL GENETIC INFORMATION AND SEXUAL REPRODUCTION RESULTS IN OFFSPRING WITH GENETIC VARIATION.



"Variants of inherited traits between parent and offspring arise from genetic differences that result from the chromosomes inherited. In sexually reproducing organisms, individuals have two of each chromosome and hence two alleles of each gene are acquired from each parent."

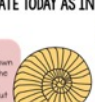


## MS-LS4-1 BIOLOGICAL EVOLUTION

ANALYZE AND INTERPRET DATA FOR PATTERNS IN THE FOSSIL RECORD THAT DOCUMENT THE EXISTENCE, DIVERSITY, EXTINCTION, AND CHANGE OF LIFE FORMS THROUGHOUT THE HISTORY OF LIFE ON EARTH UNDER THE ASSUMPTION THAT NATURAL LAWS OPERATE TODAY AS IN THE PAST.



"The collection of fossils and their placement in chronological order is known as the fossil record. It documents the existence, diversity, extinction, and change of many life forms throughout the history of life on Earth."



## MS-LS4-2 BIOLOGICAL EVOLUTION

APPLY SCIENTIFIC IDEAS TO CONSTRUCT AN EXPLANATION FOR THE ANATOMICAL SIMILARITIES AND DIFFERENCES AMONG MODERN ORGANISMS AND BETWEEN MODERN AND FOSSIL ORGANISMS TO INFER EVOLUTIONARY RELATIONSHIPS.



"Anatomical similarities and differences between organisms living today and between them and organisms in the fossil record, enable the reconstruction of evolutionary history and the inference of lines of evolutionary descent."



## MS-LS4-3 BIOLOGICAL EVOLUTION

ANALYZE DISPLAYS OF PICTORIAL DATA TO COMPARE PATTERNS OF SIMILARITIES IN THE EMBRYOLOGICAL DEVELOPMENT ACROSS MULTIPLE SPECIES TO IDENTIFY RELATIONSHIPS NOT EVIDENT IN THE FULLY FORMED ANATOMY.



"Comparison of the embryological development of different species reveals similarities that show relationships not evident in the fully-formed anatomy."



## MS-LS4-4 BIOLOGICAL EVOLUTION

CONSTRUCT AN EXPLANATION BASED ON EVIDENCE THAT DESCRIBES HOW GENETIC VARIATIONS OF TRAITS IN A POPULATION INCREASE SOME INDIVIDUALS' PROBABILITY OF SURVIVING AND REPRODUCING IN A SPECIFIC ENVIRONMENT.



"Natural selection leads to the predominance of certain traits in a population, and the suppression of others."



## MS-LS4-5 BIOLOGICAL EVOLUTION

GATHER AND SYNTHESIZE INFORMATION ABOUT THE TECHNOLOGIES THAT HAVE CHANGED THE WAY HUMANS INFLUENCE THE INHERITANCE OF DESIRED TRAITS IN ORGANISMS.



"In artificial selection, humans have the capacity to influence certain characteristics of organisms by selective breeding. One can choose desired parental traits determined by genes, which are then passed to offspring."

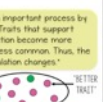


## MS-LS4-6 BIOLOGICAL EVOLUTION

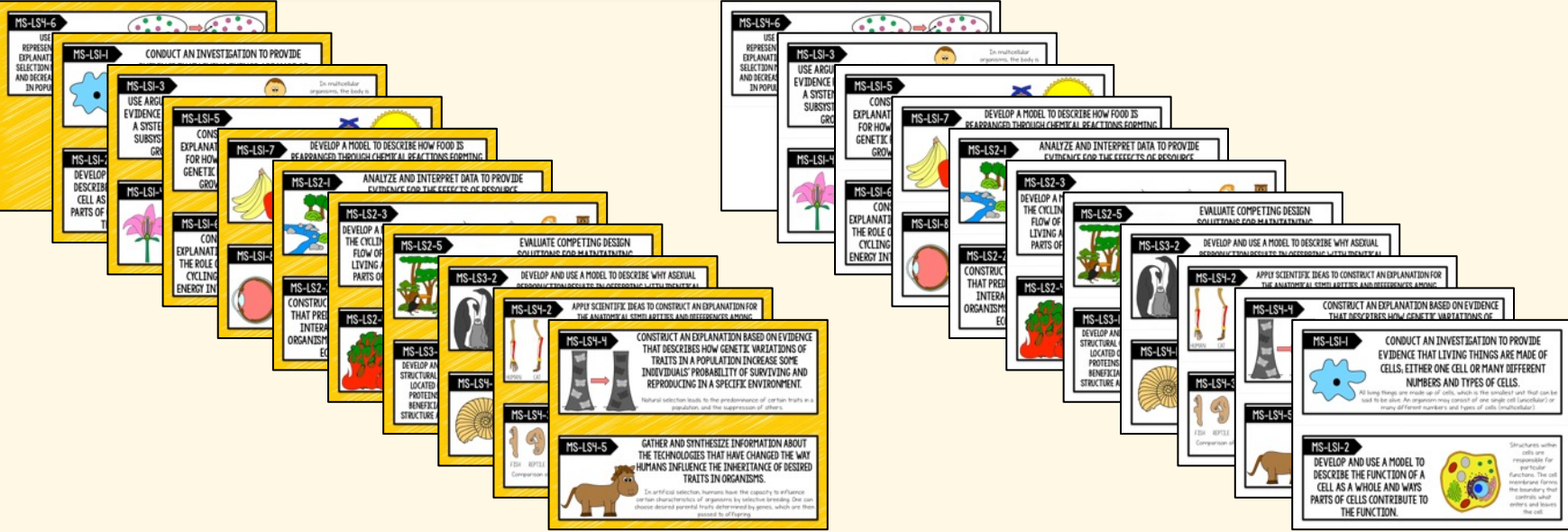
USE MATHEMATICAL REPRESENTATIONS TO SUPPORT EXPLANATIONS OF HOW NATURAL SELECTION MAY LEAD TO INCREASES AND DECREASES OF SPECIFIC TRAITS IN POPULATIONS OVER TIME.



"Adaptation by natural selection is an important process by which species change over time. Traits that support successful survival and reproduction become more common, those that do not become less common. Thus, the distribution of traits in a population changes."



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# STUDENT MINIS IN COLOR & B/W BOTH VERSIONS W/ & W/O KEYHOLE PLACEHOLDER

