

L1 – Classification and Kingdoms

S7L1. Obtain, evaluate, and communicate information to investigate the diversity of living organisms and how they can be compared scientifically.

- Develop and defend a model that categorizes organisms based on common characteristics.
 - Evaluate historical models of how organisms were classified based on physical characteristics and how that led to the six kingdom system (currently archaea, bacteria, protists, fungi, plants, and animals).
(Clarification statement: This includes common examples and characteristics such as, but not limited to prokaryotic, eukaryotic, unicellular, multicellular, asexual reproduction, autotroph, heterotroph, and unique cell structures. Modern classification will be addressed in high school.)
- Linnaeus – binomial nomenclature (2 name–system, scientific name *Genus species* or Genus species)
 - based on Latin
 - Domain, Kingdom, Phylum, Class, Order, Family, Genus, species
 - Kingdom most broad
 - Species most specific
 - More groups organisms have in common, the more closely related they are
 - 3 Domains – Archae, Bacteria, Eukarya (ABE)
 - 6 Kingdoms – Archaeobacteria, Eubacteria, Protista, Fungi, Plantae, Animalia
 - All bacteria are prokaryotic (no membrane–bound nucleus), all others are eukaryotic
 - **remember pro = no, eu = do**
 - placement into kingdoms based on CAN
 - cell type (prokaryote/eukaryote)
 - ability to make food (autotroph/heterotroph)
 - number of cells (unicellular/multicellular)
 - dichotomous keys (see diagram on right)

Who Can It Be Now?



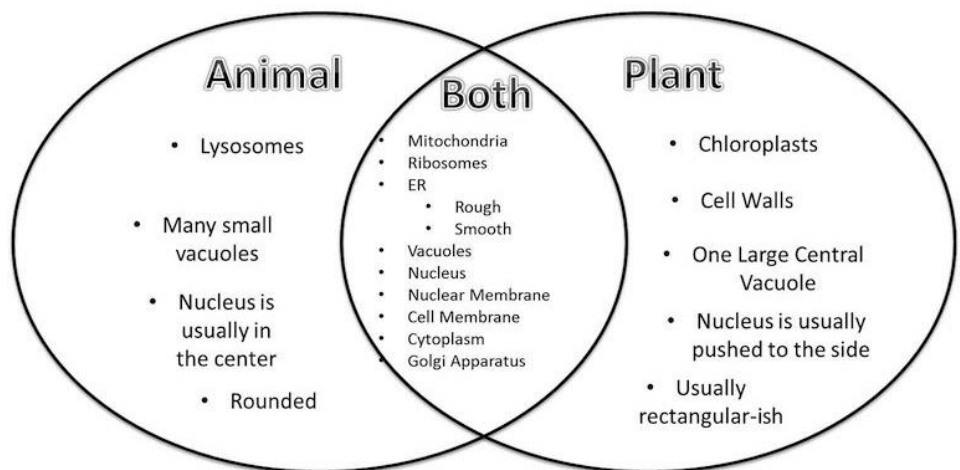
Gru has a uncanny way of telling his minions apart, but can you? Use the dichotomous key below to find the names of Gru's minions. Make sure to write the path (numbers of the questions you said yes to).

- | | |
|--|---------|
| 1a. The minion has one eye..... | go to 2 |
| 1b. The minion has two eyes..... | go to 3 |
| 2a. The minion is smiling..... | go to 6 |
| 2b. The minion is not smiling..... | Phil |
| 3a. The minion has a toothy smile..... | go to 4 |
| 3b. The minion is not showing teeth..... | go to 5 |
| 4a. The minion is riding on a rocket..... | Dave |
| 4b. The minion is standing..... | go to 7 |
| 5a. The minion is looking at you..... | go to 8 |
| 5b. The minion is working..... | Tim |
| 6a. The minion is saluting..... | Kevin |
| 6b. The minion has his finger on his chin..... | Kyle |
| 7a. The minion has both hands up..... | Stewart |
| 7b. The minion has one hand up..... | go to 9 |
| 8a. The minion is smiling..... | Mark |
| 8b. The minion is frowning..... | Ted |
| 9a. The minion has his left hand up..... | Larry |
| 9b. The minion has his right hand up..... | Bart |

L2 – Cells and Cell Processes

S7L2. Obtain, evaluate, and communicate information to construct scientific explanations to describe how cell structures, cells, tissues, organs, and organ systems interact to maintain the basic needs of organisms.

- Develop a model and construct an explanation of how cell structures (specifically the nucleus, cytoplasm, cell membrane, cell wall, chloroplasts, lysosome, and mitochondria) contribute to the function of the cell as a system in obtaining nutrients in order to grow, reproduce, make needed materials, and process waste. (Clarification statement: The intent is for students to demonstrate how the component structures of the cell interact and work together to allow the cell as a whole to carry out various processes. Additional structures, beyond those listed, will be addressed in high school Biology.)
- Develop and use a conceptual model of how cells are organized into tissues, tissues into organs, organs into systems, and systems into organisms.



c. Construct an argument that systems of the body (Cardiovascular, Excretory, Digestive, Respiratory, Muscular, Nervous, and Immune) interact with one another to carry out life processes. (Clarification statement: The emphasis is not on learning individual structures and functions associated with each system, but on how systems interact to support life processes.)

- Cell Theory
 - All life forms are made of cells
 - The cell is the smallest unit of life
 - All cells come from pre-existing cells
- Levels of Organization in multicellular organisms: cells, tissues, organs, organ systems, organisms
- Active vs passive transport: active uses cellular energy to move materials across a membrane
- Diffusion – movement from H to L concentration
- Osmosis – movement of H₂O across a membrane
- Cellular respiration (O₂ + sugar in, H₂O + CO₂ out, energy released)
- Photosynthesis (H₂O + CO₂ in, O₂ + sugar, energy stored)

Cell part	Function / Description	Animal cell	Plant cell
Cell membrane	regulates what enters and leaves the cell	X	X
Cell wall	provides a rigid structure support & protection		X
Nucleus	contains genetic information – the “brain” of the cell	X	X
Mitochondrion	energy & respiration – the “powerhouse” of the cell	X	X
Chloroplast	used in photosynthesis		X
Golgi apparatus	packages & ships materials throughout the cell	X	X
Ribosomes	where proteins are assembled	X	X
Endoplasmic reticulum	chemical reactions take place here – 2 types – rough ER and smooth ER	X	X
Centrioles	involved in cell division	X	
Vacuole	for storage of materials in cell small –vesicles, large – vacuoles	X	X
Nucleolus	in the nucleus, assembly of ribosomes begins here	X	X
Cytoplasm	squishy stuff in cell where organelles are found	X	X
Lysosomes	digestion of materials – the “stomach” of the cell	X	

L3 – Inheritance of Traits

S7L3. Obtain, evaluate, and communicate information to explain how organisms reproduce either sexually or asexually and transfer genetic information to determine the traits of their offspring.

- Construct an explanation supported with scientific evidence of the role of genes and chromosomes in the process of inheriting a specific trait.
- Develop and use a model to describe how asexual reproduction can result in offspring with identical genetic information while sexual reproduction results in genetic variation. (Clarification statement: Models could include, but are not limited to, the use of monohybrid Punnett squares to demonstrate the heritability of genes and the resulting genetic variation, identification of heterozygous and homozygous, and comparison of genotype vs. phenotype.)

Terms to know	
Dominant T	Recessive t
Homozygous/purebred TT or tt	Heterozygous/hybrid Tt
Genotype Tt	Phenotype tall
Mitosis	Meiosis
Diploid	Haploid
Probability	Punnett square
Trait	Allele
Mutation	Selective breeding
Genetic engineering	Codominance
Incomplete dominance	Multiple alleles

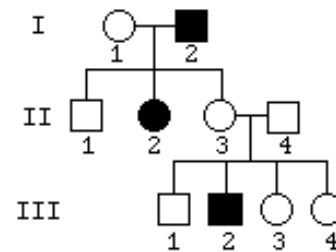
fundamentally different than natural selection.)

System	Major structures	Functions
Circulatory	Heart, blood vessels, blood (cardiovascular) lymph nodes and vessels, lymph (lymphatic)	Transports nutrients, wastes, hormones, and gases
Digestive	Mouth, throat, esophagus, stomach, liver, pancreas, small and large intestines 	Extracts and absorbs nutrients from food; removes wastes; maintains water and chemical balances
Endocrine	Hypothalamus, pituitary, pancreas and many other endocrine glands	Regulates body temperature, metabolism, development, and reproduction; maintains homeostasis; regulates other organ systems
Excretory	Kidneys, urinary bladder, ureters, urethra, skin, lungs	Removes wastes from blood; regulates concentration of body fluids
Immune	White blood cells, lymph nodes and vessels, skin	Defends against pathogens and disease
Integumentary	Skin, nails, hair	Protects against injury, infection, and fluid loss; helps regulate body temperature
Muscular	Skeletal, smooth, and cardiac muscle tissues	Moves limbs and trunk; moves substances through body; provides structure and support
Nervous	Brain, spinal cord, nerves, sense organs 	Regulates behavior; maintains homeostasis; regulates other organ systems; controls sensory and motor functions
Reproductive	Testes, penis (in males); ovaries, uterus, breasts (in females)	Produces gametes and offspring
Respiratory	Lungs, nose, mouth, trachea	Moves air into and out of lungs; controls gas exchange between blood and lungs
Skeletal	Bones and joints 	Protects and supports the body and organs; interacts with skeletal muscles, produces red blood cells, white blood cells, and platelets

c. Ask questions to gather and synthesize information about the ways humans influence the inheritance of desired traits in organisms through selective breeding. (Clarification statement: The element is specifically in reference to artificial selection and the ways in which it is



Phenotype	Genotype
O	ii
A	I ^A I ^A or I ^A i
B	I ^B I ^B or I ^B i
AB	I ^A I ^B



L4 – Interdependence of Organisms and Their Environment

S7L4. Obtain, evaluate, and communicate information to examine the interdependence of organisms with one another and their environments.

- a. Construct an explanation to describe the patterns of interactions in different ecosystems in terms of the relationships among and between organisms

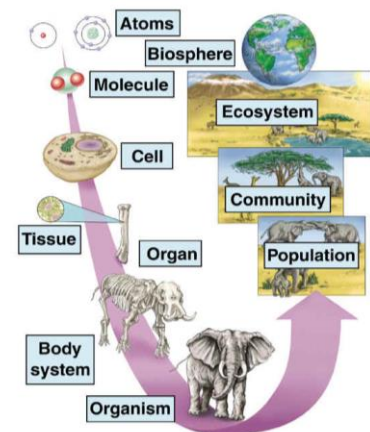
INTERACTION	TYPE OF SYMBIOSIS	EXAMPLE
 Benefits Benefits	Mutualism Species A benefits Species B benefits	 Sea anemone Clown fish
 Benefits Unaffected	Commensalism Species A benefits Species B unaffected	 Whale Barnacle
 Benefits Harmed	Parasitism Species A benefits Species B harmed	 Dog Tick

and abiotic components of the ecosystem. (Clarification statement: The interactions include, but are not limited to, predator–prey relationships, competition, mutualism, parasitism, and commensalism.)

- b. Develop a model to describe the cycling of matter and the flow of energy among biotic and abiotic components of an ecosystem. (Clarification statement: Emphasis is on tracing movement of matter and flow of energy, not the biochemical mechanisms of photosynthesis and cellular respiration.)

- c. Analyze and interpret data to provide evidence for how resource availability, disease, climate, and human activity affect individual organisms, populations, communities, and ecosystems.

- d. Ask questions to gather and synthesize information from multiple sources to differentiate between Earth's major terrestrial biomes (i.e., tropical rain forest, savanna, temperate forest, desert, grassland, taiga, and tundra) and aquatic ecosystems (i.e., freshwater, estuaries, and marine). (Clarification statement: Emphasis is on the factors that influence patterns across biomes such as the climate, availability of food and water, and location.)



- Biotic – living factor; Abiotic – nonliving factor
- Food chain – producer > herbivore > carnivore
- Producer (autotroph) – photosynthesis
- Consumers (heterotrophs): herbivore, carnivore, omnivore, scavenger, decomposer
- Review biomes
- Energy pyramids – 10% energy available to next level
- Habitat = where organism finds all resources, niche = role in environment organism plays (predator, when it breeds, nocturnal, producer, etc.)
- Temperate = seasonal, tropical = hot

L5 – Changes Over Time

S7L5. Obtain, evaluate, and communicate information from multiple sources to explain the theory of evolution of living organisms through inherited characteristics.

- a. Use mathematical representations to evaluate explanations of how natural selection leads to changes in specific traits of populations over successive generations. (Clarification statement: Referencing data should be obtained from multiple sources including, but not limited to, existing research and simulations. Students should be able to calculate means, represent this data in a table or graph, and reference it when explaining the principles of natural selection.)
- b. Construct an explanation based on evidence that describes how genetic variation and environmental factors influence the probability of survival and reproduction of a species.

c. Analyze and interpret data for patterns in the fossil record that document the existence, diversity, and extinction of organisms and their relationships to modern organisms. (Clarification statement: Evidence of evolution found in comparisons of current/modern organisms such as homologous structures, DNA, and fetal development will be addressed in high school.)

d. Ask questions to gather and synthesize information about the ways humans influence the inheritance of desired traits in organisms through selective breeding.

- Darwin – Galapagos Islands, finches, differences among islands
- Kettlewell – peppered moth (variation within a species)
- Natural selection
- Camouflage
- Fossils (sedimentary rock)
 - Oldest on lowest layer
 - Youngest on top layer