Biology EOC 10-Day Review

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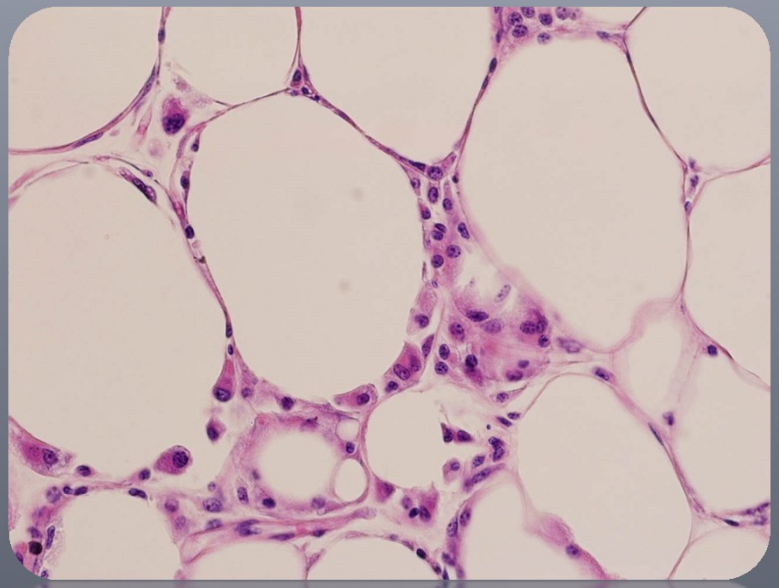
Biology EOC Review DAY 1

CELL STRUCTURE AND FUNCTION

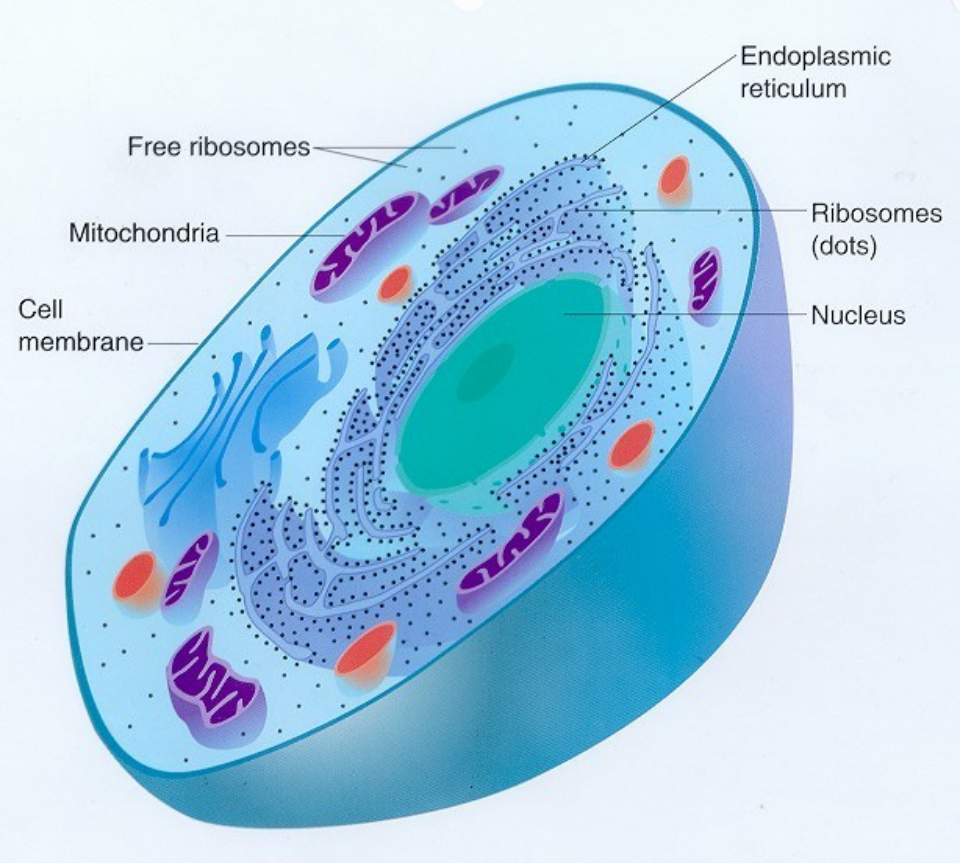
TEKS B.4B, B.4C



Cell Function

- **Cells** are the smallest unit of living things
- Simple cells are **prokaryotic** (bacteria)
- Complex cells are **eukaryotic** (plant and animal cells)

- What are the primary function of these cellular **organelles**?
  - Cell membrane
  - Cytoplasm
  - Nucleus
  - Mitochondria
  - Ribosomes
  - Endoplasmic Reticulum
  - Lysosome
  - Vacuole
  - Cell wall (plant)
  - Chloroplast (plant)



Cell Function

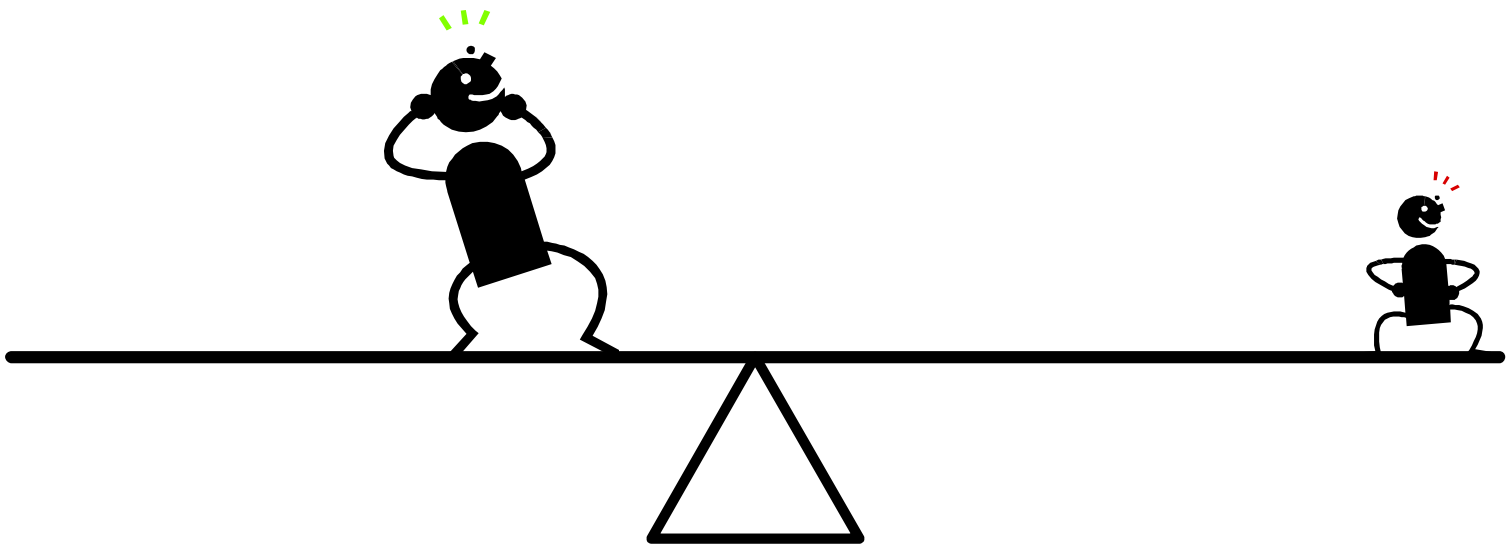
- **Cell membrane** – Surrounds the cell and controls what enters and leaves
- **Cytoplasm** – Suspends the organelles in a eukaryotic cell within the cell membrane
- **Nucleus** – controls the cells activities and contains the cell's DNA
- **Mitochondria** – converts food into energy
- **Ribosomes** – makes proteins
- **Endoplasmic Reticulum** – moves items within the cell like a pipeline
- **Lysosome** – contains enzymes
- **Vacuole** – holds the material like water
- **Cell wall (plant cell)** – surrounds the cell membrane to provide structure
- **Chloroplast (plant cell)** – contains chlorophyll for photosynthesis

Homeostasis

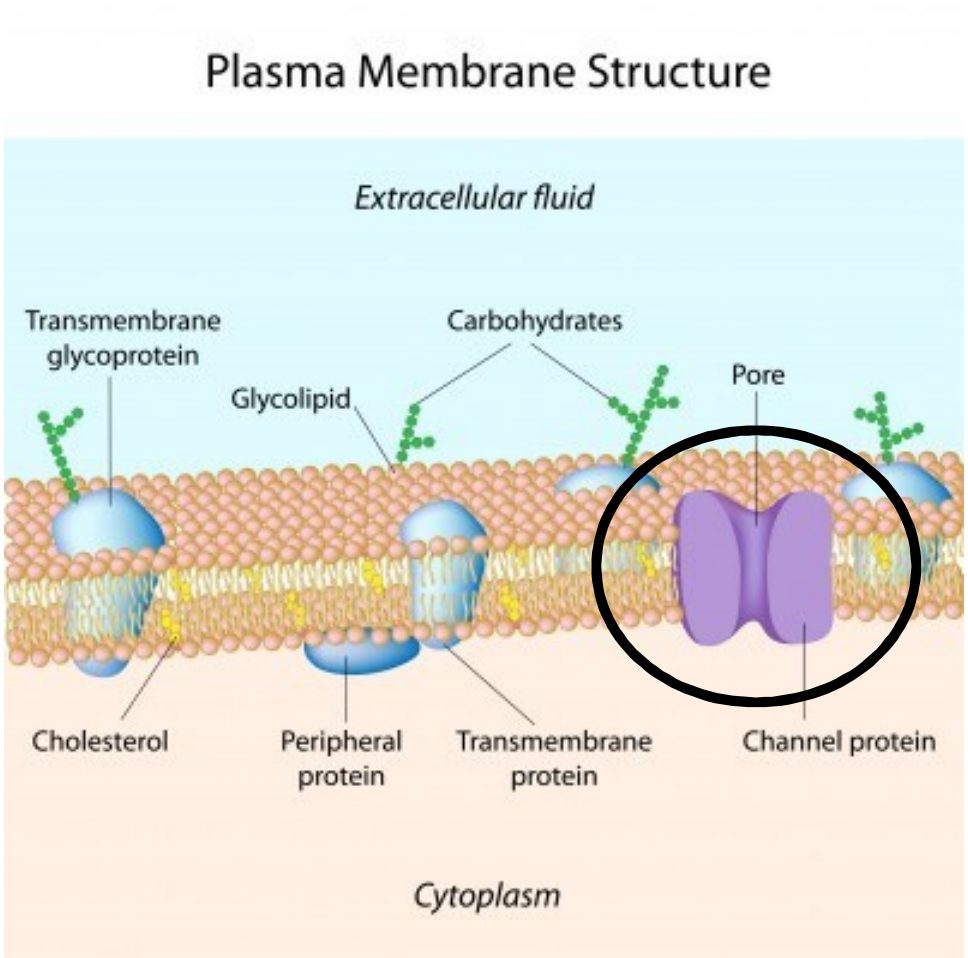
Homeostasis – describes the equilibrium the cell maintains in response to its environment.

How would the cell maintain homeostasis in a salty (hypertonic) environment?

What part of the cell is responsible for maintaining homeostasis?



Molecular Transport



Homeostasis is achieved by the cell membrane allowing material to flow in or out of the cell depending on the environment.

<u>Types of Transport</u>

ACTIVE TRANSPORT – requires the use of energy to move materials across the cell membrane

PASSIVE TRANSPORT – no energy required due to materials flowing from high concentration to low concentration (**<u>diffusion</u>**)

Energy Conversion

Plant Cells

Energy conversion is through **photosynthesis**.

Energy from the sun is converted into a sugar called glucose.

Animal Cells

Energy conversion is through **respiration**.

Mitochondria release energy by breaking down molecules like glucose.

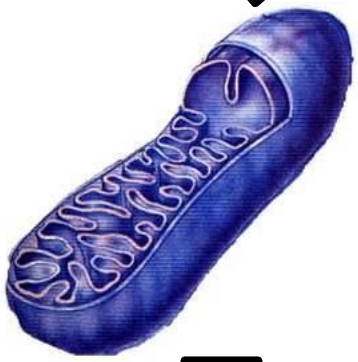
Energy Conversion Cycle

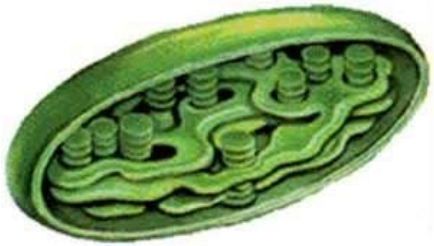
ANIMALS

PLANTS

Organic molecules and O_2

Mitochondria
Site of cellular respiration





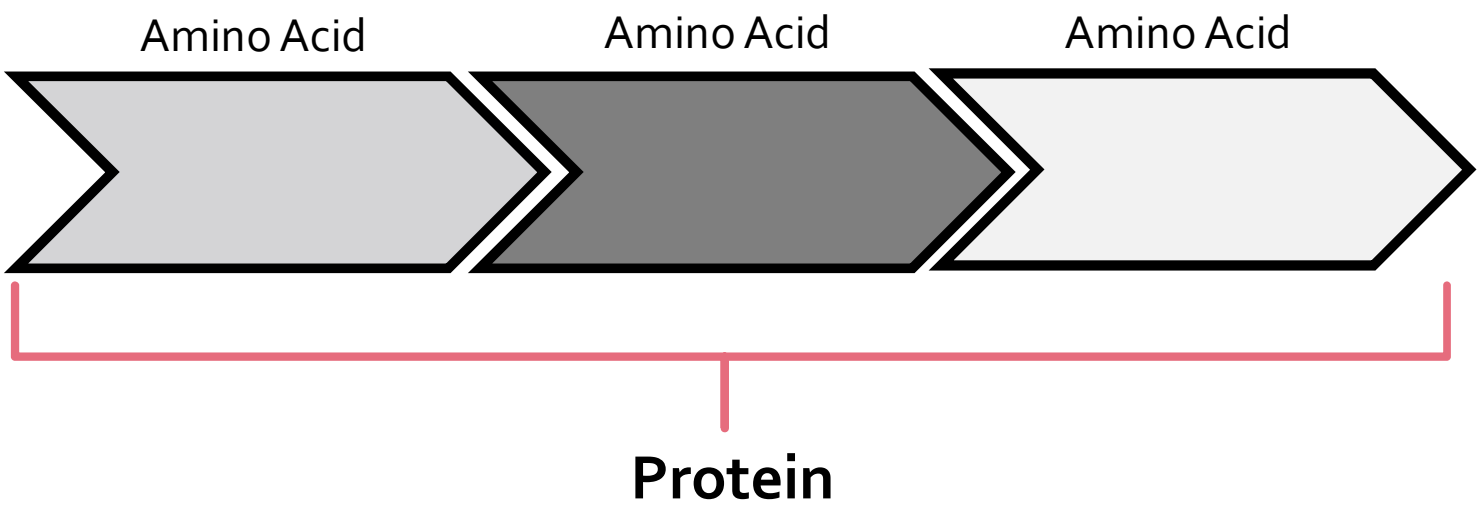
Chloroplast
Site of photosynthesis

CO_2 and H_2O

Synthesis of Molecules

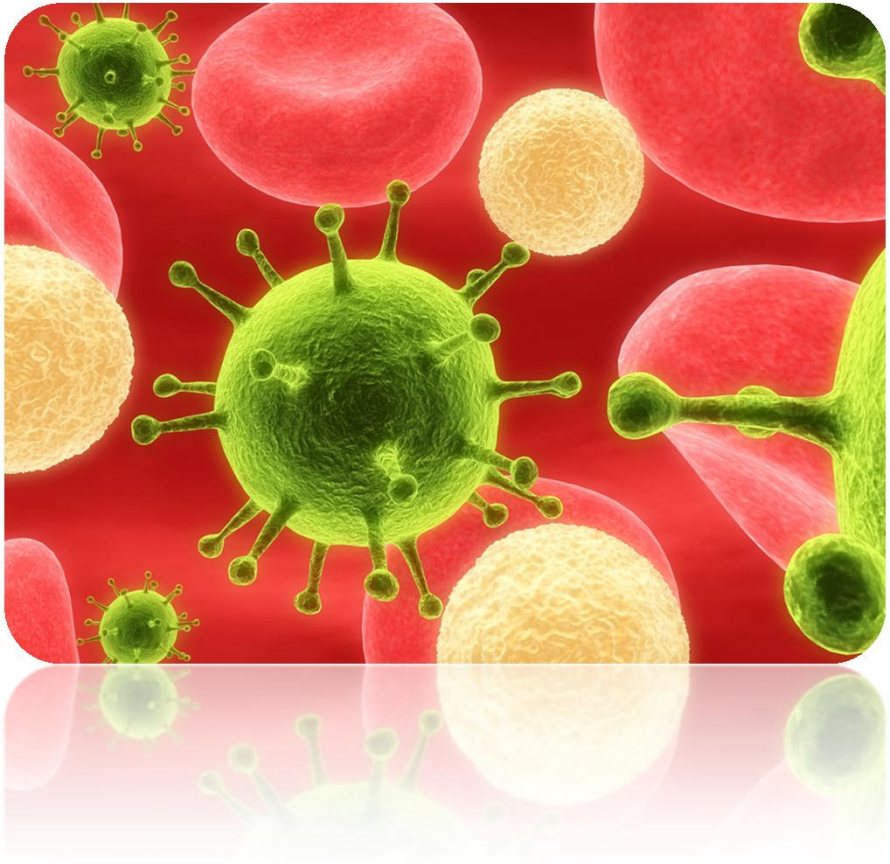
Cells can create more complex molecules from simpler molecules.

An example of this is **protein synthesis** where proteins are created by joining amino acids together during RNA translation.



Cells and Viruses

- Turn to a classmate and create a list of characteristics of viruses and cells.
- What qualities did you come up with?



Comparison of Viruses and cells

Viruses

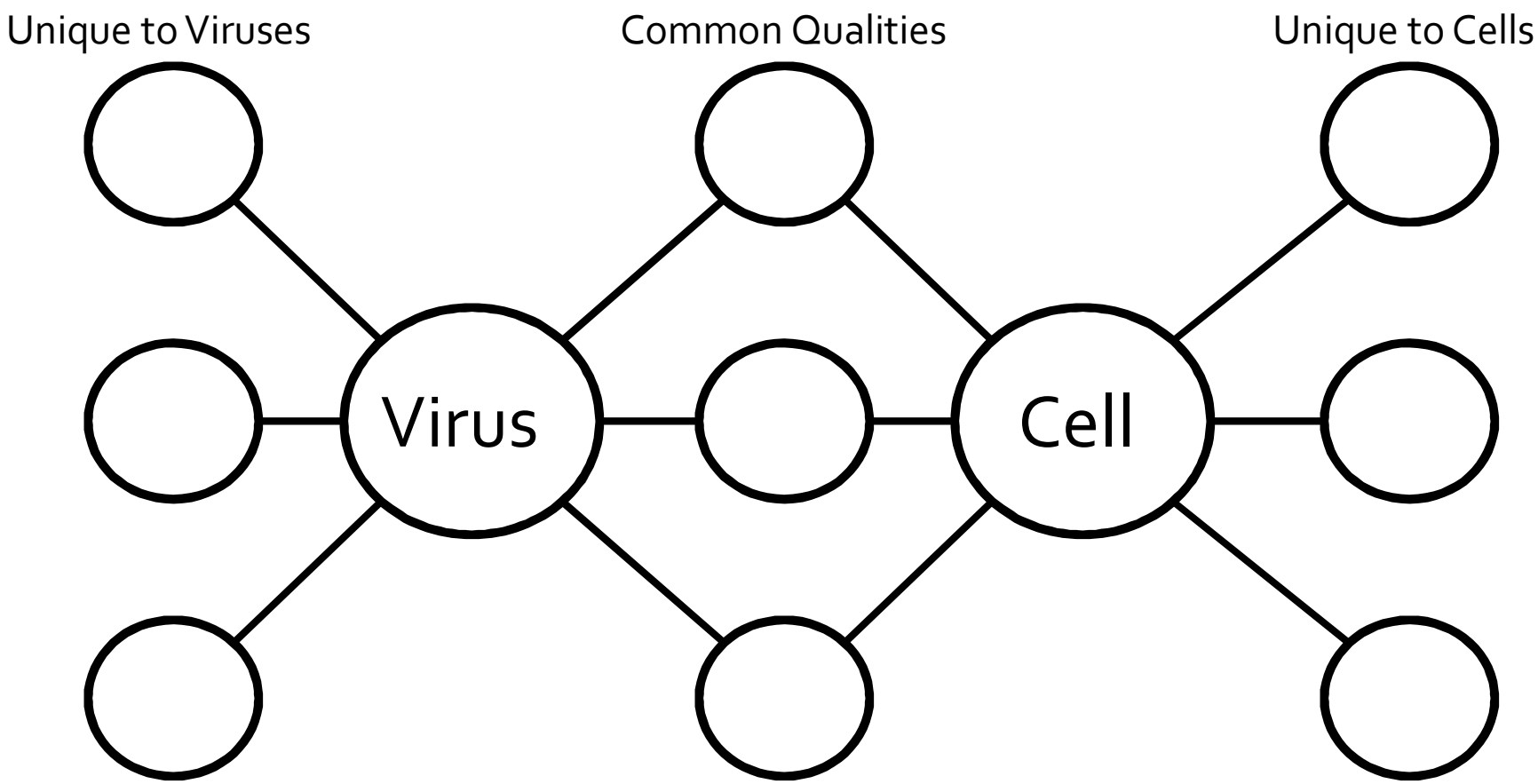
- Non-living
- No metabolism
- Has "head" with nucleic acids
- Depends on host cell of reproduction
- Do not respond to antibiotics
- Can causes diseases like Influenza and HIV

Cells (Bacteria)

- Living
- Metabolic processes
- Has nucleus with nucleic acids
- Reproduction through mitosis
- Bacteria can be killed with antibiotics
- Can causes infections like strep throat and meningitis

Comparison of Viruses and Cells

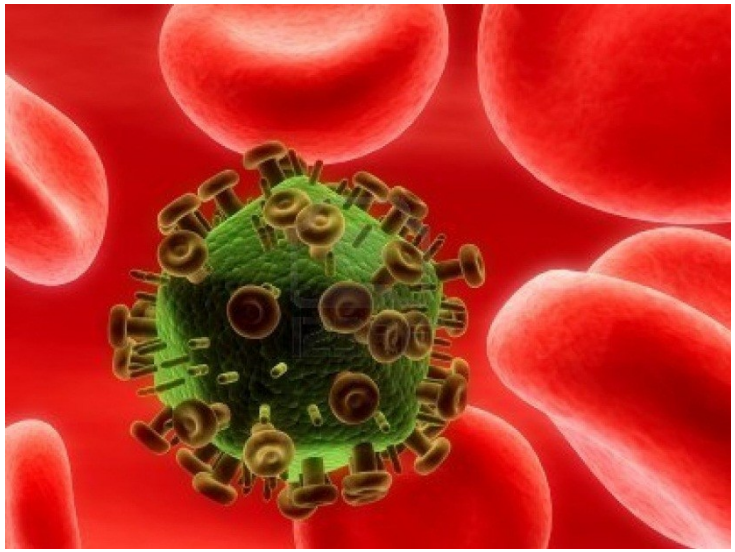
Complete the chart below.



Human Immunodeficiency Virus (HIV)

HIV is particular dangerous virus because:

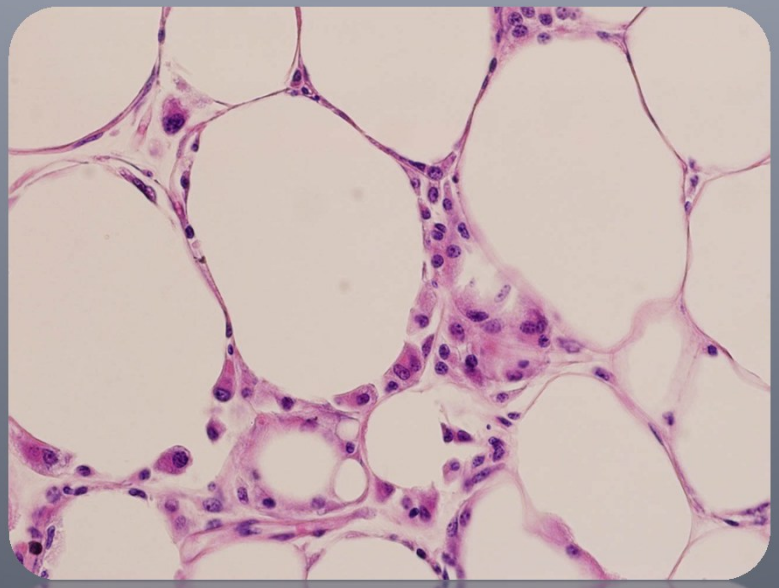
- It attacks human T-cells as its host. These cells are critical to the human immune system.
- It is sexually transmitted.
- It cannot be treated with antibiotics.
- It may undergo a latency period without being detected, allowing an infected person to pass the virus unknowingly.



Biology EOC Review DAY 2

CELL STRUCTURE AND FUNCTION

TEKS B.5A, B.9A



The Cell Cycle

I – Interphase: Cell grows, develops, and duplicates its DNA

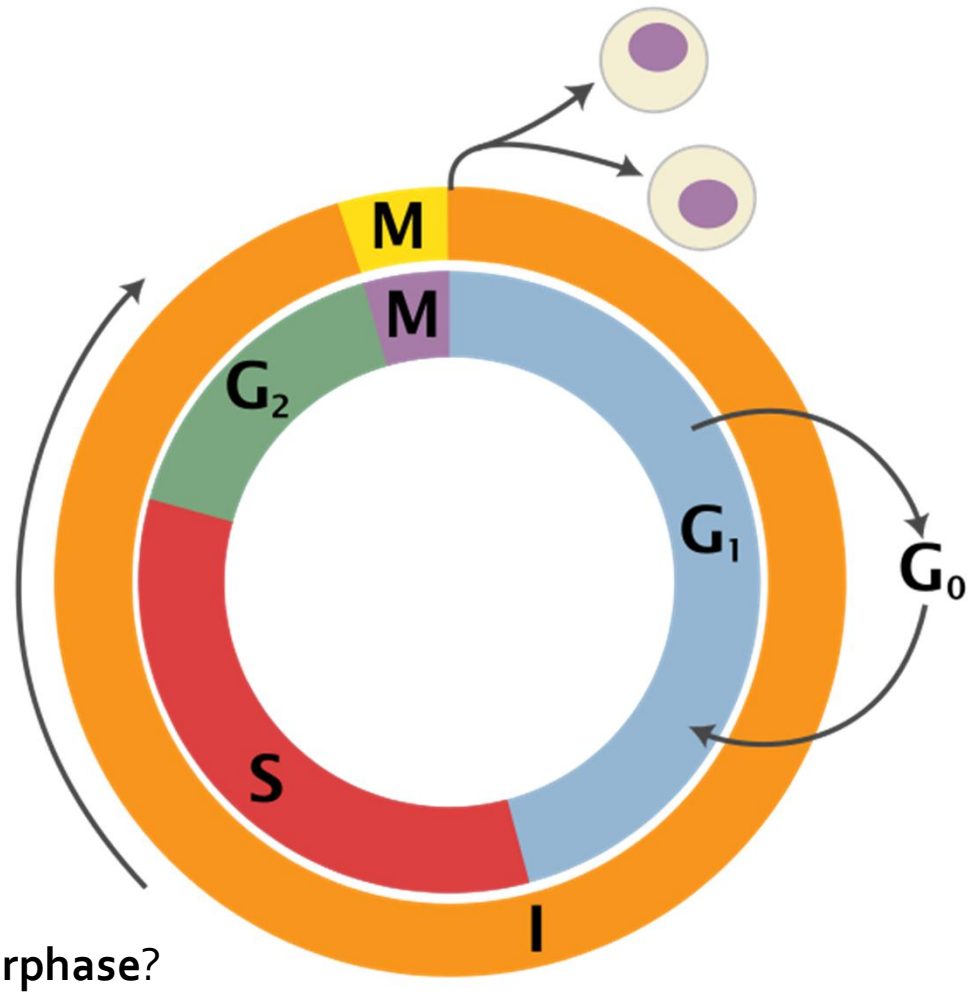
M – Mitosis: Cell division is occurring

G1 – First Gap: Cell growth

S – Synthesis: Cell replicates its DNA

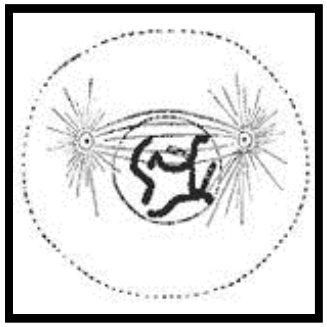
G2 – Second Gap: More cell growth and preparation for division

Go – "Holding" stage if cell density is too high



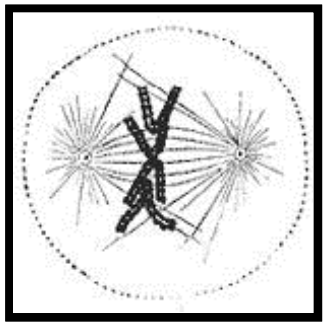
What percentage of time is spent in Interphase?

The Cell Cycle - Mitosis



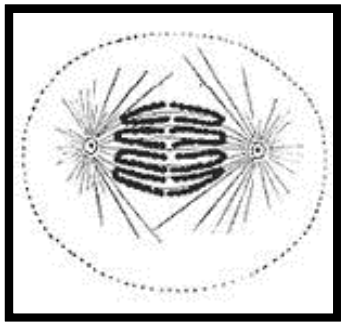
PROPHASE

The nuclear membrane disintegrates, and microtubules have invaded the nuclear space. The chromatin is condensing into chromosomes.



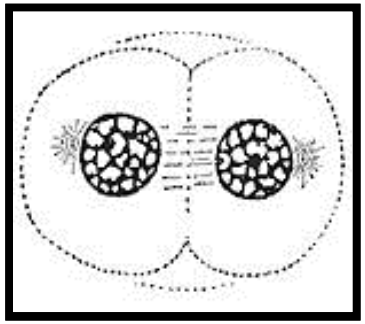
METAPHASE

The chromosomes align at the metaphase plate.



ANAPHASE

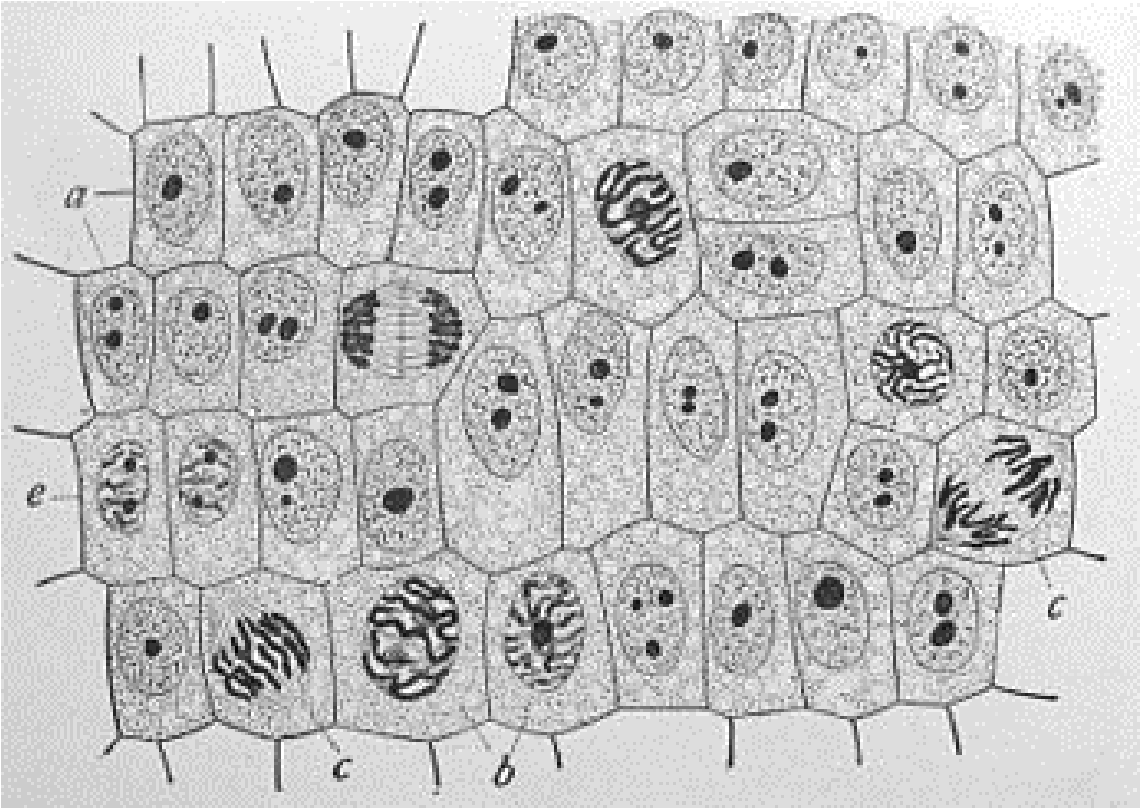
The chromosomes split and the microtubules shorten.



TELOPHASE

The decondensing chromosomes are surrounded by nuclear membranes.

The Cell Cycle



What phases of the cell cycle can you identify in the picture to the left?

Identify a cell in:

G1 Interphase
G2 Interphase
Prophase
Metaphase
Anaphase
Telophase

Biomolecules

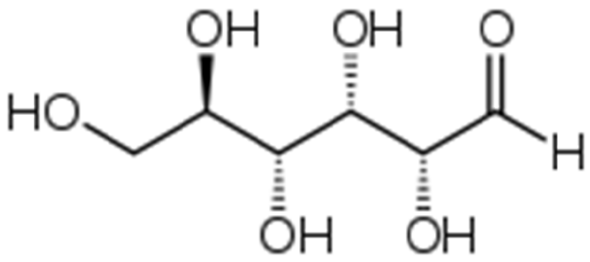
With a partner, fill in the "Structure and Function" and "Example" columns for the following biomolecules.

	Structure and Function	Example
Carbohydrate		
Lipids		
Proteins		
Nucleic Acids		

Carbohydrates

Carbohydrates

- Sugars and starches
- Contains Carbon, Oxygen, and Hydrogen
- Source of energy (glucose)
- Structural molecule (cellulose)
- Easy to digest
- Water soluble



Glucose

Lipids

Lipids

- Oils, fatty acids, wax, and steroids
- Chains of carbon, oxygen, and hydrogen
- Source of energy (fats)
- Chemical messenger (cholesterol)
- High caloric density
- Insoluble in water

Protein

Proteins

- Enzymes and hormones
- Chains of amino acids
- Can be a source of energy
- Large and complex molecules
- Transport molecule (hemoglobin)
- Chemical messenger (insulin)
- Structural molecule (collagen)

Nucleic Acids

Nucleic Acids

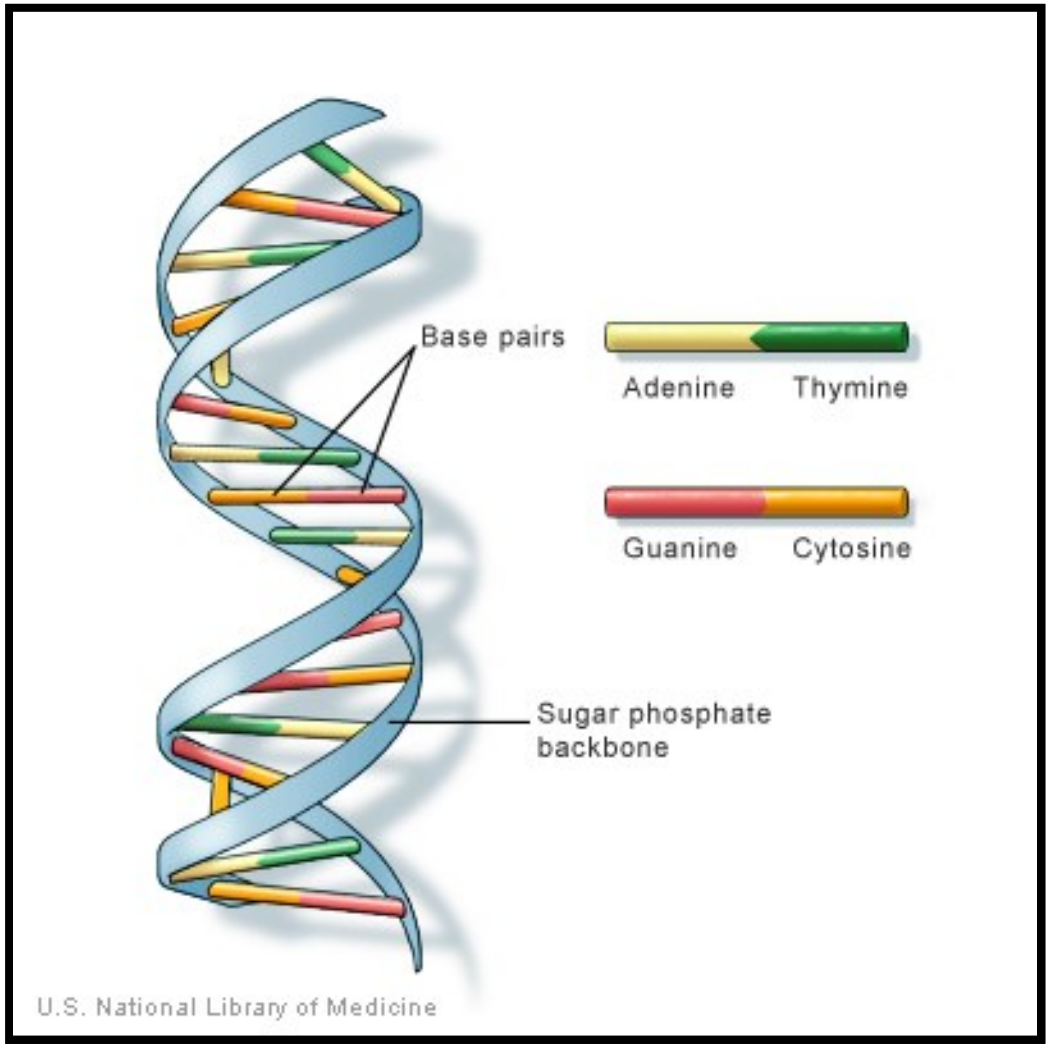
- RNA and DNA
- Carrier of genetic information
- Instructions for protein synthesis
- Large and complex molecules
- Contains carbohydrate group, phosphate group, and nitrogen base

Biology EOC Review DAY 3

MECHANSIMS OF GENETICS

TEKS B.6A, B.6E

Structure of DNA



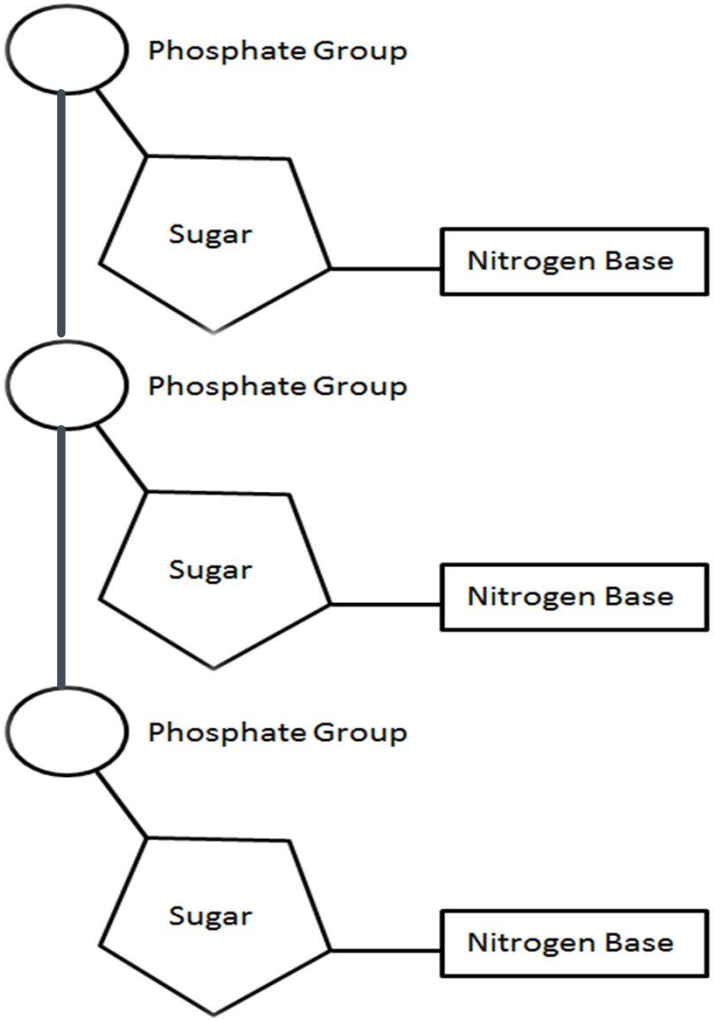
Characteristics of DNA

- Carries genetic information for traits in an organism
- Twisted, double-helix structure
- Coding is carried in two sets of complimentary bases:
  - ***Adenine-Thymine***
  - ***Guanine-Cytosine***
- Strands of millions of nucleotides

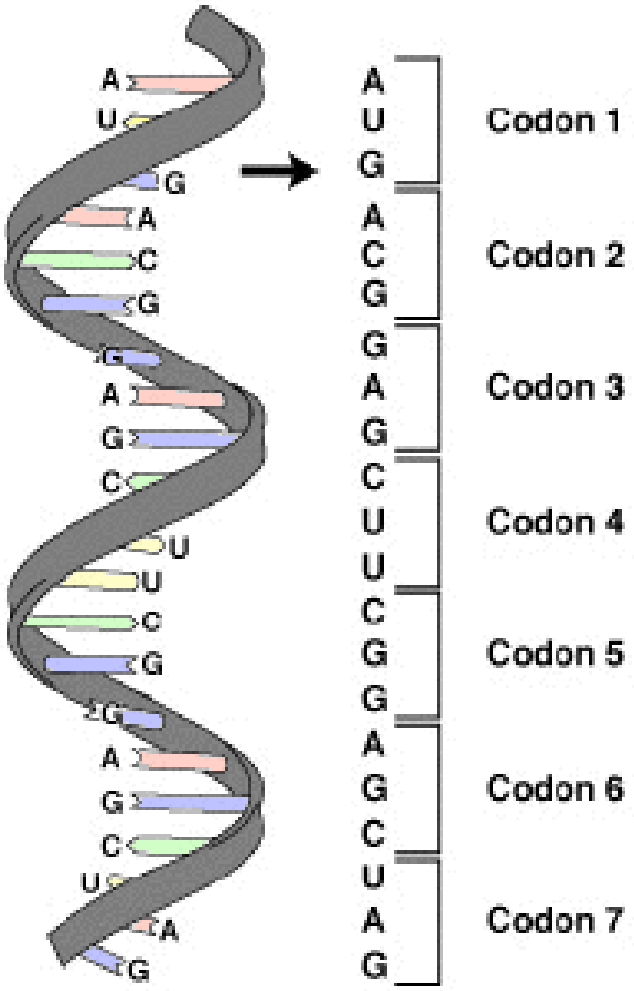
Structure of DNA

Nucleotides

- DNA is a strand of thousands or millions of nucleotides
- Nucleotides consist of:
  - A Phosphate Group
  - Sugar
  - Nitrogen Base (A, T, C, or G)
- Three nucleotides create a **codon** or **triplet**
- Each triplet will code for a particular amino acid



How DNA Creates a Trait



- Each codon, or triplet, codes for a particular amino acid.
- There are 21 possible amino acids.
- These chains of amino acids create a protein.
- Each protein will have a specific function resulting in a particular trait in the organism.

The Genetic Code of DNA

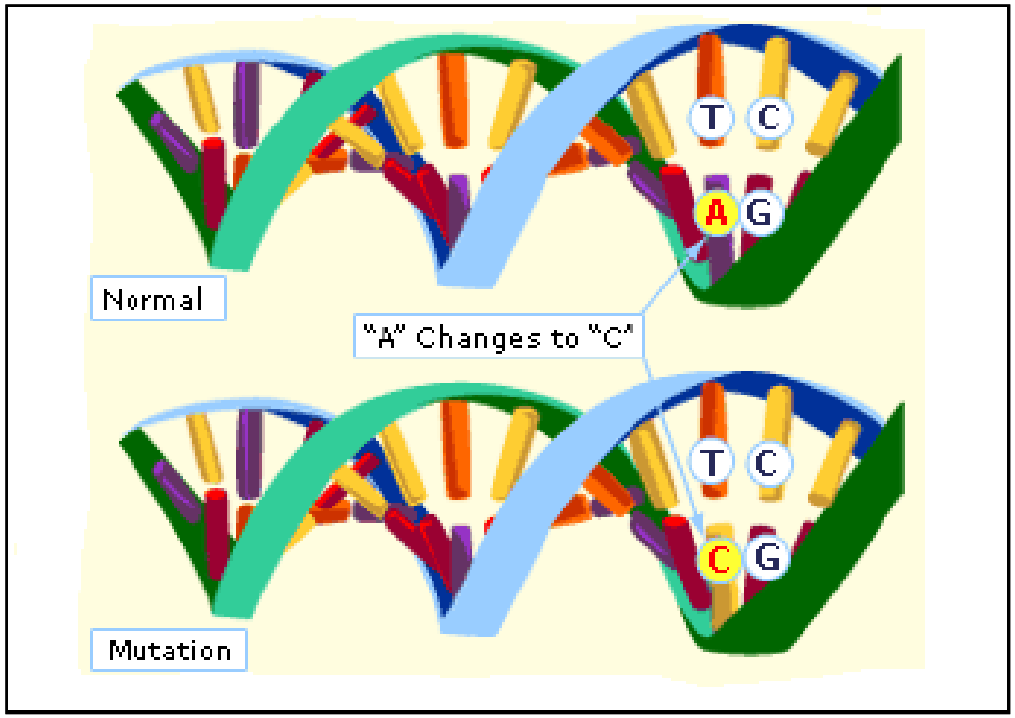
STANDARD GENETIC CODE									
1st BASE	2nd BASE								3rd BASE
	T		C		A		G		
T	TTT	Phenylalanine	TCT	Serine	TAT	Tyrosine	TGT	Cysteine	T
	TTC		TCC		TAC		TGC		C
	TTA	Leucine	TCA		TAA	Stop	TGA	Stop	A
	TTG		TCG		TAG	Stop	TGG	Tryptophan	G
C	CTT		CCT	Proline	CAT	Histidine	CGT	Arginine	T
	CTC		CCC		CAC		CGC		C
	CTA		CCA		CAA	Glutamine	CGA		A
	CTG		CCG		CAG		CGG		G
A	ATT	Isoleucine	ACT	Threonine	AAT	Asparagine	AGT	Serine	T
	ATC		ACC		AAC		AGC		C
	ATA		ACA		AAA	Lysine	AGA	Arginine	A
	ATG	Methionine	ACG		AAG		AGG		G
G	GTT	Valine	GCT	Alanine	GAT	Aspartic acid	GGT	Glycine	T
	GTC		GCC		GAC		GGC		C
	GTA		GCA		GAA	Glutamic acid	GGA		A
	GTG		GCG		GAG		GGG		G

Suppose a DNA strand has the following bases:

CGA-ACT-TTA

What three amino acids would be produced?

Mutation



A **mutation** occurs when a nitrogen base is either inserted, deleted, or changed from the original.

A mutation can:

- Create a new trait that is beneficial
- Create a new trait that is harmful
- Result in no change because the codon still results in the same amino acid

Mutation

STANDARD GENETIC CODE									
1st BASE	2nd BASE								3rd BASE
	T		C		A		G		
T	TTT	Phenylalanine	TCT	Serine	TAT	Tyrosine	TGT	Cysteine	T
	TTC		TCC		TAC		TGC		C
	TTA	Leucine	TCA		TAA	Stop	TGA	Stop	A
	TTG		TCG		TAG	Stop	TGG	Tryptophan	G
C	CTT		CCT	Proline	CAT	Histidine	CGT	Arginine	T
	CTC		CCC		CAC		CGC		C
	CTA		CCA		CAA	Glutamine	CGA		A
	CTG		CCG		CAG		CGG		G
A	ATT	Isoleucine	ACT	Threonine	AAT	Asparagine	AGT	Serine	T
	ATC		ACC		AAC		AGC		C
	ATA		ACA		AAA	Lysine	AGA	Arginine	A
	ATG	Methionine	ACG		AAG		AGG		G
G	GTT	Valine	GCT	Alanine	GAT	Aspartic acid	GGT	Glycine	T
	GTC		GCC		GAC		GGC		C
	GTA		GCA		GAA	Glutamic acid	GGA		A
	GTG		GCG		GAG		GGG		G

Suppose a DNA strand has the following bases:

TGT-CTT-GCA-AGT

However, CTT undergoes a mutation and is changed to CTA.

Will this result in a change in protein synthesis?

Mutation

STANDARD GENETIC CODE									
1st BASE	2nd BASE								3rd BASE
	T		C		A		G		
T	TTT	Phenylalanine	TCT	Serine	TAT	Tyrosine	TGT	Cysteine	T
	TTC		TCC		TAC		TGC		C
	TTA	Leucine	TCA		TAA	Stop	TGA	Stop	A
	TTG		TCG		TAG	Stop	TGG	Tryptophan	G
C	CTT		CCT	Proline	CAT	Histidine	CGT	Arginine	T
	CTC		CCC		CAC		CGC		C
	CTA		CCA		CAA	Glutamine	CGA		A
	CTG		CCG		CAG		CGG		G
A	ATT	Isoleucine	ACT	Threonine	AAT	Asparagine	AGT	Serine	T
	ATC		ACC		AAC		AGC		C
	ATA		ACA		AAA	Lysine	AGA	Arginine	A
	ATG	Methionine	ACG		AAG		AGG		G
G	GTT	Valine	GCT	Alanine	GAT	Aspartic acid	GGT	Glycine	T
	GTC		GCC		GAC		GGC		C
	GTA		GCA		GAA	Glutamic acid	GGA		A
	GTG		GCG		GAG		GGG		G

Answer: NO

CTT codes for Leucine.

CTA also codes for Leucine.

Therefore, there will be no difference in the protein produce.

Biology EOC Review DAY 4

MECHANSIMS OF GENETICS

TEKS B.6E, B.6F

Mutation Review

Mutations

- DNA is altered by either:
  - Inserting a nitrogen base (A, T, G, or C) into a DNA sequence
  - Deleting a nitrogen base (A, T, G, or C) from a DNA sequence
  - Changing a nitrogen base in a DNA sequence (A → G)

- A mutation may cause no effect if the codon in the DNA sequence still codes for the same amino acid.

- A mutation will be noticed if the codon in DNA sequence codes for a new amino acid. In this case the mutation may be either harmful or beneficial to the organism.

Mendelian Genetics

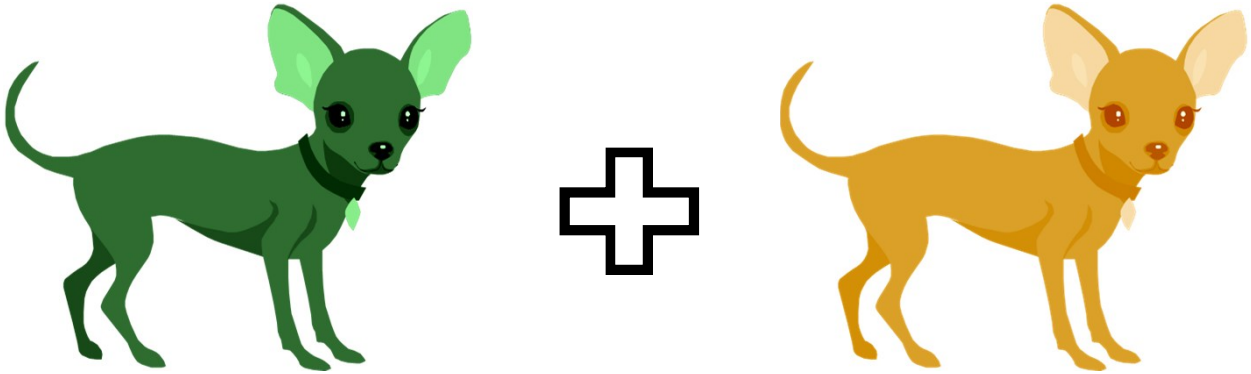
Genetics is the study of the odds and percentages any given offspring will have a set of traits.

Three Laws of Mendelian Genetics:

1. Alleles (form of a gene) **segregate** and recombine, and one allele is inherited from each parent.
2. Traits are **independent** of one another (hair color does not affect height).
3. One trait may mask another trait for the same thing (dominant over recessive).

Genetics

Green Dog (male) and Yellow Dog (female) meet, fall in love, and get married. Green and Yellow have four puppies.



If yellow coats (Y) in dogs are **<u>dominant</u>** to green coats (y), and both parents are **<u>homozygous</u>**, what are the likely colors of their four puppies?

Genetics

	Y	Y
y	Yy	Yy
y	Yy	Yy

This is an example of a **monohybrid** cross (one trait).

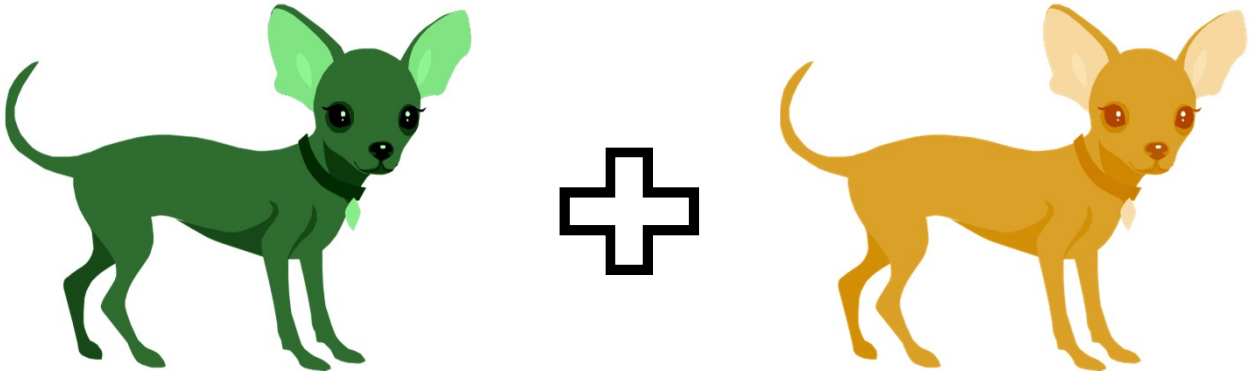
Each of the puppies will be yellow, but **heterozygous.**

The **phenotype** of each puppy is yellow.

The **genotype** of each puppy is Yy, meaning that each puppy carries a **recessive** green **allele**.

Genetics

Now let's suppose Yellow Dog has a genotype of Yy and carries a recessive green allele. What is the genotype of Green Dog?



What are the possible colors of their four puppies?

Genetics

	Y	y
y	Yy	yy
y	Yy	yy

Two puppies will likely be green and two puppies will likely be yellow.

Genetics

Example of **<u>dihybrid cross</u>** (two traits): Yellow Dog has a short tail (recessive), and Green Dog has a long tail (dominant). Green Dog is heterozygous for a long tail.

Color – yy
Tail - Tt

Color – Yy
Tail - tt

What are the possible colors and tail lengths of their four puppies?

Genetics

	Yt	Yt	yt	yt
yT				
yT				
yt				
yt				

Complete the dihybrid cross.

What are the odds a puppy will be:

yellow, long tail
yellow, short tail
green, long tail
green, short tail

Non-Mendelian Genetics

Non-Mendelian genetics do not follow the traditional laws of genetics. Non-Mendelian examples include:

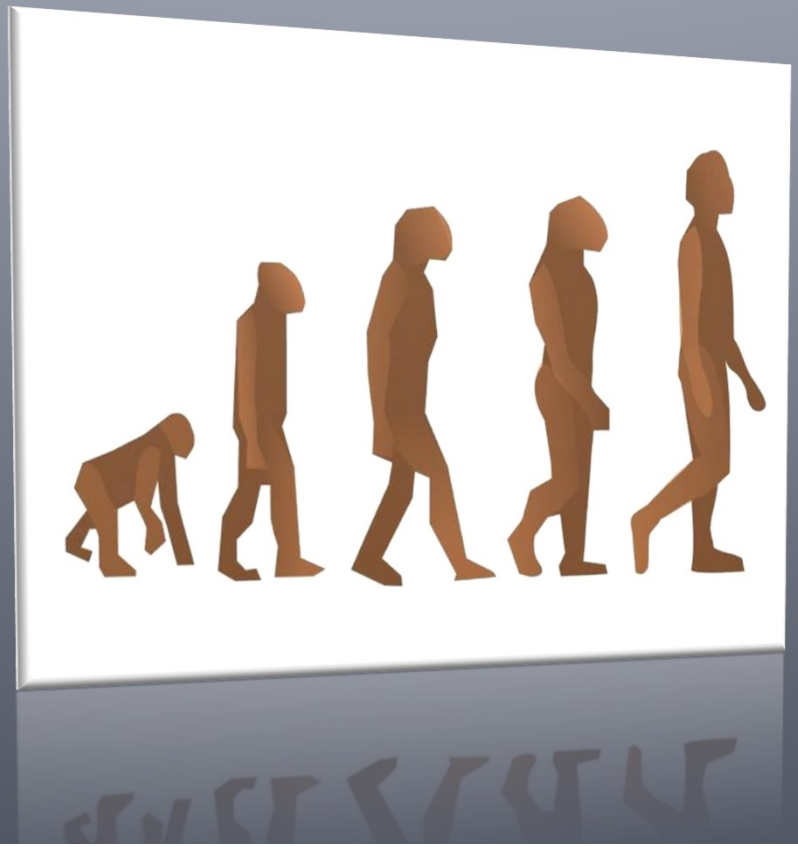
- **Incomplete dominance** – a white rose and a red rose produce a pink rose.

- **Linked genes** – hemophilia and red-green colorblindness have a high correlation in men.

Biology EOC Review DAY 5

BIOLOGICAL EVOLUTION AND CLASSIFICATION

TEKS B.7A, B.7E



Common Ancestry

Common ancestry is the theory that all organisms descended from a single ancestor. Support for this idea is found in:

- **Fossil record** – shows the variety of organisms that have existed over time, going from very simple to more complex organisms over billions of years
- **Biogeography** – indicates that organisms that live geographically closer are more likely to be genetically similar
- **Anatomical homology** – structural similarities among different species that serve different purposes (i.e., a bird's wing and a human's arm)
- **Molecular homology** – DNA and other molecular similarities between different species
- **Developmental homology** – embryonic and early developmental similarities

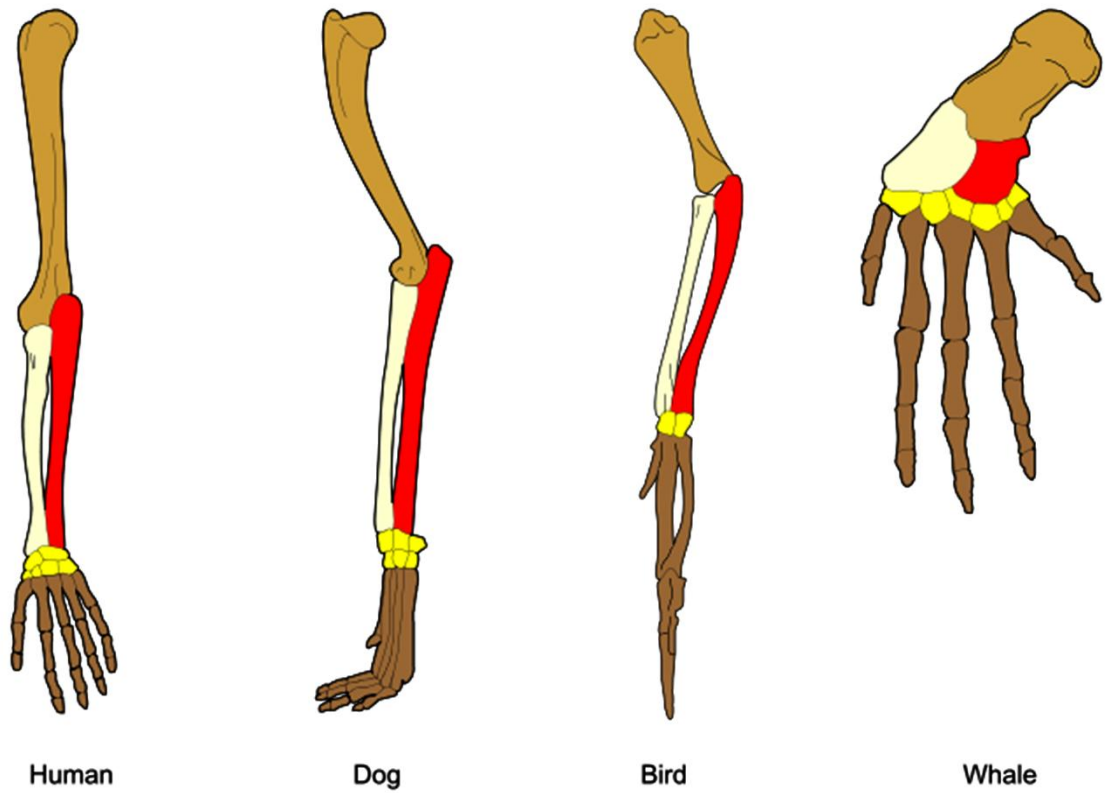
Common Ancestry

Each of the following examples give support for common ancestry. Identify each piece of evidence as derived from either:

1) Fossil record
2) Biogeography
3) Anatomical homology
4) Molecular homology
5) Developmental homology

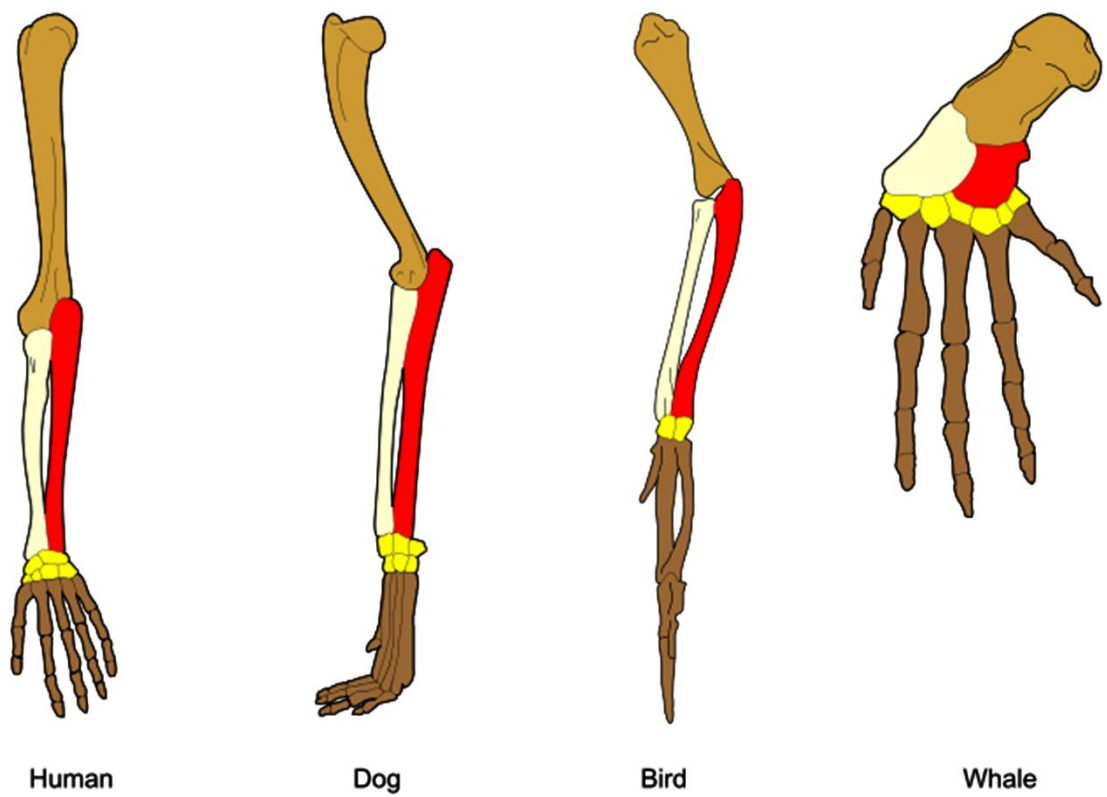
Common Ancestry

The bone comparison between a human, dog, bird, and whale is an example of _____.



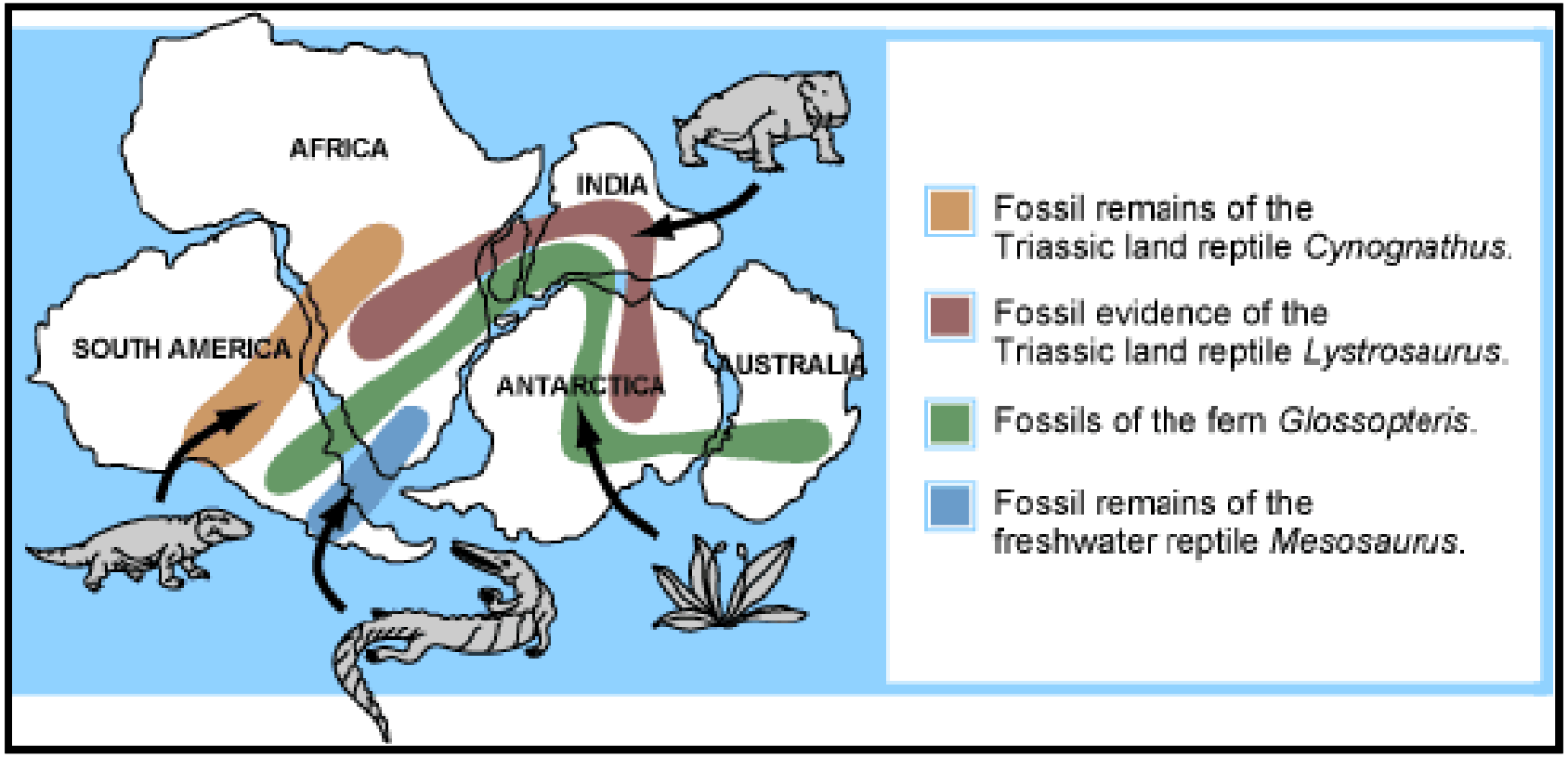
Common Ancestry

Anatomical Homology



Common Ancestry

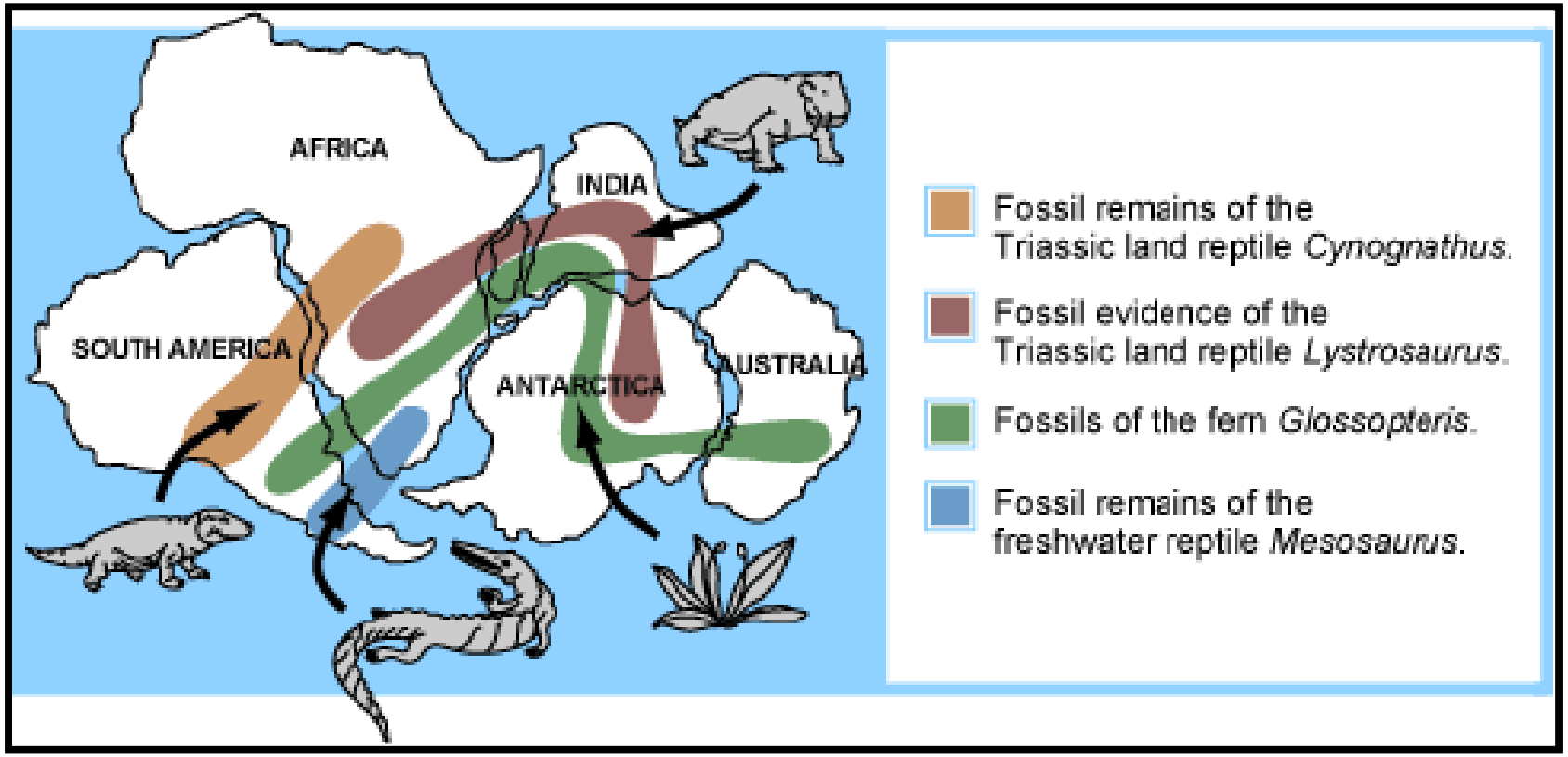
The proximity of like fossils that supports continental drift is an example of _____.



University of California - Berkley

Common Ancestry

Biogeography



University of California - Berkley

Common Ancestry

The _____ indicates that *A. africanus* is likely an ancestor of humans.

Australopithecus africanus
3 million years ago

Homo sapien
Current day

Common Ancestry

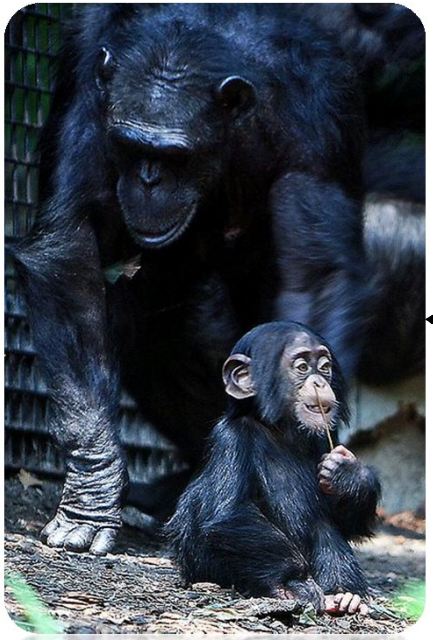
Fossil Record

Australopithecus africanus
3 million years ago

Homo sapien
Current day

Common Ancestry

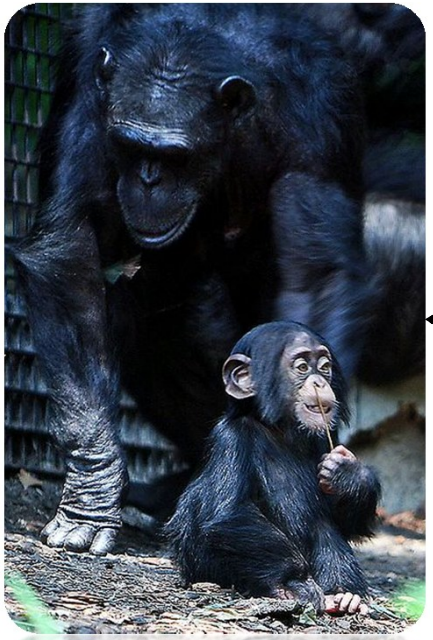
Chimps and humans share 99% of DNA coding, an example of _____.



99%
Identical
DNA

Common Ancestry

Molecular Homology



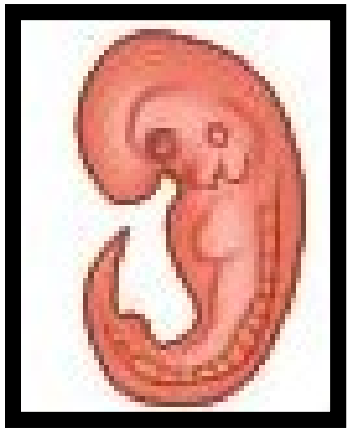
99%
Identical
DNA

Common Ancestry

_____ suggests that embryos of many organisms share similar characteristics.

Tortoise Embryo

Rabbit Embryo

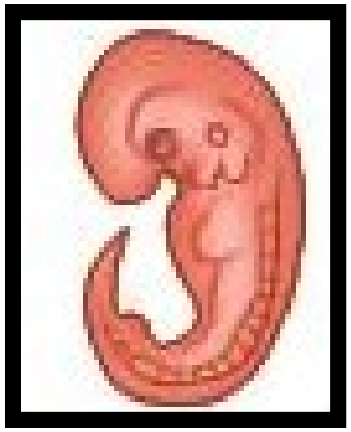


Common Ancestry

Developmental Homology

Tortoise Embryo

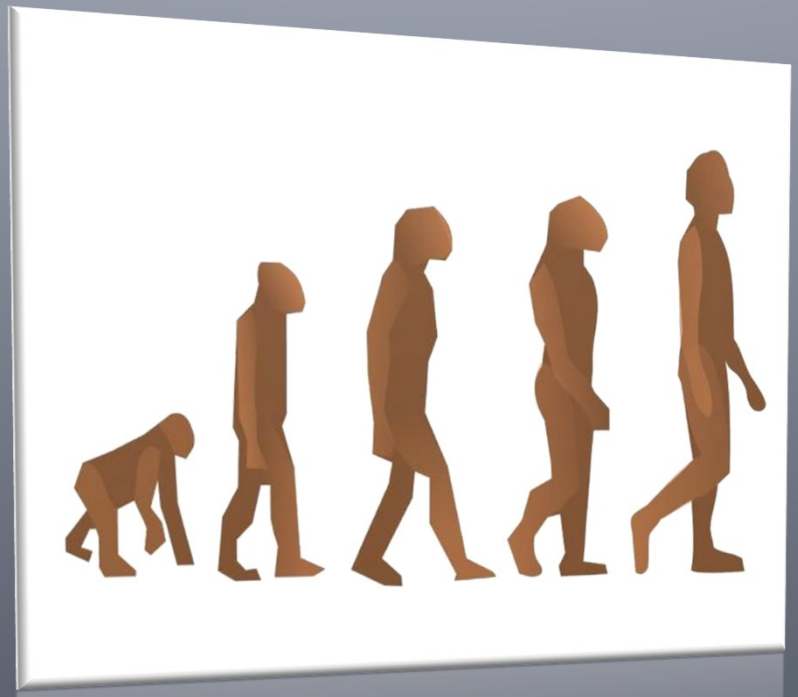
Rabbit Embryo



Biology EOC Review DAY 6

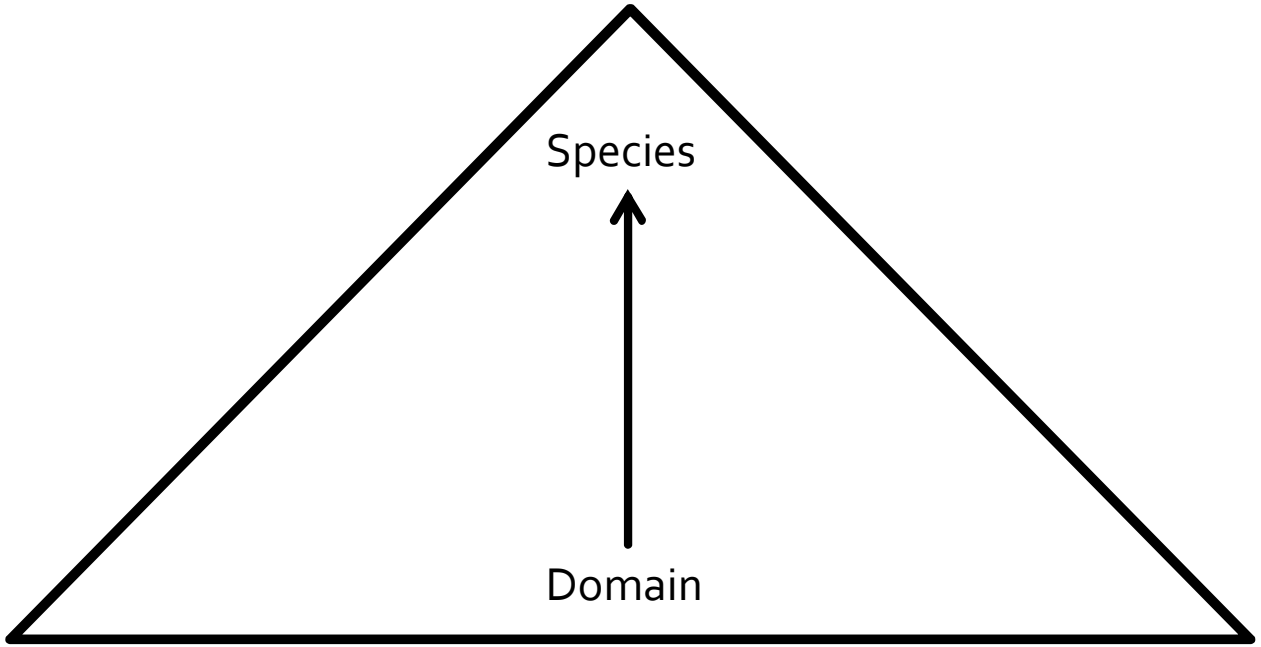
BIOLOGICAL EVOLUTION AND CLASSIFICATION

TEKS B.8B

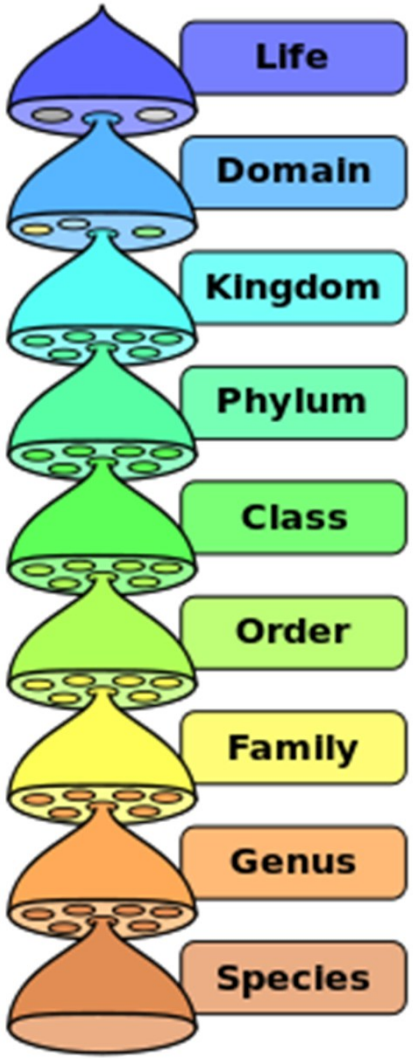


Hierarchical Classification

Hierarchical classification is a method of assigning organisms into groups and subgroups based on similar characteristics.



Hierarchical Classification



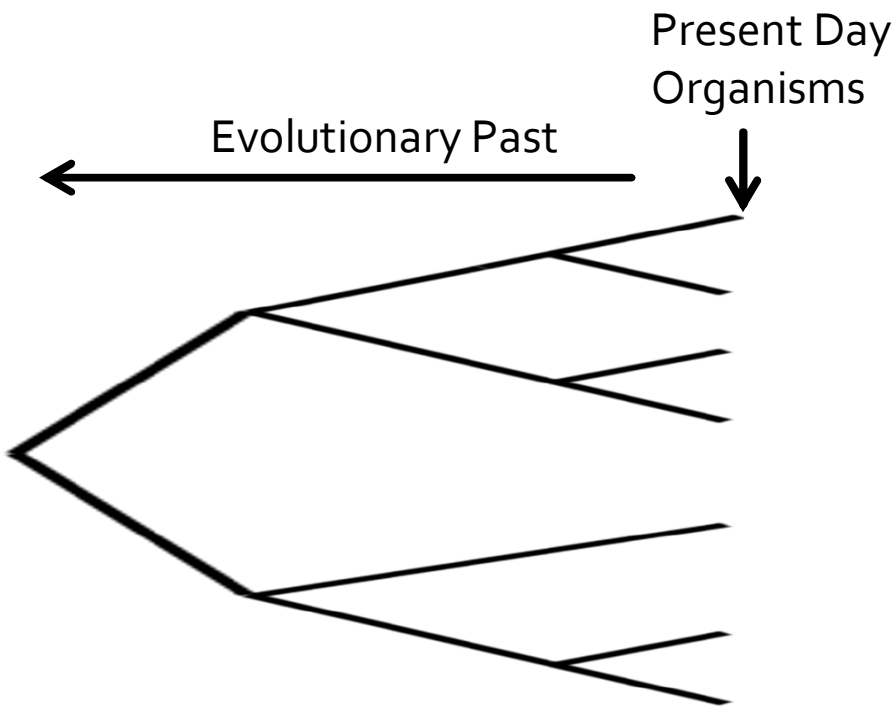
→ **3 Domains**: Bacteria, Archaea, Eukarya

↓ Increasing similarity in DNA within the group or taxon

→ **8,700,000 non-bacterial Species**

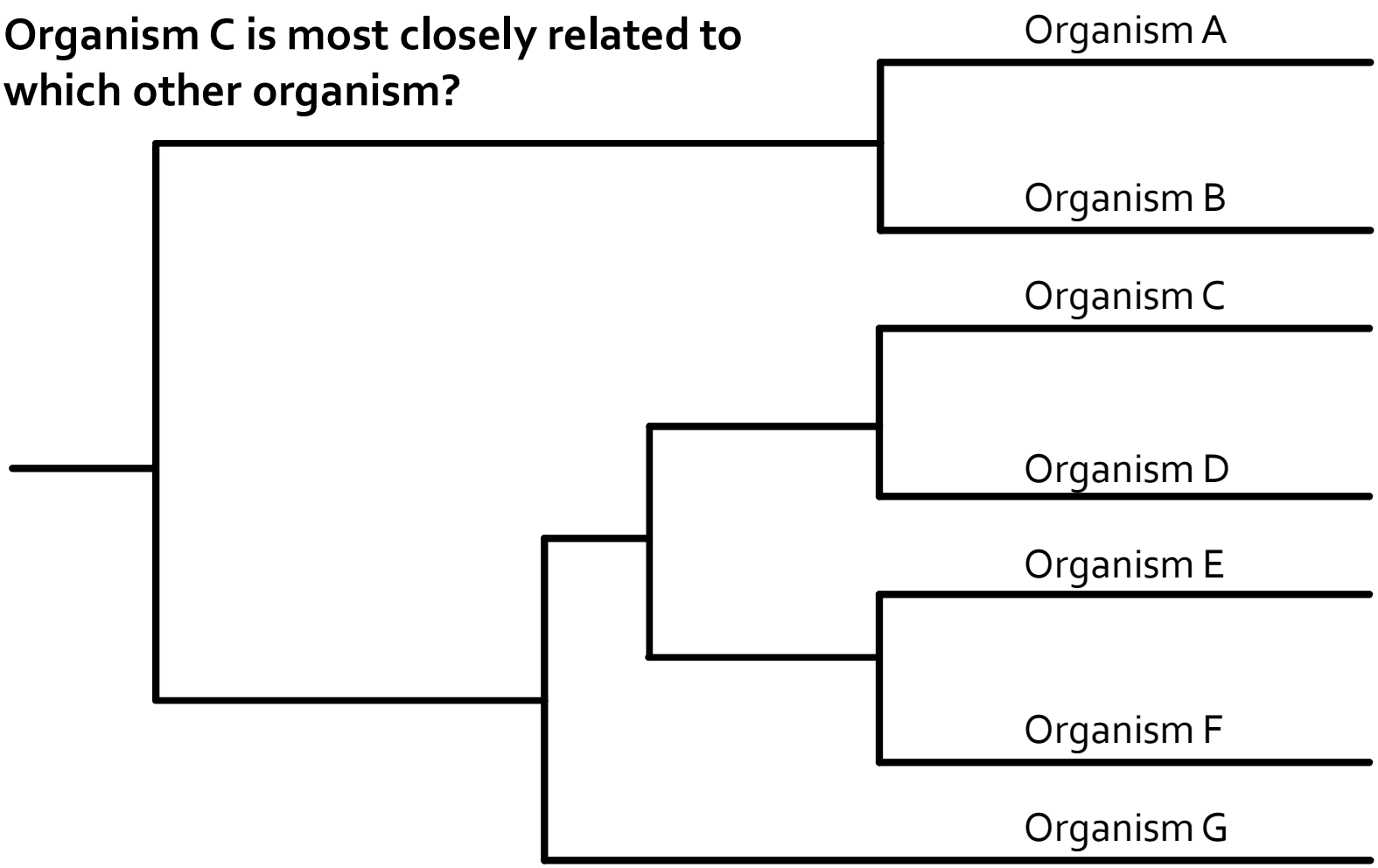
Hierarchical Classification

Phylogeny – an organism's evolutionary history which can be used to classify it.



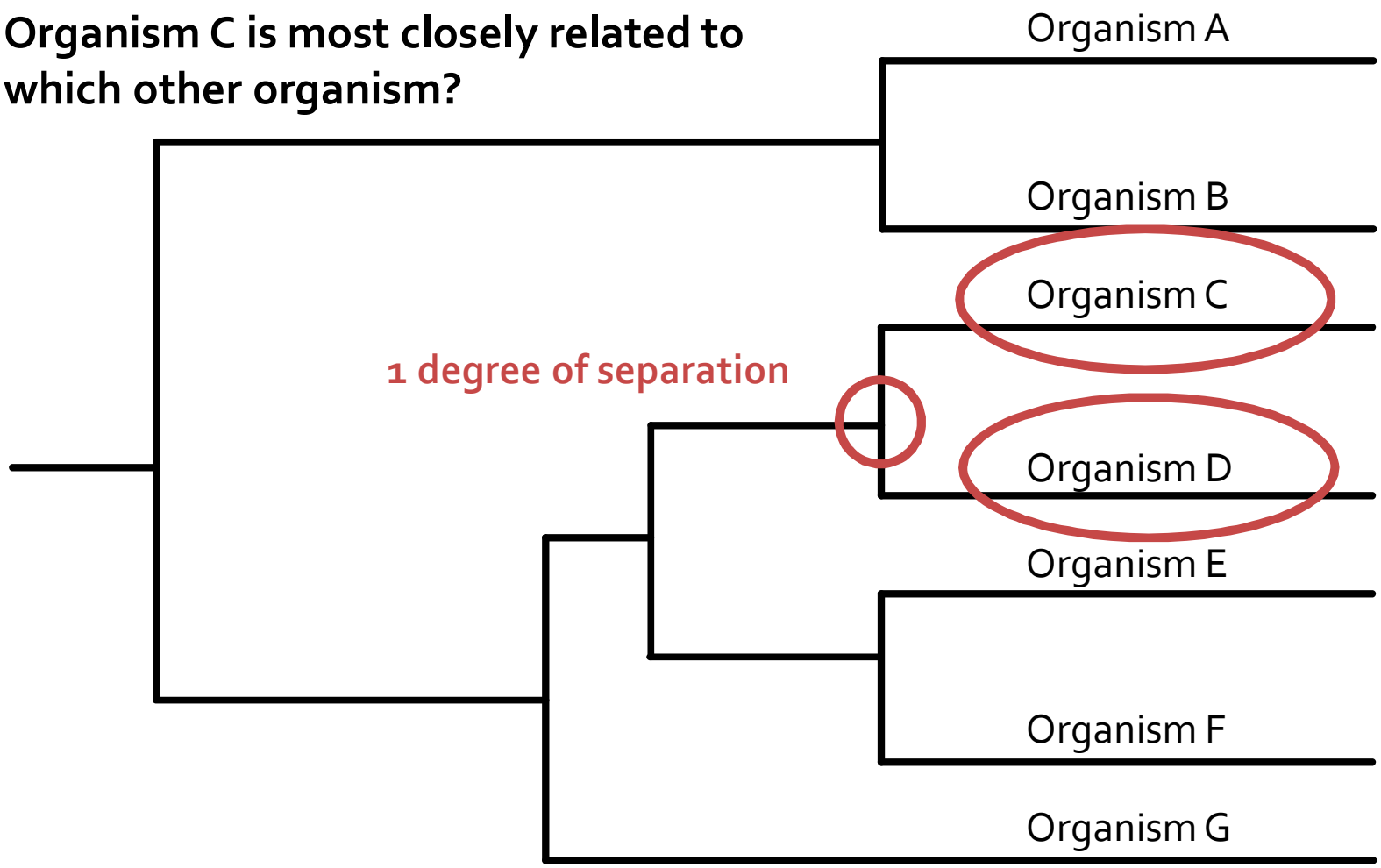
Hierarchical Classification

Organism C is most closely related to which other organism?



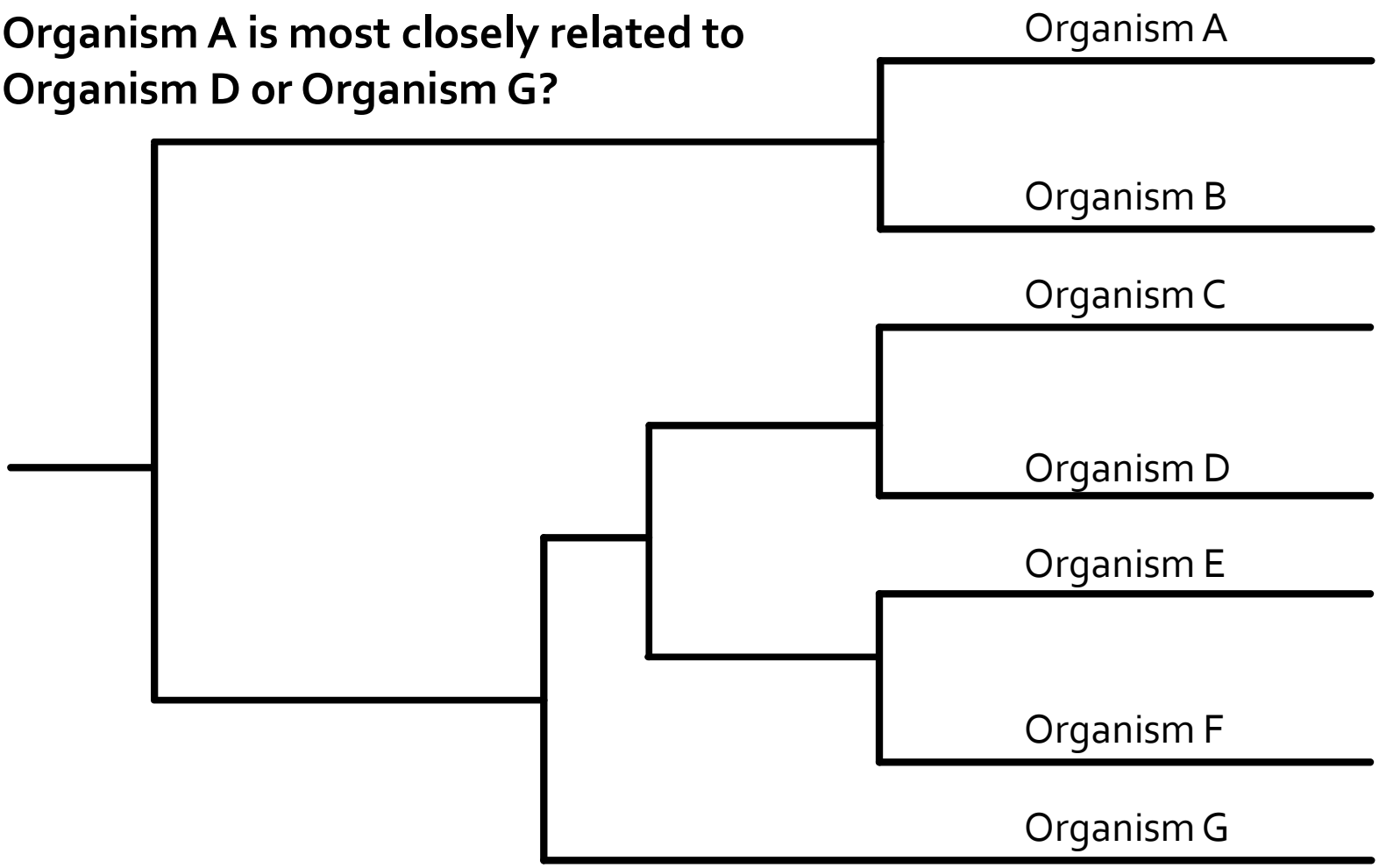
Hierarchical Classification

Organism C is most closely related to which other organism?



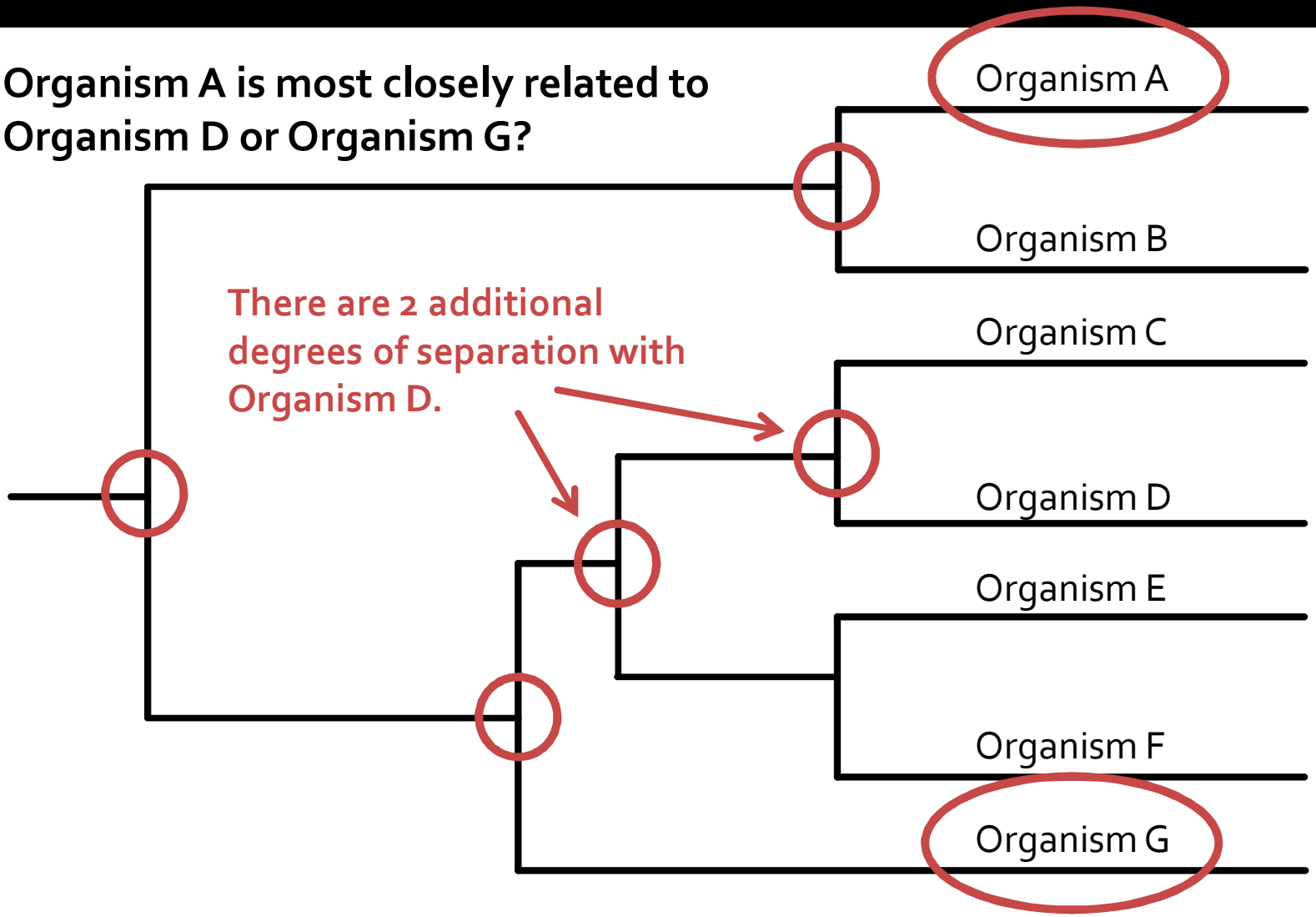
Hierarchical Classification

Organism A is most closely related to Organism D or Organism G?



Hierarchical Classification

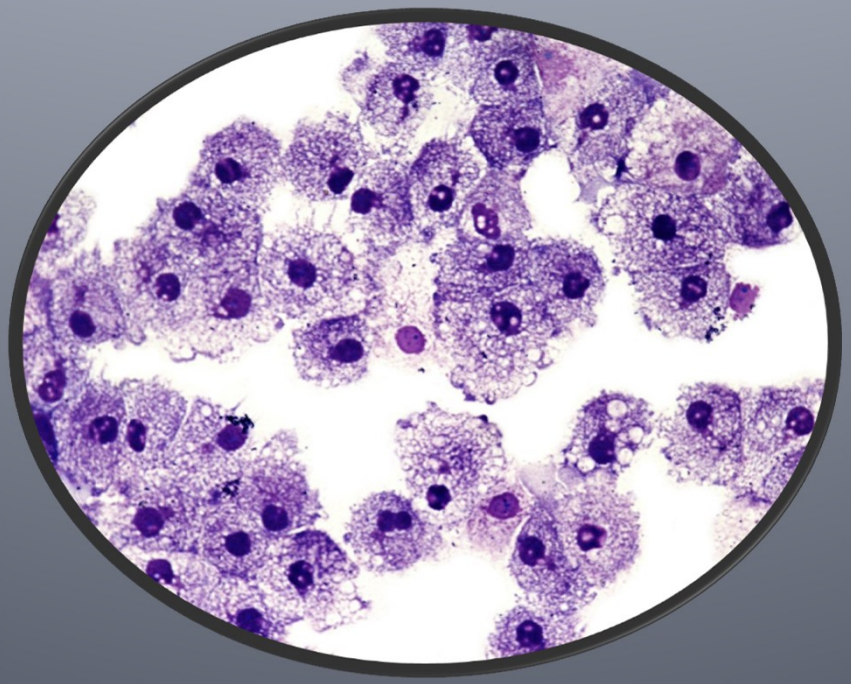
Organism A is most closely related to Organism D or Organism G?



Biology EOC Review DAY 7

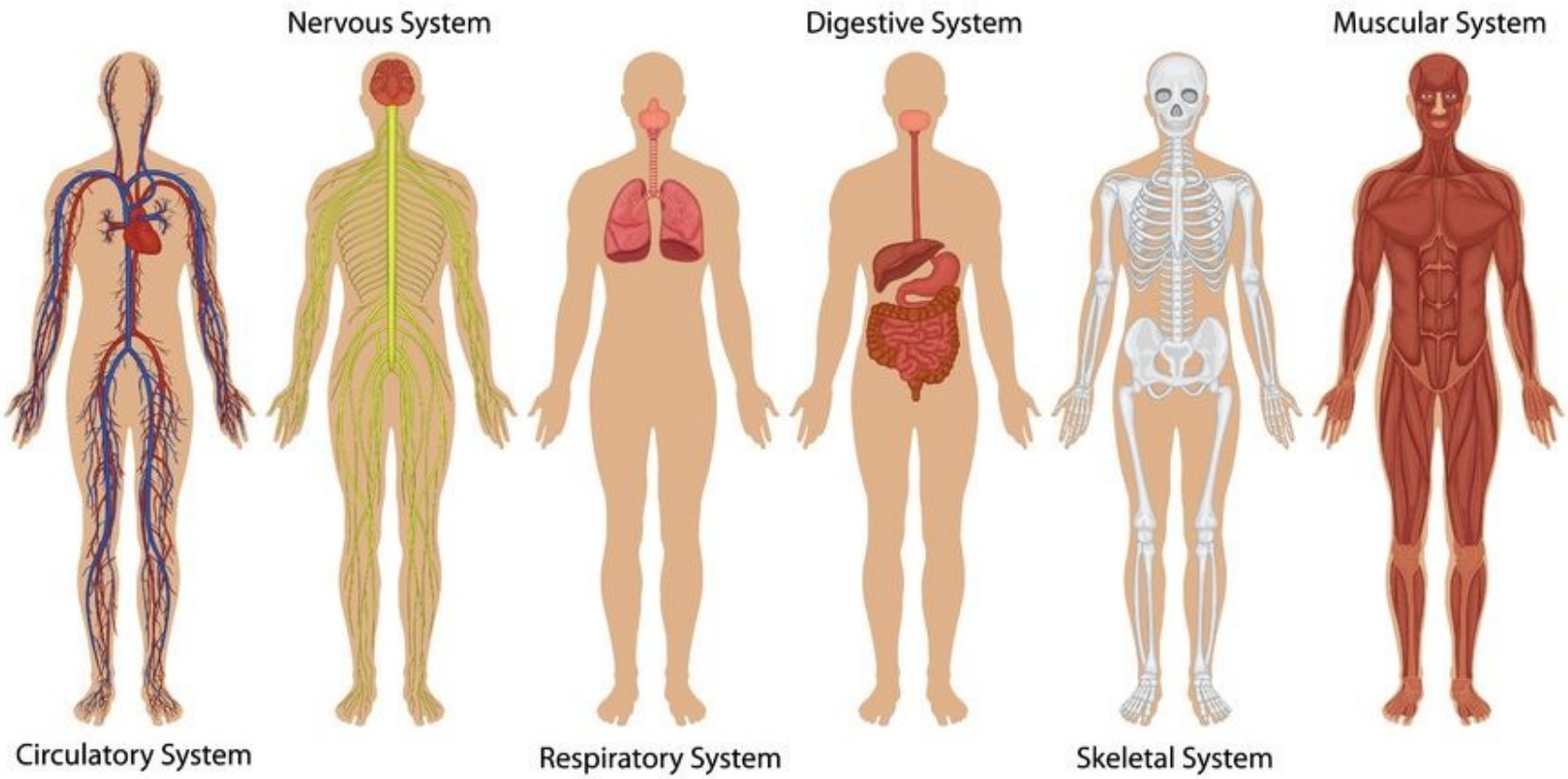
BIOLOGICAL PROCESSES AND SYSTEMS

TEKS B.10A, B.10B



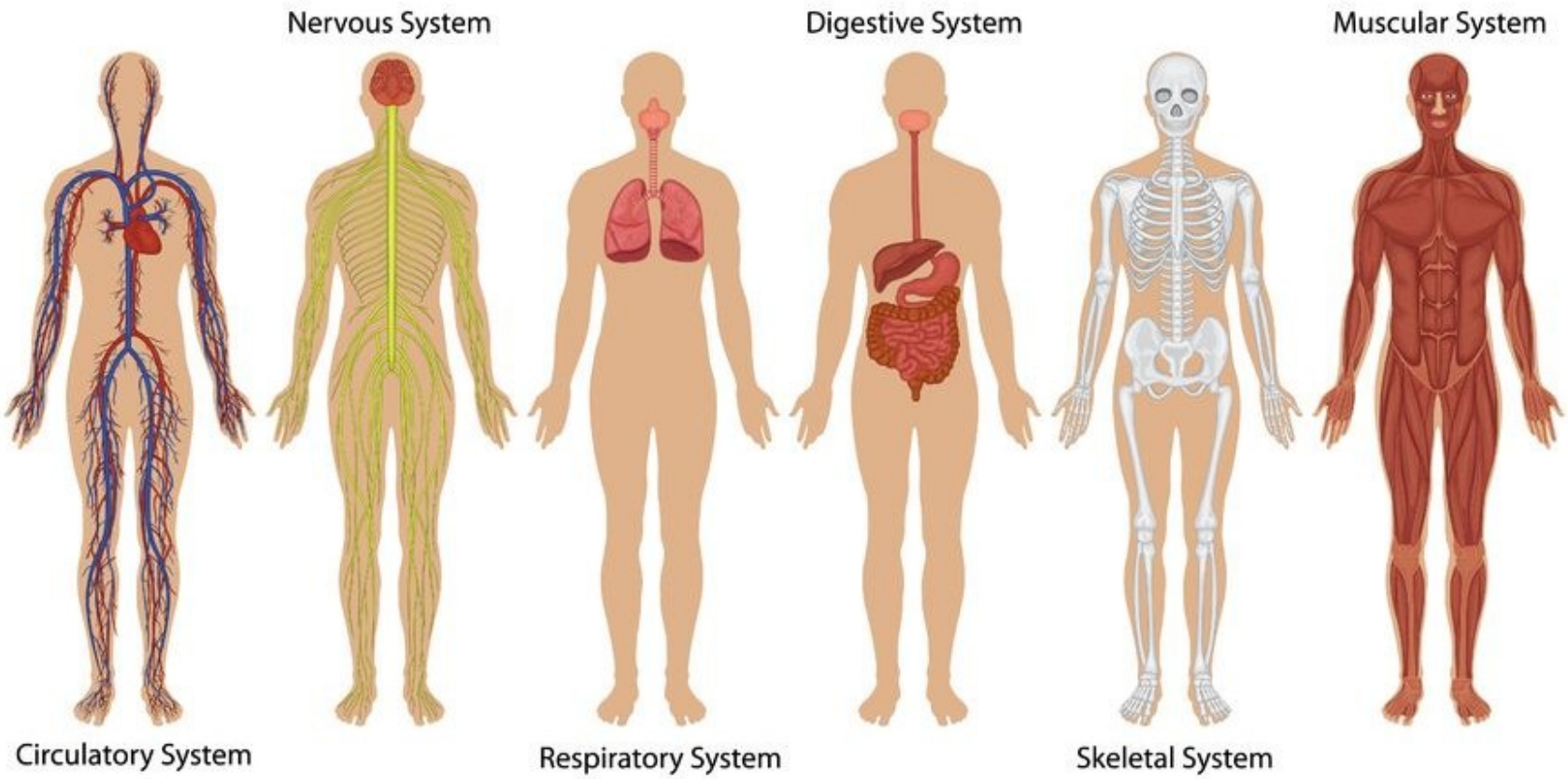
Interaction Between Systems

Discuss with a partner which body system(s) would be used for running.



Interaction Between Systems in Animals

In some form, each of these body systems are used in either the act of and providing energy for running.



Interaction Between Systems in Animals

Food is chewed, swallowed, and passed into the stomach where it is broken down into nutrients. The nutrients are then absorbed into the blood in the small intestine and distributed

What three body systems are primarily interacting with each other in this example?

Interaction Between Systems in Animals

Food is chewed, swallowed, and passed into the stomach where it is broken down into nutrients. The nutrients are then absorbed into the blood in the small intestine and distributed.

- **Muscular – chewing and swallowing food**
- **Digestive – breaking down food into nutrients in the stomach and small intestine**
- **Circulatory – distribution of nutrients by the blood**

Interaction Between Systems in Animals

A virus is inhaled from the nearby air and enters the lungs. Mucus is secreted and traps the virus. T-cells then destroy the virus. A cough is triggered by the brain to remove the virus and mucus.

What three body systems are primarily interacting with each other in this example?

Interaction Between Systems in Animals

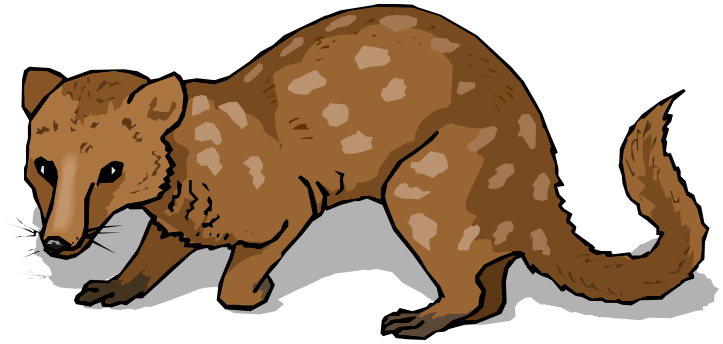
A virus is inhaled from the nearby air and enters the lungs. Mucus is secreted and traps the virus. T-cells then destroy the virus. A cough is triggered by the brain to remove the virus and mucus.

- **Respiratory – breathing in and trapping the virus**
- **Immune – T-cells destroy the virus**
- **Nervous – brain sends signal to cough**

Interaction Between Systems in Animals

A hormones in a female possum are produced that initiate ovulation.

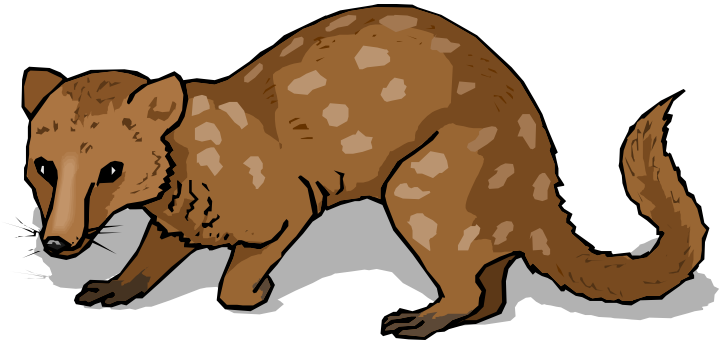
What two body systems are primarily interacting with each other in this example?



Interaction Between Systems in Animals

A hormones in a female possum are produced that initiate ovulation.

- **Endocrine – excreting hormones**
- **Reproductive – ovulation for sexual reproduction**



Interaction Between Systems in Animals

A drop in calcium in the blood triggers the release of a hormone called PTH from the parathyroid gland. PTH causes the kidneys to reabsorb more calcium from urine and the release of calcium from bones. The kidneys also produce Vitamin D, triggering the small intestine to absorb more calcium.

What body systems interact in this example?

Interaction Between Systems in Animals

- Circulatory – blood has less calcium
- Endocrine – parathyroid gland produces PTH
- Excretory – kidneys reabsorb more calcium from urine
- Skeletal – release of calcium from bones
- Digestive – more calcium is absorbed from food

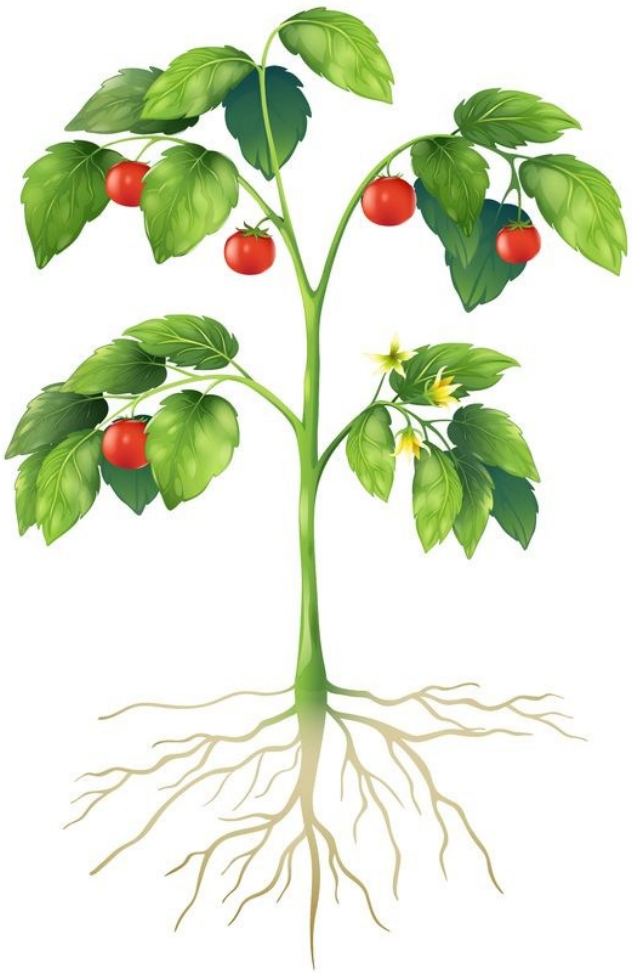
This is an example of _____.

Interaction Between Systems in Animals

- Circulatory – blood has less calcium
- Endocrine – parathyroid gland produces PTH
- Excretory – kidneys reabsorb more calcium from urine
- Skeletal – release of calcium from bones
- Digestive – more calcium is absorbed from food

This is an example of homeostasis or regulation.

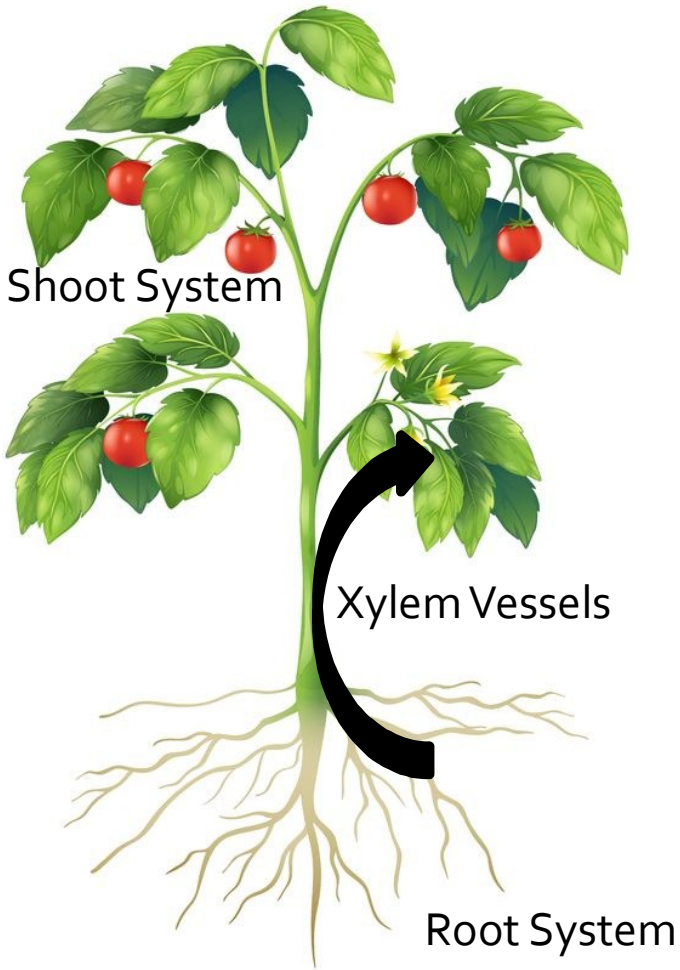
Interaction Between Systems in Plants



What systems of the tomato plant are involved in the description below?

Water and nutrients are absorbed and transported from the soil to the fruit.

Interaction Between Systems in Plants

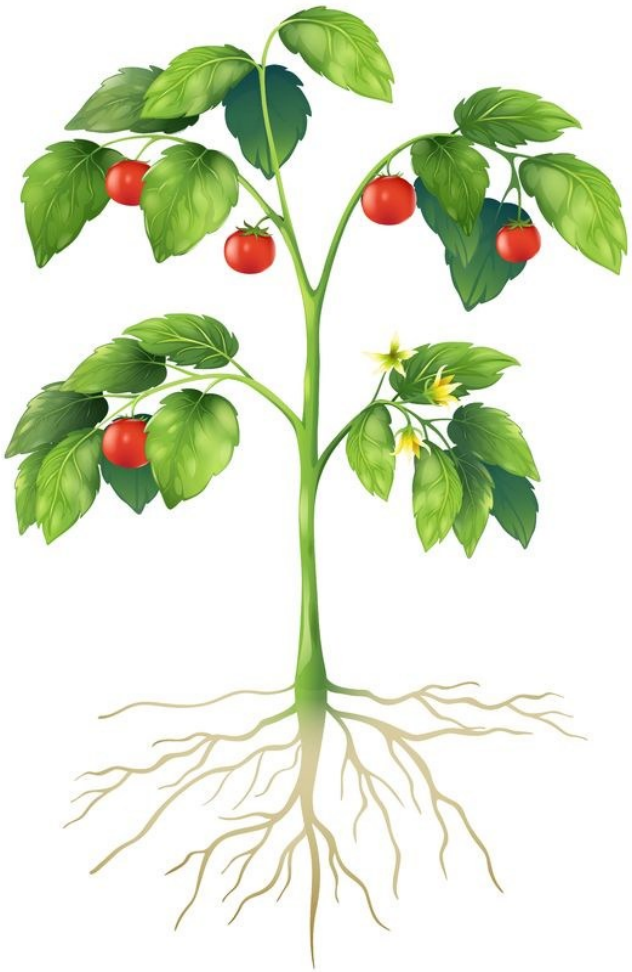


Water and nutrients are absorbed and transported from the soil to the fruit.

Root system uptakes water.

Xylem vessels transport water and nutrients upward through the **shoot system** to the fruit.

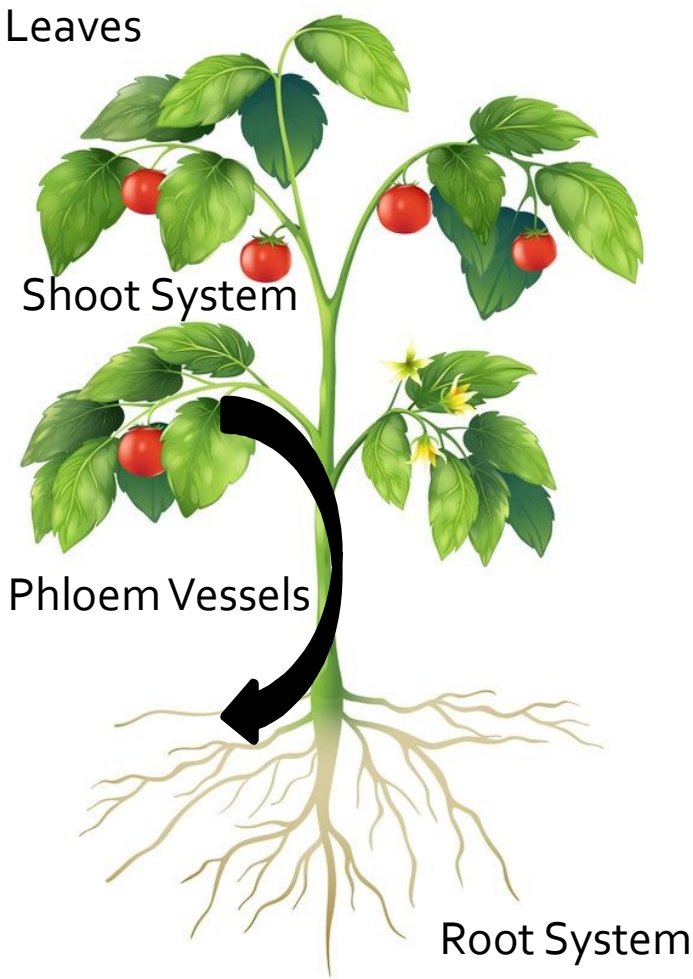
Interaction Between Systems in Plants



What systems of the tomato plant are involved in the description below?

Sugars are produced in the leaves and transported to the roots.

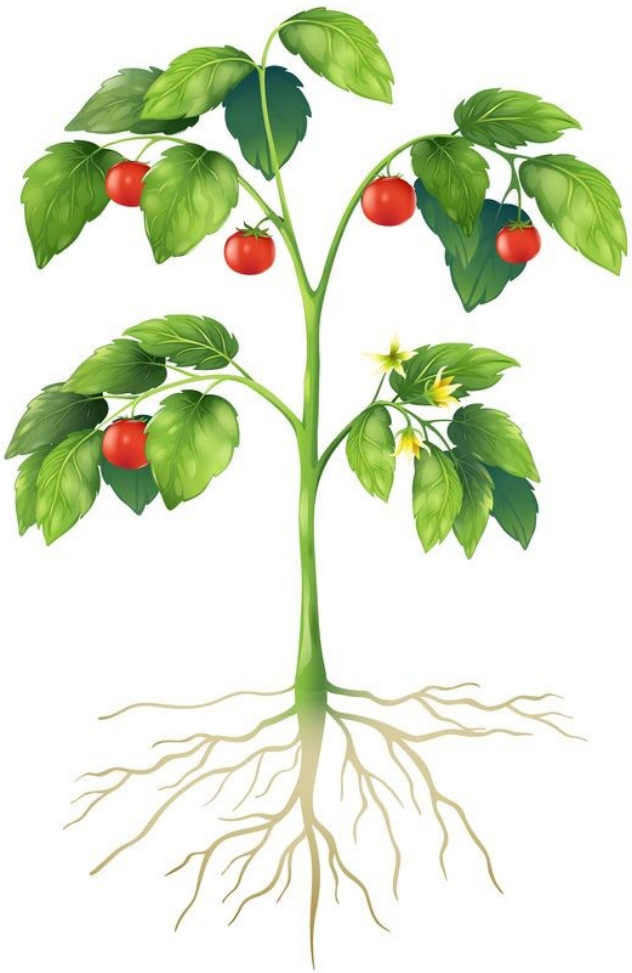
Interaction Between Systems in Plants



Sugars are produced in the leaves and transported to the roots.

Phloem vessels transport sugars from the leaves throughout the plant.

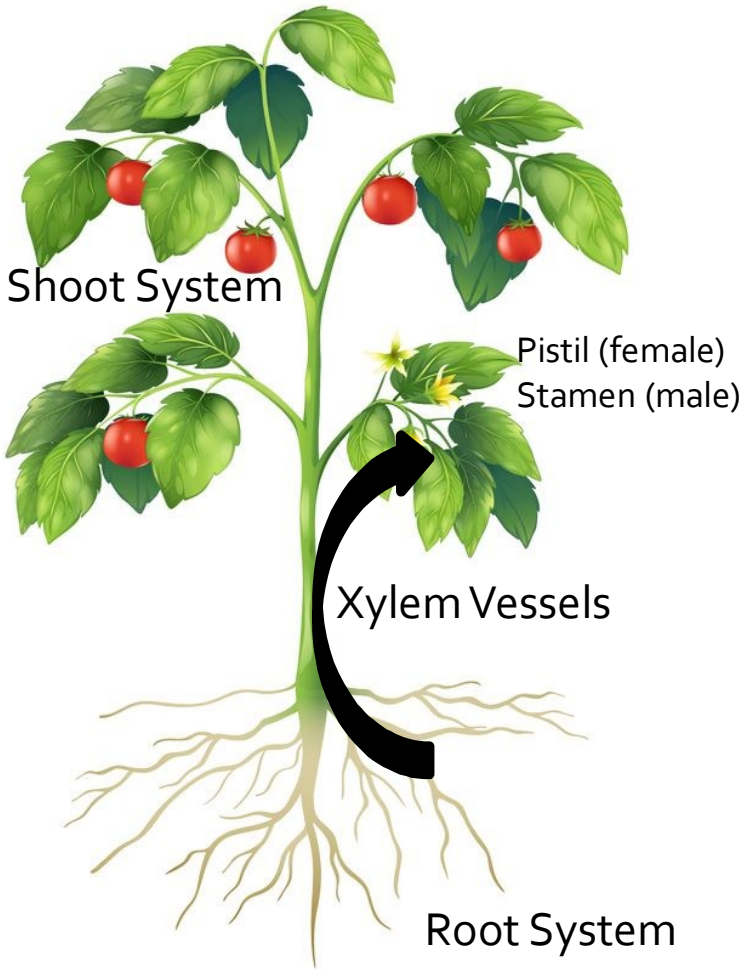
Interaction Between Systems in Plants



What systems of the tomato plant are involved in the description below?

Hormones are produced triggering seed production and growth.

Interaction Between Systems in Plants



Hormones are produced triggering seed production and growth.

The **root system** produces hormones.

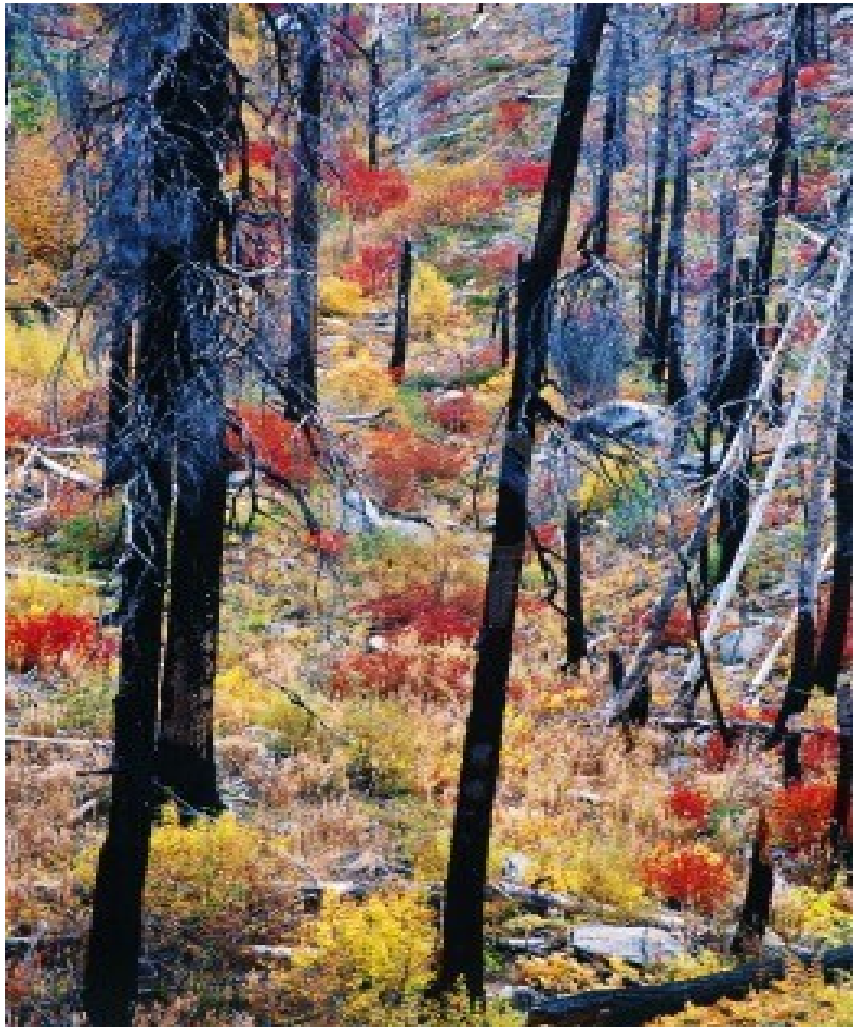
Xylem vessels move the hormones upward through the **shoot system** producing a flower.

Biology EOC Review DAY 8

INTERDEPENDENCE WITHIN ENVIRONMENTAL SYSTEMS

TEKS B.11D, B.12A

Ecological Succession



The forest in the picture experienced a destructive fire last year.

Explain what you see happening in terms of ecological succession.

Is this primary or secondary ecological succession?

Ecological Succession

Ecological succession is the process of building (primary) or rebuilding (secondary) an ecosystem over time.

Primary Succession Opportunities

- New volcano lava covering a landscape
- Retreat of a glacier uncovering bare ground
- Large hardwood tree falling, opening a clearing in a forest

Secondary Succession Opportunities

- Wild fire
- Harvesting of trees for lumber production
- Hurricanes, landslides, or tornadoes

Primary Ecological Succession

TIME →

Low Diversity — *High Diversity*

Lichens → Mosses → Ferns/Grasses → Shrubs → Trees

Lichens are called pioneer organisms and are the first organisms to appear in primary succession. At first, the species diversity is low, but eventually mosses, grasses, shrubs, and trees appear. The lichens cannot compete and disappear.

Relationships Among Organisms

TYPES OF RELATIONSHIPS	
Predation	One species captures and feeds on other type of species.
Competition	Two species struggle for the same limited resources.
Parasitism	One species benefits at the expense of another species.
Commensalism	One species benefits from one another, but does no harm.
Mutualism	Two species mutually benefit from one another.

Relationships Among Organisms

Name This Relationship

Predation, Competition, Parasitism, Commensalism, or Mutualism

Human Head Louse

Relationships Among Organisms

Name This Relationship

Predation, Competition, Parasitism, Commensalism, or Mutualism

Hummingbird feeding on nectar while pollinating a flower.

Relationships Among Organisms

Name This Relationship

Predation, Competition, Parasitism, Commensalism, or Mutualism

Eagle catching fish.

Relationships Among Organisms

Name This Relationship

Predation, Competition, Parasitism, Commensalism, or Mutualism

Plants in a dense rain forest

Relationships Among Organisms

Name This Relationship

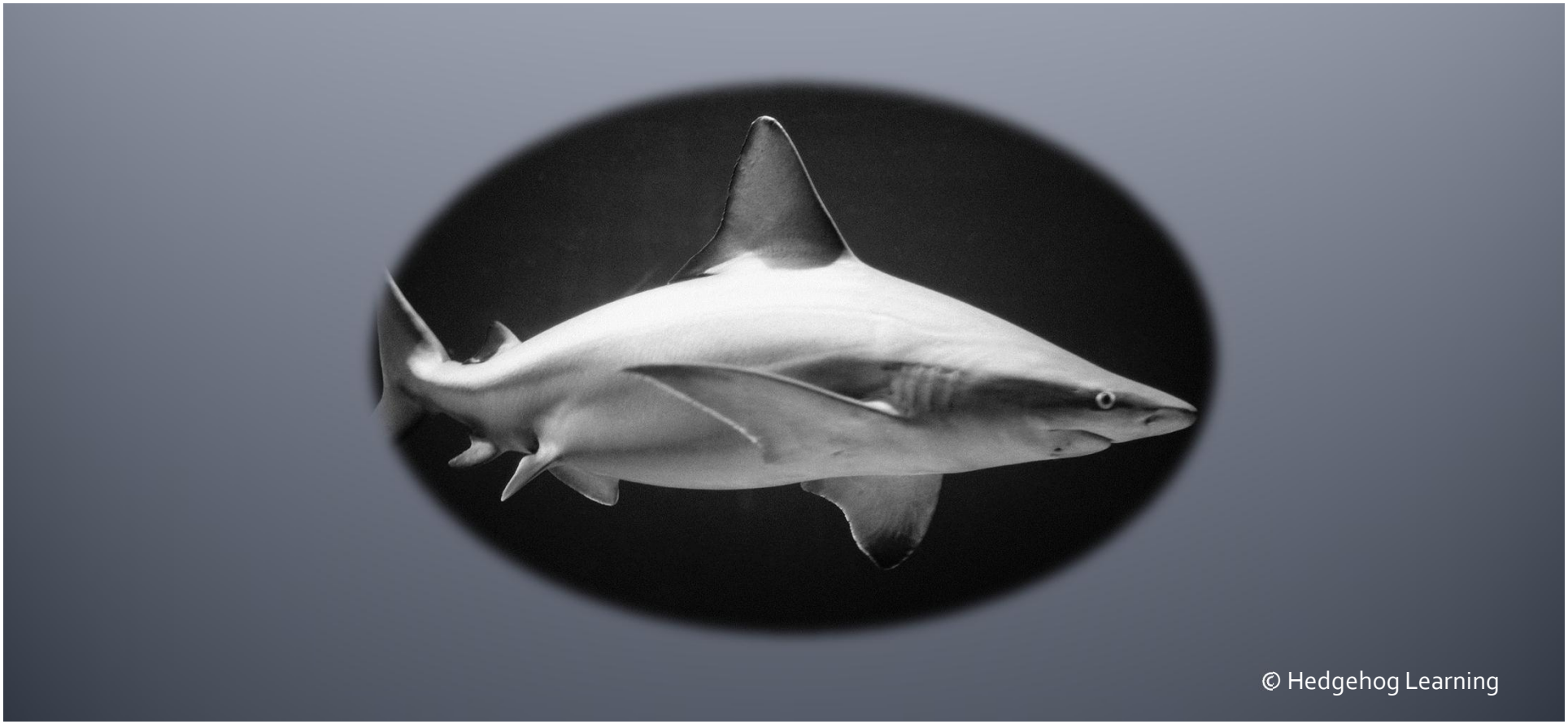
Predation, Competition, Parasitism, Commensalism, or Mutualism

An egret looking for insects stirred up by the movement of the rhino.

Biology EOC Review DAY 9

INTERDEPENDENCE WITHIN ENVIRONMENTAL SYSTEMS

TEKS B.12C, B.12F



Energy Flow in an Ecosystem

Roles of Organisms in an Ecosystem

PRODUCER – Makes own food from sun's energy

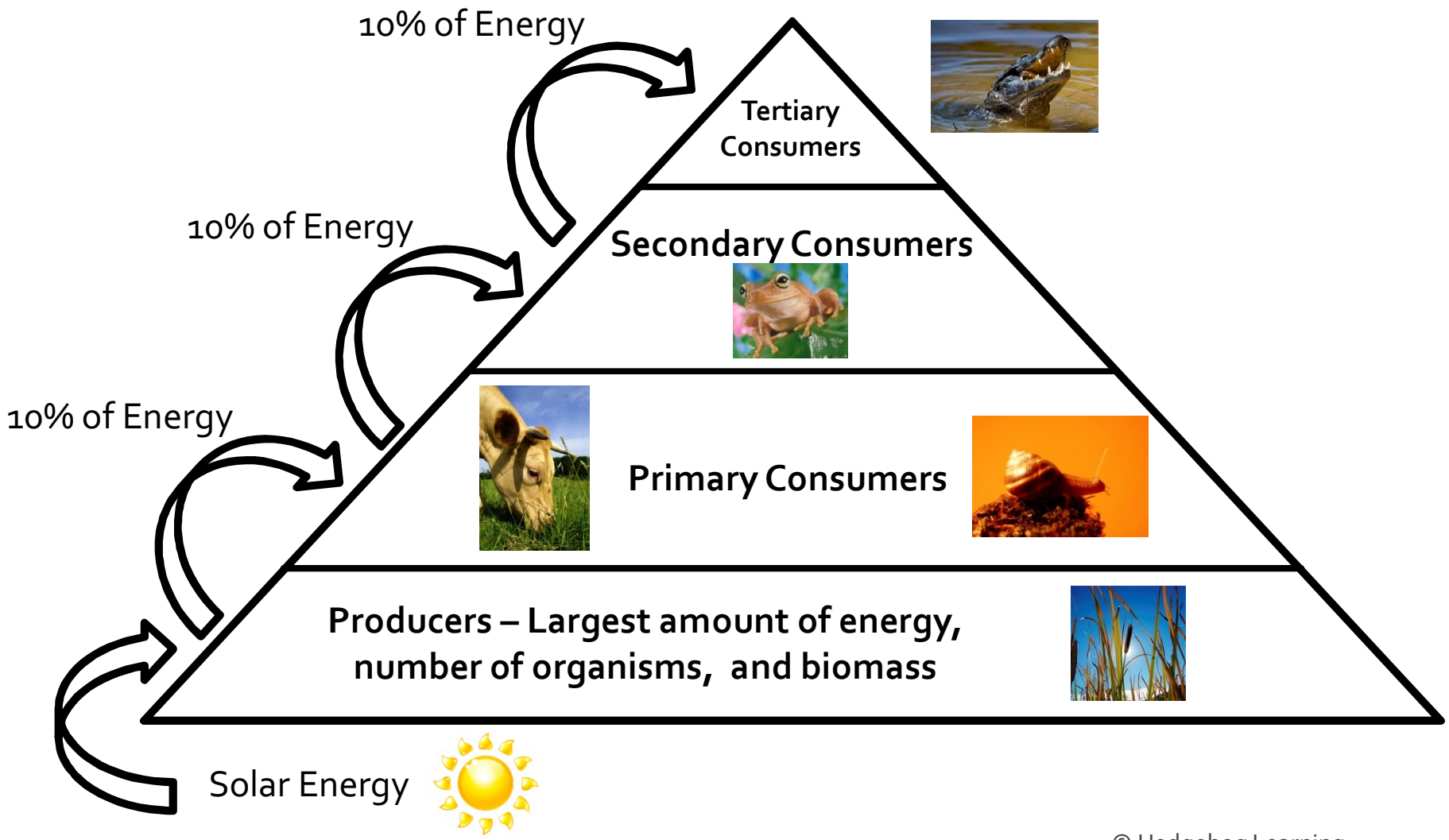
CONSUMER – Gets food from other organisms

- <u>Primary</u> – Eats plants
  - (HERBIVORES eating PRODUCERS)

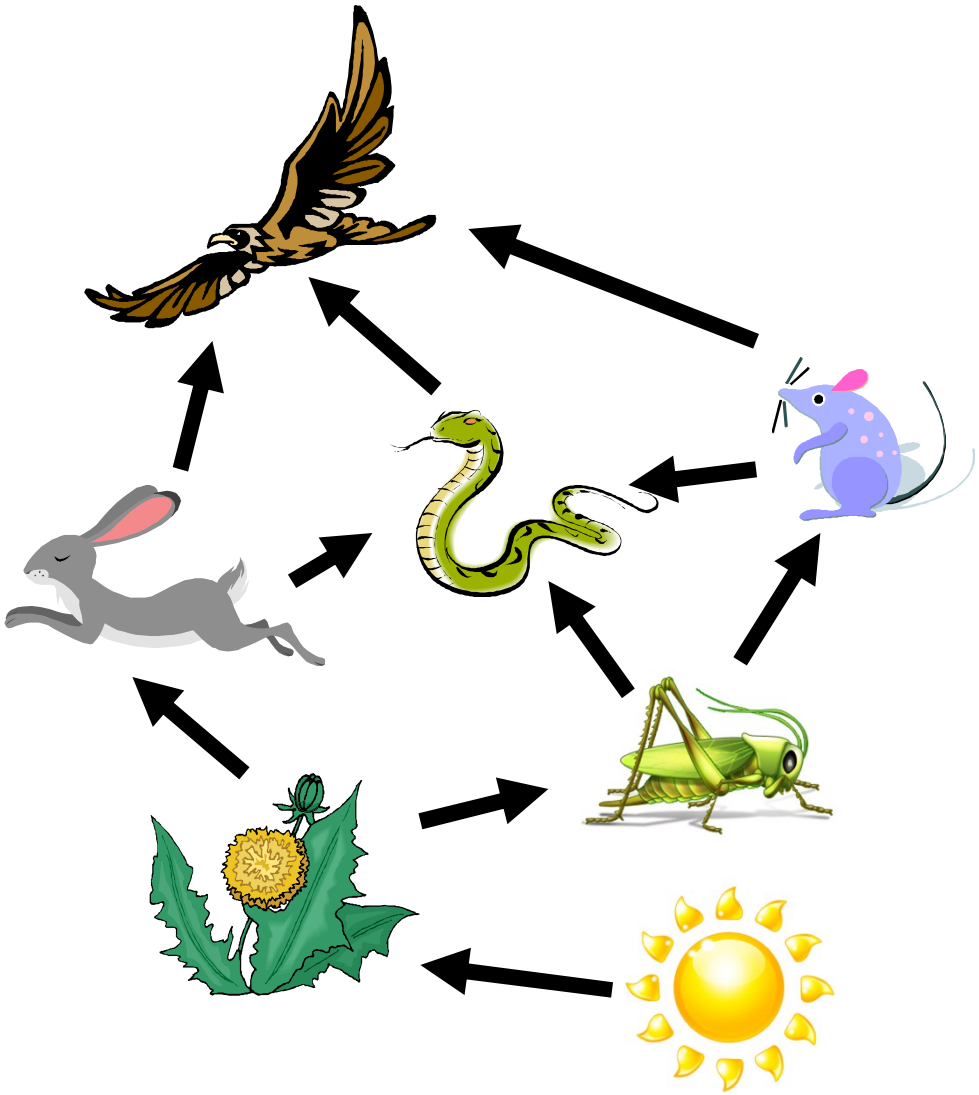
- <u>Secondary</u> – Eats animals that eat plants
  - (CARNIVORES eating HERBIVORES)

- <u>Tertiary</u> – Eats animals that eat other animals
  - (CARNIVORES eating CARNIVORES)

Energy Flow in an Ecosystem



Energy Flow in an Ecosystem



In the food web, identify:

- Herbivores, carnivores, and producers
- Organisms at the second trophic level
- Organism with the highest concentration of toxins
- Which organism represents the highest amount of energy and biomass

Ecosystem Stability

Changes in the environment, whether natural or human-caused, may affect the stability of an ecosystem.

These changes can affect the populations, possibly causing some species to increase in number while others decrease.

Ecosystem Stability

Discuss the ecological impacts of draining runoff water in rivers like in the picture to the right.

What populations will increase?

What populations will decrease?

Ecosystem Stability

Discuss the ecological impacts of drought like in the picture to the left.

What populations would be the first to suffer?

What populations are most likely to be least effected?

Day 10 Review Game

1. Open "Jeopardy – Biology EOC Review" on the CD
2. Follow the directions in the folder on Day 10.
3. Have fun!

Best wishes for success on the Biology EOC!

Written by Chris Jackson, Ed.D.
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