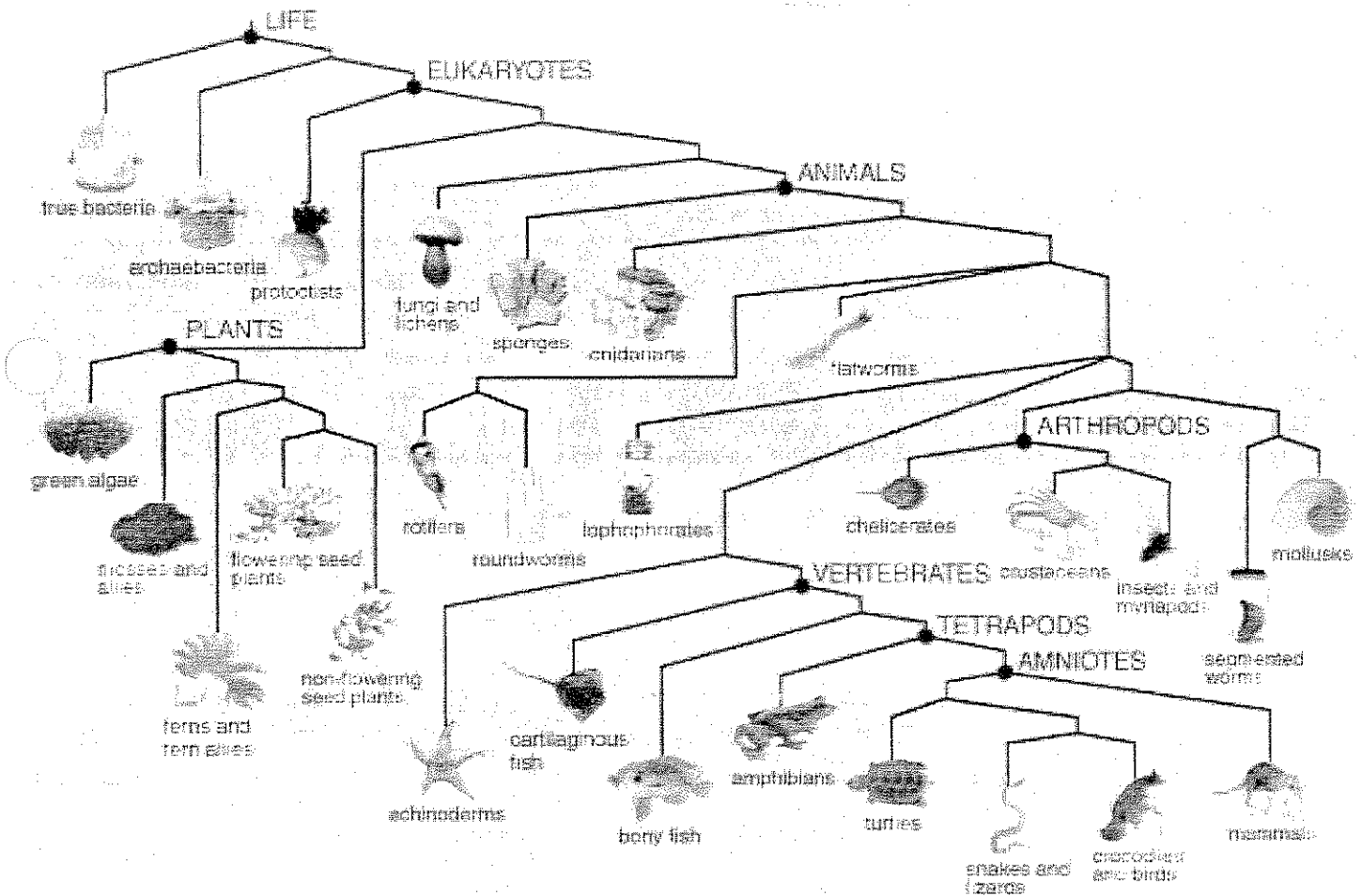


# EVOLUTION



Name: \_\_\_\_\_

Hour: \_\_\_\_\_

## WORDS TO KNOW

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Phylogeny  
Cladogram  
Evolution  
Fitness  
Fossils  
Homologous Structures  
Analogous Structures  
Vestigial Structures  
Embryology  
Competition

Variations  
Natural Selection  
Adaptation  
Charles Darwin  
Jean Lamarck  
Descent with modification  
Theory  
Common Ancestor  
Survival of the Fittest  
Genetic drift

Camouflage  
Behavior  
Gene Pool  
Geographic Isolation  
Genetic Equilibrium  
Species  
Speciation  
Extinction

## LEARNING GOALS

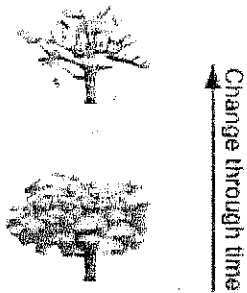
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After completing this unit you should be able to...

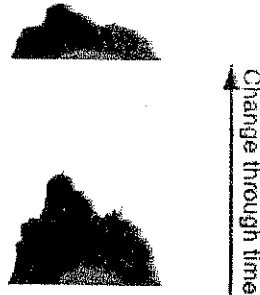
- Explain the theory of evolution as it relates to heredity, mutation, natural selection, and genetic drift
- Recognize key pieces of evidence that support evolution including fossil records, homologous and analogous structures, embryology, and biochemistry.
- Recognize how diversity can ensure survival in cataclysmic changes of the environment.
- Explain homology and common ancestry and that closely related organisms have recent common ancestors.
- Compare Lamarck's theory of acquired traits to Darwin's theory of Natural Selection.
- Summarize the major concepts of natural selection and explain how it is a mechanism, that supports evolution.
- Identify examples of genetic variation and environmental factors that spur evolution and biodiversity.
- Understand phylogeny and classification of living things
- Explain how morphology, molecular history, embryology, and behavior are used to classify living things.
- Read a cladogram
- Identify what a species is, describe speciation, and the role geographic isolation plays in speciation.
- Identify changes in populations and shifts in equilibrium.
-

BIOLOGICAL EVOLUTION:

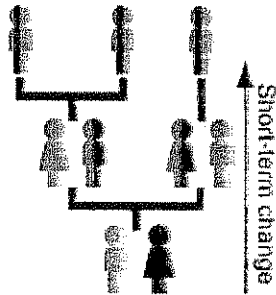
- ❖ **BUT ITS NOT THAT SIMPLE** – all things can change but if they do not involve descent through genetic inheritance it cannot be described as an example of biological evolution.
- ❖ **CHANGES** are due to \_\_\_\_\_ in populations
- ❖ **CHANGES** involve \_\_\_\_\_ of different species from a \_\_\_\_\_  
\_\_\_\_\_ over generations



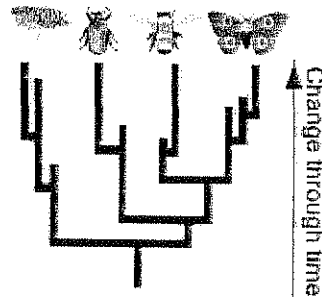
Leaves on trees change color and fall over several weeks.



Mountain ranges erode over millions of years



A genealogy illustrates change with inheritance over a small number of years.

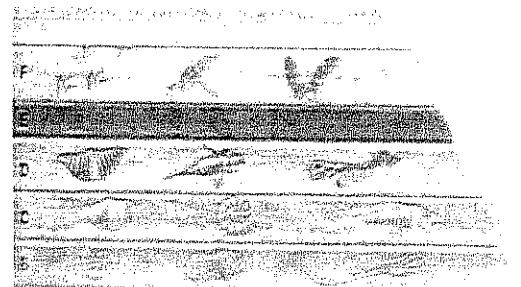


Over a large number of years, evolution produces tremendous diversity in life forms

II: Evidence of Evolution

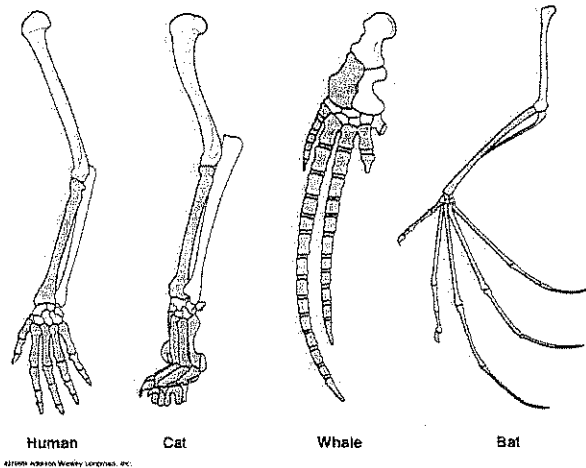
a. **Fossil Records:** \_\_\_\_\_ or \_\_\_\_\_ of organisms from past, preserved in \_\_\_\_\_ showing succession of organisms

- Each layer is a boundary of \_\_\_\_\_ that destroyed many species at that time in an area
- The \_\_\_\_\_ of species increased the chance of some species surviving these events due to adaptation over time.



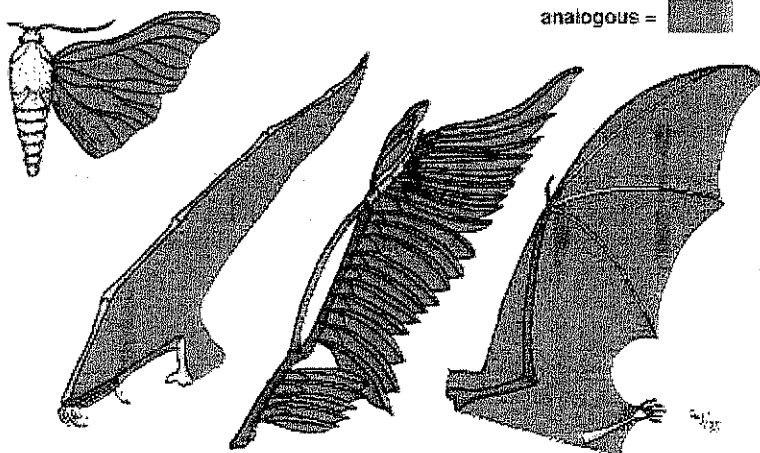
b. **Homology:** different organisms share similar characteristics due to inherited traits from a

- Structures may look similar, \_\_\_\_\_
- Altered version of ancestors
- Ex. All \_\_\_\_\_ have same number of bones in forelimb but position, shape and function are different



c. **Analogy:** different organisms share similar characteristics despite \_\_\_\_\_

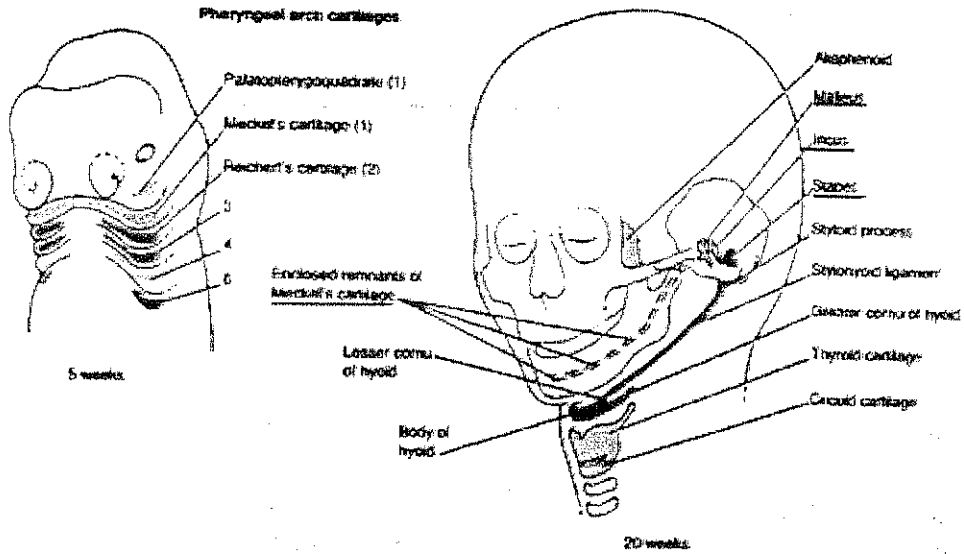
- Structure looks similar, \_\_\_\_\_
- Changes due to response to \_\_\_\_\_, nature shaped \_\_\_\_\_
- Ex. Winged Animals: Insect and a Bat, two plant both have thorns but one has more thickened or dense thorns.



d. Embryonic Development:

- Adult homology \_\_\_\_\_ be apparent
- During mitotic divisions - stages of offspring \_\_\_\_\_ of different animal species may have \_\_\_\_\_ (morphologies)
- similar structure may develop different functions

Ex. All vertebrates have \_\_\_\_\_ – develop into gills of fish or tubes in ears that connect to throat in humans



e. Biochemistry: Similar species share nearly the same genetic machinery.

- Similar \_\_\_\_\_ and \_\_\_\_\_ sequences
- Similar \_\_\_\_\_ sequencing
- Ex. Hemoglobin(blood proteins), digestive enzymes

<http://www.youtube.com/watch?v=e1BEeqJQEW0&feature=related>

### How Does Evolution Work?

1. Following Charles Darwin's lead, biologist Chris Schneider and his colleagues travel to Ecuador to study evolution. Natural selection is at the core of their research on \_\_\_\_\_.
2. Natural selection seems to be an incredibly important factor in generating new \_\_\_\_\_.
3. Individuals within a species \_\_\_\_\_ from one to the other. For evolution to work by natural selection, the characteristics that give an individual an advantage in a certain environment have to be passed on from one \_\_\_\_\_ to the next.
4. Due to competition, hummingbirds compete for food, space, even mates. Nectar is a very limited resource. Natural selection will favor individuals that are more efficient at getting nectar. Natural selection will result in changes in \_\_\_\_\_ will allow them to fly longer distances or be more maneuverable to be more efficient.
5. Individual survivors are more likely to \_\_\_\_\_ and pass on their advantageous traits as well as other genes to their offspring.
6. Species cannot develop \_\_\_\_\_ that benefit them in their lifetimes.
7. In hummingbirds, many of the species found are relatively young. They evolved in the last \_\_\_\_\_ million years, pretty quick on the evolutionary time scale.
8. Darwin emphasized repeatedly in his book that small changes accrue every generation but add up to \_\_\_\_\_ changes over the length of time that life has been on Earth.
9. Darwin's genius indentified \_\_\_\_\_ as the central force in evolution.

Genetic Variation is the driving force behind evolution. There are many ideas of why populations change overtime and the changes may be due to mutation, movement of alleles between different populations, interbreeding, isolation and natural selection.

### Theories of Evolution:

#### A. Jean Baptiste Lamarck:

- ❖ Evolution occurs due to **inheritance of** \_\_\_\_\_  
\_\_\_\_\_ not from changes in the environment.
- ❖ Idea that variation in a population is created by experience.
- ❖ Ex. individuals passed on to offspring body and behavior changes acquired during life

#### B. Charles Darwin:

##### 2 Major Theories:

1. **Descent with Modification:** stated that all \_\_\_\_\_ species were \_\_\_\_\_  
of \_\_\_\_\_ and arose from similar geographic locations.
2. **Natural Selection:** proposes that \_\_\_\_\_ or environmental conditions \_\_\_\_\_  
an individual's \_\_\_\_\_, which in turn leads to an \_\_\_\_\_ population  
over time.

##### ➤ 4 Mechanisms of Natural selection:

- \_\_\_\_\_  
\_\_\_\_\_
- ❖ Only if variation is \_\_\_\_\_ will natural selection lead  
to evolution
- ❖ \_\_\_\_\_ and \_\_\_\_\_ of genes may produce  
beneficial changes and **INCREASE** gene variation within a population
- \_\_\_\_\_  
\_\_\_\_\_ – in turn will increase the success  
of the population
- \_\_\_\_\_  
\_\_\_\_\_
- ❖ \_\_\_\_\_: individuals response to environmental pressures – may  
reduce competition within a population



○ \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

– “Survival of the Fittest”

❖ \_\_\_\_\_: reproductive success of one individual's genetic contribution to the next generation

- Ex. bacterial resistance to antibiotics – methicillin-resistant staphylococcus aureus (MRSA)
- Ex. Insect resistance to pesticides
- Ex. Skin color - melanin
- Ex. Heterozygote Advantage: Sickle cell and CF
- Ex. Snow shoe hare: camouflage



## The Role of Variation in Evolution

1. What is a gene mutation? \_\_\_\_\_
2. What is recombination? \_\_\_\_\_
3. Under normal conditions, do mutations occur often? \_\_\_\_\_
4. What do most mutations do to an allele? \_\_\_\_\_
5. How is the mutation causing hemophilia A maintained in the human population?  
\_\_\_\_\_
6. When is a mutation inherited? \_\_\_\_\_
7. The ultimate source of all new genetic information in evolution is: \_\_\_\_\_
8. What is critical for generating diversity? \_\_\_\_\_  
\_\_\_\_\_
9. What do you think raises the mutation rate in populations? \_\_\_\_\_  
\_\_\_\_\_
10. The major source of genetic variation in most species is: \_\_\_\_\_  
\_\_\_\_\_
11. Crossing over occurs when? \_\_\_\_\_
12. What determines the frequency of recombination? \_\_\_\_\_  
\_\_\_\_\_

13. What is an exception to the rule that genes assort independently?

---

14. How can fossils help us to view change in species over time?

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15. What organism is an example of slow and gradual change over time?

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16. What did the ancestors of horses look like?

---

17. What exactly is a hoof?

---

18. Natural selection acts on variations in a population that improve what?

---

19. What does the environment have to do with adaptations?

---

20. What is an example of continuous variation?

---

21. Why might short horses have died out?

---

22. Explain what punctuated equilibrium is:

---

23. How does geographical isolation help new species evolve quickly?

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24. Whether gradual or punctuated, all evolution is influenced by what?

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## Are populations constantly evolving?

- Within a diverse population, individuals may have a \_\_\_\_\_ of \_\_\_\_\_ collectively called the \_\_\_\_\_

- Population that are diverse are \_\_\_\_\_ because they can \_\_\_\_\_ environmental changes due to their abilities to adapt.

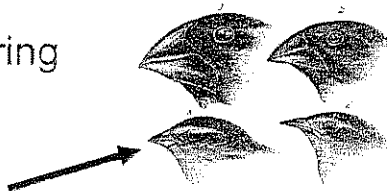
When populations are \_\_\_\_\_ evolving they are in a state called \_\_\_\_\_

- After each successive generation \_\_\_\_\_ stay the \_\_\_\_\_ and the population is not evolving.

Not until there is a disruption within the environment will populations evolve.

## Stable Populations "In Theory"

- Population is \_\_\_\_\_
- \_\_\_\_\_ or \_\_\_\_\_ mutations occur – allele frequency does not change
- Natural Selection \_\_\_\_\_ occurring  
• Environment non-changing



Populations have a \_\_\_\_\_ of adaptations, provide greater opportunities to survive major changes in environment

Greater diversity creates \_\_\_\_\_ within a population

# What causes populations to evolve?

Evolution happens when the genes in a population change over a long period of time.

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Ex. Disease, non-mating, reduction in population size

- Each of these factors are foundations for changes in populations and eventually \_\_\_\_\_ the formation of a new \_\_\_\_\_.

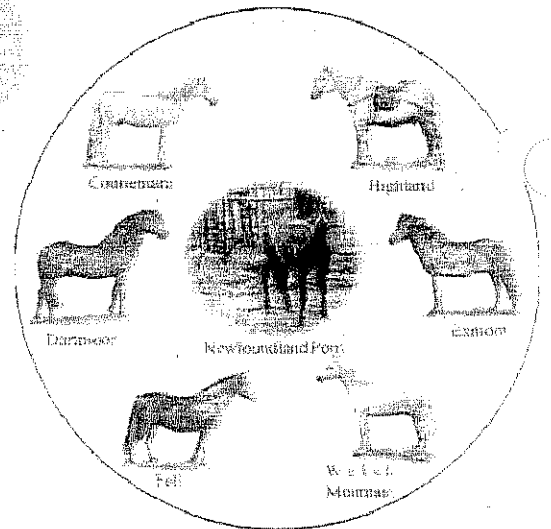
# What is a Species?

A \_\_\_\_\_:

- Population of organisms evolved from a recent common ancestor having \_\_\_\_\_

\_\_\_\_\_ and \_\_\_\_\_ similarities.

- Have the ability to successfully interbreed and produce \_\_\_\_\_ offspring



# SPECIATION

Why do new species develop?

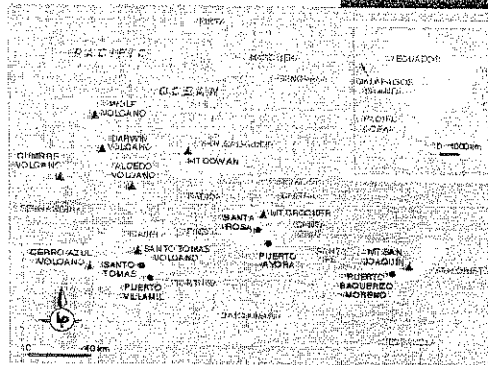
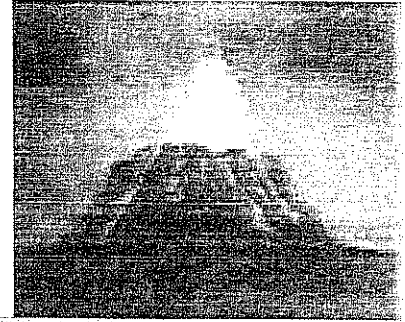
## GEOGRAPHIC ISOLATION

Physical

\_\_\_\_\_ of members of a

\_\_\_\_\_ Original habitat is divided

How does this happen?



Galapagos Islands

## ISOLATION

Once subpopulations become isolated

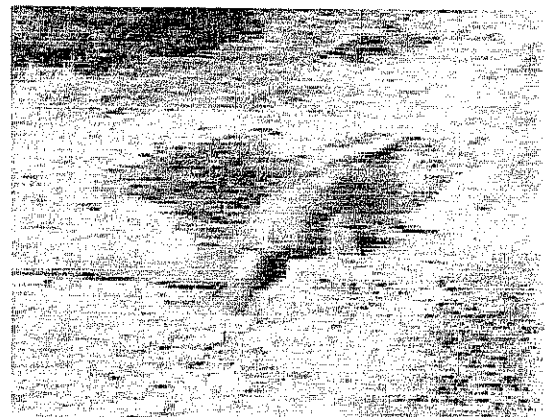
Gene flow between them

Subpopulations will eventually become \_\_\_\_\_

\_\_\_\_\_ due to natural selection and genetic drift

Will not be able to \_\_\_\_\_ and \_\_\_\_\_ successfully

MARINE IGUANA



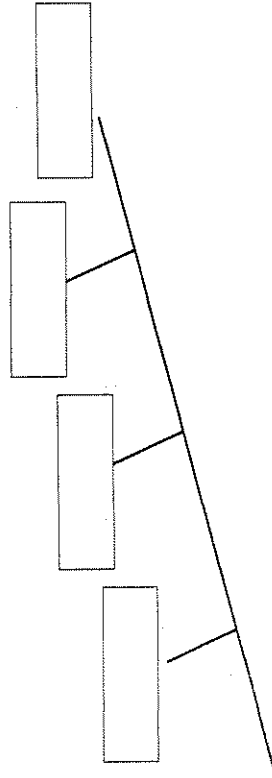
LAND IGUANA

Cladogram Worksheet Name: \_\_\_\_\_ Date: \_\_\_\_\_ Per: \_\_\_\_\_

1. Fill in the following table. Mark an 'X' if an organism has each trait.

	hair	legs	thumbs	eyes
Human				
Snake				
Monkey				
Mouse				

2. Add each of these organisms to the cladogram below: human, snake, monkey, mouse



3. USING COMPLETE SENTENCES, explain why you put each organism where you did on the cladogram.

4. On the cladogram above, add traits that make the organisms different from each other, like we did on our notes.

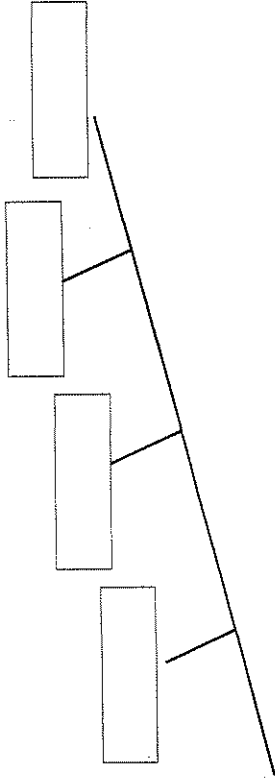
5. According to your cladogram, which two species are more closely related: humans and snakes or humans and mice? How do you know?

6. According to your diagram, what species are humans most closely related to? How do you know?

7. Fill in the following table. Mark an 'X' if an organism has each trait.

	cells	legs	6 legs	wings
Worm				
Spider				
Ant				
Fly				

8. Add each of these organisms to the cladogram below: worm, spider, ant, fly



9. USING COMPLETE SENTENCES, explain why you put each organism where you did on the cladogram.

10. On the cladogram above, add traits that make the organisms different from each other, like we did on our notes.

11. According to your cladogram, which two species are more closely related: worms and spiders or worms and ants? How do you know?

12. According to your cladogram, what species are flies most closely related to? How do you know?

## History of Life on Earth: Classification and Taxonomy

### I. Evolutionary biology is both process and history of geologic time.

- Fossil records, continental drift (Pangaea) and cataclysmic changes causing periods of mass extinction species tell us how organisms have evolved over time

### A. Phylogeny:

- Greek - *phylon* " \_\_\_\_\_ " and *genesis* " \_\_\_\_\_ "

- \_\_\_\_\_  
\_\_\_\_\_

- Other ways to trace phylogeny

- \_\_\_\_\_: comparative anatomy

- \_\_\_\_\_: DNA

- \_\_\_\_\_

- \_\_\_\_\_

### B. Biological Classification:

- Based on how \_\_\_\_\_ organisms are related due to their \_\_\_\_\_

- Organisms \_\_\_\_\_ into hierarchical \_\_\_\_\_ and subgroups

#### Taxonomy:

- Classification Scheme to \_\_\_\_\_ a particular species

K P C O F G S: King Philip Came Over For Good Soup

- Each classification group is a more \_\_\_\_\_ group

- \_\_\_\_\_: group of related phyla

- \_\_\_\_\_: group of related classes

- \_\_\_\_\_: group of related orders

- \_\_\_\_\_: group of related families

- \_\_\_\_\_: group of related genus

- \_\_\_\_\_: group of related species

- \_\_\_\_\_: individual

### C. Representations of phylogenetic relationships

- \_\_\_\_\_

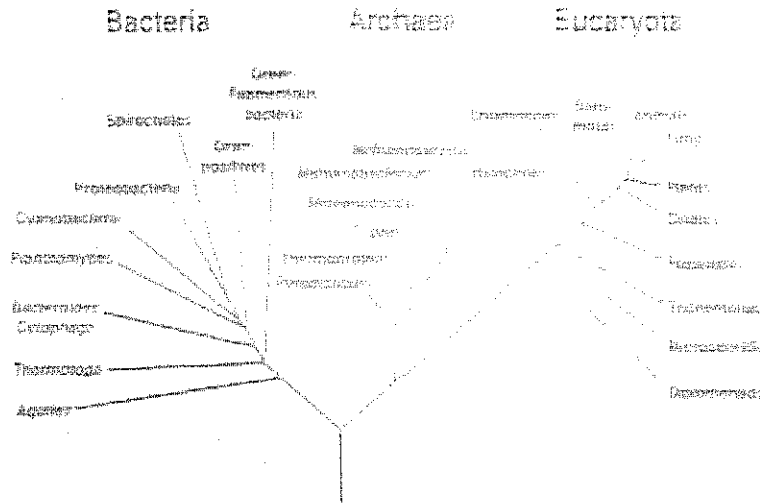
- \_\_\_\_\_

# Phylogenetic Tree and Cladograms

## Phylogenetic Tree:

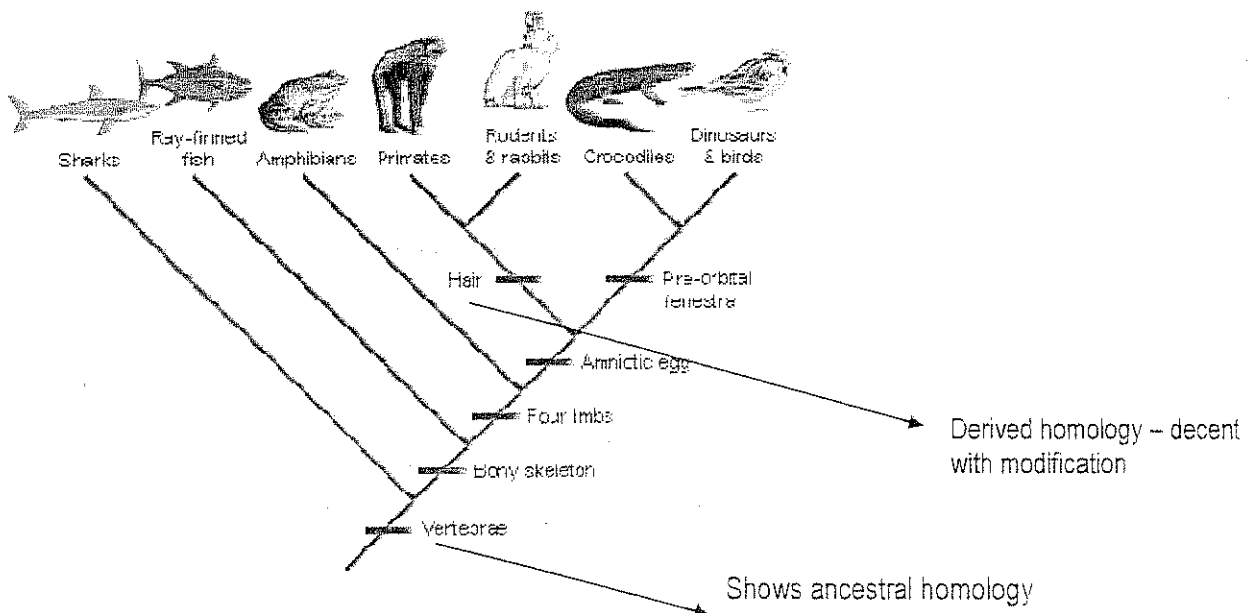
- Tree showing evolutionary relationships among various species believed to have a common ancestor
- Branch lengths may show evolutionary time between organisms

## Phylogenetic Tree of Life



## Cladogram:

- A **cladogram** is a diagram that looks like a series of Y's or forks in a road. At each branch, or "Y" junction, characteristics of evolutionary origin are used to separate off one group from the rest.
- Cladograms can be constructed for any group of organisms.
- Ignores when and where branches occur





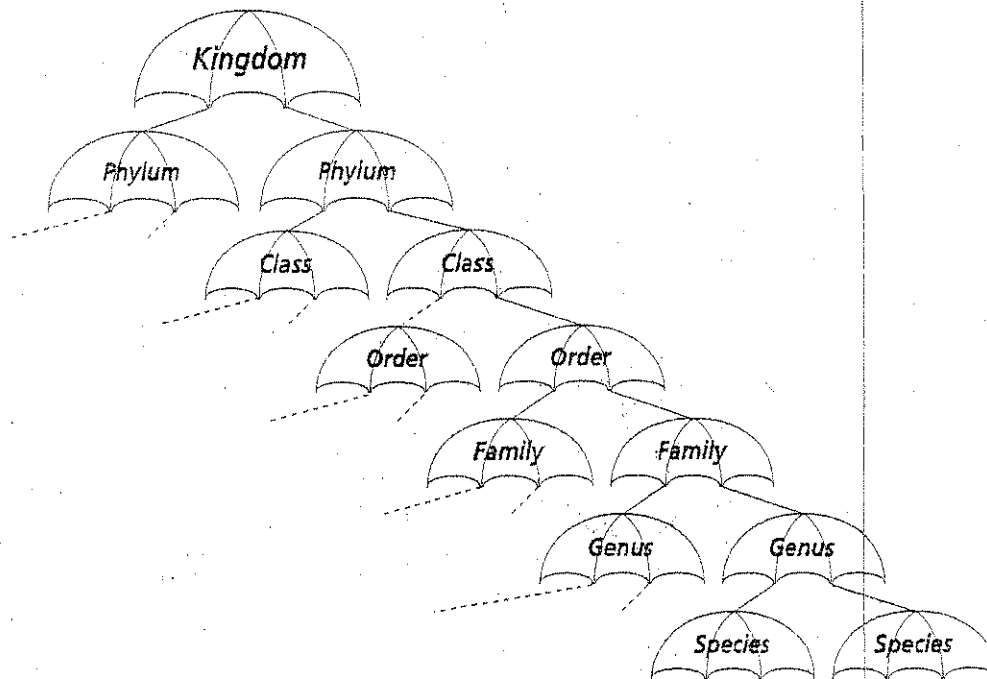
## Chapter

## Content Mastery

## Organizing Life's Diversity

## Get the Big Picture

Read the paragraph in the box and study the picture. Then answer the questions that follow.



The classification of organisms into groups is based on similarities and differences of the organisms' traits. Organisms that are placed in the same group have more traits in common than those in different groups. All the organisms on Earth belong to one of six kingdoms. Each kingdom is divided into two or more smaller groups (each called a phylum). Those groups are divided into two or more smaller groups (each called a class), and so on. Each smaller group includes a smaller number of different types of organisms.

1. What are the seven kinds of groups that make up the above classification system?

\_\_\_\_\_

2. In the above classification system, two or more families make up a(n) \_\_\_\_\_.

3. Do you think there are more species or more families of organisms on Earth? Explain.

\_\_\_\_\_

\_\_\_\_\_

4. What is the basis for classifying organisms into groups? *What do we call the shape or form of an organism?*

\_\_\_\_\_



