Unit 11: Classification

ame Completed Notes Period

Learning Goals

1. I can list the phylogenetic order of classification, largest to smallest.
2. I can explain the parts of a scientific name.
3. I can organize living things according to relatedness based on similarities in structure and biochemistry.
4. I can interpret and construct a cladogram.
5. I can describe the endosymbiotic theory.

Vocabulary

- Binomial nomenclature
- Cladogram
- Class
- Derived character
- Domain
- Endosymbiotic Theory
- Family
- Genus
- Kingdom
- Order
- Phylogeny
- Phylum
- Species
- Symbiosis
- Taxonomy

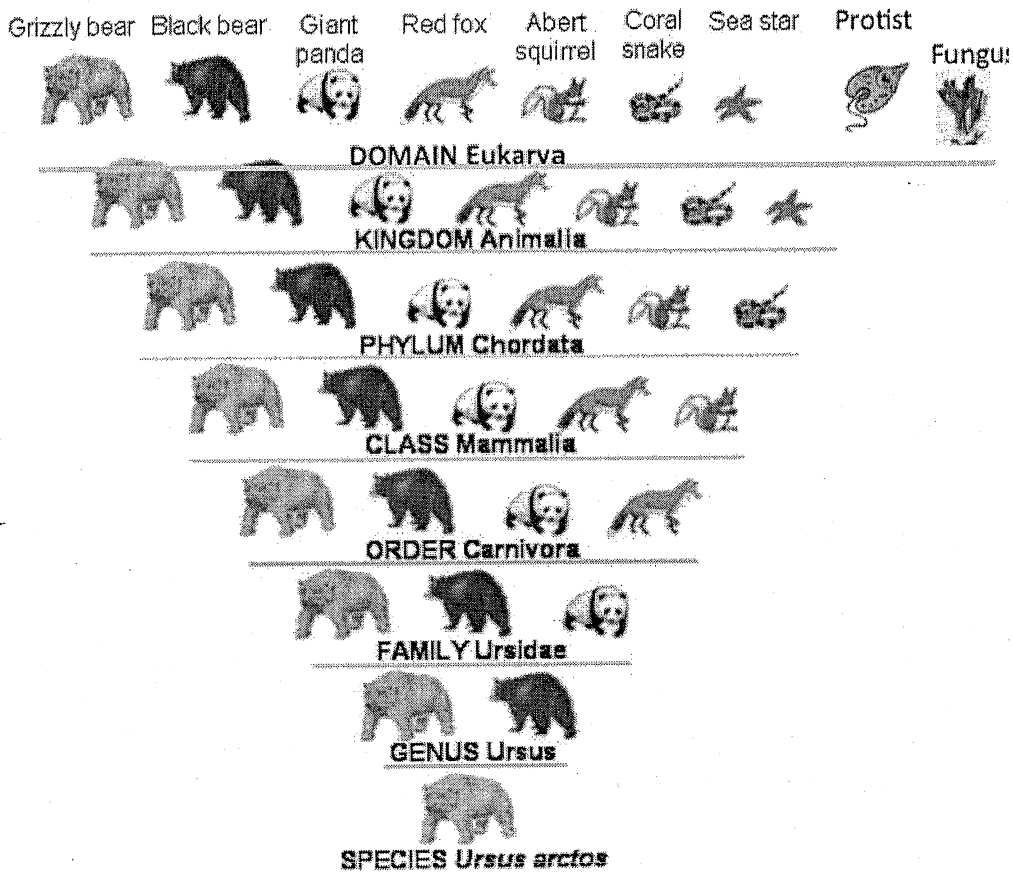
Unit 11 Warm-Ups

Phylogenetic Order

Organisms are classified into groups based on relatedness. There are very broad categories and extremely specific ones. The broader categories include many organisms that have greater degrees of differences physically and biochemically. The smaller the category, the more related the organisms will be within the category.

Record the order of the phylogenies in order from largest to smallest.

Name of category	Pneumonic Device
largest Domain	Dear
Kingdom	King
Phylum	Phillip
Class	Called
Order	Olivia
Family	For
Genus	Good
Species	Soup
Smallest	



True or False:

1. T A domain contains many species.
2. F A genus contains many families.
3. F A species contains many orders.
4. T An order contains many families.
5. F A phylum contains many kingdoms.
6. T A kingdom contains many phyla.

Classification of Living Things

Domain	Bacteria	Archaea	Eukarya			
Kingdom	Eubacteria	Archaeabacteria	Protista	Fungi	Plantae	Animalia
Cell Type						
Cell Structure						
Number of Cells						
Mode of Nutrition						
Examples						

Classification and Taxonomy Notes

atural selection and other processes have led to a staggering diversity of organisms. Biologists have identified and named about 1.5 million species so far. They estimate that anywhere between 2 and 100 million additional species have yet to be discovered.

1) Why Classify?
   a) To study the diversity of life, biologists use a classification system to name organisms and group them in a logical manner.
   b) **Taxonomy** - a discipline where scientist classify organisms and assign each a universally accepted name
   c) In a good system of classification, organisms placed into a particular group are more similar to one another than they are to organisms in other groups.
2) Assigning Scientific Names – common names are confusing because they are not universally applied. Some organisms can have multiple names and some names can have multiple meanings depending on country.
   a) Early efforts at naming organisms focused on describing physical characteristics of species with great detail

      Drawbacks:
      i) These names could be 20 words long.
      ii) Different scientists described different characteristics of the organism.
   b) The Solution: **Binomial Nomenclature** - a 2-word naming system
      i) The scientific name is always written in italics (slanted)
      ii) The first word is capitalized, and the second word is lower case.
      iii) Examples:
         (1) Ursus arcto
         (2) Ursus maritimus
      iv) The first part of the scientific name is the genus (1) to which the organism belongs.
      v) The second part of a scientific name is unique to each species (2) within the genus. Often this part of the name is a latinized description of some important trait of the organism or an indication of where the organism lives.

3) Which Similarities Are Most Important?

a) Evolutionary Classification

i) **Phylogeny** - the study of evolutionary relationships among organisms

ii) Biologists now group organisms into categories that represent evolutionary decent, or phylogeny, not just physical similarities.

iii) All members of a genus share a recent common ancestor.

iv) The higher the level of taxon, the further back in time is the common ancestor of all the organisms in the taxon.

v) Be careful, not all organisms that appear similar are closely related because of convergent evolution.

b) Classification Using **Cladograms** - a diagram that shows the evolutionary relationships among groups of organisms

i) Cladistic analysis identifies and considers only those characteristics that are evolutionary innovations - new characteristics that arise as lineages over time.

(1) **Derived Characters** - characteristics that appears in recent parts of a lineage but not in older members

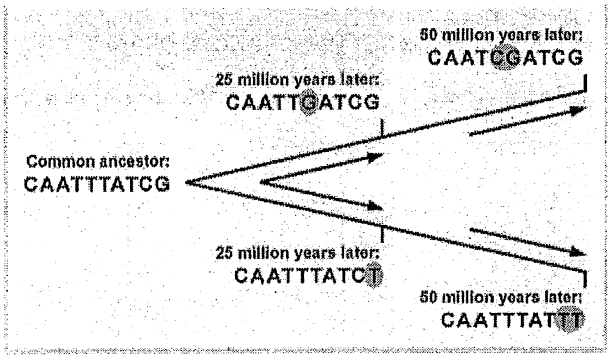
ii) Cladograms are useful tools that help scientists understand how one lineage branched from another in the course of evolution.

iii) Think of a cladogram as similar to a family tree.

c) Similarities in DNA and RNA – all organisms use DNA and RNA to pass on information and to control growth and development. Hidden in the genetic code of all organisms are remarkably similar genes.

i) Similar genes show many surprising similarities – that humans and yeast share a common ancestor.

ii) DNA Evidence – the more similar the DNA sequence of two species, the more recently they shared a common ancestor, and the more closely they are related in evolutionary terms.



Cladogram Analysis

What is a cladogram? It is a diagram that depicts evolutionary relationships among groups. It is based on **Phylogeny**, which is the study of evolutionary relationships. Sometimes a cladogram is called a phylogenetic tree (though technically, there are minor differences between the two).

In the past, biologists would group organisms based solely on their physical appearance. Today, with the advances in genetics and biochemistry, biologists can look more closely at individuals to discover their pattern of evolution, and group them accordingly - this strategy is called **Evolutionary Classification.**

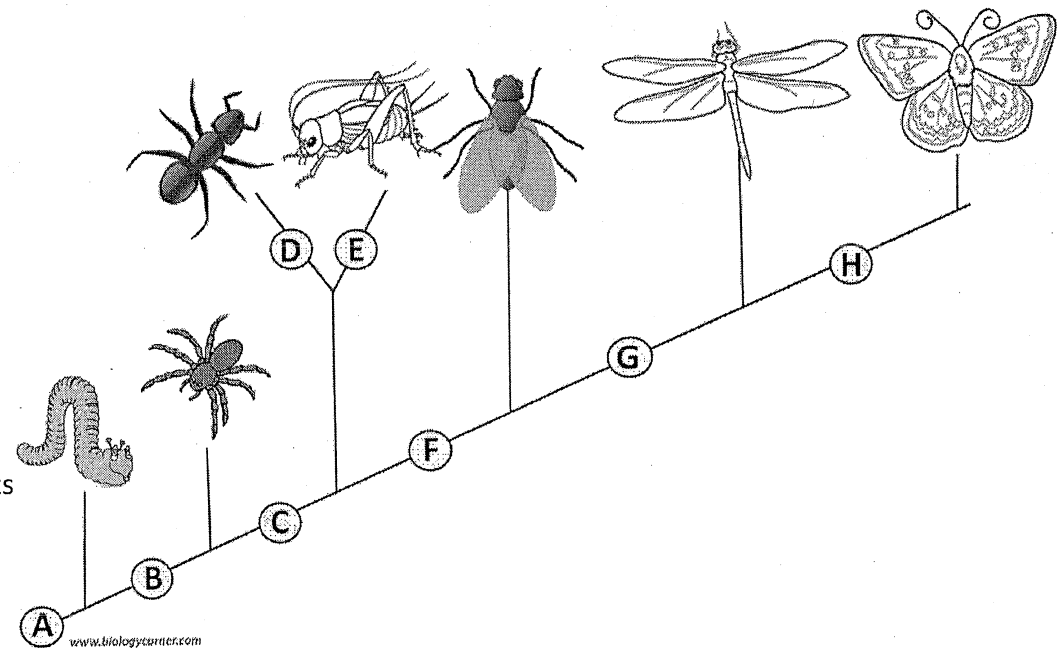
Today, many evolutionary biologists use new characteristics that arise as lineages evolve over time. Characteristics that appear in recent parts of a lineage but not in its older members are called **derived characters.**

Derived characters can be used to construct a cladogram, a diagram that shows the evolutionary relationships among a group of organisms. Cladograms are useful tools that help scientists understand how one lineage branched from another in the course of evolution. Just as a family tree shows the relationships among different lineages within a family, a cladogram represents a type of evolutionary tree, showing evolutionary relationships among a group of organisms.

PART 1 - Analyze the Cladogram

Examine the sample cladogram, each letter on the diagram points to a derived character, or something different (or newer) than what was seen in previous groups. Match the letter to its character.

1. _____ Wings
2. _____ 6 Legs
3. _____ Segmented Body
4. _____ Double set of wings
5. _____ Jumping Legs
6. _____ Crushing mouthparts
7. _____ Legs
8. _____ Curly Antennae



PART 2 - Create Your Own Cladogram

To make a cladogram, you must first look at the animals you are studying and establish characteristics that they share and ones that are unique to each group.

For the animals on the table, indicate with an X whether the characteristic is present or not.

	Cells	Backbone	Legs	Hair	Opposable Thumbs
Human					
Tiger					
Slug					
Catfish					
Frog					

Based on the table above, create a cladogram in the space below like the one pictured above in Part 1.

Endosymbiotic Theory

'hat does the prefix endo- mean?

What is symbiosis?

The Endosymbiotic Theory seeks to answer *the* How *of evolution from* prokyotes *to* eukaryotic *cells.* (eukaryotes evolved from prokaryotes)

What are the two major internal differences between prokaryotic cells and eukaryotic cells?

How do most scientists believe the nucleus evolved?

- The outer cell membrane folded inward and encompassed the DNA, forming a nuclear envelope.
- This is also how they believe the ER was formed, from the outer membrane folding inward.

How do scientists believe membrane-bound organelles (mitochondria and chloroplasts) evolved?

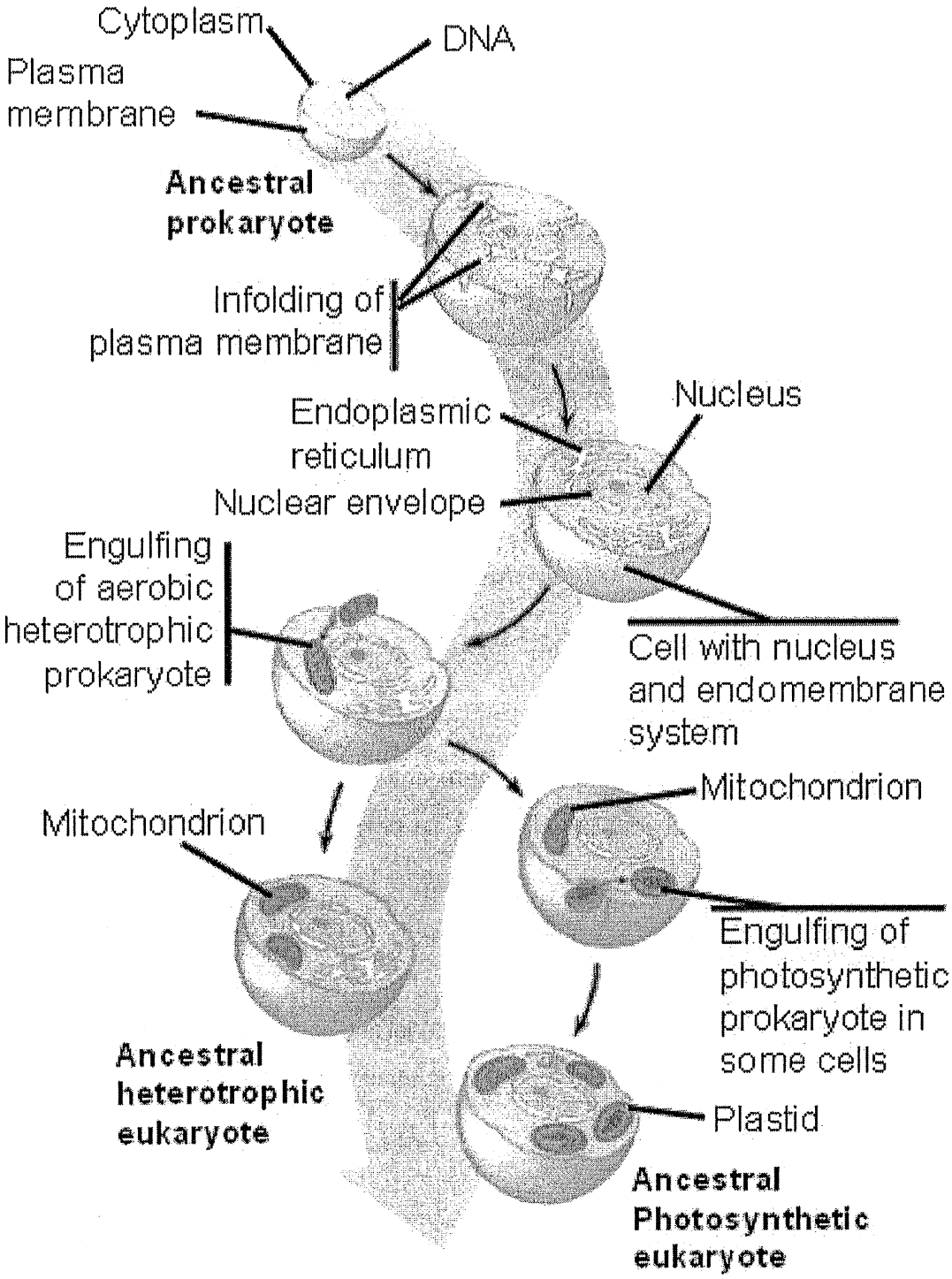
- Small prokaryotes that could produce energy were either ingested as prey or became internal symbionts (meaning living and working together with the host cell) of larger prokaryotes.
- Over time the survival of the host and the symbiont were linked together such that they could no longer survive independently of one another.

Evidence to Support Endosymbiosis:

- We have found examples of these kinds of relationships in present-day organisms (for example: *Giardia*, a primitive flagellated protist has symbiotic, energy-transducing bacteria instead of mitochondria).
- There are species of cyanobacteria and heterotrophic bacteria that strongly resemble chloroplasts and mitochondria.
- The enzymes embedded in mitochondrial and chloroplast internal membranes are more similar to those of prokaryote than they are to other enzymes found in eukaryotes
- Mitochondria and chloroplasts have their own DNA, separate from and largely independent of the nuclear DNA.

- Mitochondrial and chrloroplast DNA are circular, similar to that of prokaryotic DNA.
- Mitochondria and chloroplasts reproduce asexually in cells, very similar to the reproduction seen in prokaryotes.
- Mitochondria, and chloroplasts all have two membranes.
  - The inner membrane is more similar to that of prokaryotes.
  - The outer membrane is more similar to that of eukaryotes.

The following figure is a pictorial overview of the Endosymbiotic Theory:

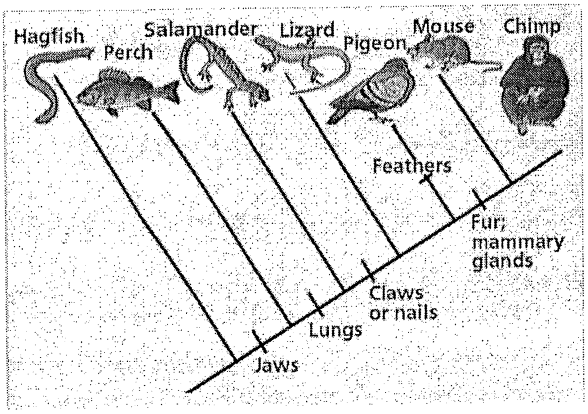


Unit 11 Study Guide

1. What is one characteristic unique to the animal kingdom?
2. Which kingdoms contain only unicellular organisms?
3. What do phylogenists do?
4. What do taxonomists do?
5. List the taxons in order from largest to smallest. (Remember your pneumonic device!)

Test taking strategy: when you first get your test, write this down in the margin so that you can relax and refer back to it when you need it.

6. Which taxon is most inclusive (contains the largest number of different organisms)?
7. Which taxon is the least inclusive?
8. How long ago did the common ancestor for all domains exist (relatively speaking)?
9. How long ago did the common ancestor for all genera in a family exist (relatively speaking)?
10. The more recent the common ancestor the _____ the taxon.
11. What are the two parts of the scientific name?
12. Describe the proper way to write a scientific name.
13. The image to the right is a _____.
14. What is a derived character?



15. Which derived character separates a perch from a salamander?
16. Which pair of organisms are more closely related: lizard and pigeon, or lizard and mouse?
17. Come up with a derived character that could separate the mouse and chimp from the rest of the organisms.

18. What does endosymbiotic theory seek to answer?

19. Describe how scientists believe endosymbiosis occurred.

20. Describe at least three pieces of evidence that support endosymbiosis.

The study of evolutionary relationships.	Theory that eukaryotic cells formed from a symbiosis among several different prokaryotic organisms.	A group of closely related classes.	A group of genera with many shared characteristics
A diagram that depicts evolutionary relationships among groups of organisms.	Most inclusive taxonomic group, larger than a kingdom.	Relationship in which two species live closely together.	A group of similar orders.
Characteristics that appear in recent members of a lineage, but not in older members.	Group of similar organisms that can breed and produce fertile offspring.	A group of closely related species, the first part of the scientific name in binomial nomenclature.	The discipline of classifying organisms and assigning each organism a universally accepted name.
Classification system in which each species is assigned a two-part scientific name.	A group of similar families.	Taxanomic group consisting of closely related phyla.	