NAME_____

DATE_____PERIOD_____

PHYLOGENY AND SYSTEMATICS

PHYLOGENY	SYSTEMATICS
Evolutionary history of species or group of related species	Study of biological diversity in an evolutionary context

TAXONOMY

- **Identification and classification of species**
- **Linnaeus – based classification on morphology**
- **Features**
    - **Binomial (Genus pecies)**
    - **Filing system (family, order, class, phylum, kingdom, domain)**

- **Objective of taxonomy as component of systematics**
    - **Assign organism to species**
    - **Placement into higher taxa**

- **Classification reflects evolutionary relationships**
- **Tree represents evolutionary history**
- **Monophyletic**
  - o **1 ancestor gave rise to all species in that taxon and to no species in another taxon**
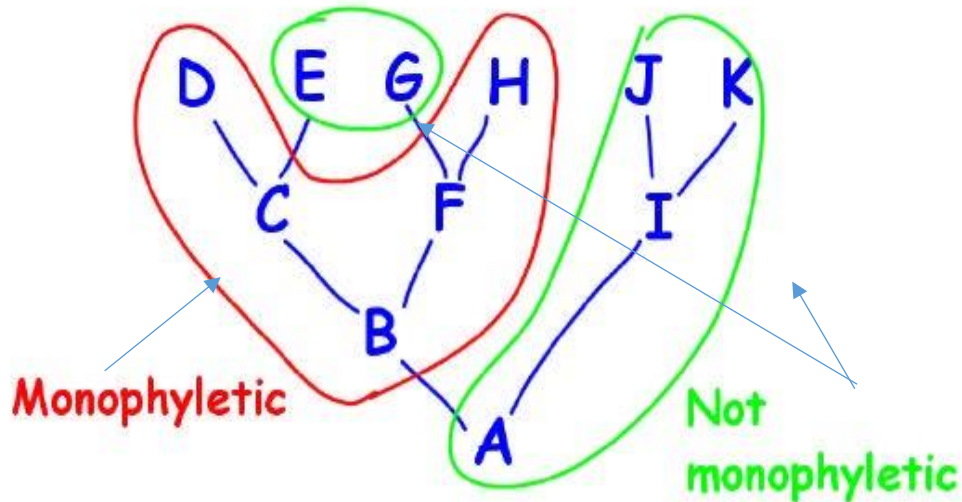
MOLECULAR BIOLOGY

- **Comparison of macromolecules**
- **Protein comparison**
  - o **Compare AA sequence**
  - o **Ex. Cyt C**
    - o **Common to all aerobic organisms**
    - o **# of differences provides info. related to when branched from common ancestor**
- **DNA-DNA hybridization**
- **RFLP analysis**
- **Seq. mitochondrial DNA for closely related species**
- **Seq. rRNA for distantly related species**
- **PCR – amplifies sample of DNA**

Evolution Activity #15

GOAL:	
Make classification more objective and consistent with evolutionary history	
PHENETICS	**CLADISTICS**
• **Reflects anatomical similarities**	• **Reflects evolutionary relationships**
• **Based on measurable similarities and differences**	• **Phylogenetic systematics**
• **Compares as many anatomical features as possible**	• **Classifies organisms according to order in time branches arose along dichotomous phylogenetic tree**
• **Does NOT sort homology from analogy**	• **Each branch identified by novelty**
	• **Reflects evolution**

QUESTIONS:

26.1

1. Match the term with the correct definition.
    A. Phylogenetic tree   B. Phylogeny   C. Systematics
    _____ Evolutionary history of a species or group of related species
    _____ Diagram of a proposed evolutionary relationship of various groups
    _____ Study of biological diversity in an evolutionary context

2. What is taxonomy? _____

    _____

3. Who developed the hierarchy of classification that is still used today?

    _____

4. What are the two components of every binomial? What is your binomial?
    _____

5. What is the goal of systematics? _____

    _____

6. List the major taxonomic categories from most to least inclusive.

    _____

Evolution Activity #15

7. So, which are more closely related, organisms in the same phylum, or those in the same order? _____

6. Here is a *phylogenetic tree.* Recall that branch points represent common ancestors of the two lineages beyond the branch or *node*. Circle the common ancestor of badgers and otters, and label it as A. Circle the common ancestor of cats and dogs, and label it as B.
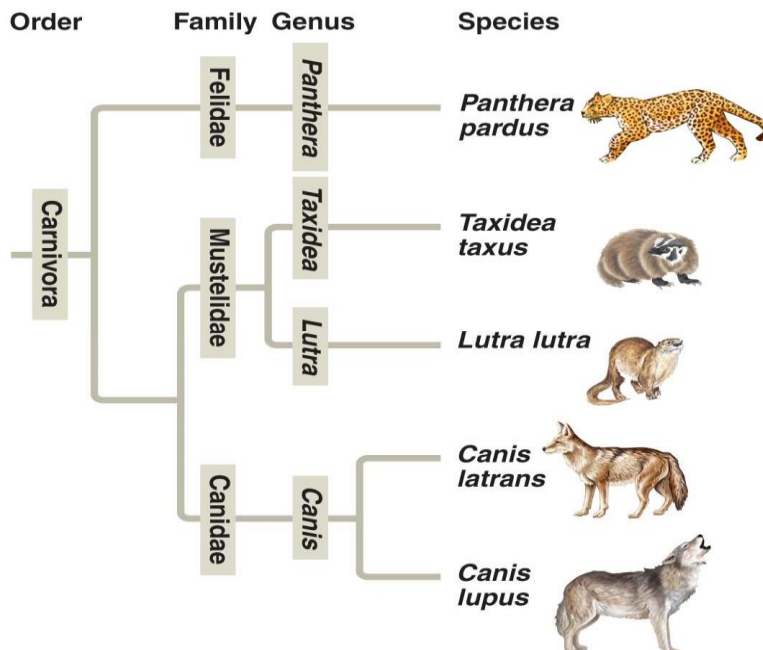
26.2

8. Indicate if each of the following statements is true of **H**omologous structures or **A**nalogous structures.
   _____ Similar structure
   _____ Indicates common ancestry
   _____ Similar function but different structure
   _____ Forelimbs of a bird and human
   _____ Wing of a bird and wing of an insect
   _____ Eye of a bird and eye of a squid

9. The wings of a butterfly and the wings of a bird are both adapted for flight. Does this mean that these two organisms are closely related? Explain.

   _____

   _____

26.3

Evolution Activity #15

10. What are the differences between phenetics and cladistics?

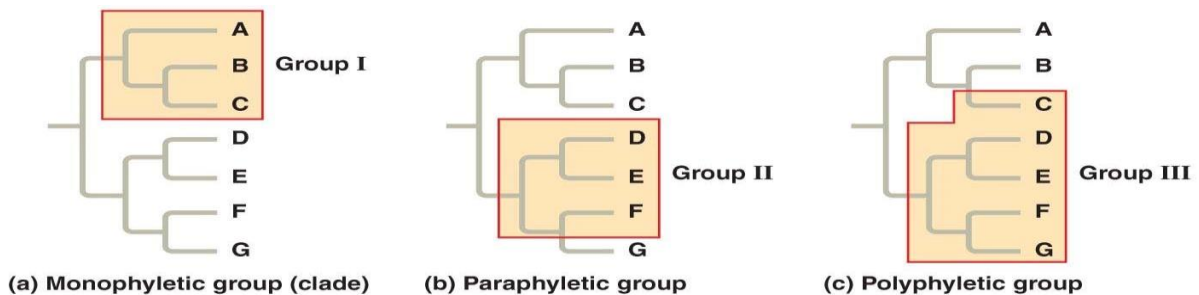| PHENETICS	CLADISTICS

10.   Below are three *cladograms*. What is a *clade*? Circle a clade that is not highlighted below.

11.   Why is Group I *monophyletic*?
_____

12.   Explain why Group II is *paraphyletic*. _____

13.   What is a *polyphyletic group*?
_____

(a) Monophyletic group (clade)   (b) Paraphyletic group   (c) Polyphyletic group

14.   Clades are derived by using *shared derived characters*. What are these?
_____

_____

15.   Explain why for mammals, hair is a shared derived character, but a backbone is not.
_____

_____

26.4

Evolution Activity #15

The rate of evolution of DNA sequences varies from one part of the genome to another; therefore, comparing different sequences helps us to investigate relationships between groups of organisms that diverged a long time ago. For example, DNA that codes for *ribosomal RNA (rRNA)* changes relatively slowly and is useful for investigating relationships between taxa that diverged hundreds of millions of years ago. DNA that codes for *mitochondrial DNA (mtDNA)* evolves rapidly and can be used to explore recent evolutionary events.

16.   Which method reveals that fungi are more closely related to animals than to green plants? _____

17.   Which method reveals that the Pima of Arizona and Yanomami of Venezuela are descendants of the same Native Americans that crossed the Bering Land Bridge 13,000 years ago? _____

26.5
18. Match the process with the correct description.

A.	DNA-RNA Sequencing	B.	DNA-DNA Hybridization
C.	Molecular Clocks	D.	PCR
E.	Protein Comparison	F.	RFLP Analysis

_____ Comparison of the amino acid sequence in proteins common to several different species
_____ Measures the extent of hydrogen bonding between single-stranded DNA from two different sources; can estimate overall similarities of two genomes
_____ DNA digested with restriction enzymes; resulting fragments subjected to gel electrophoresis; pattern of bands produced compared with other patterns
_____ Produces many clones of a small sample of DNA
_____ Determination of the sequence of nucleotides in a segment of DNA or RNA
_____ Process that uses the rate of mutation of nucleic acids to determine a relative measure of time that elapsed since the two lineages being compared branched

26.6

Evolution Activity #15

EUKARYA

ARCHAEA

BACTERIA
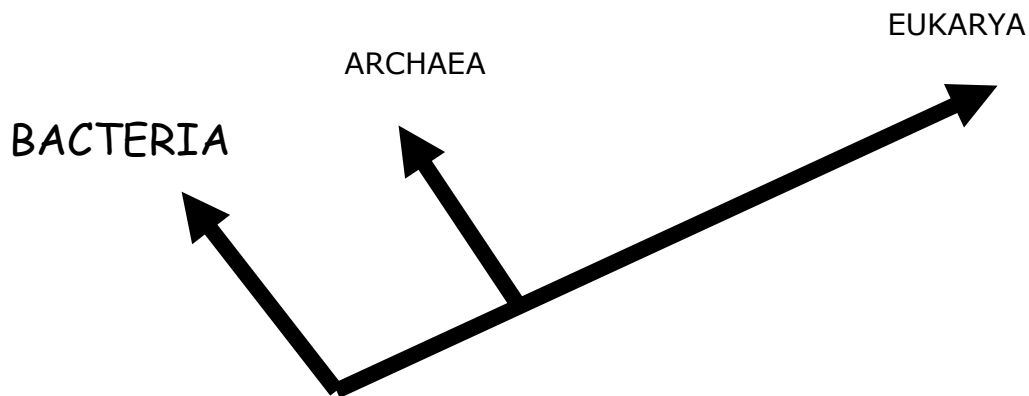
19. On the figure above, place an arrow at the point showing the common ancestor of all three domains.

20. What two domains include all prokaryotes? Which two domains are most closely related? _____

_____

21. Which kingdom is made obsolete by the three-domain system? Why?
_____

_____

22. Which kingdom crumbled because it is polyphyletic?
_____

End of Chapter Synthesis and Evaluation Problems
1. Answer questions 1-7, 10. Then, check and correct your answers 1-7 in the back of the text.
   1._____
   2._____
   3._____
   4._____
   5._____
   6._____
   7._____

   > ***Question #10 should be typed out, then answered in no more and no less than 100 to 150 words. Turn in separately to the tray. This is worth **20 points**! Do not plagiarize. Use your own words and thoughts…but, use vocabulary terms and ideas taught in this chapter!

Study Guide/ISN (20 points)
1. In your study guide book, review pages 171 to 174. In your ISN, title a page as follows: **Chapter 26 Phylogeny and the Tree of Life Must Know!** In one color, copy down the must know items listed on page 171 in study guide leaving space underneath to include in an different color a brief description, diagram, model, or pneumonic device that will help you study for the unit test and more importantly the AP Test in May.

Bozeman Science/ AP Biology/ISN (See Syllabus for format) **(20 points each)**
1. Phylogenetics (Big idea 1)
2. Review Natural Selection (Supplemental AP bio resources)
3. Review Speciation (Supplemental AP bio resources)

UNIT TEST: Evolution and Heredity!
Note: Review all study materials: Reading guides, Must know, Podcast notes, labs, and other activities for the unit test. You have everything you need in your possession to do well on the test.

Evolution Activity #15