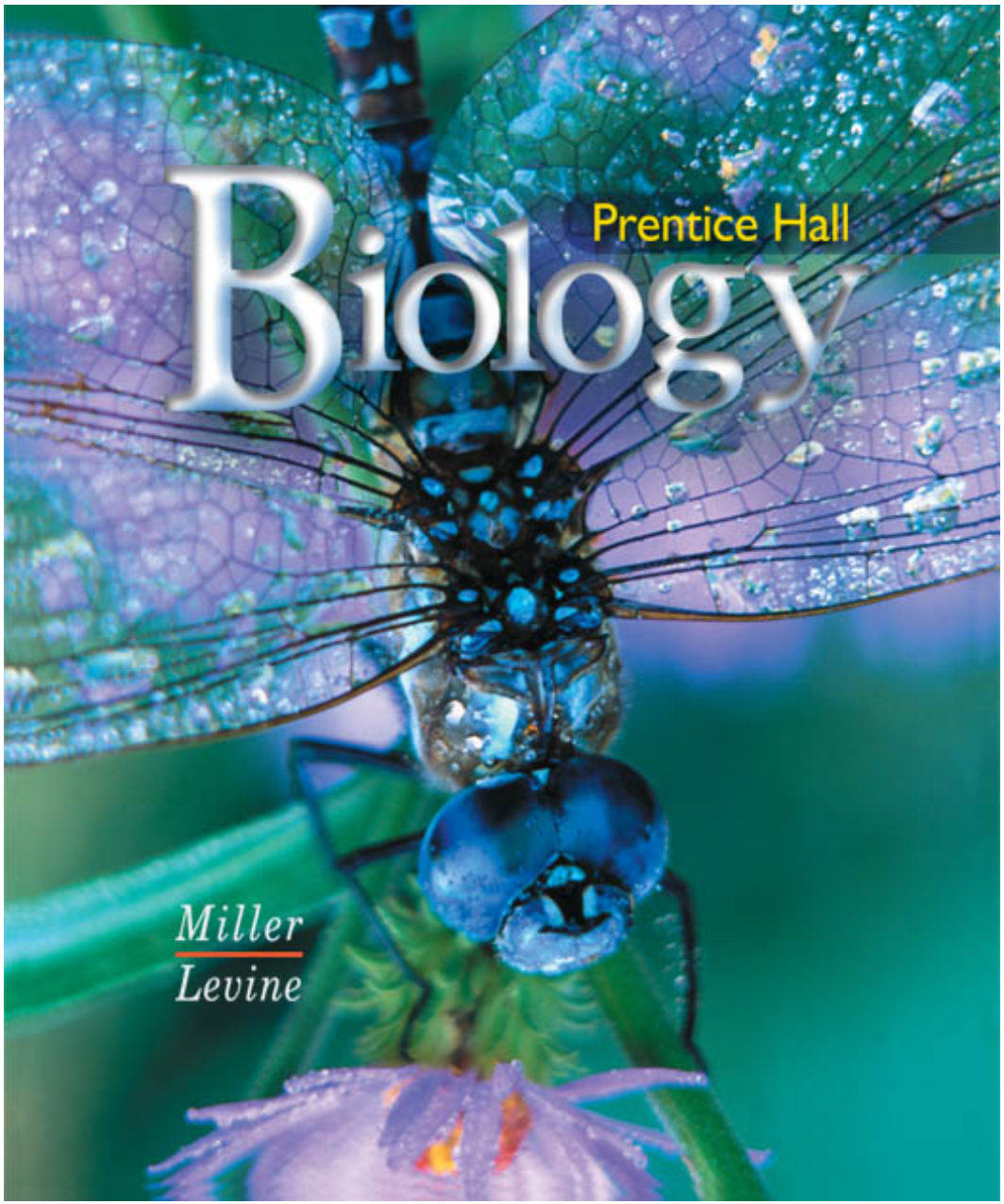
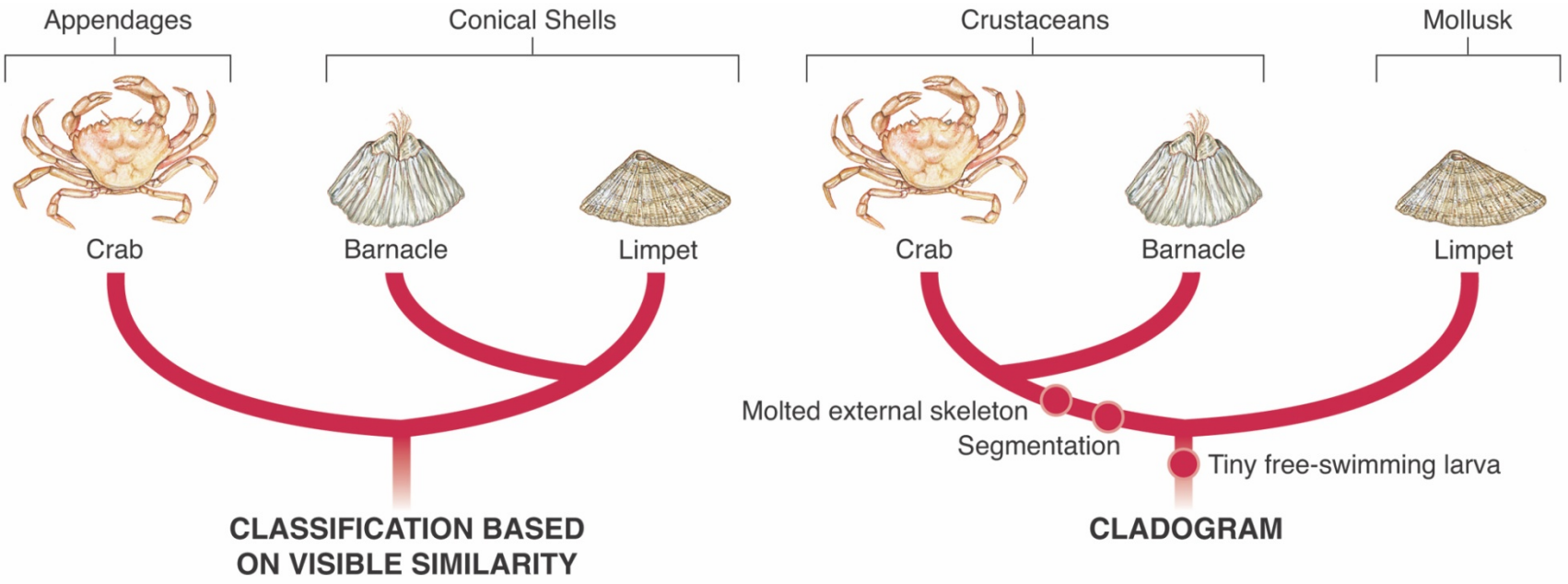


18-2 Modern Evolutionary Classification



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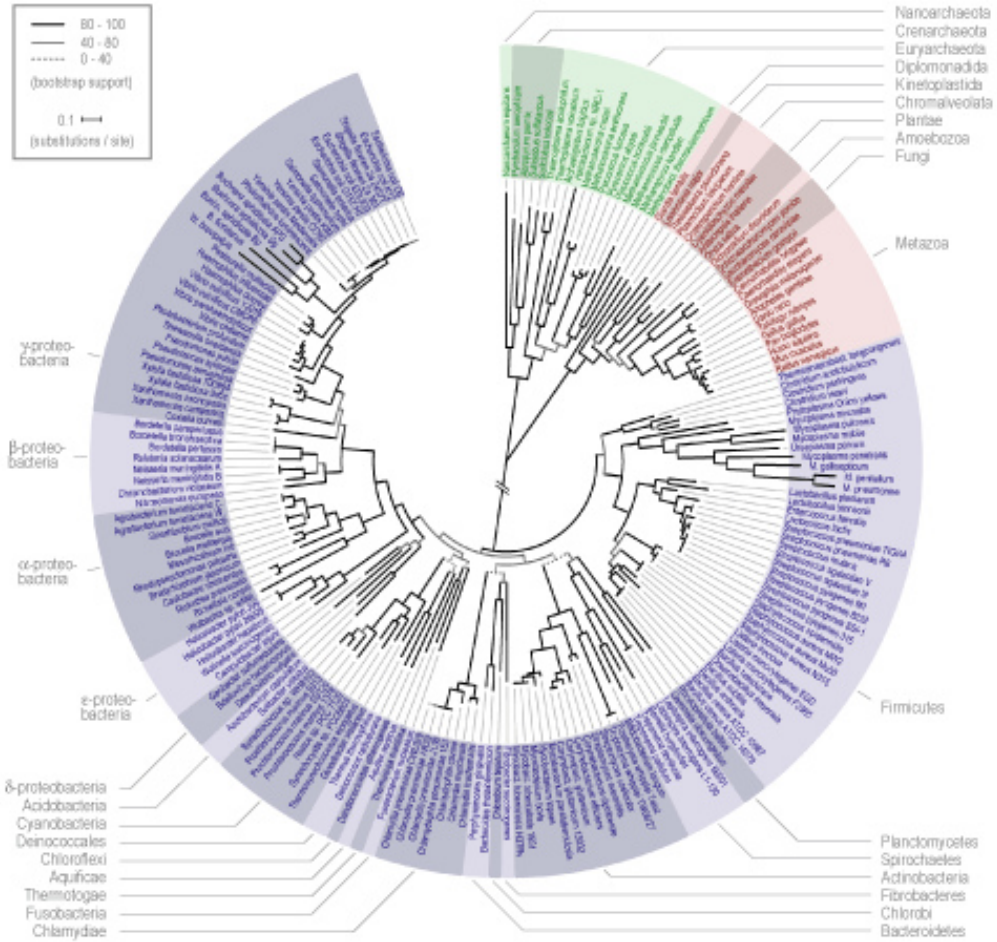
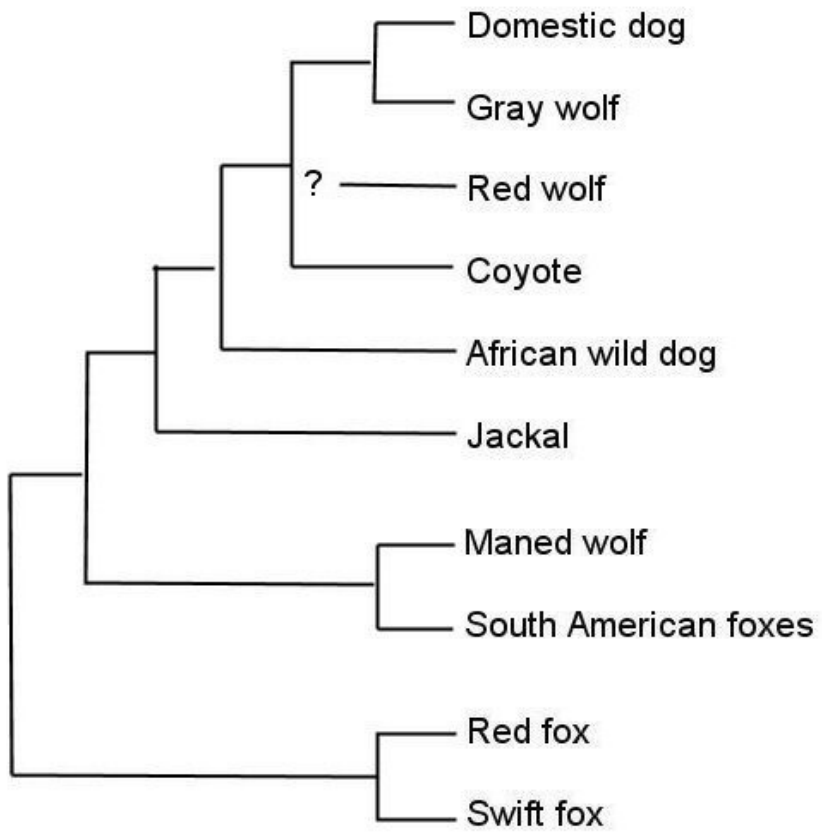
Evolutionary Classification

Phylogeny is the study of evolutionary relationships among organisms.





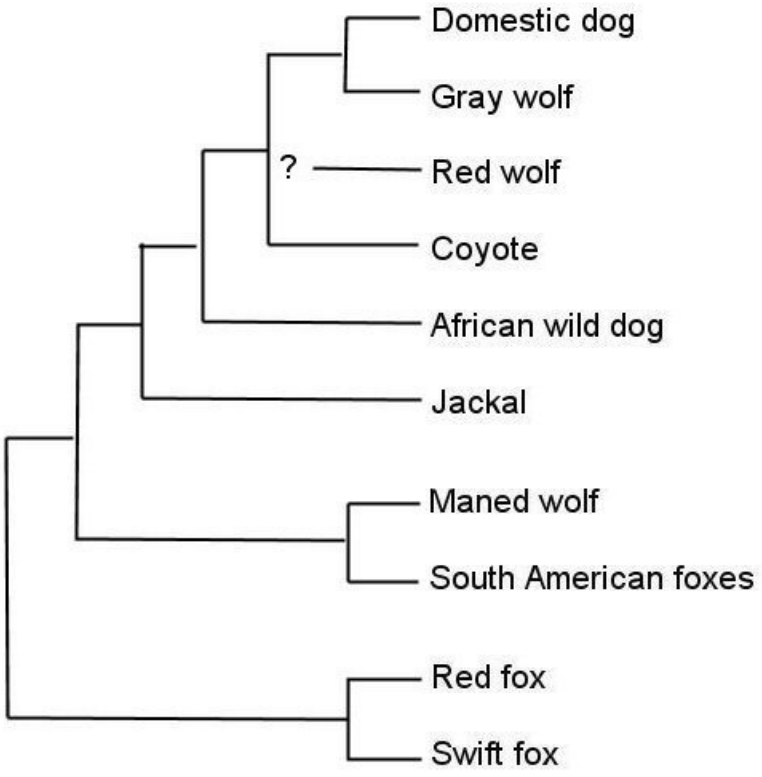
Redrawn from Wayne, 1993. Molecular evolution of the dog family

Biologists currently group organisms into categories that represent lines of evolutionary descent, or phylogeny, not just physical similarities.

The strategy of grouping organisms is based on evolutionary history and is called **evolutionary classification.**

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

Organisms that appear very similar may not share a recent common ancestor.



Redrawn from Wayne, 1993. Molecular evolution of the dog family

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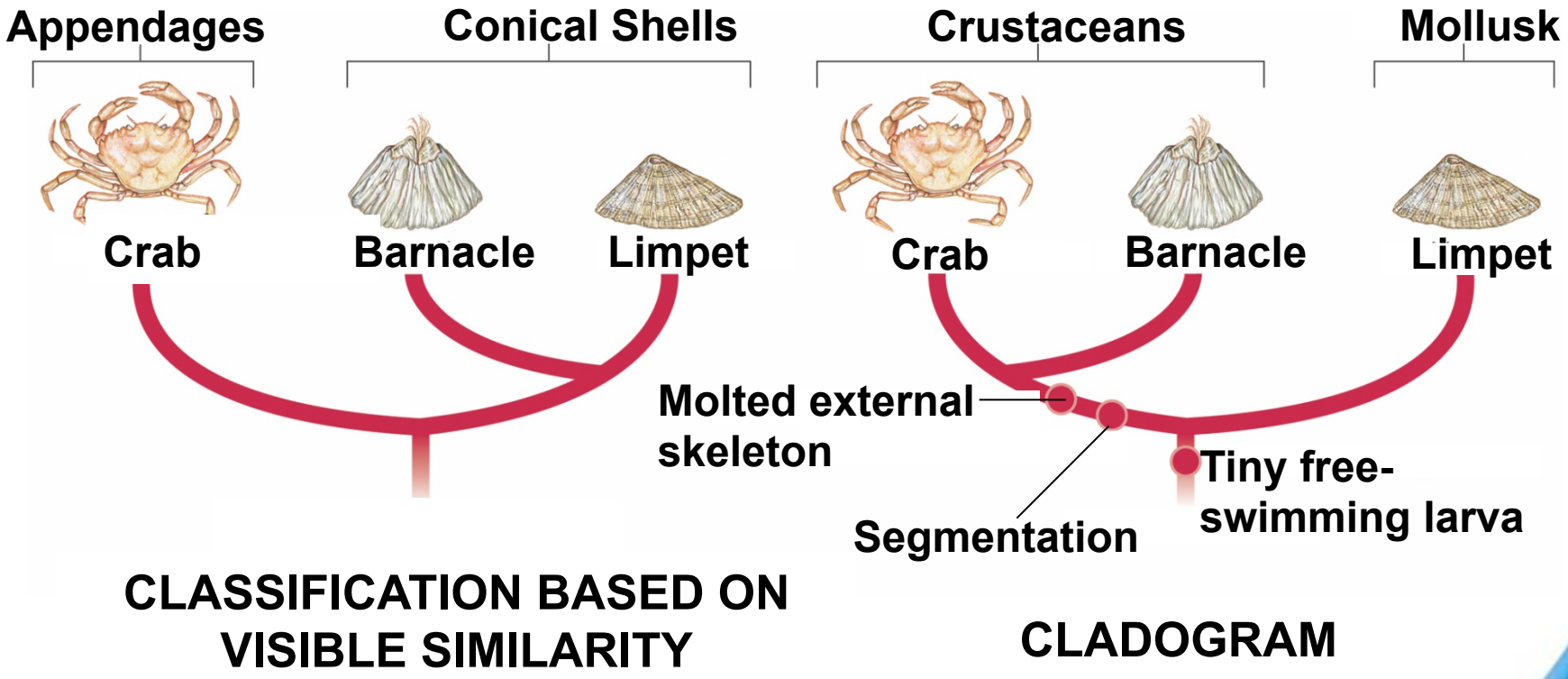
Different Methods of Classification

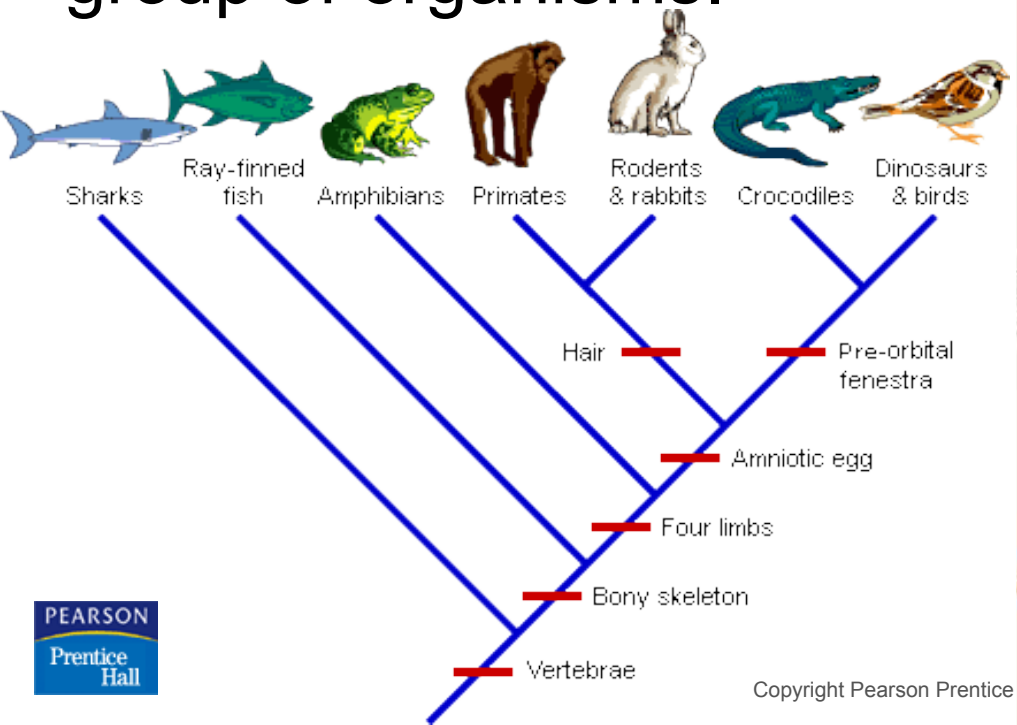


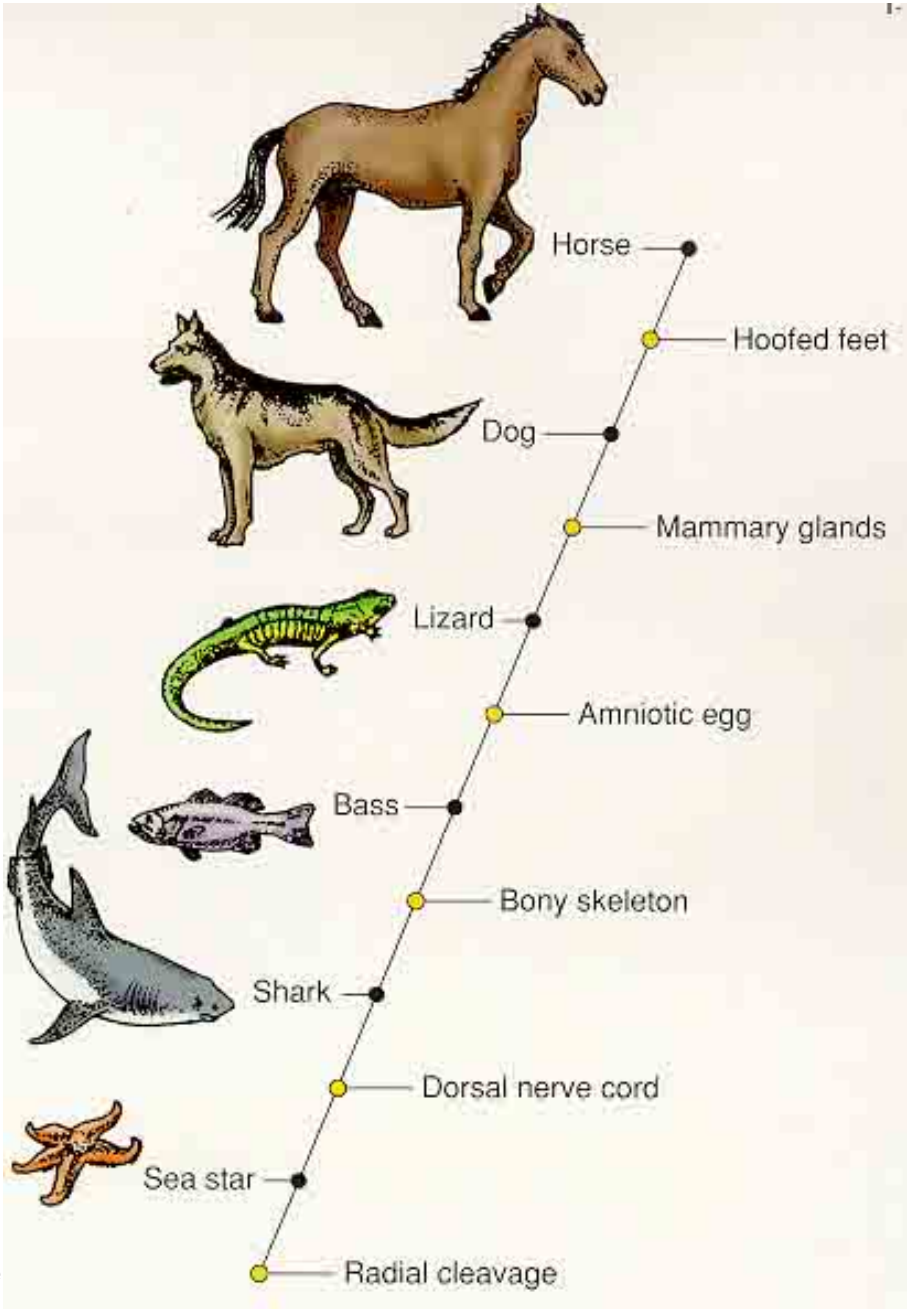
Classification Using Cladograms

Many biologists now use a method called **cladistic analysis.**

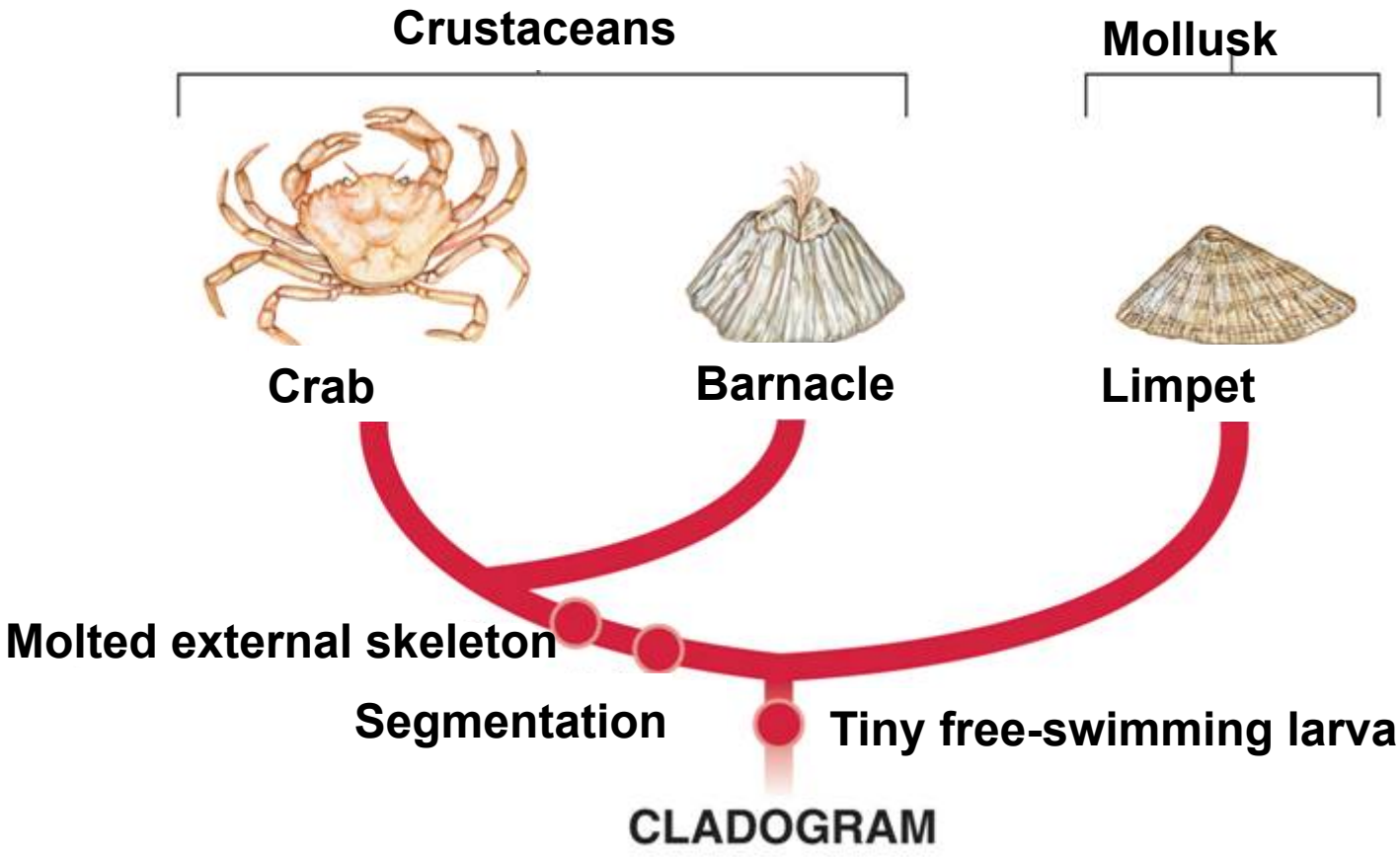
Characteristics that appear in recent parts of a lineage but not in its older members are called **derived characters**.

Derived characters can be used to construct a **cladogram**, a diagram that shows the evolutionary relationships among a group of organisms.





A cladogram shows the evolutionary relationships between crabs, barnacles, and limpets.



Similarities in DNA and RNA

The genes of many organisms show important similarities at the molecular level.

Similarities in DNA can be used to help determine classification and evolutionary relationships.

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Similarities in DNA can be used to help determine classification and evolutionary relationships.

DNA Evidence

The more similar the DNA of two species, the more recently they shared a common ancestor, and the more closely they are related in evolutionary terms.

```
                1                                                   50
    Ovis aries X    CCCTTCCAGC CCCAGTCCAT CCAGCCGCAG CCTCACCAGC CCCTGCAGCC
Cervus elaphus X    CCCTTCCAGC CCCAGTCCAT CCAGCCGCAG CCTCACCAGC CCCTGCAGCC
    Ovis aries Y    CCCTTCCAGC CCCAGCCCAT CCAGCCACAG CCTCACCAGC CCCTACAGCC
Cervus elaphus Y    CTC....AGG CCCAGCCCAT CCAGCCACAG CCTCACCAAC CCCTACAGCC

               51                                                  100
    Ovis aries X    CCTGCAGCCC CTGCAGCCCT TGCAGCCCCT GCAGCCCCTG CAGCCCCAGT
Cervus elaphus X    CCTGCAGCCC CTGCAGCCCT TGCAGCCCCT GCAGCCCCTG CAGCCCCAGC
    Ovis aries Y    CCATGTCAGC CTG..... .......... .......... ..........
Cervus elaphus Y    CCAGTAGCAC CTG..... .......... .......... ..........

              101                                                  150
    Ovis aries X    CACCCG..TG CACCCCATCC AGCCCCTTGC CGCCGCAGCC ACCTCTGCCT
Cervus elaphus X    CGCCCAGTTG CACCCCATCC AGCCCCTTGC CGCCACAGCC ACCTCTGCCT
    Ovis aries Y    ........TG CACCCCATCC AGCCCTT... .......GCC ACCTCTGCCT
Cervus elaphus Y    ........TG CACCCCATCC AGCCCTT... .......GCC ACCTCTGCCT

              151                                                  200
    Ovis aries X    CCGATATTCC CCATGCAGCC TTTGCCCCCC .ATGCTTCCT GACCTGCCT
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    Ovis aries Y    CCGATATTCC CCATGCAGCC TTTGCCCCCC TGTGCTTCCT GAGCTGCCT
Cervus elaphus Y    CCGATATTCC CCATGCAGCC TTTGCCCCCT .GTGCTTCCT GACCTGCCT
```
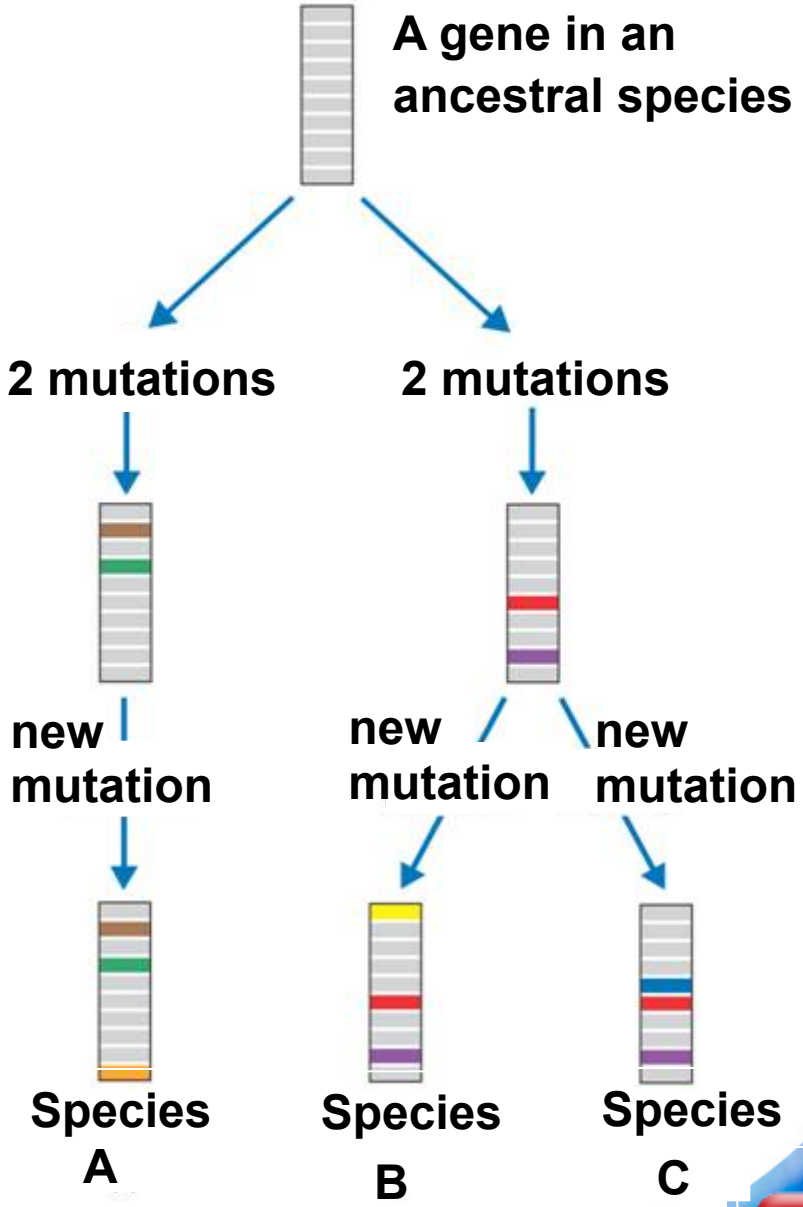

DNA sequence comparison of the X and Y amelogenin gene fragments of sheep and European red deer.

Pfeiffer and Brenig *BMC Genetics* 2005 **6**:16 doi:10.1186/1471-2156-6-16

Molecular Clocks

A **molecular clock** uses DNA comparisons to estimate the length of time that two species have been evolving independently.



18-2 Section QUIZ

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Section QUIZ

- or -

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End Show

18-2 Section QUIZ

1 Grouping organisms together based on their evolutionary history is called

a. evolutionary classification.

b. traditional classification.

c. cladogram classification.

d. taxonomic classification.

2 Traditional classification groups organisms together based on

a. derived characters.

b. similarities in appearance.

c. DNA and RNA similarities.

d. molecular clocks.

3 In an evolutionary classification system, the higher the taxon level,

a. the more similar the members of the taxon become.

b. the more common ancestors would be found in recent time.

c. the fewer the number of species in the taxon.

d. the farther back in time the common ancestors would be.

4 Classifying organisms using a cladogram depends on identifying

a. external and internal structural similarities.

b. new characteristics that have appeared most recently as lineages evolve.

c. characteristics that have been present in the group for the longest time.

d. individual variations within the group.

5 To compare traits of very different organisms, you would use

a. anatomical similarities.

b. anatomical differences.

c. DNA and RNA.

d. proteins and carbohydrates.

END OF SECTION