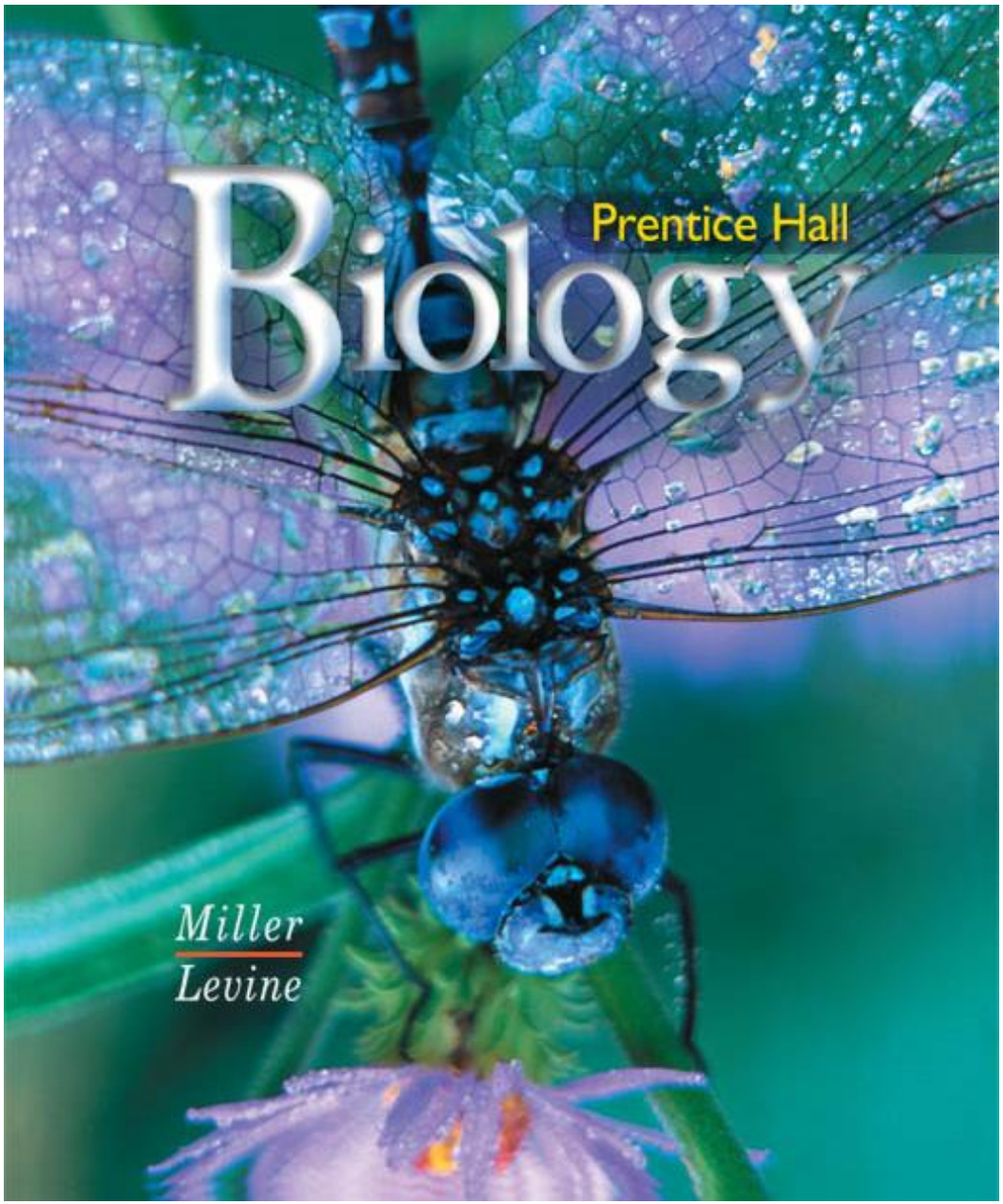
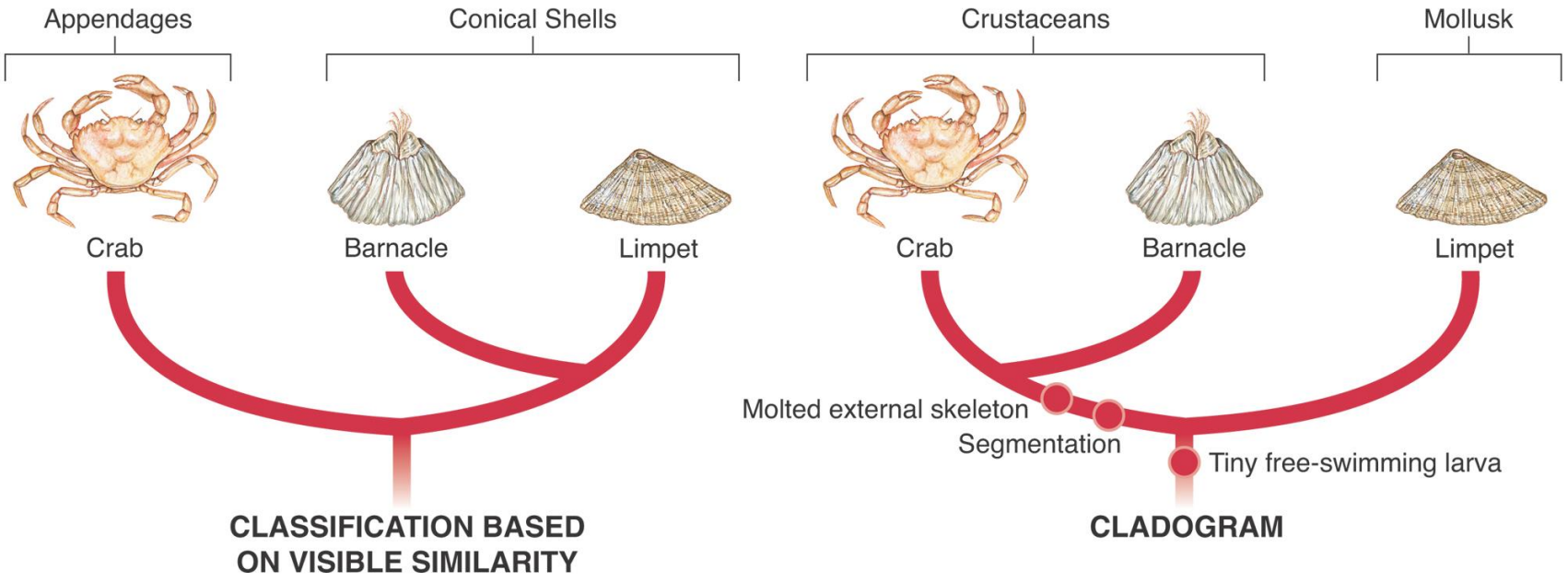


18-2 Modern Evolutionary Classification



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Linnaeus grouped species into larger taxa mainly according to visible similarities and differences.

How are evolutionary relationships important in classification?

Evolutionary Classification

Phylogeny is the study of evolutionary relationships among organisms.

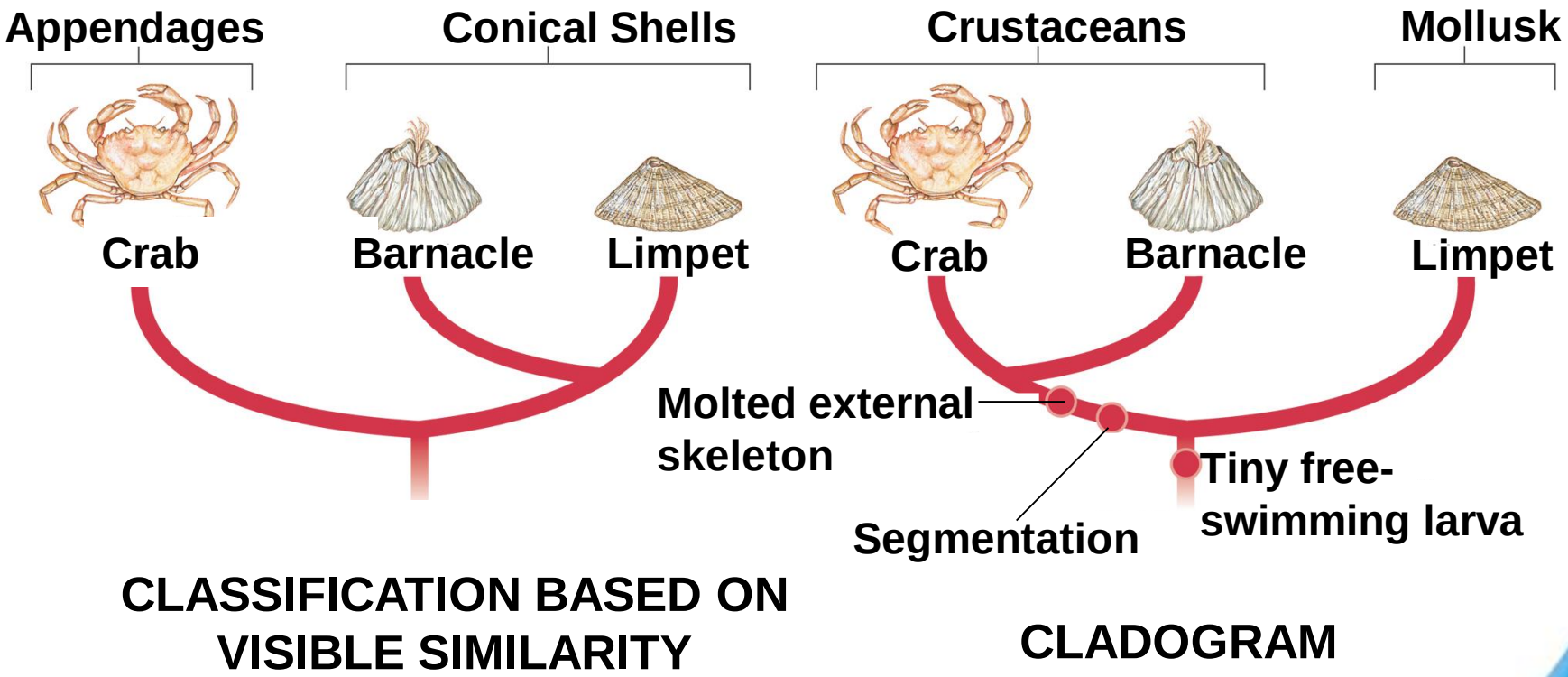
Biologists currently group organisms into categories that represent lines of evolutionary descent, or phylogeny, not just physical similarities.

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

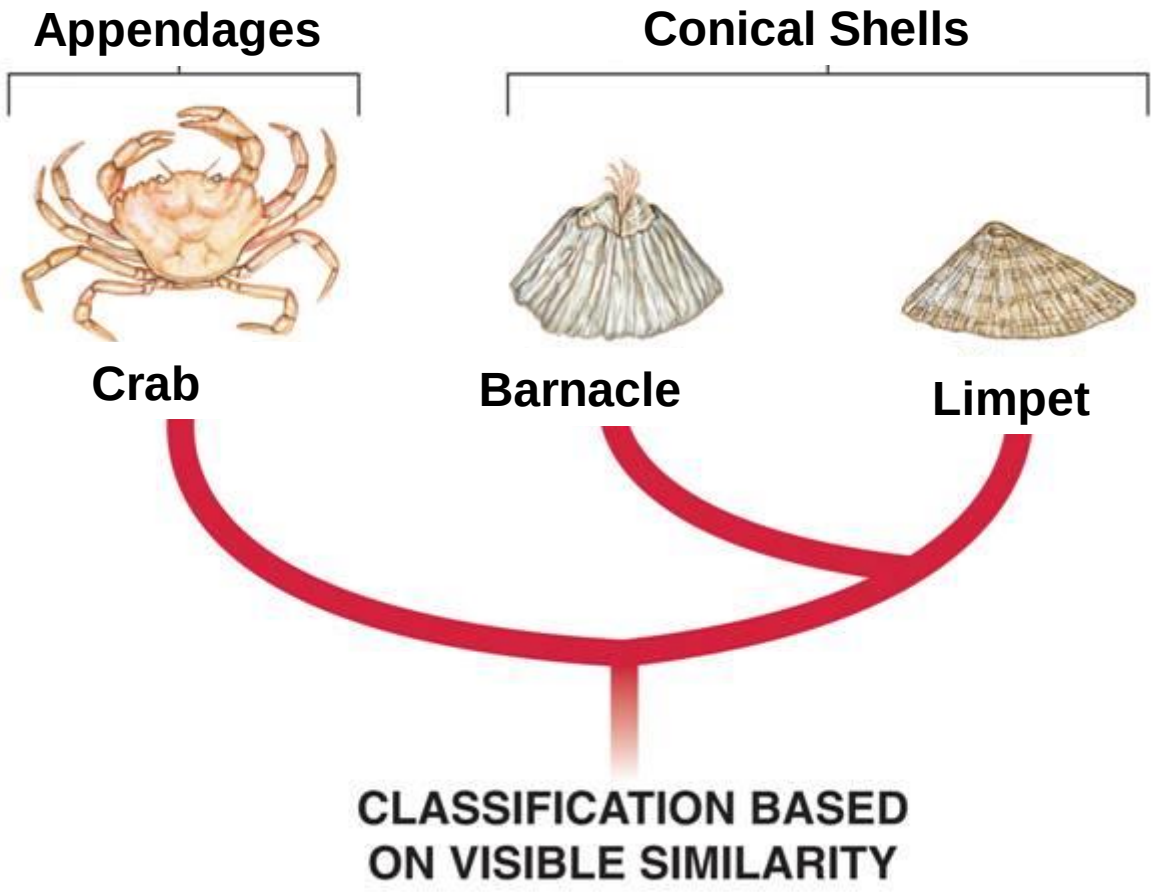
The higher the level of the taxon, the further back in time is the common ancestor of all the organisms in the taxon.

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

Different Methods of Classification



Superficial similarities once led barnacles and limpets to be grouped together.



However, barnacles and crabs share an evolutionary ancestor that is more recent than the ancestor that barnacles and limpets share.

Barnacles and crabs are classified as crustaceans, and limpets are mollusks.

Classification Using Cladograms

Many biologists now use a method called cladistic analysis.

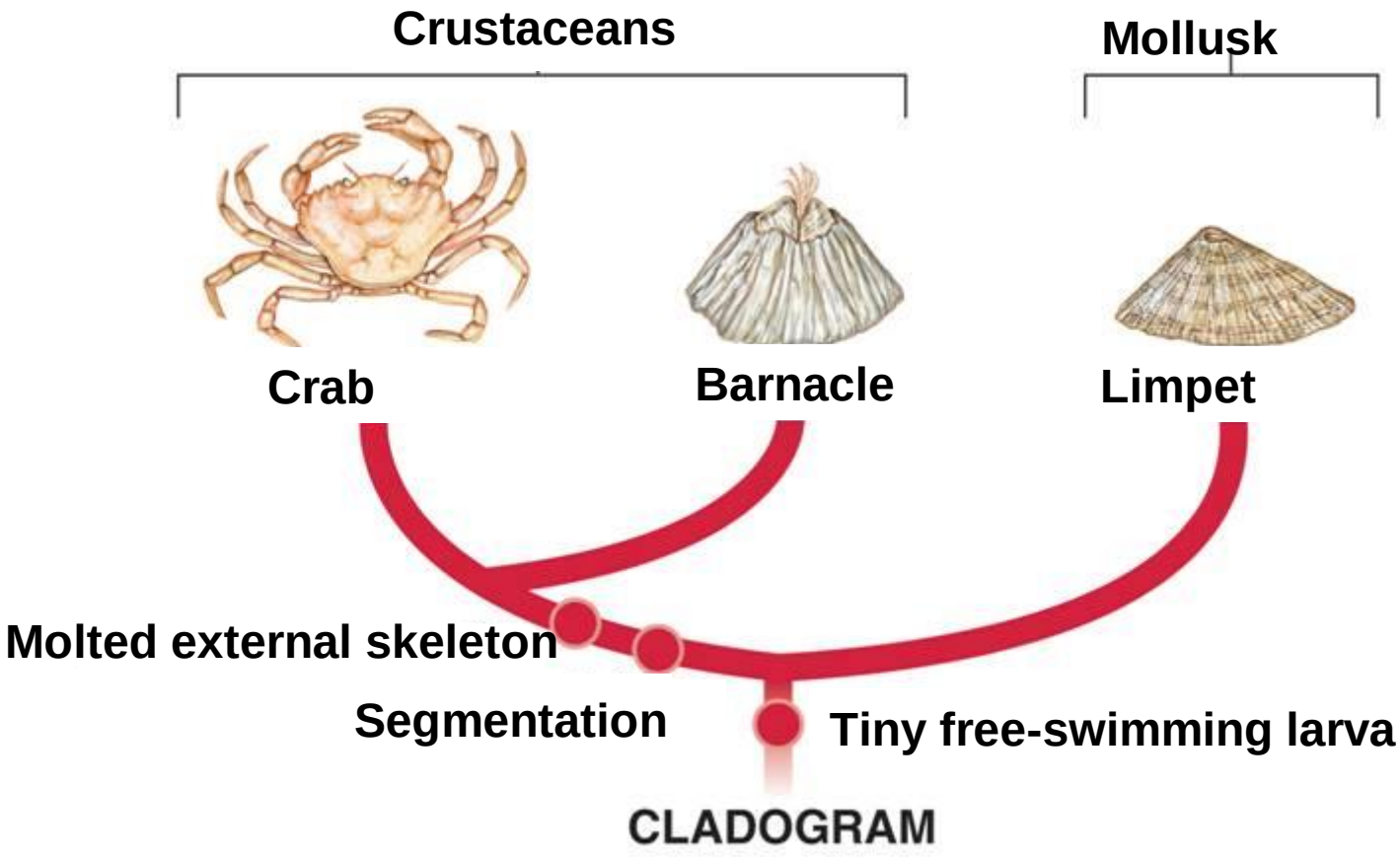
Cladistic analysis identifies and considers only new characteristics that arise as lineages evolve.

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 help scientists understand how one lineage branched from another in the course of evolution.

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



Similarities in DNA and RNA

How can DNA and RNA help scientists determine evolutionary relationships?

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.

DNA Evidence

DNA evidence shows evolutionary relationships of species.

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.

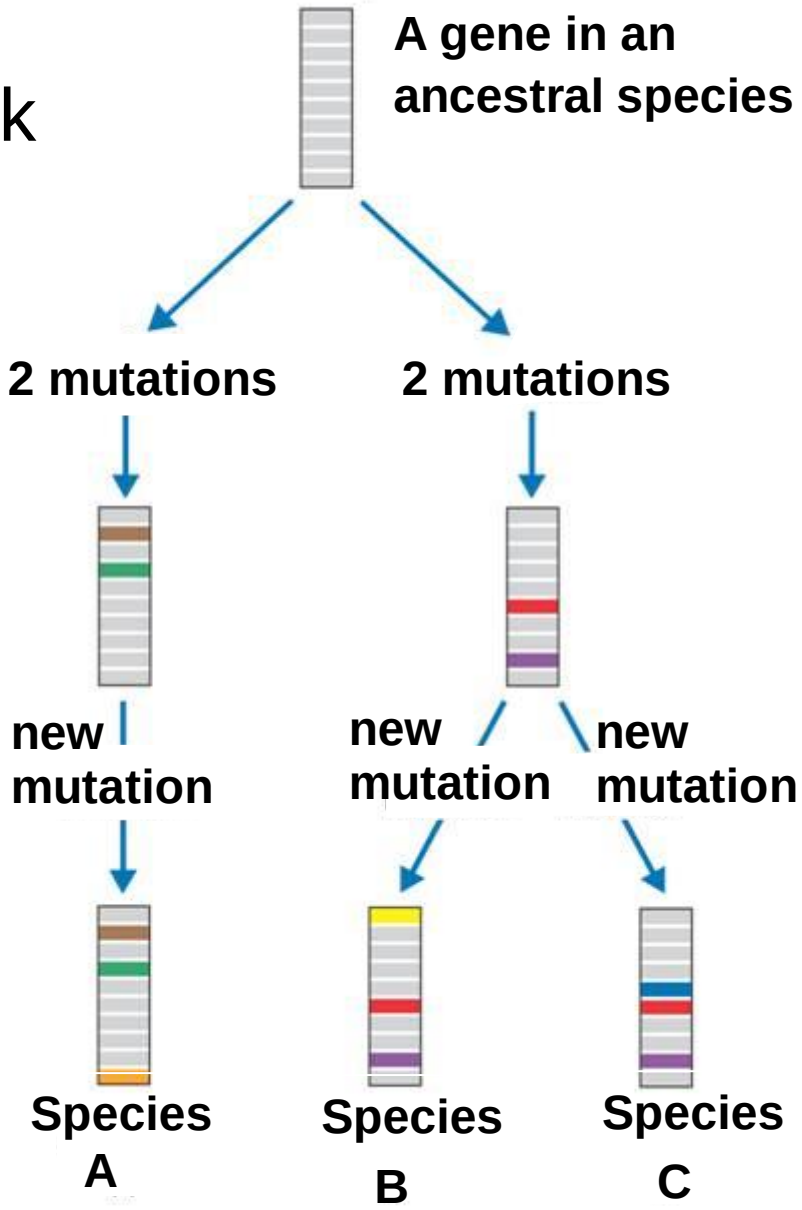
The more two species have diverged from each other, the less similar their DNA will be.

Molecular Clocks

Comparisons of DNA are used to mark the passage of evolutionary time.

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

Molecular Clock



A molecular clock relies on mutations to mark time.

Simple mutations in DNA structure occur often.

Neutral mutations accumulate in different species at about the same rate.

Comparing sequences in two species shows how dissimilar the genes are, and shows when they shared a common ancestor.

18-2 Section QUIZ

Continue to:

Section QUIZ

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18-2 Section QUIZ

1 Grouping organisms together based on their evolutionary history is called

A a. evolutionary classification.

b. traditional classification.

c. cladogram classification.

d. taxonomic classification.

2 Traditional classification groups organisms together based on

a. derived characters.

A 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.

A 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.

A 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.

A c. DNA and RNA.

d. proteins and carbohydrates.

END OF SECTION