The student is expected to:

7A analyze and evaluate how evidence of common ancestry among groups is provided by the fossil record, biogeography, and homologies, including anatomical, molecular, and developmental;

8A define taxonomy and recognize the importance of a standardized taxonomic system to the scientific community;

8B categorize organisms using a hierarchical classification system based on similarities and differences shared among groups.
KEY CONCEPT
Organisms can be classified based on physical similarities.
Linnaeus developed the scientific naming system still used today.

- **Taxonomy** is the **science of naming and classifying organisms**.

- A **taxon** is a group of organisms in a classification system.

White oak: *Quercus alba*
Binomial nomenclature is a two-part scientific naming system.

- uses Latin words
- scientific names always written in italics
- two parts are the genus name and species descriptor

Diagram:
```
  two  name  naming  system
   |     |       |
   bi  nomial  nomen  clature
     |        |
      1 Genus (2) species
```
• A genus includes one or more physically similar species.
  – Species in the same genus are thought to be closely related.
  – Genus name is always capitalized.

• A species descriptor is the second part of a scientific name.
  – always lowercase
  – always follows genus name; never written alone

Tyto alba
17.1 The Linnaean System of Classification

- Scientific names help scientists to communicate.
  - Some species have very similar common names.
  - Some species have many common names.

<table>
<thead>
<tr>
<th>COMMON NAMES</th>
<th>SCIENTIFIC NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roly-poly, pill bug, sow bug, potato bug</td>
<td>Armadillidium vulgare</td>
</tr>
<tr>
<td>Dandelion, Irish daisy, lion’s tooth</td>
<td>Taraxacum officinale</td>
</tr>
<tr>
<td>House sparrow, English sparrow</td>
<td>Passer domesticus</td>
</tr>
<tr>
<td>Mountain lion, cougar, puma</td>
<td>Puma concolor</td>
</tr>
<tr>
<td>Red maple, scarlet maple, swamp maple</td>
<td>Acer rubrum</td>
</tr>
</tbody>
</table>
Linnaeus’ classification system has **seven levels called taxa.**

- Each level is included in the level above it.
- Hierarchy
- Levels get increasingly specific from kingdom to species.
17.1 The Linnaean System of Classification

• Nested Hierarchy

KINGDOM: Animalia

PHYLUM: Chordata

CLASS: Mammalia

ORDER: Carnivora

FAMILY: Canidae

GENUS: Canis

SPECIES: Canis lupis
The Linnaean classification system has *limitations*.

- Linnaeus taxonomy *doesn’t account for molecular evidence*.
  - The technology didn’t exist during Linneaus’ time.
  - Linnaean system *based only on physical similarities*.
  - Physically similar species might NOT be closely related.
Limitations Cont.

- Physical similarities are not always the result of close relationships.

- Genetic similarities more accurately show evolutionary relationships.
Classification
Scientific Names

Organisms are universally named based on a two part system called **binomial nomenclature**.

*Genus* *species*: *Canis familiaris*

**Binomial Nomenclature Rules**
- **Genus** is always **capitalized**
- The **species** is always **lowercase**

Scientific names are either italicized or underlined
Classification

Scientific Names

**Animalia**

**Chordata**

**Mammalia**

**Carnivora**

**Felidae**

*Panthera leo*

**Plantae**

**Angiosperms**

**Eudicots**

**Rosales**

**Rosaceae**

*Rosa canina*

**Animalia**

**Chordata**

**Mammalia**

**Pilosa**

**Bradypodidae**

*Bradypus tridactylus*

**Bacteria**

**Firmicutes**

**Bacilli**

**Lactobacillales**

**Streptococcaceae**

*Streptococcus mutans*
Classification
Phylogeny

* Phylogeny - Studying the **evolutionary relationships** between organisms

* Organisms are classified based on **phylogeny**, or shared lines of evolutionary descent

* Evolutionary descent is based on - **Derived Characteristics**: new traits that appear as **organisms evolve over time**
Phylogeny

* **Cladograms** - *Diagrams* that show *the evolutionary relationships* between organisms based on *derived characteristics*
Classification

Phylogeny

* DNA - **Similarities in DNA** can help to gauge evolutionary relationships between organisms

   DNA is **more similar** in more **closely related** organisms