

## Chapter 17

### Classification

#### Table of Contents

Section 1 Biodiversity

Section 2 Systematics

Section 3 Modern Classification



Chapter menu

Resources

Copyright © by Holt, Rinehart and Winston. All rights reserved.

## Chapter 17

### Section 1 Biodiversity

#### Objectives

- **Relate** biodiversity to biological classification.
- **Explain** why naturalists replaced Aristotle's classification system.
- **Identify** the main criterion that Linnaeus used to classify organisms.
- **List** the common levels of modern classification from general to specific.



Chapter menu

Resources

Copyright © by Holt, Rinehart and Winston. All rights reserved.

## Chapter 17

### Section 1 Biodiversity

#### Classifying Organisms

- Naturalists have invented several systems for categorizing **biodiversity**, which is the variety of organisms considered at all levels from populations to ecosystems.



Chapter menu

Resources

Copyright © by Holt, Rinehart and Winston. All rights reserved.

## Chapter 17

### Section 1 Biodiversity

#### Taxonomy

- Naturalists replaced Aristotle's classification system because it did not adequately cover all organisms and because his use of common names was problematic.
- **Taxonomy** is the science of describing, naming, and classifying organisms.



Chapter menu

Resources

Copyright © by Holt, Rinehart and Winston. All rights reserved.

## Chapter 17

### Section 1 Biodiversity

#### Taxonomy, *continued*

- The Linnaean System

- Carolus Linnaeus devised a seven-level hierarchical system for classifying organisms according to their form and structure.
- From the most general to the most specific, the levels are kingdom, phylum, class, order, family, genus, and species.



Chapter menu

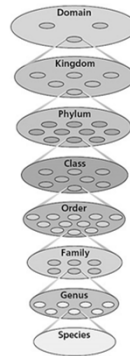
Resources

Copyright © by Holt, Rinehart and Winston. All rights reserved.

## Chapter 17

### Section 1 Biodiversity

#### Classification Hierarchy of Organisms



Domain	Pangolin	Dandelion
Kingdom	Eukarya	Eukarya
Phylum/Division	Chordata	Magnoliophyta
Class	Mammalia	Magnoliopsida
Order	Pholidota	Asterales
Family	Manidae	Asteraceae
Genus	Manis	Taraxacum
Species	<i>Manis temminckii</i>	<i>Taraxacum officinale</i>



Chapter menu

Resources

Copyright © by Holt, Rinehart and Winston. All rights reserved.

## Chapter 17

### Section 1 Biodiversity

#### Levels of Classification

- Binomial Nomenclature

- An important part of Linnaeus's system was assigning each species a two-part scientific name—a genus name, such as *Homo*, and a species identifier, such as *sapiens*.
- This system of a two-part name is known as **binomial nomenclature**.



Chapter menu

Resources

Copyright © by Holt, Rinehart and Winston. All rights reserved.

## Chapter 17

### Section 2 Systematics

#### Objectives

- **Identify** the kinds of evidence that modern biologists use in classifying organisms.
- **Explain** what information a phylogenetic diagram displays.
- **State** the criteria used in cladistic analysis.
- **Describe** how a cladogram is made.
- **Discuss** how proteins and chromosomes are used to classify organisms.
- **Explain** cladistic taxonomy, and identify one conclusion that is in conflict with classical taxonomy.



Chapter menu

Resources

Copyright © by Holt, Rinehart and Winston. All rights reserved.

## Chapter 17

### Section 2 Systematics

#### Phylogenetics

- A modern approach to taxonomy is **systematics**, which analyzes the diversity of organisms in the context of their natural relationships.
- When classifying organisms, scientists consider fossils, homologous features, embryos, chromosomes, and the sequences of proteins and DNA.



Chapter menu

Resources

Copyright © by Holt, Rinehart and Winston. All rights reserved.

## Chapter 17

### Section 2 Systematics

#### Phylogenetics, *continued*

- A **phylogenetic diagram** displays how closely related a subset of taxa are thought to be.



Chapter menu

Resources

Copyright © by Holt, Rinehart and Winston. All rights reserved.

## Chapter 17

### Section 2 Systematics

#### Phylogenetics, *continued*

- **Evidence of Shared Ancestry**
  - Homologous features as well as similarities in patterns of embryological development provide information about common ancestry.



Chapter menu

Resources

Copyright © by Holt, Rinehart and Winston. All rights reserved.

## Chapter 17

### Section 2 Systematics

#### Cladistics

- **Cladistics** uses **shared, derived characters** as the only criterion for grouping taxa.



Chapter menu

Resources

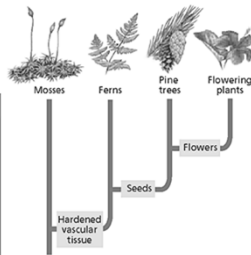
Copyright © by Holt, Rinehart and Winston. All rights reserved.

## Chapter 17

Section 2 Systematics

### Cladogram: Major Groups of Plants

Group of organisms	Characters		
	Vascular tissue	Seeds	Flowers
Mosses (out-group)	0	0	0
Ferns	1	0	0
Pine trees and other conifers	1	1	0
Flowering plants	1	1	1



Chapter menu

Resources

Copyright © by Holt, Rinehart and Winston. All rights reserved.

## Chapter 17

Section 2 Systematics

### Cladistics, *continued*

- **Molecular Cladistics**
  - Molecular similarities (such as similar amino acid or nucleotide sequences), as well as chromosome comparisons, can help determine common ancestry.



Chapter menu

Resources

Copyright © by Holt, Rinehart and Winston. All rights reserved.

## Chapter 17

Section 2 Systematics

### Cladistics, *continued*

- **Chromosomes**
  - Analyzing karyotypes can provide more information on evolutionary relationships.



Chapter menu

Resources

Copyright © by Holt, Rinehart and Winston. All rights reserved.

## Chapter 17

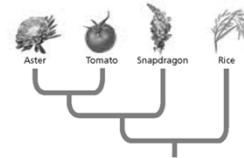
Section 2 Systematics

### Similarities in Amino Acid Sequences

Amino Acid Sequence of a Petal-Forming Gene in Different Plants

```

Aster  M G R I G K I I E I K I I E N I N T I N R Q V I T Y S K R I N G I I F K I A I H E L T V L L C D A K V I S L T I M F I S N T R K F I N E Y
Tomato  I I I G K I E I T K I E N S T N R Q V I T Y S K R I N G I I F K I A I H E L T V L L C D A K V I S L T I M F I S N T R K F I N E Y
Snapdragon M A R I G K I I Q I K R I I E N Q T N R Q V I T Y S K R I N G I I F K I A I H E L S V L L C D A K V I S I I M I S I T Q K L H E Y
Rice  M G R I G K I I E I K R I I E N A I T N R Q V I T Y S K R I N T I G I I M K I A R E L I T V L L C D A Q V A I I T M F I S I T I G I K Y I E I
    
```



Chapter menu

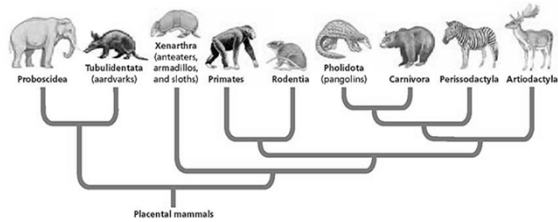
Resources

Copyright © by Holt, Rinehart and Winston. All rights reserved.

## Chapter 17

### Section 2 Systematics

#### Phylogenetic Diagram of Mammals



Chapter menu

Resources

Copyright © by Holt, Rinehart and Winston. All rights reserved.

## Chapter 17

### Section 3 Modern Classification

#### Objectives

- **Describe** the evidence that prompted the invention of the three-domain system of classification.
- **List** the characteristics that distinguish between the domains Bacteria, Archaea, and Eukarya.
- **Describe** the six-kingdom system of classification.
- **Identify** problematic taxa in the six-kingdom system.
- **Explain** why taxonomic systems continue to change.

Chapter menu

Resources

Copyright © by Holt, Rinehart and Winston. All rights reserved.



## Chapter 17

### Section 3 Modern Classification

#### The Tree of Life

- **Revising the Tree**
  - The phylogenetic analysis of rRNA nucleotide sequences by Carol Woese led to a new “tree of life” consisting of three domains aligned with six kingdoms.



Chapter menu

Resources

Copyright © by Holt, Rinehart and Winston. All rights reserved.

## Chapter 17

### Section 3 Modern Classification

#### Three Domains of Life

- The three domains are *Bacteria*, *Archaea*, and *Eukarya*.



Chapter menu

Resources

Copyright © by Holt, Rinehart and Winston. All rights reserved.

## Chapter 17

Section 3 Modern Classification

### Three Domains of Life, *continued*

- Domain **Bacteria**
  - Domain **Bacteria** aligns with Kingdom Eubacteria, which consists of single-celled prokaryotes that are true bacteria.



Chapter menu

Resources

Copyright © by Holt, Rinehart and Winston. All rights reserved.

## Chapter 17

Section 3 Modern Classification

### Three Domains of Life, *continued*

- Domain **Archaea**
  - Domain **Archaea** aligns with Kingdom Archaeobacteria, which consists of single-celled prokaryotes that have distinctive cell membranes and cell walls.



Chapter menu

Resources

Copyright © by Holt, Rinehart and Winston. All rights reserved.

## Chapter 17

Section 3 Modern Classification

### Three Domains of Life, *continued*

- Domain **Eukarya**
  - Domain **Eukarya** includes the kingdoms Protista, Fungi, Plantae, and Animalia.
  - All members of this domain have eukaryotic cells.



Chapter menu

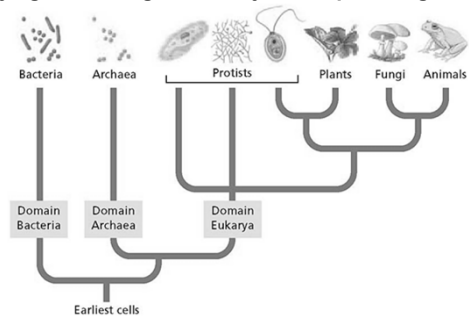
Resources

Copyright © by Holt, Rinehart and Winston. All rights reserved.

## Chapter 17

Section 3 Modern Classification

### Phylogenetic Diagram of Major Groups of Organisms



Chapter menu







Resources

Copyright © by Holt, Rinehart and Winston. All rights reserved.

# Chapter 17

## Section 3 Modern Classification

### Six Kingdoms

Domain Bacteria	Domain Archaea	Domain Eukarya	
			
Kingdom Eubacteria	Kingdom Archaeobacteria	Kingdom Protista	Kingdom Plantae
			
		Kingdom Fungi	Kingdom Animalia

[Chapter menu](#)

[Resources](#)

Copyright © by Holt, Rinehart and Winston. All rights reserved.

# Chapter 17

## Section 3 Modern Classification

### Kingdom and Domain Characteristics

Domain	Kingdom	Characteristics				Example
		Cell type	Cell structure	Body type	Nutrition	
Bacteria	Eubacteria	Prokaryotic	Cell wall, peptidoglycan	Unicellular	Autotrophic and heterotrophic	Enterobacteria Spirochetes
Archaea	Archaeobacteria	Prokaryotic	Cell wall, no peptidoglycan	Unicellular	Autotrophic and heterotrophic	Methanogens
Eukarya	Protista	Eukaryotic	Mixed	Unicellular and multicellular	Autotrophic and heterotrophic	Amoebas Euglenas Kelps
Eukarya	Fungi	Eukaryotic	Cell wall, chitin	Unicellular and multicellular	Heterotrophic	Yeasts Mushrooms
Eukarya	Plantae	Eukaryotic	Cell wall, cellulose	Multicellular	Autotrophic	Ferns Pine trees
Eukarya	Animalia	Eukaryotic	No cell wall	Multicellular	Heterotrophic	Birds Earthworms

[Chapter menu](#)

[Resources](#)

Copyright © by Holt, Rinehart and Winston. All rights reserved.