

## Ch 16: Plant Classification & Intro to Evolution

### Brief History

Greek philosophers  
Kingdoms & Genera

Carolus Linnaeus =  
Carl von Linne

Inventions

species - binomial formal  
names

other taxonomic levels: plant  
classes



So how many kingdoms?

1969: Whittaker 5

1990' s: Woese 6  
(and 3 Domains)

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**TABLE 16.1**

Five Classifications of Organisms into Kingdoms

TWO KINGDOMS (TRADITIONAL)	THREE KINGDOMS (HOGG AND HAECKEL)	FOUR KINGDOMS (COPELAND)	FIVE KINGDOMS (WHITTAKER)	SIX KINGDOMS (WOESE ET AL.)	FEATURES
		<b>Monera</b> Bacteria	<b>Monera</b> Bacteria	<b>Archaea</b> Archaeobacteria	Cells prokaryotic; lack muramic acid
	<b>Protocista</b> Bacteria Algae Slime molds Flagellate fungi	<b>Protocista</b> Algae Slime molds Flagellate fungi	<b>Protista</b> Algae Slime molds Flagellate fungi	<b>Bacteria</b> True bacteria	Cells prokaryotic; have muramic acid
	True fungi Protozoa Sponges	True fungi Protozoa Sponges	Protozoa Sponges	<b>Protista</b> Algae Slime molds Water molds Protozoa Sponges	Cells eukaryotic
<b>Plantae</b> Bacteria Algae Slime molds Flagellate fungi True fungi Bryophytes Vascular plants	<b>Plantae</b> Bryophytes Vascular plants	<b>Plantae</b> Bryophytes Vascular plants	<b>Fungi</b> True fungi <b>Plantae</b> Bryophytes Vascular plants	<b>Fungi</b> True fungi <b>Plantae</b> Bryophytes Vascular plants	Absorb food in solution Produce food via photosynthesis
<b>Animalia</b> Protozoa Sponges Multicellular animals	<b>Animalia</b> Multicellular animals	<b>Animalia</b> Multicellular animals	<b>Animalia</b> Multicellular animals	<b>Animalia</b> Multicellular animals	Ingest food

What's in Charge?

International Code of Botanical Nomenclature

Other taxonomic levels

Domain: Eukarya

Kingdom: Plantae

Phylum: Magnoliophyta

Class: Liliopsida

Order: Liliales

Family: Liliaceae

Genus: *Allium*

Species: *Allium cepa* L.



common name: onion, cebolla, etc.

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**TABLE 16.2**

**Classification of Organisms in Six Kingdoms**

**Domain Archaea**  
**Kingdom Archaea**  
 Phylum Archaeobacteria (methane, salt, and sulfur bacteria)

**Domain Bacteria**  
**Kingdom Bacteria**  
 Phylum Eubacteria  
 Class Eubacteriae (unpigmented, purple, and green sulfur bacteria)  
 Class Cyanobacteriae (cyanobacteria)  
 Class Chloroxybacteriae (chloroxybacteria)

**Domain Eukarya**  
**Kingdom Protista**  
 Phylum Chlorophyta (green algae)  
 Phylum Chromophyta (yellow-green, golden-brown, and brown algae)  
 Phylum Rhodophyta (red algae)  
 Phylum Euglenophyta (euglenoids)  
 Phylum Dinophyta (dinoflagellates)  
 Phylum Cryptophyta (cryptomonads)  
 Phylum Pymnesiophyta (haptophytes)  
 Phylum Charophyta (stoneworts)  
 Phylum Myxomycota (plasmodial slime molds)  
 Phylum Dictyosteliomycota (cellular slime molds)  
 Phylum Oomycota (water molds)  
 [Phylum Protozoa—protozoans]  
 [Phylum Porifera—sponges]

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**TABLE 16.2**

**Classification of Organisms in Six Kingdoms**

**Kingdom Fungi**  
 Phylum Chytridiomycota (chytrids)  
 Phylum Zygomycota (coenocytic fungi)  
 Phylum Ascomycota (sac fungi)  
 [Lichens]  
 Phylum Basidiomycota (club fungi)  
 Phylum Deuteromycota (imperfect fungi)

**Kingdom Plantae**  
 Phylum Hepaticophyta (liverworts)  
 Phylum Anthocerotophyta (hornworts)  
 Phylum Bryophyta (mosses)  
 Phylum Psilotophyta (whisk ferns)  
 Phylum Lycopodiophyta (club mosses)  
 Phylum Equisetophyta (horsetails)  
 Phylum Polypodiophyta (ferns)  
 Phylum Pinophyta (conifers)  
 Phylum Ginkgophyta (*Ginkgo*)  
 Phylum Cycadophyta (cycads)  
 Phylum Gnetales (*Gnetum*, *Ephedra*, *Welwitschia*)  
 Phylum Magnoliophyta (flowering plants)  
 Class Magnoliopsida (dicots)  
 Class Liliopsida (monocots)

**Kingdom Animalia (multicellular animals)**

Division Tracheophyta  
of earlier classifications

**A KEY TO MAJOR GROUPS OF ORGANISMS  
(EXCLUSIVE OF KINGDOM ANIMALIA)**

**Dichotomous Key of All Organisms (except animals): a document for identification (only 1<sup>st</sup> page of 2)**

1. Unicellular, prokaryotic organisms with cell walls ..... **Domain (Kingdom) Bacteria**
2. Cell walls with muramic acid ..... **Domain (Kingdom) Archaea**
2. Cell walls without muramic acid ..... **Domain Eukarya**
1. Unicellular, colonial, filamentous, or multicellular eukaryotic organisms, with or without cell walls ..... **Domain Eukarya**
3. Organisms whose female (and usually male) reproductive structures consist of a single cell or with sterile cells surrounding the one-celled reproductive structures; zygotes not developing into embryos ..... **Kingdom Protista**
4. Organisms unicellular, filamentous, or plasmodial (i.e., with naked protoplasm) ..... **Kingdom Protista**
5. Cell walls without chitin ..... **Kingdom Protista**
6. Cells with plastids ..... **Kingdom Protista**
7. Plastids with yellow, brown, or orange pigments more conspicuous than the chlorophyll pigments ..... **Kingdom Protista**
8. Food reserves oils or carbohydrates other than starch; two flagella both located at one end of the cell ..... **Phylum Chromophyta (in part)**
9. A haptonema (third flagellum) usually present ..... **Phylum Pymnesiophyta**
9. A haptonema absent ..... **Phylum Cryptophyta**
10. The unequal flagella bearing stiff lateral hairs ..... **Phylum Cryptophyta**
10. Flagella not as above ..... **Phylum Chromophyta (in part)**
8. Food reserve starch; cells with a flagellum at one end and another at right angles to it in a central groove ..... **Phylum Dinophyta**
7. Plastids with chlorophyll pigments more conspicuous than other pigments ..... **Phylum Dinophyta**
11. Cells flexible; carbohydrate food reserve paramylon ..... **Phylum Euglenophyta\***
11. Cells not flexible; carbohydrate food reserve starch ..... **Phylum Chlorophyta (in part)**
6. Plastids absent; vegetative bodies of organisms consisting of filaments with walls containing cellulose, multinucleate masses of protoplasm, or amoeba-like cells ..... **Phylum Oomycota**
12. Cell walls with cellulose; organisms aquatic ..... **Phylum Oomycota**
12. Cell walls without cellulose; organisms not aquatic ..... **Phylum Myxomycota**
13. Vegetative bodies consisting of multinucleate masses of protoplasm (plasmodia) ..... **Phylum Myxomycota**
13. Vegetative bodies amoeba-like ..... **Phylum Dictyosteliomycota**
5. Cell walls containing chitin ..... **Kingdom Fungi**
14. Vegetative bodies consisting primarily of a single cell, often with rhizoids; zoospores produced ..... **Phylum Chytridiomycota**
14. Vegetative bodies consisting primarily of branched filaments; no flagellated cells produced ..... **Kingdom Fungi**
15. Filaments of the vegetative bodies containing numerous nuclei; not partitioned into individual cells ..... **Phylum Zygomycota**
15. Filaments of the vegetative bodies partitioned into individual cells, each with one to several nuclei ..... **Phylum Zygomycota**
16. Sexual reproductive cells produced within sacs ..... **Phylum Ascomycota**
16. Sexual reproductive cells produced externally on club-shaped structures ..... **Phylum Basidiomycota**
4. Organisms multicellular, not filamentous or plasmodial ..... **Kingdom Plantae**
17. Organisms with accessory pigments essentially similar to those of higher plants; carbohydrate food reserve starch ..... **Kingdom Plantae**
18. Organisms with complex bodies differentiated into nodes and internodes ..... **Phylum Charophyta**
18. Organisms with bodies not differentiated into nodes and internodes ..... **Phylum Chlorophyta (in part)**
17. Organisms with some accessory pigments differing from those of higher plants; food reserves carbohydrates other than ordinary starch ..... **Kingdom Plantae**
19. Organisms brownish in color due to presence of brown pigments; carbohydrate food reserve laminarin ..... **Phylum Chromophyta (in part)**
19. Organisms reddish in color due to presence of red pigments; carbohydrate food reserve floridian starch ..... **Phylum Rhodophyta**

4. Only about a third of euglenoid species develop chloroplasts.  
 5. See p. 387 for a discussion of ematons.

**Taxonomy:** study of classification & naming

**How do we determine how to group organisms?**

**Phylogeny:** actual relationships between organisms  
(a.k.a. lines of descent)

**Systematics:** study that generates possible phylogenetic relationships, 2 philosophical approaches to doing this:

a) **Phenetics:** use observable similarities & differences  
(older and out of favor currently)

b) **Cladistics:** use only shared, derived characteristics to infer an evolutionary pathway (currently the dominant approach)

**Some characteristics that are used to figure out the pattern**

1. appearance/form of the organism: includes anatomy, morphology

2. physiology: includes biochemistry linked to structure

3. DNA: genetic information which shapes and controls some of the above

(epigenetics: information that can affect how the DNA is used – this is a relatively new field of study in biology)

## What is evolution?

### Darwin's major idea: evolution by **natural selection**

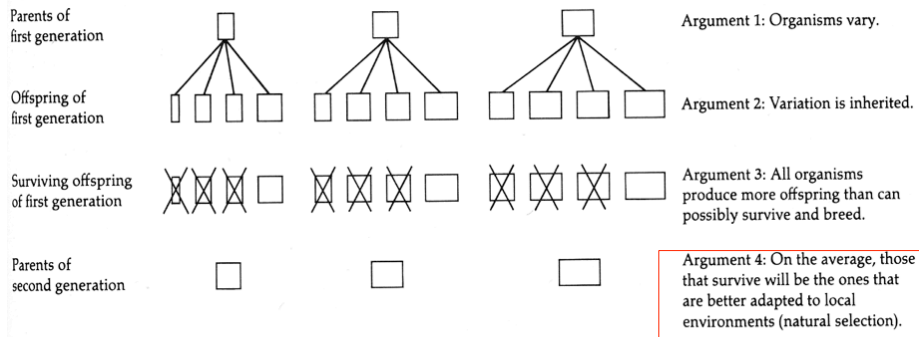


Figure 25-9

Darwinian evolution by natural selection as a four-step argument. It is assumed here that reproduction is asexual and that more elongated rect-

angles are better adapted to their environment. Note how the average form of the population shifts toward more elongated rectangles.

So what is a **species**?  
It gets complicated...

Don't study "The Species Concept" on p292-296

Discovering the Great Tree Of Life  
[http://sustainability.yale.edu/videos/  
discovering-great-tree-life](http://sustainability.yale.edu/videos/discovering-great-tree-life)

Overview of all the modern plant phyla:  
Beyond the (Kew) Gardens: The Plant  
Family Tree  
[https://www.youtube.com/watch?  
v=QT8Q22rVvuE](https://www.youtube.com/watch?v=QT8Q22rVvuE)