Biology of Plants

What is botany?

Botany: The study of plants and 'plant-like' organisms.

Botany without Borders Link 10 min video

http://www.youtube.com/watch?v=2MBmkTJkghQ&eurl=http://www.botany.org/botany-without-borders.php

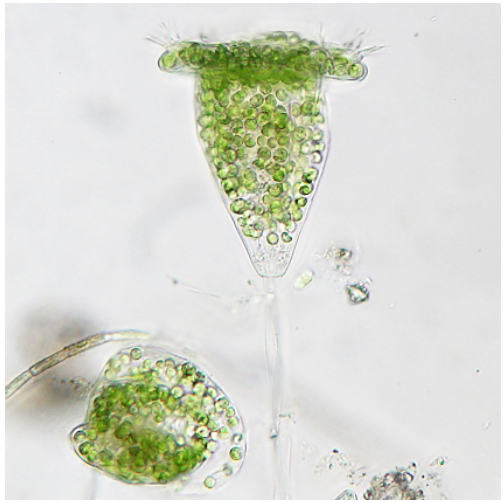
Botanical organisms – what do they have in common?

Do they all conduct photosynthesis?

- All photosynthetic organisms are considered botanical organisms

but,

- not all botanical organisms are photosynthetic.

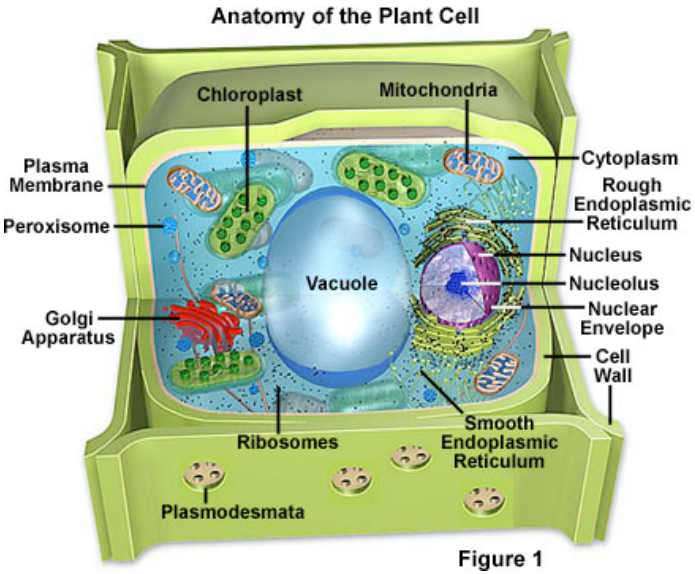


Botanical organisms
Do they all have cell walls?

- All cell-walled eukaryotes are botanical organisms

  but,

- some botanical organisms lack cell walls.

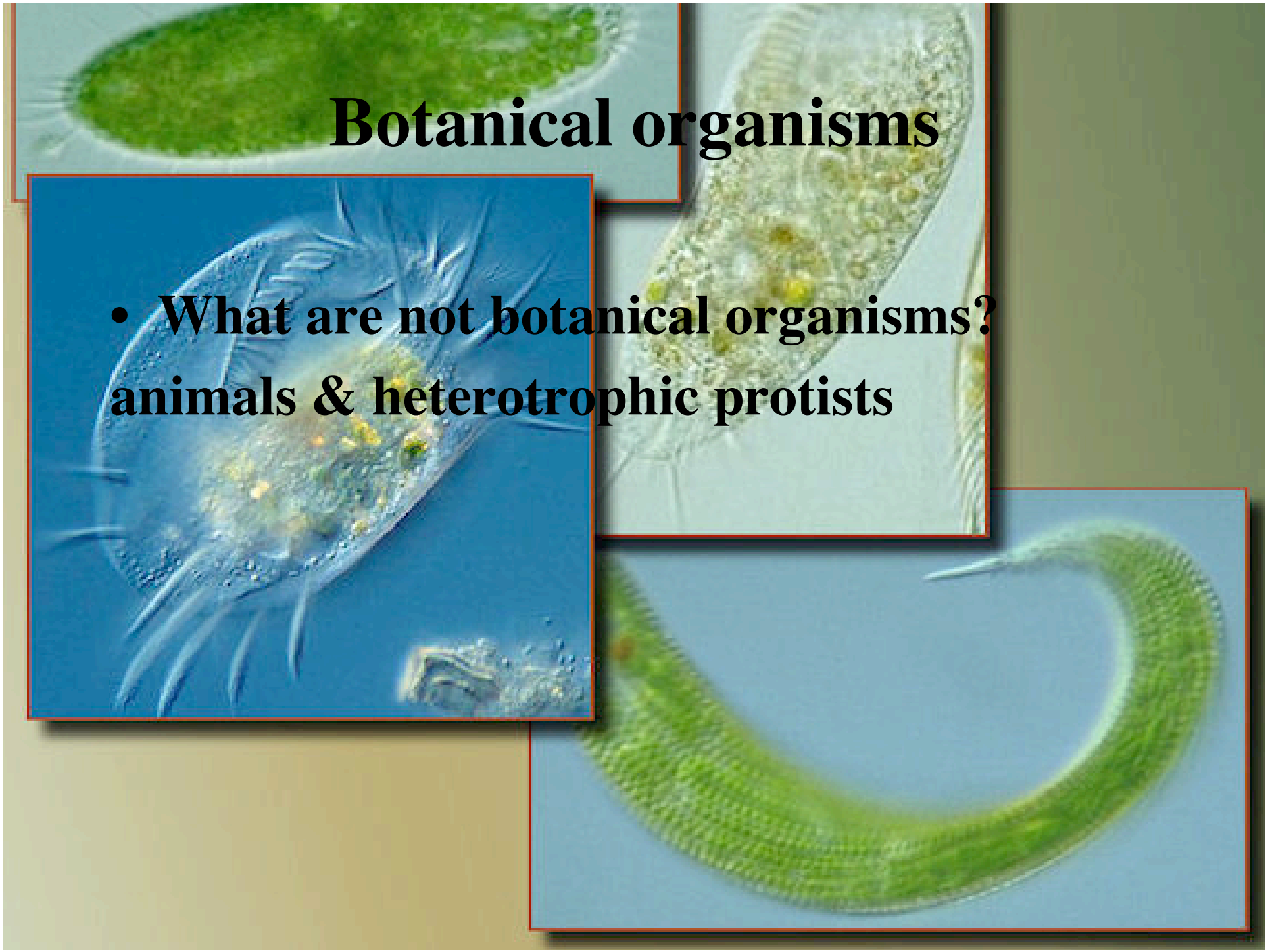


Botanical organisms

- **Do they lack motility?**
- Plants and fungi are non-motile
- but,

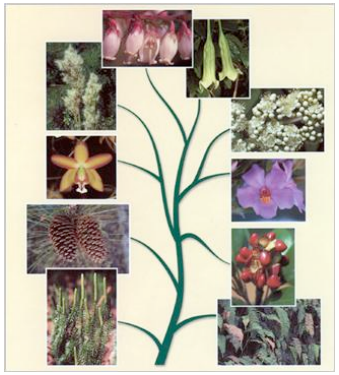
cyanobacteria motile as are some algae and

Botanical organisms



- What are not botanical organisms?

animals & heterotrophic protists



Systematics

- Organisms are grouped into broader taxonomic categories arranged in Hiearchy – Kingdom was the most inclusive unit; Now we also have Domains
- Current Hierarchal order of Organisms

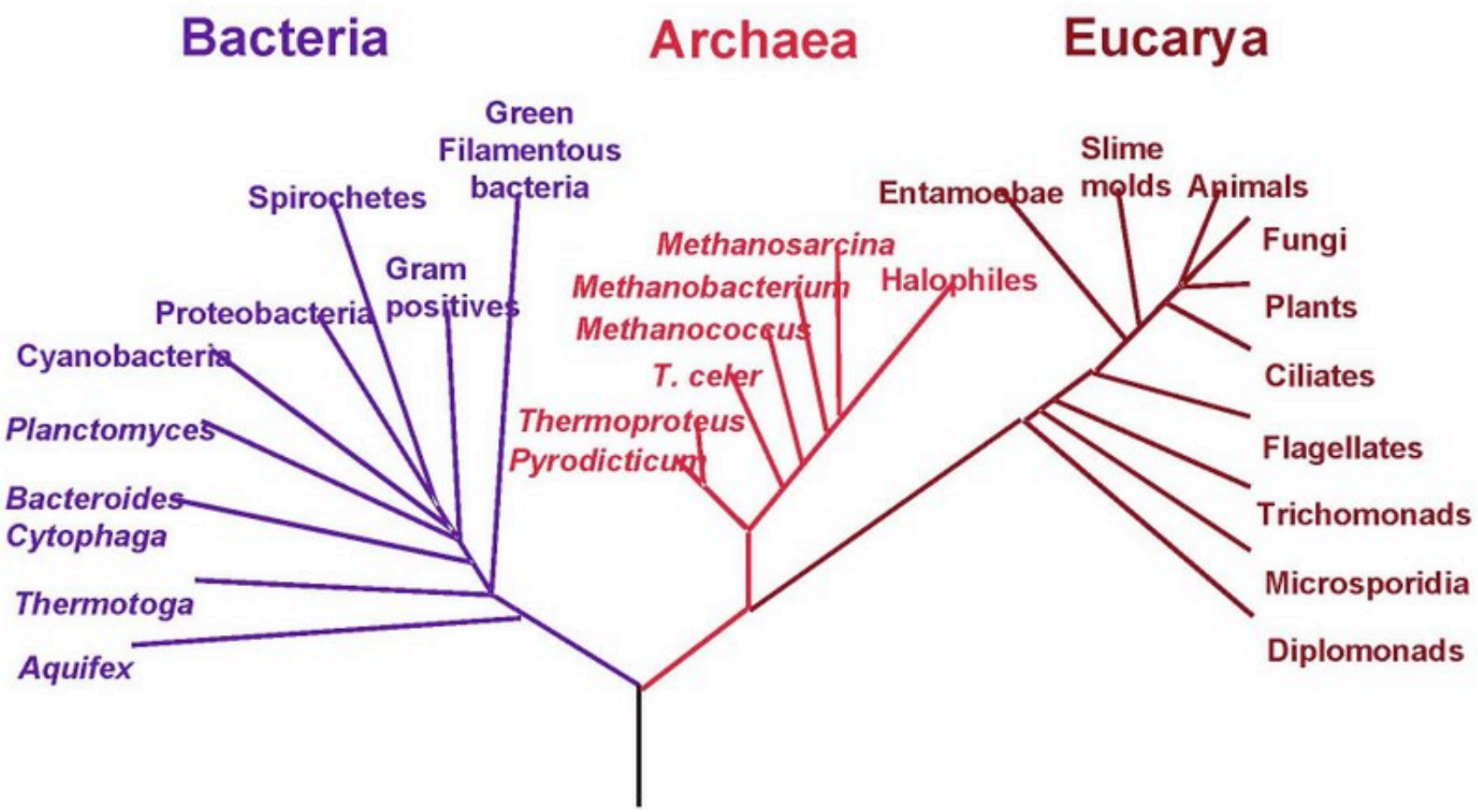
D K P C O F G S

Organisms are grouped into broader Taxonomic Categories

- Five Kingdoms
  - Monera- bacteria (prokaryotes)

  The other four are Eukaryotes
  - Protista
  - Animal
  - Fungi
  - Plant

Phylogenetic Tree of Life



Phylogenetic trees
The History of Creation
German Naturalist Ernst Haeckel 1866

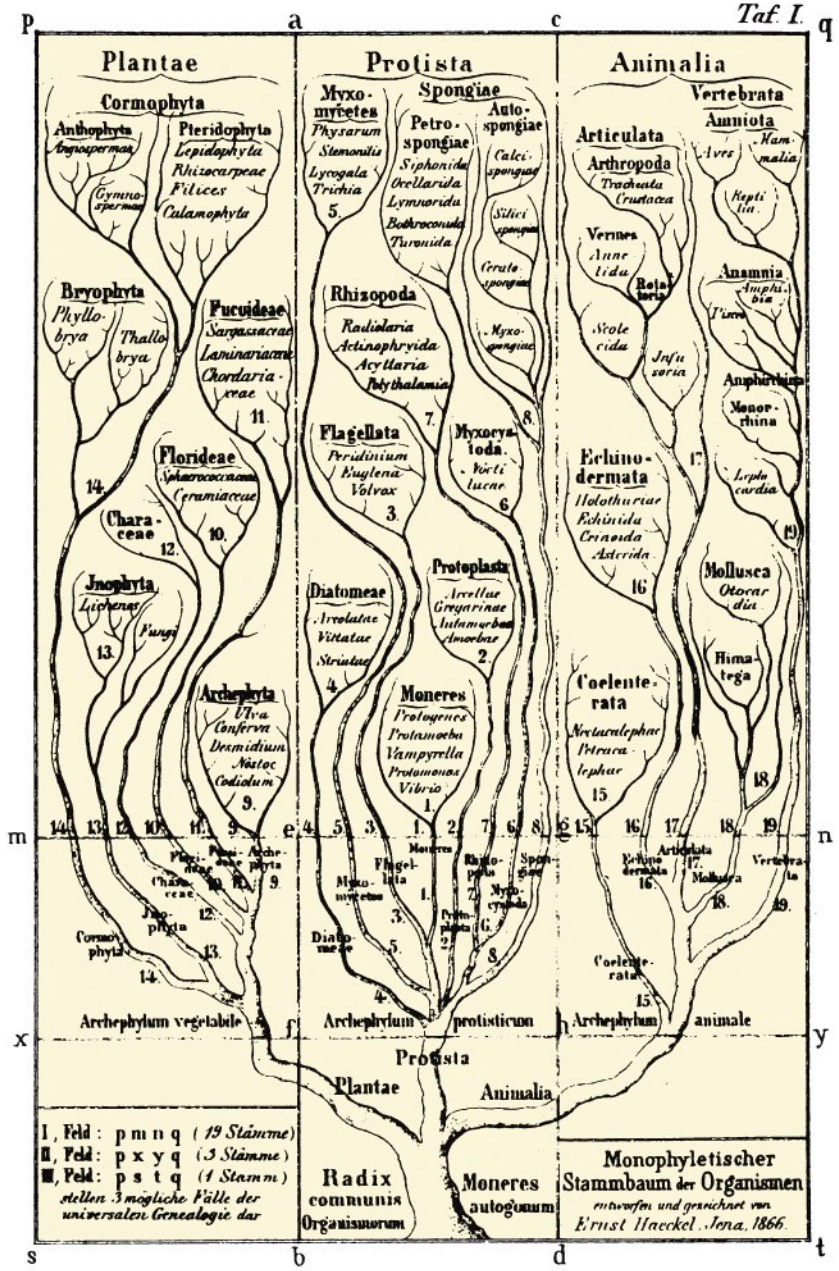


Figure 12-4
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Artificial Taxa

- Relationhips are unknown or uncertain
- Widely accepted taxa containing members descended from more than one ancestral line- Polyphyletic

Phylogenetic trees

- Depict the genealogical relationship b/w taxa
- Tested with fossil records and structural and molecular studies
- Ideally every taxa is monophyletic- the members of the taxon at whatever category should all be descendents of a single common ancestral species
- Natural Taxa

Traditional Method
Based on outward similarities

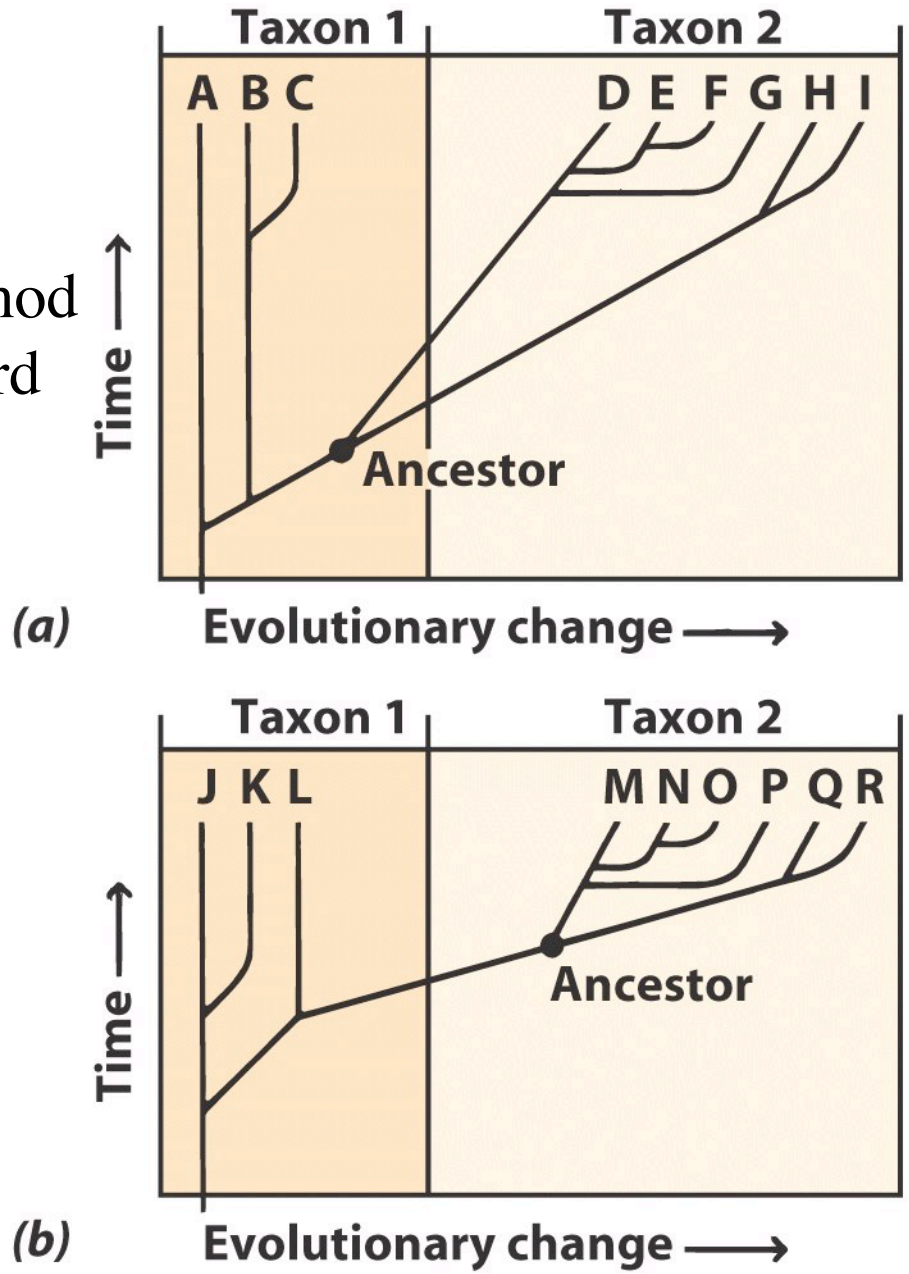

Figure 12-5
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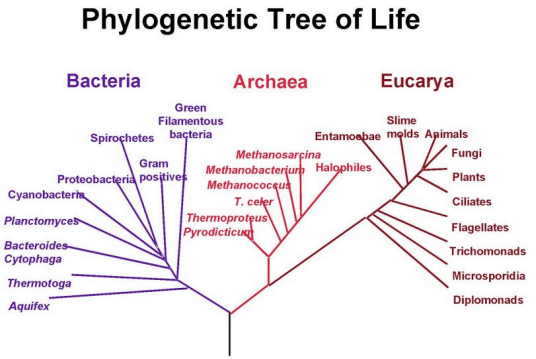
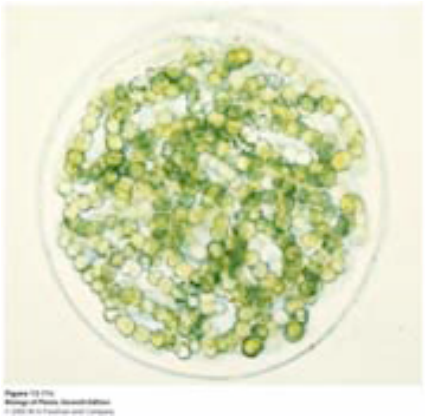
Forms of blue-green algae



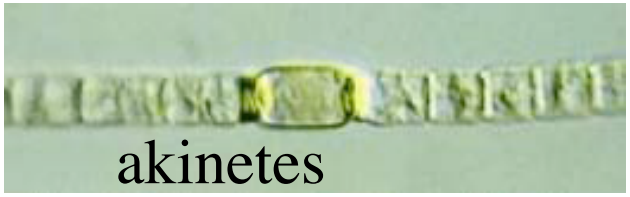
extant species occur as single cells (unicellular) and colonial forms



Colonial forms of blue green algae

- • each cell is independent
- • specialization largely restricted to two
- cell types = heterocysts and akinetes
- • no ‘true’ multicellular forms

heterocysts


akinetes

Chapter 12

Systematics: The Science of Biological Diversity

Evolution

- Charles Darwin
- Over 30 million different kinds of species

From simple organisms to more complex

Nomenclature

- Common names
  Scientific barrier

- Scientific name- a two word latin name that identifies it precisely (identity card)
- Today rules and rationale
- Characteristics used for classifying
- Overview of major groups
- Hypothetical mechanism of eukaryotic evolution

What is the binomial system of nomenclature?

Prunus persica

Systematics

- The scientific study of biological diversity

& its evolutionary History

Goal-

- Genera grouped into Families (- aceae)
- Families into Orders (-ales)
- Orders into Classes
- Classes into Phylum
  - (Plants) groups of classes into Divisions now known as Phylum
- Phylum into Kingdoms

- The higher the category, the more inclusive it is
- Members of a kingdom share general characters; members of a species share quite specific characters

- Category- the level at which it is ranked
- i.e. genus and species are categories
- Taxon- taxonomic group at any level
- i.e. *Prunus* and *Prunus persica* are taxa within those categories

TABLE 12–1 **Biological Classification. Notice how much you can tell about an organism when you know its place in the system. The descriptions here do not define the various categories but tell you something about their characteristics. The kingdoms Plantae and Fungi belong to the domain Eukarya.**

Category	Taxon	Description
Maize		
Kingdom	Plantae	Organisms that are primarily terrestrial, with chlorophylls *a* and *b* contained in chloroplasts, spores enclosed in sporopollenin (a tough wall substance), and nutritionally dependent multicellular embryos.
Phylum (Division)	Anthophyta	Vascular plants with seeds and flowers; ovules enclosed in an ovary, pollination indirect; the angiosperms.
Class	Monocotyledones	Embryo with one cotyledon; flower parts usually in threes; many scattered vascular bundles in the stem; the monocots.
Order	Commelinales	Monocots with fibrous leaves; reduction and fusion in flower parts.
Family	Poaceae	Hollow-stemmed monocots with reduced greenish flowers; fruit a specialized achene (caryopsis); the grasses.
Genus	*Zea*	Robust grasses with separate staminate and carpellate flower clusters; caryopsis fleshy.
Species	*Zea mays*	Maize, or corn.

Table 12-1 part 1
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TABLE 12–1 **Biological Classification. Notice how much you can tell about an organism when you know its place in the system. The descriptions here do not define the various categories but tell you something about their characteristics. The kingdoms Plantae and Fungi belong to the domain Eukarya.**

Category	Taxon	Description
Edible Mushroom		
Kingdom	Fungi	Nonmotile, multinucleate, heterotrophic, absorptive organisms in which chitin predominates in the cell walls.
Phylum	Basidiomycota	Dikaryotic fungi that form a basidium bearing four spores (basidiospores); the Basidiomycetes, Teliomycetes, and Ustomycetes.
Class	Basidiomycetes	Fungi that produce basidiomata, or "fruiting bodies," and club-shaped, aseptate basidia that line gills or pores; the hymenomycetes.
Order	Agaricales	Fleshy fungi with radiating gills or pores.
Family	Agaricaceae	Agaricales with gills.
Genus	*Agaricus*	Dark-spored soft fungi with a central stalk and gills free from the stalk.
Species	*Agaricus bisporus*	The common edible mushroom.

Table 12-1 part 2
Biology of Plants, Seventh Edition

Taxonomy

- The identifying, naming and classifying of species
- 18th century Swedish Naturalist Carl Linnaeus
- Polynomial- descriptive phrases
- Nepeta floribus interrupte spicatus pedunculatis

- Binomial- two term system a single word combined with the genus
- *Nepeta cataria (cat associated)*
- *International code of Botanical Nomenclature*

Carl Linnaeus
18th Century
Naturalist

Figure 12-1

The Species Name consist of the Genus name plus the specific Epithet

- Species name- two parts
- First part- genus (generic name)
- Second part- specific epithet

- Catnip- *Nepeta* and *cataria*

- Generic name is used to refer to entire group of species

Species 1
Of violet genus
Viola papilionaceae

Figure 12-2a
Biology of Plants, Seventh Edition

Viola tricolor

Figure 12-2b
Biology of Plants, Seventh Edition

Figure 12-2c
Biology of Plants, Seventh Edition

Viola hortensis over 500 species of violas

Specific epithet

- *Artemisia biennis*- a kind of wormwood tarragon, sage brush

- Lactuca biennis- a species of wild lettuce

- *Oenothera biennis-*
- *O. biennis*
- O. biennis

Type specimen- each species
Housed in a herbarium

<u>Podandrogyne formosa</u>

Figure 12-3
Biology of Plants, Seventh Edition

Subspecies names may consist three parts

- *Prunus persica var. persica* Peach
- *Prunus persica var. nectarina* Nectarine

California plants link

http://calphotos.berkeley.edu//flora/

- Does the similarity of a particular feature reflect inheritance from a common ancestor or does it reflect adaptation to similar environments?

Homologous features

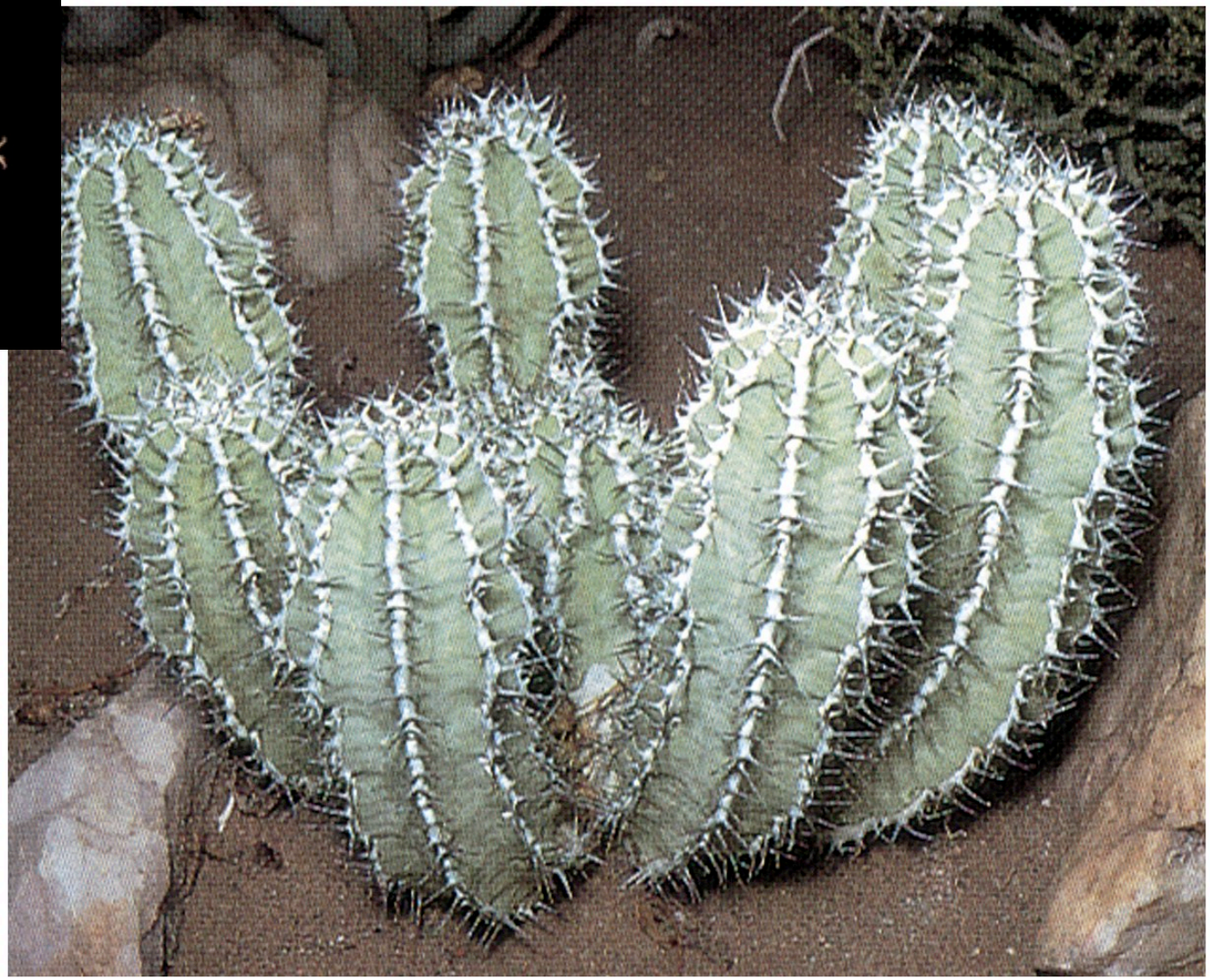
- Have a common origin
- But not necessarily a common function

- Foilage leaves, bud scales floral parts modification of the leaf

Analagous feature

- Have a common function but different evolutionary origin

- Structures area said to be analagous and are the result of convergent evolution- selective forces result in similar structures



Spurge Family
Euphorbiaceae

ESS 12 Figure 1a
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Fleshy, columnar stems, protective spines, reduced leaves

Catus family
Cactaceae

ESS 12 Figure 1b
Biology of Plants, Seventh Edition

Milweed family
Asclepiadaceae

Hoodia

ESS 12 Figure 1c
Biology of Plants, Seventh Edition

The Cladistic method

- Cladistic or phylogenteic analysis- most widely used method
- Approach focuses on branching of one lineage to another in the course of evolution
- Attempts to identify monophyletic groups or clades- defined by a possession of unique feature
- Widespread feature- preexisting or ancestral

- Outgroup- closely related taxa outside the one being analyzed.
- Cladogram- provides a graphical representation of a working model of branching sequences.

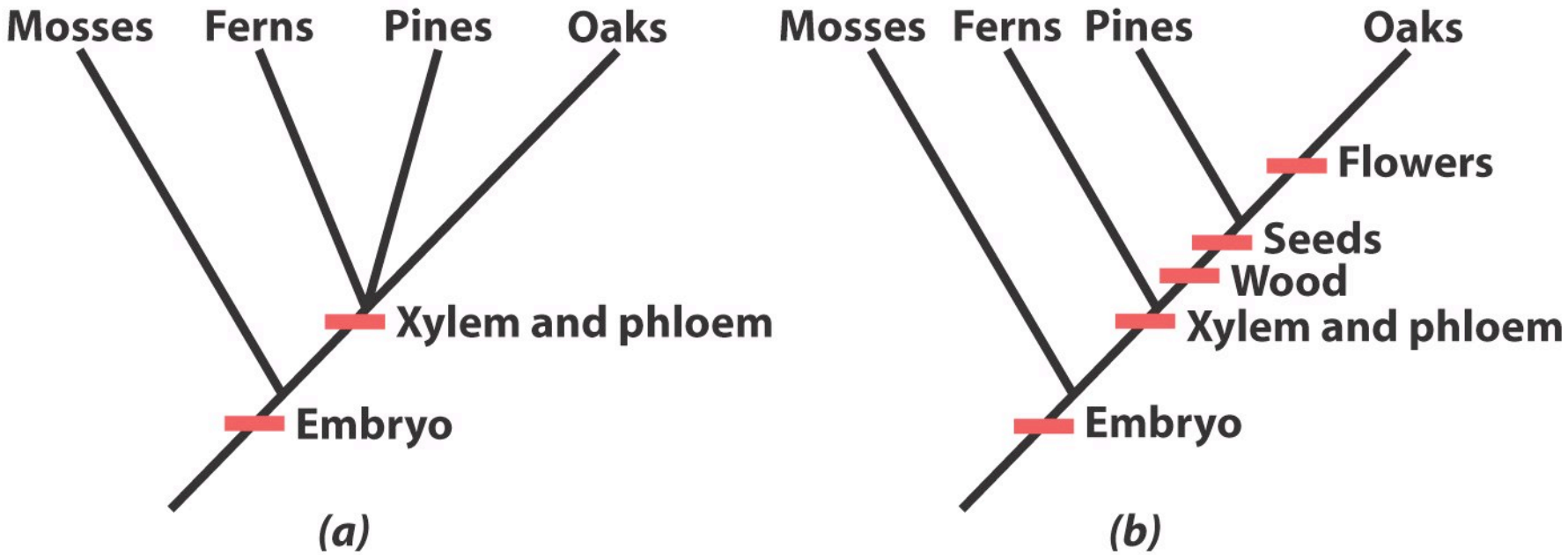

Figure 12-6
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