

Introduction to Botany. Lecture 27

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Outline

- 1 Monday test
- 2 Diversity of plants
 - Systematics
 - Kingdoms and domains
 - Fungi, algae and other protists

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 - Systematics
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Monday test (5 points)

1 Botanical name of strawberry fruit:

Monday test (5 points)

- 2 Which groups of animals will preferably pollinate red, unscented flowers?

Monday test (5 points)

3 Which taxonomic rank is between class and family?

Monday test (5 points)

1 What is hesperidium?

Monday test (5 points)

5 What is perisperm?

Labs 10, 11, 12

- Lab 10 will be today
- Lab 11 is scheduled on **November 22th**
- Lab 12 is scheduled on **December 5th**. This is also the least day to present honors works and other extra stuff.

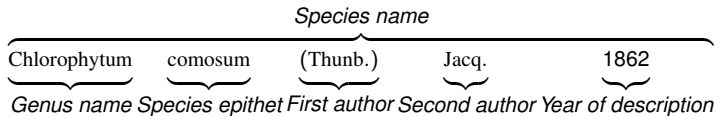
Basics of systematics

Terms covered:

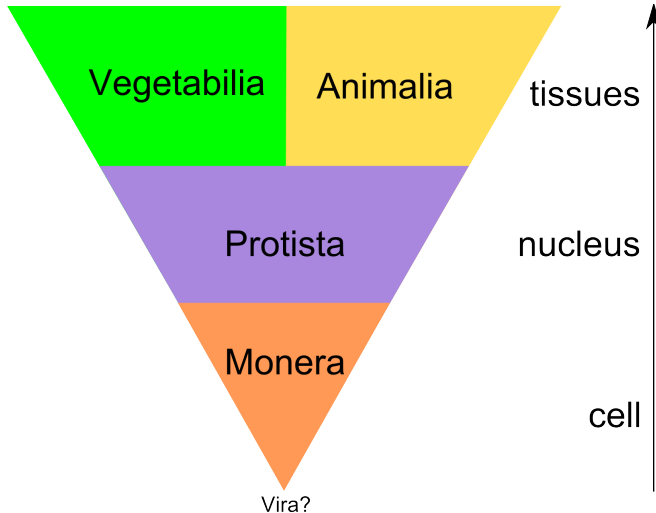
- Systematics and taxonomy
- Species, taxonomic hierarchy
- Taxon, rank, classification
- Kingdom, phylum, class, subclass, order, family, genus
- Binomial name, species epithet, reference
- Biological nomenclature, type specimens, standardized endings, starting dates
- Shortcuts: “sp.”, “spp.”, “s.l.”, “s.str.”, “i.s.”
- **Subspecies and cultivars**

Examples

		Example 1	Example 2
Kingdom	Regnum	Vegetabilia	Animalia
Phylum	Phylum	Spermatophyta	Chordata
Class	Classis	Angiospermae (Magnoliopsida)	Mammalia
Order	Ordo	Liliales	Primates
Family	Familia	Asparagaceae	Hominidae
Genus	Genus	<i>Chlorophytum</i>	<i>Homo</i>
Species	Species	<i>Chlorophytum comosum</i> (Thunb.) Jacq. 1862	<i>Homo sapiens</i> L.



Kingdoms



Domains

- Domain concept was proposed by molecular biologists (Carl Woese and others in 1980s)
- Monera have two radically different molecular systems, one is bacterial (Bacteria domain) and other is archaeal (Archaea domain).
- Eukaryotes (Eukarya domain) have third molecular system.

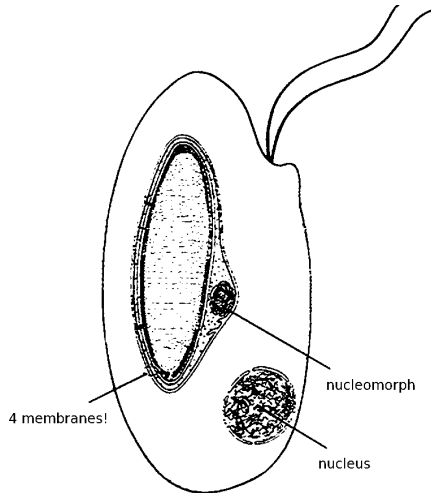
Two most significant lifestyles

- Fungal lifestyle—organisms develop hyphae and mycelium in order to adapt for external nutrition
- Algal lifestyle—in order to perform photosynthesis, organisms include chloroplasts from cyanobacteria or other algae via endosymbiosis

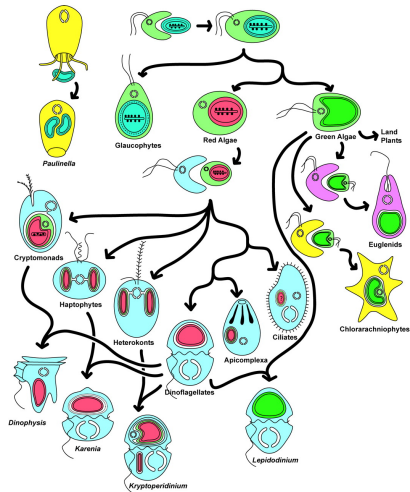
Endosymbiosis

- The concept was re-introduced by Lynn Margulis in 1970s; she followed works of Russian botanists in 1910s–1920s (Konstantin Merezhkovsky, Boris Kozo-Poljansky and others)
- **Primary**—inclusion of cyanobacterial (prokaryotic) cells; results in double-membrane chloroplast. Main groups: red algae (Rhodophyta) and green algae (Chlorophyta).
- **Secondary**—inclusion of other eukaryotic cell with already has chloroplasts from cyanobacteria; results in 3–4-membrane chloroplast and sometimes also nucleomorph (second nucleus!). Main groups: Chromophyta, cryptomonads (Cryptophyceae), euglenoids (Euglenophyceae). Discovered in 1980s (Sarah Gibbs and others).
- **Tertiary**—inclusion of eukaryotic cell which has secondary endosymbiosis. Main group: dinoflagellates (Dinoflagellata).
- Many groups of protists nearly lost their chloroplasts. e.g. Apicomplexa (e.g., *Plasmodium* caused malaria) or Oomycota (e.g., late blight of potato, *Phytophthora*).

Nucleomorph of cryptomonads



Endosymbiosis Pacman game



Subsidiary pigments

- Chromophyta and some other algae have chlorophylls c_1 and c_2
- Chromophyta also have multiple yellow- or brown-colored pigments, xanthins
- Red algae and some others (and most of cyanobacteria) have blue- or violet-colored phycobilins usually producing deep red color.

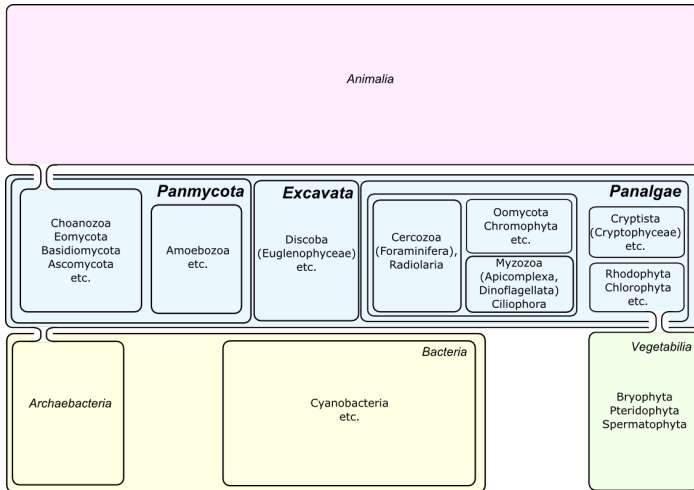
Life forms of protists

- Ameboid: lobose or filose/reticulose (fungal lifestyle is close)
- Flagellate, colonial flagellate and multiple flagellate
- Coccoid and palmelloid
- Filamentous
- Thalloid
- Siphonous
- Intracellular parasitic

Three super-super-groups (subkingdoms) of protists

- Panmycota includes different lobose amoebae and most of slime molds (Amoebozoa), “true” fungi (Eomycota, Basidiomycota and Ascomycota), and choanoflagellates (Choanozoa, which are sister group to animals). They are very rarely photosynthetic (green slugs, green corals and green fungus *Geosiphon*).
- Excavata includes different parasitic flagellates (e.g., lamblia (*Giardia*)) and photosynthetic (“algal”) euglenoids (like *Euglena*)
- Panalgae includes all others, not only photosynthetic like green algae (Chlorophyta, which are sister to plants), but also Oomycota “fungi”, ciliates (Ciliophora), radiolarians (Radiolaria) and Foraminifera “protozoans”

Subkingdoms, some phyla and classes



Green fungus *Geosiphon*



Parasitic *Giardia* from Excavata



Summary

- Excavata, Panmycota and Panalgae are three main subdivisions of protists
- “True” fungi are protist lineage with fungal lifestyle adapted to the terrestrial life
- Algae chloroplasts are products of primary, secondary or even tertiary endosymbiosis

For Further Reading



Th. L. Rost, M. G. Barbour, C. R. Stocking, T. M. Murphy.
Plant Biology. 2nd edition.
Thomson Brooks/Cole, 2006.
Chapter 21.1, 21.6, 21.8.