

# Introduction to Botany. Lecture 30

Alexey Shipunov

Minot State University

November 14, 2011

# Outline

- 1 Questions and answers
- 2 Diversity of plants
  - Systematics
  - Kingdoms and domains
  - Fungi, algae and other protists

# Outline

- 1 Questions and answers
- 2 Diversity of plants
  - Systematics
  - Kingdoms and domains
  - Fungi, algae and other protists

## Previous final question: the answer

Phylum, ..., order?

## Previous final question: the answer

Phylum, ..., order?

- Class
- Subclass, infraclass, cohort, superorder are additional ranks sometimes used here

# Diversity of plants

## Systematics

# Biological nomenclature

## Terms covered:

- Binomial name, species epithet, reference
- Priority, starting dates, synonyms
- Type names, type specimens, standardized endings
- Shortcuts: “sp.”, “spp.”, “s. l.”, “s. str.”, “i. s.”

		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.

Chlorophytum	comosum	(Thunb.)	Jacq.	1862
<i>Genus name Species epithet First author Second author Year of description</i>				



# Oleasters and buffaloberry



## Elaeagnaceae Juss. (oleaster family)



*Elaeagnus* L. (oleasters)



*Elaeagnus angustifolia* L. (Russian olive)



*Elaeagnus commutata* Bernh. (silverberry)



*Shepherdia* Nutt. (buffaloberries)

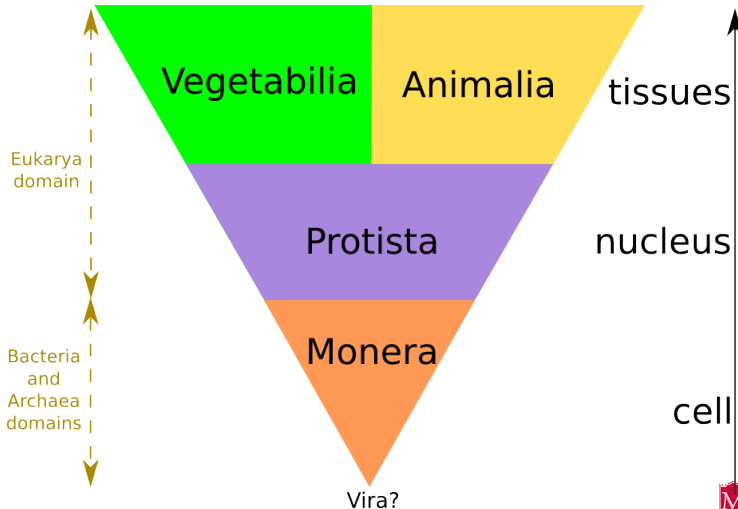


*Shepherdia argentea* (Pursh) Nutt. (buffaloberry)

# Diversity of plants

## Kingdoms and domains

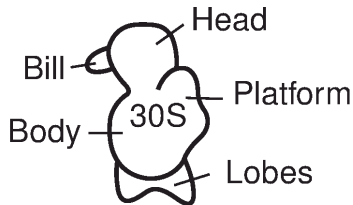
# Kingdoms and domains



# Domains

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

# Structure of ribosomes



*Bacteria*



*Archaea*



*Eukarya*

# Diversity of plants

## Fungi, algae and other protists

## Two most significant lifestyles

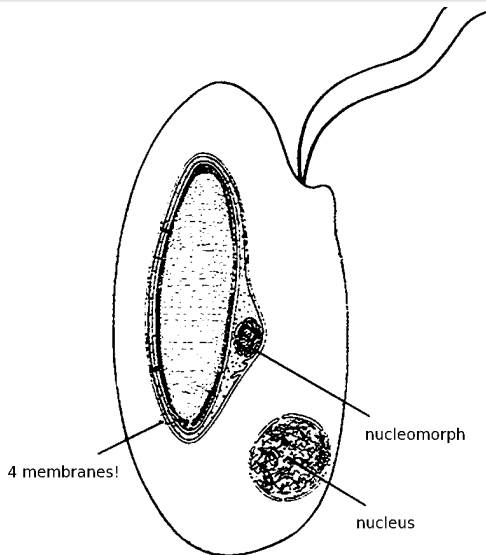
- Fungal lifestyle—organisms develop hyphae and mycelium in order to adapt for external nutrition
- Algal lifestyle—in order to perform photosynthesis, organisms include chloroplasts from cyanobacteria or other algae via endosymbiosis

# Endosymbiosis

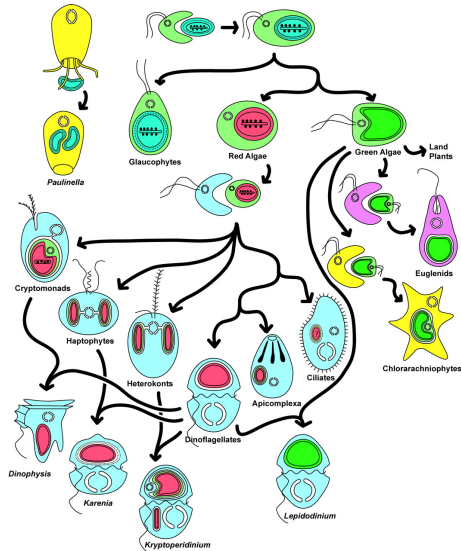
- The concept was re-introduced by Lynn Margulis in 1970s; she followed works of Russian botanists in 1910s–1920s (Konstantin Merezhkovsky, Boris Kozo-Poljansky and others)
- **Primary**—inclusion of cyanobacterial (prokaryotic) cells; results in double-membrane chloroplast. Main groups: red algae (Rhodophyta) 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.

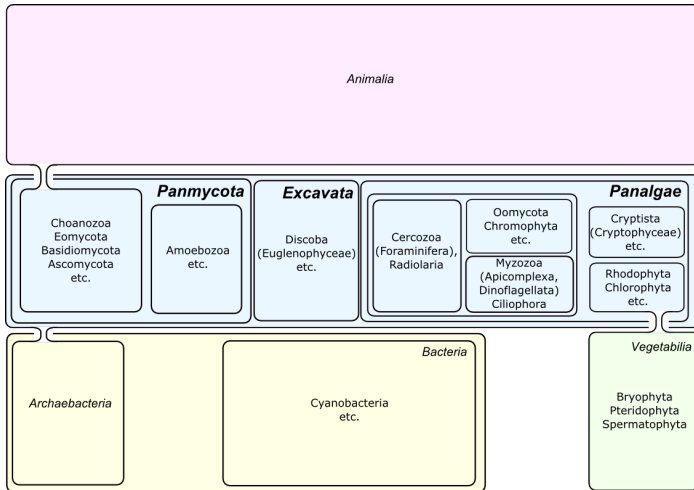
# Life forms of protists

- **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

## Final question (2 points)

## Final question (2 points)

- 1 *Arabidopsis thaliana* (L.) Heynh
- 2 *Citrus*
- 3 Piperaceae

Where is a genus name?

## For Further Reading



J. E. Bidlack, Sh. H. Jansky.  
*Stern's introductory plant biology*. 12th edition.  
McGraw-Hill, 2011.  
*Chapter 17–19.*



Th. L. Rost, M. G. Barbour, C. R. Stocking, T. M. Murphy.  
*Plant Biology*. 2nd edition.  
Thomson Brooks/Cole, 2006.  
*Chapter 19–21.*