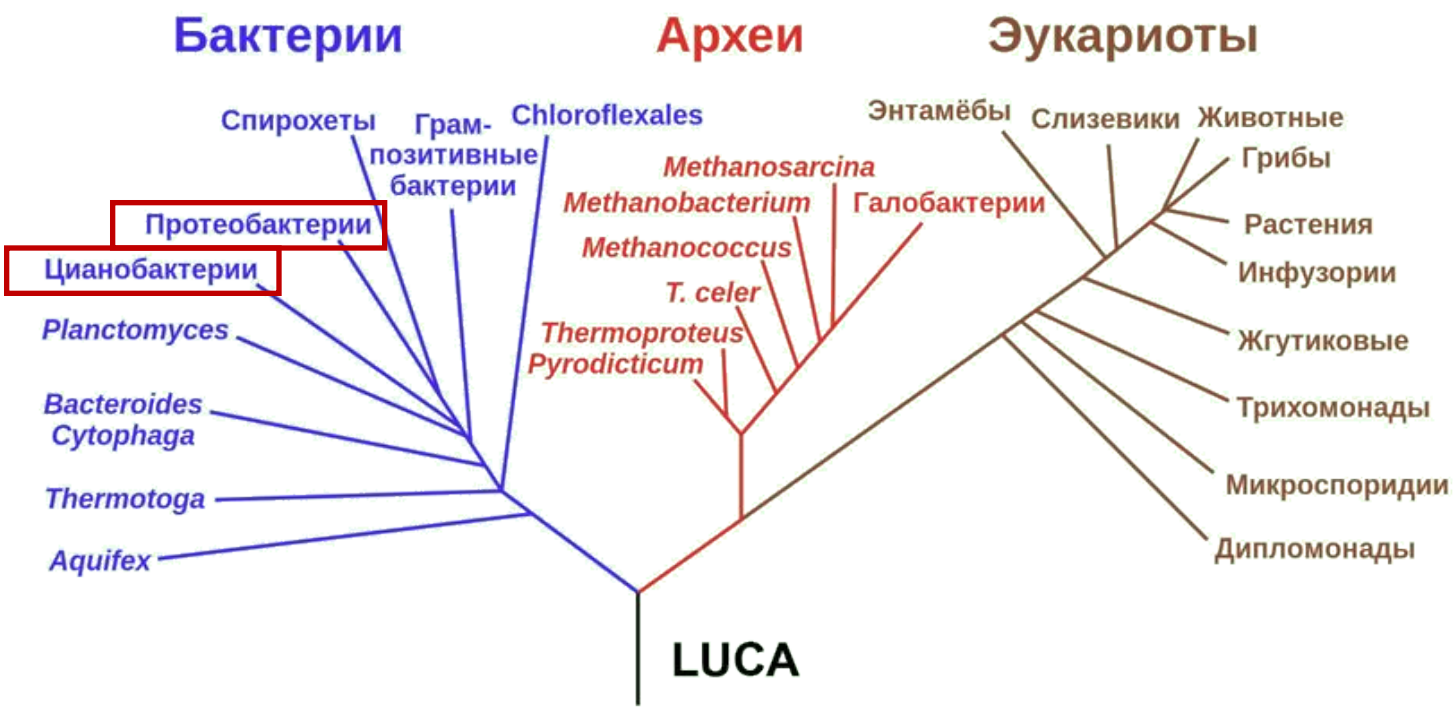
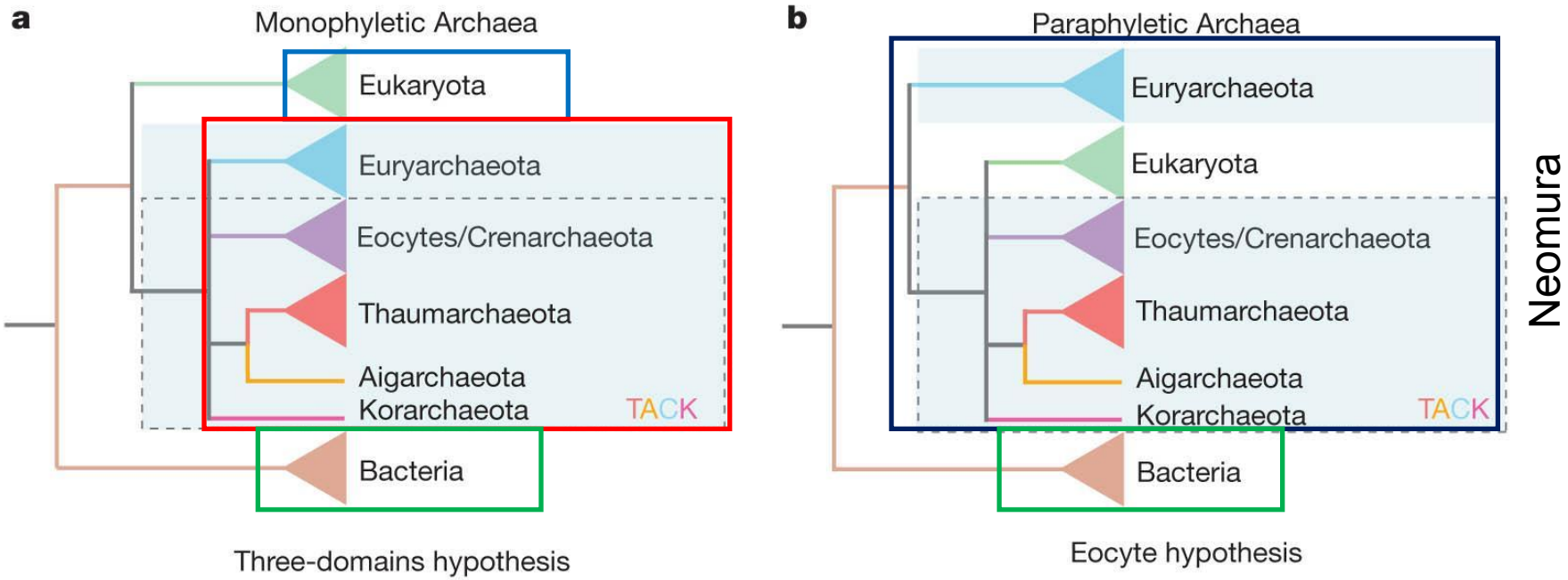
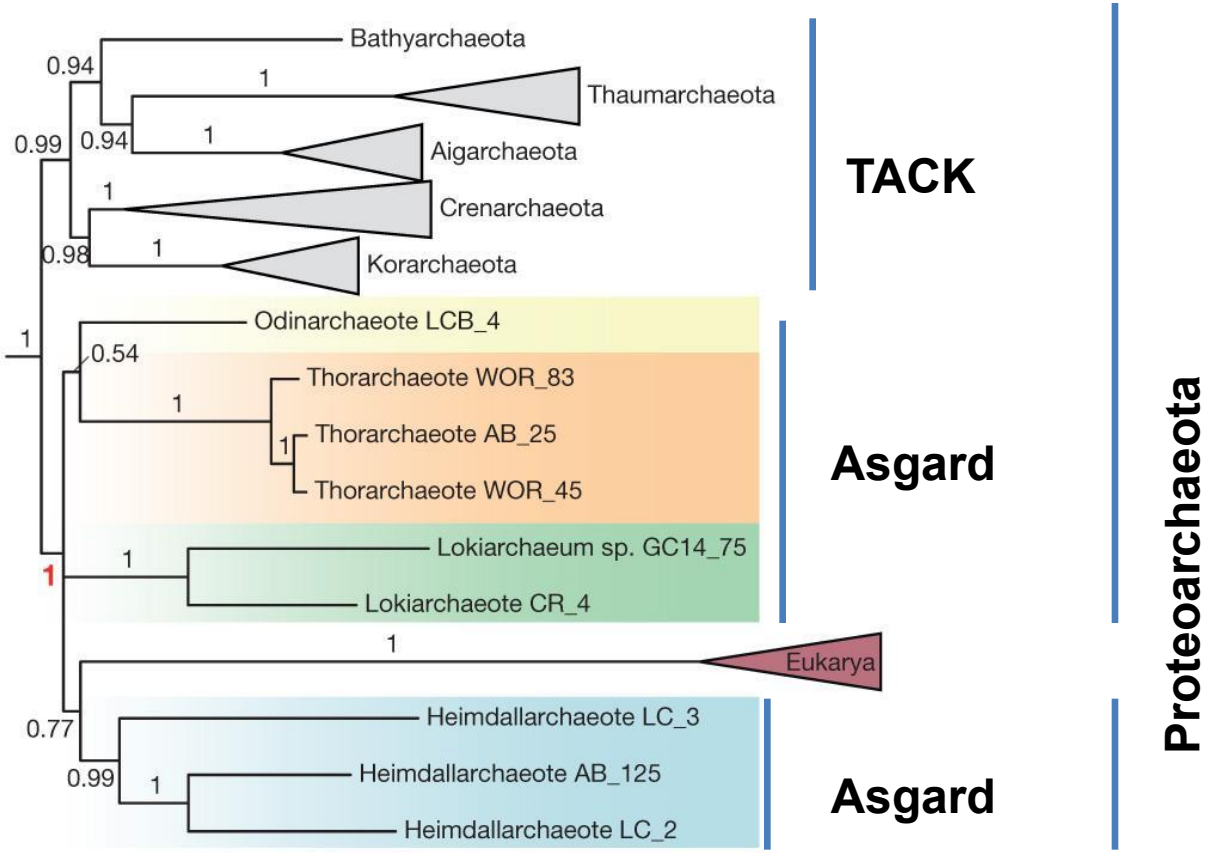

Бактерии
Археи
Эукариоты
Спирохеты
Грам-позитивные бактерии
Chloroflexales
Протеобактерии
Цианобактерии
Planctomyces
Bacteroides
Cytophaga
Thermotoga
Aquifex
Methanosarcina
Methanobacterium
Галобактерии
Methanococcus
T. celer
Thermoproteus
Pyrodicticum
Энтамёбы
Слизевики
Животные
Грибы
Растения
Инфузории
Жгутиковые
Трихомонады
Микроспоридии
Дипломонады
LUCA

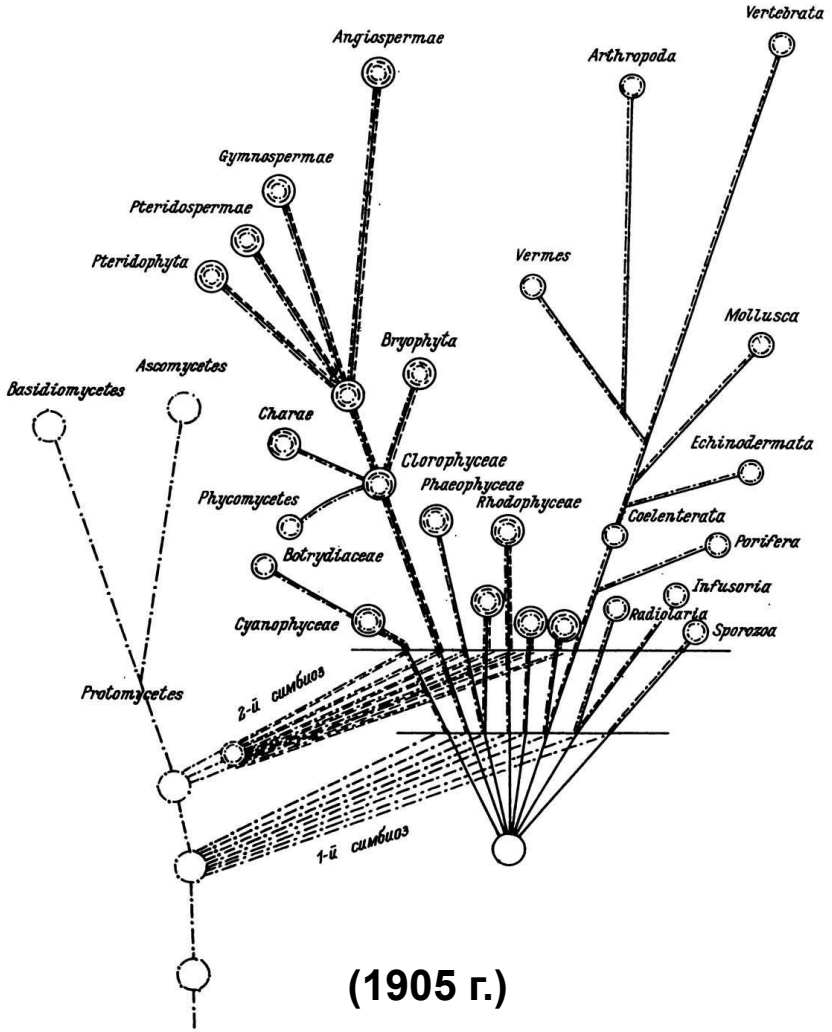

a
Monophyletic Archaea
Eukaryota
Euryarchaeota
Eocytes/Crenarchaeota
Thaumarchaeota
Aigarchaeota
Korarchaeota
TACK
Bacteria
Three-domains hypothesis
b
Paraphyletic Archaea
Euryarchaeota
Eukaryota
Eocytes/Crenarchaeota
Thaumarchaeota
Aigarchaeota
Korarchaeota
TACK
Bacteria
Eocyte hypothesis
Neomura

	Bacteria	**Archaea**	**Eucaryota**
Пептидогликан (муреин)	есть	нет	нет
Гистоны	нет	есть	есть
Инициирующая аминокислота при биосинтезе белков	N-формилметионин	митеонин	митеонин
РНК-полимераза	1 тип	Несколько типов	Несколько типов

Парафилия архей



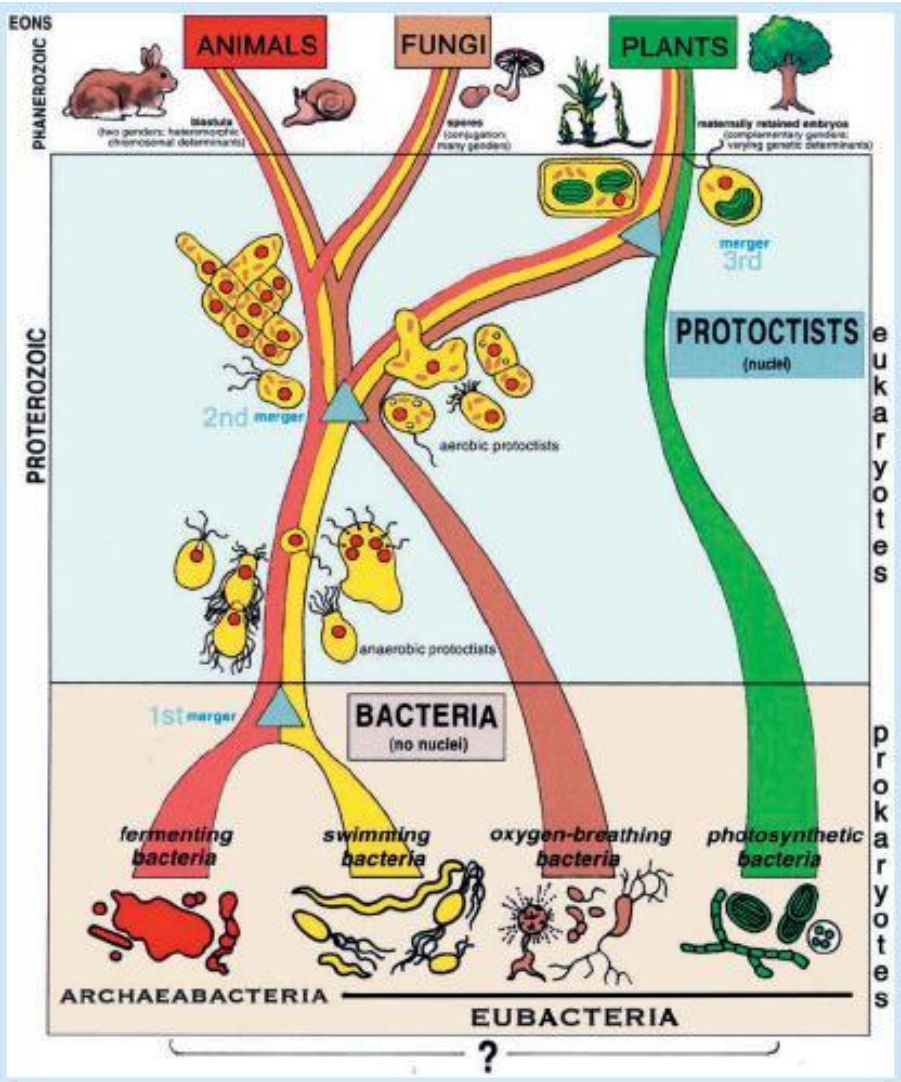
Теория симбиогенеза



(1905 г.)

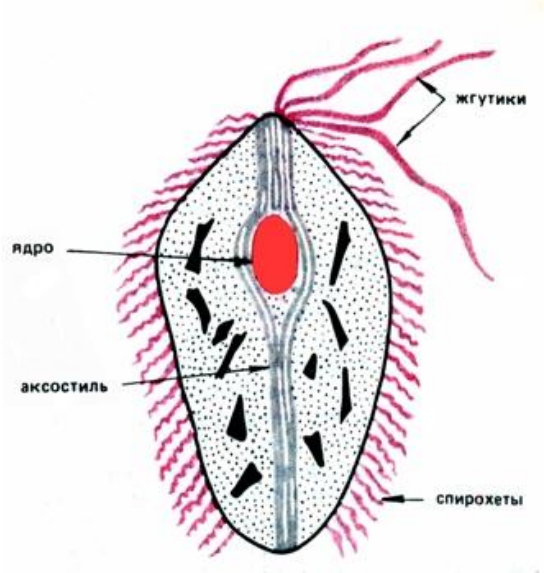
Константин Сергеевич Мережковский

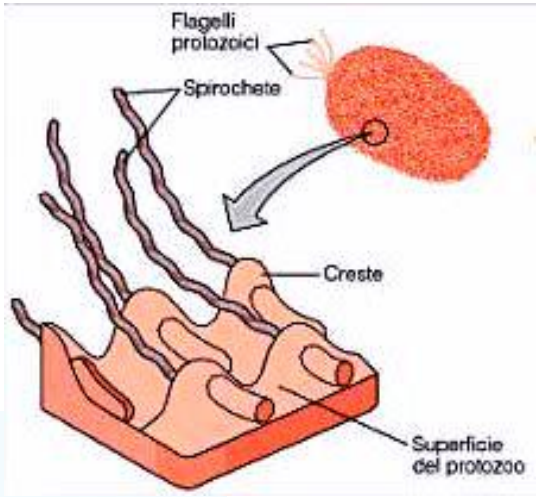
(1855-1921)

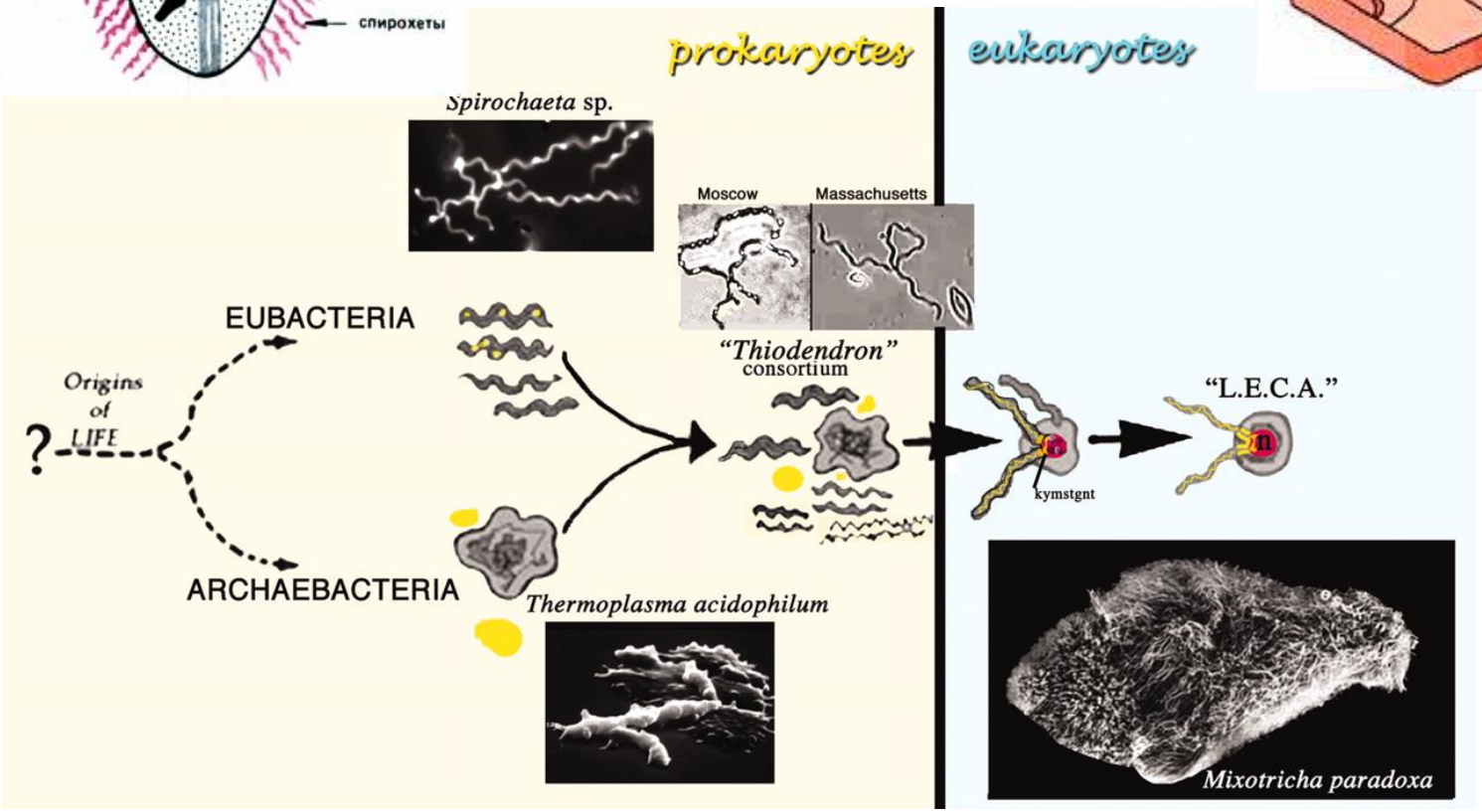


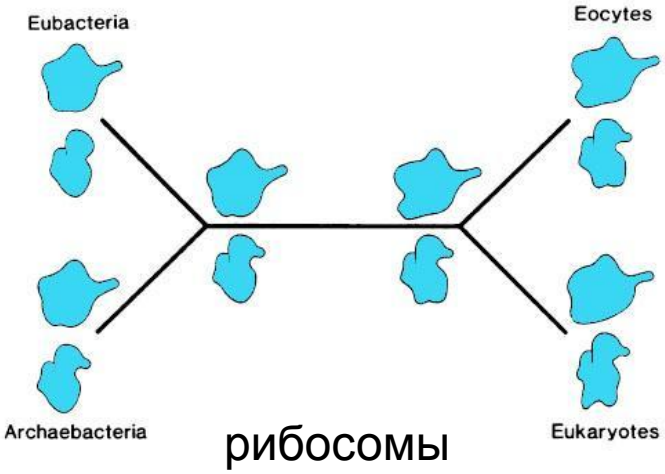
Линн Маргулис (1938-2011)

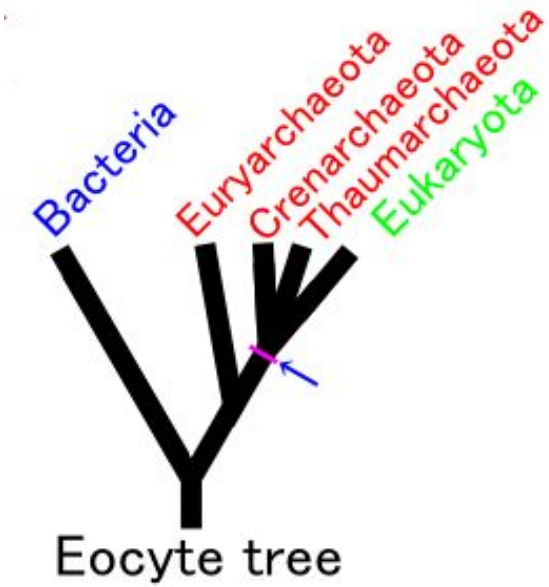
Mixotricha paradoxa



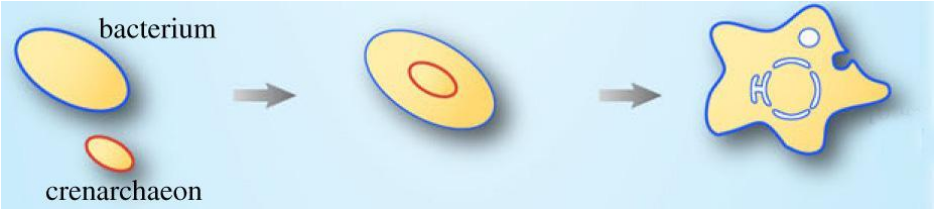






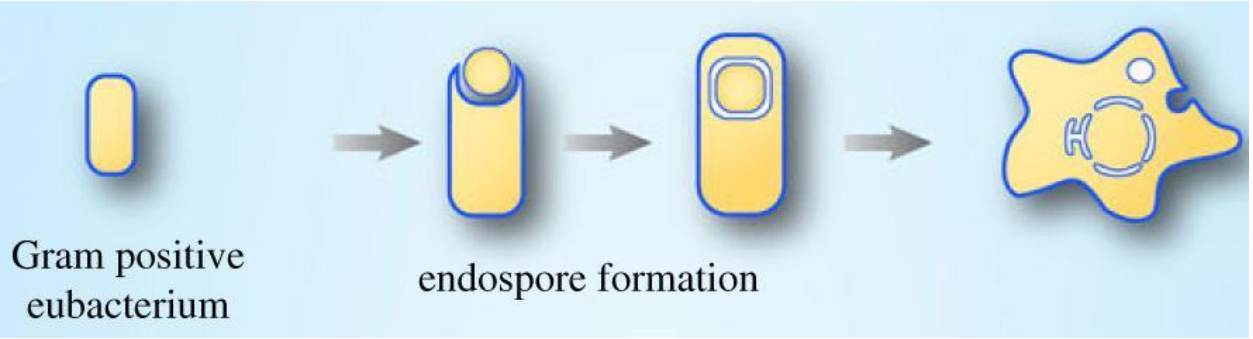


Автогенетическая гипотеза происхождения ядра на основе архейной клетки

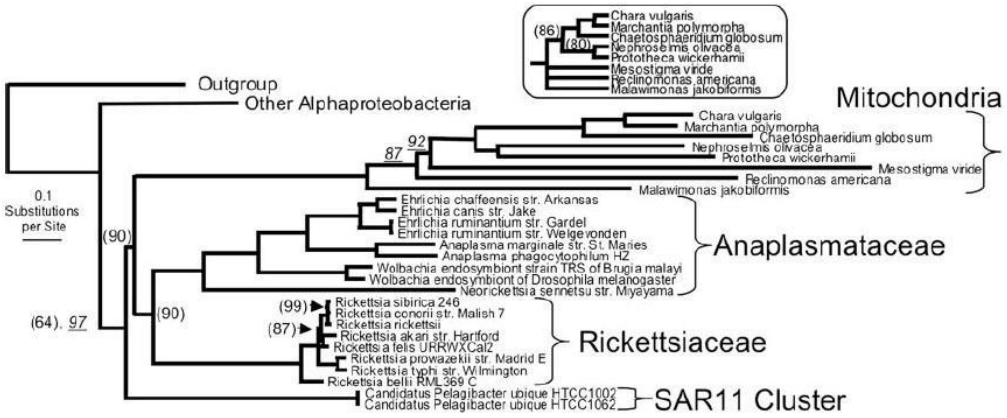


Симбиогенетическая гипотеза происхождения ядра на основе архейной и бактериальной клеток

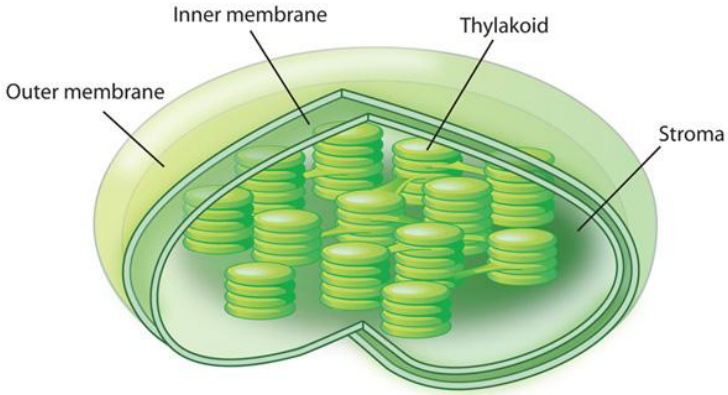
Автогенетические гипотезы происхождения ядра на основе бактериальных клеток

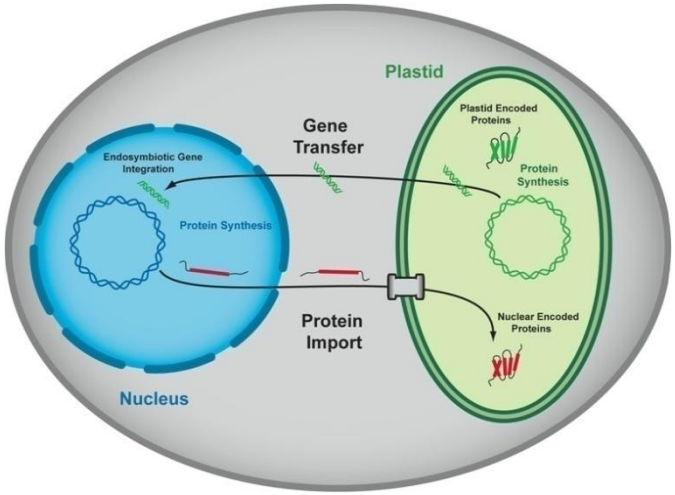


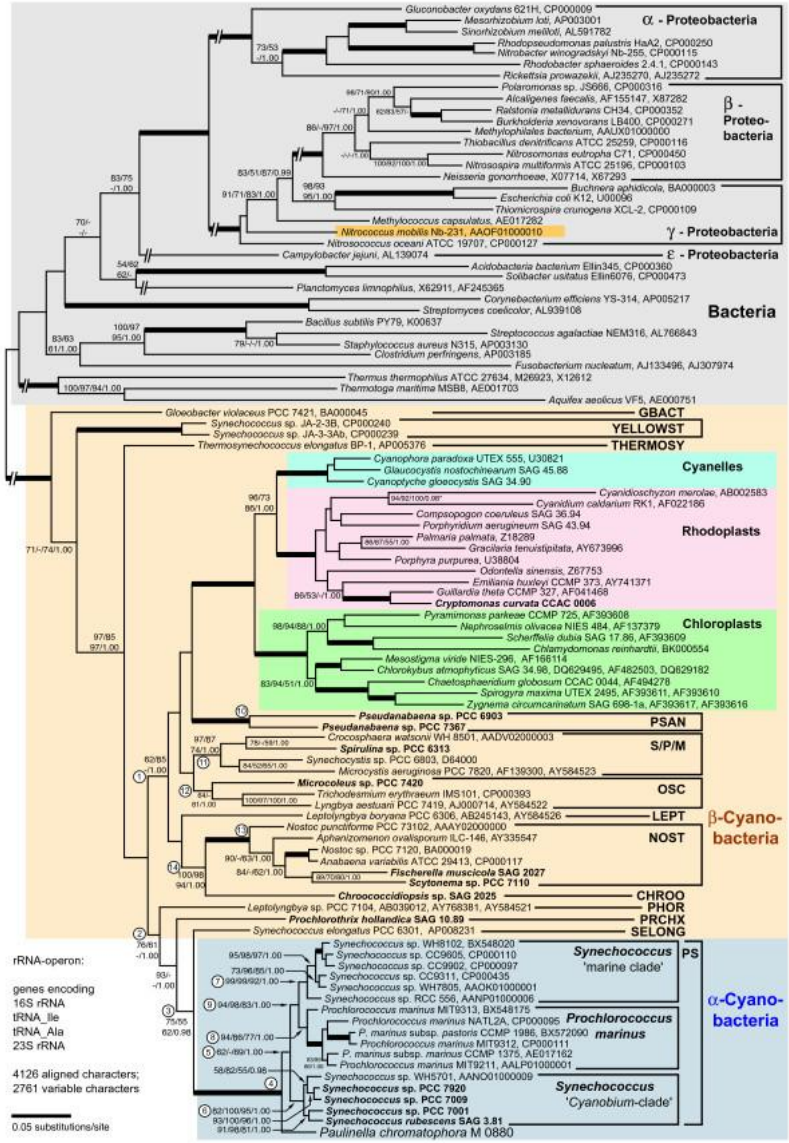
Митохондрии – видоизмененные альфапротеобактерии, близкие к риккетсиям



Пластиды – видоизмененные цианобактерии

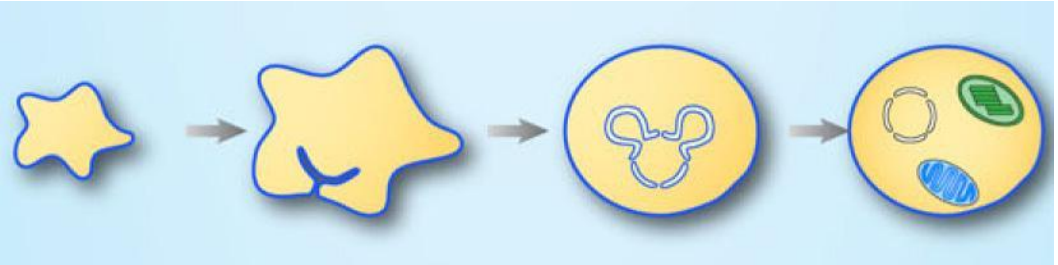




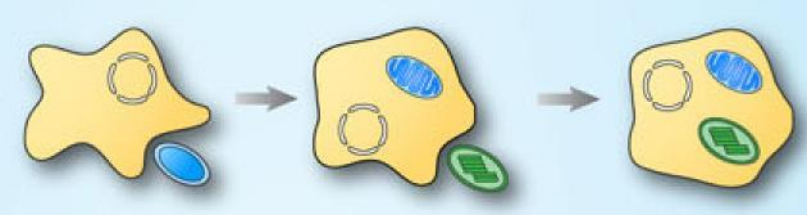


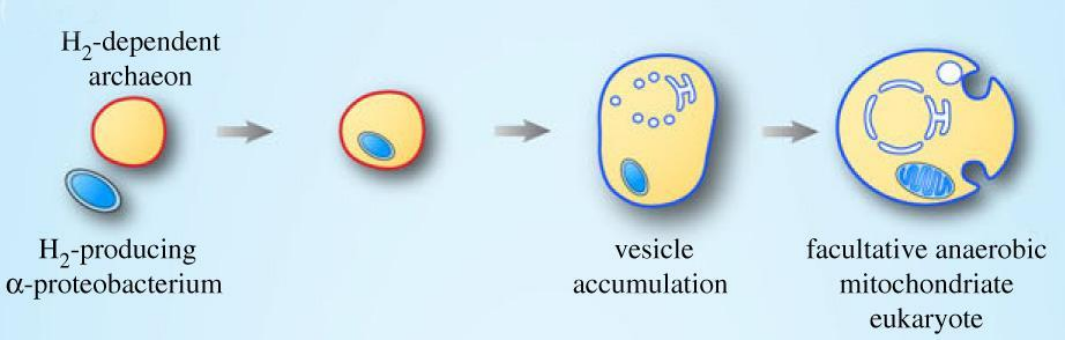
Гипотезы происхождения митохондрий и хлоропластов

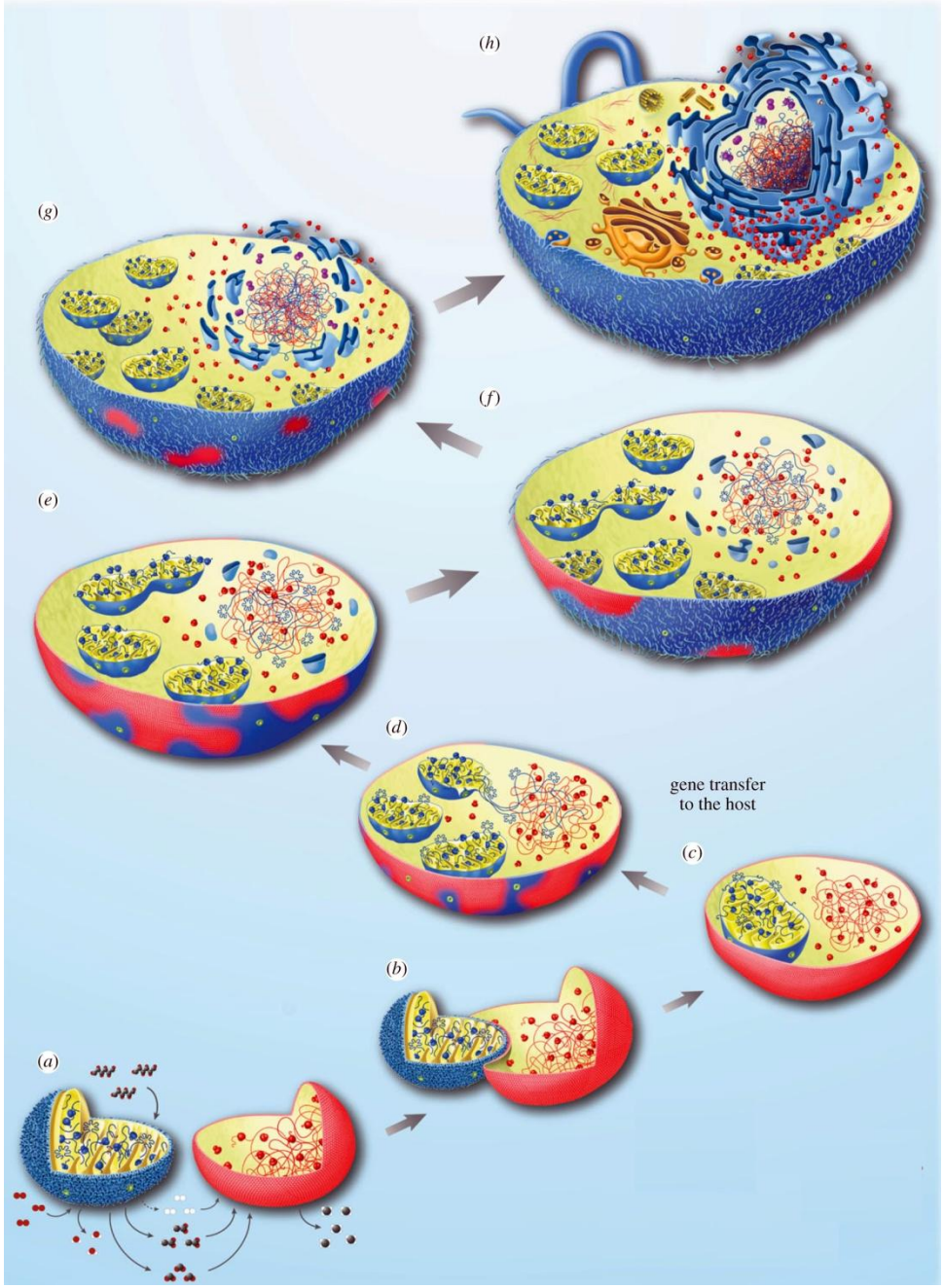
Автогенетическая гипотеза



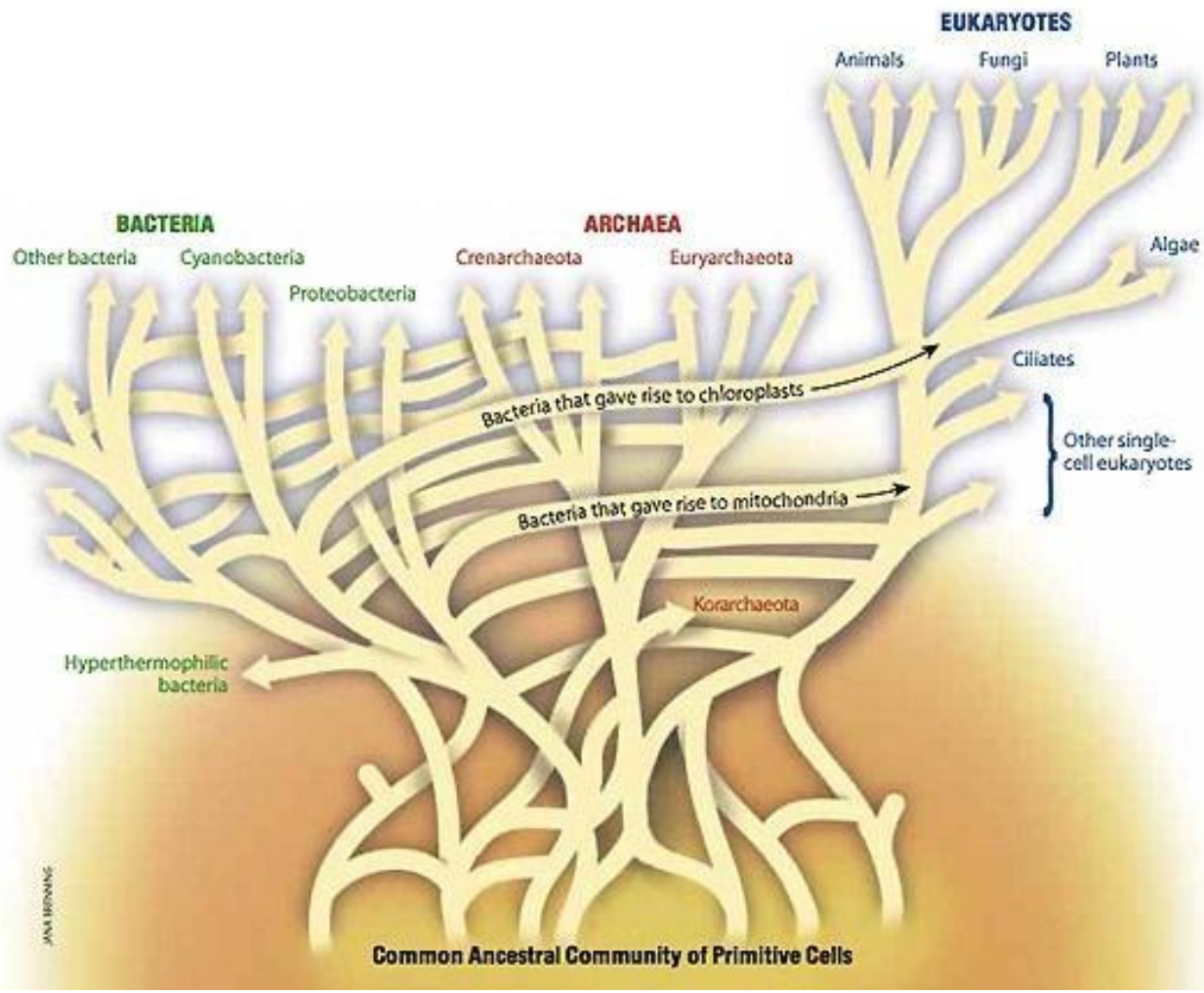
Симбиогенетическая гипотеза



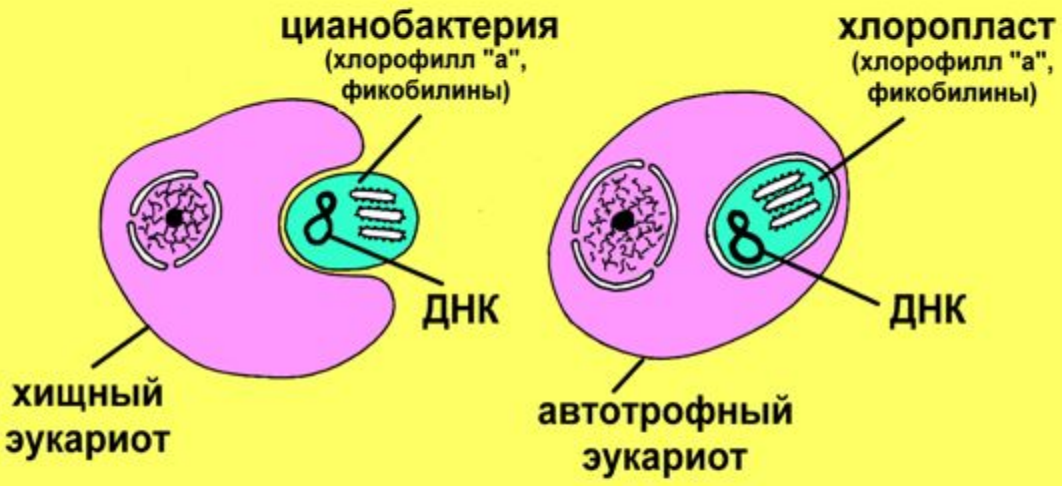



(h)
(g)
(f)
(e)
(d)
gene transfer
to the host
(c)
(b)
(a)

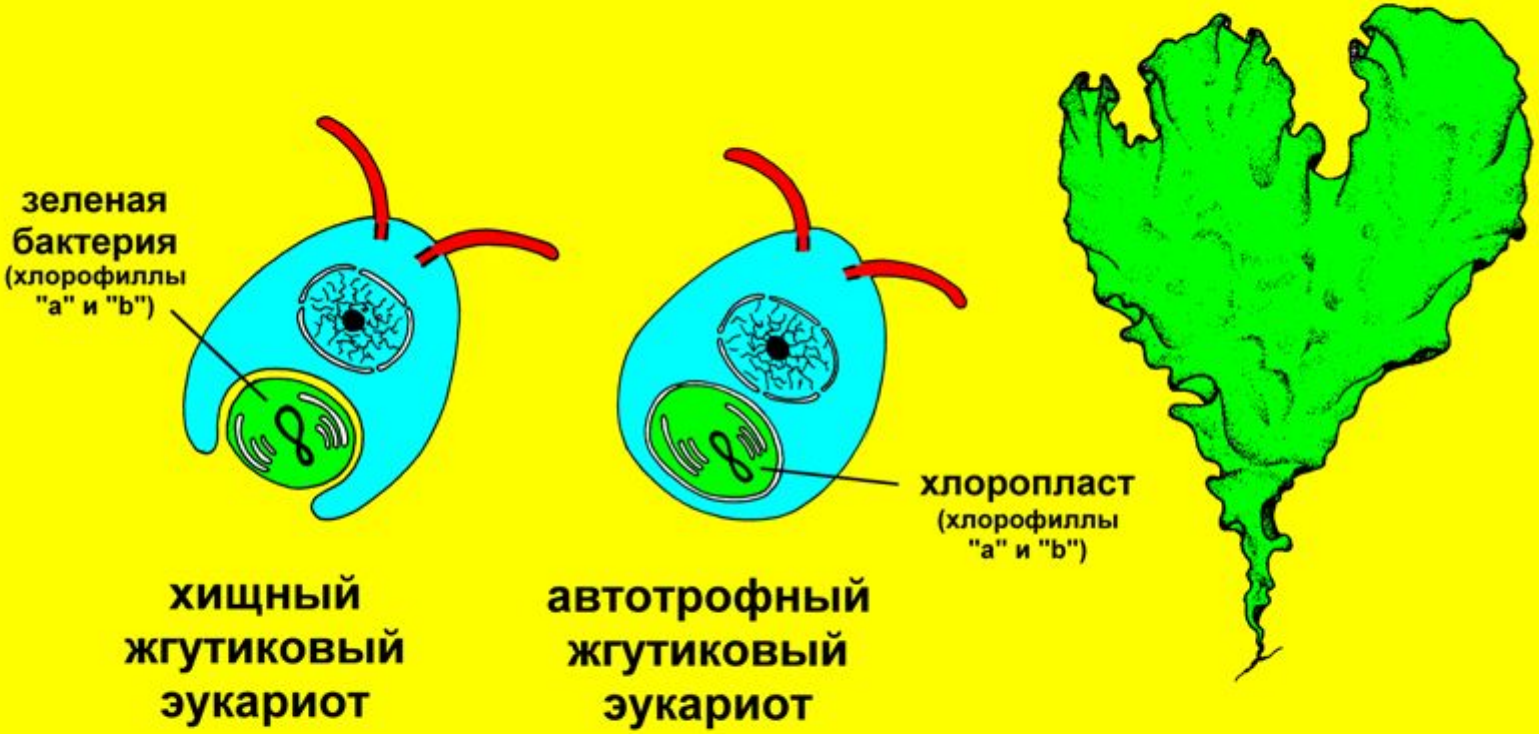
Горизонтальный перенос генов



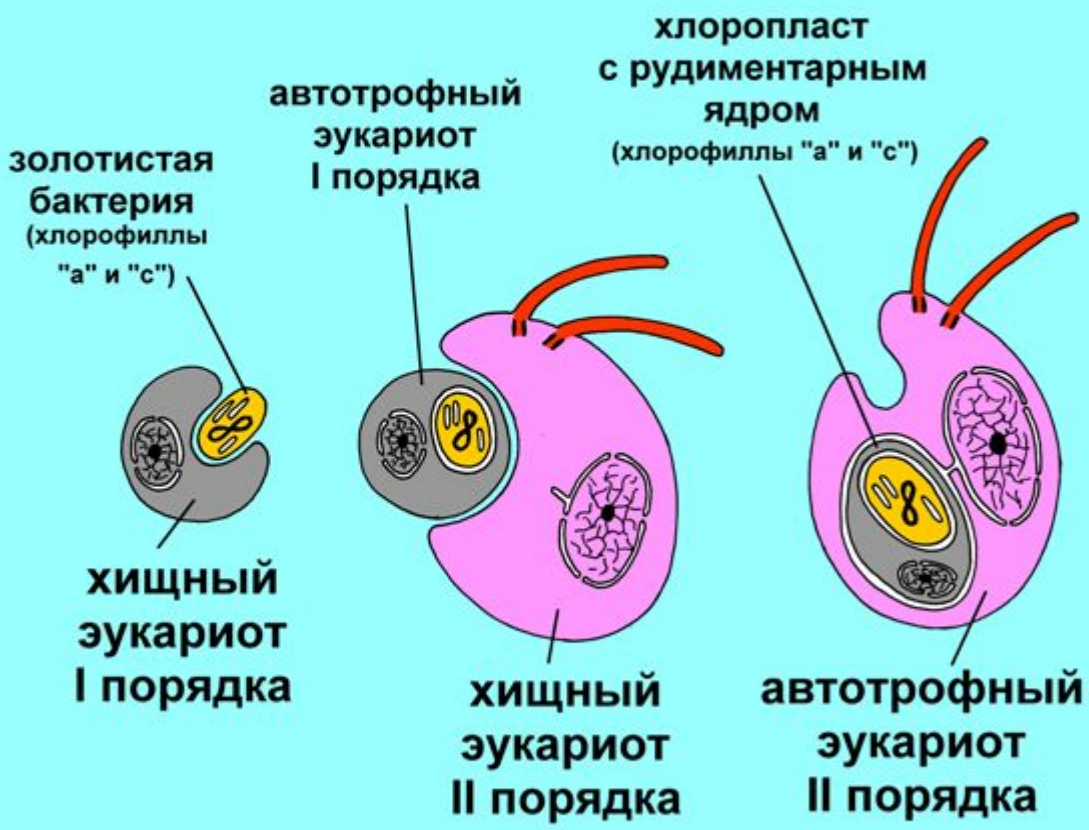
ПРОИСХОЖДЕНИЕ КРАСНЫХ ВОДОРОСЛЕЙ

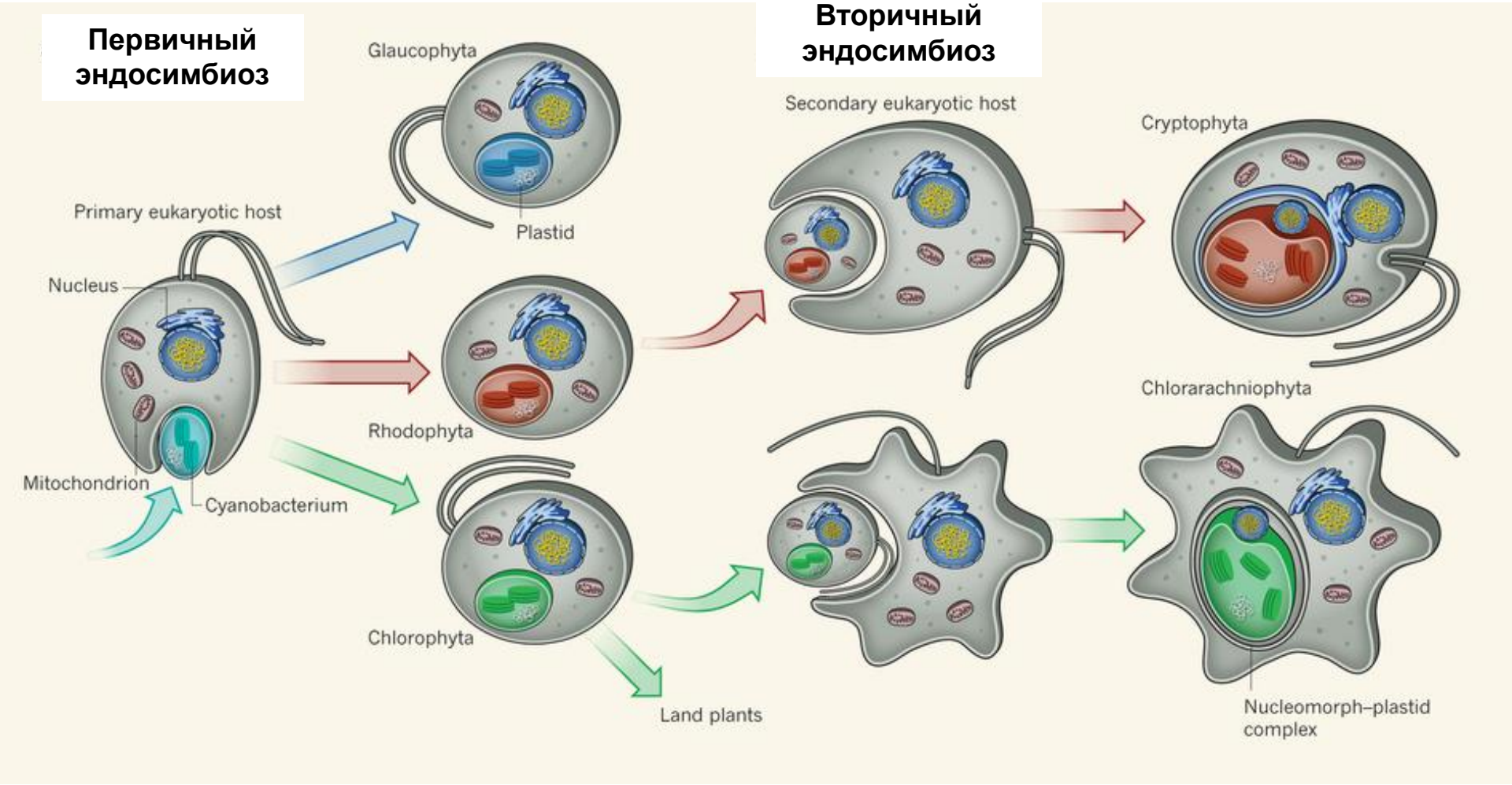


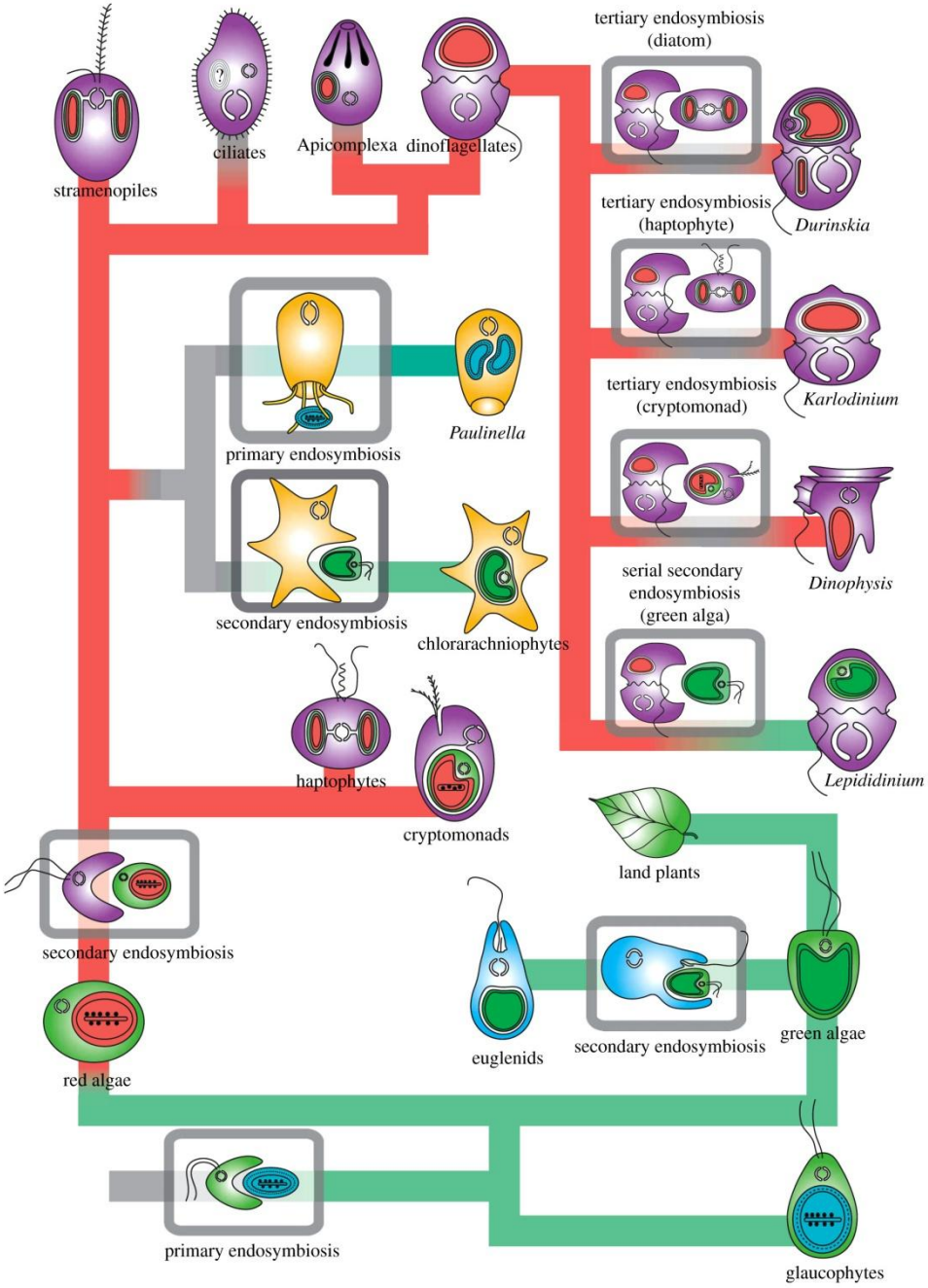
ПРОИСХОЖДЕНИЕ ЗЕЛЕНЫХ ВОДОРОСЛЕЙ

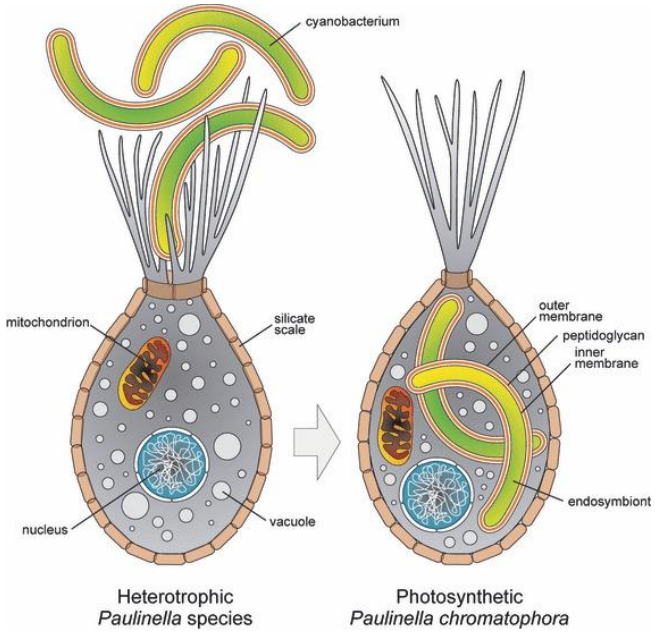


ПРОИСХОЖДЕНИЕ КРИПТОФИТОВЫХ, ЗОЛОТИСТЫХ, БУРЫХ И ДИАТОМОВЫХ ВОДОРОСЛЕЙ

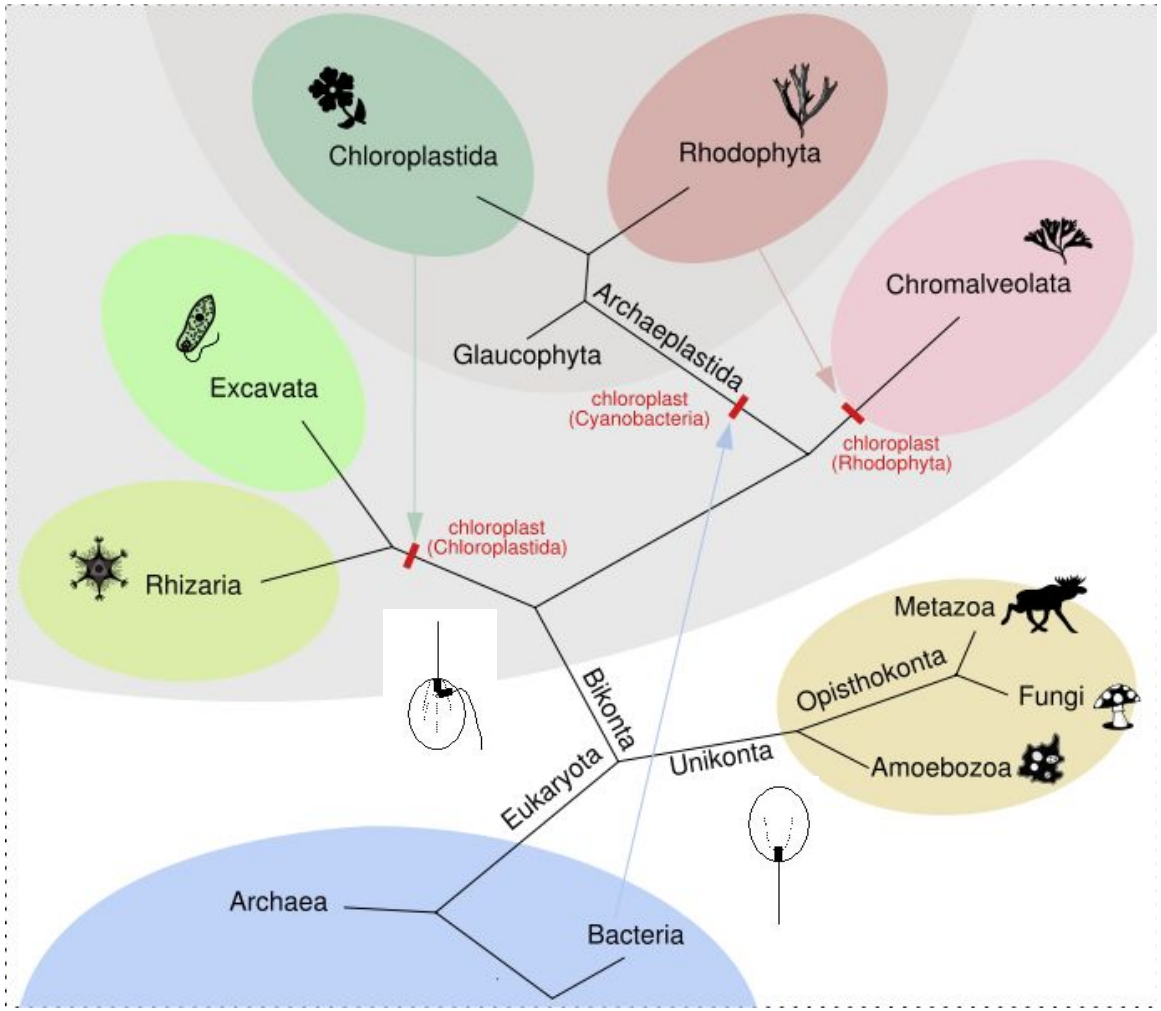



Первичный эндосимбиоз
Вторичный эндосимбиоз
Glaucophyta
Plastid
Primary eukaryotic host
Nucleus
Mitochondrion
Cyanobacterium
Rhodophyta
Chlorophyta
Land plants
Secondary eukaryotic host
Cryptophyta
Chlorarachniophyta
Nucleomorph–plastid complex

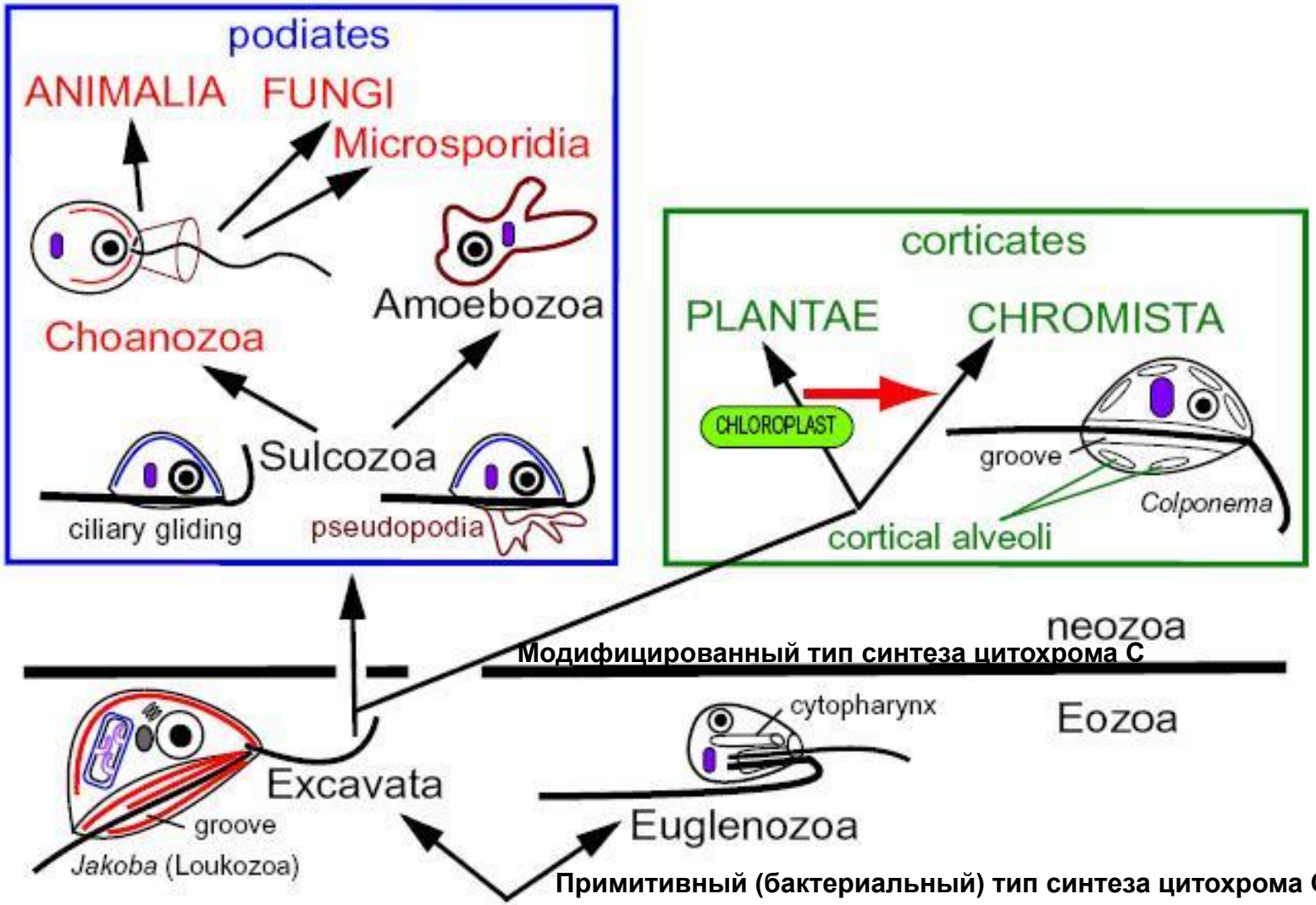

tertiary endosymbiosis
(diatom)
stramenopiles
ciliates
Apicomplexa
dinoflagellates
tertiary endosymbiosis
(haptophyte)
Durinskia
Paulinella
primary endosymbiosis
tertiary endosymbiosis
(cryptomonad)
Karlodinium
secondary endosymbiosis
chlorarachniophytes
serial secondary
endosymbiosis
(green alga)
Dinophysis
haptophytes
cryptomonads
Lepididinium
land plants
secondary endosymbiosis
euglenids
secondary endosymbiosis
green algae
red algae
primary endosymbiosis
glaucophytes


cyanobacterium
mitochondrion
silicate
scale
nucleus
vacuole
outer
membrane
peptidoglycan
inner
membrane
endosymbiont
Heterotrophic
Paulinella species
Photosynthetic
Paulinella chromatophora

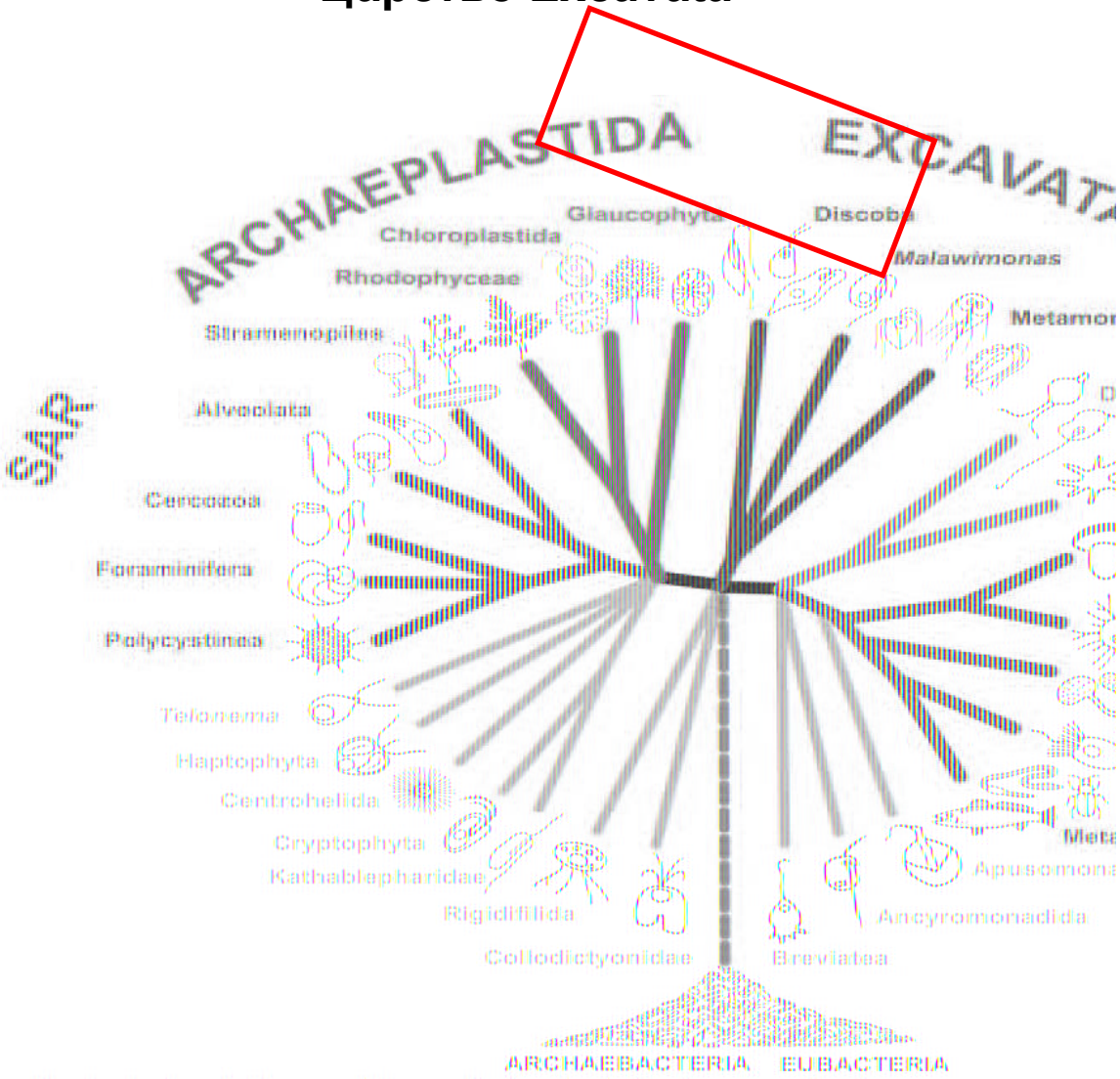
Надцарства Bikonta и Unikonta

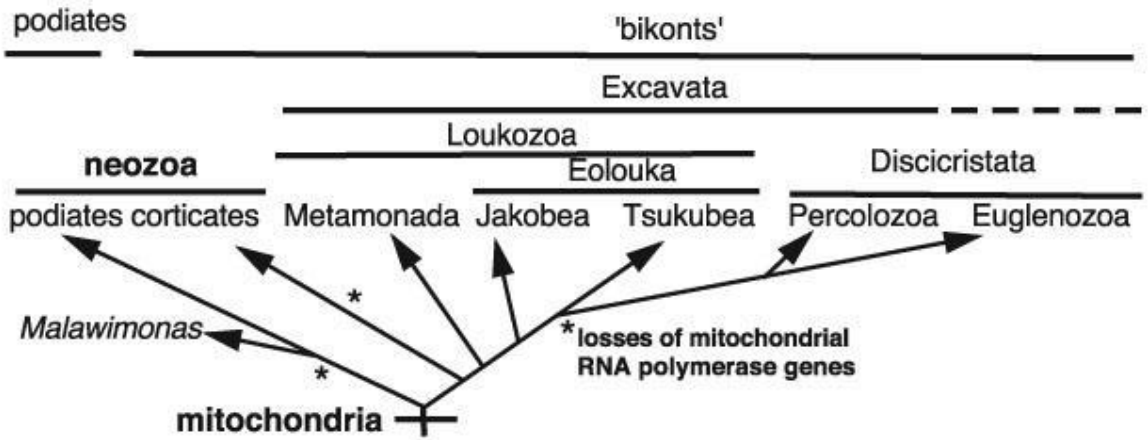


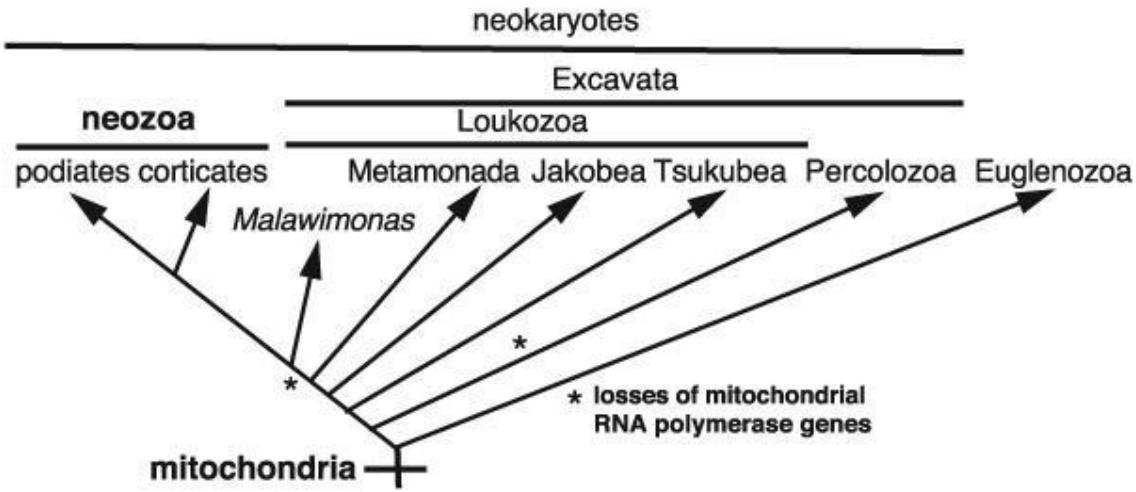
Надцарства Eozoa и Neozoa



Царство Excavata



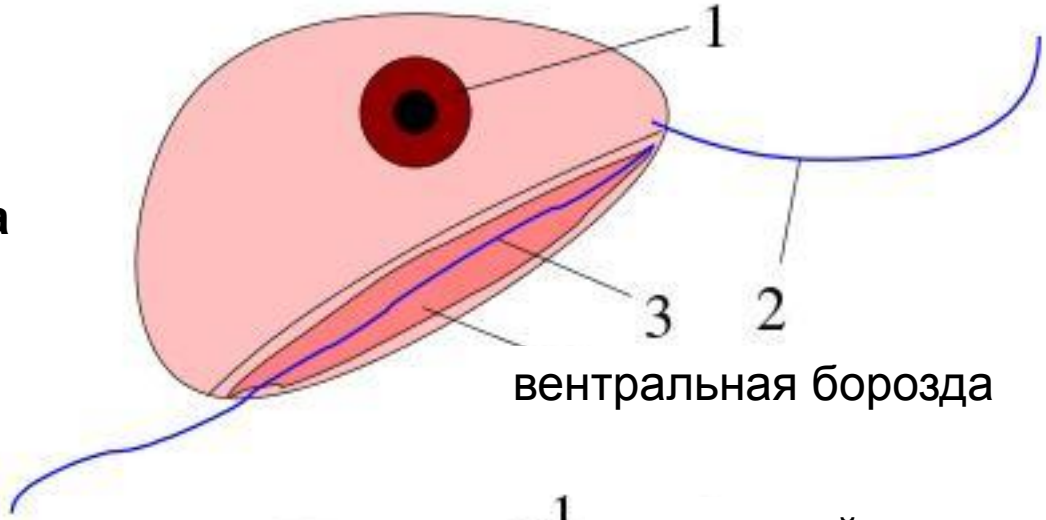




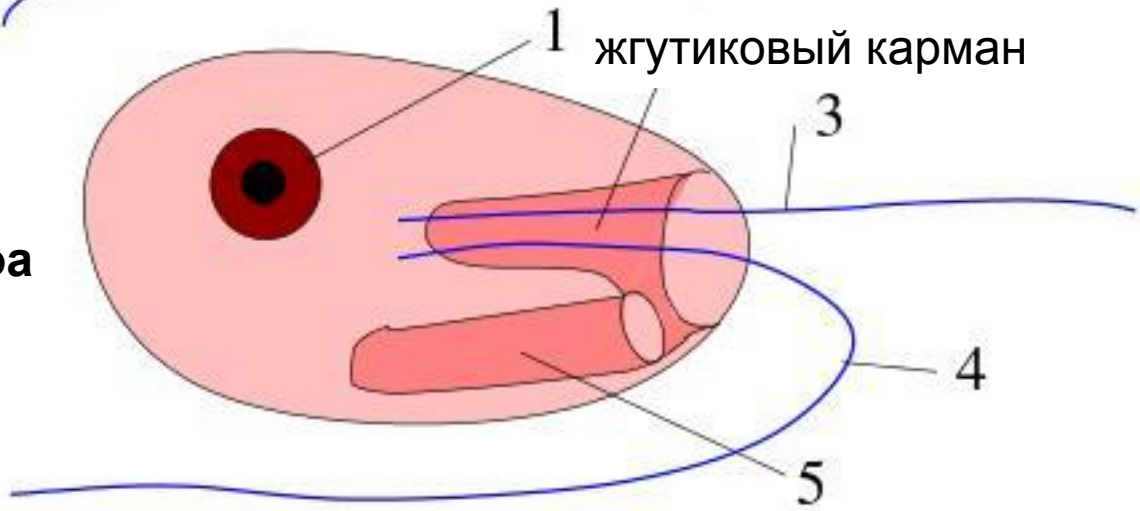
Надтипы

Discoba
Metamonada
Perkolozoa
Loukozoa

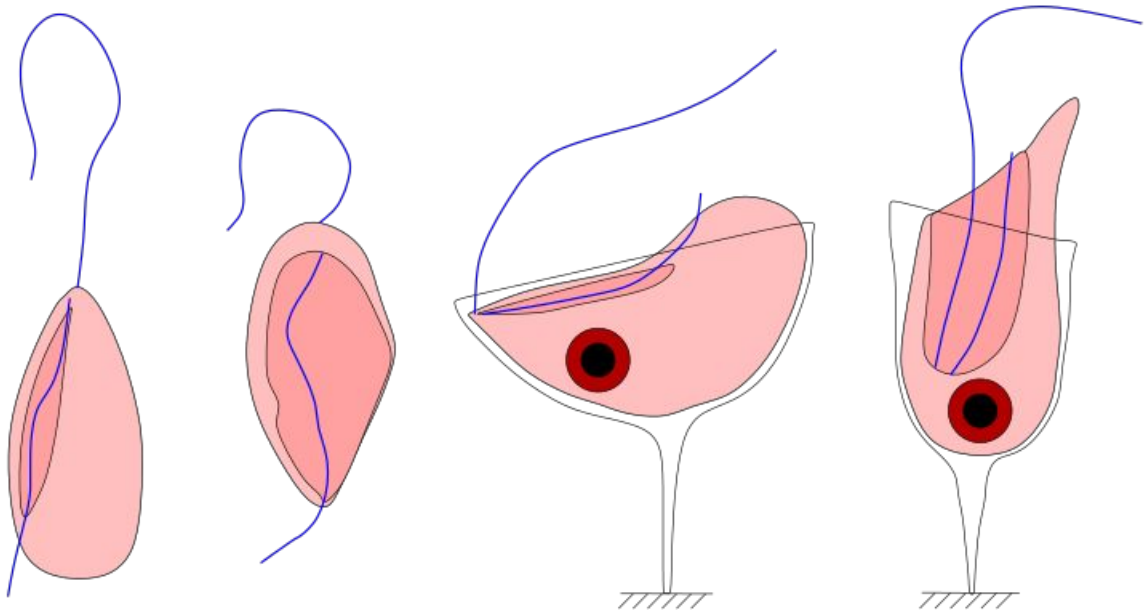
Jakobida



Euglenozoa



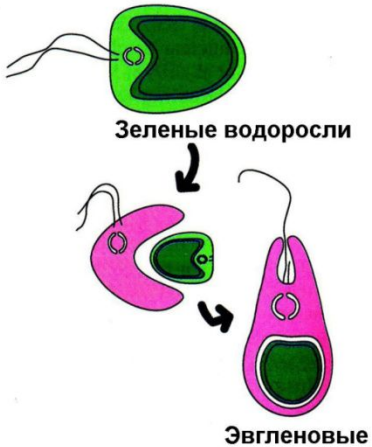
Тип Jakobea

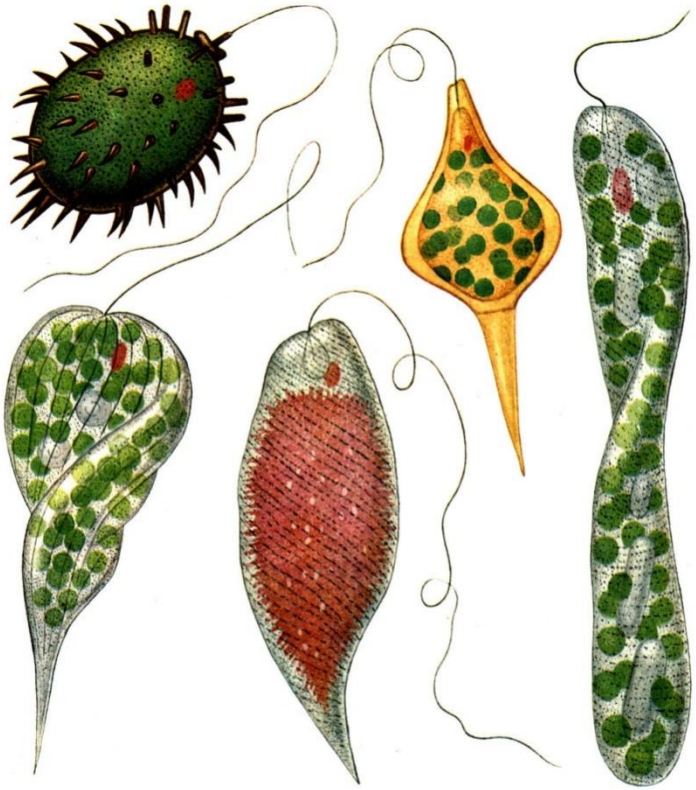


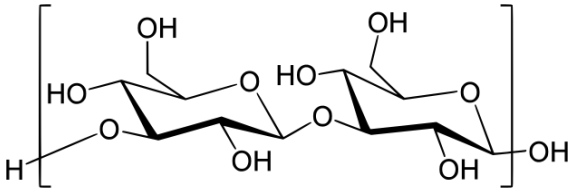
Jakobia

Тип Euglenozoa
Класс Эвгленовые водоросли

Хлорофилл *a* и *b*

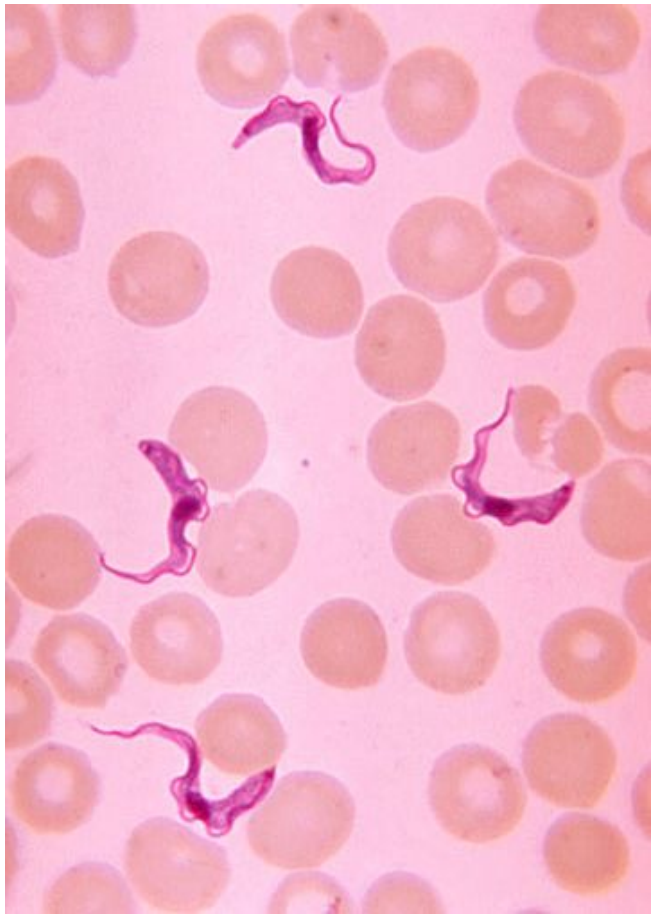




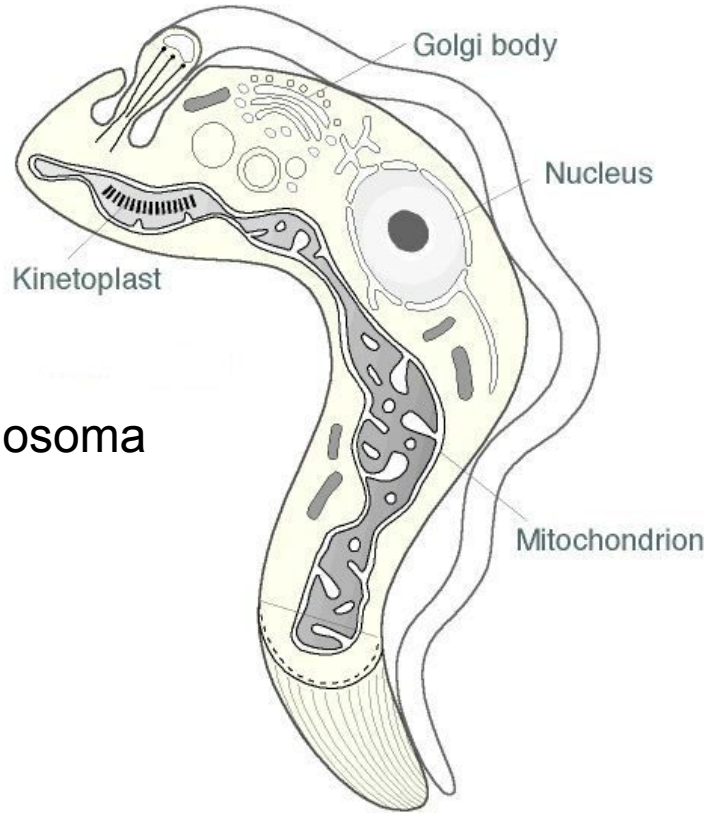


парамил

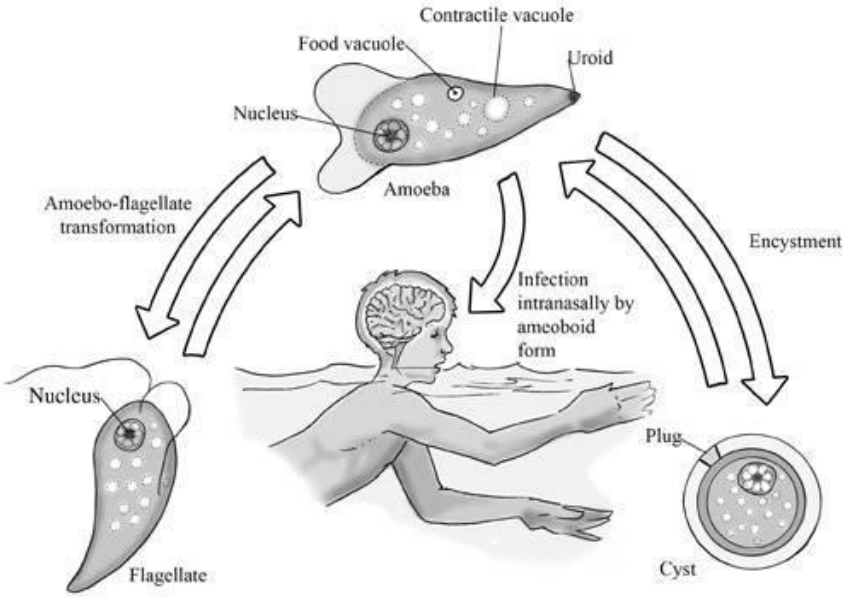
Тип Euglenozoa
Класс Кинетопластиды



Trypanosoma



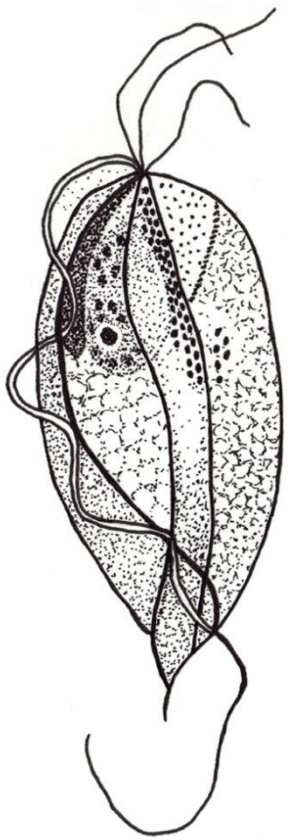
Тип Percolozoa



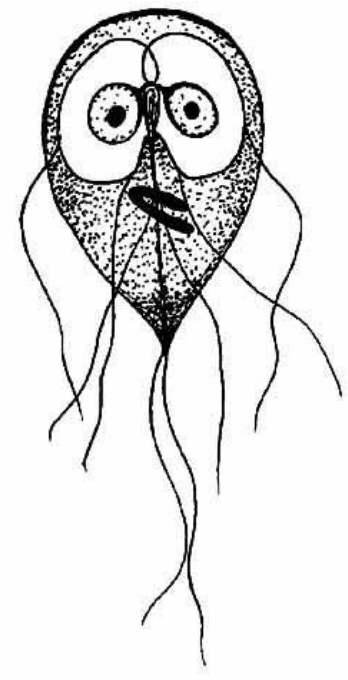
Naegleria

Acrasis

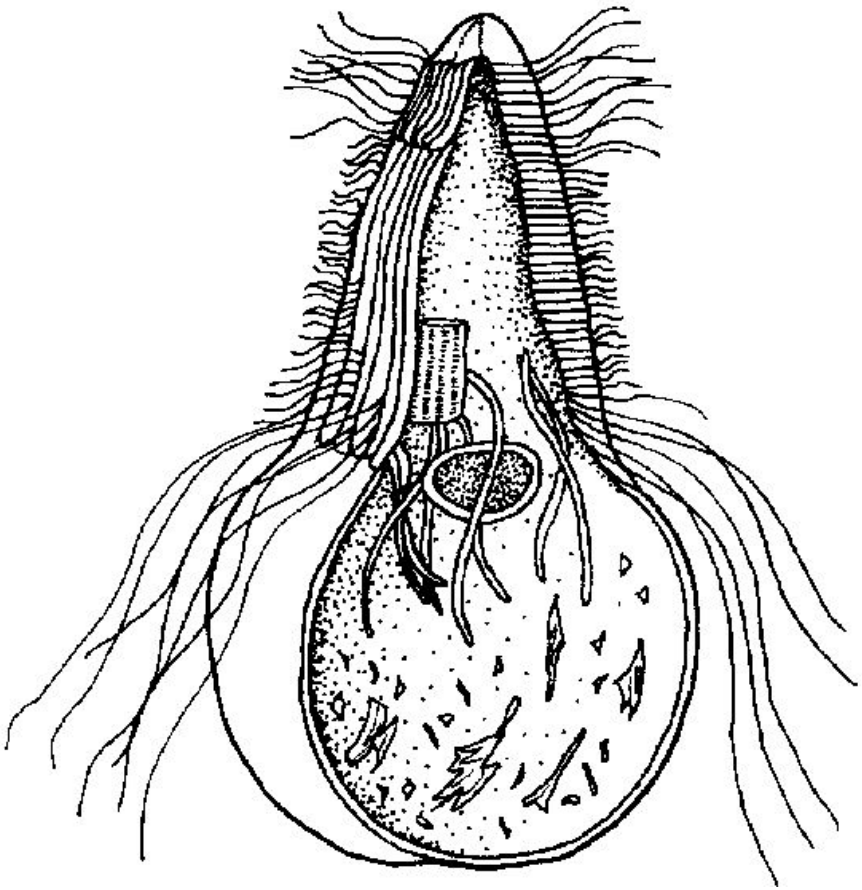
Тип Metamonada



Trichomonas

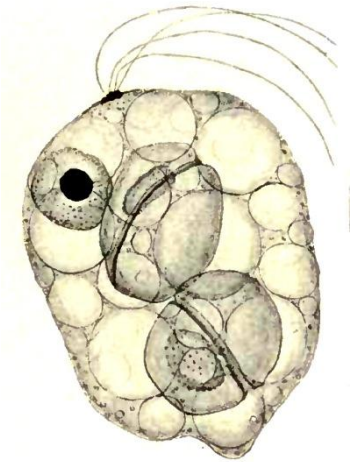


Giardia

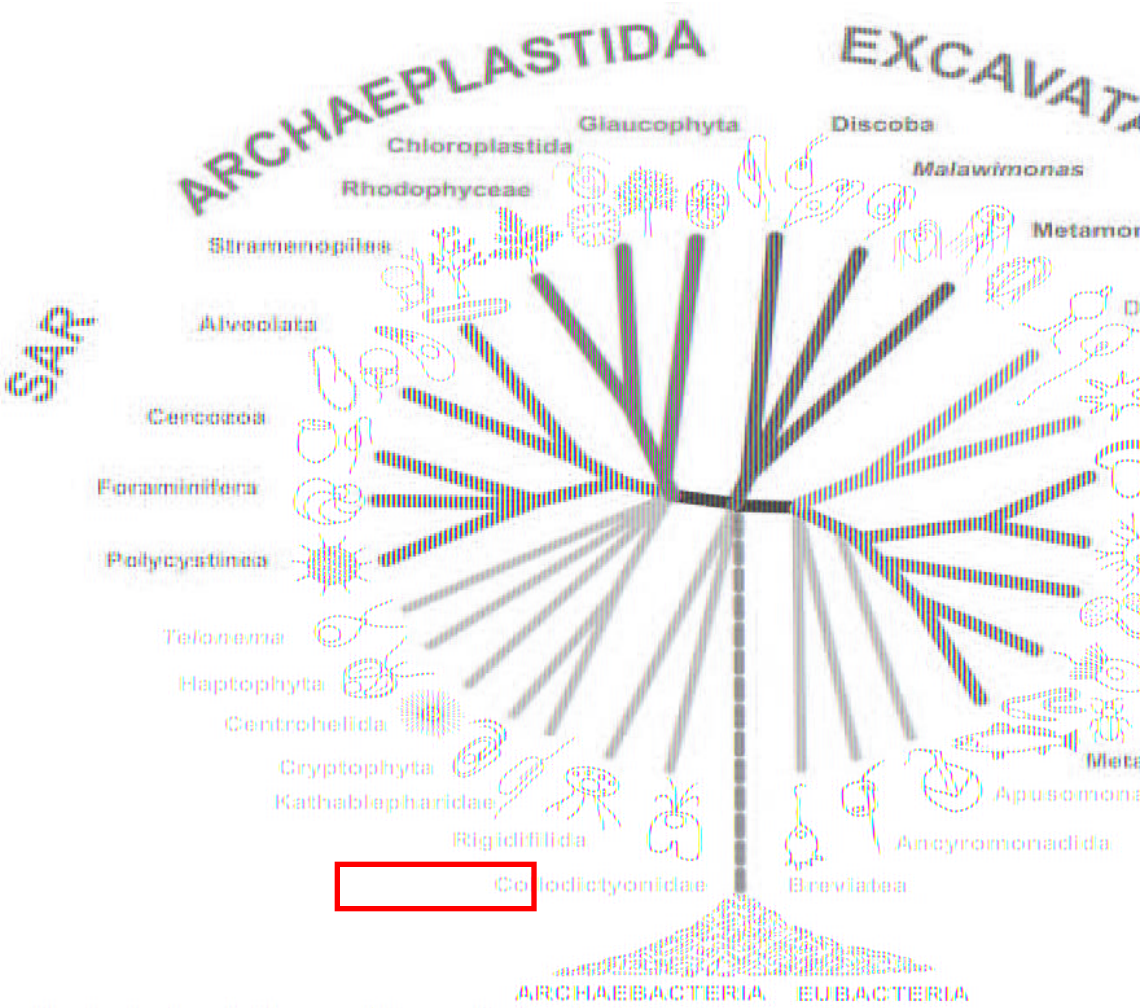


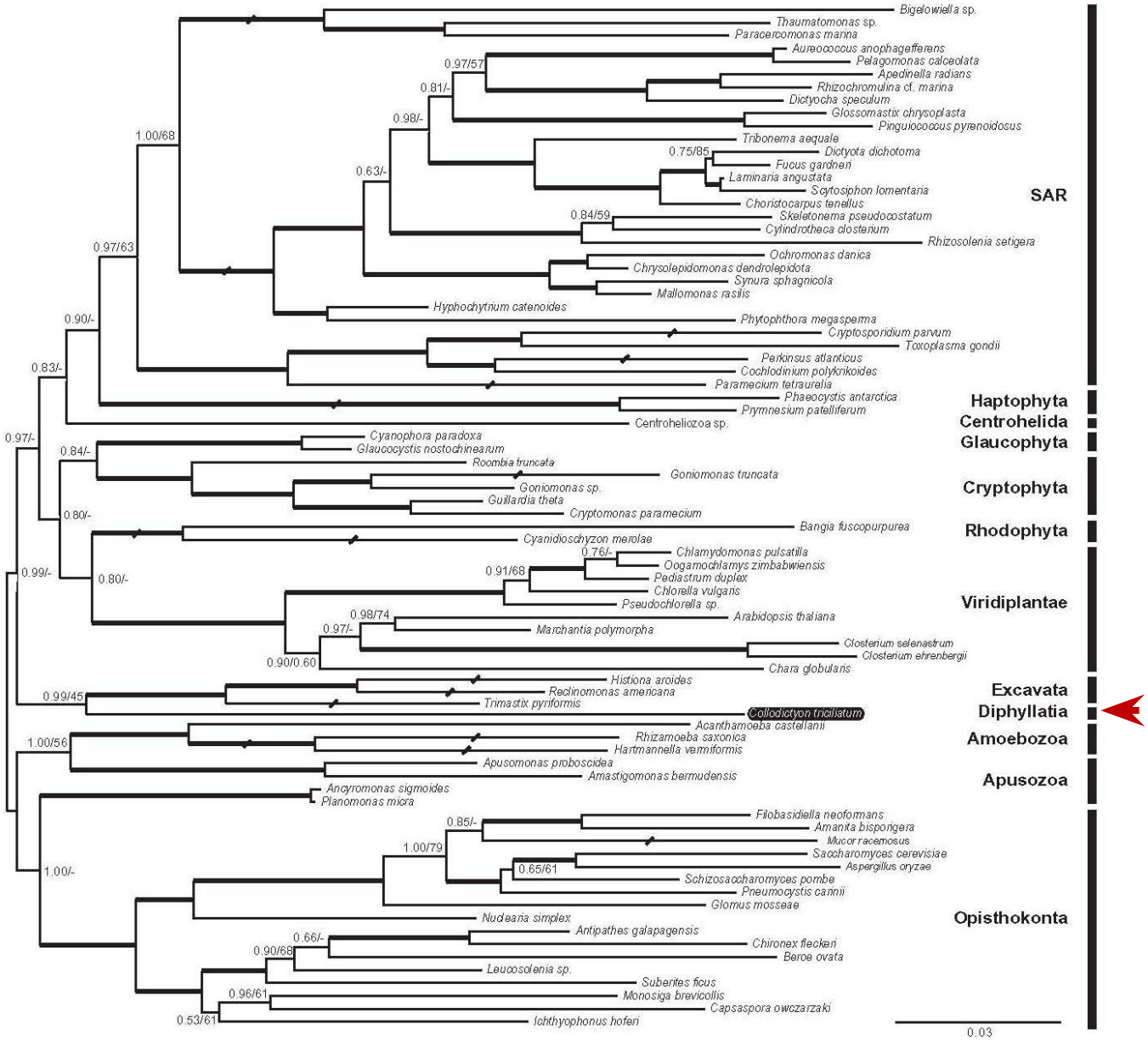
Trichomonympha

Тип Varisulca

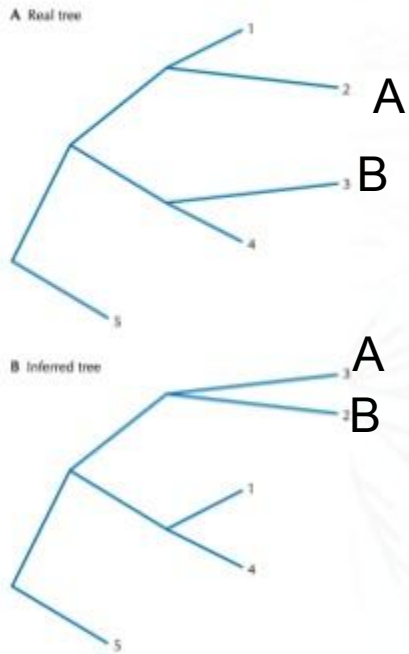


Collodictyon



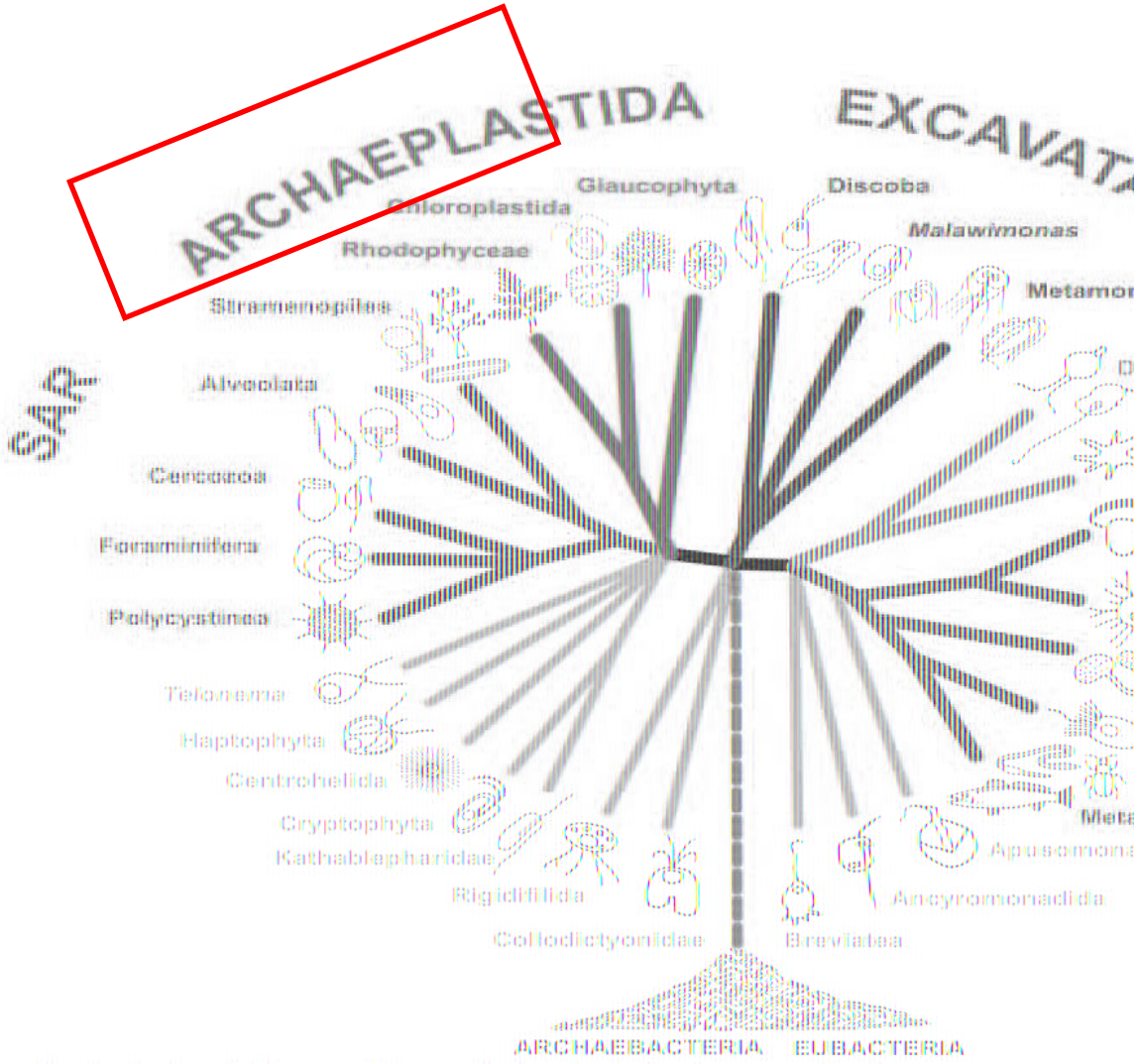

Bigelowiella sp.
Thaumatomonas sp.
Paracercomonas marina
Aureococcus anophagefferens
Pelagomonas calceolata
Apedinella radians
Rhizochromulina cf. marina
Dictyocha speculum
Glossomastix chrysoplasta
Pinguiococcus pyrenoidosus
Tribonema aequale
Dictyota dichotoma
Fucus gardneri
Laminaria angustata
Scytosiphon lomentaria
Choristocarpus tenellus
Skeletonema pseudocostatum
Cylindrotheca closterium
Rhizosolenia setigera
Ochromonas danica
Chrysolepidomonas dendrolepidota
Synura sphagnicola
Mallomonas rasilis
Hyphochytrium catenoides
Phytophthora megasperma
Cryptosporidium parvum
Toxoplasma gondii
Perkinsus atlanticus
Cochlodinium polykrikoides
Paramecium tetraurelia
Phaeocystis antarctica
Prymnesium patelliferum
Centroheliozoa sp.
Cyanophora paradoxa
Glaucocystis nostochinearum
Roombia truncata
Goniomonas truncata
Goniomonas sp.
Guillardia theta
Cryptomonas paramecium
Bangia fuscopurpurea
Cyanidioschyzon merolae
Chlamydomonas pulsatilla
Oogamochlamys zimbabwiensis
Pediastrum duplex
Chlorella vulgaris
Pseudochlorella sp.
Arabidopsis thaliana
Marchantia polymorpha
Closterium selenastrum
Closterium ehrenbergii
Chara globularis
Histiona aroides
Reclinomonas americana
Trimastix pyriformis
Collodictyon triciliatum
Acanthamoeba castellanii
Rhizamoeba saxonica
Hartmannella vermiformis
Apusomonas proboscidea
Amastigomonas bermudensis
Ancyromonas sigmoides
Planomonas micra
Filobasidiella neoformans
Amanita bisporigera
Mucor racemosus
Saccharomyces cerevisiae
Aspergillus oryzae
Schizosaccharomyces pombe
Pneumocystis carinii
Glomus mosseae
Nuclearia simplex
Antipathes galapagensis
Chironex fleckeri
Beroe ovata
Leucosolenia sp.
Suberites ficus
Monosiga brevicollis
Capsaspora owczarzaki
Ichthyophonus hoferi
SAR
Haptophyta
Centrohelida
Glaucophyta
Cryptophyta
Rhodophyta
Viridiplantae
Excavata
Diphyllatia
Amoebozoa
Apusozoa
Opisthokonta
1.00/68
0.97/57
0.81/-
0.98/-
0.63/-
0.75/85
0.84/59
0.97/63
0.90/-
0.83/-
0.97/-
0.84/-
0.80/-
0.99/-
0.80/-
0.76/-
0.91/68
0.98/74
0.97/-
0.90/0.60
0.99/45
1.00/56
1.00/-
0.85/-
1.00/79
0.65/61
0.66/-
0.90/68
0.96/61
0.53/61
0.03

Long branch attraction

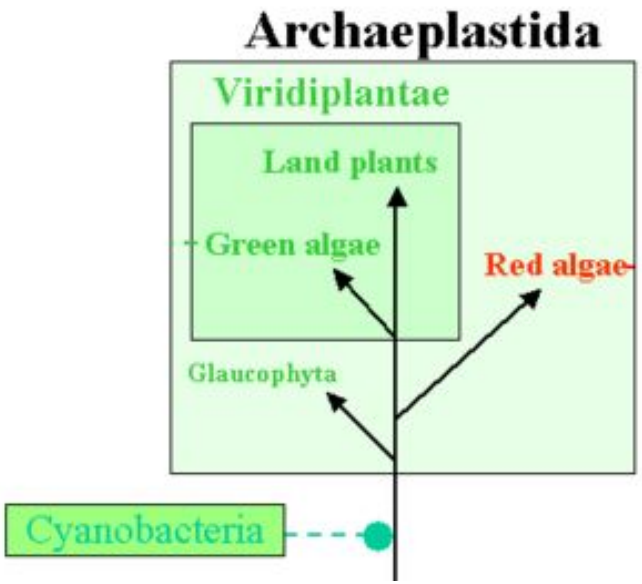


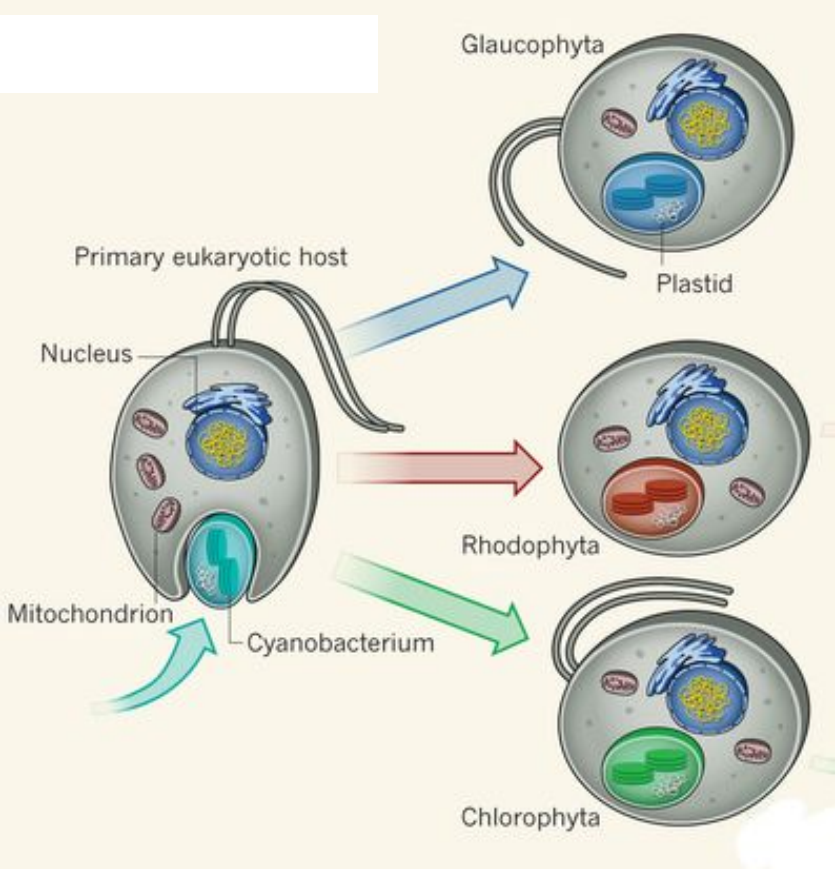
Царство Archaeplastida (= Plantae)

Подцарства:
“Biliphyta”
Viridiplantae

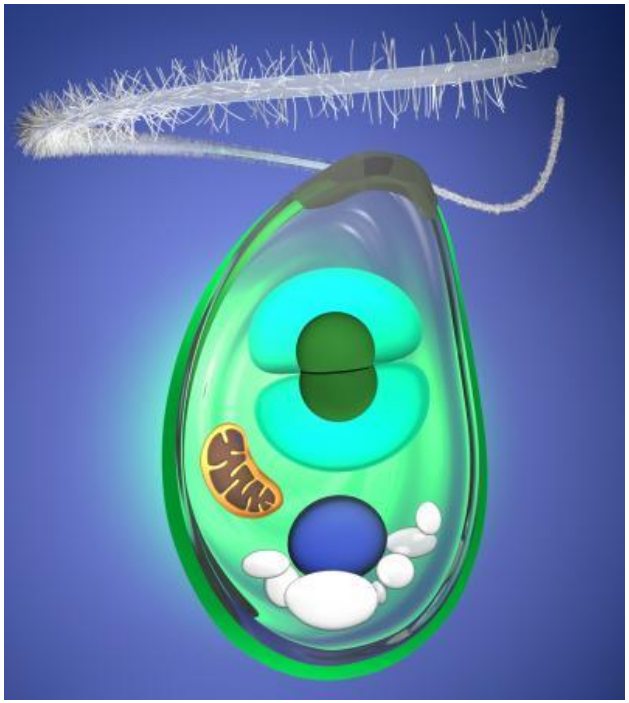


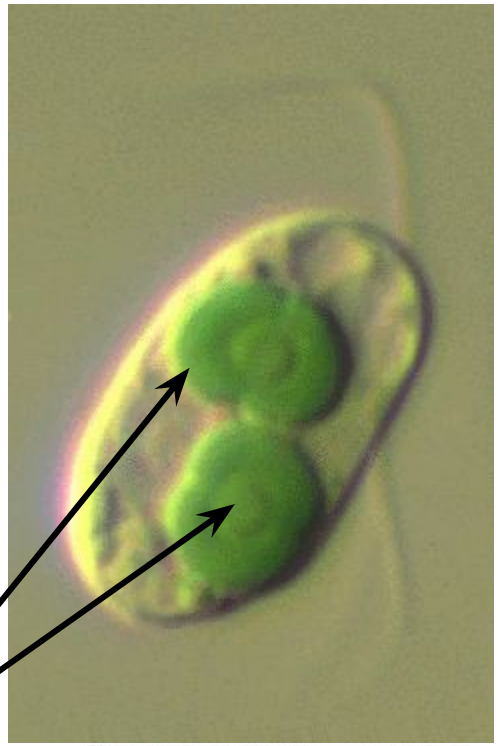
Царство Archaeplastida – настоящие растения



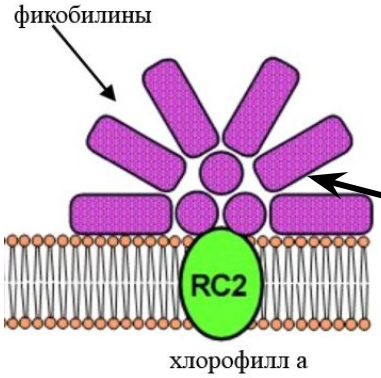


Тип Glaucophyta – глаукофитовые водоросли

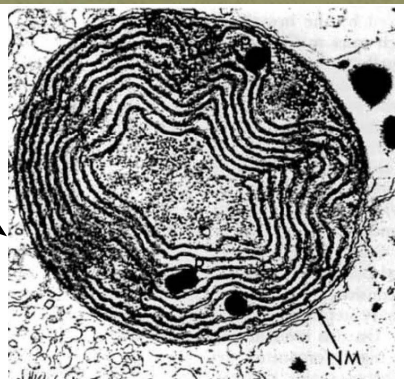




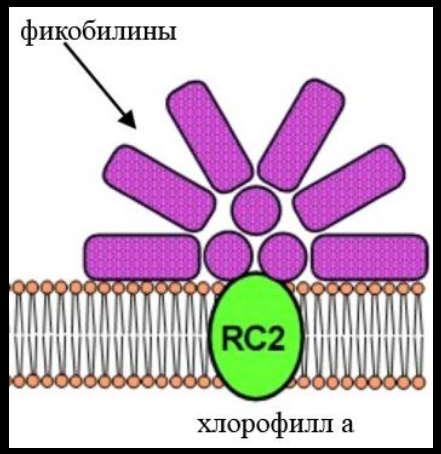
цианеллы



фикобилисома

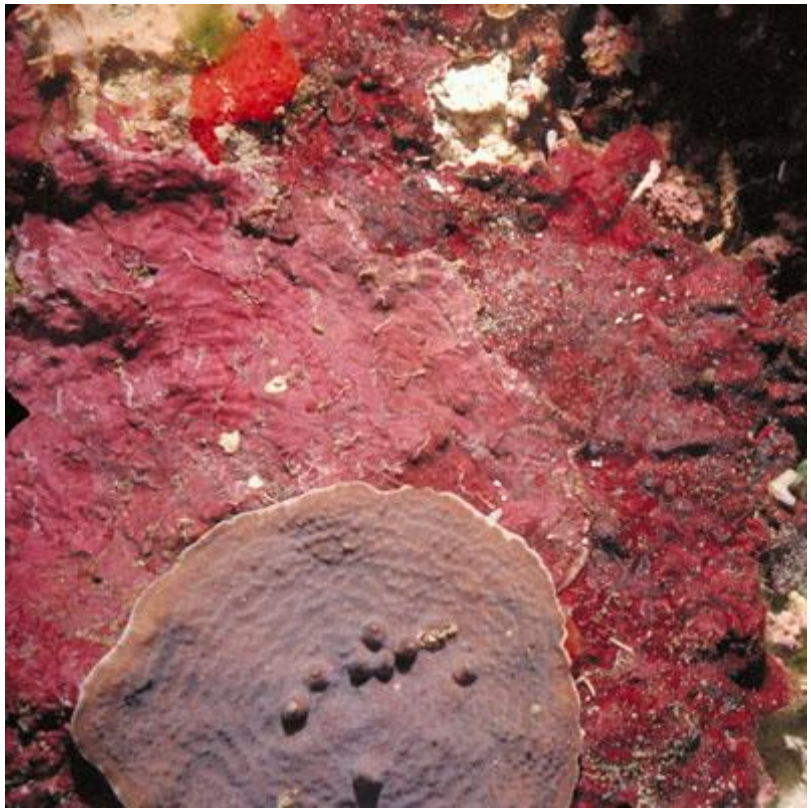


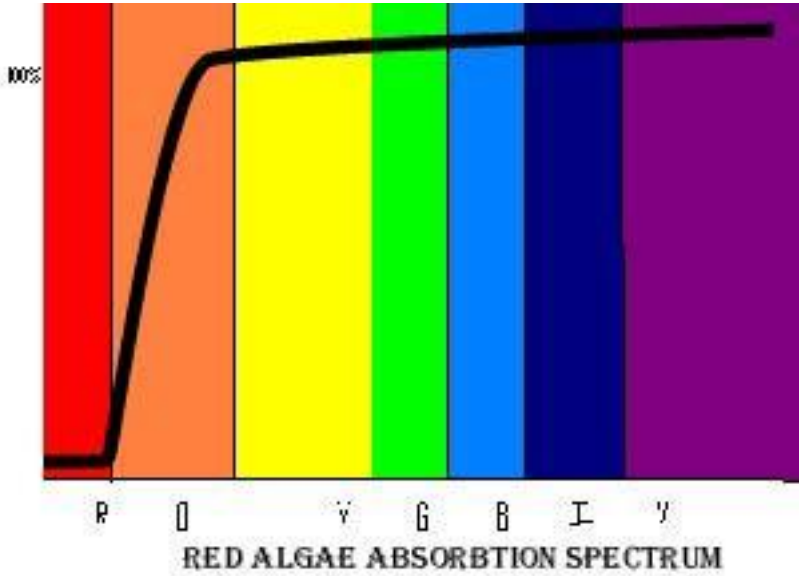
Тип Rhodophyta –красные водоросли



Багрянковый крахмал

Багрянки – наиболее глубоководные водоросли

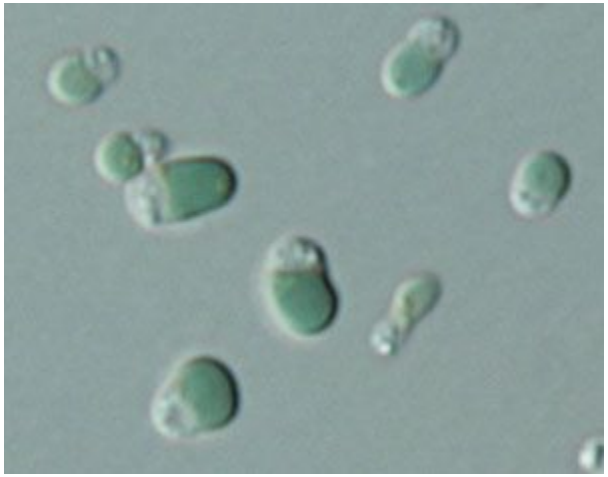




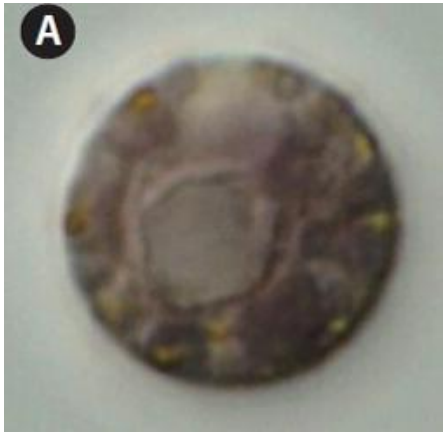
Subphylum Cyanidiophytina

Подтип Cyanidiophytina (Тип Cyanidiophyta)

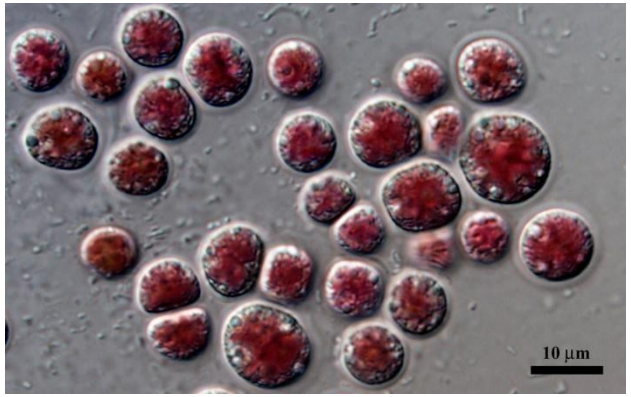
Класс Cyanidiophyceae – наиболее древние красные водоросли



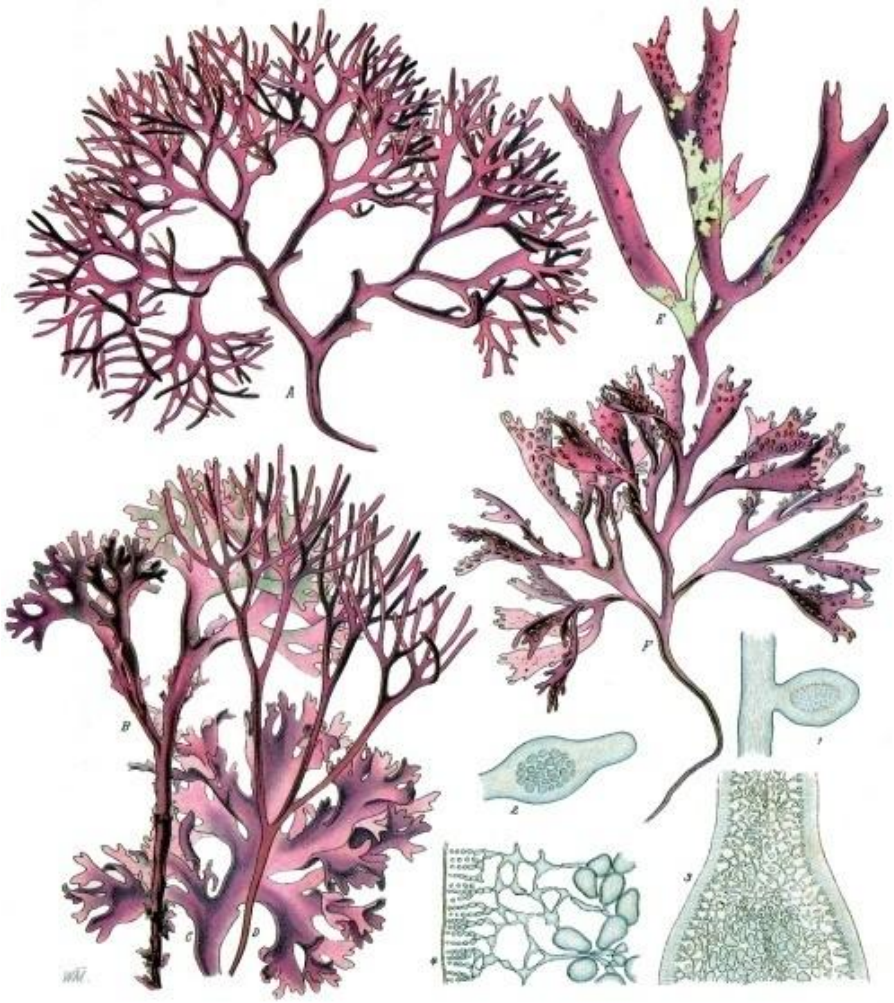
Subphylum Rhodophytina



Rhodella reticulata



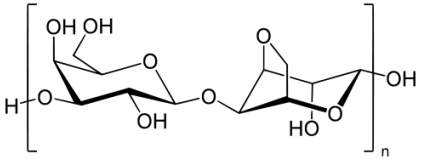
Porphyridium cruentum



Агароза

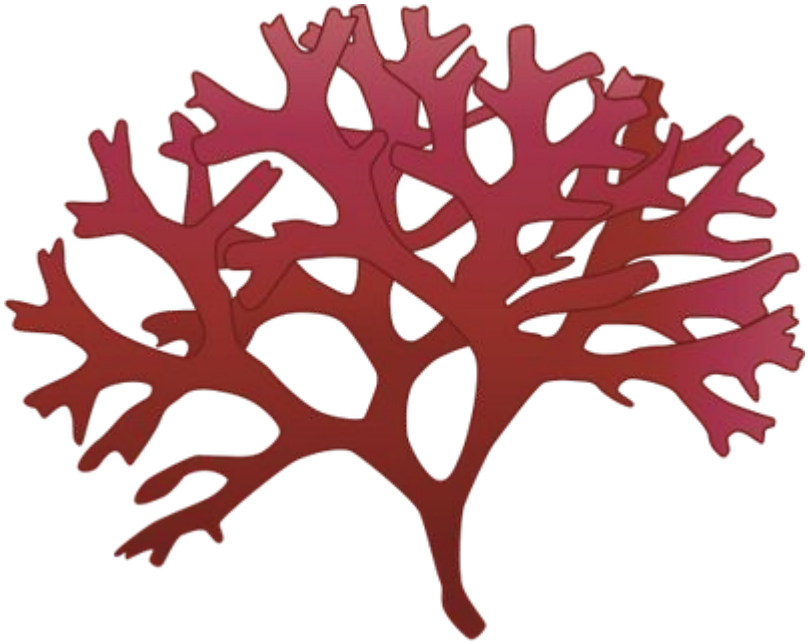
Анфельция

Грацилярия

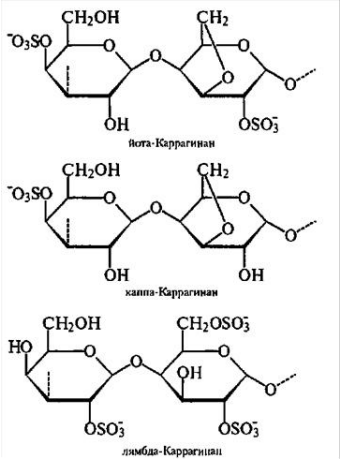


Агароза

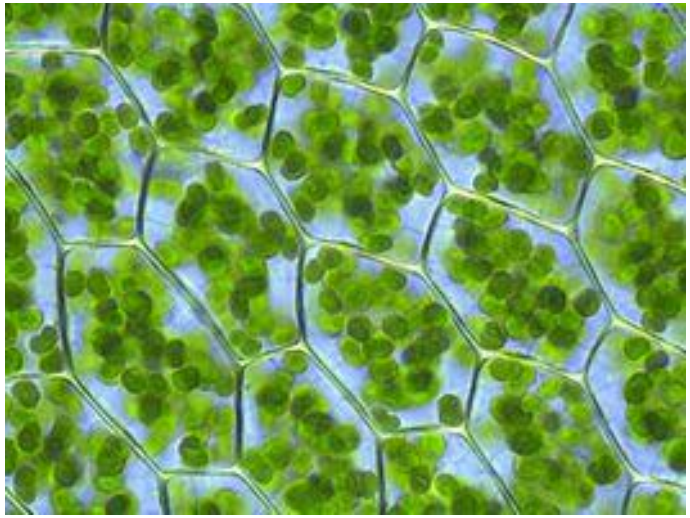
Каррагинаны

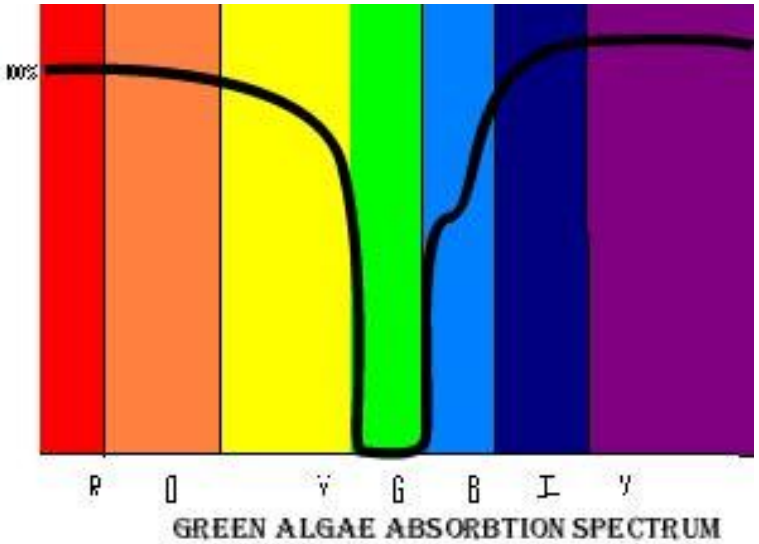


Хондрус



Подцарство Viridiplantae – зеленые растения

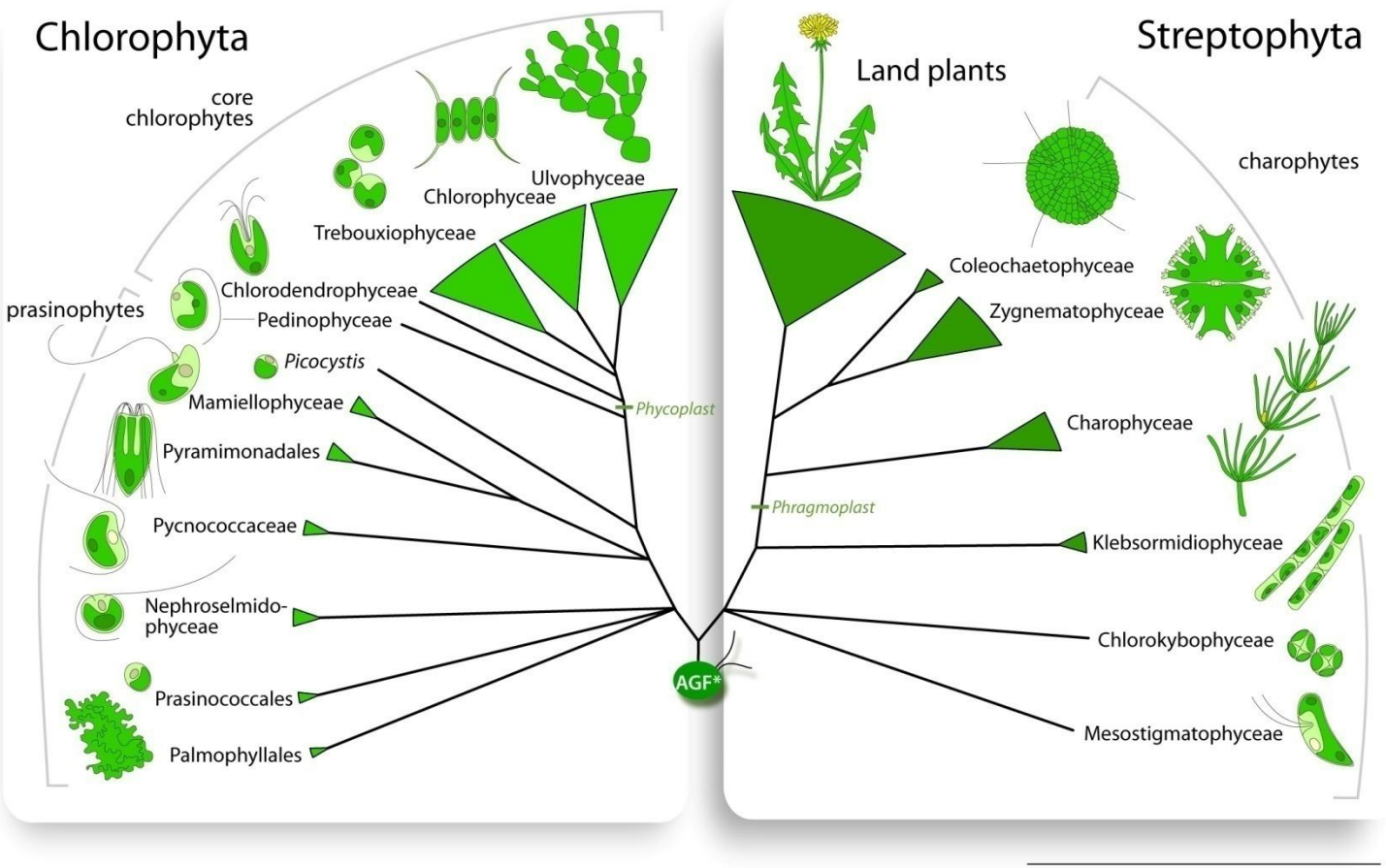




Хлорофиллы *a*, *b*
+ каротины и
ксантофиллы

Зеленые водоросли

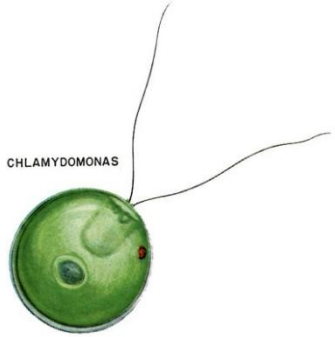
Высшие растения

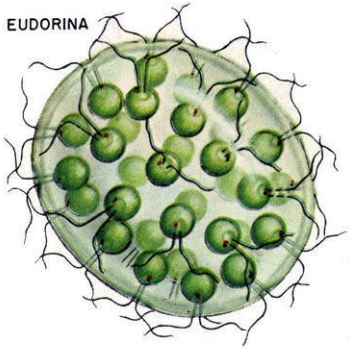


*AGF: (hypothetical) ancestral green flagellate

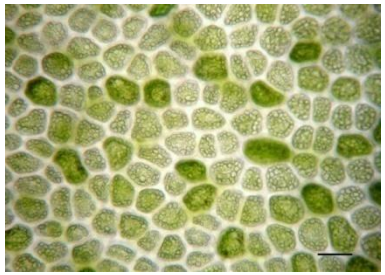
Leliaert *et al.*, *Crit. Rev. Plant Sci.* 31:1-46 (2012)
updated 8 Aug 2012

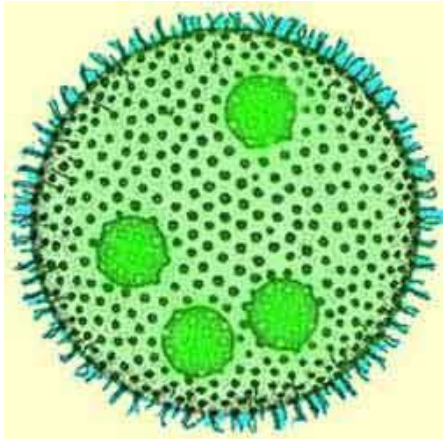
Зеленые водоросли



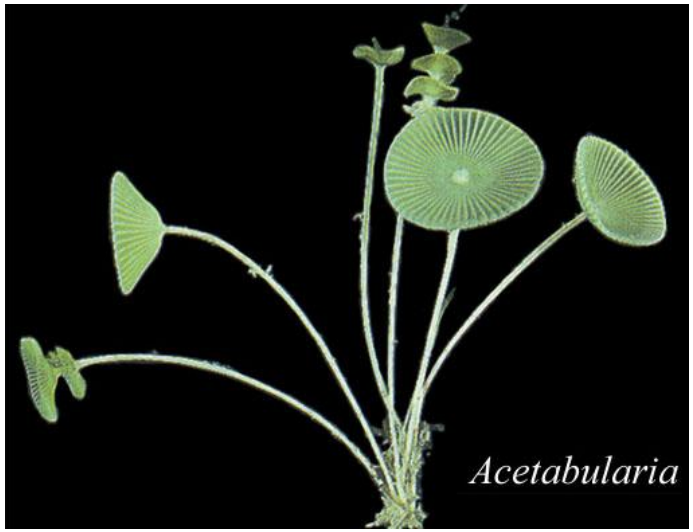


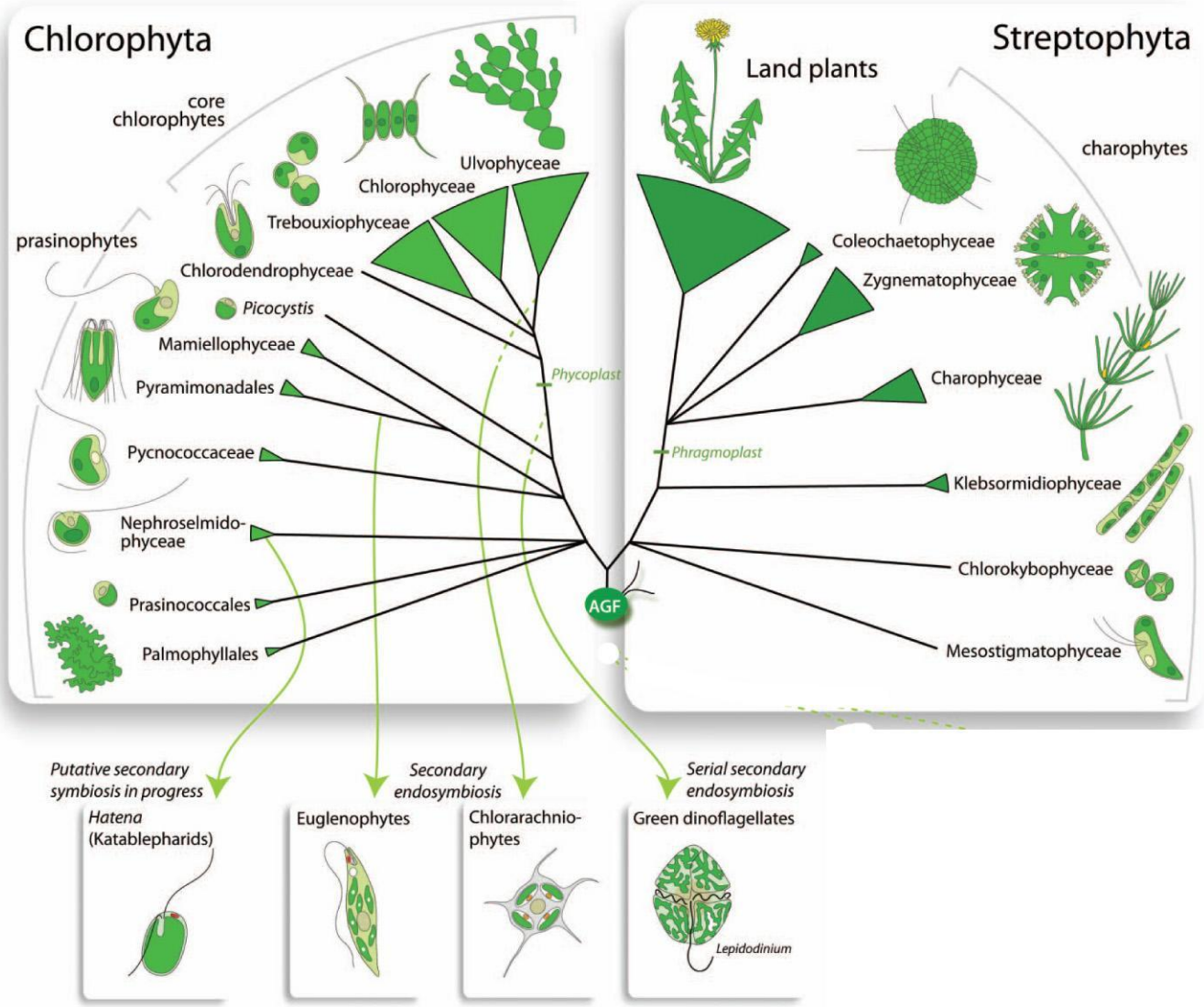
Ulva



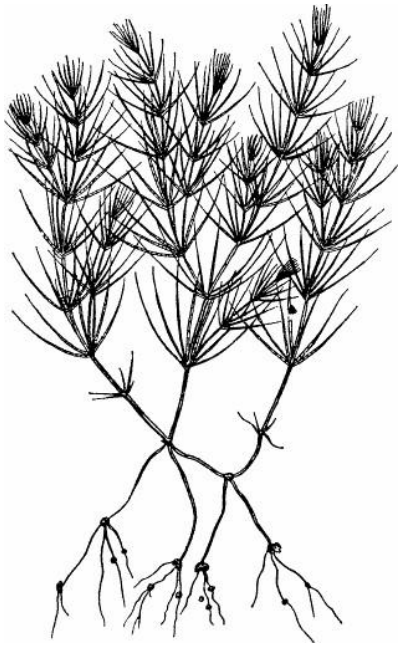


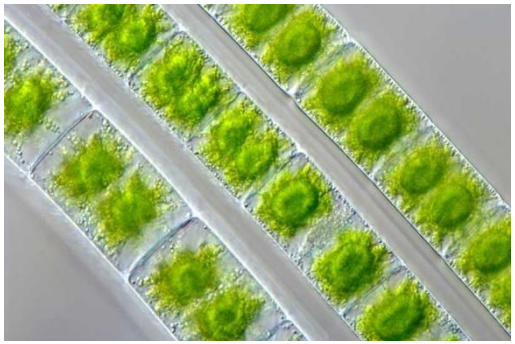
Volvox

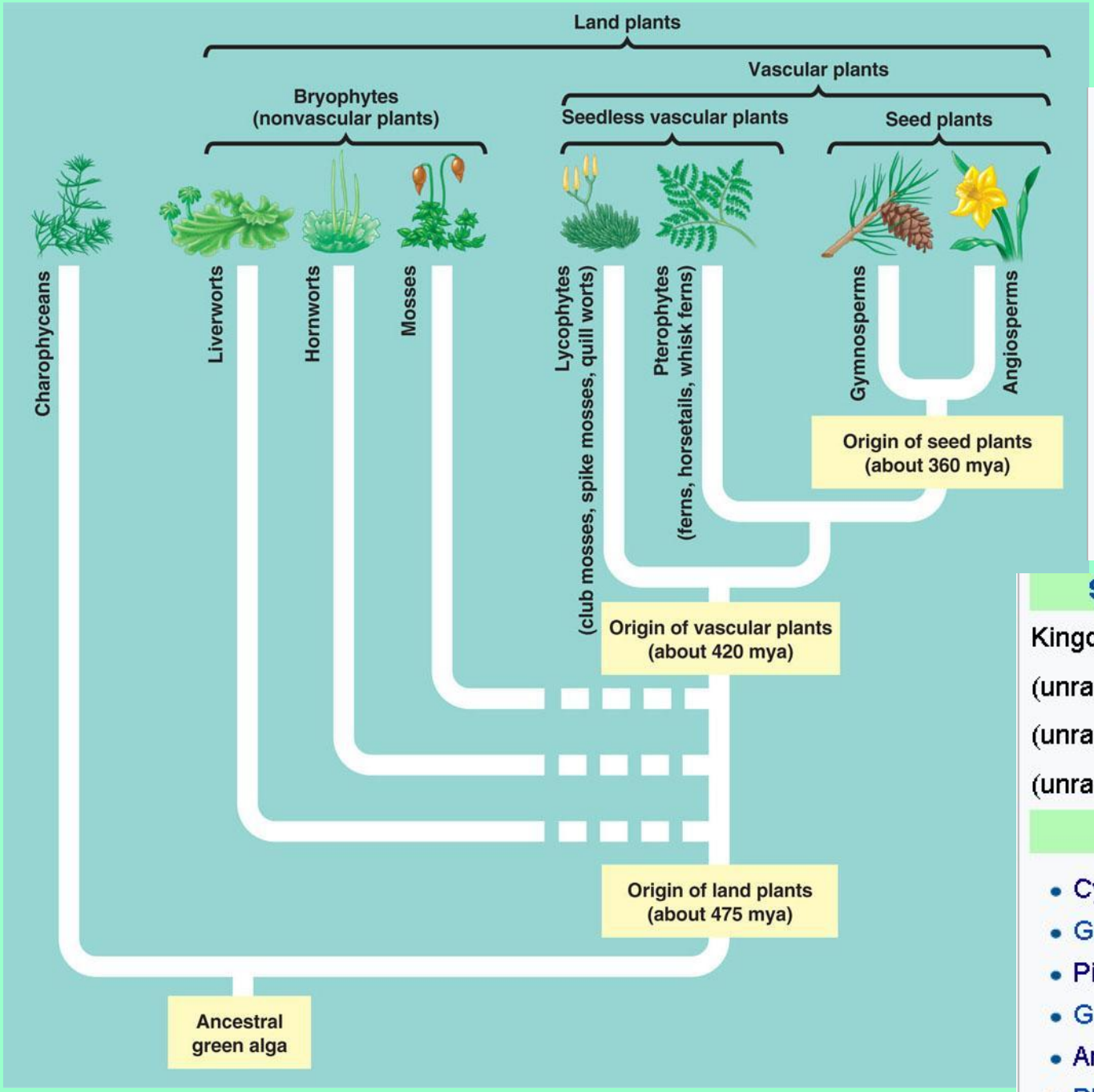



Chlorophyta
core chlorophytes
Ulvophyceae
Chlorophyceae
Trebouxiophyceae
prasinophytes
Chlorodendrophyceae
Picocystis
Mamiellophyceae
Pyramimonadales
Pycnococcaceae
Nephroselmido-phyceae
Prasinococcales
Palmophyllales
Phycoplast
AGF
Streptophyta
Land plants
charophytes
Coleochaetophyceae
Zygnematophyceae
Charophyceae
Phragmoplast
Klebsormidiophyceae
Chlorokybophyceae
Mesostigmatophyceae
Putative secondary symbiosis in progress
Hatena (Katablepharids)
Secondary endosymbiosis
Euglenophytes
Chlorarachnio-phytes
Serial secondary endosymbiosis
Green dinoflagellates
Lepidodinium

Высшие растения







Domain:	Eukaryota
Kingdom:	Plantae
Clade:	**Streptophyta** Jeffrey 1967,[1] *sensu* Leliaert et al. 2012

Divisions

- Klebsormidiophyceae
- Phragmoplastophyta
  - Charophyceae
  - Coleochaetophyceae
  - Zygnematophyceae
  - Embryophyta

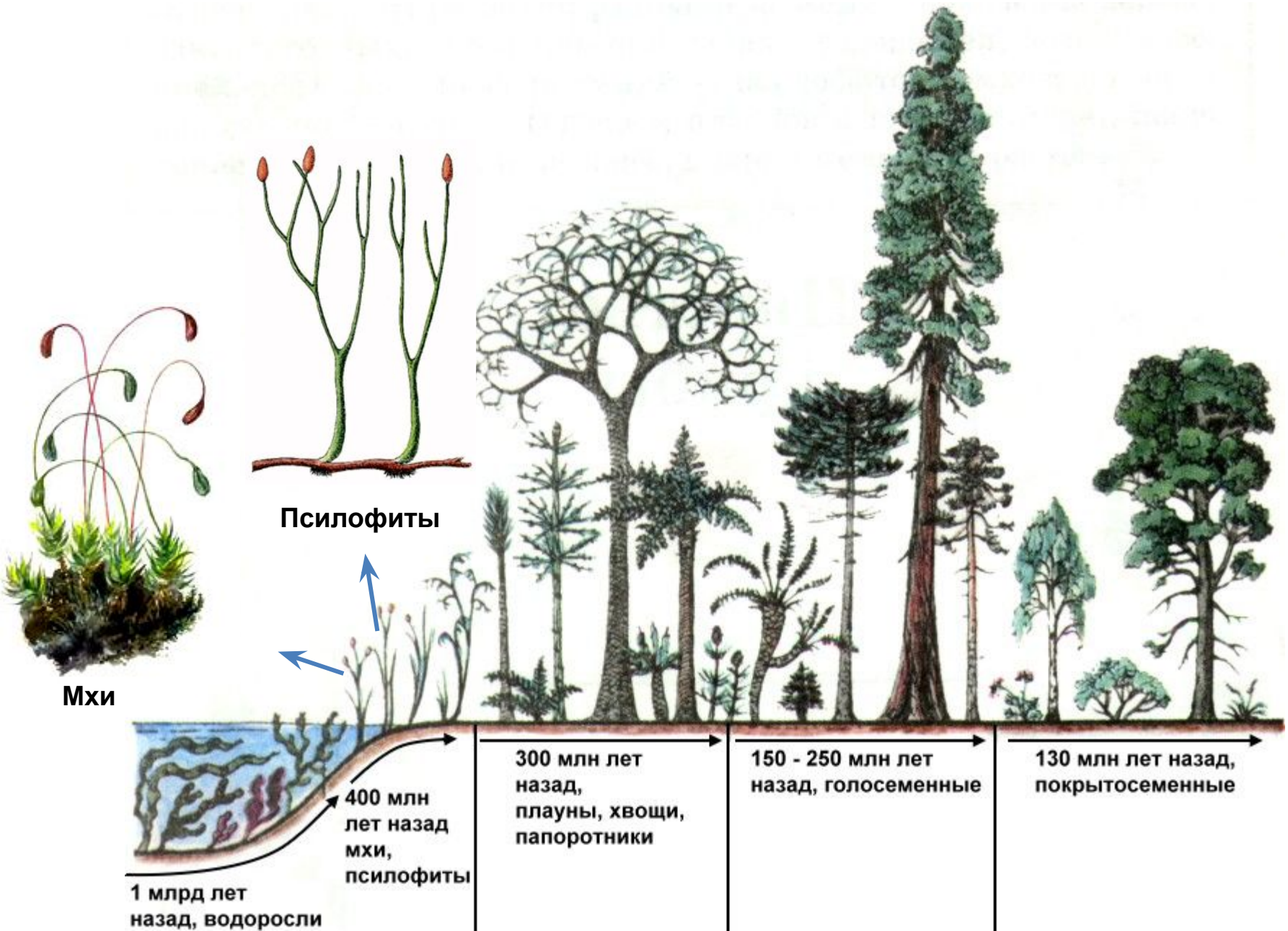
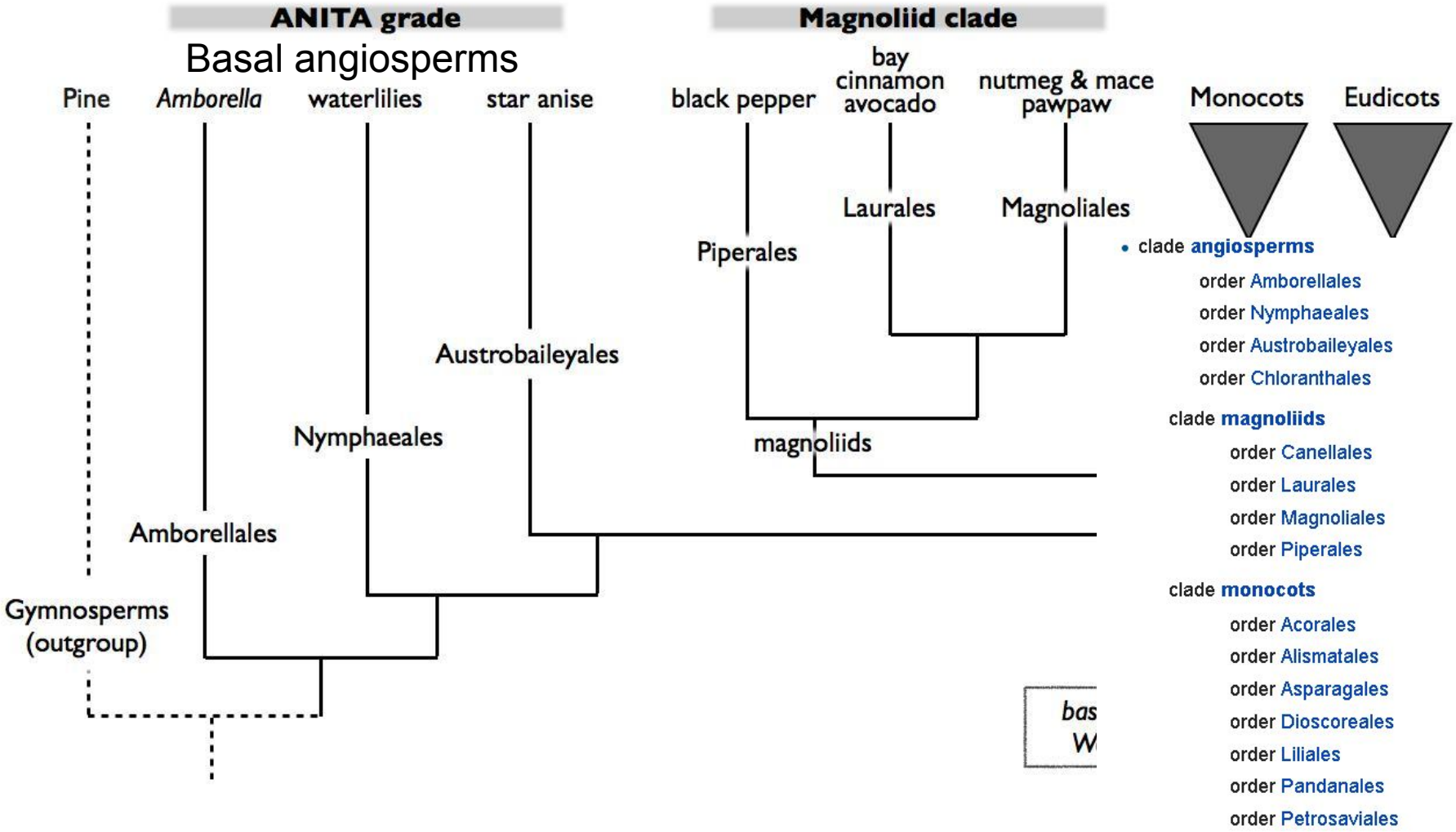
Scientific classification

Kingdom:	Plantae
(unranked):	Embryophyta
(unranked):	Tracheophyta
(unranked):	**Spermatophyta**

Divisions

- Cycadophyta
- Ginkgophyta
- Pinophyta
- Gnetophyta
- Angiospermae
- Pteridospermatophyta†

Основные этапы развития наземных растений



Core angiosperms