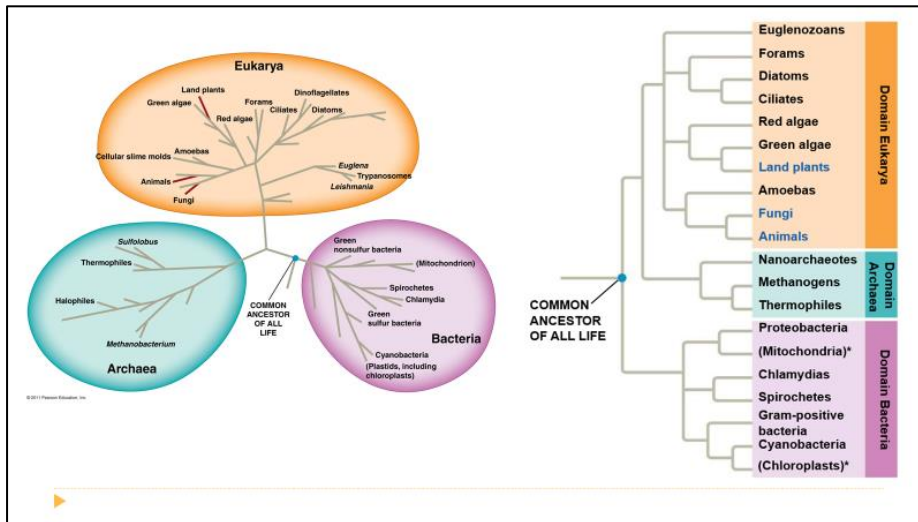
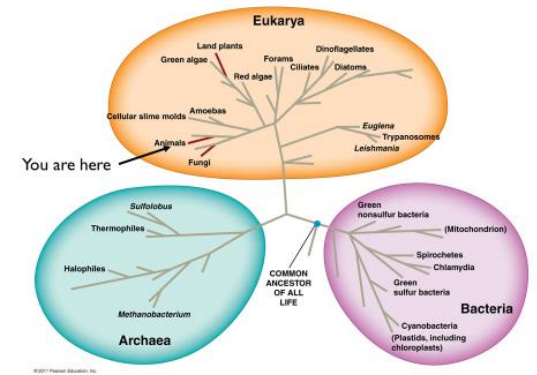


“The man who asks a question is a fool for a minute, the man who does not ask is a fool for life.”
— Confucius

Intro to Life, Protists and Fungi

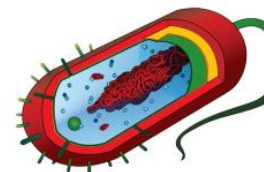
Domains of Life

- ▶ **Bacteria**
 - ▶ Unicellular prokaryotes
- ▶ **Archaea**
 - ▶ Unicellular prokaryotes
 - ▶ Extremophiles
- ▶ **Eukarya**
 - ▶ Unicellular and multicellular eukaryotes
 - ▶ Protists
 - ▶ Fungi
 - ▶ Plants
 - ▶ Animals



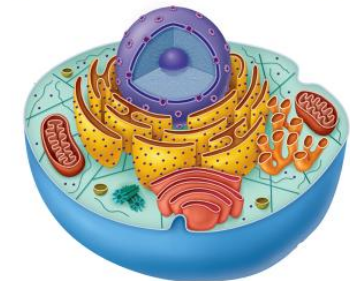
Two Main Groups of Cells

Prokaryotic
(Bacteria and Archaea)

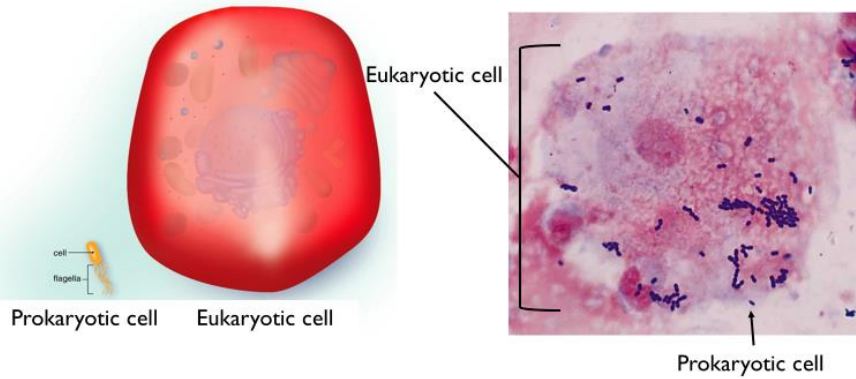


*Not to scale

Eukaryotic
(Protists, Plants, Animals and Fungi)



Prokaryotic and Eukaryotic Cells



Domain: Bacteria

- ▶ Prokaryotic cells
- ▶ No membrane bound nucleus or organelles
- ▶ Single-celled organisms
- ▶ Asexual reproduction
- ▶ _____ in cell wall separates bacteria from archaea



Bacteria: Cyanobacteria

Autotrophic bacteria: obtain food energy through photosynthesis.

- ▶ 1st photosynthetic organisms on Earth
 - ▶ Increased oxygen in atmosphere
 - ▶ Accounts for most primary production in open oceans
 - ▶ Likely evolved into chloroplast in eukaryotic cells
- ▶ Only organism that can _____ (product of photosynthesis)



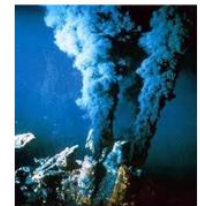
Oscillatoria



Domain: Archaea

Prokaryotic cell but similar to Eukaryotes in DNA replication and protein synthesis

- ▶ More closely related to _____
- _____: organisms that live grow best in one or more conditions that would kill most organisms
 - ▶ **Thermophiles:** live in extremely hot environments
 - ▶ **Halophiles:** live in extremely salty environments
 - ▶ **Methanogens:** Methane releasing archaea that are poisoned by oxygen



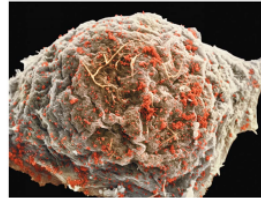
A Borrowed Life

Virus: an infectious particle incapable of replicating outside of a cell, which consists of an RNA or DNA genome enclosed in a protein coat (capsid)

▶ _____ parasites

Arguments for describing viruses as non-living

- ▶ Can not _____ outside of host cell
- ▶ Can not carry out metabolic processes outside of outside of host cell



HIV attacking a white blood cell

Prokaryotic Cell Structure

FOUR STRUCTURES IN ALL PROKARYOTES

PLASMA MEMBRANE

Encloses cell contents: DNA, ribosomes, and cytoplasm

CYTOPLASM

Jelly-like fluid inside cell

DNA

One or more circular loops containing genetic information

RIBOSOMES

Proteins in the cytoplasm that convert genetic information into protein structure

ADDITIONAL STRUCTURES

CELL WALL

Protects and gives shape to the cell

CAPSULE

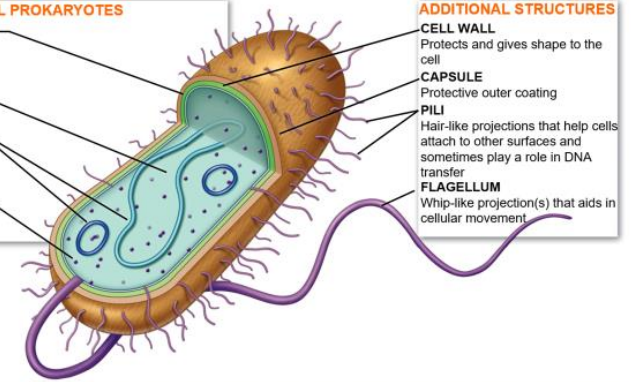
Protective outer coating

PILI

Hair-like projections that help cells attach to other surfaces and sometimes play a role in DNA transfer

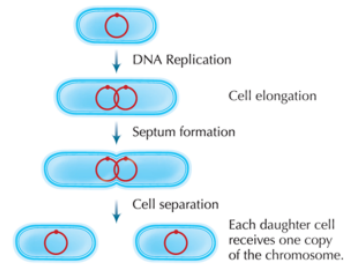
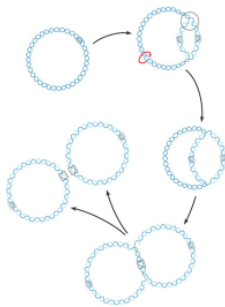
FLAGELLUM

Whip-like projection(s) that aids in cellular movement

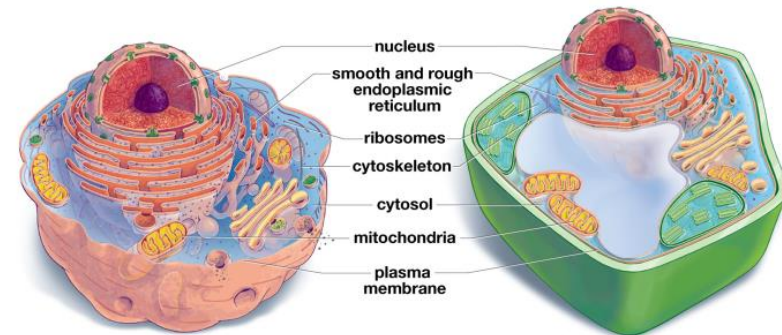


Prokaryotic Reproduction

_____ : DNA replicates and then the cell divides into two separate cells



Eukaryotic Cell Structure



Animal cell

Plant cell

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Prokaryotic and Eukaryotic Cells

Characteristics	Prokaryotic Cells	Eukaryotic Cells
Cell Size	Small (0.2 – 2.0 μm in diameter)	Large (10 – 100 μm in diameter)
Organization	Always single celled	Often _____
Nucleus	_____	Membrane bound nucleus
Membrane-enclosed organelles	Absent	Present (e.g. lysosomes, Golgi complex, mitochondria)
Chromosomes (DNA)	Usually _____ chromosome	_____ chromosomes
Cell division	Binary fission	Involves mitosis
Sexual Recombination	None, transfer of DNA only	Involves meiosis



Check Your Understanding

Which of the following are **not** one of the characteristics of bacteria?

- Cell wall containing peptidoglycan
- Contain a membrane bound nucleus
- Asexual reproduction
- Single-cell organisms
- More than one of the above



Check Your Understanding

Archaea that thrive in extremely hot environments are known as _____.

- Halophiles
- Heatophiles
- Methanogens
- Feugophiles
- Thermophiles



Domain: Eukarya, Kingdom: “Protista”

Protists: similar appearing but diverse phyla that are not related through an exclusive common ancestor, which have different life cycles, trophic levels, modes of locomotion and cellular structures.

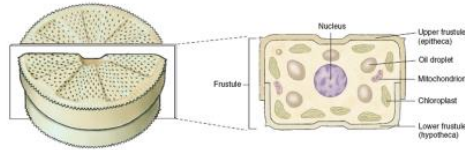
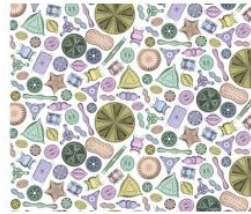
- ▶ Under constant debate and revision
- ▶ Eukaryotic organisms that are not plants, animals, or fungi
- ▶ Most are unicellular
- ▶ Without _____
- ▶ First eukaryotes arose ~1.5 bya
- ▶ Photosynthetic plant-like protists (algae) and heterotrophic animal-like protists



Kingdom: Protista

Diatoms

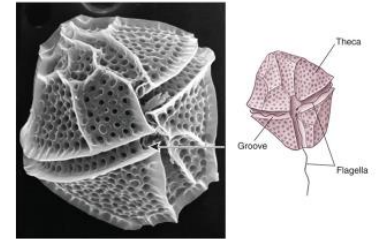
- ▶ Planktonic
- ▶ Unicellular, but often form chains
- ▶ Cell walls made of silica (glass-like material) called frustule
 - ▶ Diatomaceous earth
- ▶ Carotenoids (yellow and brown pigments)
- ▶ Important primary producers



Kingdom: Protista

Dinoflagellates

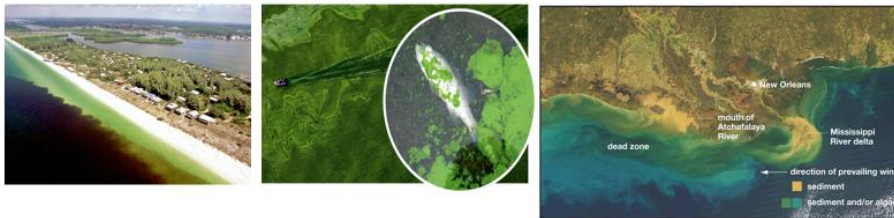
- ▶ Planktonic
- ▶ Unicellular
- ▶ Many are mixotrophic
 - ▶ **Mixotroph:** organisms that perform photosynthesis but are also heterotrophic
- ▶ Cell wall made of cellulose plates
- ▶ Two flagella
- ▶ Some are bioluminescent
- ▶ Algal blooms (red tides)
- ▶ Domoic acid



Algal Blooms

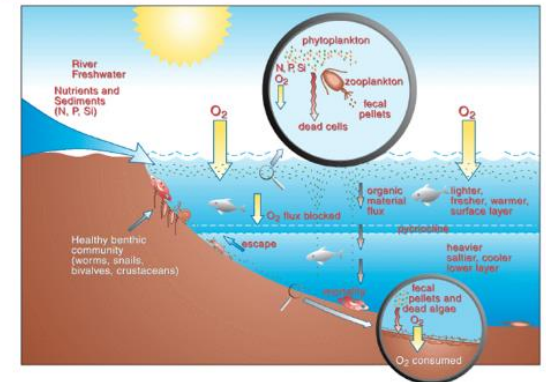
_____ : excessive richness of nutrients in a body of water, frequently due to runoff from agricultural areas on land

- ▶ Can cause algal blooms, which is the dense growth of algae and bacteria that can result in _____ where animals die from lack of oxygen (hypoxia).



What Causes Dead Zones?

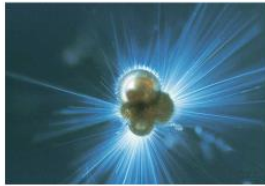
1. During the summer months nutrient rich runoff from land enters the oceans resulting in eutrophication
2. Eutrophication along with abundant solar energy leads to massive algal blooms
3. Dead algae sink to the bottom where bacteria aid in decomposition
4. Heterotrophic bacteria deplete oxygen available to other organisms forming a hypoxic environment



Kingdom: Protista

Foraminiferans

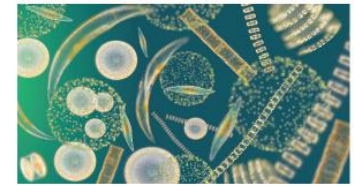
- ▶ Porous, _____ tests (shells)
 - ▶ *Foramen* (little hole), *ferre* (to bear)
- ▶ Thin pseudopodia (false feet) capture food
- ▶ Marine and freshwater
 - ▶ Most are benthic (live on the bottom)
- ▶ Fossilized forams = limestone rock
- ▶ Chemical markers in tests used to determine previous climates



Plankton

Plankton: aquatic organisms that are unable to swim against the current

- ▶ **Phytoplankton:** photosynthetic planktonic organisms
- ▶ **Zooplankton:** heterotrophic planktonic organisms



Multicellular Primary Producers

Macroalgae (seaweeds): multicellular, photosynthetic organisms that lack true tissue, leaves, stems, and roots.

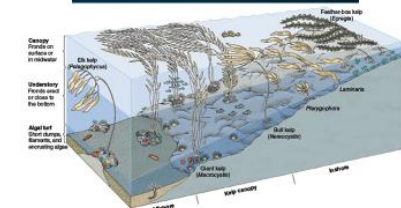
- ▶ Classification depends on photosynthetic pigments
 - ▶ Green, red, and brown seaweeds
- ▶ Wide range of growth forms



Kelp Forest Communities

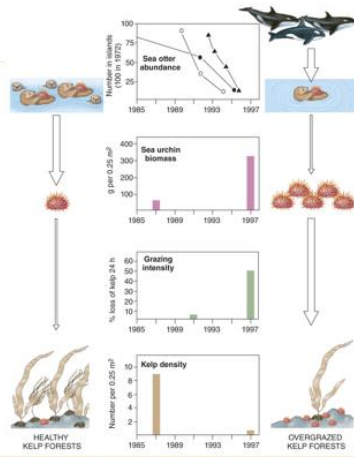
Kelp Forests

- ▶ Dense forests of fast-growing brown algae
- ▶ Different species of brown algae grow best at different depths
- ▶ Found in temperate and subpolar regions
- ▶ Important food source and shelter for many organisms



Kelp Forest Ecology

- ▶ A decline in seal and sea lion populations has led to more sea otters being eaten by killer whales
- ▶ A decline in sea otters has led to an increase in sea urchins
- ▶ An increase in sea urchins has led to an increase in sea urchin grazing intensity on the kelp
- ▶ Increased grazing by sea urchins has led to a decline in healthy kelp forests



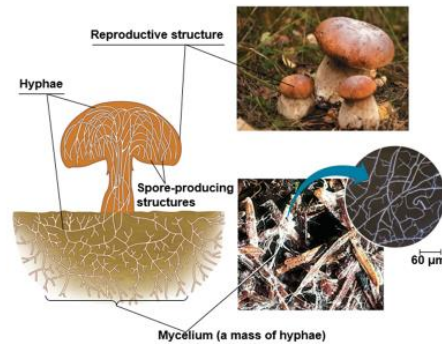
Kingdom Fungi

- ▶ _____ eukaryotes that _____ nutrients from environment
- ▶ Mostly multicellular
 - ▶ Yeast = unicellular
- ▶ Decomposers, parasites or mutualists
 - ▶ Excess sugar stored as _____
 - ▶ Similar to animals
- ▶ Primarily terrestrial



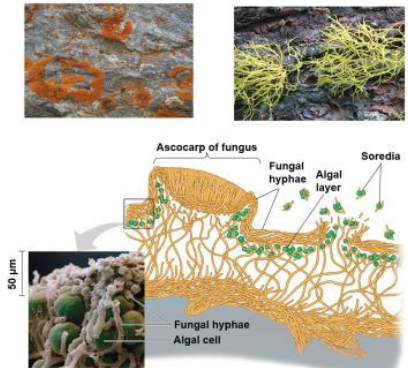
Fungi Anatomy

- ▶ Multicellular or single celled (yeasts)
- ▶ _____: long, thread-like filamentous structure that forms the main vegetative growth of fungi
 - ▶ Tubular cell walls strengthened by chitin
 - ▶ Fast growing
- ▶ _____: the interwoven mass of hyphae
- ▶ Above ground parts produce spores



Lichen

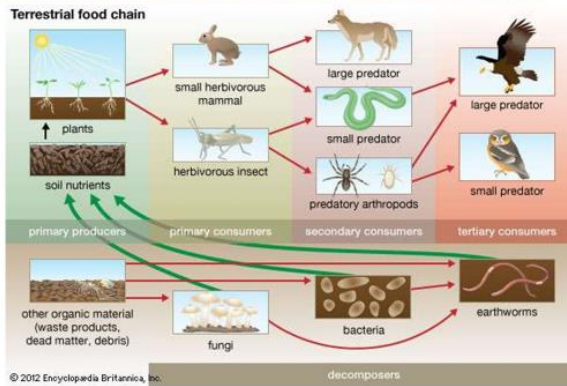
- ▶ Symbiotic association between a _____ microorganism and a fungus
 - ▶ Photosynthetic organism (cyanobacteria or green algae) provides carbon compounds
 - ▶ Fungi provided environment suitable for growth



Importance of Fungi

Fungi are important decomposers in terrestrial ecosystems.

- ▶ Break down organic material and return nutrients to the soil, which are then taken up by plants
- ▶ Nutrient cycling



Ecological Impacts and Uses of Fungi

- ▶ Important decomposers
 - ▶ Nutrient recycling
- ▶ Mutualistic relationships
 - ▶ Lichen
 - ▶ Mycorrhizae
- ▶ Parasitic pests (30% of all fungi)
 - ▶ Chestnut blight
 - ▶ _____: fungal infection in animals
 - ▶ Chytridiomycosis caused by *B. dendrobatidis*
 - ▶ Athletes foot and ring worm
- ▶ Yeasts = booze and bread. Yay!
- ▶ Antibiotics
 - ▶ Penicillin