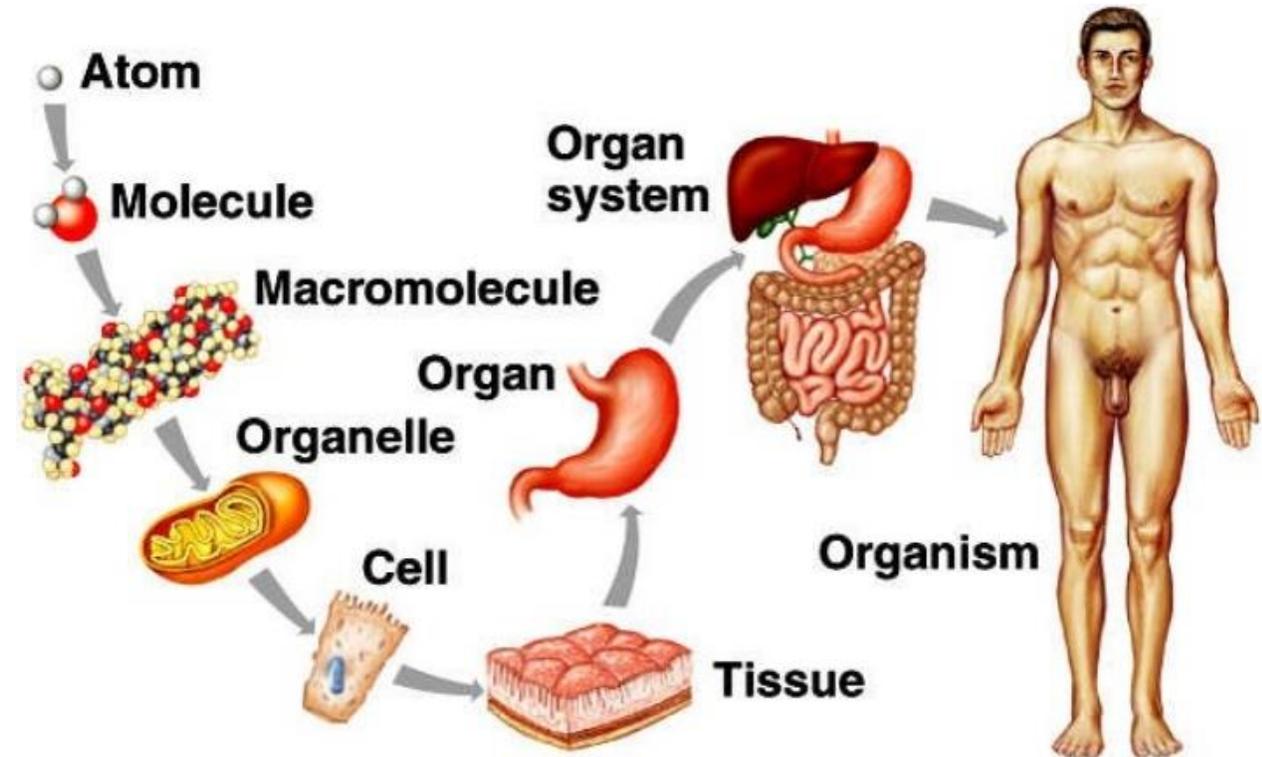
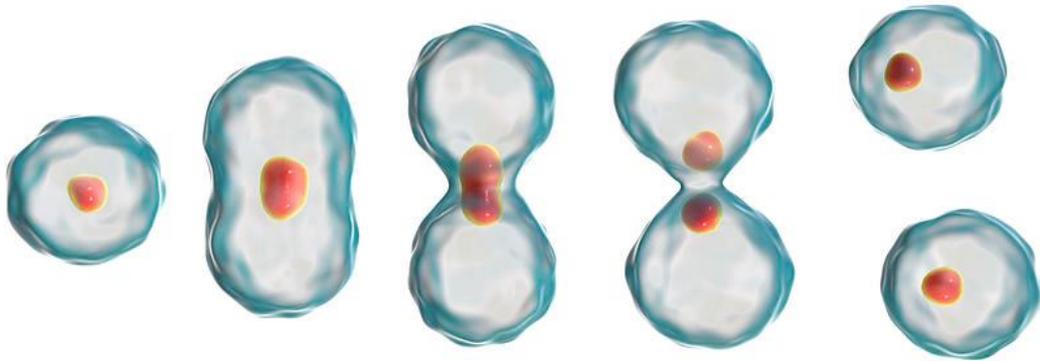


The Cell, Plankton, and Microscopes

Lab 1

Cell Theory

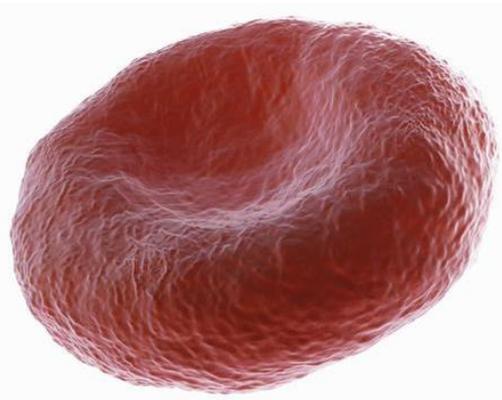
- ▶ All living organisms are composed of cells
 - ▶ Unicellular or multicellular
- ▶ Cells come from existing cells



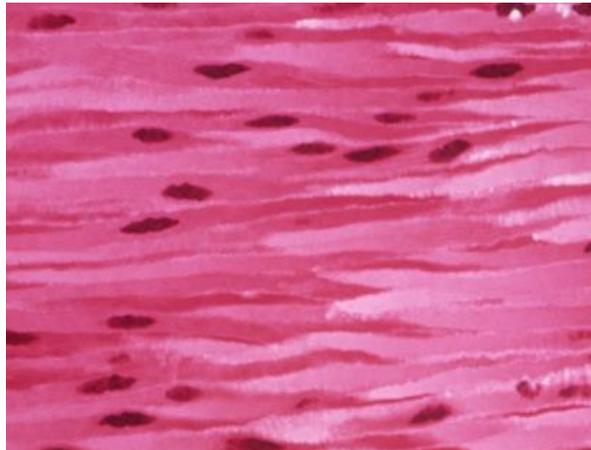
Cells are Specialized

- ▶ Over 200 different cells in the human body
- ▶ You are made of trillions of cells!!

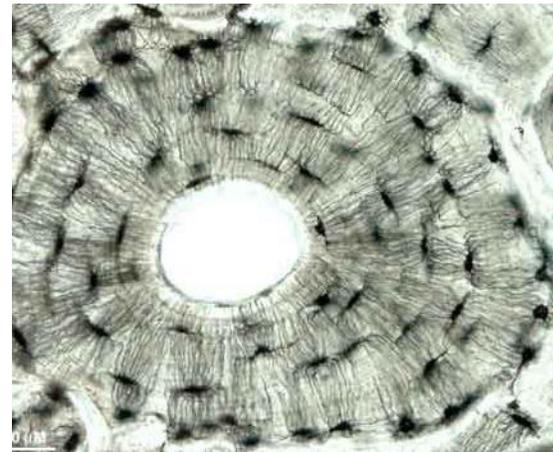
Reproductive cells



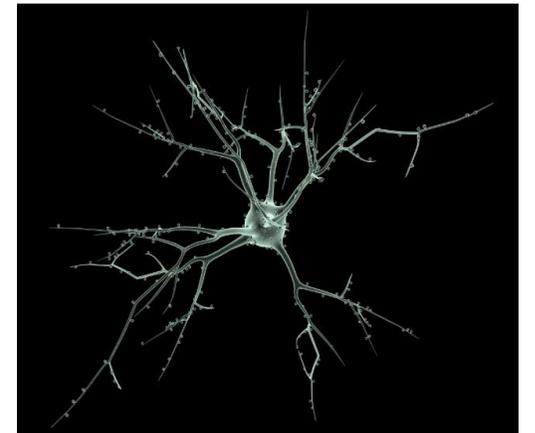
Red blood cell



Cardiac muscle cells



Bone cells



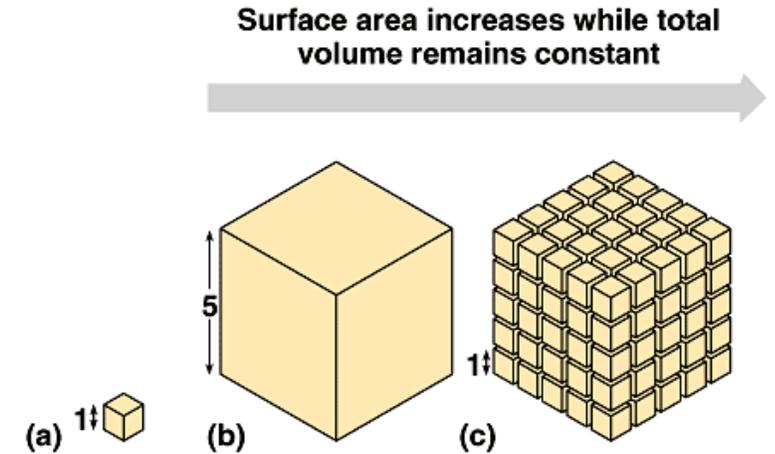
Nerve cell



Why so small?

Surface area to volume ratio!

- ▶ Greater surface area means greater efficiency
 - ▶ Transporting stuff into and out of the cell

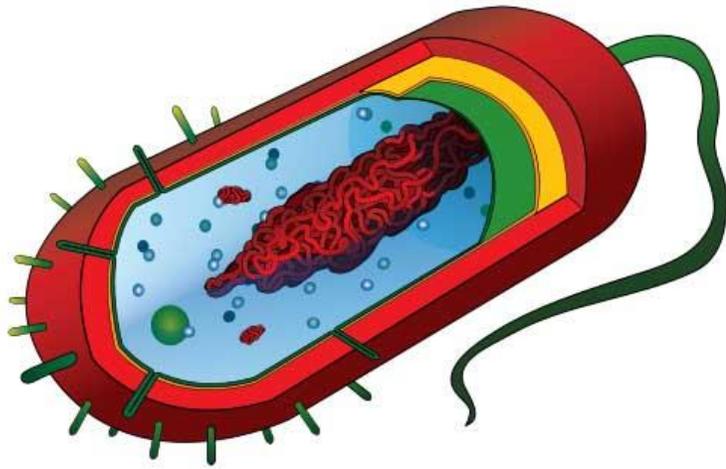


Total surface area (height × width × number of sides × number of boxes)	6	150	750
Total volume (height × width × length × number of boxes)	1	125	125
Surface-to-volume ratio (area ÷ volume)	6	1.2	6

Two Main Groups of Cells

Prokaryotic

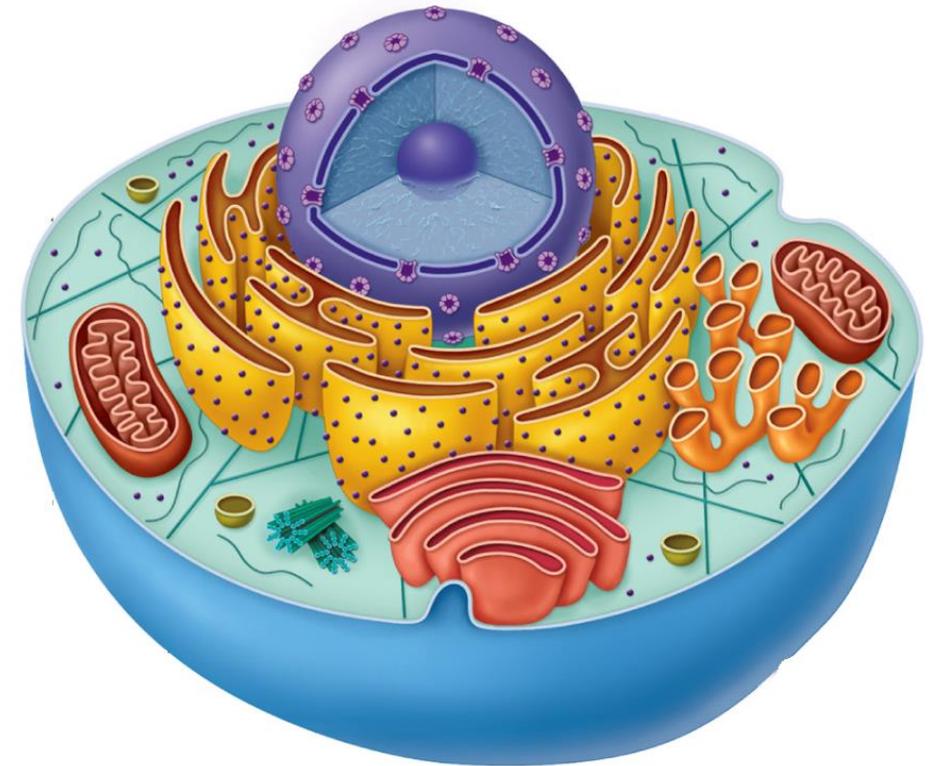
(Bacteria and Archaea)



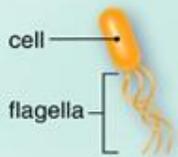
*Not to scale

Eukaryotic

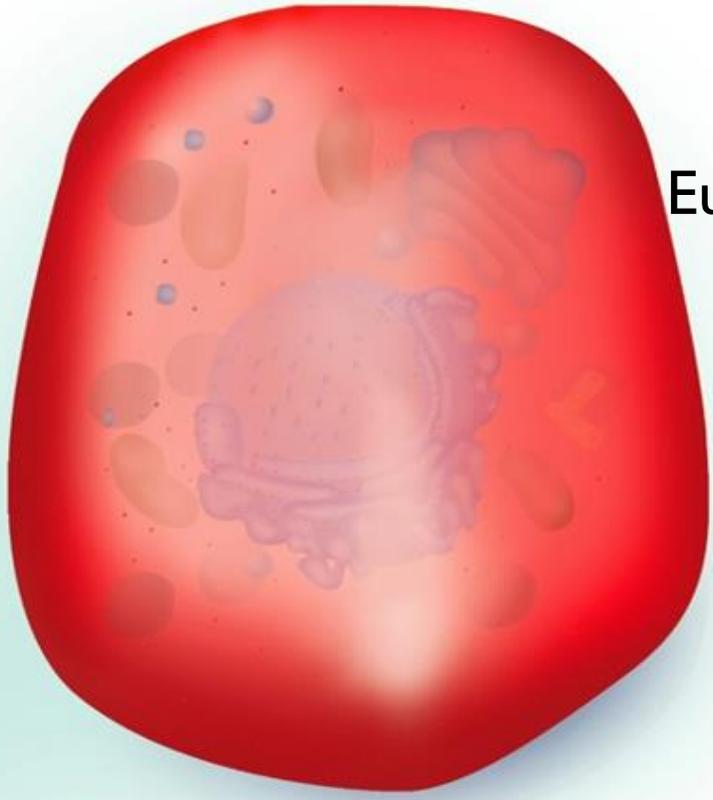
(Protists, Plants, Animals and Fungi)



Prokaryotic and Eukaryotic Cells

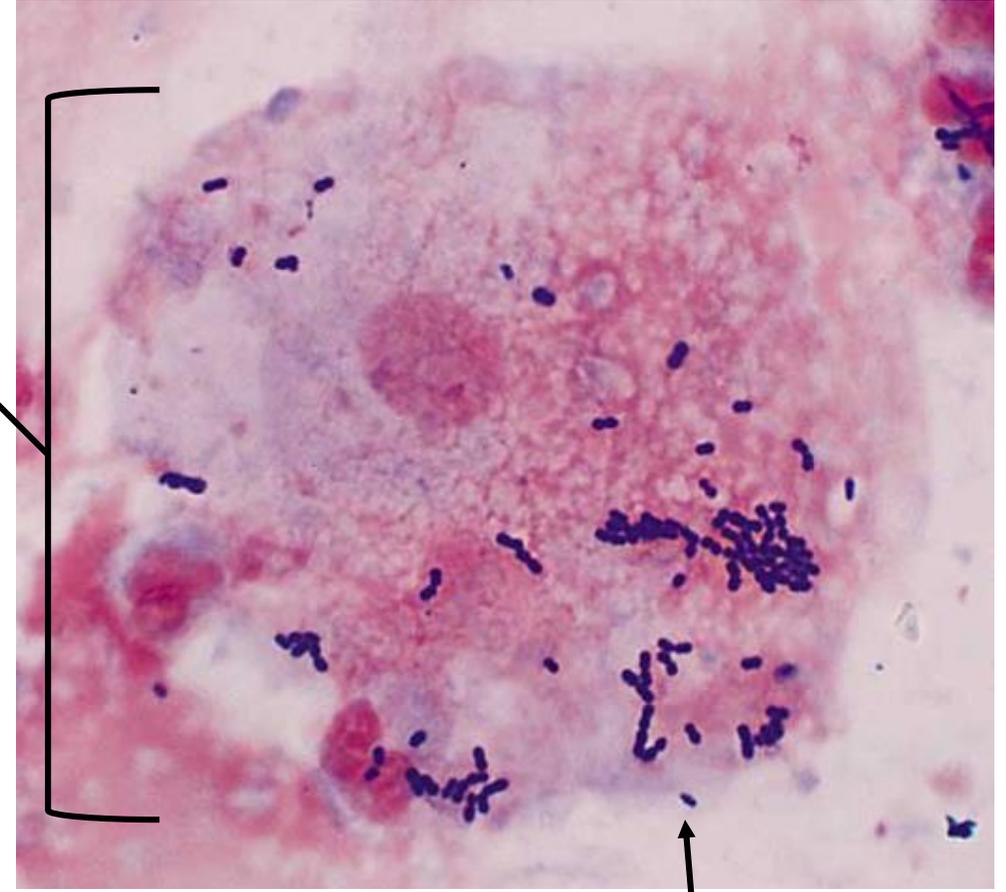


Prokaryotic cell



Eukaryotic cell

Eukaryotic cell

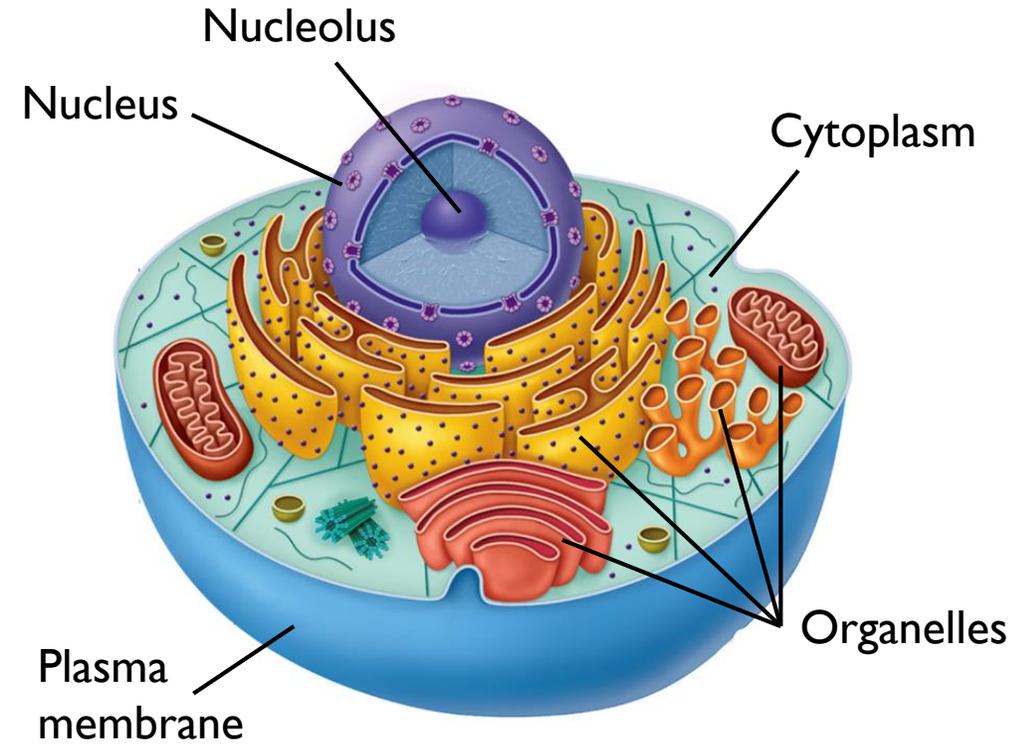


Prokaryotic cell



Major Components of Eukaryotic Cells

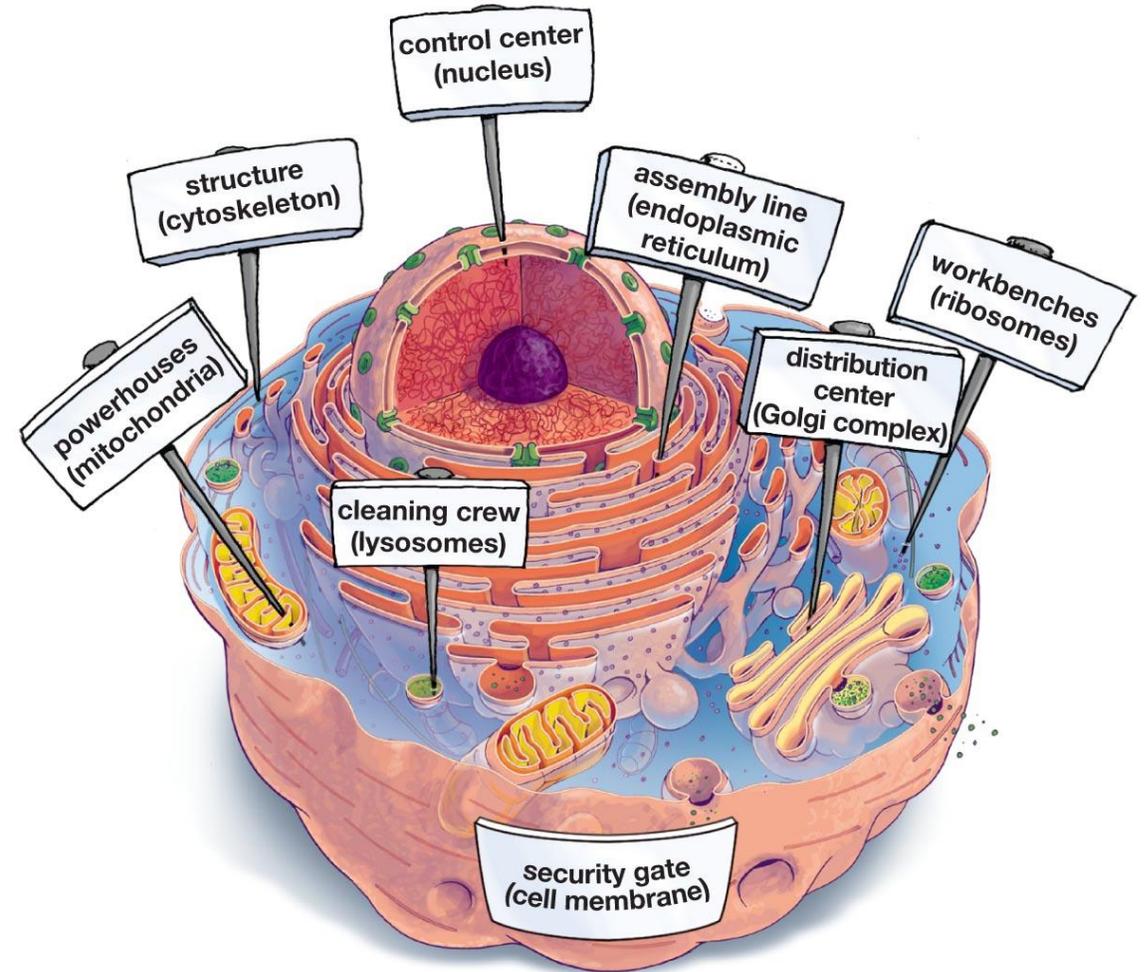
- ▶ **Nucleus:** membrane bound region that contains the cell's DNA. The **nucleolus** is where protein making organelles (Ribosomes) are made
- ▶ **Organelles:** highly organized structure in the cell that performs a specific cellular function
- ▶ **Plasma membrane:** a complex, two-layered membrane that encloses the cytoplasm and regulate passage of ions and molecules into and out of the cell
- ▶ **Cytoplasm:** protein rich, jelly-like fluid between the nucleus and the plasma membrane in which the organelles are immersed



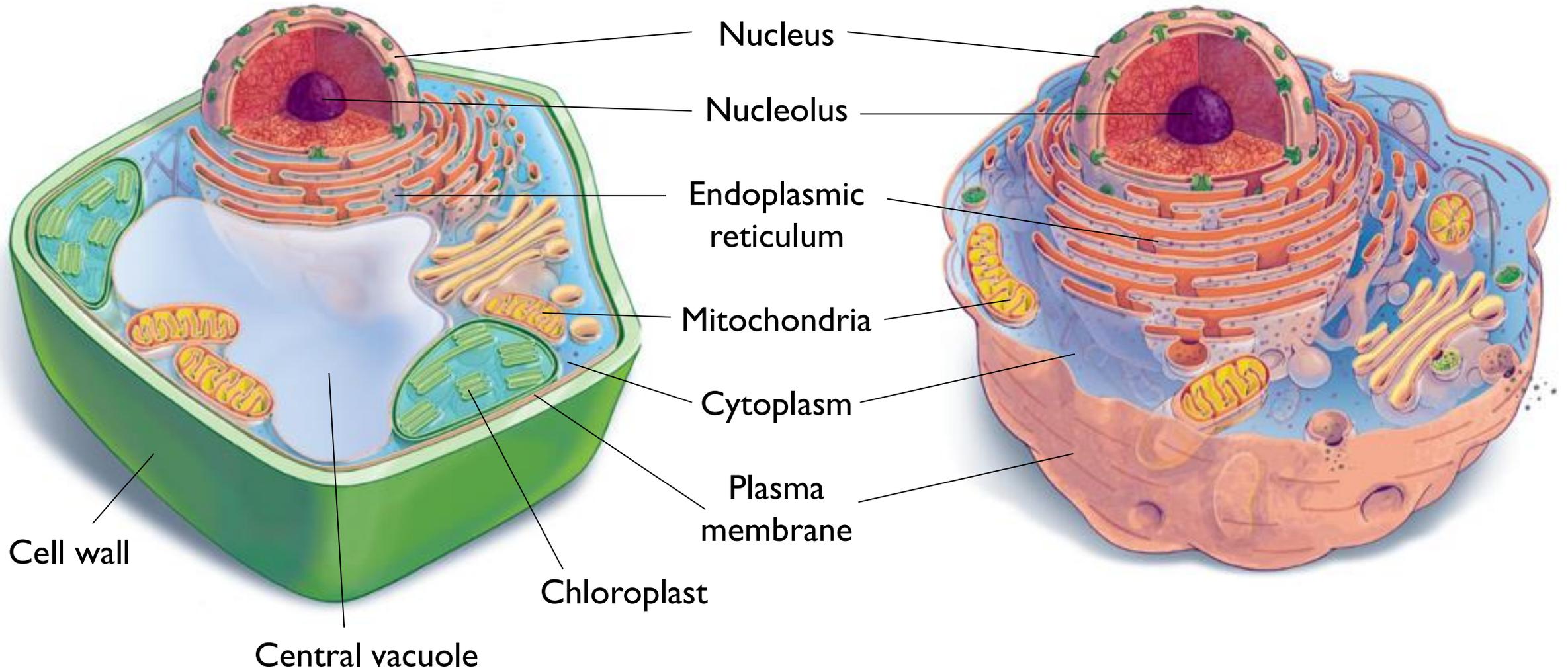
Major Components of Eukaryotic Cells

Eukaryotic cells contain organelles which allow for larger cell size through compartmentalization.

- ▶ Increased efficiency
- ▶ Separation of chemical reactions



Plant and Animal Cells

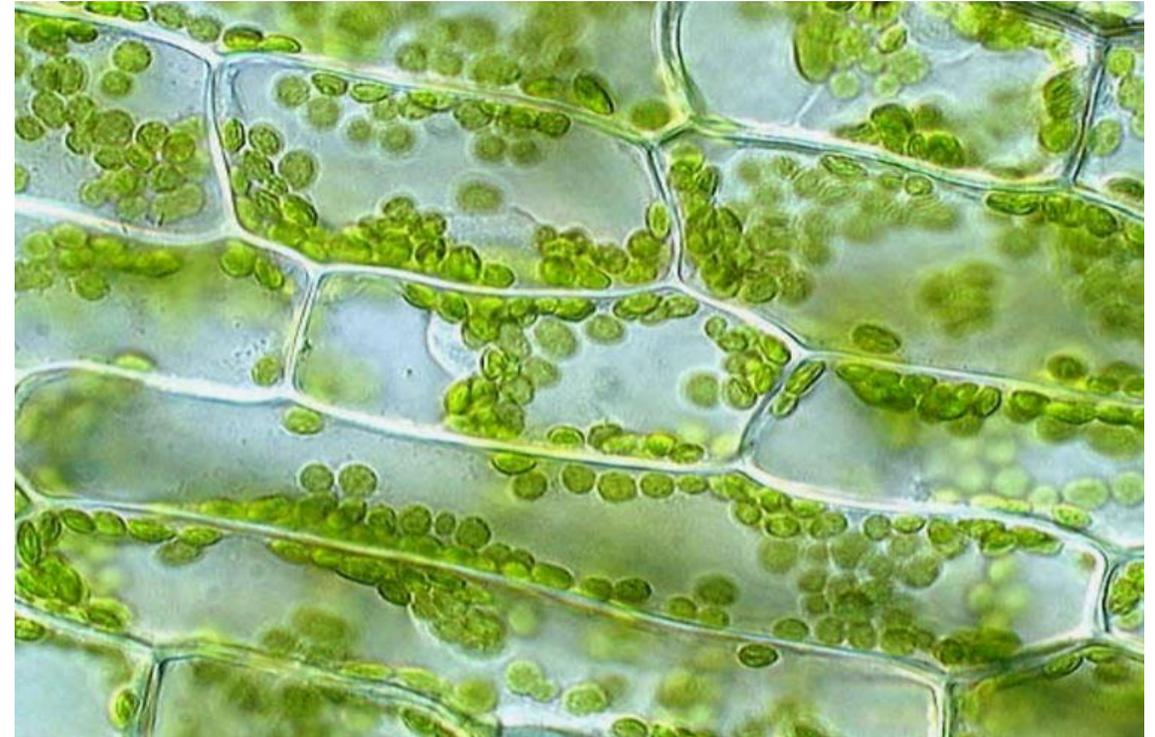


Plant and Animal Cells

Human cheek cell



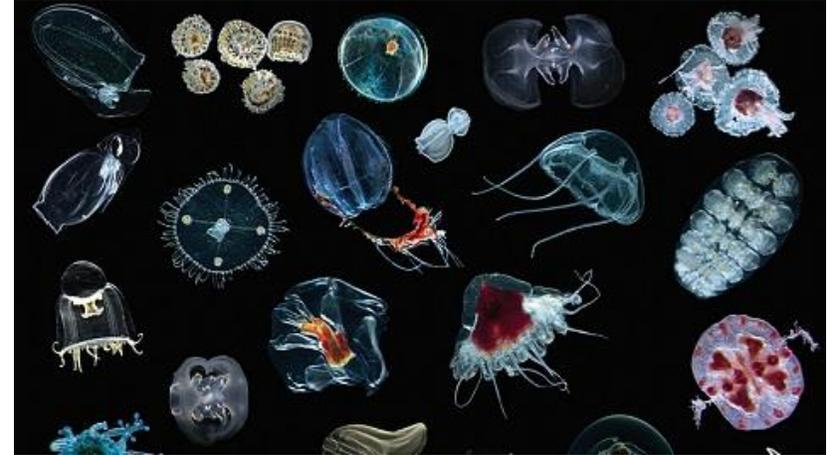
Plant cell (Elodea)



Plankton versus Nekton

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

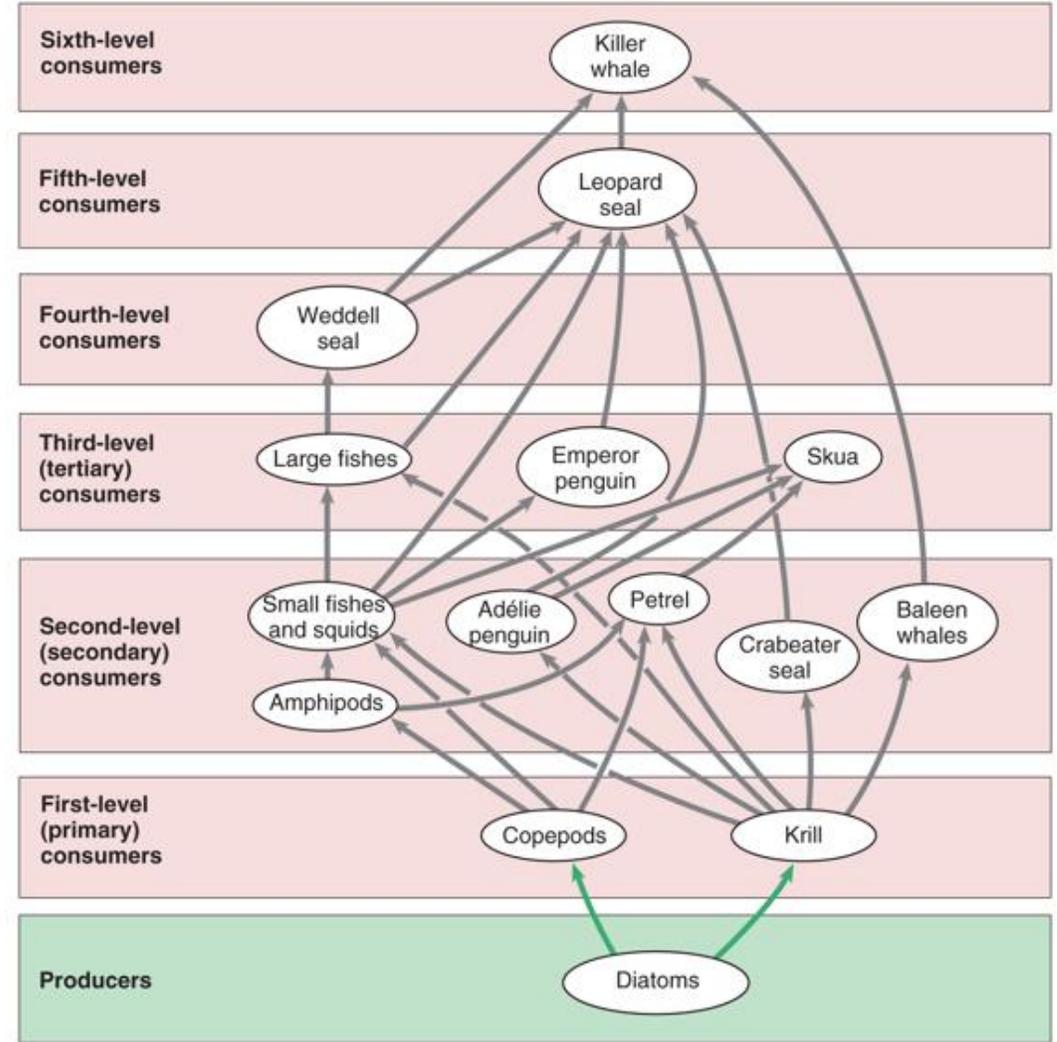
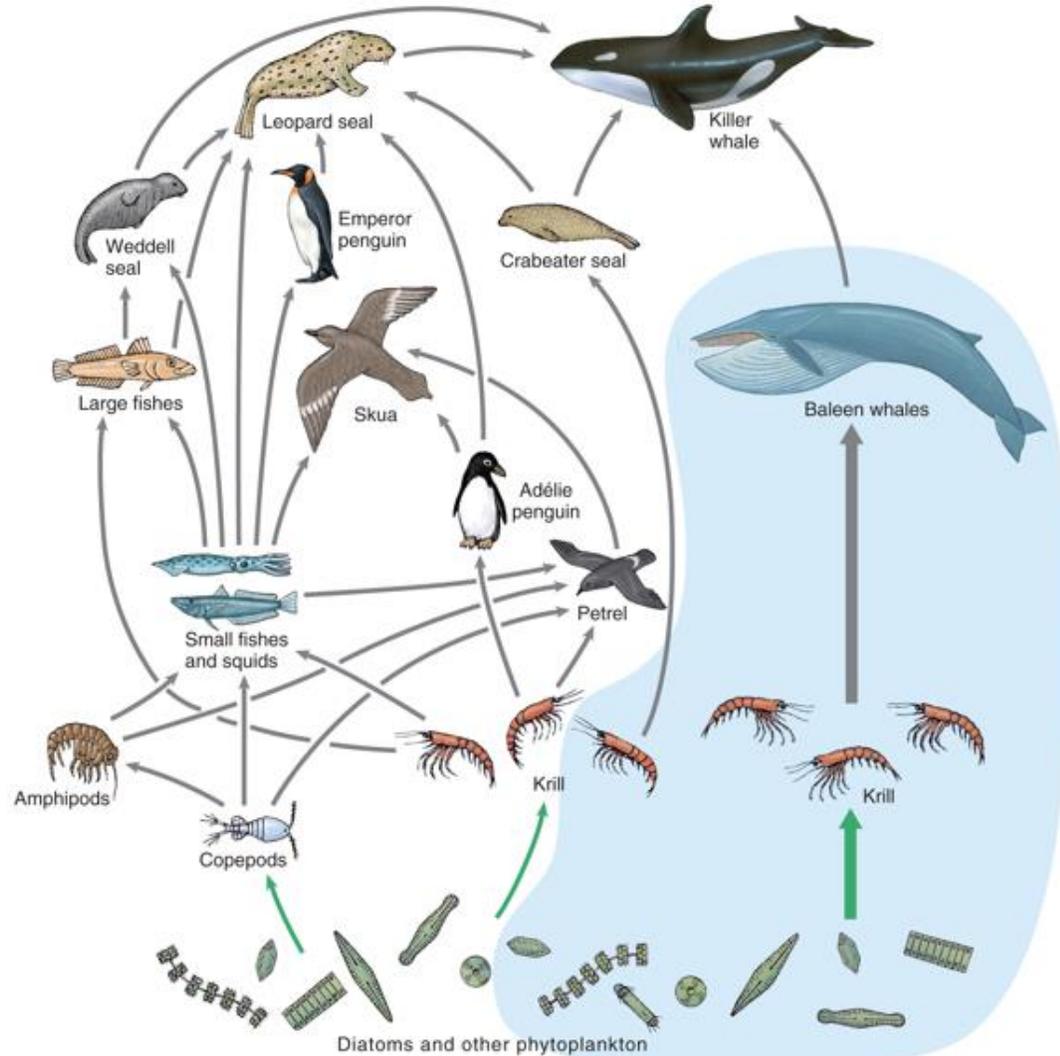
- ▶ **Phytoplankton:** photosynthetic planktonic organisms
- ▶ **Zooplankton:** heterotrophic planktonic organisms



Nekton: actively swimming organisms that can swim against the current



Trophic Levels



Trophic Levels

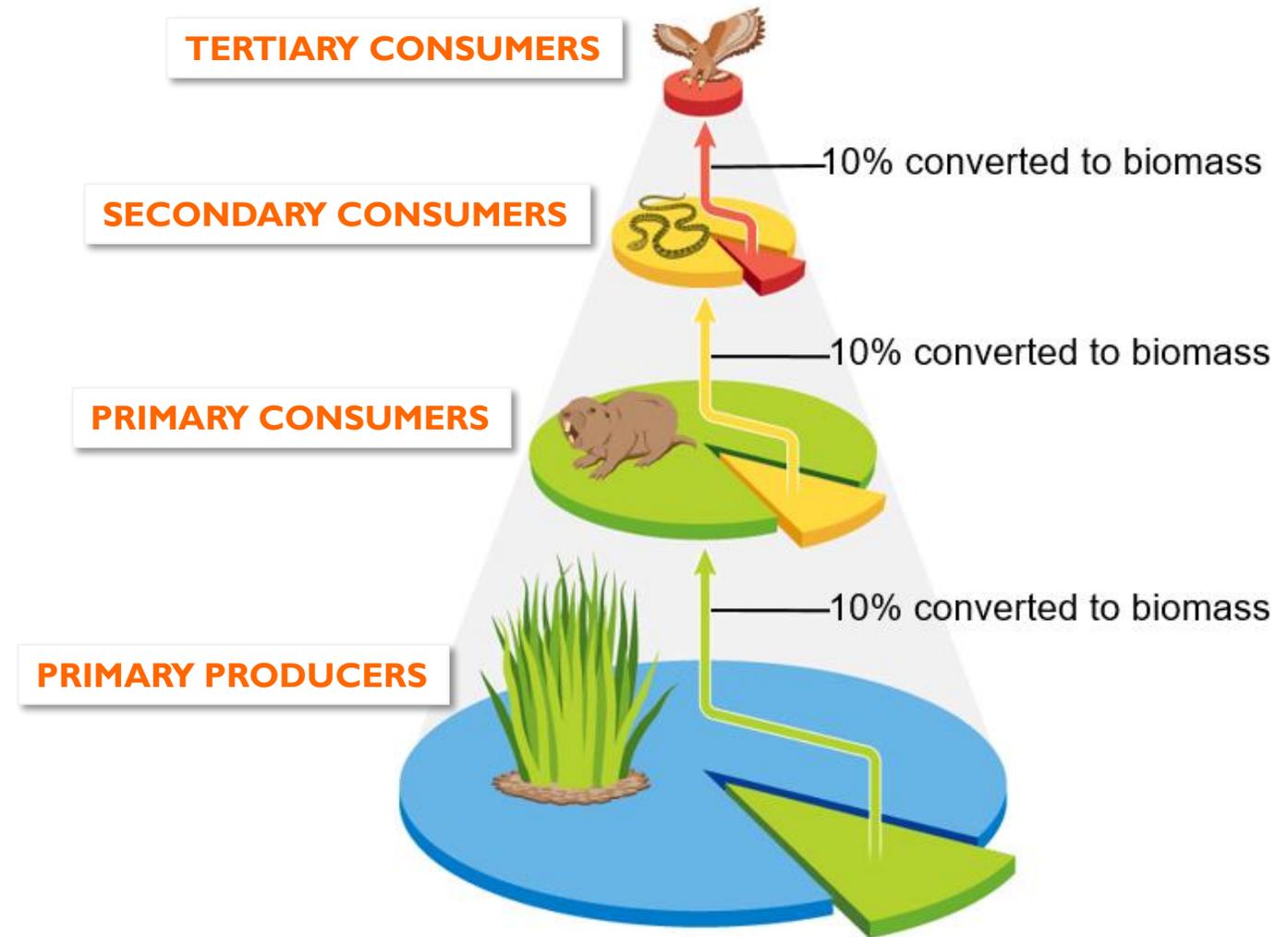
Tertiary consumers: carnivores that eat other carnivores

Secondary consumers: carnivores are animals that eat herbivores

Primary consumers: herbivores are animals that eat plants

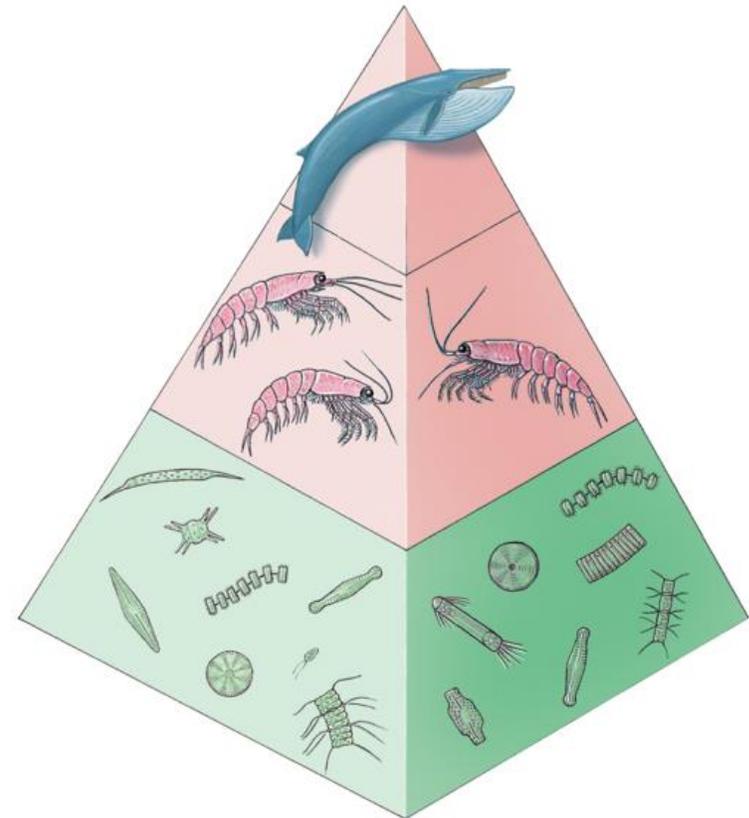
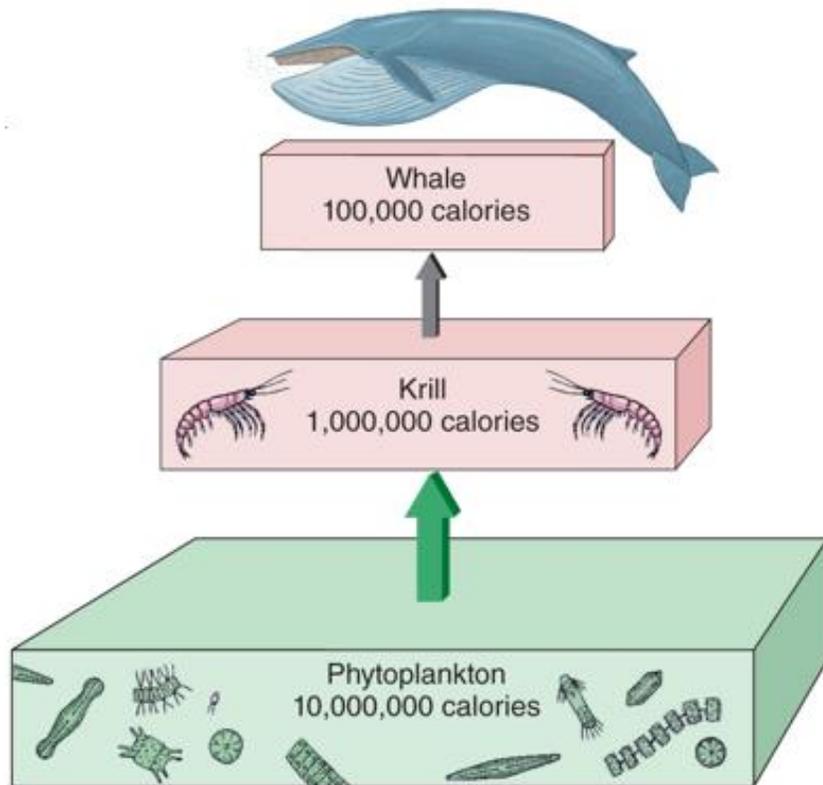
Primary producers: autotrophs (algae) that convert solar energy to chemical energy

- ▶ Only about 10% of the biomass from one trophic level is converted to biomass in the next trophic level

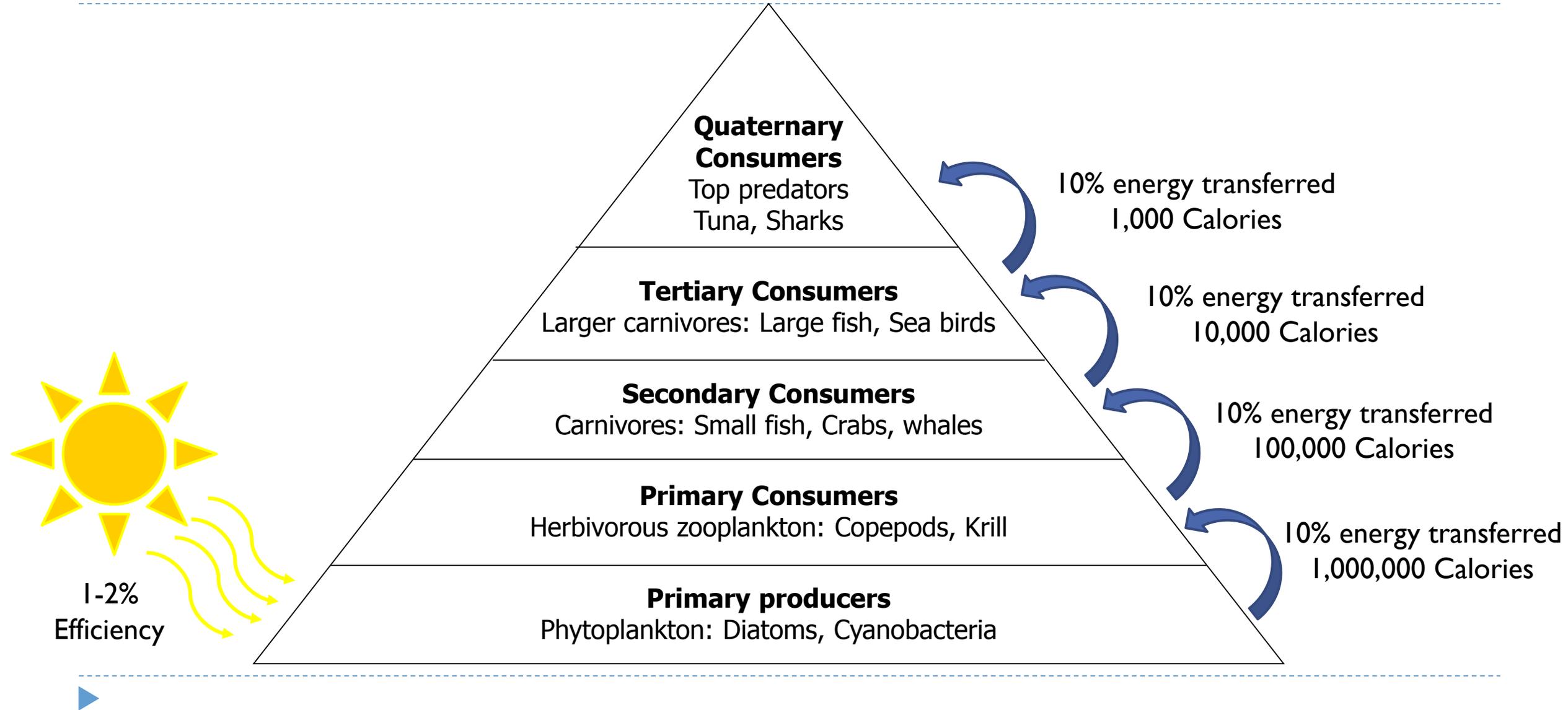


Trophic Levels

- ▶ Only about 10% of the biomass from one trophic level is converted to biomass in the next trophic level, which results in fewer top predators

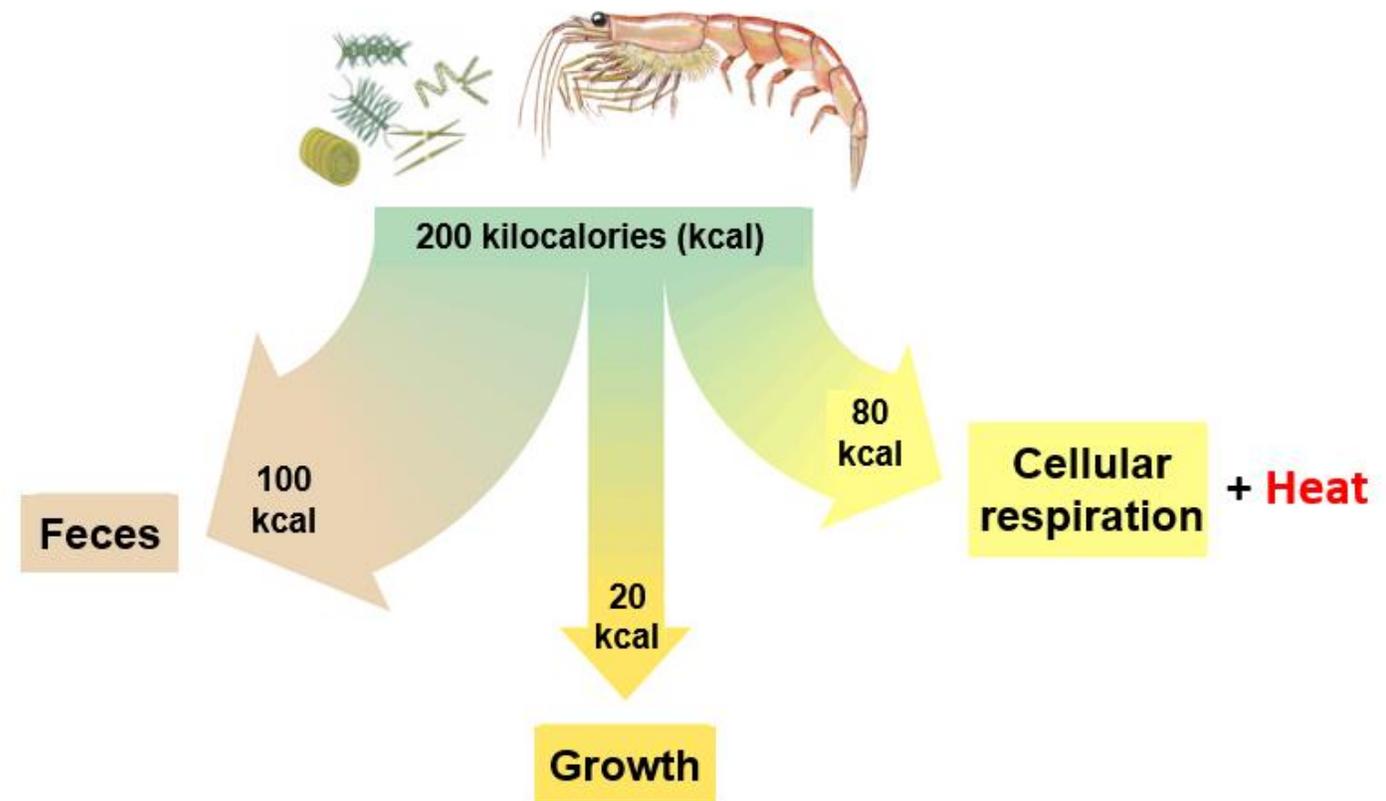


Marine Trophic Levels



Energy Transfer Between Trophic Levels

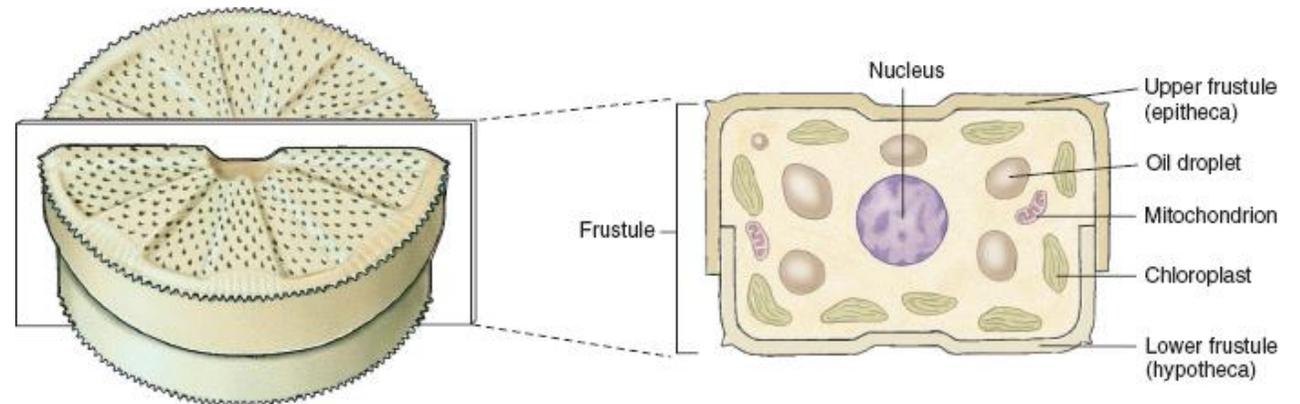
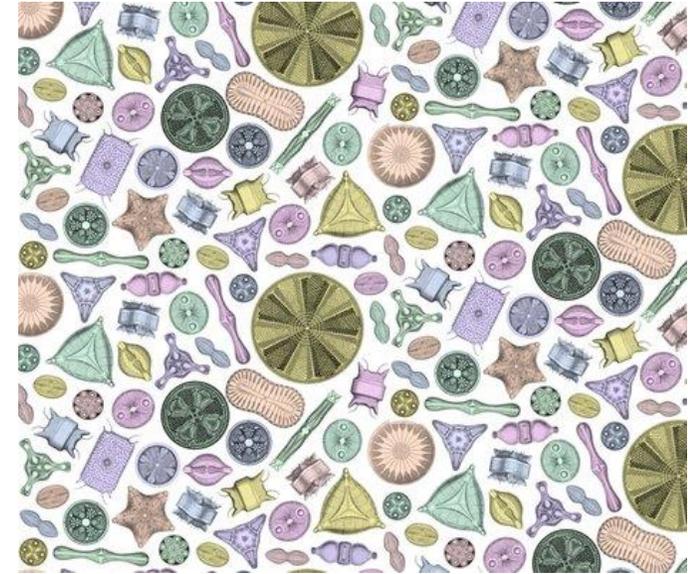
- ▶ Most energy consumed is lost as waste or is used in cellular respiration and is lost as heat.
- ▶ Only about 10% of consumed energy goes toward growth (stored energy), which can then be passed on to the next trophic level
- ▶ Less energy available at higher trophic levels



Phytoplankton

Diatoms

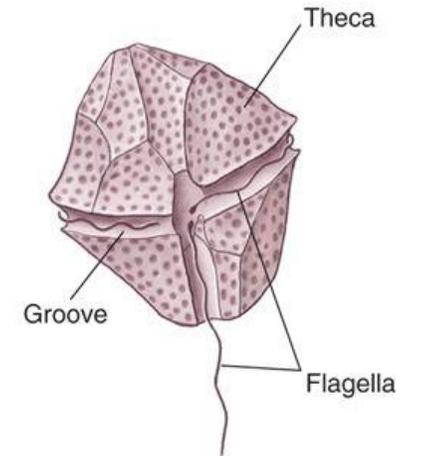
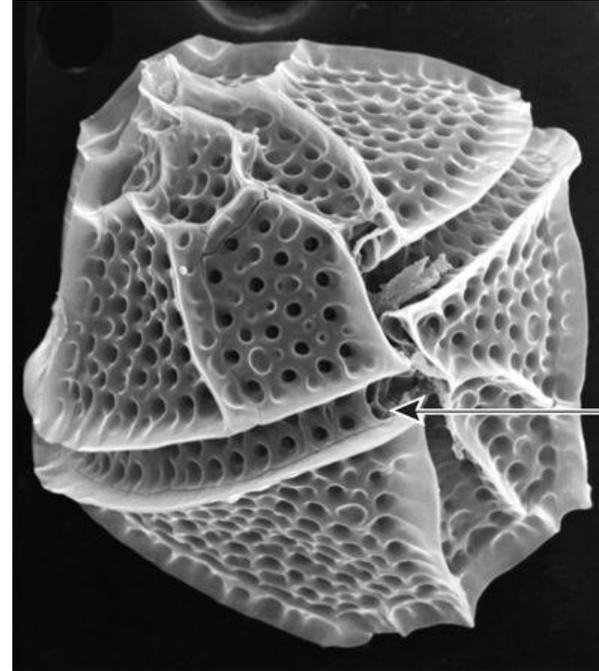
- ▶ Planktonic
- ▶ Unicellular, but often form chains
- ▶ Cell walls made of silica (glass-like material) called frustule
 - ▶ Diatomaceous earth
- ▶ Carotenoids (yellow and brown pigments)
- ▶ Important primary producers



Phytoplankton (and Zooplankton)

Dinoflagellates

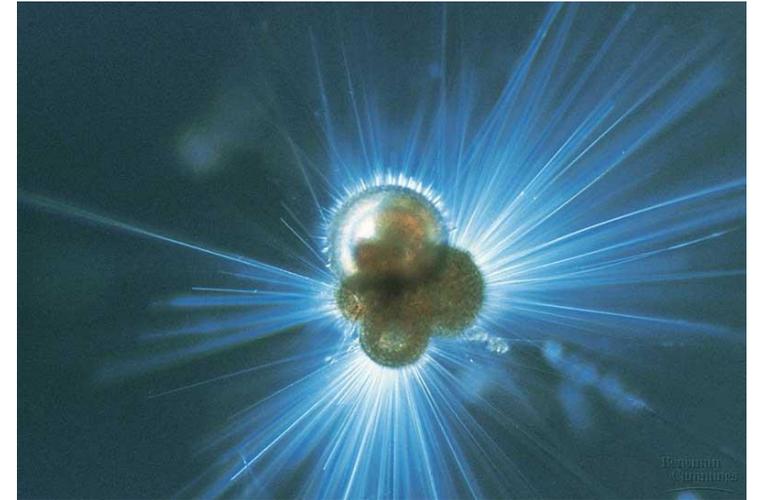
- ▶ Planktonic
- ▶ Unicellular
- ▶ Many are mixotrophic
 - ▶ **Mixotroph:** organisms that perform photosynthesis but are also heterotrophic
- ▶ Cell wall made of cellulose plates
- ▶ Two flagella
- ▶ Some are bioluminescent
- ▶ Algal blooms (red tides)
- ▶ Domoic acid



Zooplankton

Foraminiferans

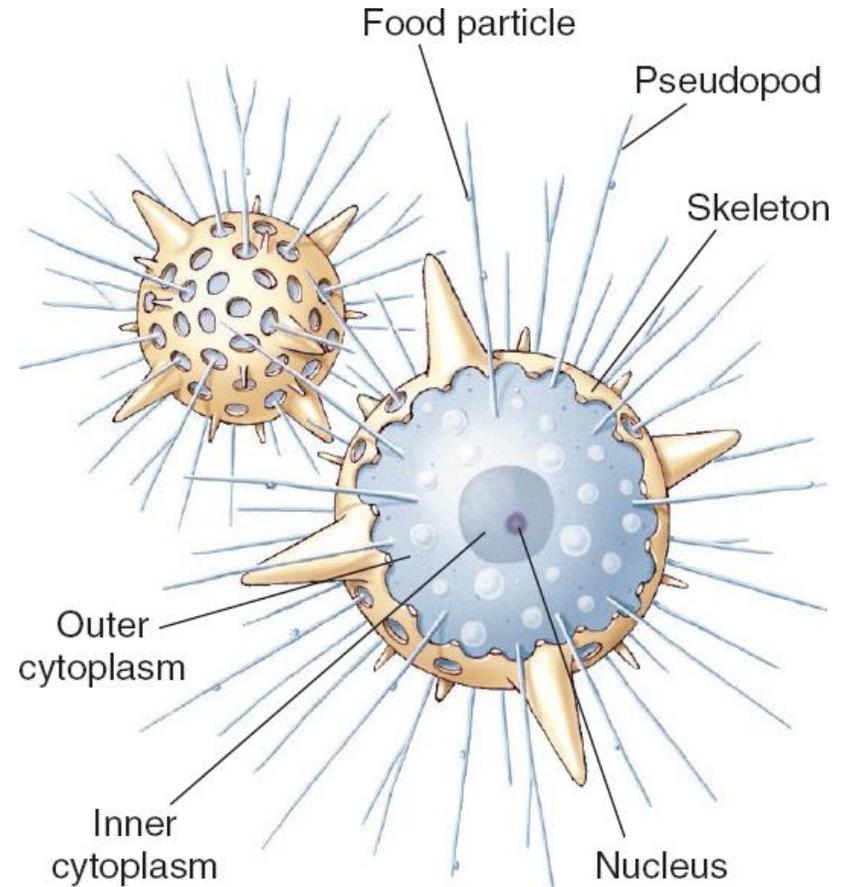
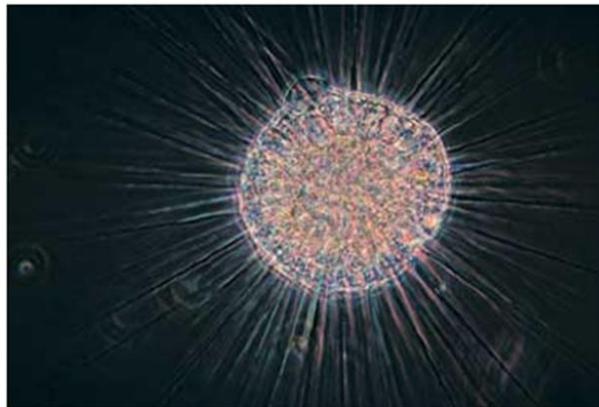
- ▶ Porous, calcium carbonate tests (shells)
 - ▶ *Foramen* (little hole), *ferre* (to bear)
- ▶ Thin pseudopodia (false feet) capture food
- ▶ Marine and freshwater
 - ▶ Most are benthic (live on the bottom)
- ▶ Fossilized forams = limestone rock
 - ▶ Pyramids made of fossilized forams
- ▶ Chemical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



Zooplankton

Radiolarians

- ▶ Porous, silica (glass) tests
- ▶ Thin pseudopodia capture food
- ▶ Planktonic
- ▶ Radiolarian ooze: skeletal remains of radiolarians that settles on the bottom



Zooplankton

Copepods

- ▶ Most planktonic
- ▶ Marine, freshwater and wet terrestrial habitats
- ▶ Arthropods
- ▶ Tear-drop shaped body with large antennae
- ▶ Food source for many fish species

