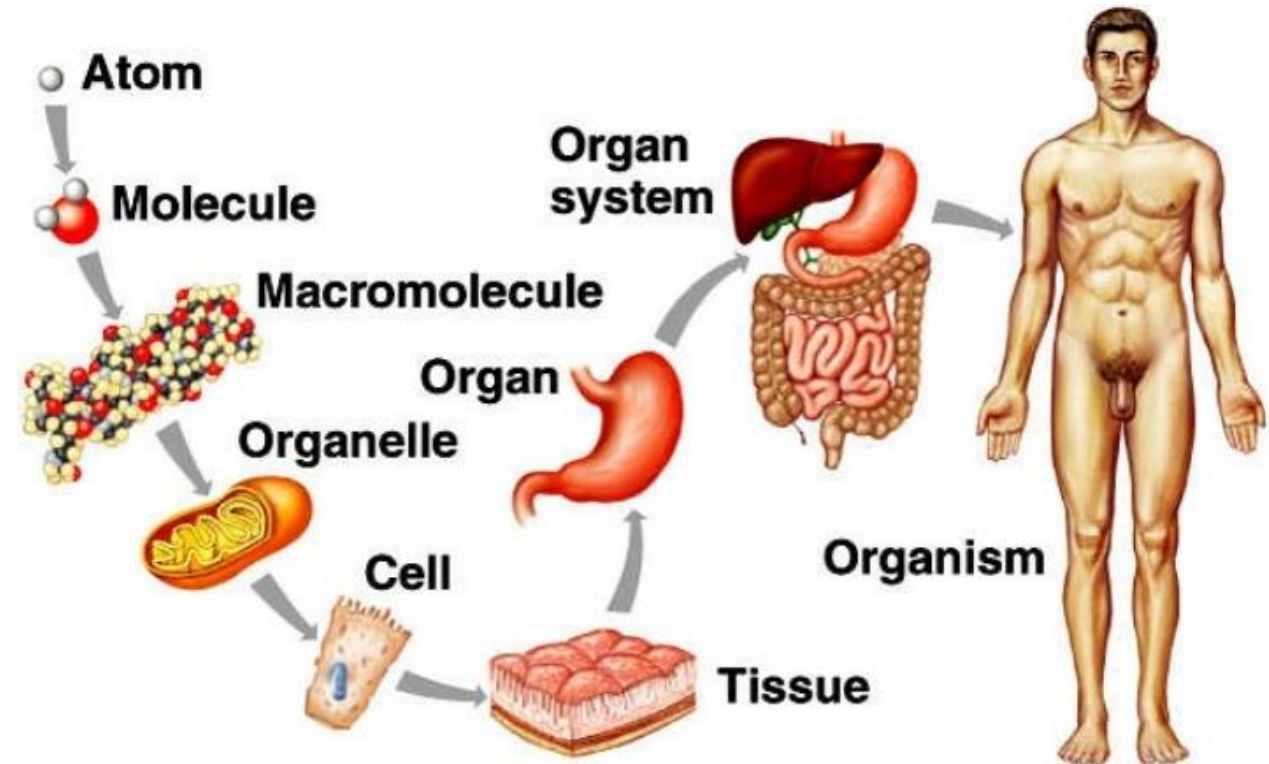
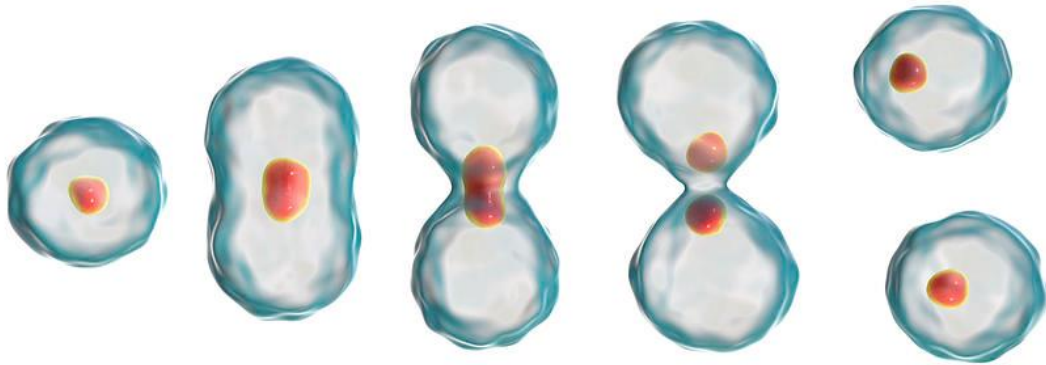


# The Cell, Plankton, and Microscopes

Lab 1

# Cell Theory

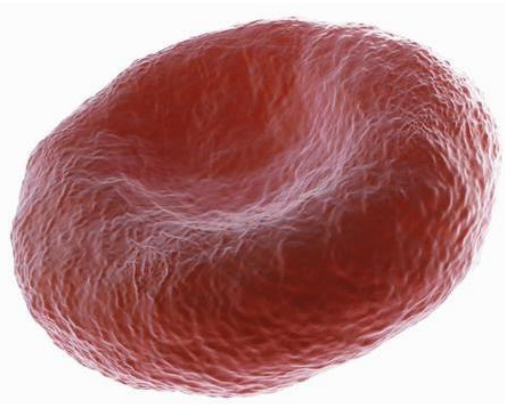
- ▶ All living organisms are composed of cells
  - ▶ Unicellular or multicellular
- ▶ Cells come from existing cells



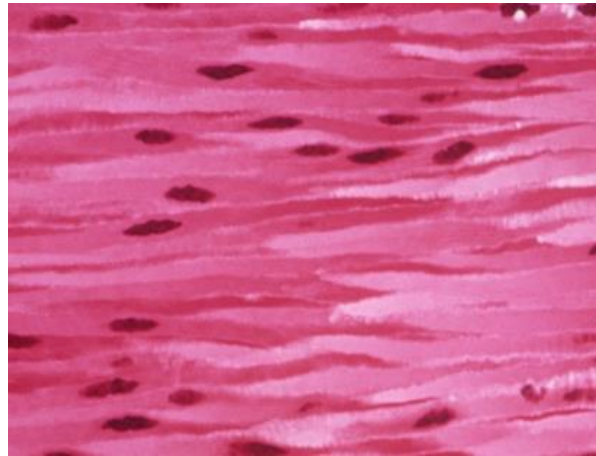
# Cells are Specialized

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

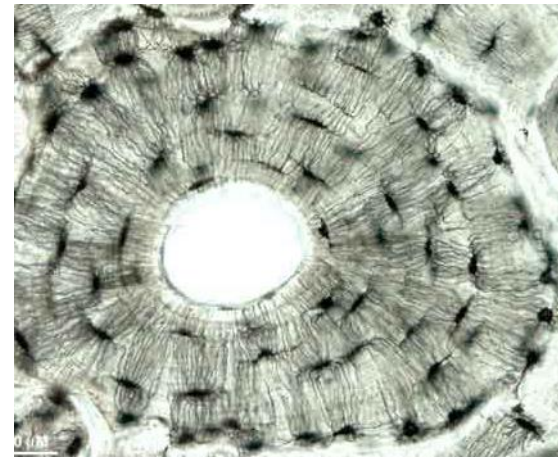
Reproductive cells



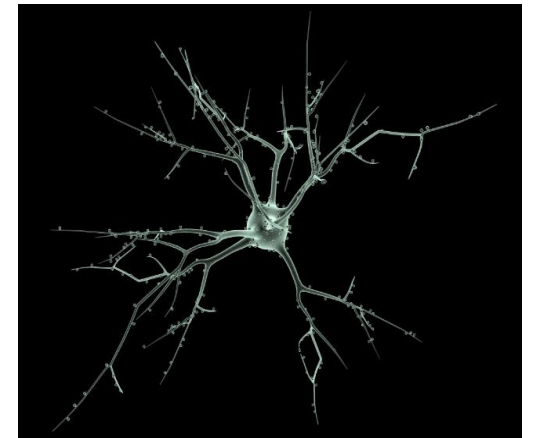
Red blood cell



Cardiac muscle cells



Bone cells



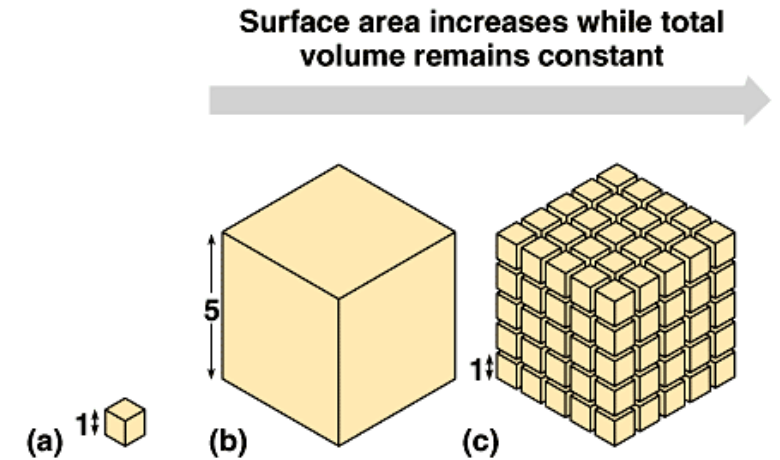
Nerve cell



# Why so small?

## Surface area to volume ratio!

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



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

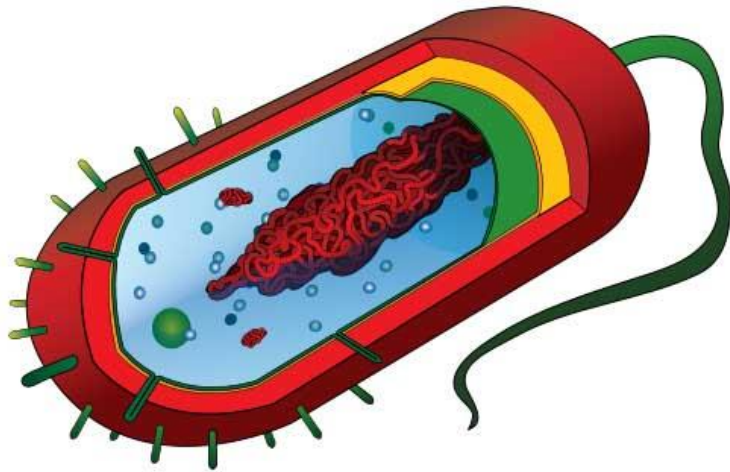


# Two Main Groups of Cells

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## Prokaryotic

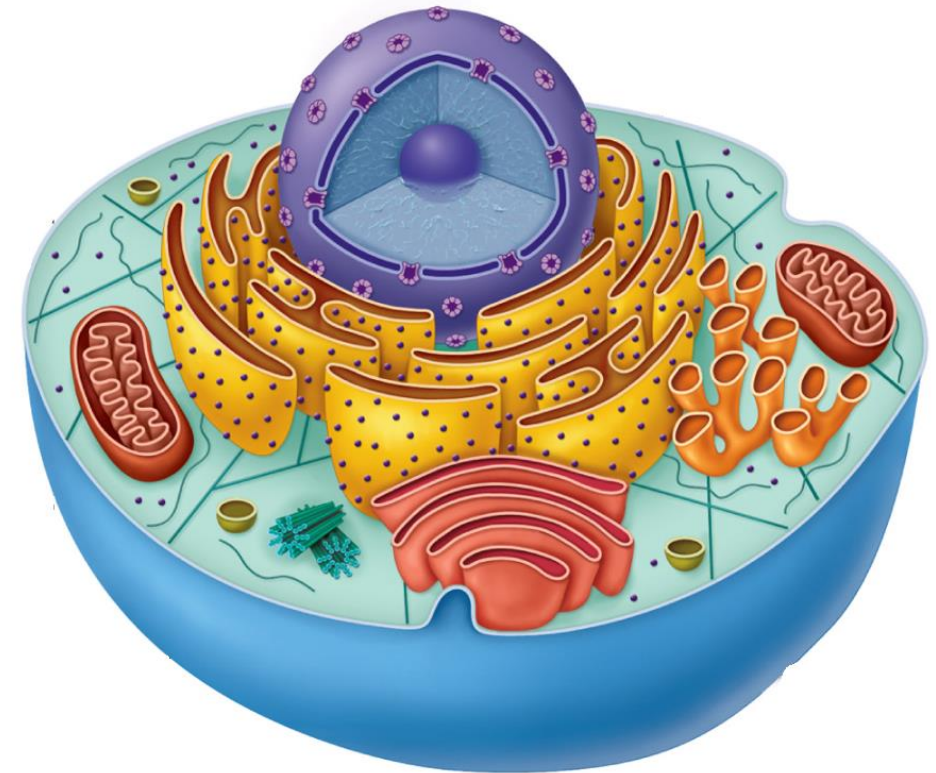
(Bacteria and Archaea)



\*Not to scale

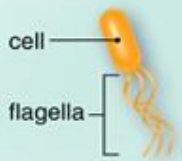
## Eukaryotic

(Protists, Plants, Animals and Fungi)

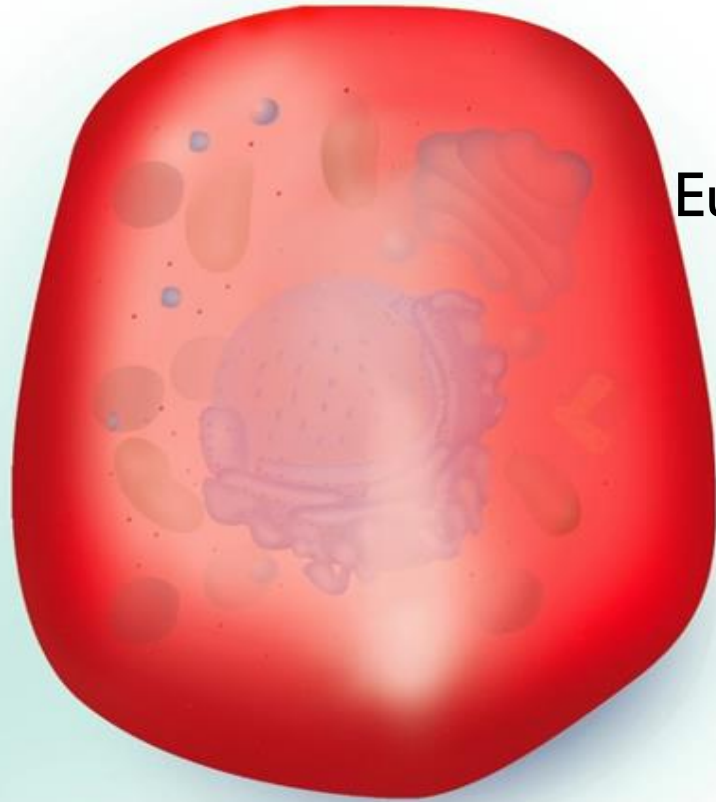


# Prokaryotic and Eukaryotic Cells

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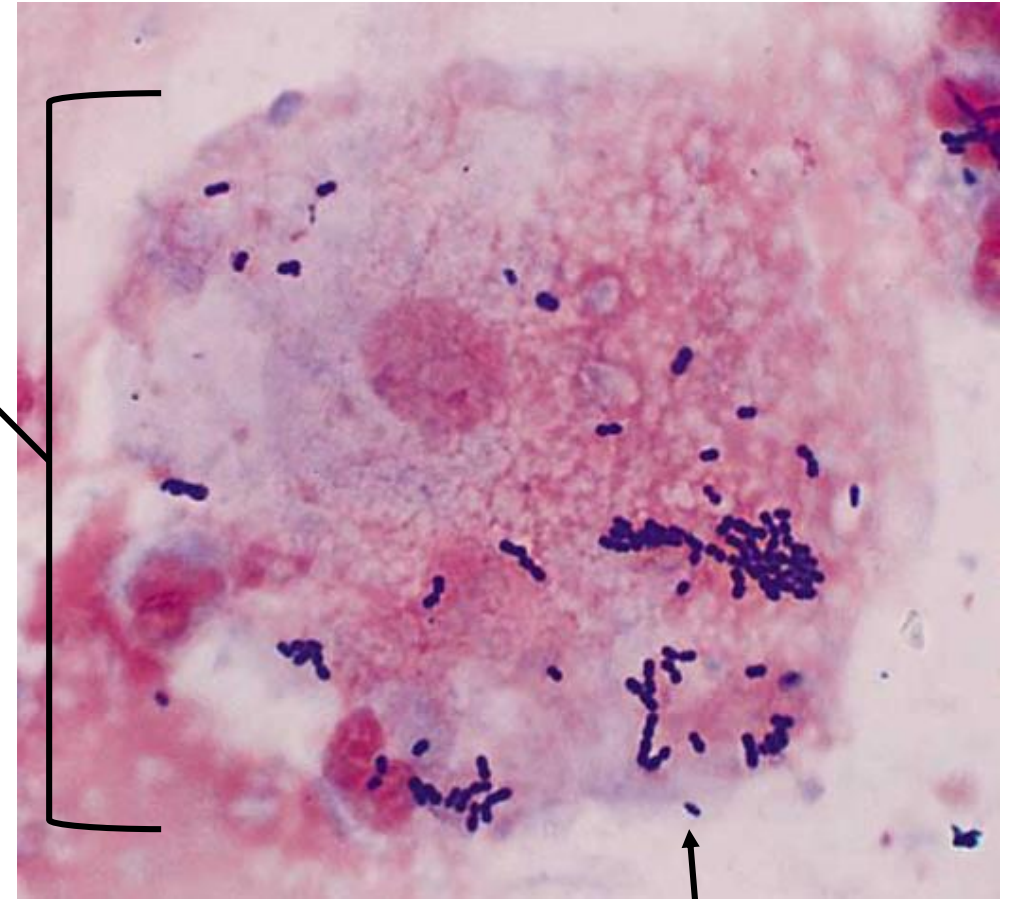


Prokaryotic cell



Eukaryotic cell

Eukaryotic cell



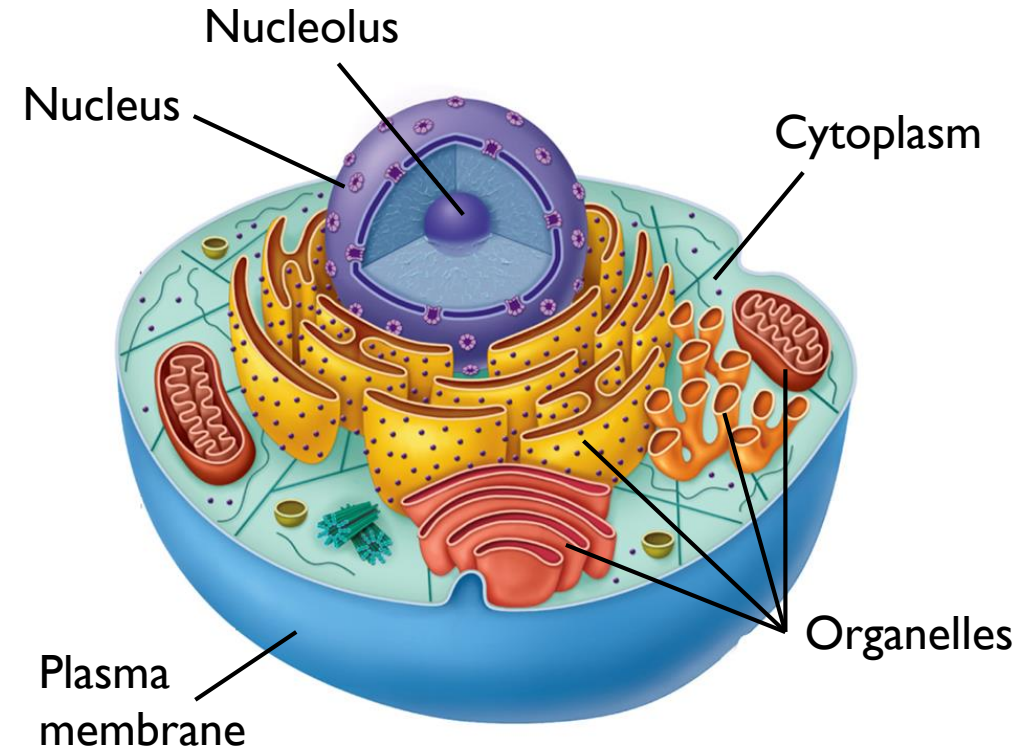
Prokaryotic cell



# Major Components of Eukaryotic Cells

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- ▶ **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

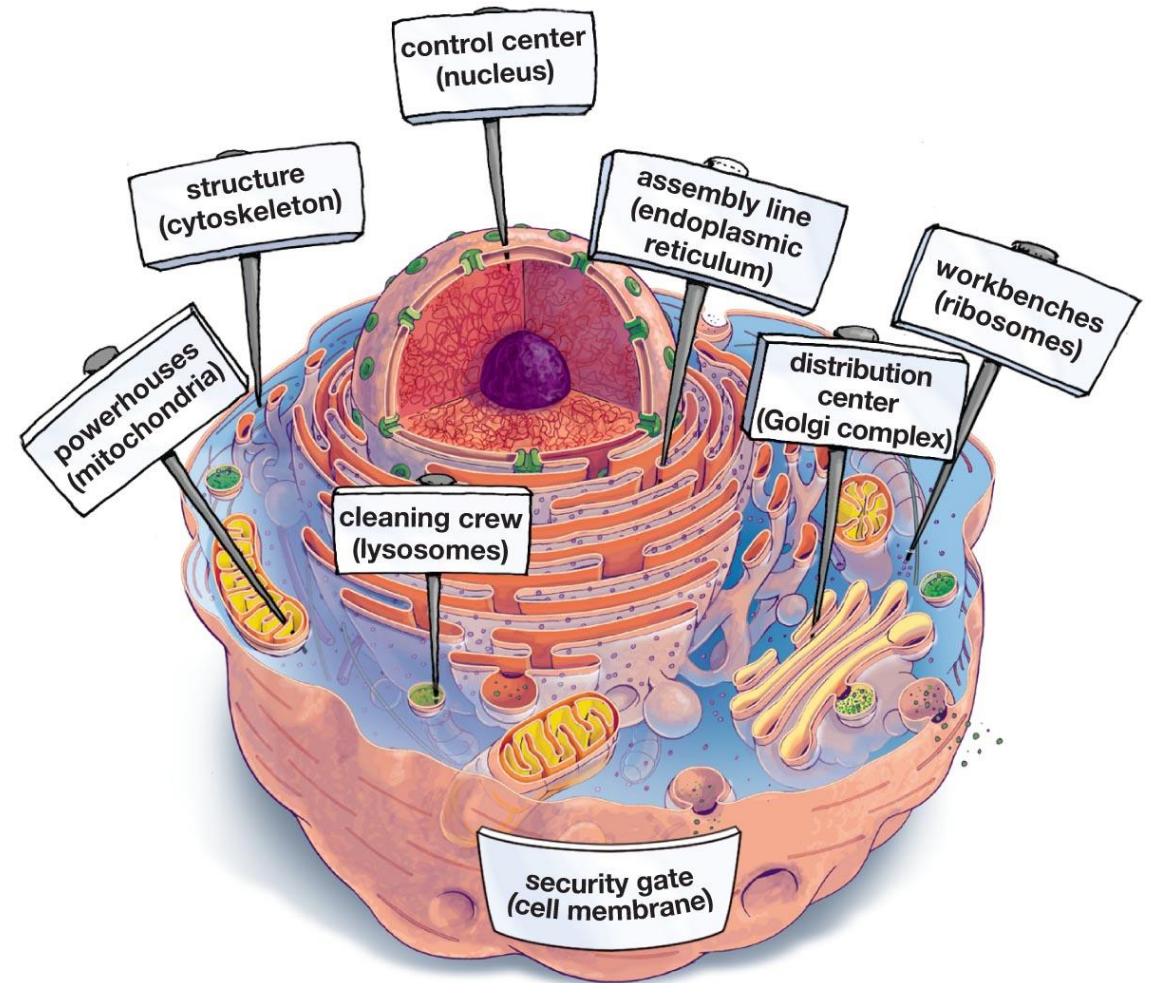




# Major Components of Eukaryotic Cells

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

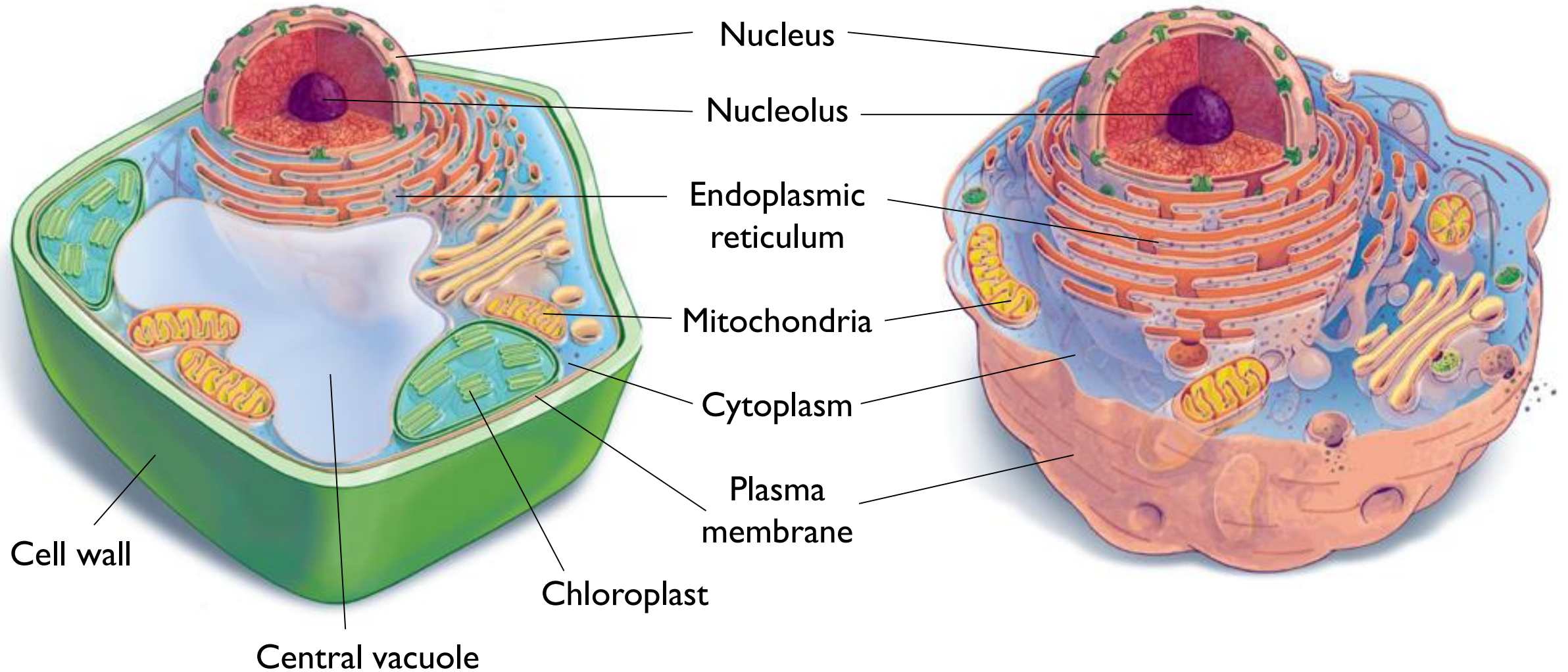
- ▶ Increased efficiency
- ▶ Separation of chemical reactions





# Plant and Animal Cells

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# Plant and Animal Cells

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Human cheek cell



Plant cell (Elodea)

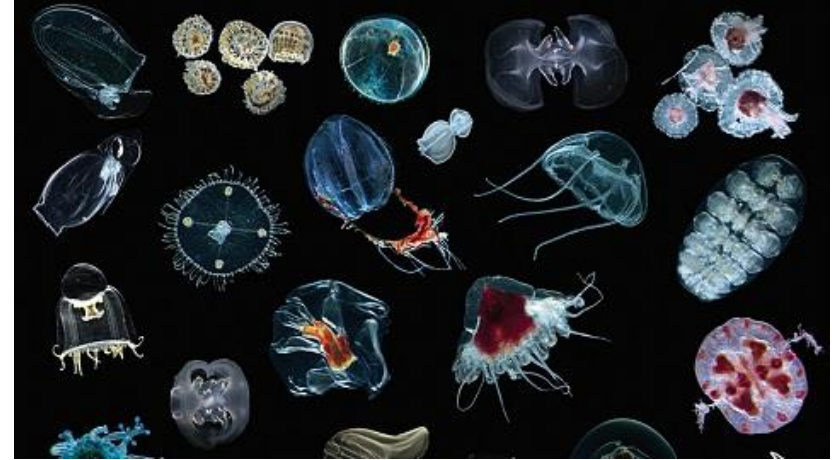




# Plankton versus Nekton

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

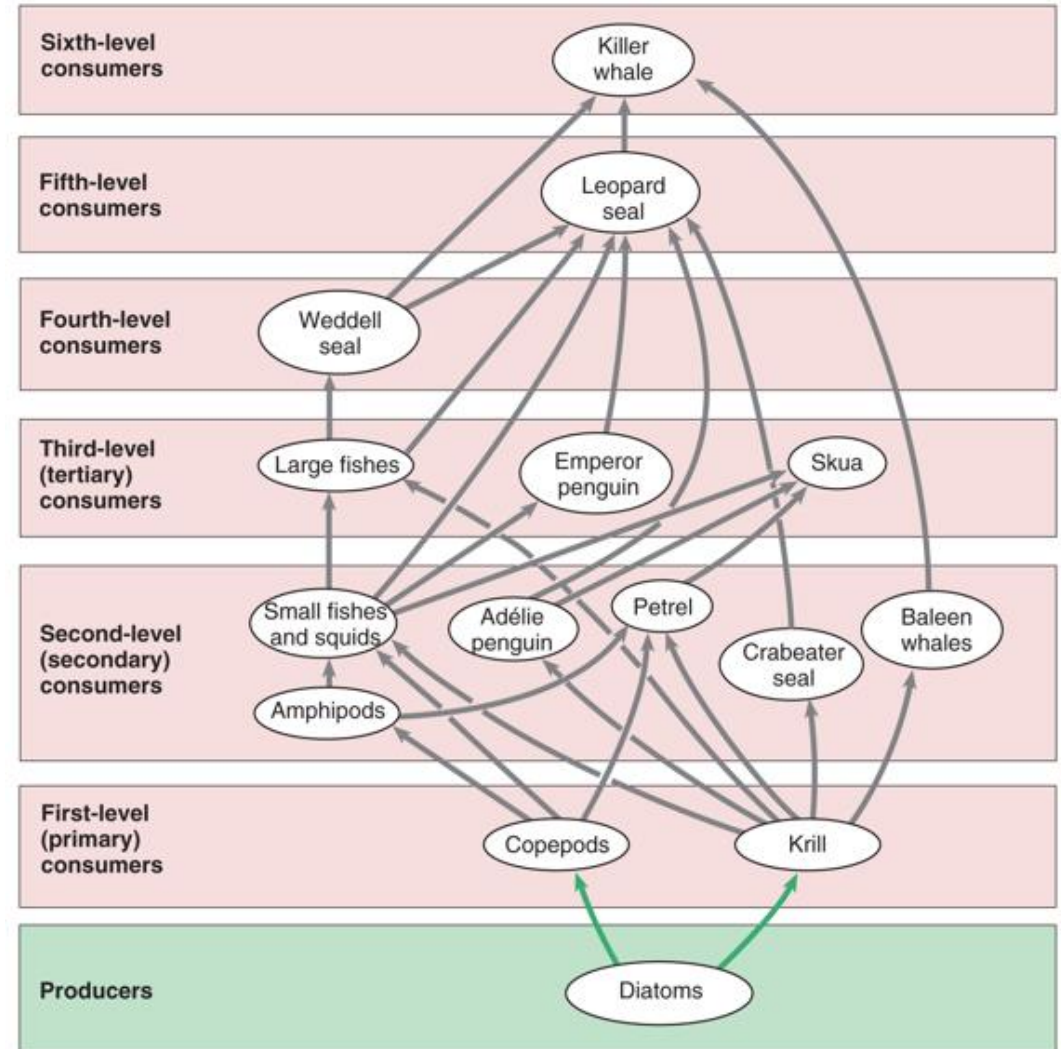
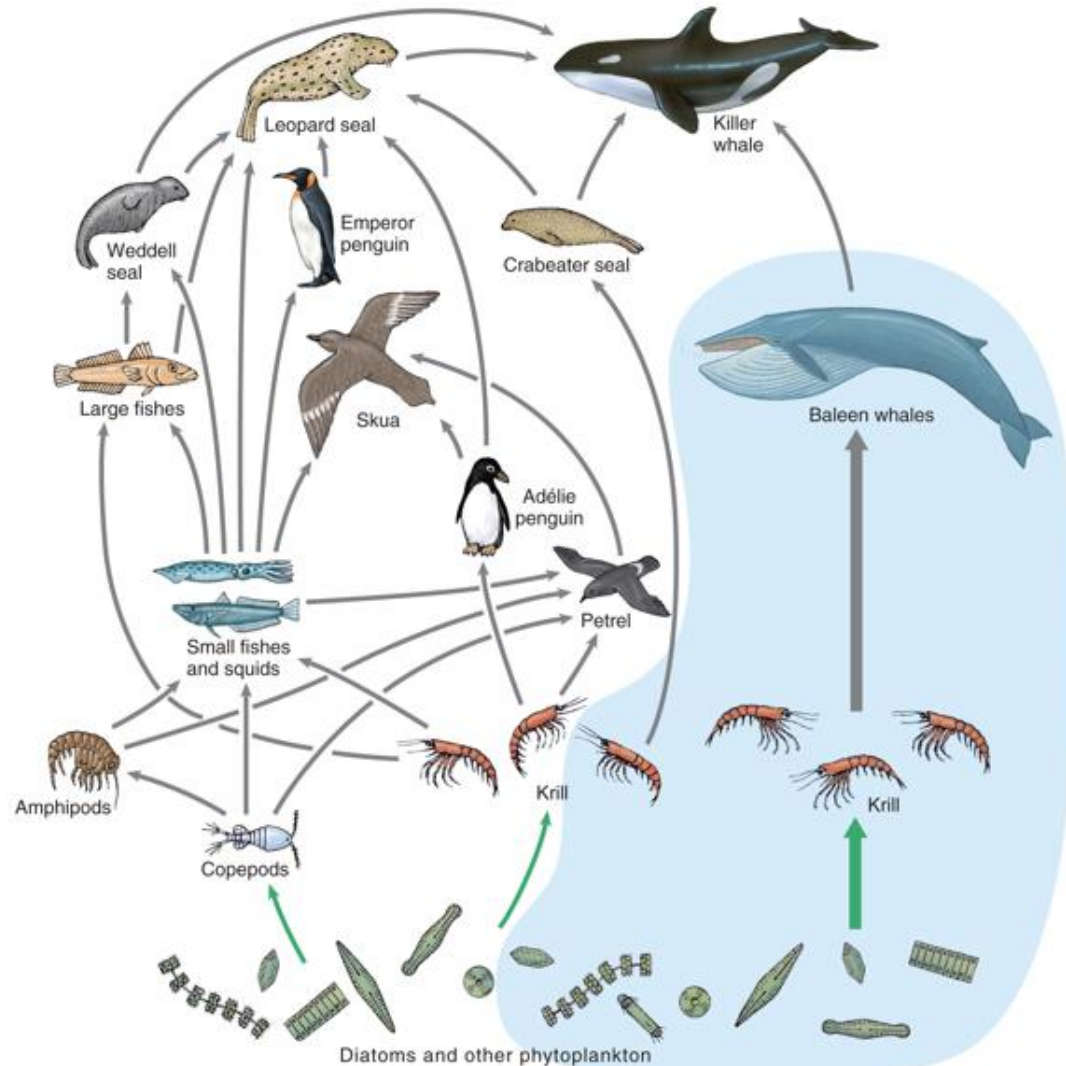
- ▶ **Phytoplankton:** photosynthetic planktonic organisms
- ▶ **Zooplankton:** heterotrophic planktonic organisms



**Nekton:** actively swimming organisms that can swim against the current



# Trophic Levels





# Trophic Levels

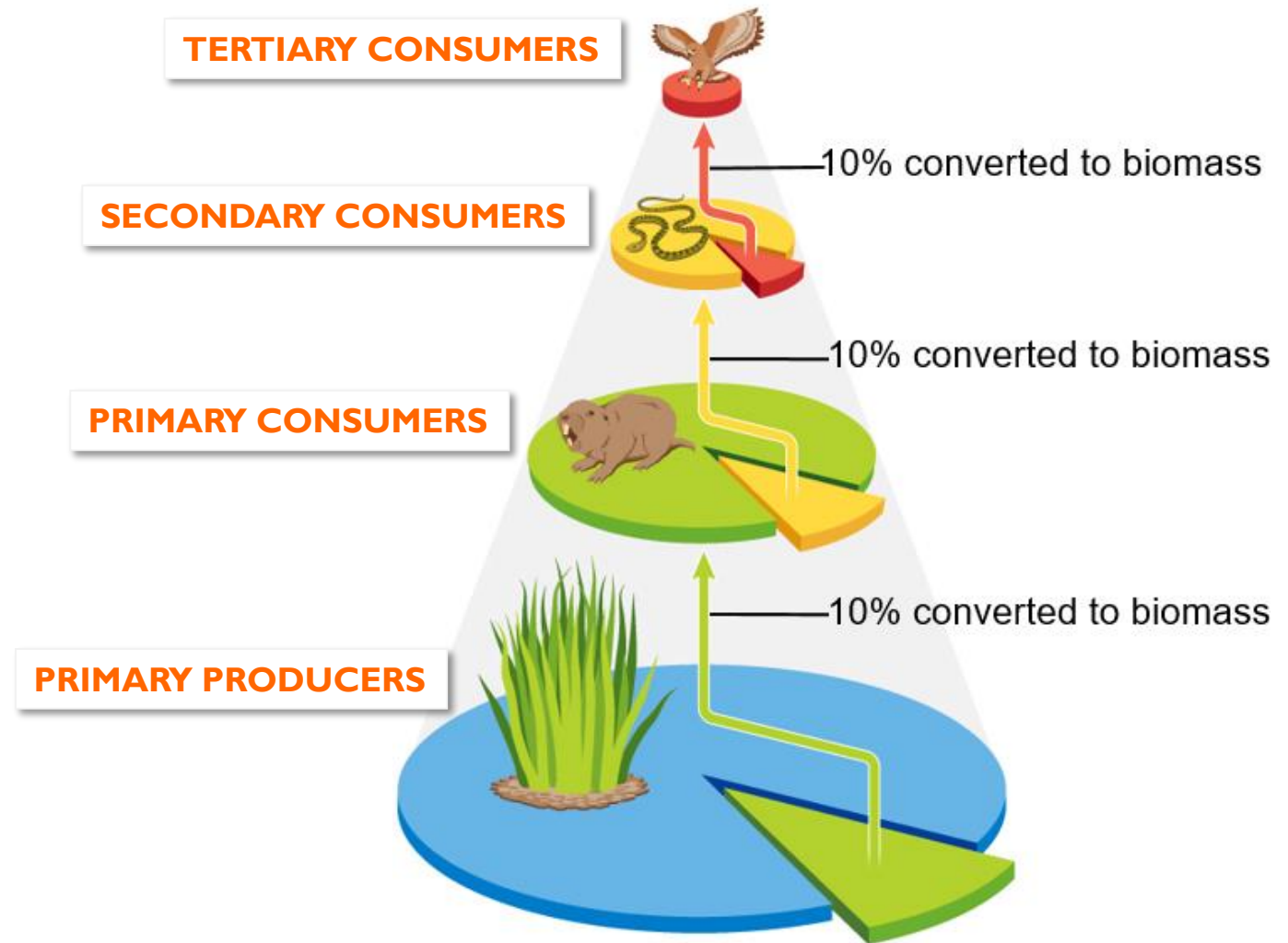
**Tertiary consumers:** carnivores that eat other carnivores

**Secondary consumers:** carnivores are animals that eat herbivores

**Primary consumers:** herbivores are animals that eat plants

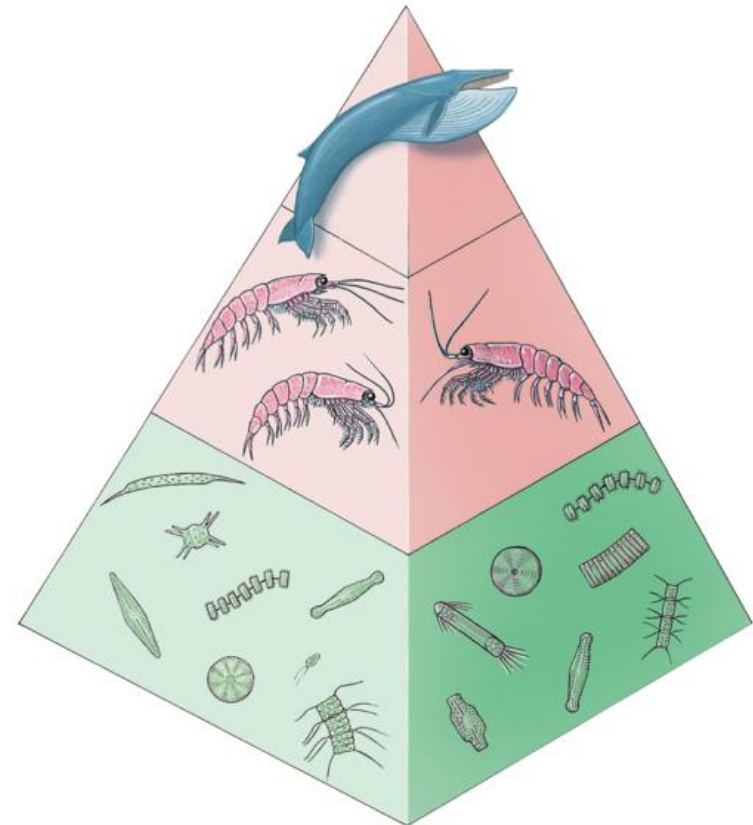
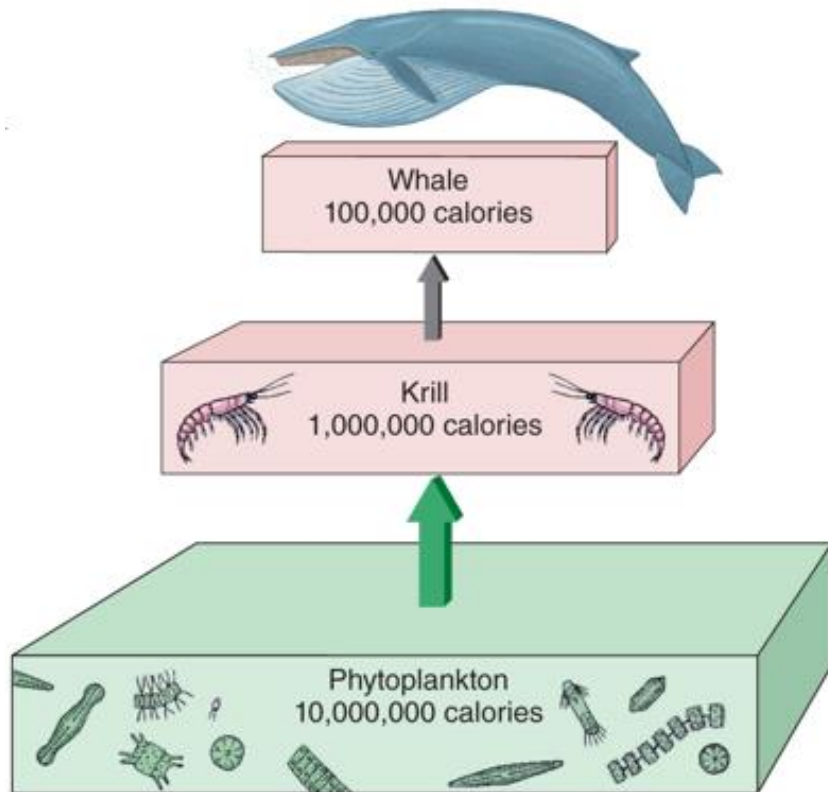
**Primary producers:** autotrophs (algae) that convert solar energy to chemical energy

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

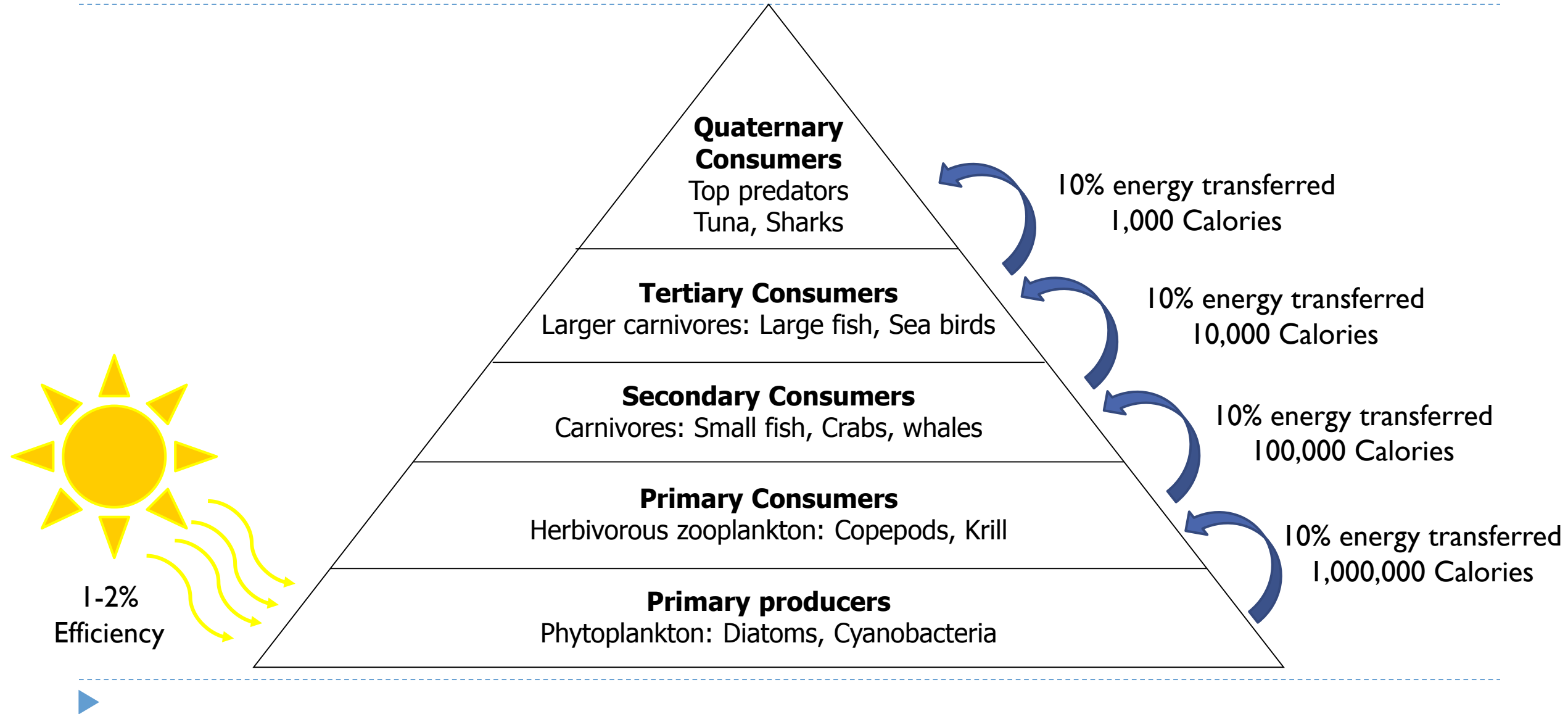


# Trophic Levels

- ▶ 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

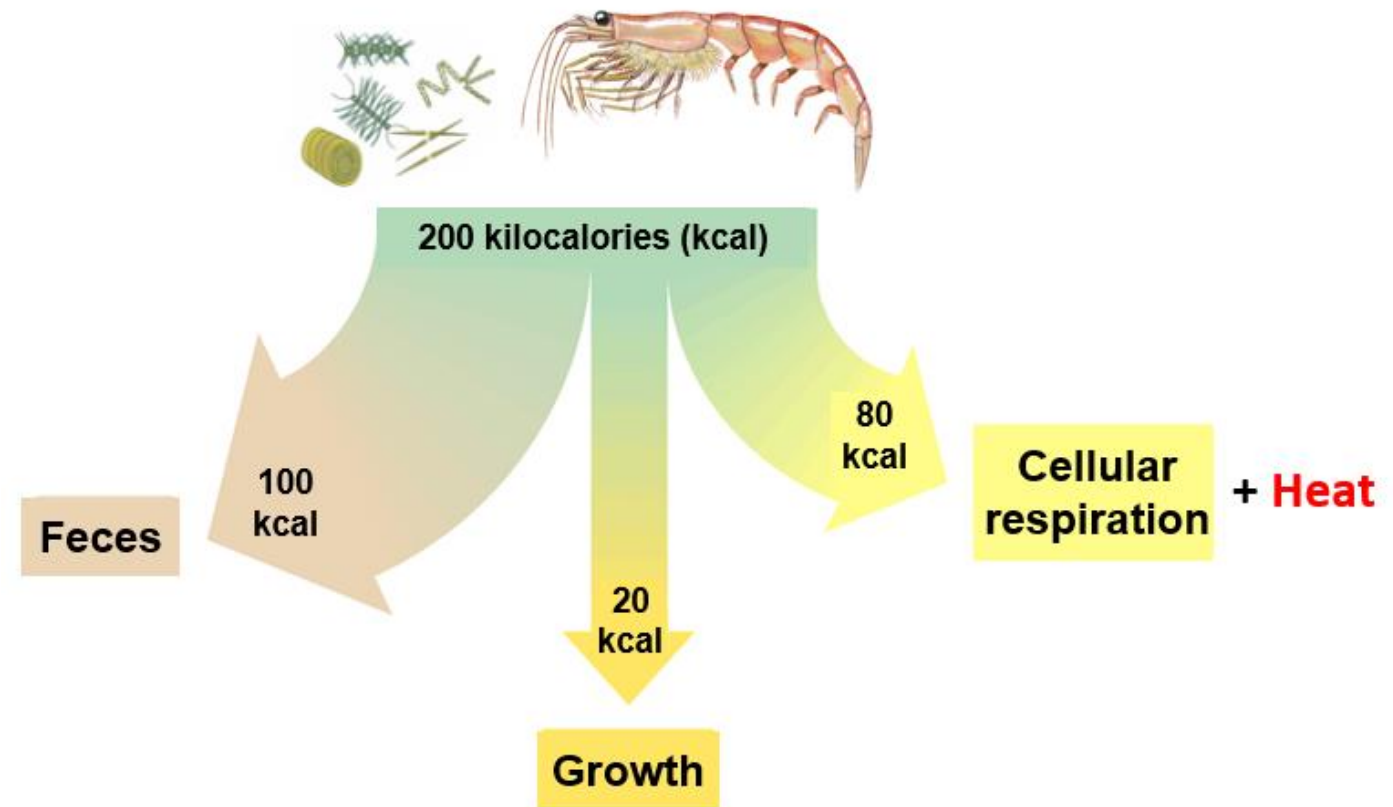


# Marine Trophic Levels



# 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

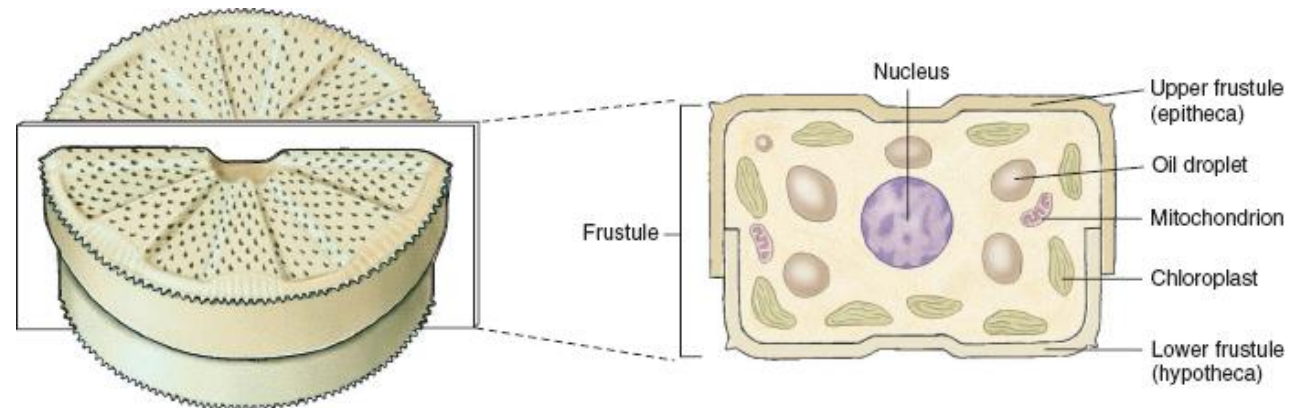
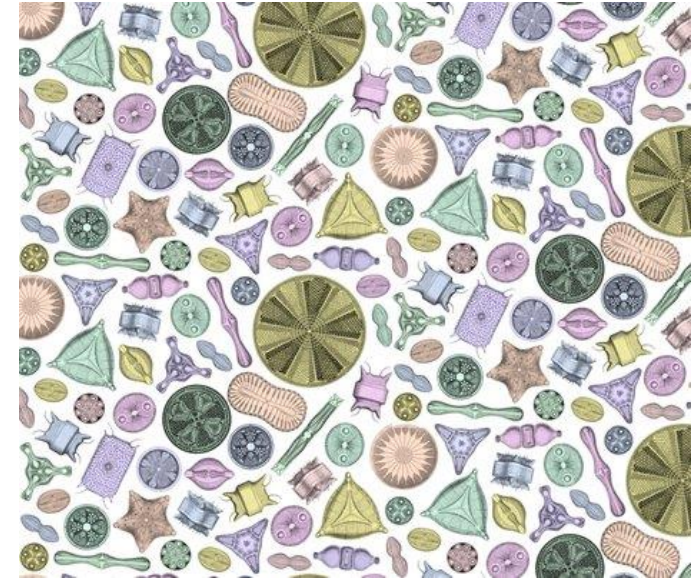




# Phytoplankton

## 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

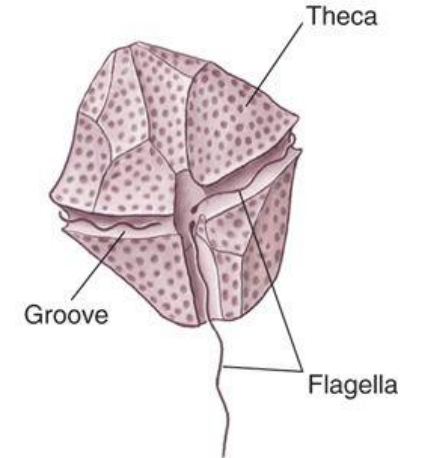
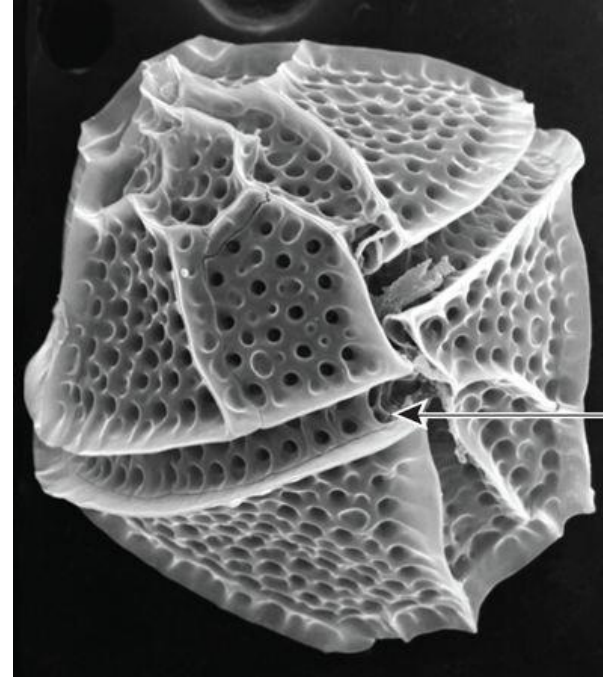


# Phytoplankton (and Zooplankton)

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## Dinoflagellates

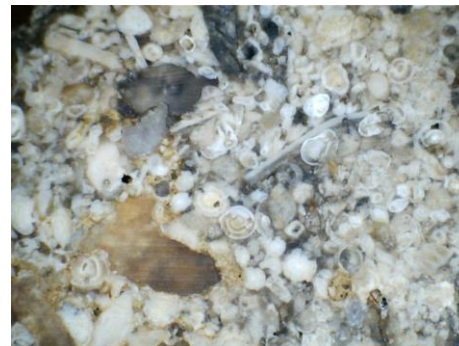
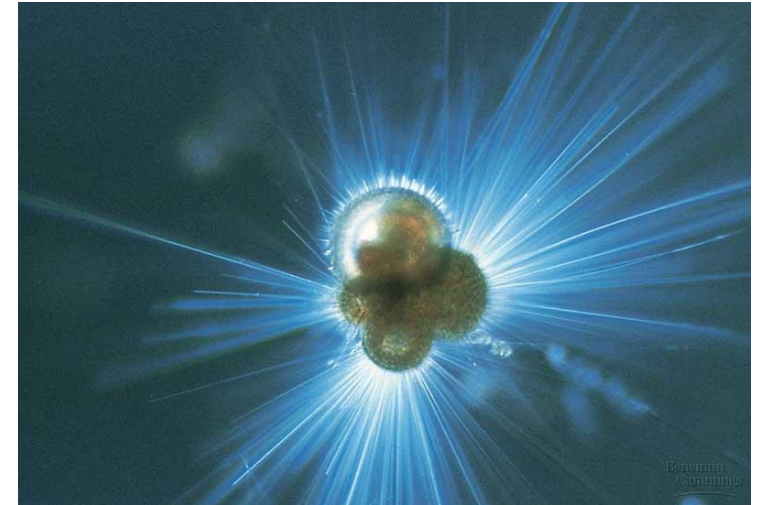
- ▶ Planktonic
- ▶ Unicellular
- ▶ Many are mixotrophic
  - ▶ **Mixotroph:** organisms that perform photosynthesis but are also heterotrophic
- ▶ Cell wall made of cellulose plates
- ▶ Two flagella
- ▶ Some are bioluminescent
- ▶ Algal blooms (red tides)
- ▶ Domoic acid



# 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

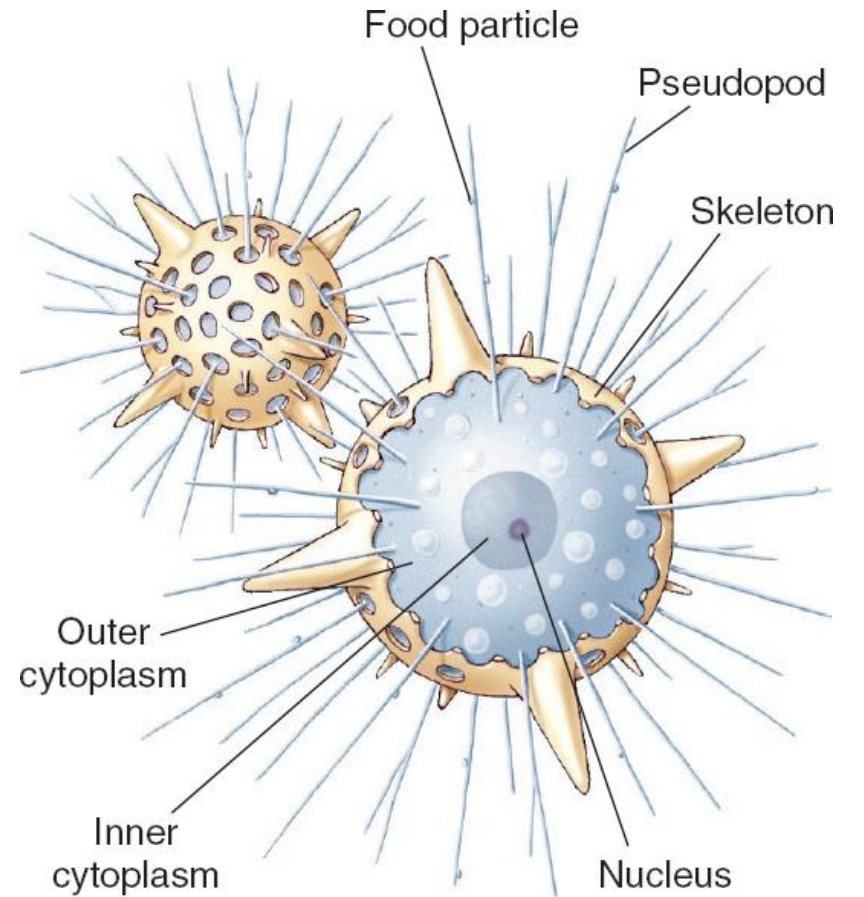
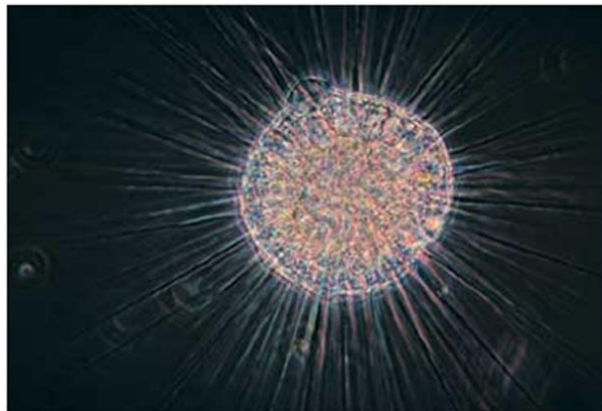




# Zooplankton

## 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

