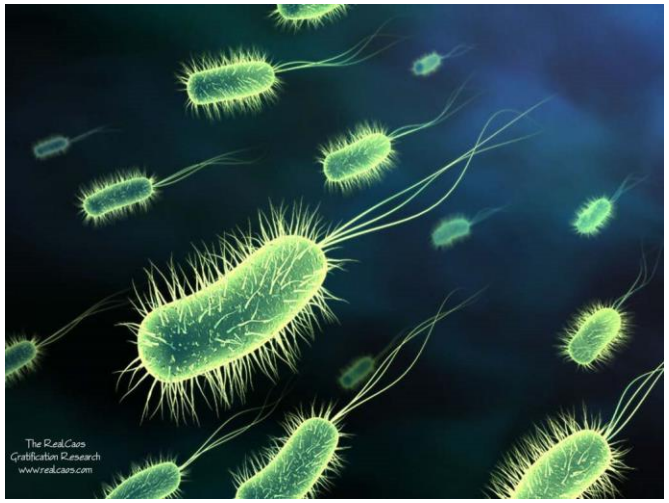
The Microbial World

Microorganisms of the Sea

Microorganisms

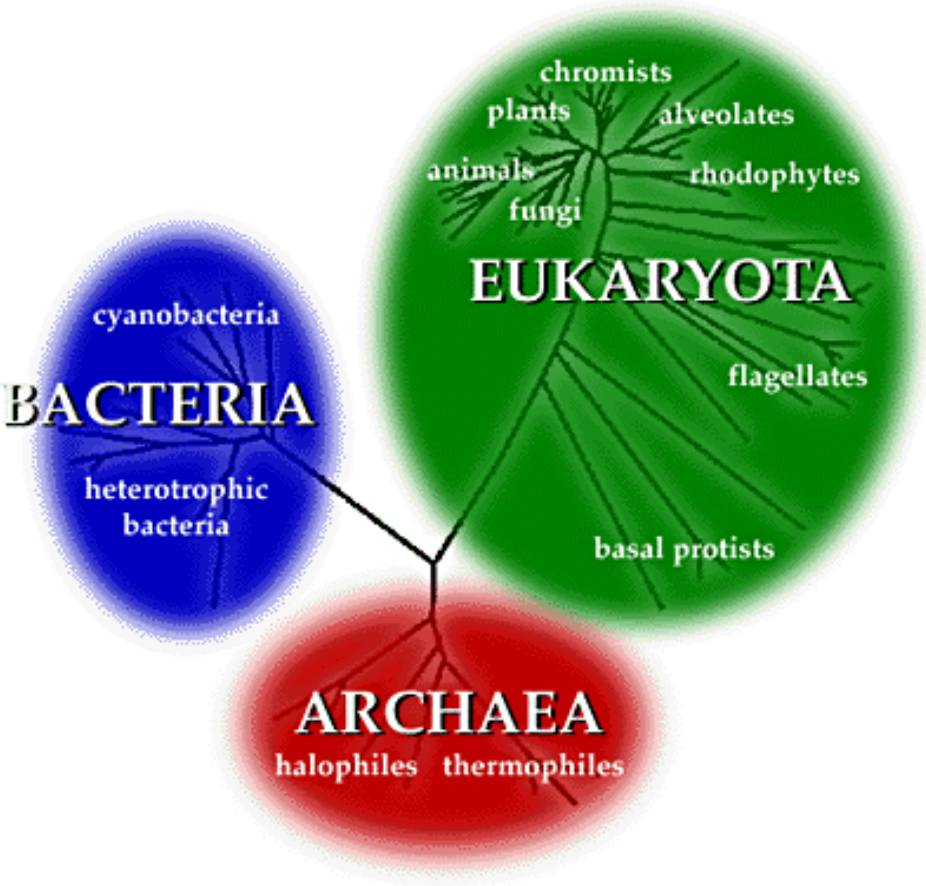
- Smallest, simplest marine organisms.
- Very important in evolutionary history of life on Earth.
- Important primary producers.
- Include prokaryotes & eukaryotes.



Biological Domains

- Domain: largest and most wide-ranging division of organisms.

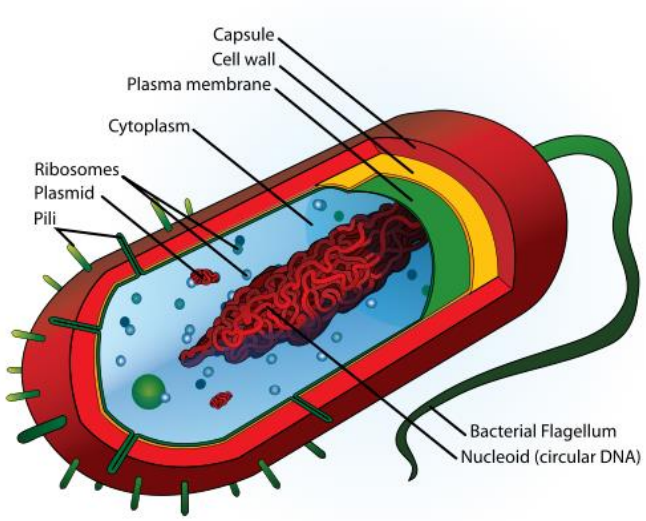
1. **Bacteria** – prokaryotic (no nucleus)
2. **Archaea** – prokaryotic (no nucleus)
3. **Eukarya** – eukaryotic (nucleus)



Prokaryotic Domains

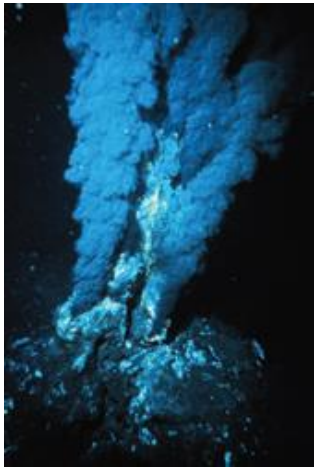
Bacteria

- Most abundant (common) organisms on Earth.
- Unicellular (single celled), thick cell wall.
- Asexual, they reproduce by themselves by dividing in two.



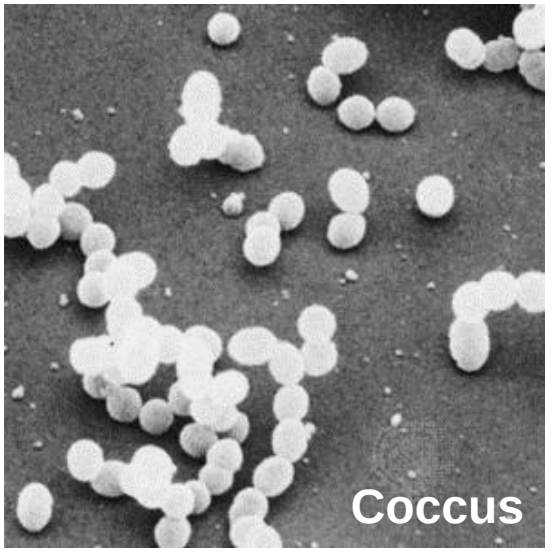
Archaea

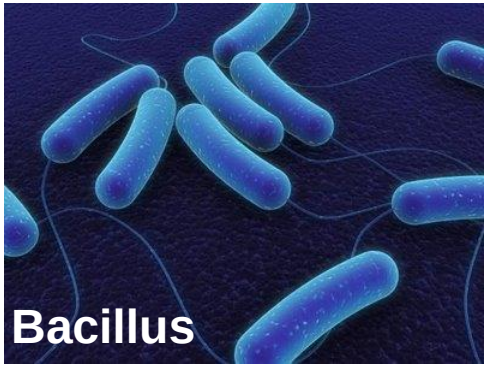
- Ancient bacteria
- Small, spherical cells
- Include autotrophs **and** heterotrophs.
- Cell walls
- Found in extreme environments
  - thermal vents
  - conditions with no oxygen.

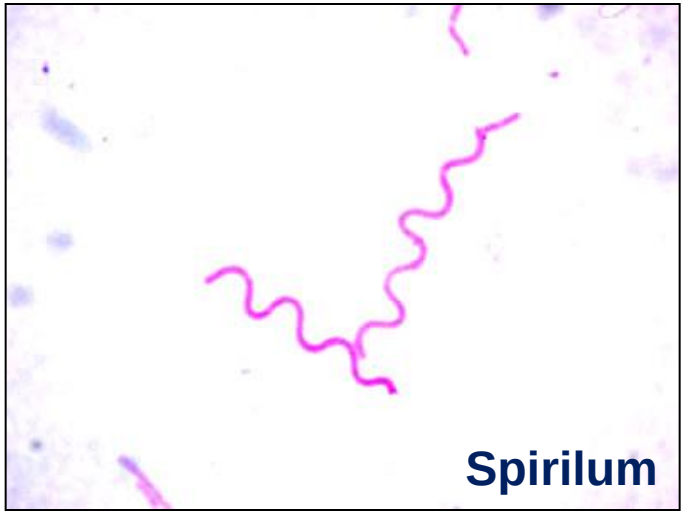


Bacteria: 3 shapes

1. Round bacteria called ***coccus***.
2. Rod-shaped bacteria called ***bacillus***.
3. Spiral shaped bacteria called ***spirillum***.

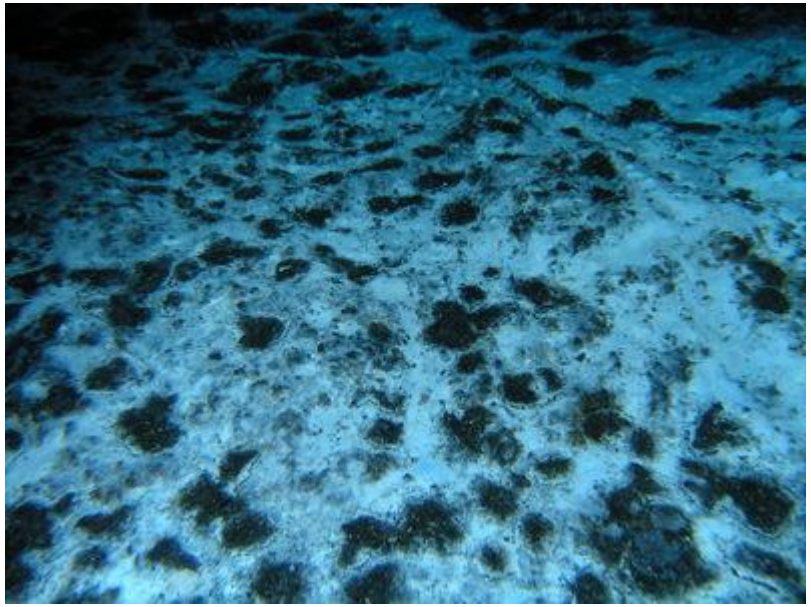






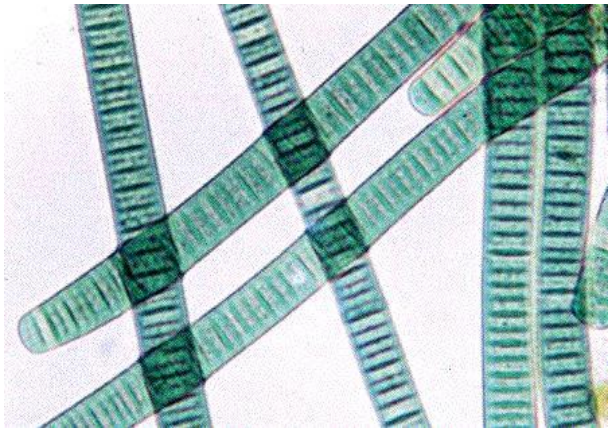
Marine Decay Bacteria

- In the ocean, decay bacteria are **decomposers**.
- Break down waste and dead organic matter.
- Release nutrients.



Cyanobacteria

- Also known as blue-green algae.
- Prokaryotes
- They have the green pigment ***chlorophyll*** (and phycocyanin)
  - Allows them to make their own food (sugars) using **photosynthesis** (sunlight).
- They are the **only** bacteria that can do photosynthesis.
- They also contain the blue pigment *phycocyanin*.
- We among the first photosynthetic organisms on earth.
- Most abundant photosynthetic organism in the ocean.

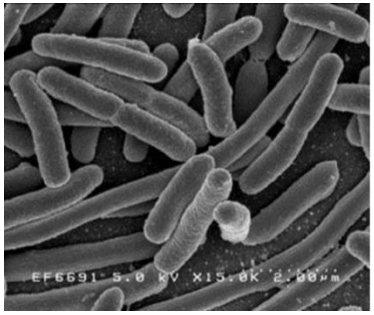


Oscillatoria

2 bacterial kingdoms

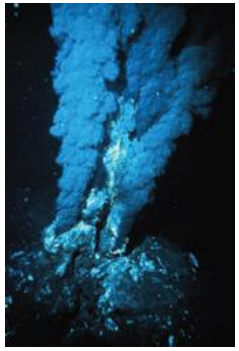
Eubacteria

- Simple organisms (single-cell)
- "Common bacteria" - most bacteria are in this kingdom.
- Include autotrophs and heterotrophs.
- Cell walls – with peptidoglycan
- Found everywhere.



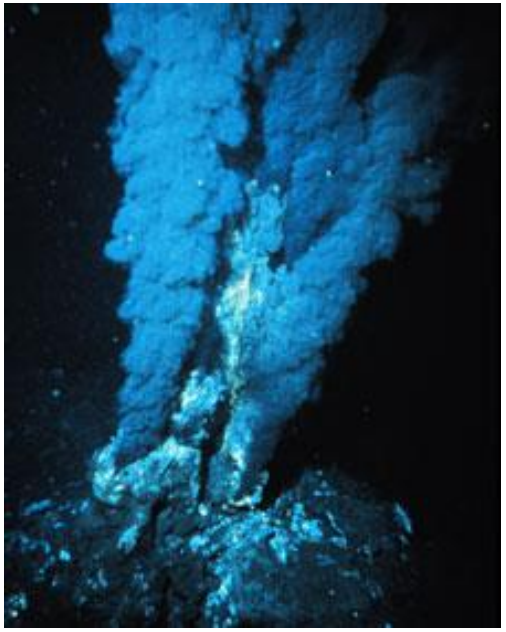
Archaebacteria

- Simple organisms (single cell)
- Ancient bacteria
- Include autotrophs and heterotrophs.
- Cell walls – NO peptidoglycan
- Found in extreme environments
  - thermal vents
  - conditions with no oxygen.



Chemosynthesis

- The **sulfur species of bacteria** can produce food (glucose) through the process of **chemosynthesis**.
- Bacteria break down the compound hydrogen sulfide (H_2S) for energy.
- This energy is used to form sugar from carbon dioxide and water.



The Microbial World

Microorganisms of the Sea

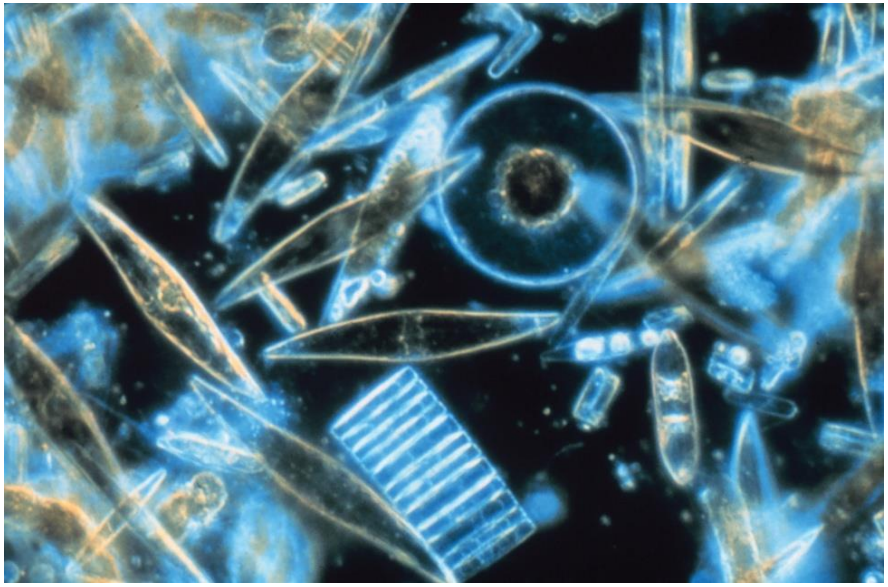
The 6 Kingdoms - 2 main categories

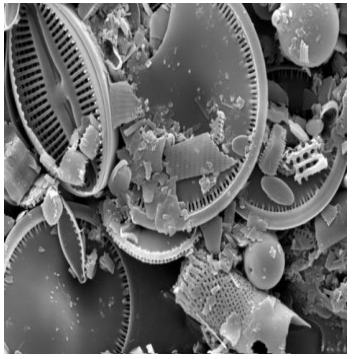
A. **Prokaryotes** (simple organisms; NO nucleus)
   - Archaebacteria
   - Eubacteria

B. **Eukaryotes** (complex organisms; nucleus)
   - Protista
   - Fungi
   - Plantae
   - Animalia

Diatoms

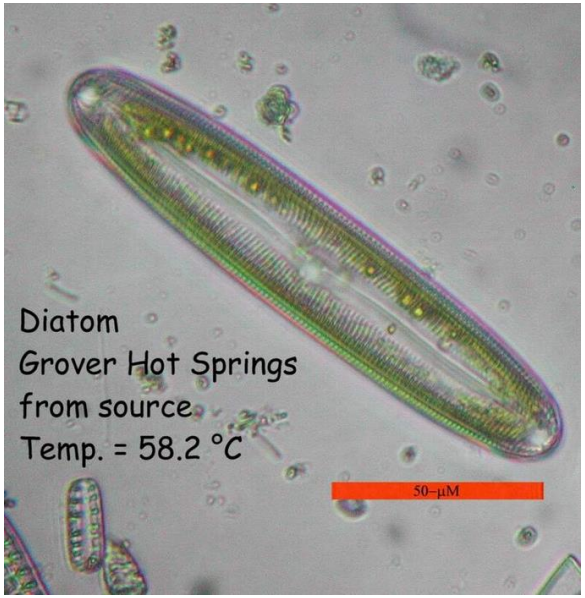
- In the **kingdom Protista**; they are eukaryotic.
- Part of the **plankton** community.
  - Plankton **drift** throughout the ocean.
- Most diatoms are **phyto**plankton, meaning they are **photosynthetic** (can use sunlight to make food).

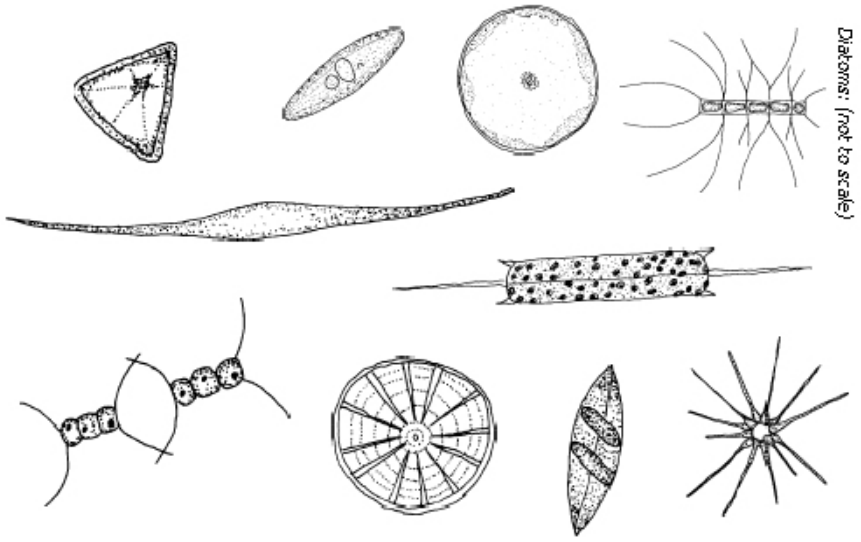




Adaptations of Diatoms

- Diatoms have a transparent **cell wall** (frustule) made of **silica**.
  - Lets sunlight into the cell for **photosynthesis**.
- Some diatoms have **spines** projecting from their cell wall
  - help to **prevent sinking**.
- Can reproduce sexually *and* asexually.





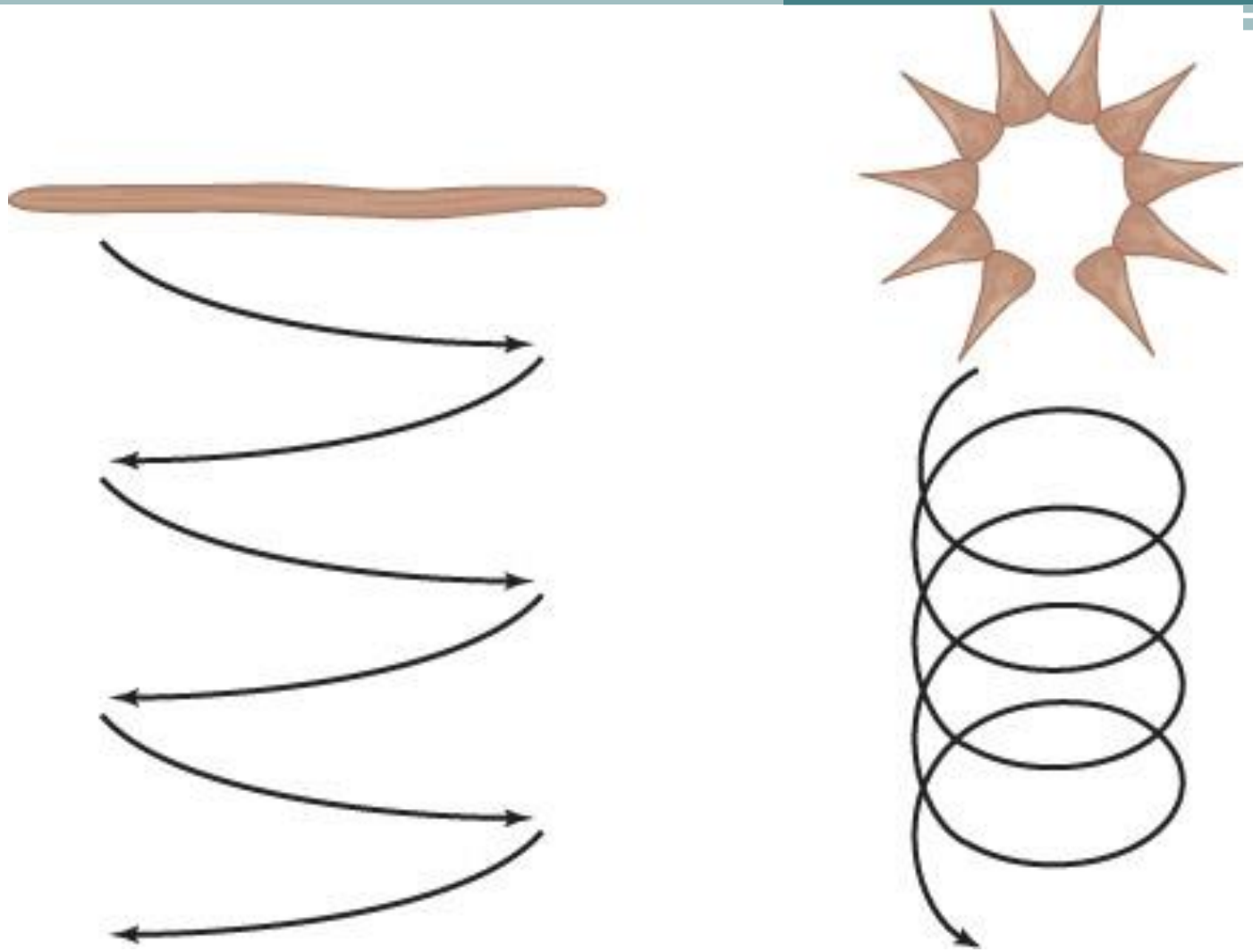
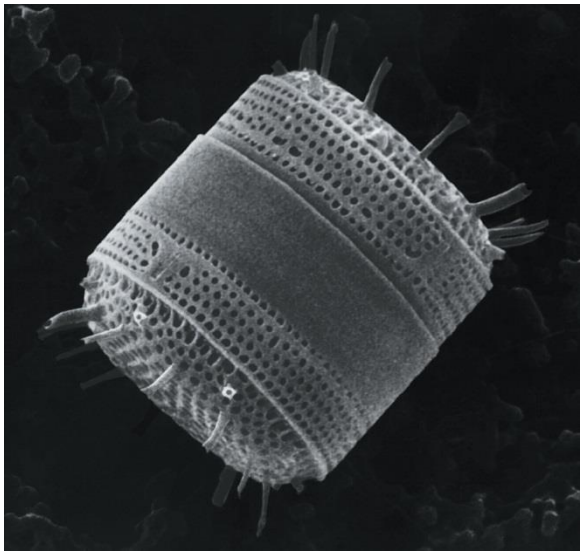
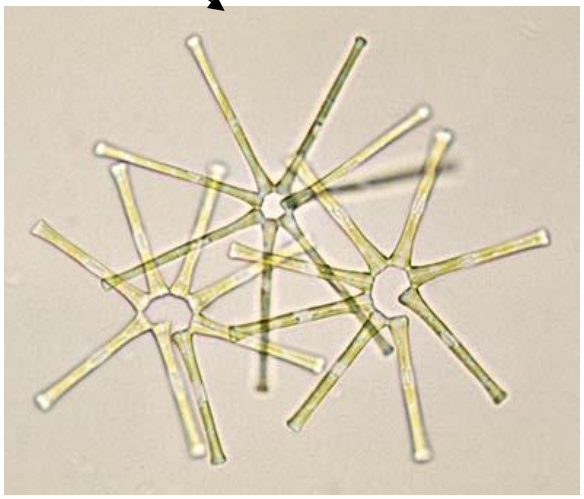


Figure 3.18: Sinking patterns of *Rhizosolenia* and *Asterionella*

Diatom Shapes

- Most diatoms are classified according to shape:
  - Thalassiosira
  - Nitzschia
  - Asterionella



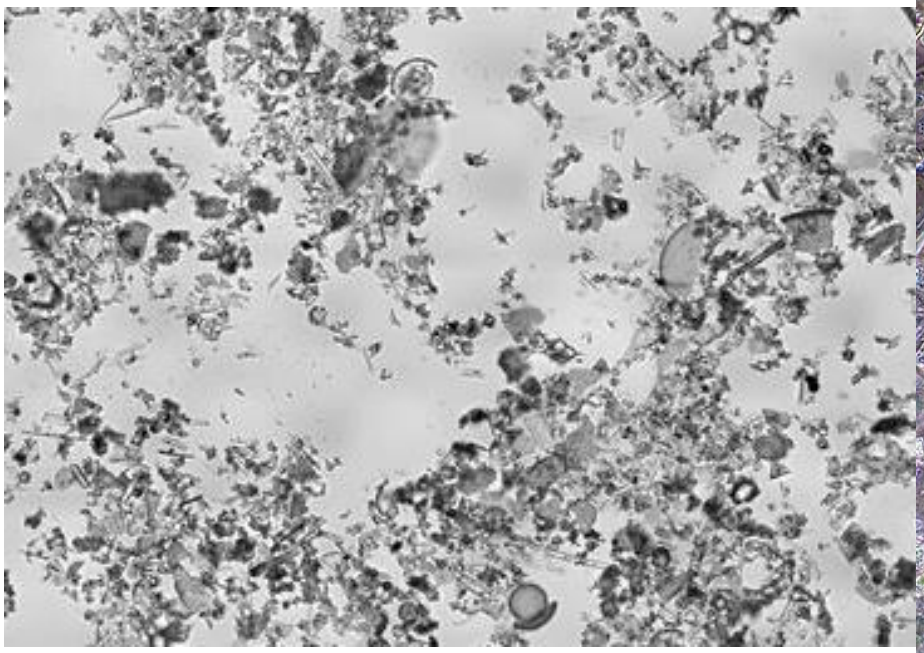


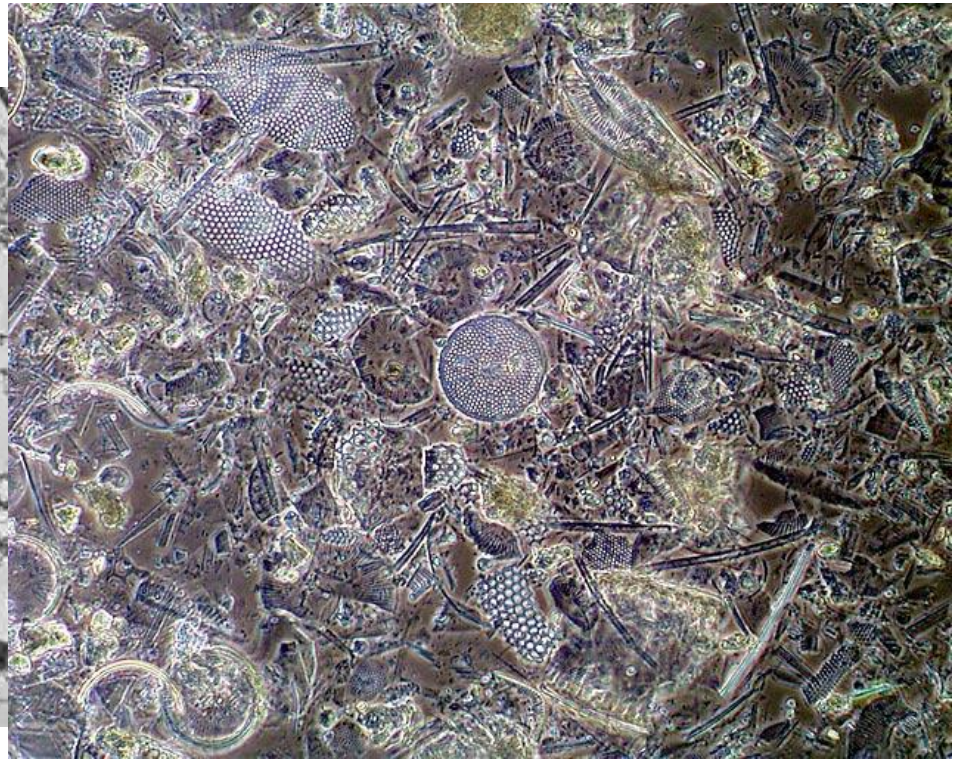
Diatoms

- A sudden increase in the diatom population can occur in shallow coastal waters – lots of nutrients, light.
  - **Causes an algal bloom**
- Crowded waters lower ability for diatoms to perform life processes.
- Algal blooms can use up oxygen and kill the fish in those areas that require dissolved oxygen.

Diatomaceous Earth

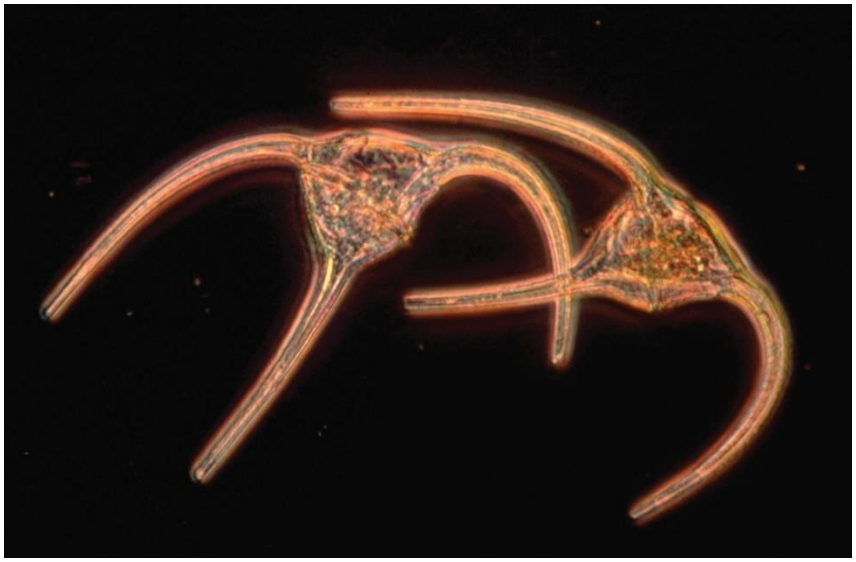
- Silica frustules of diatoms fall to the ocean floor when the organism dies.
- Frustules build up on the floor forming layers of **silica** known as diatomaceous earth (can be hundreds of meters thick).





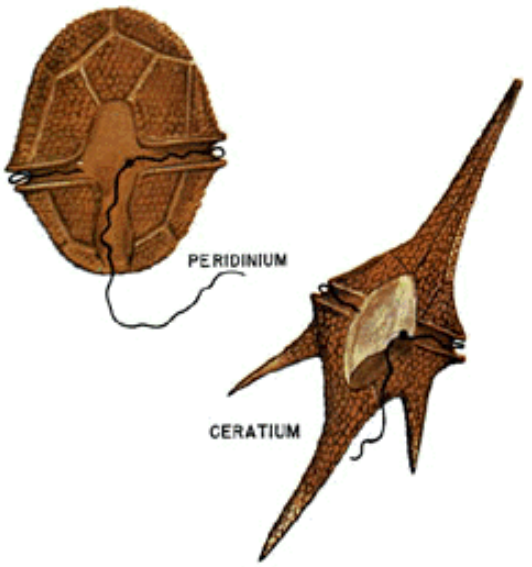
Dinoflagellates

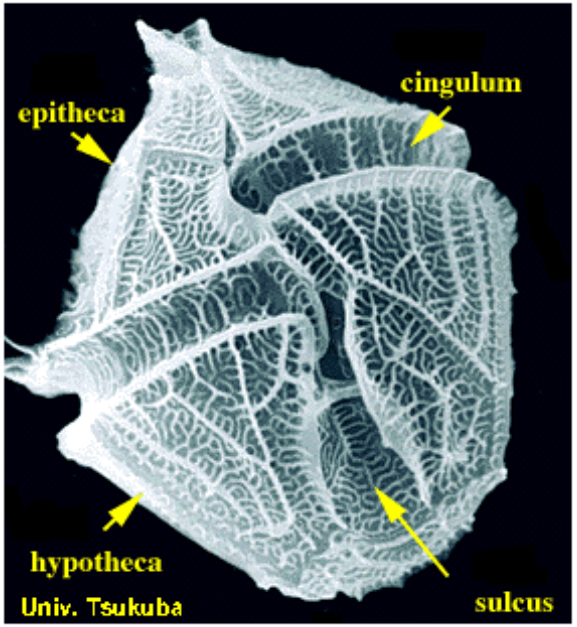
- In the Kingdom Protista.
- They are **eukaryotes**.
- They have two **flagella**, whip-like projections (like tails) that help to move the organism through the water.



Dinoflagellates

- Dinoflagellates have an **eyespot** that is sensitive to light.
  - This allows them to swim closer to sunlight.
- They can eat food in addition to making their own through **photosynthesis**.
  - Autotrophs *and* heterotrophs
- They have **cell walls** made of **<u>cellulose</u>**, like those in plants.





Dinoflagellates

- Red Tide: sudden explosions of the populations of dinoflagellates can occur in shallow coastal waters.
  - The species *Gymnodinium*, contains a pigment that produces the red color in water during a red tide.
  - The *Gymnodinium* have powerful **toxins** that can kill other organisms in the marine food web.