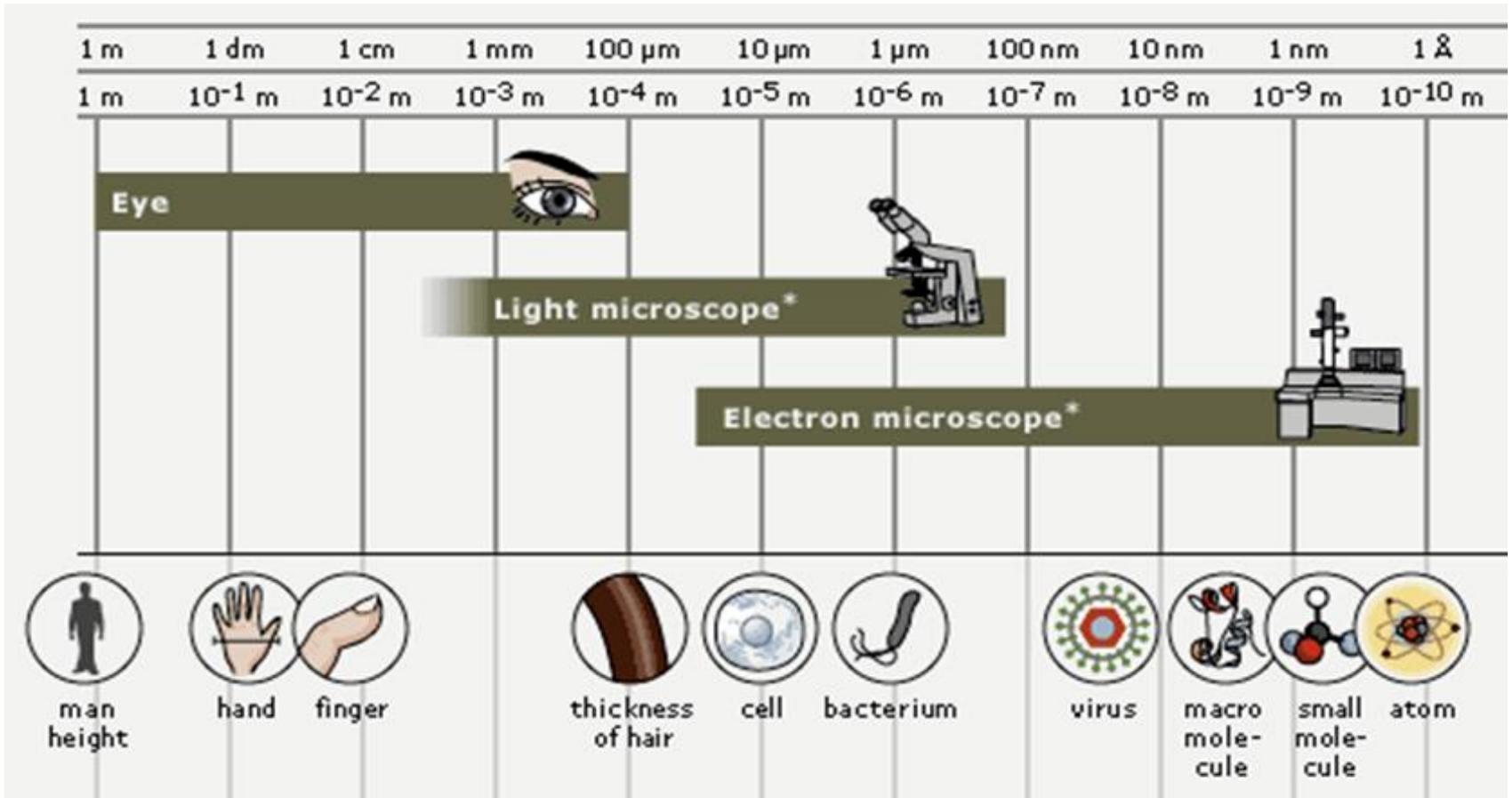


# Observing Cells: Microscopes

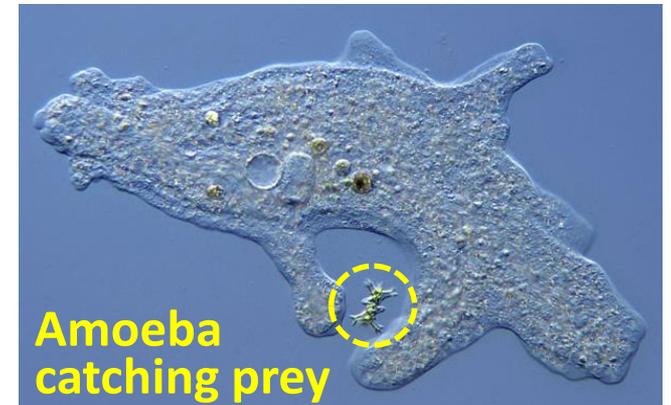
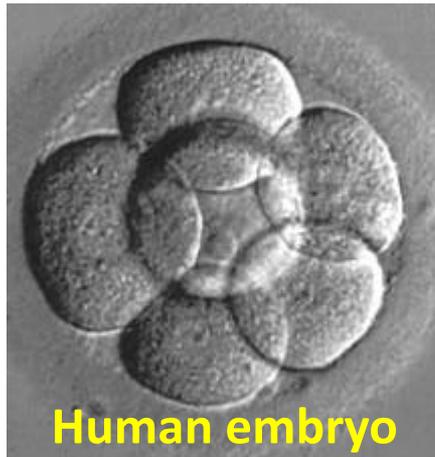
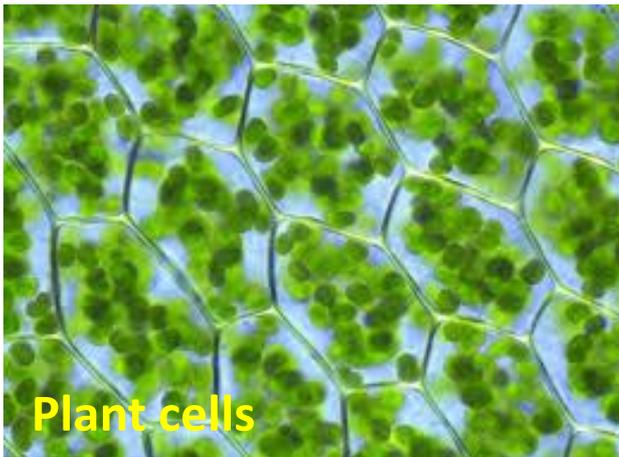


- **Magnification:** refers to the microscope's power to increase an object's apparent size.

- **Resolution:** refers to the microscope's power to show detail clearly.

# Observing Cells: Light Microscope

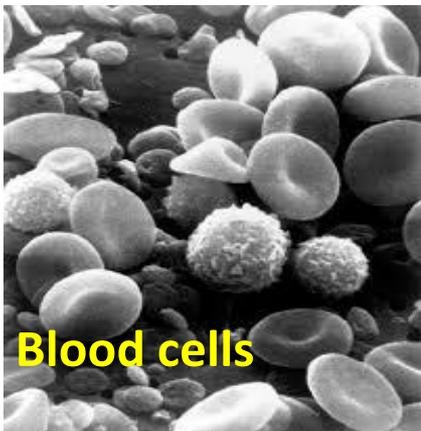
- Invented around 1590-1600, name “microscope” given in 1625.
- Uses **visible light** and a **system of lenses**.
- Magnification of up to **~2000X**.
- Resolution ~200-500 nm (limited by diffraction of visible light).
- Makes it possible to **observe living cells in true color**.



# Observing Cells: Electron Microscope

- Uses **accelerated electrons** as a source of illumination together with **electrostatic and electromagnetic lenses** to control the electron beam and focus it to form an image.
- 2D or 3D black and white images (may be colorized) with magnification of up to **~10,000,000X**
- Preparation needed (for example, chemical fixation or freeze drying) **kills the cells.**

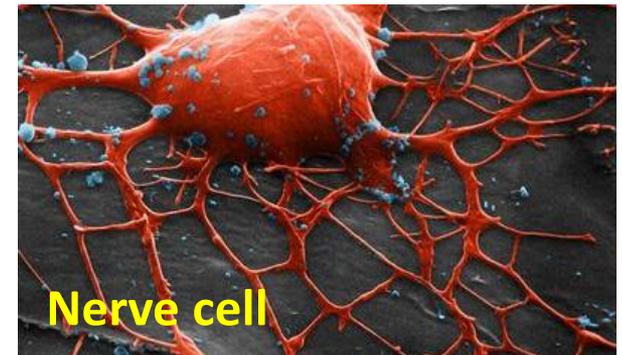
Invented  
~1930; first  
commercial  
device  
produced by  
Siemens in  
1939.



Blood cells



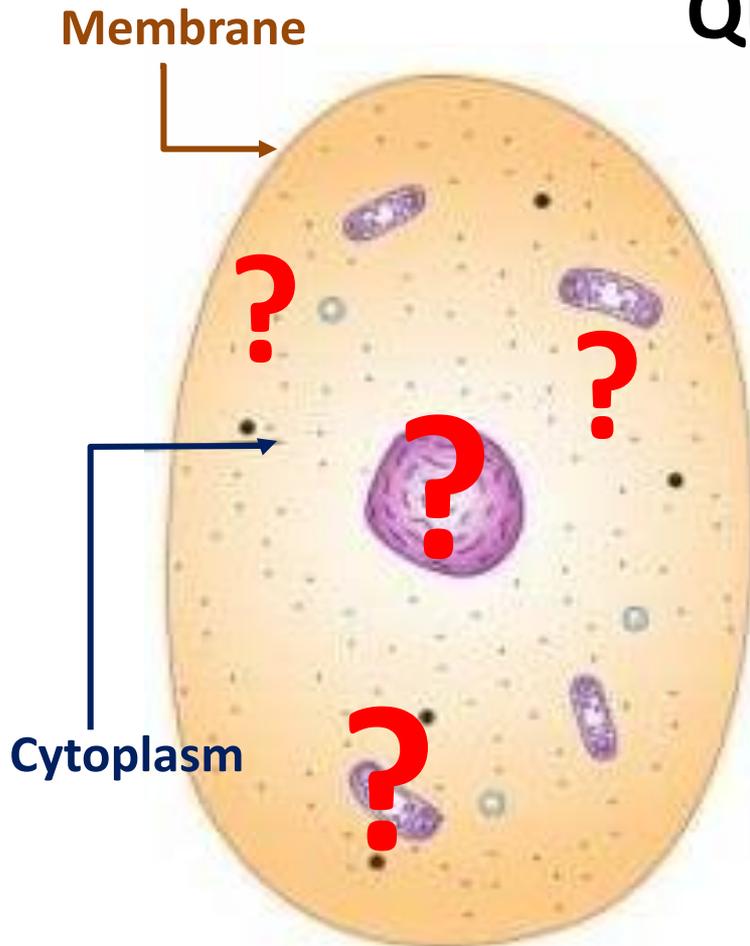
Plant cells



Nerve cell

# Cell Composition

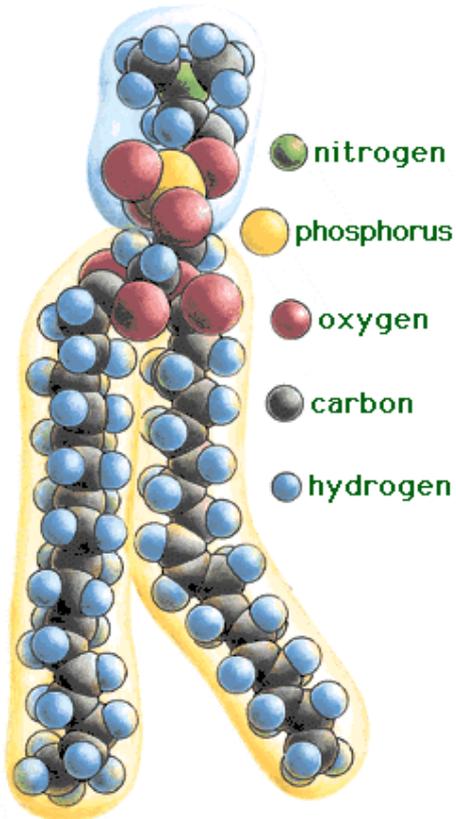
All cells consist of a **cytoplasm** enclosed within a **membrane**.



Question: **What's inside?**

- **Organelles** – later 😊
- **Cytoplasm** is composed of a mixture of small molecules (ions, amino acids, sugars and 70-90% water), and macromolecules which are essential to the cell's functions.
- Major classes of intracellular organic macromolecules:
  - **Nucleic acids**
  - **Proteins**
  - **Carbohydrates**
  - **Lipids**

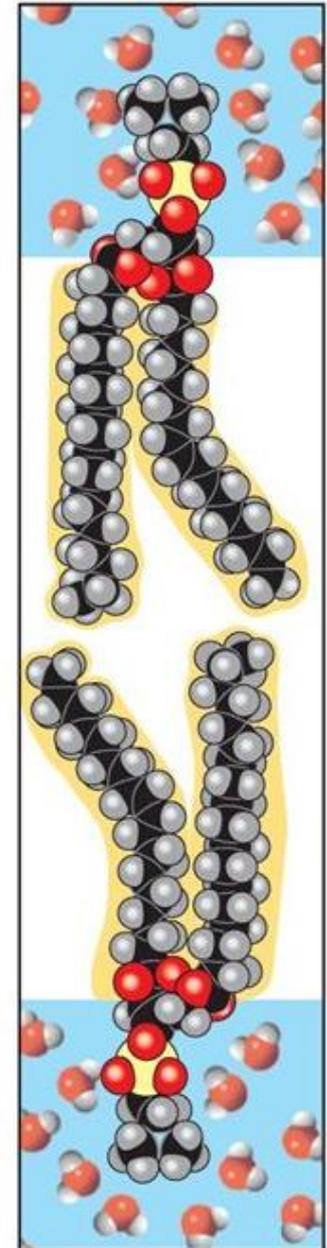
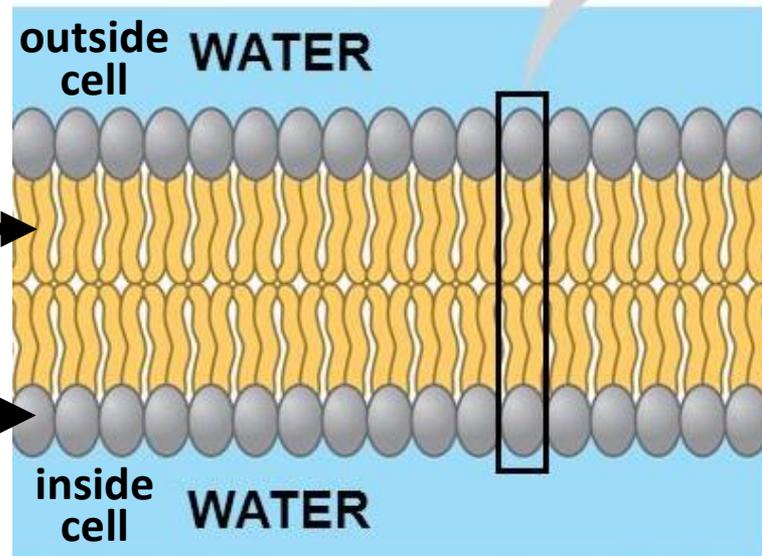
# Lipids (Fat)



Lipids or fat molecules are **components of cell membranes**; they are also involved in energy storage, as well as relaying signals within cells.

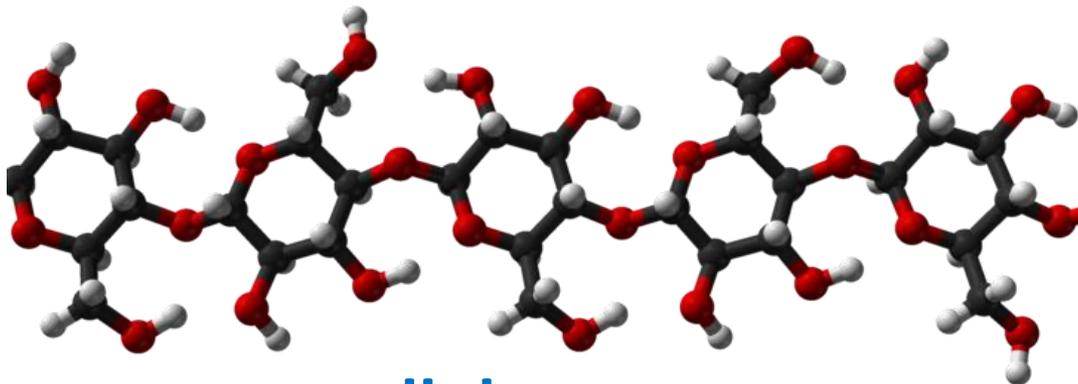
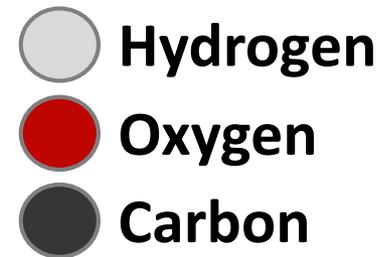
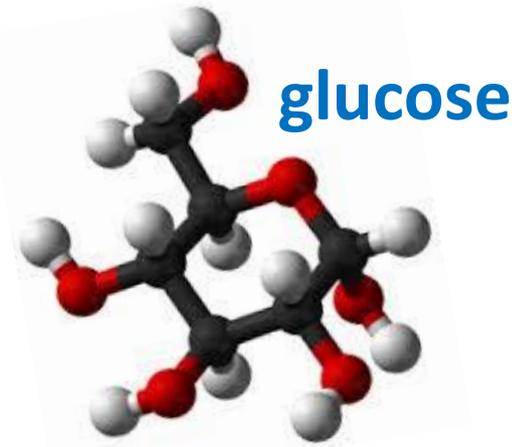
**Hydrophobic**  
(water-repelling)  
**tail**

**Hydrophilic**  
(water-attracting)  
**head**

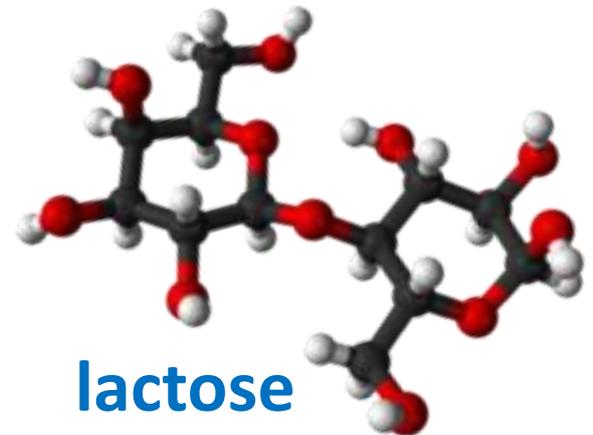


# Carbohydrates

- Simple carbohydrates (*sugars*) are used for the cell's immediate energy demands.
- Complex carbohydrates (*polysaccharides*) can serve as intracellular energy stores (*starches* and *glycogen*) or have structural functions (*cellulose* and *chitin*); they are also found on a cell's surface, where they play a crucial role in cell recognition.



cellulose

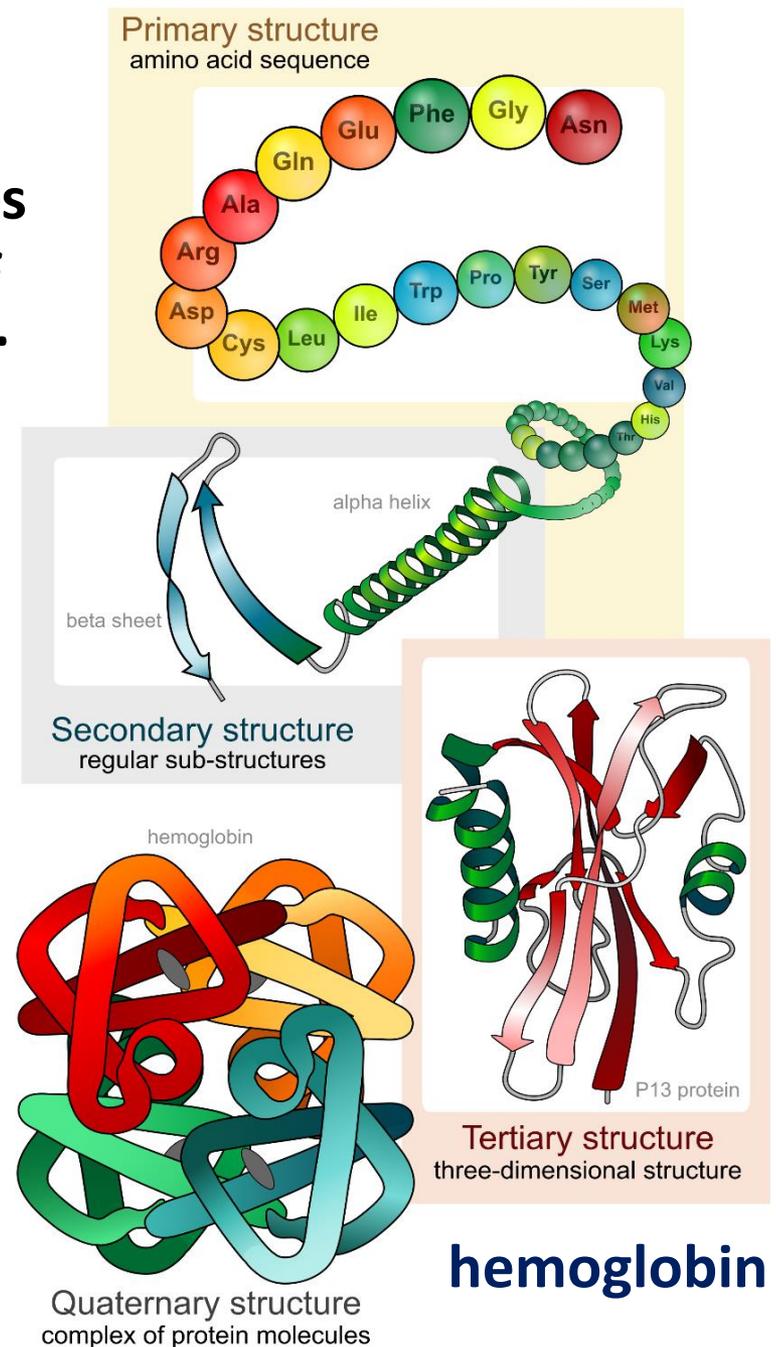


lactose

# Proteins

Proteins are the complex molecules that **do most of the work** (*that is produce change*) in living organisms.

- Made from **chains** of smaller molecules called **amino acids**.
- A protein is **defined by the sequence** of amino acids.
- Serve a variety of functions:
  - **catalytic (*enzymes*)** - almost all processes in the cell need help speeding up in order to occur at rates fast enough to sustain life
  - **structural/mechanical**
- Cells are capable of synthesizing (making) essential proteins.



# Examples of Proteins

