

# **VACUOLE**

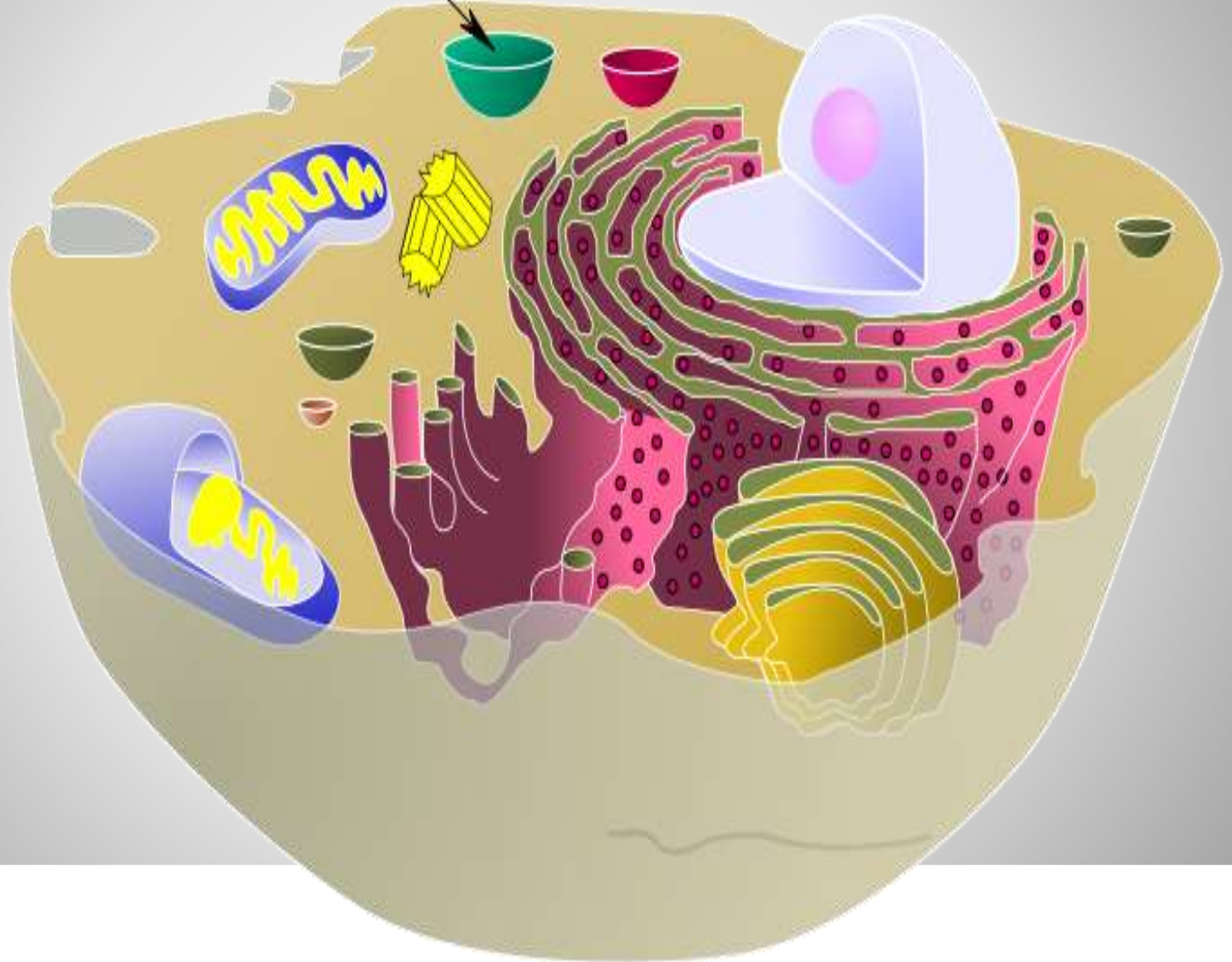
## **STRUCTURE AND FUNCTIONS**

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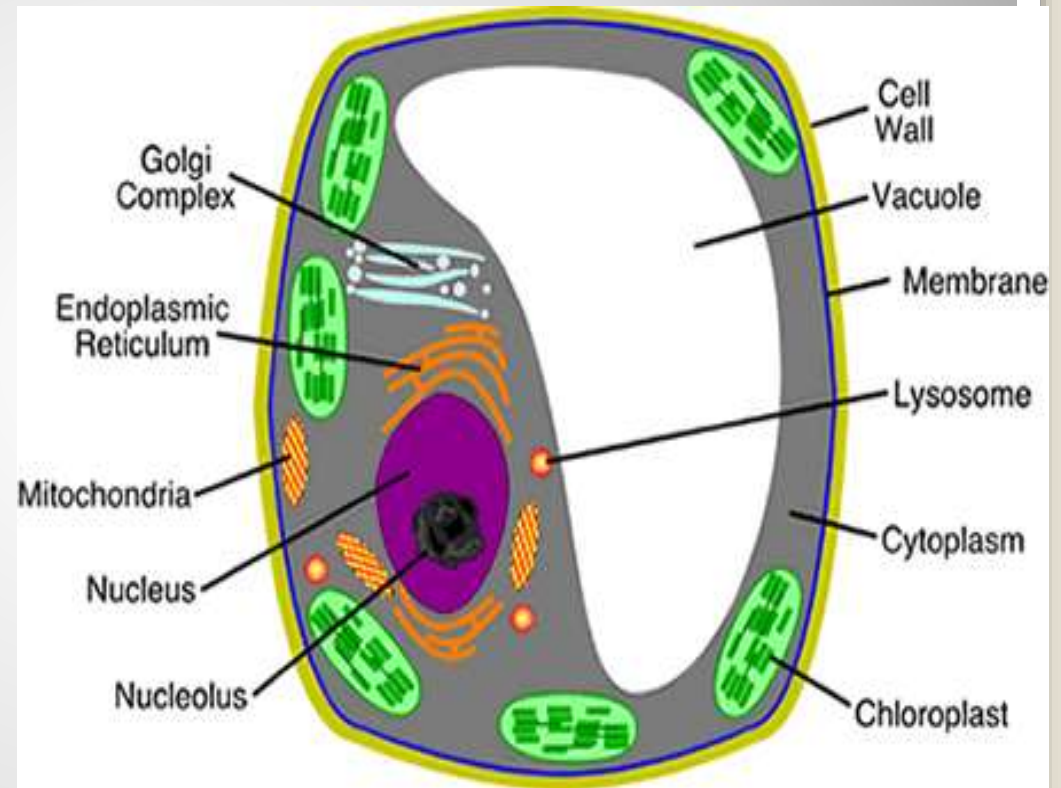
Vacuole



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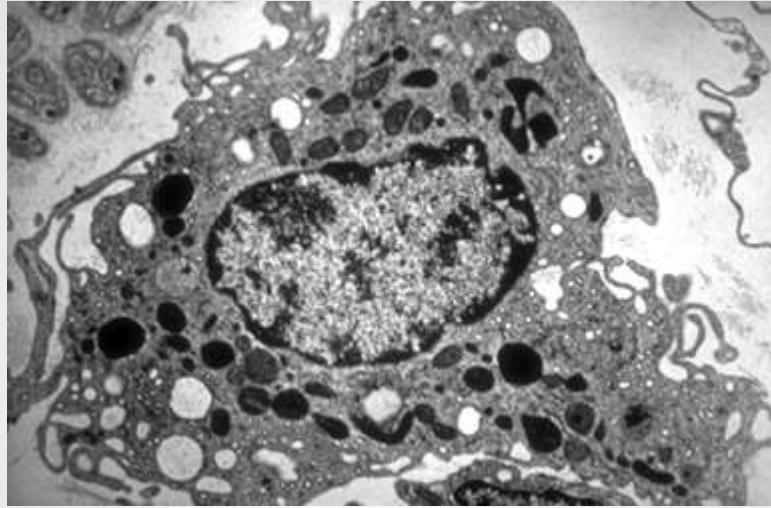
# Vacuoles

- **Fluid filled sacks for storage**
- **Small or absent in *animal* cells**
- ***Plant* cells have a large **Central Vacuole****
- **No vacuoles in *bacterial* cells**



- The vacuoles ( *Vacuus*–empty) are non–living, most conspicuous components of the plant cells.
- They are very large, filled with fluid called as vacuolar sap.
- In young cell the vacuoles are smaller in size and many in numbers but in mature cells their number decreases and size increases.
- Sometimes only one vacuole is presents in a cell. The shape of vacuole is variable.

## **Introduction**

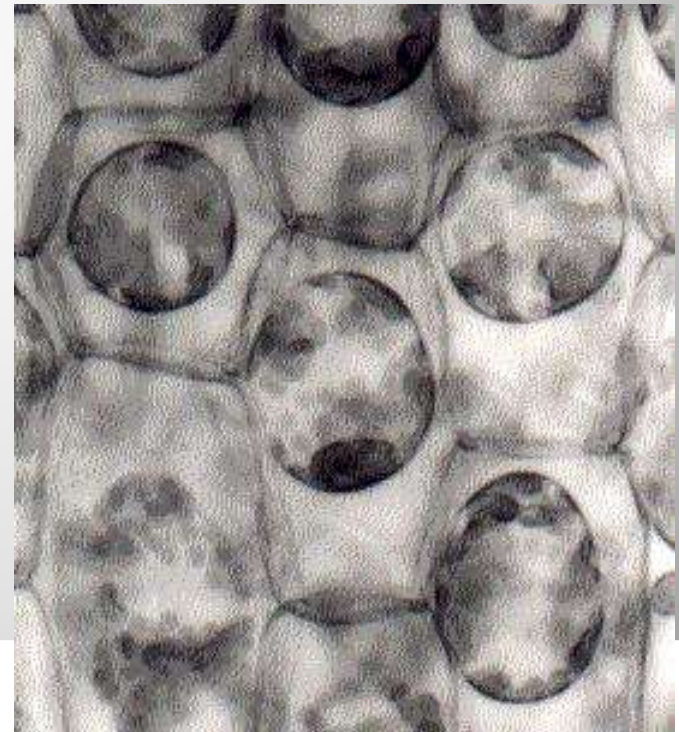


**Vacuole**



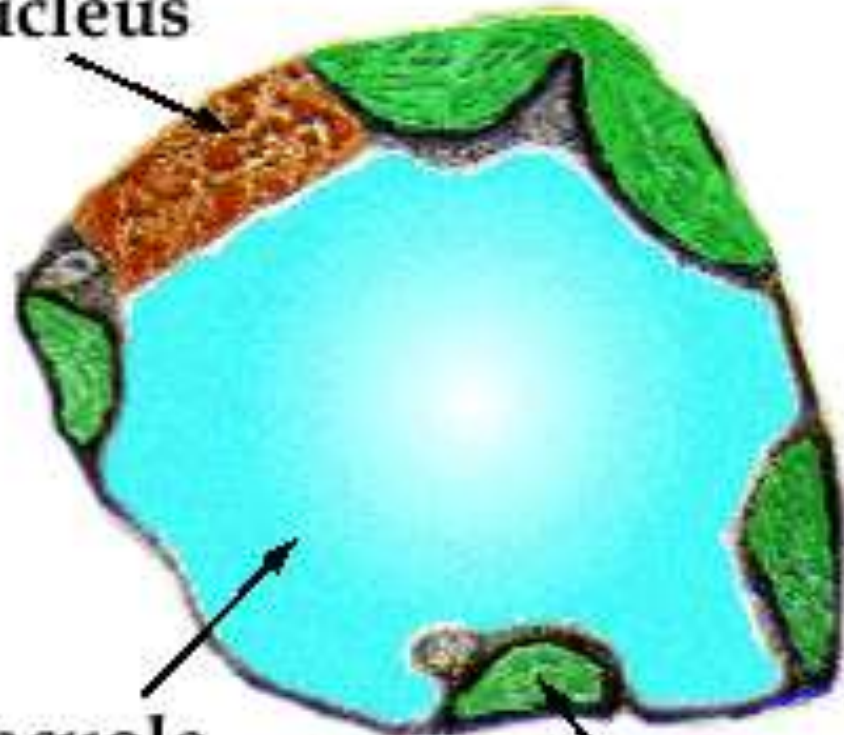
# Vacuoles

- In plants, they store **Cell Sap**
- Includes storage of **sugars, proteins, minerals, lipids, wastes, salts, water, and enzymes**



# Vacuole

nucleus

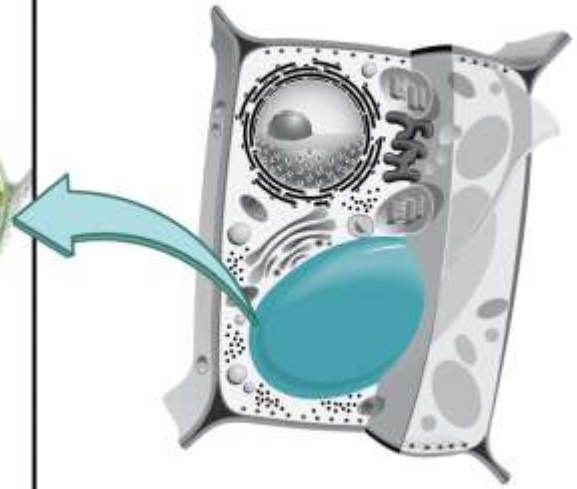
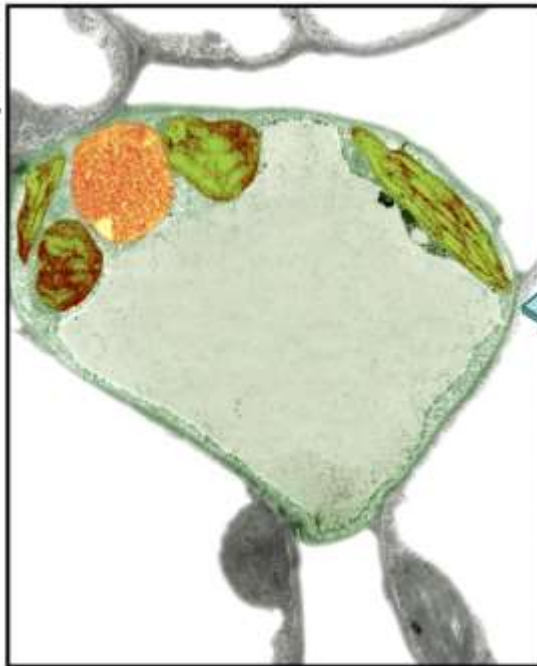


vacuole

chloroplast

- Membrane bound storage sacs
- More common in plants than animals
- Contents
  - Water
  - Food
  - wastes

TEM 15,000×

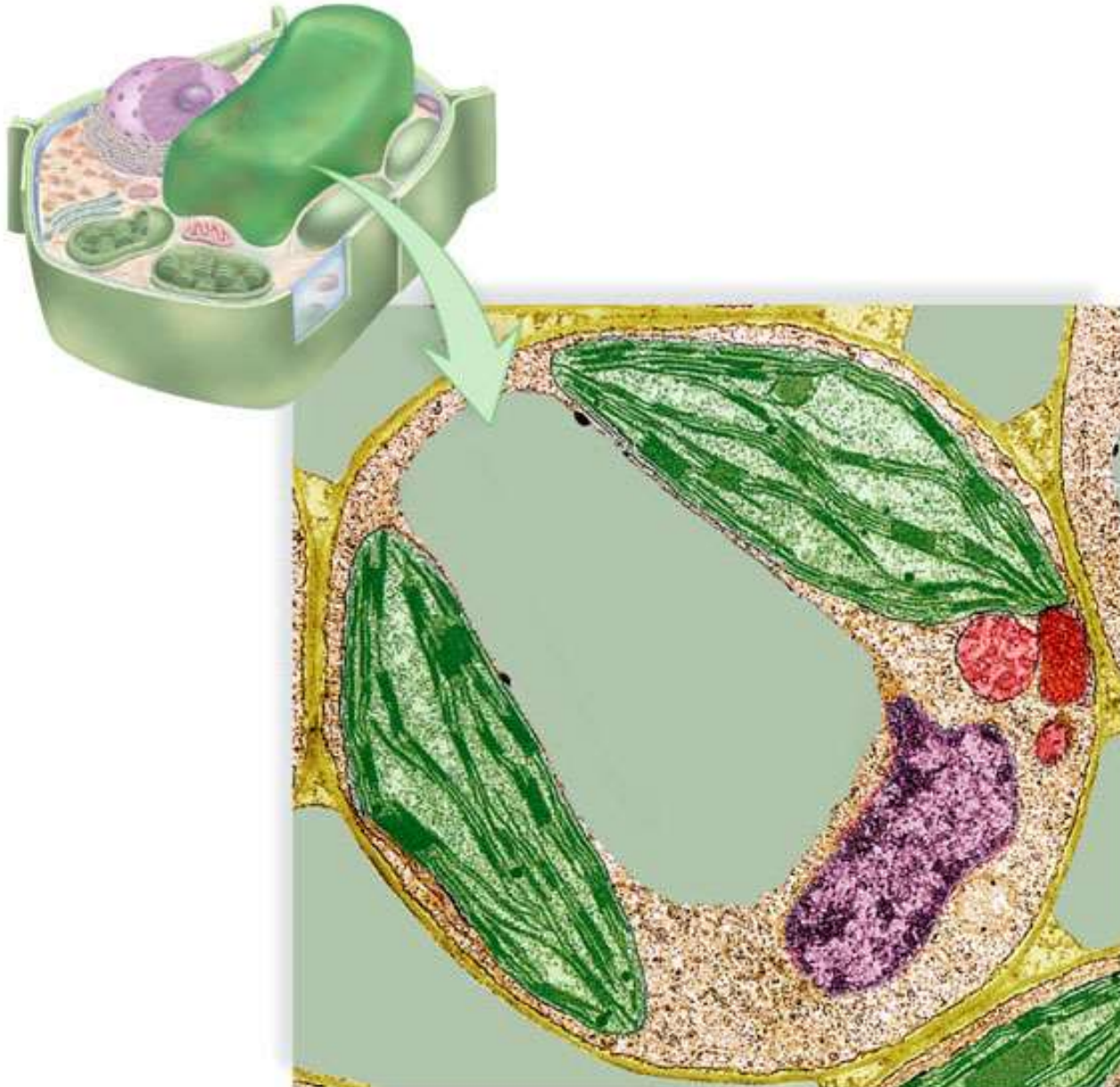


**Vacuoles**



## Structure

- Each vacuole is separated from a cytoplasm by a single unit membrane called tonoplast or vacuolar membrane.
- The tonoplast encloses the liquid substance which includes carbohydrates (sugars), amides, amino acids, proteins, organic acids, anthocyanin pigments, waste products of mineral salts like chlorides and phosphates etc.



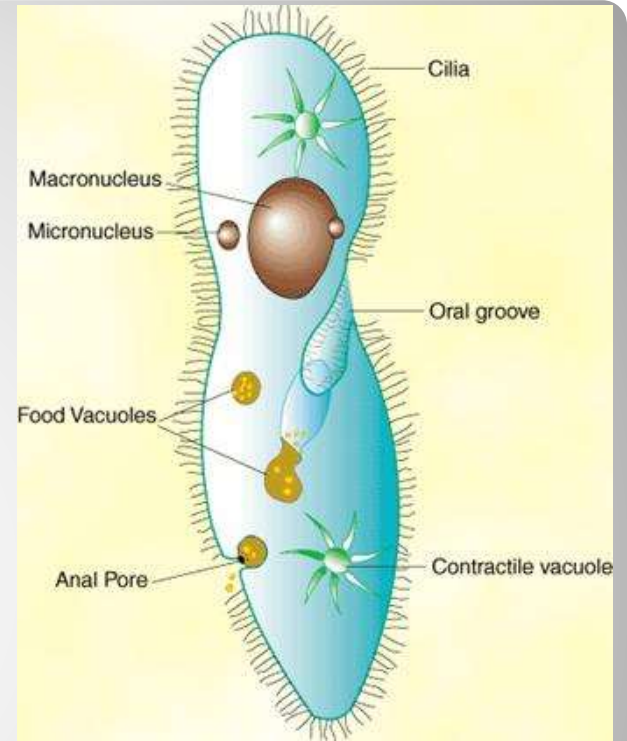
100 nm

# Structure

- Vacuoles are structurally and functionally related to lysosomes in animal cells and may contain a wide range of hydrolytic enzymes.
- The pH of vacuole may be as high as 8–10 due to large quantity of alkaline substances as low as 3 due to the accumulation of acids (citric oxalic and malic acid).

# Contractile Vacuole

- Found in unicellular protists like **paramecia**
- **Regulate water intake by pumping out excess (homeostasis)**
- **Keeps the cell from lysing (bursting)**



Contractile vacuole animation 

# Functions :

- Vacuole act as storage organelles for various substances.
- Vacuolar sap maintain the turgor pressure of a cell.
- Vacuoles also store anthocyanin pigment which gives various colors to flowers, fruits that helps in the pollination and ornamental value.
- Plant vacuole also contain the product such as rubber latex (*Hevea brasiliensis*) or opium (*Papaver somniferum*).



# Functions

- They also help in enlargement of cell.
- Several metabolic activities takes place in the cell sap or vacuole.
- Isolating materials that might be harmful or a threat to the cell
- Containing waste products
- Containing water in plant cells
- Maintaining internal hydrostatic pressure ( pressure exerted by liquid) within the cell.

# Functions

- Maintaining an acidic internal pH
- Containing small molecules
- Exporting unwanted substances from the cell
- Allows plants to support structures such as leaves and flowers due to the pressure of the central vacuole
- In seeds, stored proteins needed for germination are kept in 'protein bodies', which are modified vacuoles.

- Vacuoles also play a major role in autophagy maintaining a balance between biogenesis (production) and degradation (or turnover), of many substances and cell structures in certain organisms.

## Functions