



OSMOSIS



It is important that substances are able to move in and out of living cells

- In both animal and plants cells **the cell membrane controls what enters and leaves the cell**
- The cell membrane is **SELECTIVELY PERMEABLE**
- In plant cells there is also a **cell wall**
- This is **fully permeable** and plays no role in controlling what enters or leaves the cell

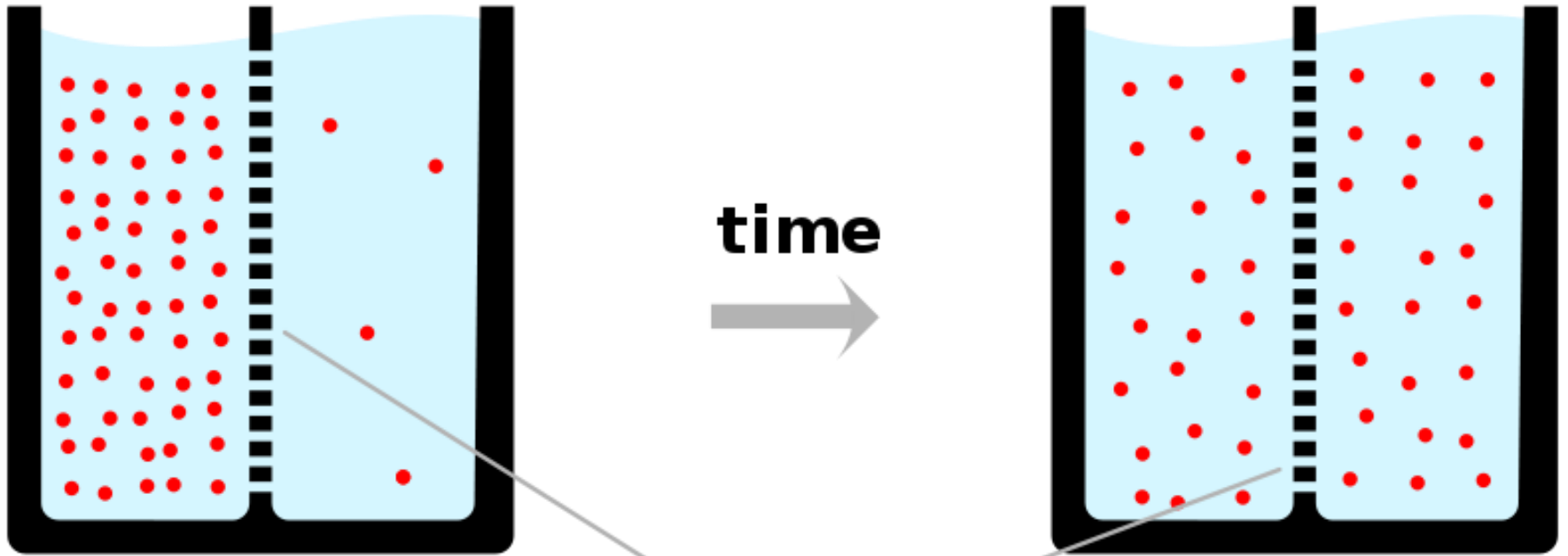
Two important factors affect the movement of substances

- **Size of the particles** – the cell membrane has small **pores** in its structure. Large particles cannot pass through
- **Concentration gradient** – refers to the balance of particles on either side of the membrane. If the difference in concentration is great the concentration gradient is steep and substances will move quickly **from the high concentration to the low concentration.**

Diffusion

FOR REVISION

- The random movement of molecules from an area of high concentration to an area of low concentration
- Diffusion happens in various biological systems and most are adapted to allow it to happen at a rapid rate
- e.g. gas exchange in the alveoli and nutrient uptake in the ileum.



semipermeable membrane

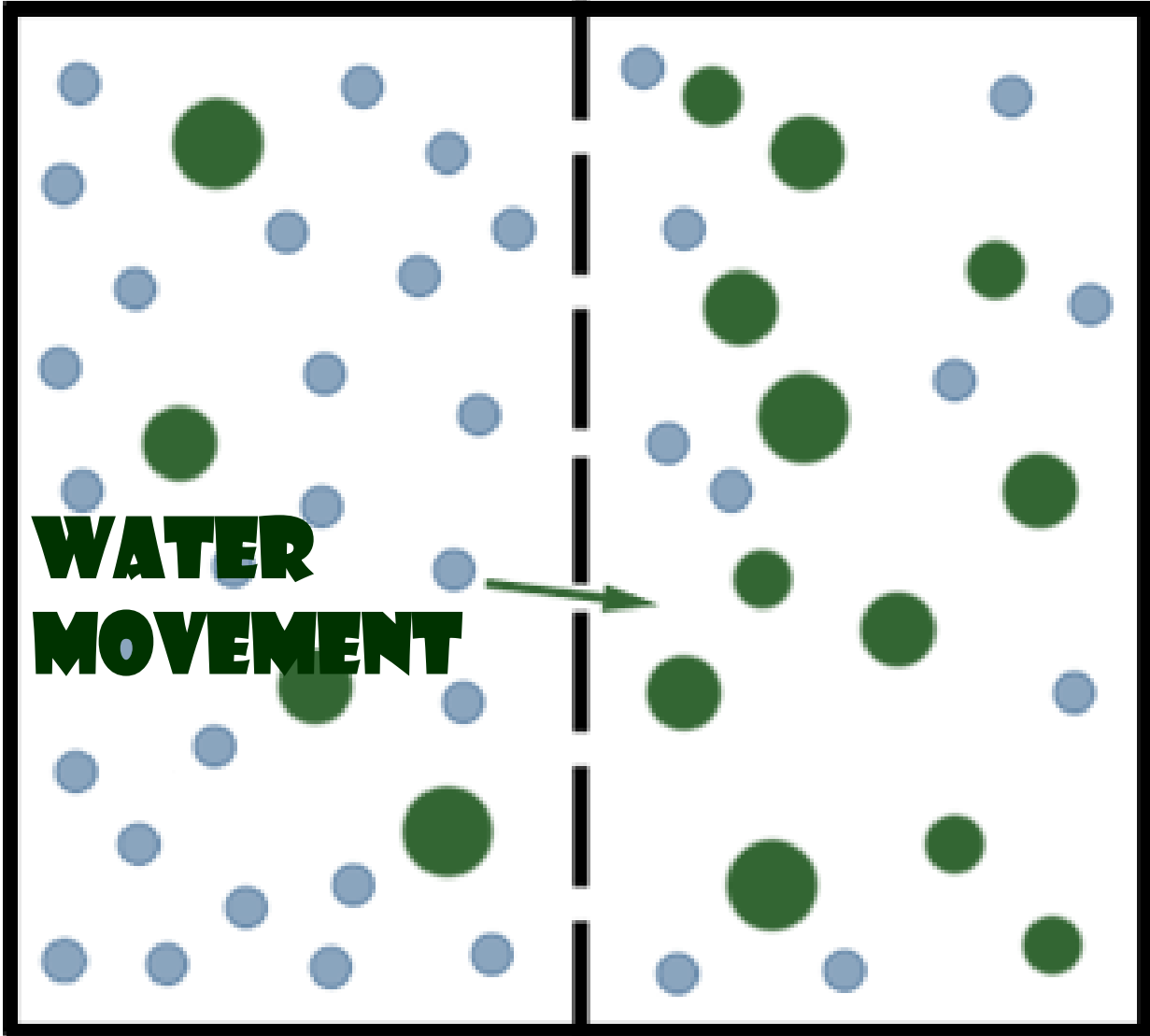
**What would happen if
the particles were bigger than
the pores in the membrane?**

OSMOSIS

The movement of **water** from an area of higher water concentration to an area of lower water concentration through a **selectively permeable membrane**

● solute

● water



high water concentration

low water concentration

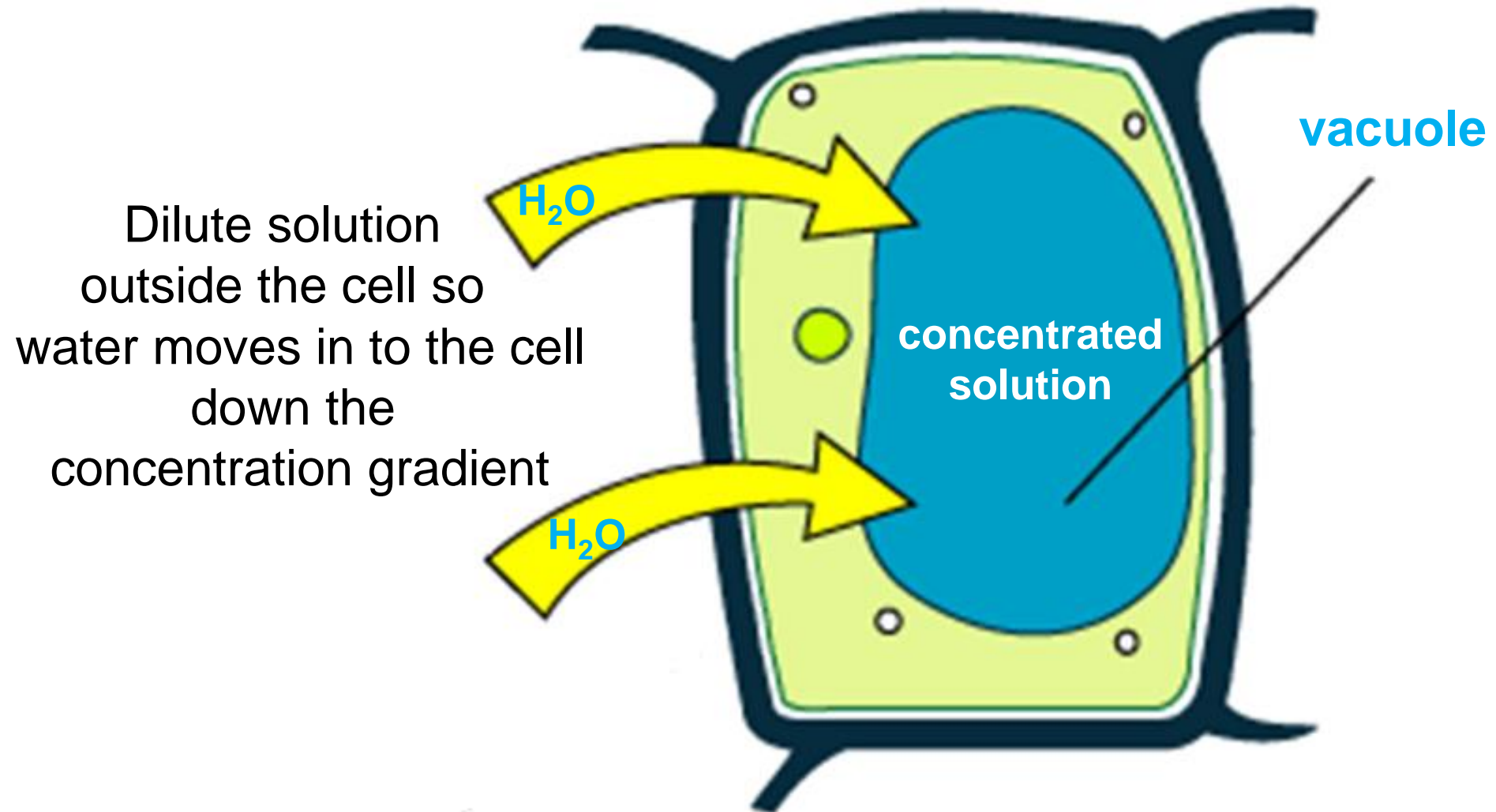
- In the diagram above only the water molecules move because the solute molecules are **too large** to move through the selectively permeable membrane
- Osmosis describes the movement of **water molecules only**

PLANT CELLS IN DIFFERENT SOLUTIONS

In Dilute solution (high water)

- There is more water **outside the cell than inside**
- Water will move **into the cell down the concentration gradient, by osmosis**
- The vacuole **increases in size**
- The cell membrane **pushes against the cell wall due to the pressure of the water**
- The cell is said to be **turgid**

TURGID



- The cell wall prevents too much water entering the cell **so preventing the cell from bursting**
- **TURGOR PRESSURE** is very important as it **gives the plant support**
- In non-woody plants it is essential in **keeping the plant upright.**



In Concentrated solution (low water)

- There is more water **inside the cell than outside**
- Water will **move out of the cell down the concentration gradient by osmosis**
- The vacuole and cytoplasm lose water and shrink
- At this point the plant may begin to **wilt**

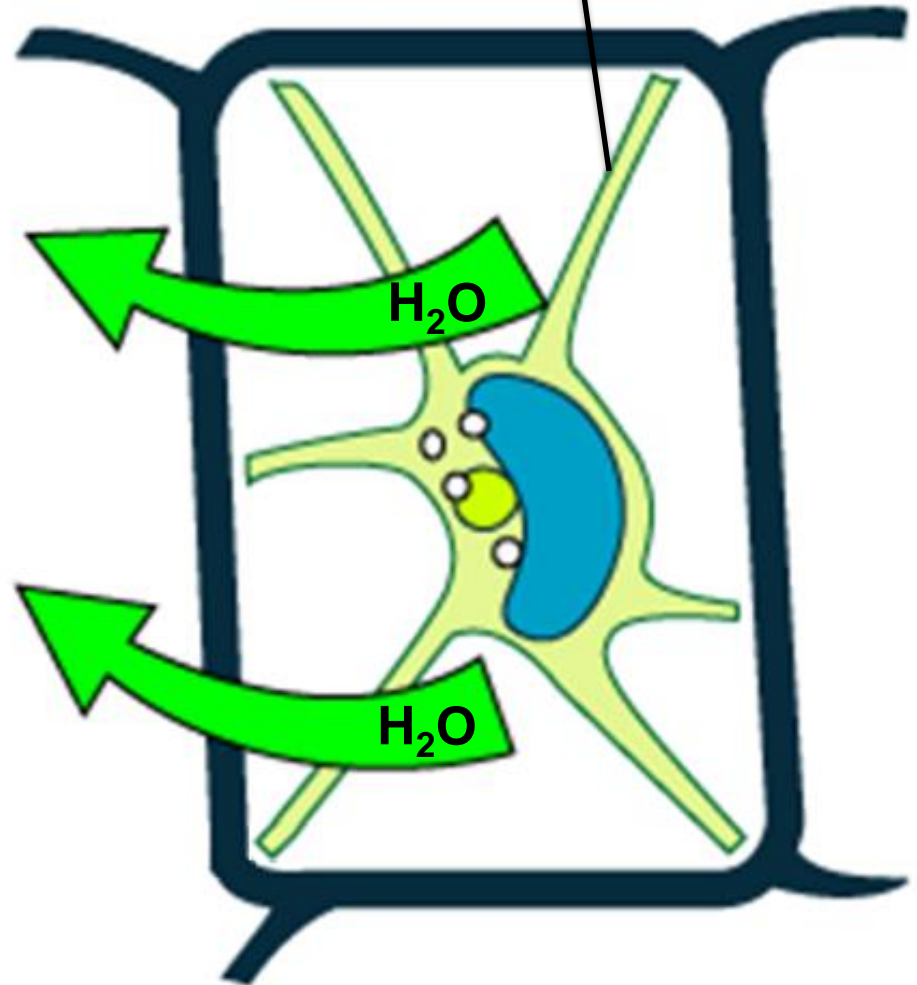


- If the cell loses too much water **the membrane is pulled away from the cell wall and the vacuole shrinks**
- The cell is said to be **PLASMOLYSED**
- Cells which become plasmolysed are **unlikely to survive.**

PLASMOLYSED

Cell
membrane

Concentrated solution
outside the cell so
water leaves the cell
down the
concentration
gradient



turgor & wilting



ANIMAL CELLS IN DIFFERENT SOLUTIONS

In Dilute solution (high water)

- ▶ There is **more water outside the cell than inside**
- ▶ Water will **move into the cell by osmosis**
- ▶ Because there is no cell wall **the cells burst because pressure increases**
- ▶ This is known as **CELL LYSIS**

DEMMO:

Blow up a balloon with a hand pump

Safety: pupils to stand back!

Place the balloon in a pair of tights.

Blow up the balloon with hand pump as far as you can.

The rubber of the balloon acts like the cell membrane. As more air enters the balloon the pressure increases until the membrane can no longer withstand the outward force and the balloon ruptures.

The tights act like the cell wall. As the pressure increases the tights push back on the rubber balloon. This restricts the volume of air that can enter and helps to support the cell, preventing it from bursting.

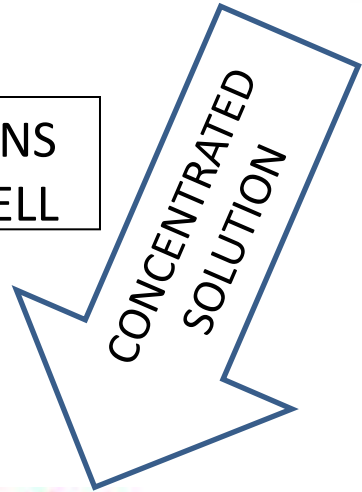
In Concentrated solution (low water)

- There is **more water inside the cell than outside**
- Water will **move out of the cell down the concentration gradient by osmosis**
- The cell shrinks and becomes **CRENATED**



**CELLS MAINTAIN
NORMAL SHAPE**

WATER CONCENTRATIONS
ARE EQUAL INSIDE & OUT



WATER CONCENTRATIONS
ARE LOWER OUTSIDE CELL

WATER CONCENTRATIONS
ARE HIGHER OUTSIDE CELL

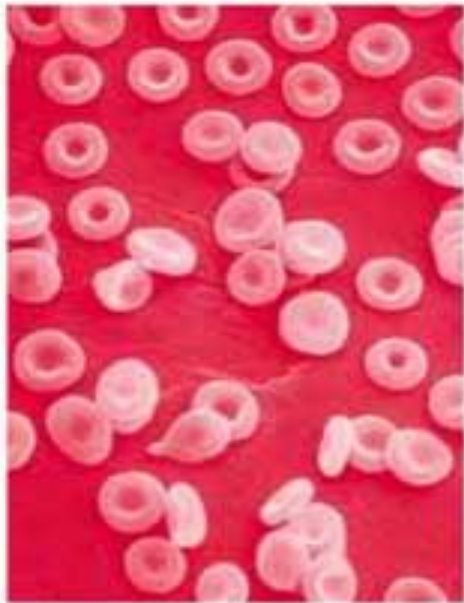
**CELLS SHRINK
BECAUSE WATER
LEAVES THE CELLS
(CRENATION)**



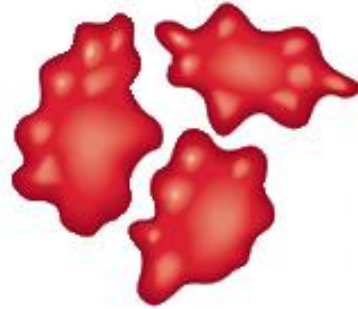
**CELLS SWELL AND
BURST BECAUSE
WATER ENTERS
THE CELLS
(LYSIS)**



A



B



C



- These changes would not happen to cells in a healthy body.
- The concentration of our blood is carefully **monitored** and **controlled** by the **brain** and **kidneys** to ensure large volumes of water do not enter or leave our blood or other cells

PRACTICAL WORK

investigating osmosis in potato

looking at plasmolysed onion cells

