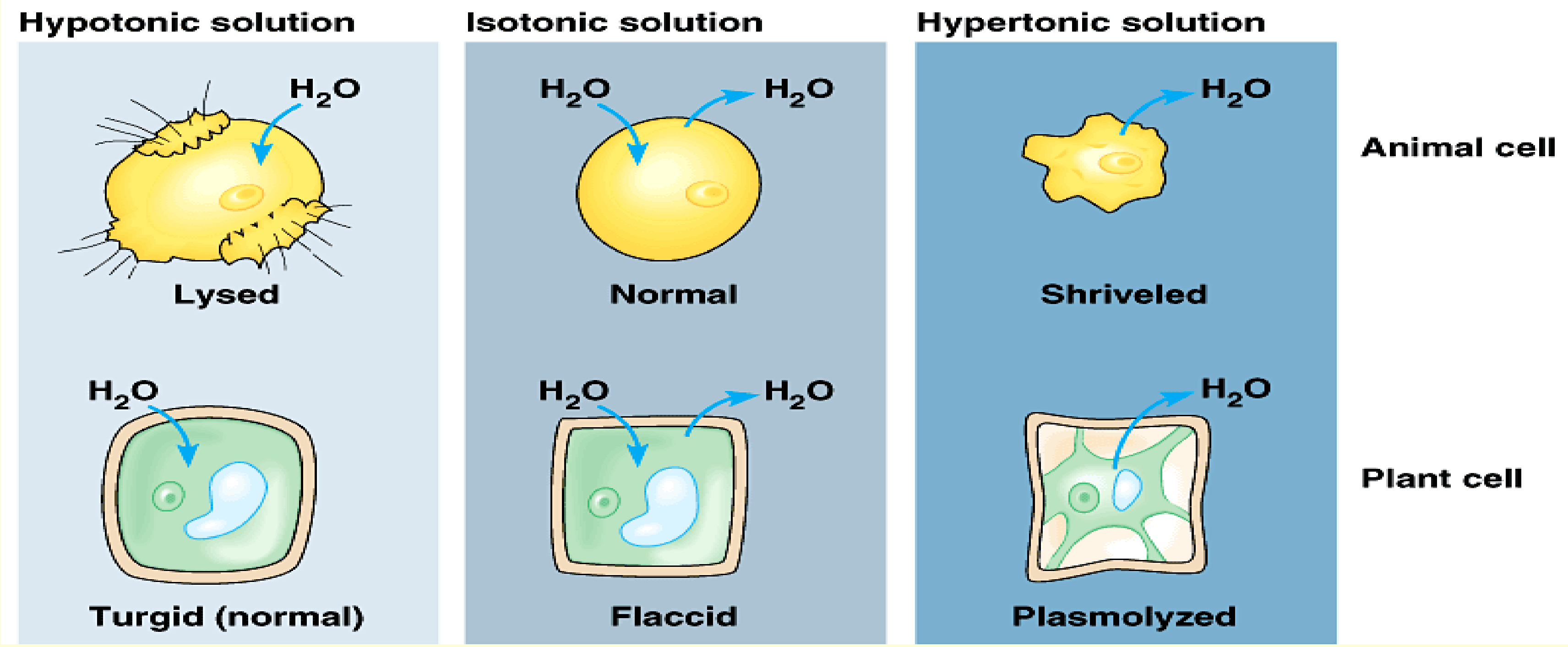
Aim: What is osmoregulation?

Cell survival depends on balancing water uptake and loss

- An animal cell immersed in an isotonic environment experiences no net movement of water across its plasma membrane.
  - Water flows across the membrane, but at the same rate in both directions.
  - The volume of the cell is stable.

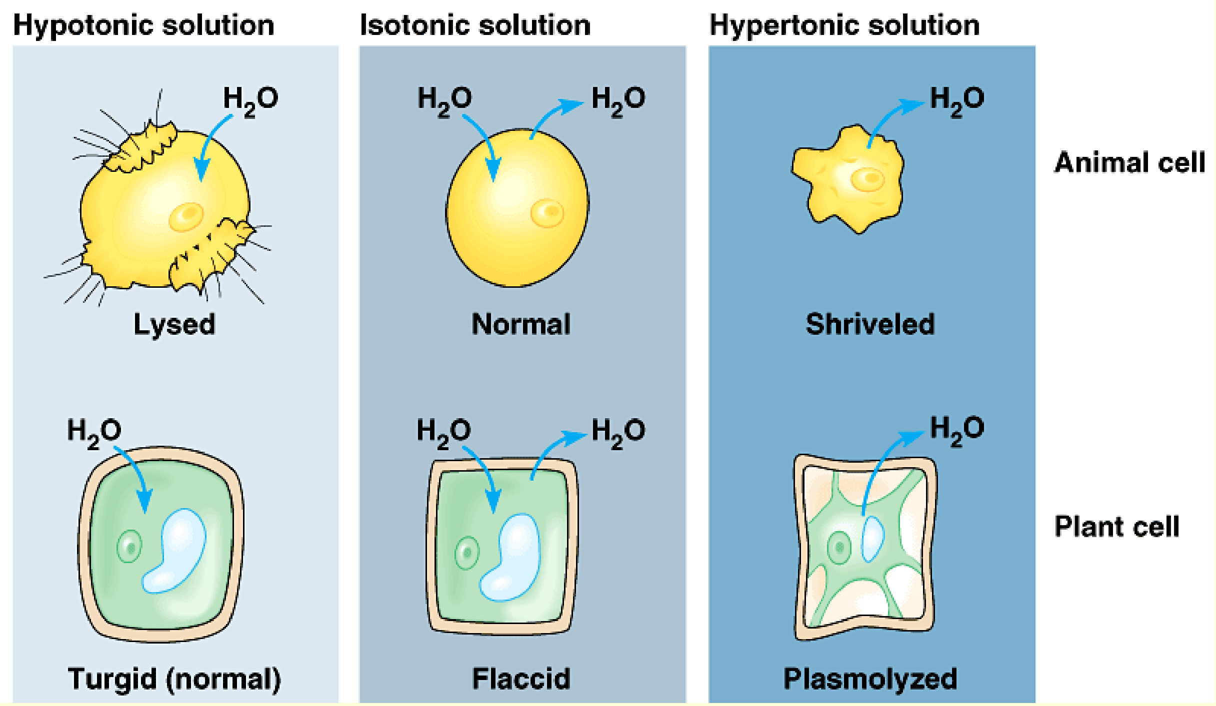
- The same cell in a hypertonic environment will loose water, shrivel, and probably die.
- A cell in a hypotonic solution will gain water, swell, and burst.



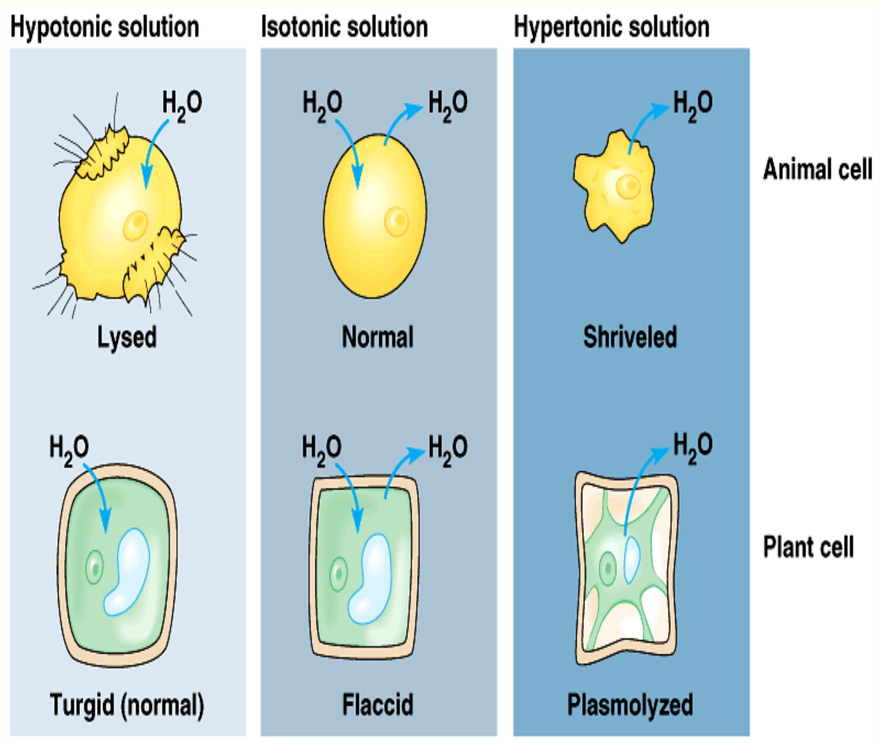
- For a cell living in an isotonic environment (for example, many marine invertebrates) osmosis is not a problem.
  - Similarly, the cells of most land animals are bathed in an extracellular fluid that is isotonic to the cells.
- Organisms without rigid walls have osmotic problems in either a hypertonic or hypotonic environment and must have adaptations for **osmoregulation** to maintain their internal environment.

- For example, *Paramecium*, a protist, is hypertonic when compared to the pond water in which it lives.
    - In spite of a cell membrane that is less permeable to water than other cells, water still continually enters the *Paramecium* cell.
    - To solve this problem, *Paramecium* have a specialized organelle, the contractile vacuole, that functions as a bilge pump to force water out of the cell.

- The cells of plants, prokaryotes, fungi, and some protists have walls that contribute to the cell's water balance.
- An plant cell in a hypotonic solution will swell until the elastic wall opposes further uptake.
  - At this point the cell is **turgid**, a healthy state for most plant cells.



- Turgid cells contribute to the mechanical support of the plant.
- If a cell and its surroundings are isotonic, there is no movement of water into the cell and the cell is **flaccid** and the plant may wilt.



- In a hypertonic solution, a cell wall has no advantages.
- As the plant cell looses water, its volume shrinks.
- Eventually, the plasma membrane pulls away from the wall.
- This **plasmolysis** is usually lethal.