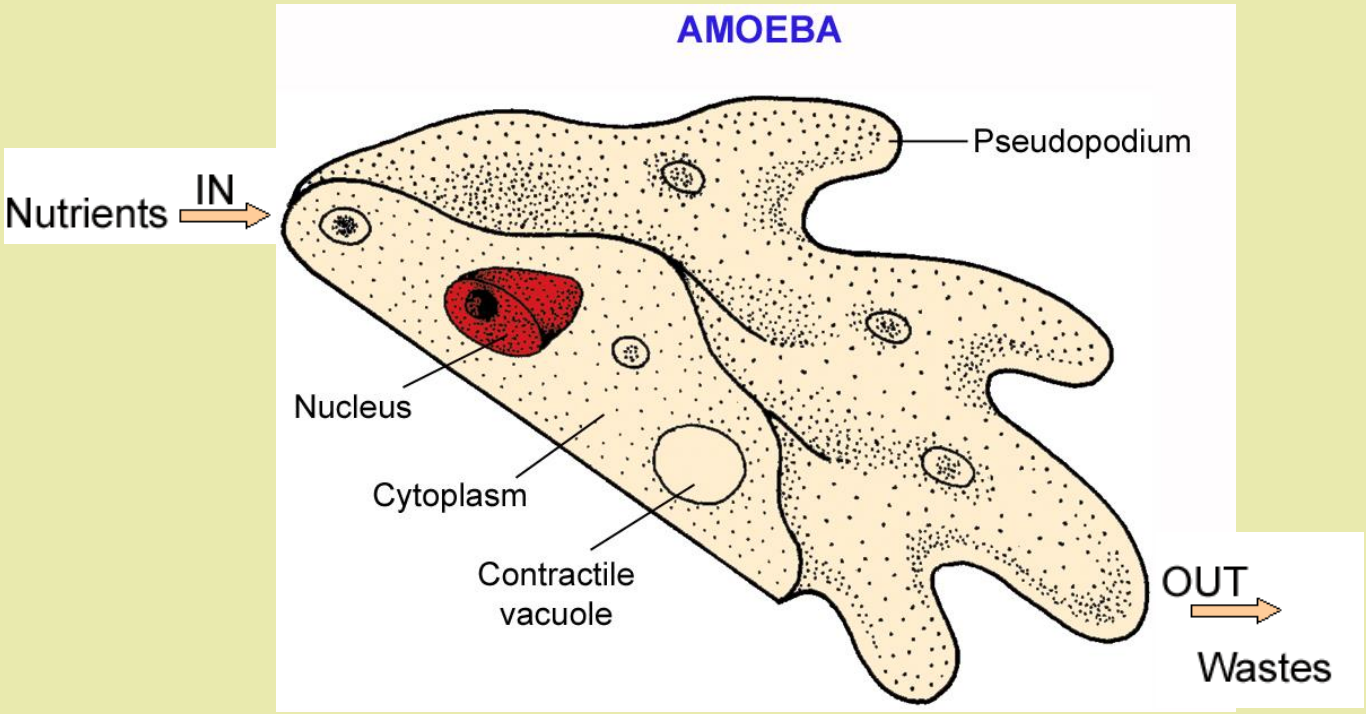
3.4.1 --- HOMEOSTASIS

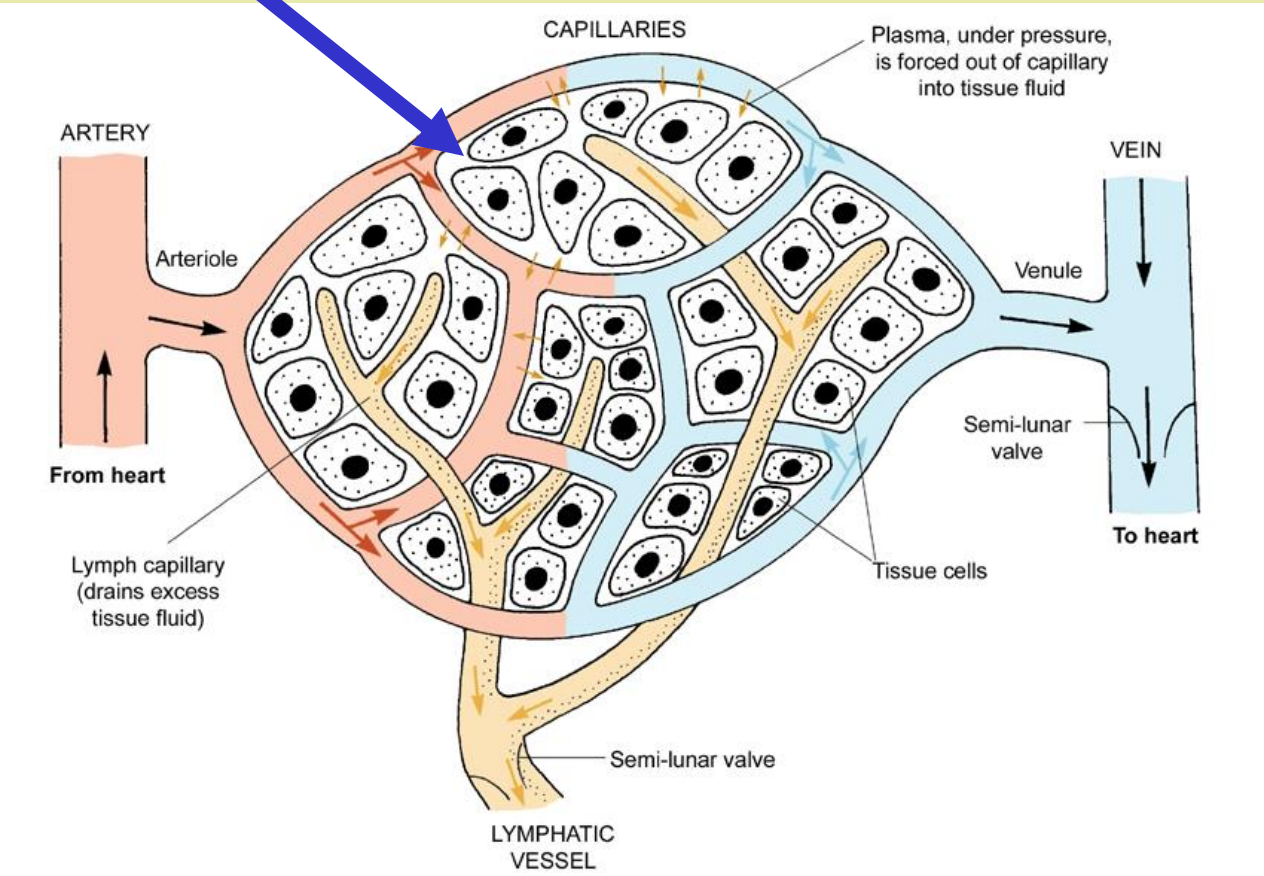
- Def:Homeostasis is the maintenance of a constant internal environment for our cells.
  - Your body and its individual cells need just the right conditions to perform at their best.
  - A cell's delicately balanced chemical reactions work best within narrow limits of temperature, pH, solute concentration etc.

- Simple aquatic organisms (like Amoeba and seaweeds) obtain their food, water and oxygen directly from the water that surrounds them.



- More complex organisms carry their own internal sea inside them (the tissue fluid), which is in contact with all the living cells of the body.

Tissue Fluid



Homeostasis

Homeostasis means "controlling internal conditions":

Waste products need to be removed --- how ?

CO_2	Produced by respiration, removed via lungs
Urea	Produced by liver breaking down amino acids, removed by kidneys and transferred to bladder

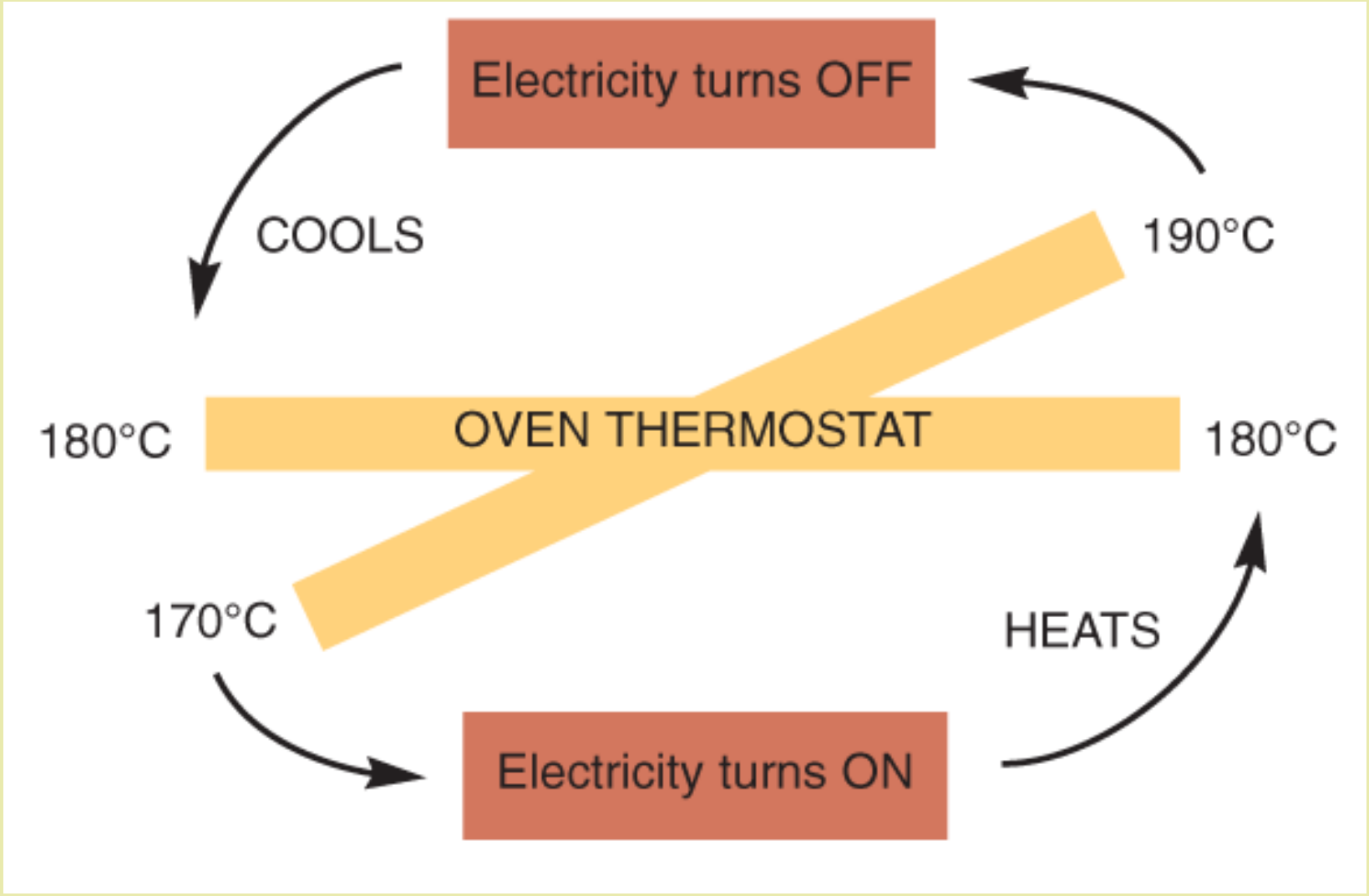
Internal conditions need controlling --- how ?

Temperature	Increased by shivering, decreasesd by sweating
Ion content	Increased by eating, lost by sweating + urine
Water content	Increased by drinking, lost by sweating + urine
Blood glucose	Increased and decreased by hormones

Why do we need HOMEOSTASIS

- Homeostasis is necessary if an organism is to be independent of its surroundings, and if its metabolism is to function efficiently.

- Most homeostatic mechanisms work by negative feedback, i.e. if there is a change away from the normal optimum value, action is automatically taken to reverse this change.


Electricity turns OFF
COOLS
190°C
180°C
OVEN THERMOSTAT
180°C
170°C
HEATS
Electricity turns ON

Homeostasis – Temperature Regulation

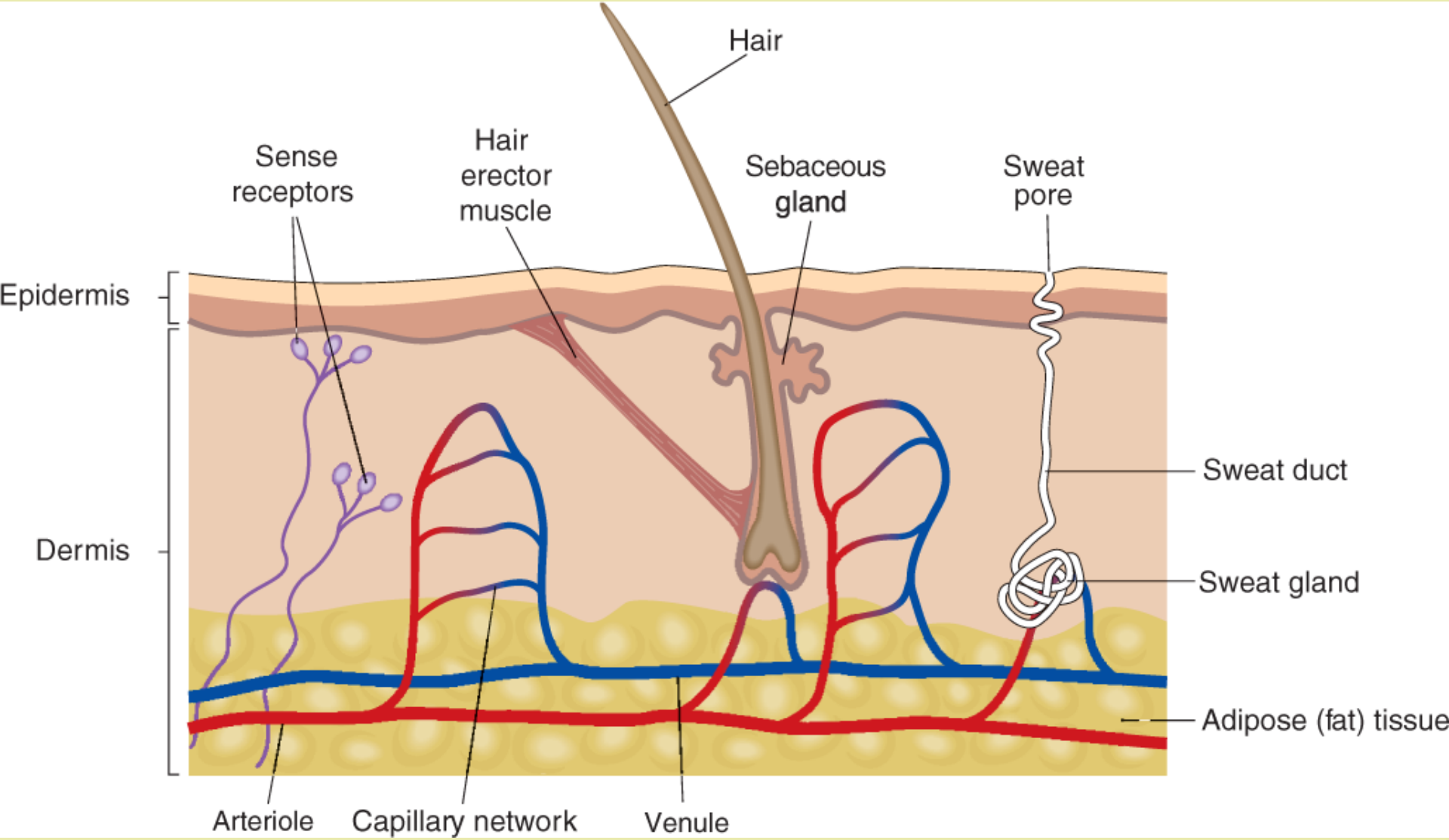
- Temperature influences the rate of enzyme-controlled reactions that sustain life.

- Mammals and birds are endotherms (warm blooded): they have a fairly constant body temperature.

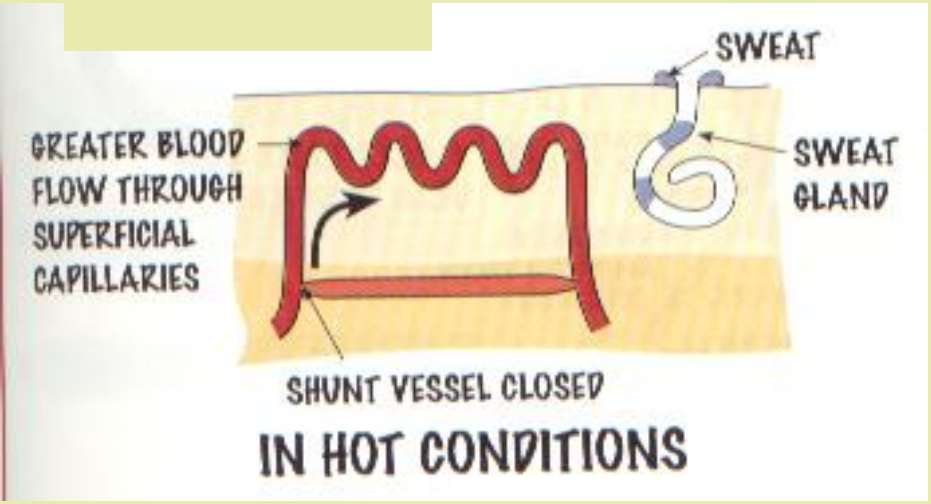
- They can operate in low temperature environments, as they can keep the rate of enzyme activity high.

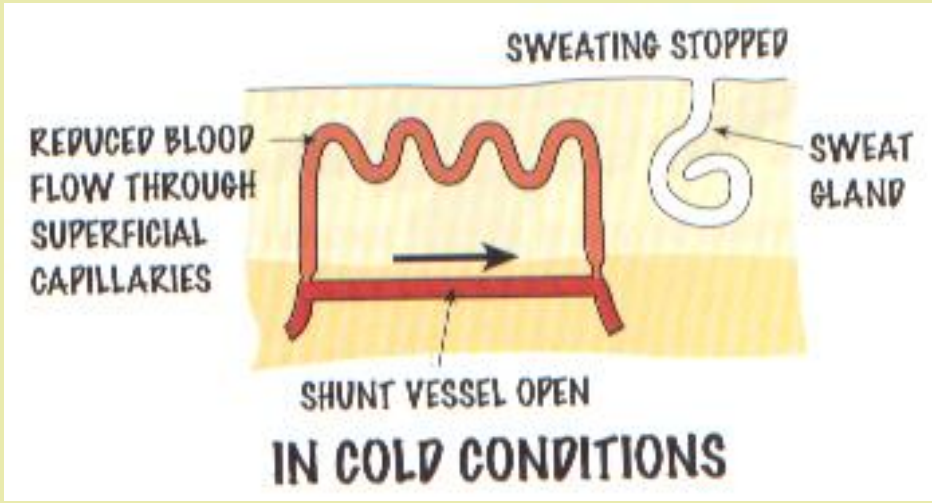
- Most animals are ectotherms (cold blooded) —their body temperature varies with the external temperature, e.g. fish, amphibians, reptiles.

The SKIN – Temperature control



Controlling body temperature





Body temperature is controlled by the thermo-regulatory centre in the _____. It is kept at 37^{0}C as this is the best temperature for _____ to work in. If the body becomes too hot then blood vessels _____ and sweat glands release _____. If the body is too _____ then blood vessels constrict and muscles start to _____.

Words – sweat, enzymes, cold, dilate, shiver, brain

Homeostasis --Body Temperature

- Control of body temperature is an example of how homeostasis works in humans.

- Our normal core body temperature is maintained at 37°C, the heat being mainly produced from the liver during its metabolism.

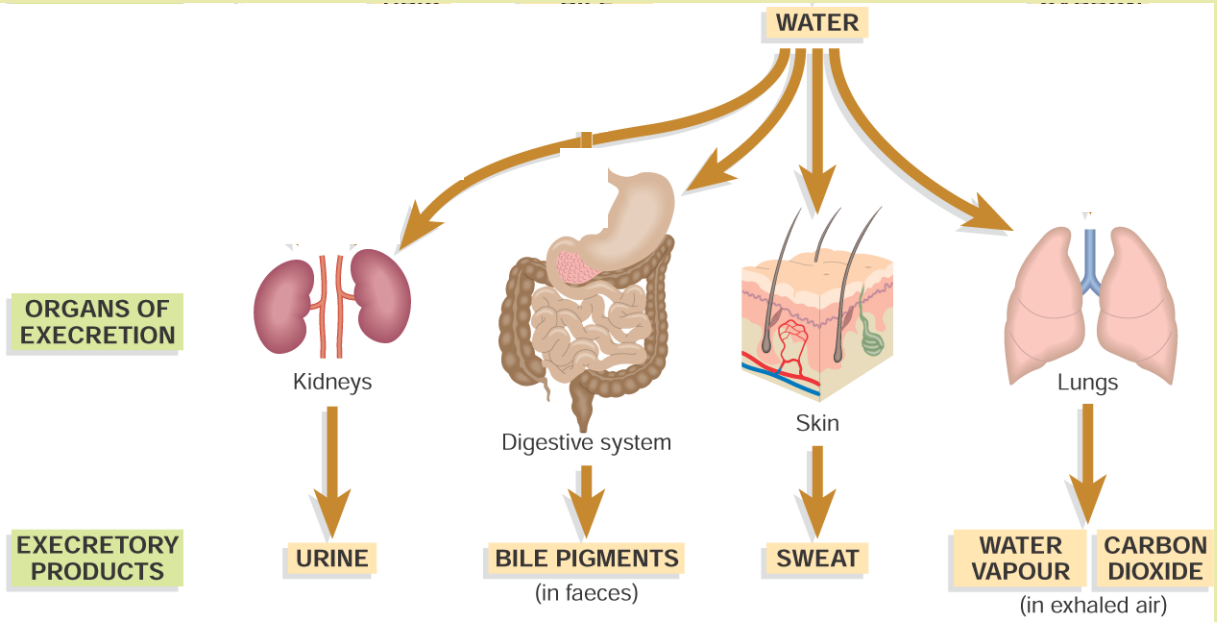
- Muscles, skin and blood all play a role in controlling body temperature.

Homeostasis – Water Levels in the Body

- Being a land animal, we have a continuous need to conserve water.
- Water must be taken in daily and its loss must be carefully regulated.
- Water is taken in as food and drink, and is also formed inside the cells during some reactions, especially respiration.

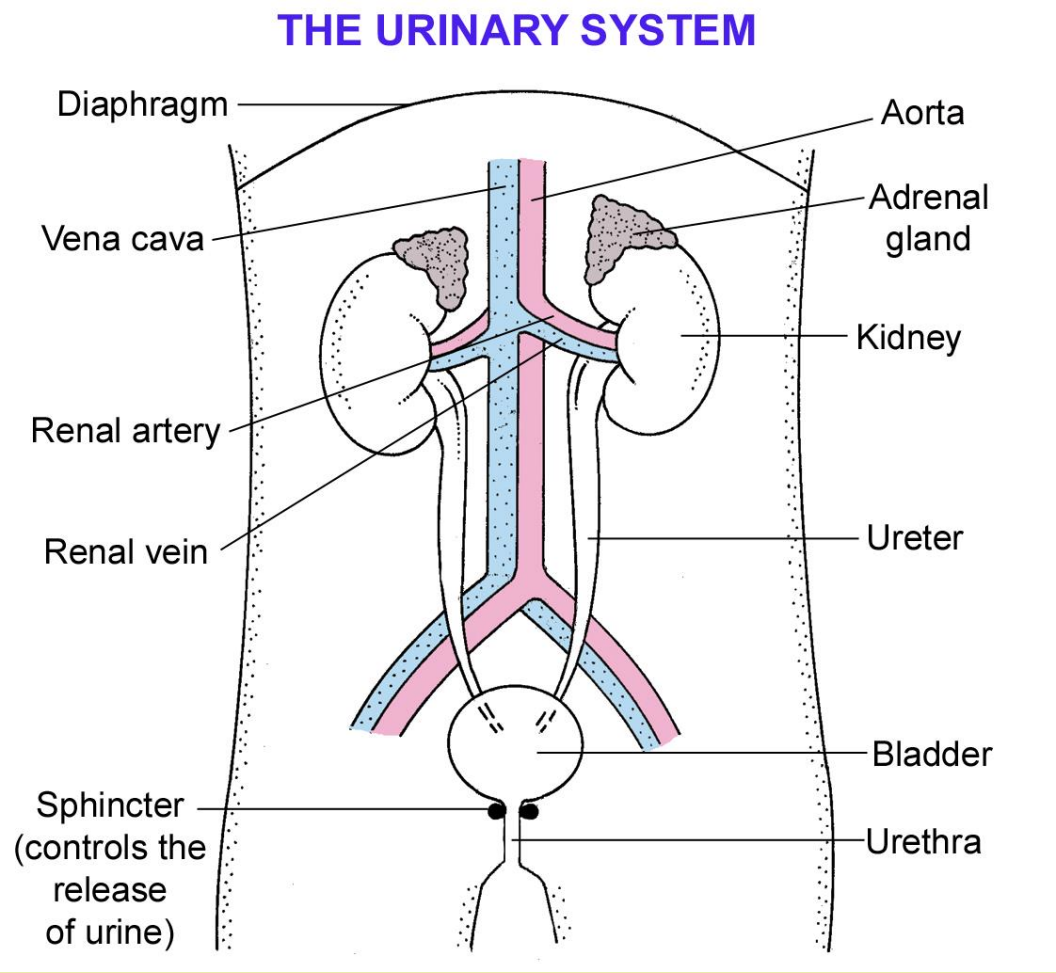
Water is lost from the body through a number of ways:

- Lungs – some water gets evaporated as we exhale from our warm, damp lungs.
- Skin – by evaporation from cells and through sweat.
- Intestines – in the faeces (undigested food).
- Kidneys – in dissolving the poisons and wastes we wish to excrete from the body.



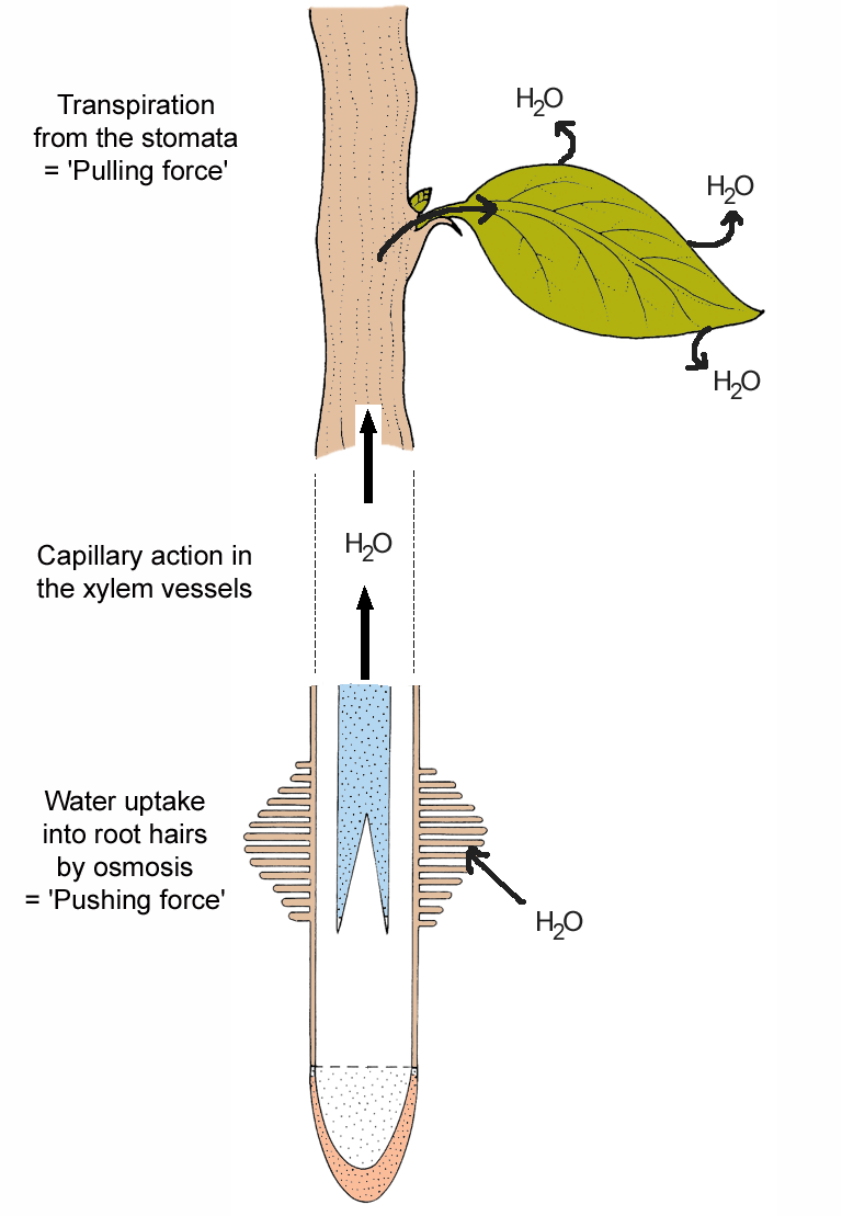
- We have no control over the amount of water lost each day from the lungs, skin or intestines.

- So the kidneys are the water control (osmoregulatory) organs of the body – conserving or eliminating water as the body requires.

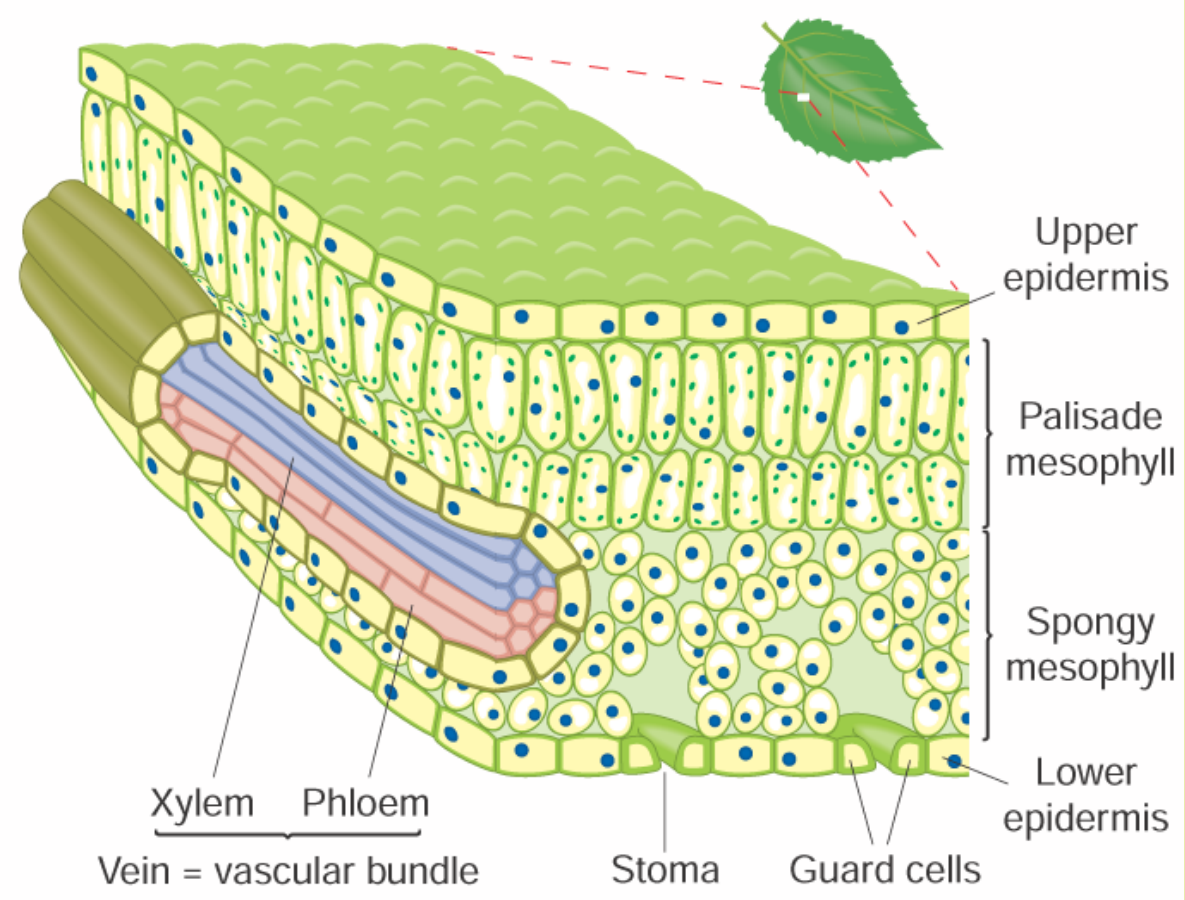


Homeostasis -- Plants

- Plants absorb water through their roots, but lose water from their leaves by evaporation (transpiration).
- Over 90% of the water that enters a leaf goes right on through it and evaporates into the surrounding air.
- The evaporation of water from leaves [and stems] is called transpiration.



- The loss of water is reduced by a waxy cuticle and by the closing of the stomata [pores] on the lower surface of the leaf.



- These pores **stay open** during the day so **that CO_2 can enter, f**or photosynthesis. But, **water can escape** at this time too.
- Stomata **can stay closed at night**, when there is no light for photosynthesis. This allows **plants to conserve water**.
- The guard cells control the opening and closing