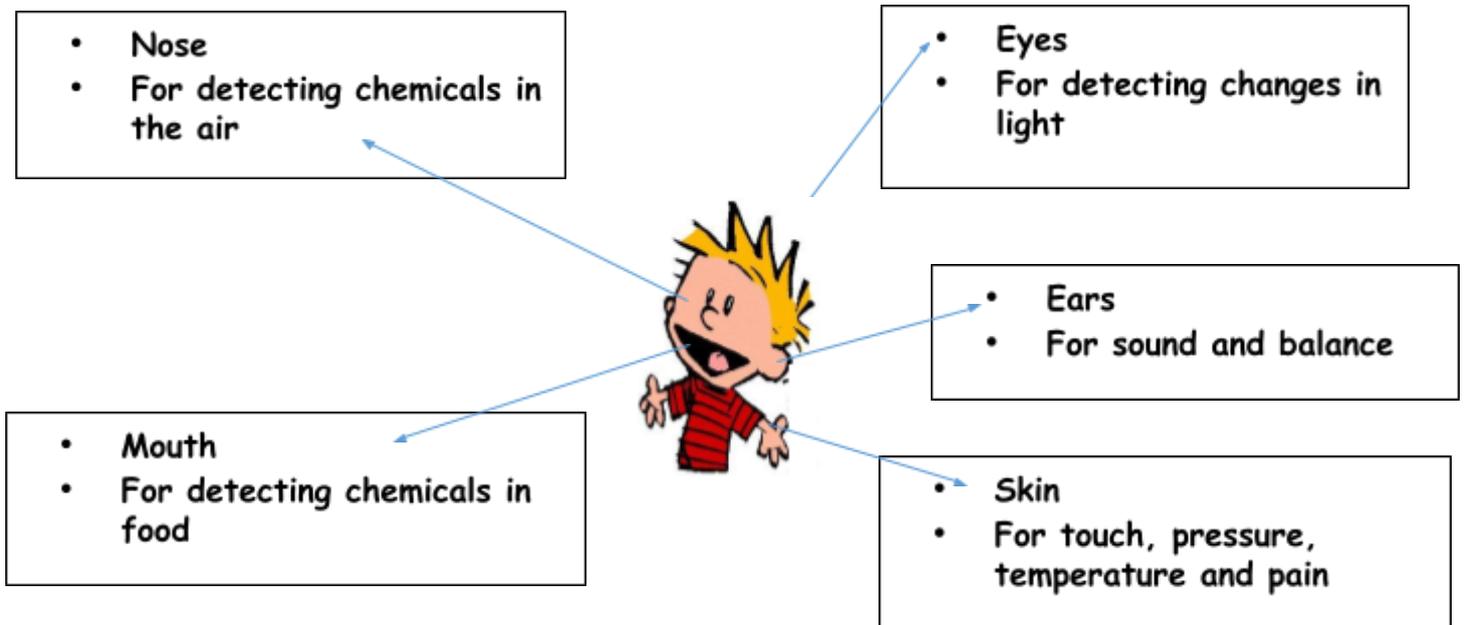
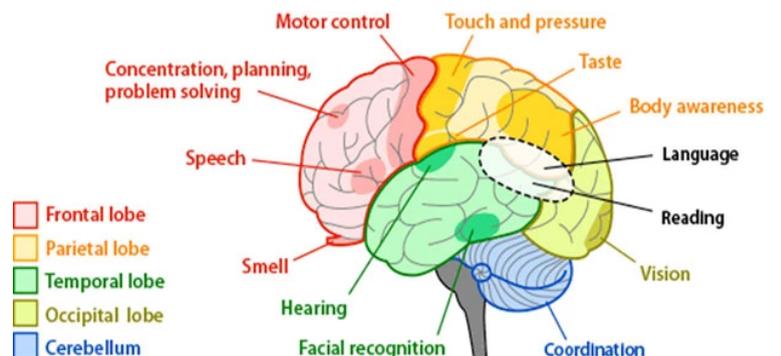


Detecting a Change

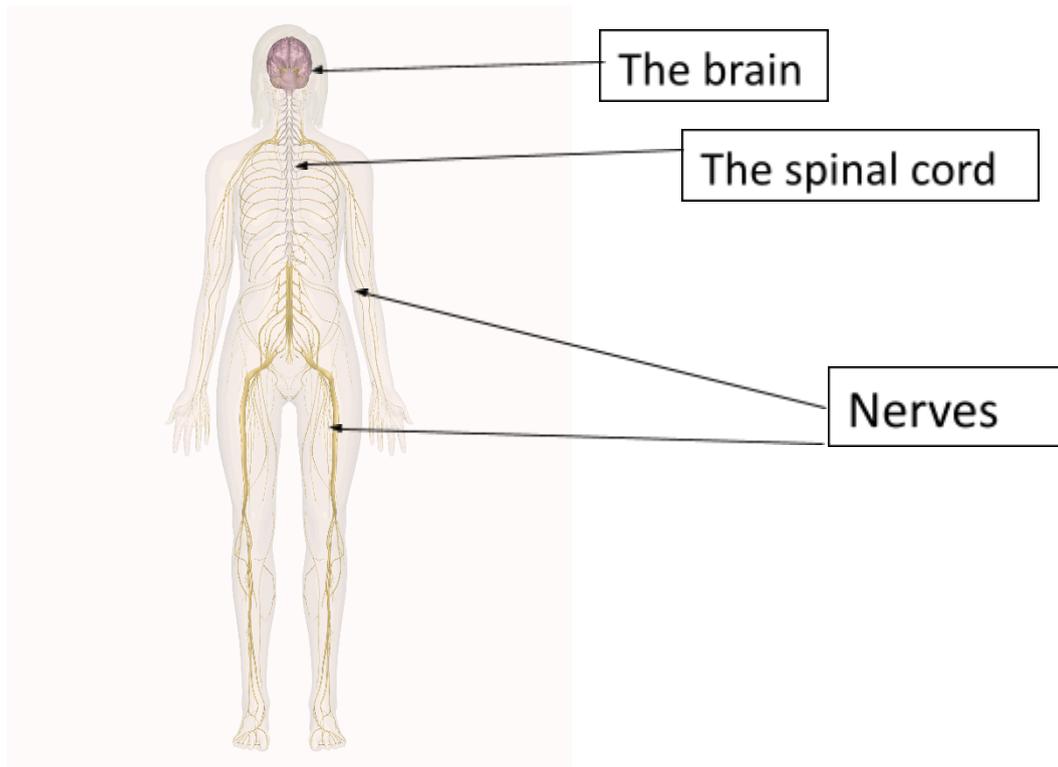
Your body is sensitive to a variety of **stimuli**.
Specialised nerve endings called **receptors** detect the stimuli.
Receptors are often part of a **sense organ**.
Sense organs pass information to the **brain** to process.
The brain produces a **response**.
All information is transmitted by **electrical impulses** that pass along **nerves**.



Different parts of your brain are responsible for your different senses.



The Nervous System

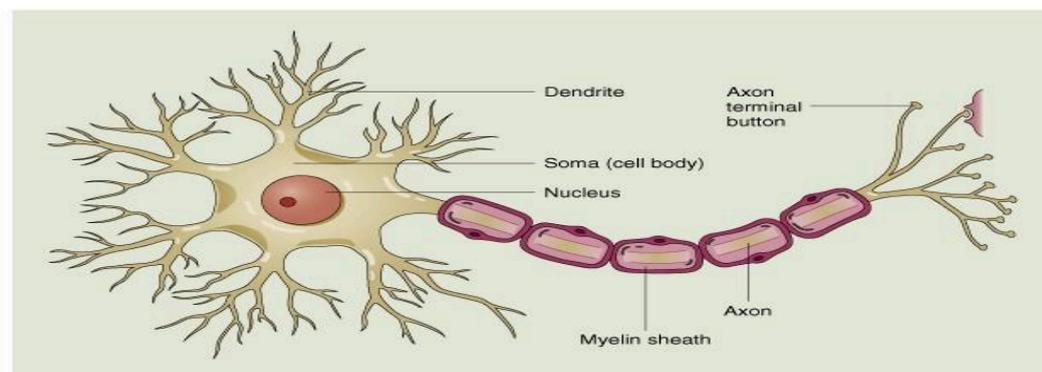


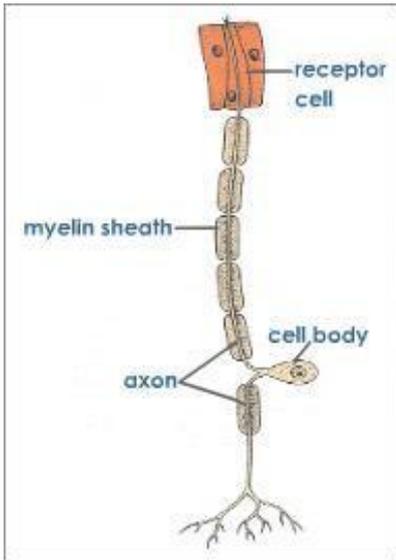
The Nervous System has 2 parts:

- Brain + Spinal Cord = Central Nervous System (CNS)
- Nerves = Peripheral Nervous System (PNS)

Nerves are bundles of nerve fibres, arranged like wires in an electric cable.

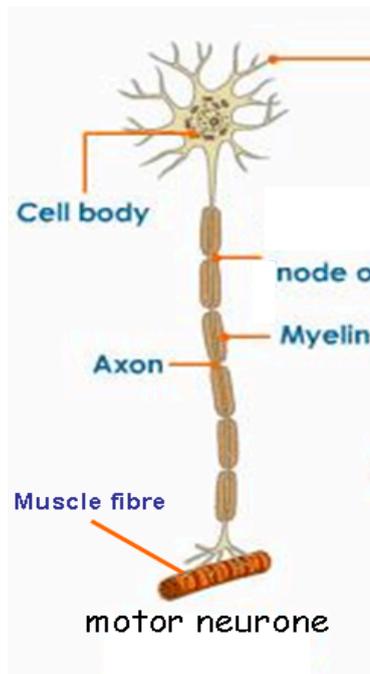
Nerve fibres (also called axons) are the elongated part of a specialised cell called a **neurone**.





Sensory neurones detect the stimulus and carry impulses from sense organs to the CNS.

Motor Neurones



Motor neurones are involved in the **response** and carry impulses from the CNS to the **effectors** (e.g. a muscle or a gland, where there is an effect).

Responses to Stimuli

There are **two** important types of responses:

- Voluntary responses:
- Automatic responses called **reflex actions**

Stimulus → Receptor → Coordinator → Effector → Response

Stimulus	Receptor	Co-ordinator	Effector	Response
Bright Light	Light sensitive receptors in the eye	CNS	Muscles in eyelids	Eyelids close
Losing balance	Receptors in ear detect changes in position	CNS	Muscles in arms and legs	Move to regain balance
Hot pan	Temperature receptors in the skin	CNS	Muscles in arms	Hand pulled away
Sit on a drawing pin	Pain receptors in the skin	CNS	Muscles in legs, tear glands	Jump up, eyes water
Smell of food	Chemical receptors in the nose	CNS	Salivary glands	Begin to salivate

Reflex actions are involved in the **fight or flight** response. They help us **survive dangerous situations**.

Homeostasis

The processes through which the body monitors and controls its internal environment to keep the conditions the same.

The body produces several **waste products**, including:

- Carbon dioxide, from respiration, which is removed via the lungs when we exhale.
- Urea, which is produced in the liver from the breakdown of excess amino acids and is removed by the kidneys in urine.

If these waste products are not removed, they build up and will poison the body.

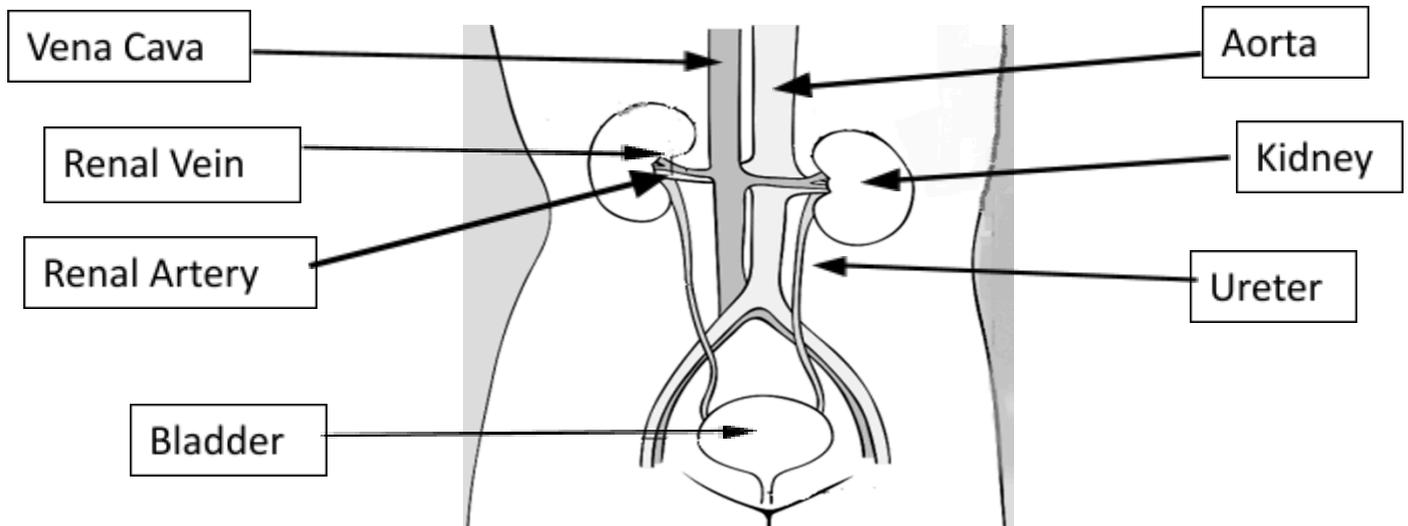
Two conditions that need to be kept the same are:

The **water content** of the blood

The **temperature** of the body

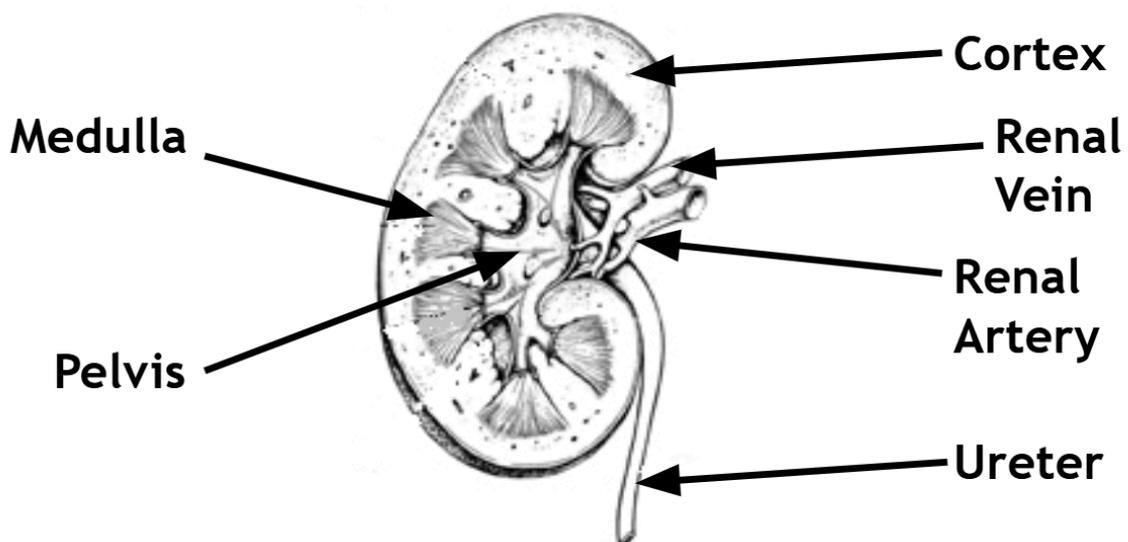
The Kidneys

The kidneys play an important role in keeping the water concentration in the blood constant.



Oxygenated blood from the renal artery arrives at each of the two kidneys under high pressure.

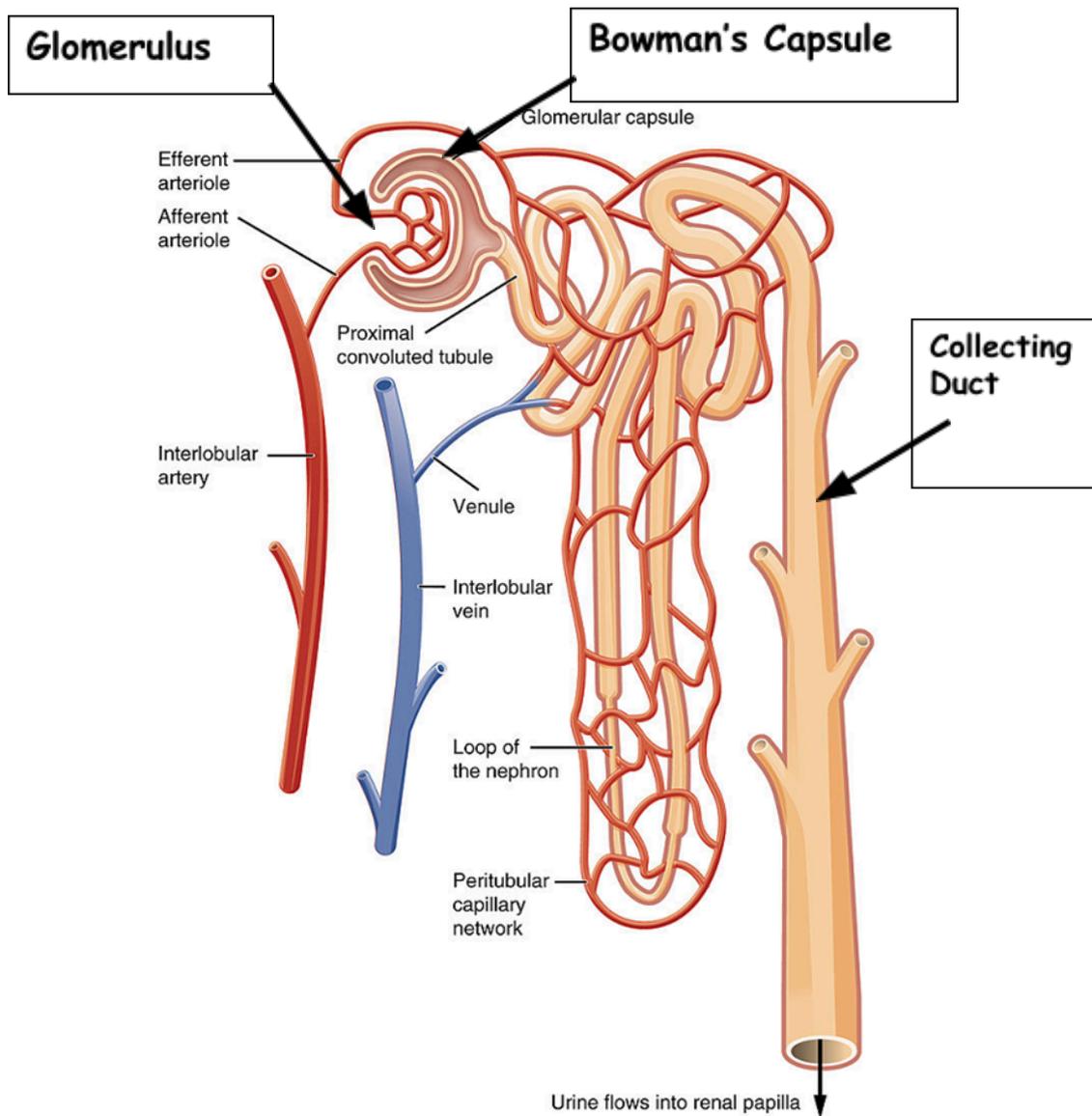
Inside the kidney, the blood is filtered and wastes like urea are removed, along with excess salts and water.



These are made into urine, which collects in the pelvis of the kidney, before travelling down the ureter to the bladder, where it is stored.

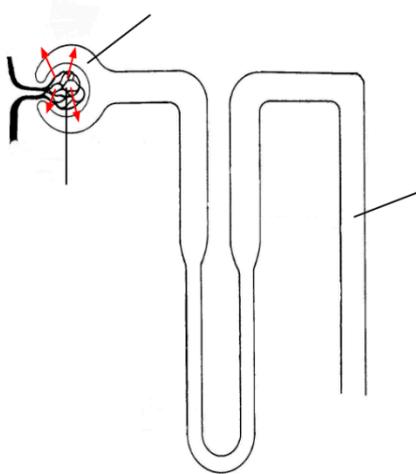
The renal vein carries the filtered 'clean' blood with balanced concentrations of salts and water away from the kidneys.

The Nephron

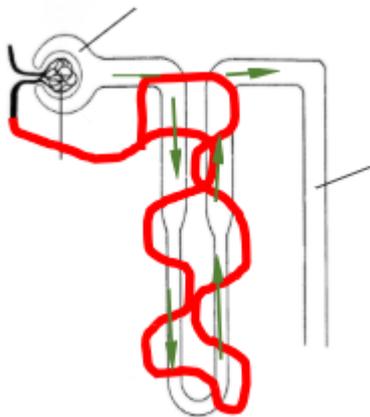


Each kidney contains over a million tiny filtering units called **nephrons**.

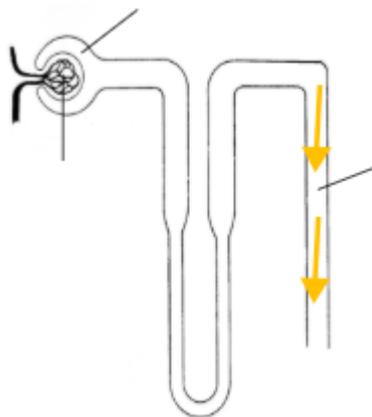
A small blood vessels enters a nephron at the **Bowman's Capsule** and branches to form a bunch of thin-walled blood capillaries called a **Glomerulus**.



Because the blood in the glomerulus is under high pressure, the fluid part (**water, glucose, salts and urea**), is forced through the walls of the capillaries into **Bowman's capsule**. Molecules such as protein are too large and should remain in the blood.



This **filtrate** then passes along the tubule, where useful substances like **glucose** and some of the **water** are **reabsorbed** into the **capillary** that wraps around the tubule.



The fluid remaining in the tubule becomes the **urine** and travels down the **collecting duct** to the **pelvis** of the kidney and then onwards to the **bladder**.

Drugs Affecting Water Balance

1) Alcohol

This causes the kidneys to produce a greater volume of more dilute urine. This can lead to dehydration. Symptoms: dizziness or light-headedness, headache, tiredness, dry mouth, lips and eyes and will lead to very concentrated urine.

2) Ecstasy

This causes the kidneys to produce a smaller volume of less dilute urine. This can result in the body having too much water which can be very dangerous. Ecstasy is also associated with excessive sweating and increased body temperature.

Thermoregulation

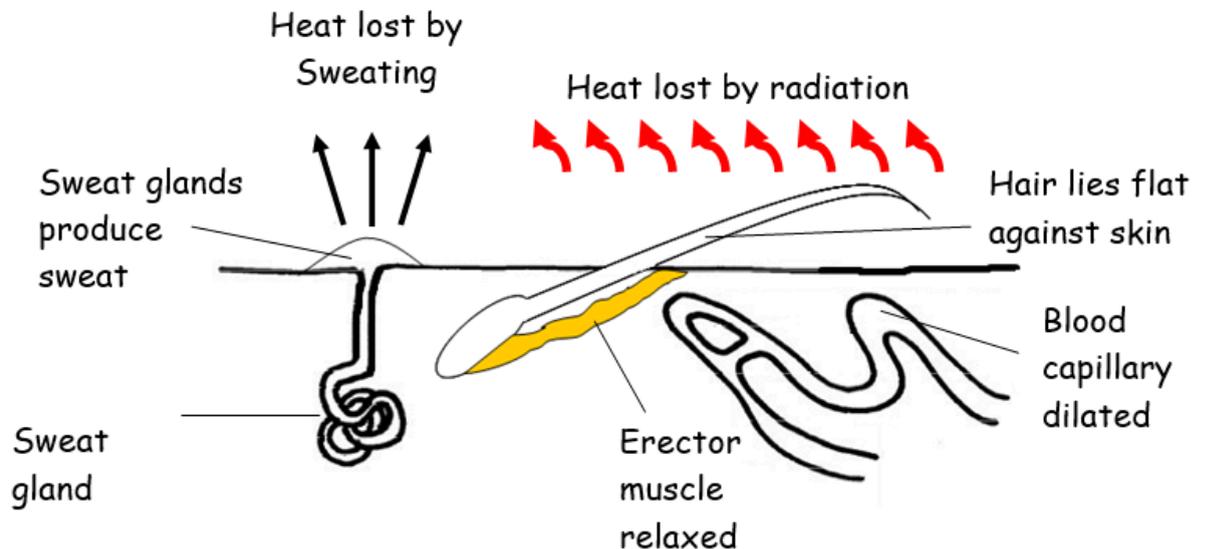
Our body temperature needs to be kept at around 37°C to enable our **enzymes** to function correctly.

Our body temperature can alter slightly depending on:

- where it is measured
- the **time** and **day**
- the stage of the **menstrual** cycle in women

A body temperature of above 40 degrees celcius is known as hyperthermia and can be sign of infection. If body temperature is below 35 degrees celcius it is known as hypothermia. A temperature of below 32 usually leads to death.

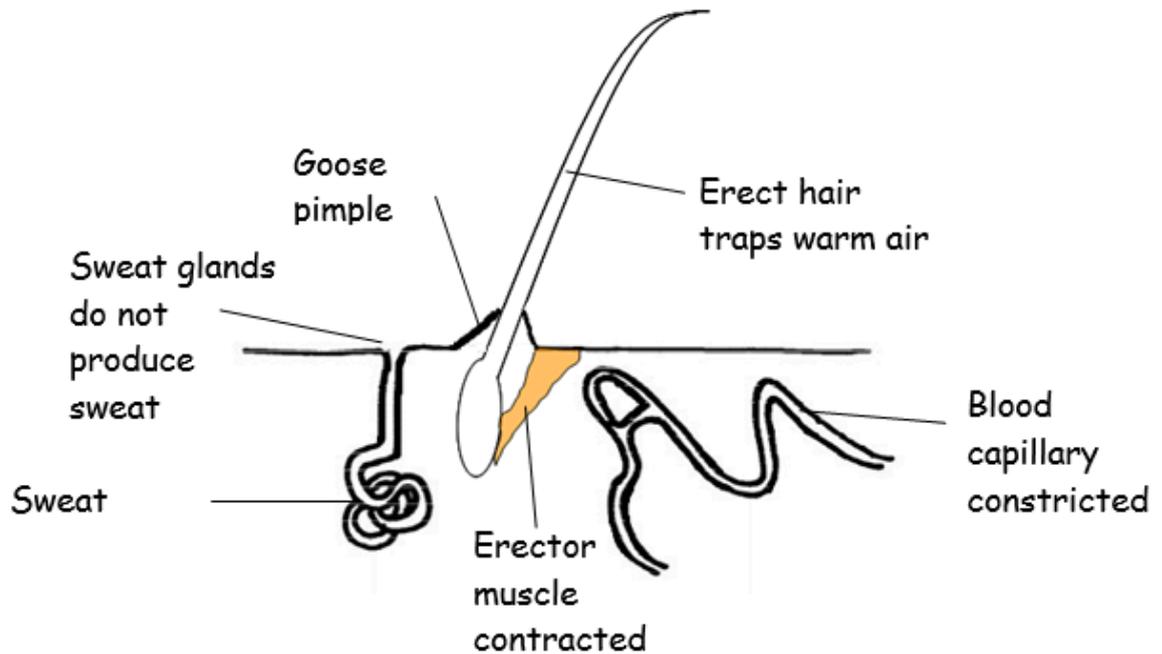
How your body responds to a temperature increase



When it is hot, our skin acts to increase heat loss:

- The hair erector muscles relax and make the hairs lie flat against the skin surface. Body heat is lost by radiation.
- Sweat glands make more sweat. This evaporates from the skin surface, transferring heat energy from the body to the environment and cooling the body down.
- Blood capillaries near the skin surface widen (called vasodilation). This causes more blood to flow near the skin surface and the skin reddens. Excess heat is lost to the environment by radiation.

How your body responds to a temperature decrease



When it is cold, our skin acts to reduce heat loss:

- The hair erector muscles contract and make the hairs stand more upright. This traps warm, still air close to the surface of the skin. Less heat is lost by radiation.
- Sweat glands stop making as much sweat, reducing heat loss by evaporation.
- Blood capillaries near the skin surface get narrower (called vasoconstriction). This results in less blood flowing near to the skin surface and so the skin appears pale. This reduces heat loss by radiation.
- The muscles in the skin undergo a rapid cycle of contraction and relaxation, called shivering. As the muscles do work, they release heat energy, warming the body up.

Responding to Change

