

Homeostasis

What is Homeostasis?

The maintenance of a relatively constant environment in the body

(*homeo* = same; *stasis* = state)

- Body cells work best if they have the correct
 - Temperature
 - Water levels
 - Glucose concentration
 - Etc.

- Your body has mechanisms to keep the cells in a constant environment

Controlling body temperature

- All mammals maintain a constant body temperature.
- Human beings have a body temperature of about 37°C.
 - E.g. If your body is in a hot environment your body temperature is 37°C
 - If your body is in a cold environment your body temperature is still 37°C

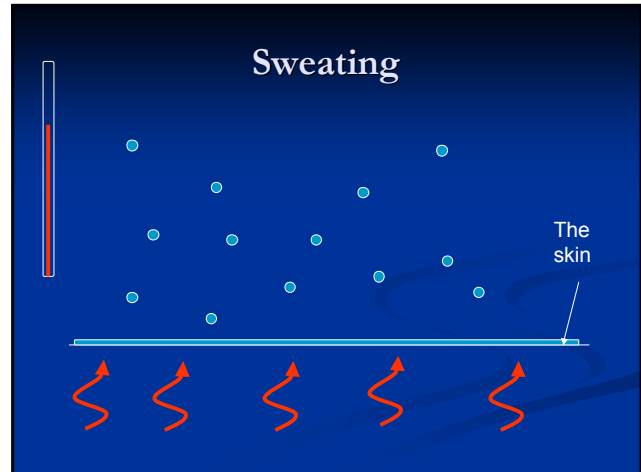
Penguins huddling to keep warm



What mechanisms are there to cool the body down?

1. Sweating

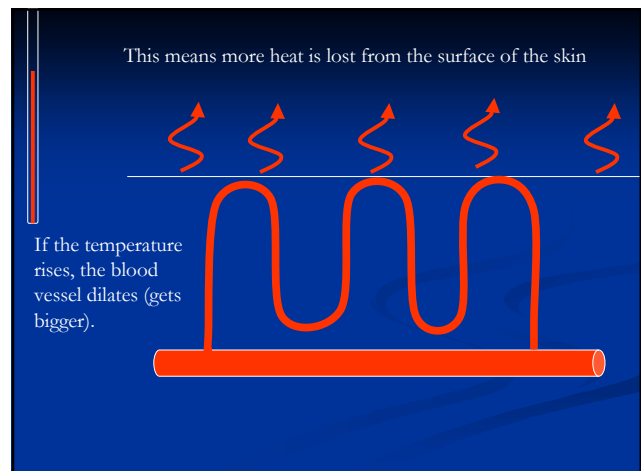
- When your body is hot, sweat glands are stimulated to release sweat.
- The liquid sweat turns into a gas (it evaporates)
- To do this, it needs heat.
- It gets that heat from your skin.
- As your skin loses heat, it cools down.



What mechanisms are there to cool the body down?

2. Vasodilation

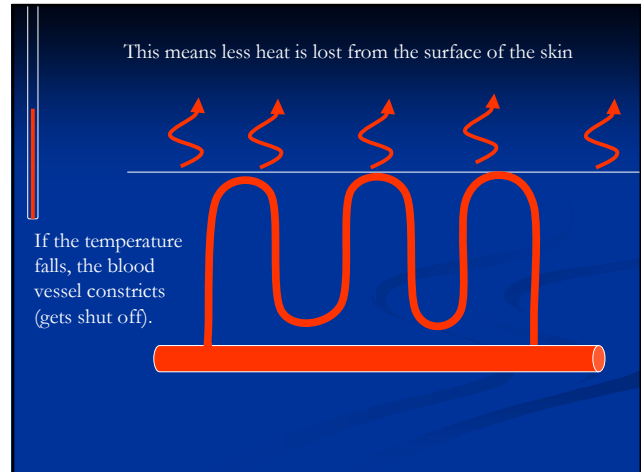
- Your blood carries most of the heat energy around your body.
- There are capillaries underneath your skin that can be filled with blood if you get too hot.
- This brings the blood closer to the surface of the skin so more heat can be lost.
- This is why you look red when you are hot!



What mechanisms are there to warm the body up?

1. Vasoconstriction

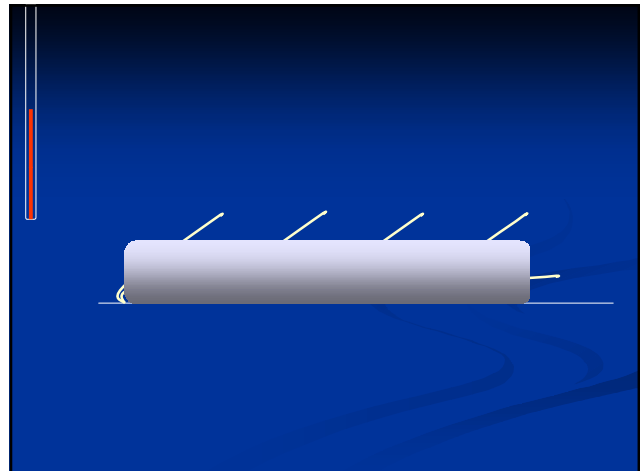
- This is the opposite of vasodilation
- The capillaries underneath your skin get constricted (shut off).
- This takes the blood away from the surface of the skin so less heat can be lost.



What mechanisms are there to warm the body up?

2. Piloerection

- This is when the hairs on your skin “stand up” .
- It is sometimes called “goose bumps” or “chicken skin”!
- The hairs trap a layer of air next to the skin which is then warmed by the body heat
- The air becomes an insulating layer.



Other aspects of thermoregulation (maintaining a constant body temperature)

- Shivering – rapid muscle contractions
 - These generate heat which helps raise body temperature
- Behavioral responses:
 - When too warm, seeking out a cooler environment (eg. Shade)
 - Huddling together to keep warm (eg. penguins)

Maintaining Homeostasis involves Negative feedback loops

Negative feedback loop – a process that detects a change in homeostasis and reverses the change.

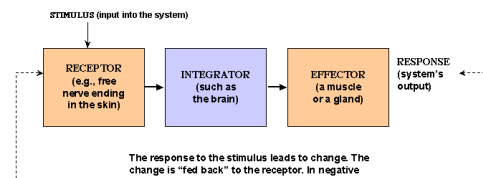
Example: a lowering of blood glucose sets off a process that returns the blood glucose back to normal.

Parts of Negative Feedback Loop

1. **Receptor** – part of the nervous system that can detect stimuli, such as changes in temperature, pH, blood pressure, or some other level
2. **Integrator** – the brain (usually the hypothalamus), which receives information from receptors and relays information to effectors
3. **Effector** – a tissue, organ, gland, or muscle of the body, which carries out a response to help bring the body back to homeostasis

Homeostasis

- Stable operating conditions in the internal environment
- Three components interact



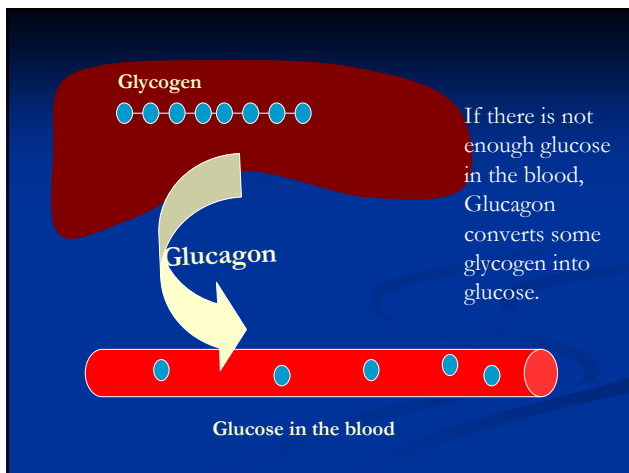
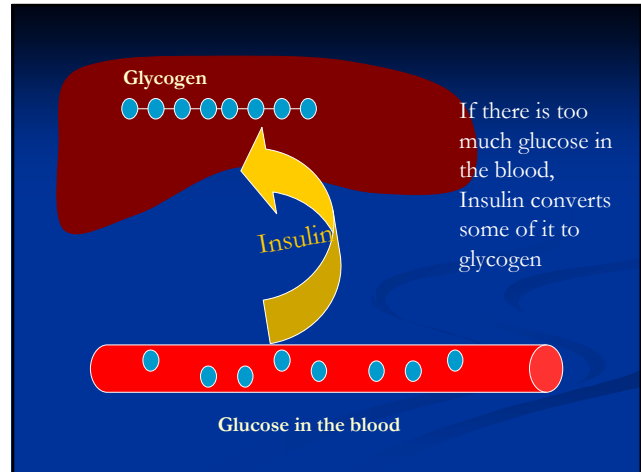
The response to the stimulus leads to change. The change is "fed back" to the receptor. In negative feedback, the response of the system cancels or counteracts the effect of the original stimulus.

[Homeostasis Weblink](#)

Controlling Glucose levels

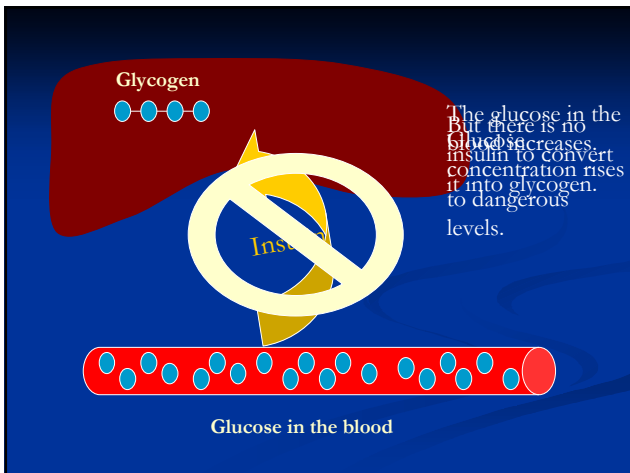
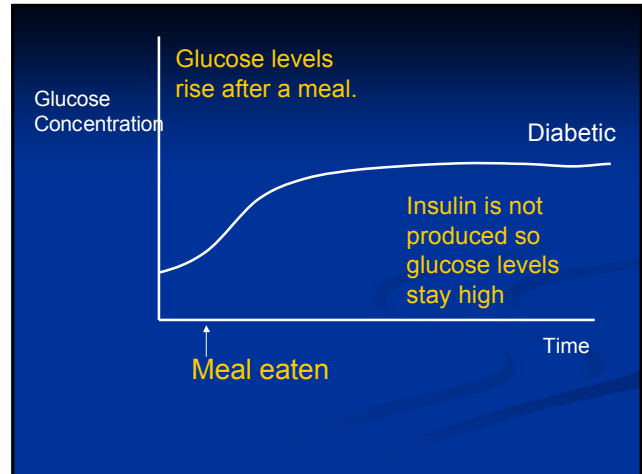
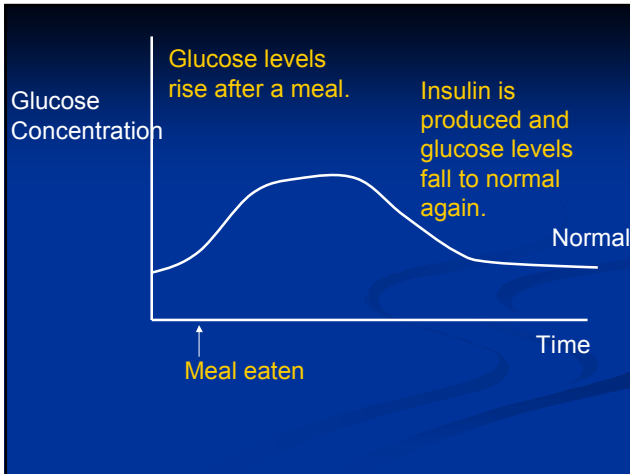
- Your cells also need an exact level of glucose in the blood.
- Excess glucose gets turned into glycogen in the liver
- This is regulated by 2 hormones (chemicals) from the pancreas called:

Insulin
Glucagon



Diabetes

- Some people do not produce enough insulin.
- When they eat food, the glucose levels in their blood cannot be reduced.
- This condition is known as DIABETES.
- Diabetics sometimes have to inject insulin into their blood. They have to be careful of their diet.



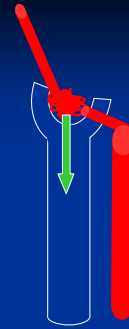
Controlling water levels

- The control of water levels is carried out by the **KIDNEYS**.
- It is closely linked to the excretion of urea.
- Urea is a waste product that is made when the **LIVER** breaks down proteins that are not needed by the body.
- Urea contains the element Nitrogen.

The kidneys

The kidneys "clean" the blood of waste products and control how much water is kept in the body. The waste products and water make up urine which is excreted via the ureter.

"Dirty" blood enters the kidney through the renal artery. Then, several things happen to clean the blood...



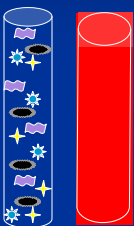
1. Filtration

Blood enters the tubule area in a capillary.

The capillary forms a small "knot" near the kidney tubule.

The blood is filtered so all the small particles go into the tubule.

The capillary then carries on to run next to the tubule.

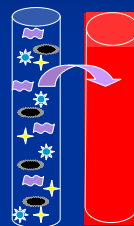


The kidney tubule now contains lots of blood components including:

Glucose: *
Ions: +
Water: ~
Urea: o

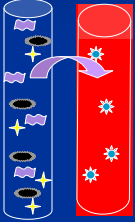
2. Reabsorb sugar

The body needs to have sugar in the blood for cells to use in respiration. So all the sugar is reabsorbed back into the capillary.



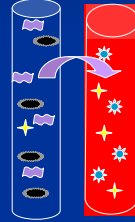
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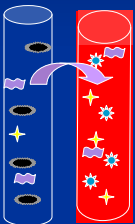
3. Reabsorb water

Water and ions are the next to be absorbed. It depends on how much is needed by the body.



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Reabsorbing water

If you have too little water in your blood, you will produce very concentrated urine.

(very little water in it)

If you have too much water in your blood, you will produce very dilute urine.

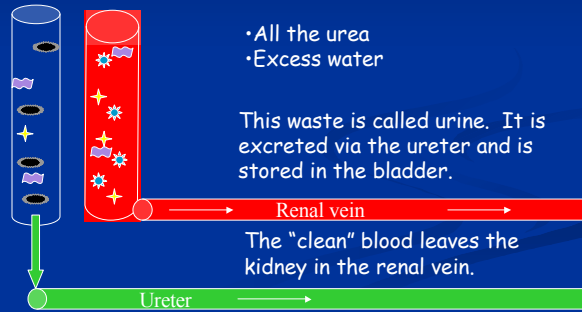
(lots of water in it)

5. Excrete the waste

Everything that is left in the kidney tubule is waste:

- All the urea
- Excess water

This waste is called urine. It is excreted via the ureter and is stored in the bladder.



Summary of urine production

- Urea is a waste product made in the **LIVER**
- Water content of the body is controlled in the **KIDNEYS**
- Urea, water and other waste makes up **URINE**.
- Urine travels down the **URETER** and is stored in the **BLADDER**
- Urine is excreted through the **URETHRA**.

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