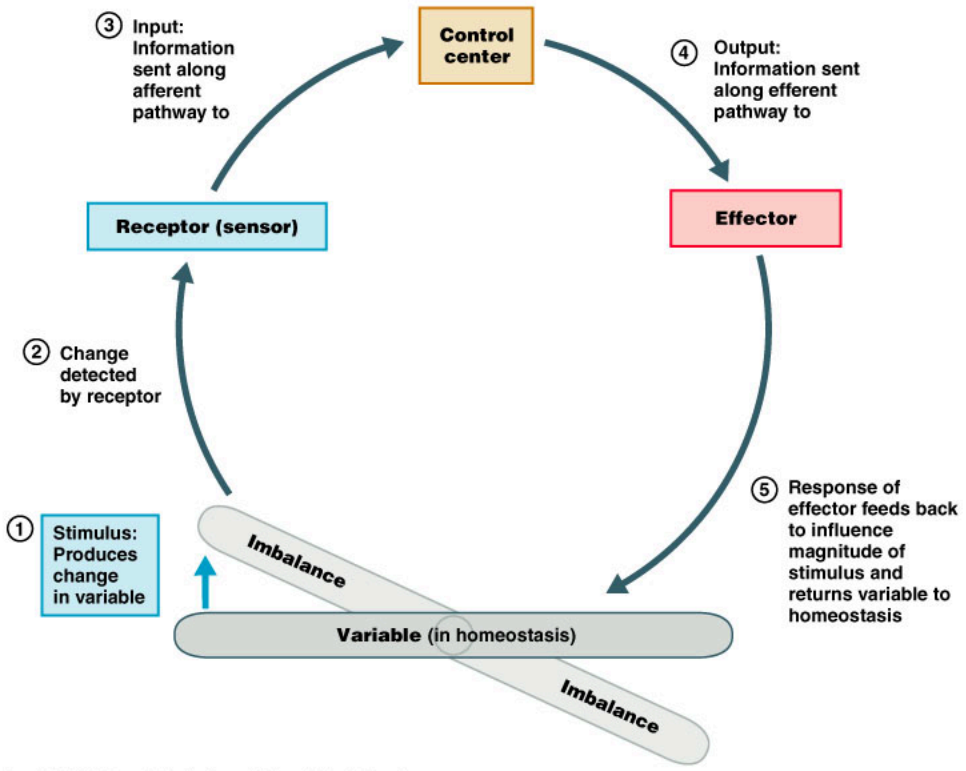
HOMEOSTASIS

STAGE 2 BIOLOGY

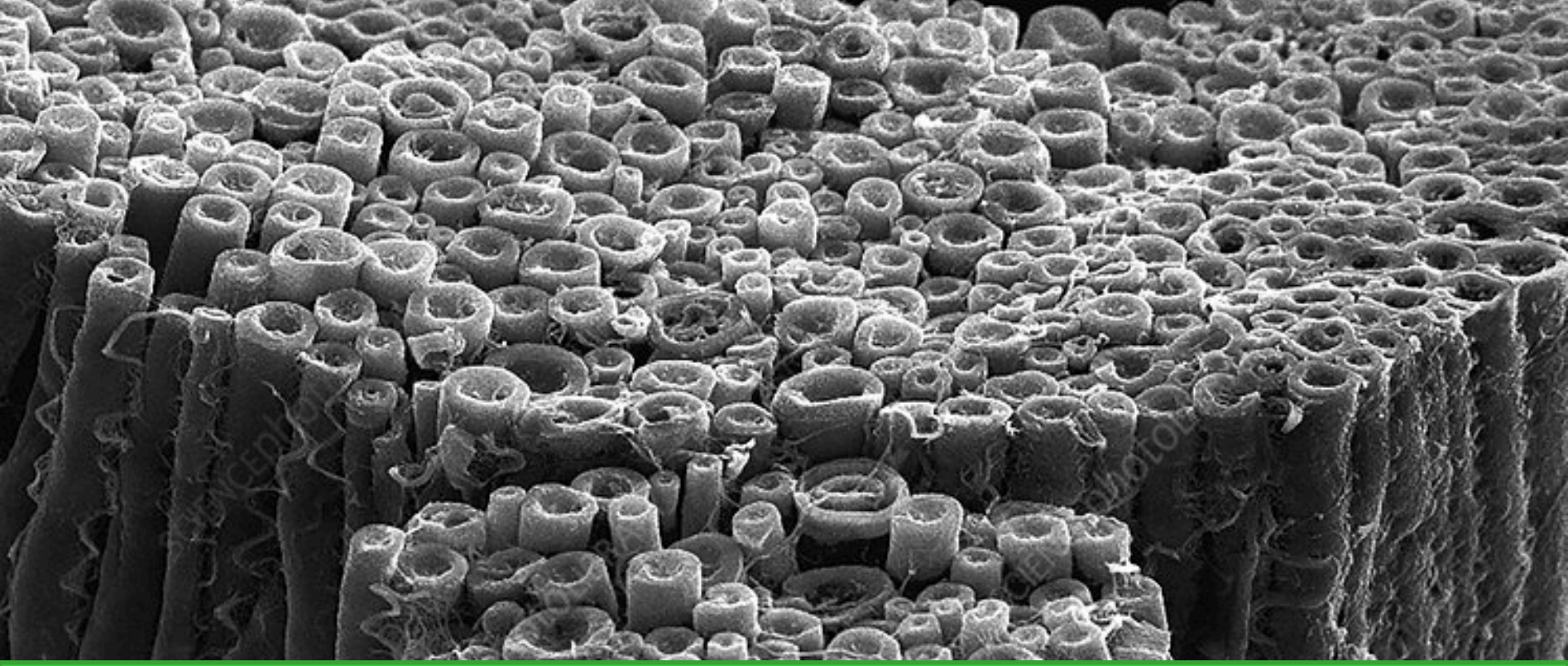


3.5 HOMEOSTATIC CONTROL MECHANISMS

Maintaining Homeostasis

While the **nervous** and **endocrine systems** work in unison to maintain homeostasis, both systems act in very different ways.

	Nervous	Endocrine
Transmission	Electrochemical impulse	Chemical signal (hormone)
Transmission path	Direct via axons of nerve cells to the muscle or gland	Indirect via blood to the target tissue
Site of Action	Localised, highly specific	Widespread (may be a target organ or more general)
Speed of Action	Rapid	Slow
Duration of Effect	Short term, reversible	Long term, possible permanent changes



Compare the action of the **nervous** and **endocrine systems**.

INTENDED STUDENT LEARNING

Maintaining Homeostasis

Homeostasis is the maintenance of a relatively constant internal environment.

Stimuli are detected via **sensory receptors**, however signalling **effectors** involves both the **nervous** and **endocrine systems**.

The above systems are involved in the following processes:

- **Thermoregulation**
- **Osmoregulation**
- **Glucoregulation**
- **Chemoregulation**

Thermoregulation

Thermoregulation refers to the processes that allow our body to maintain a relatively constant internal temperature.

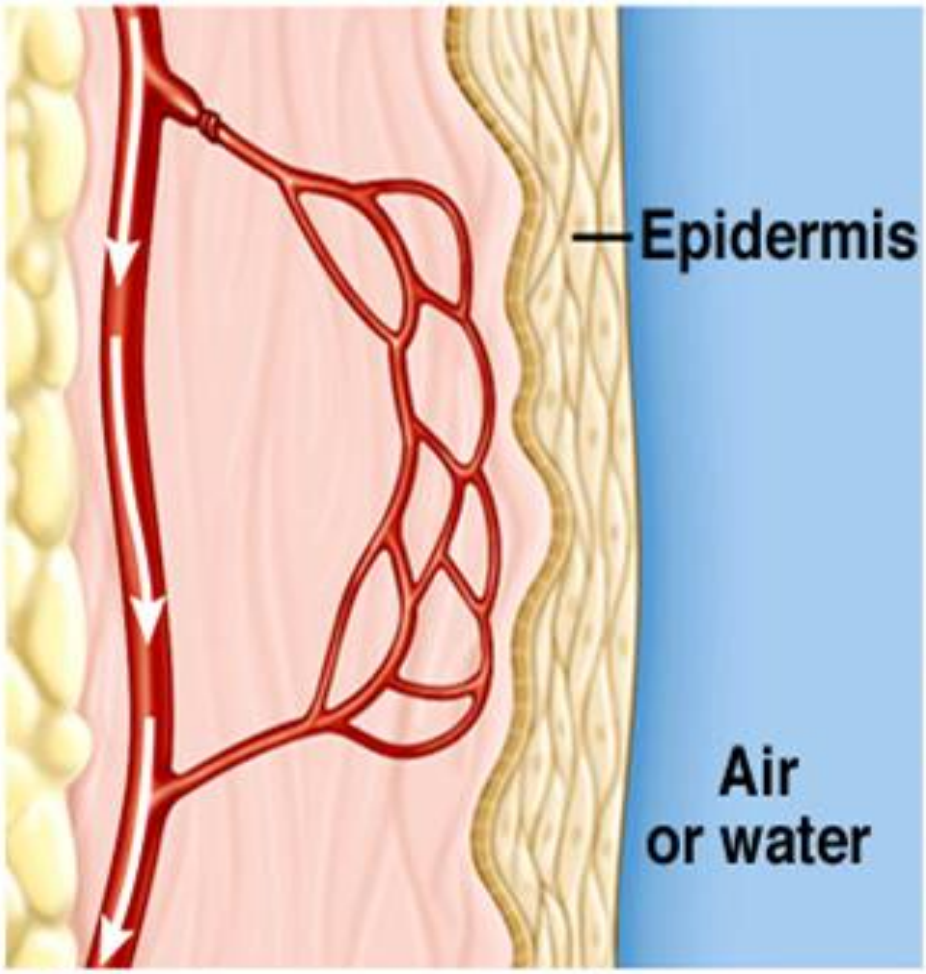
When **body temperature is too low (ie: cold)**:

- **Vasoconstriction** restricts heat loss through surface capillaries
- **Shivering** produces heat through rapid contraction of skeletal muscles
- **Piloerection** allows hairs to stand on end to trap some heat closer to the surface of the body

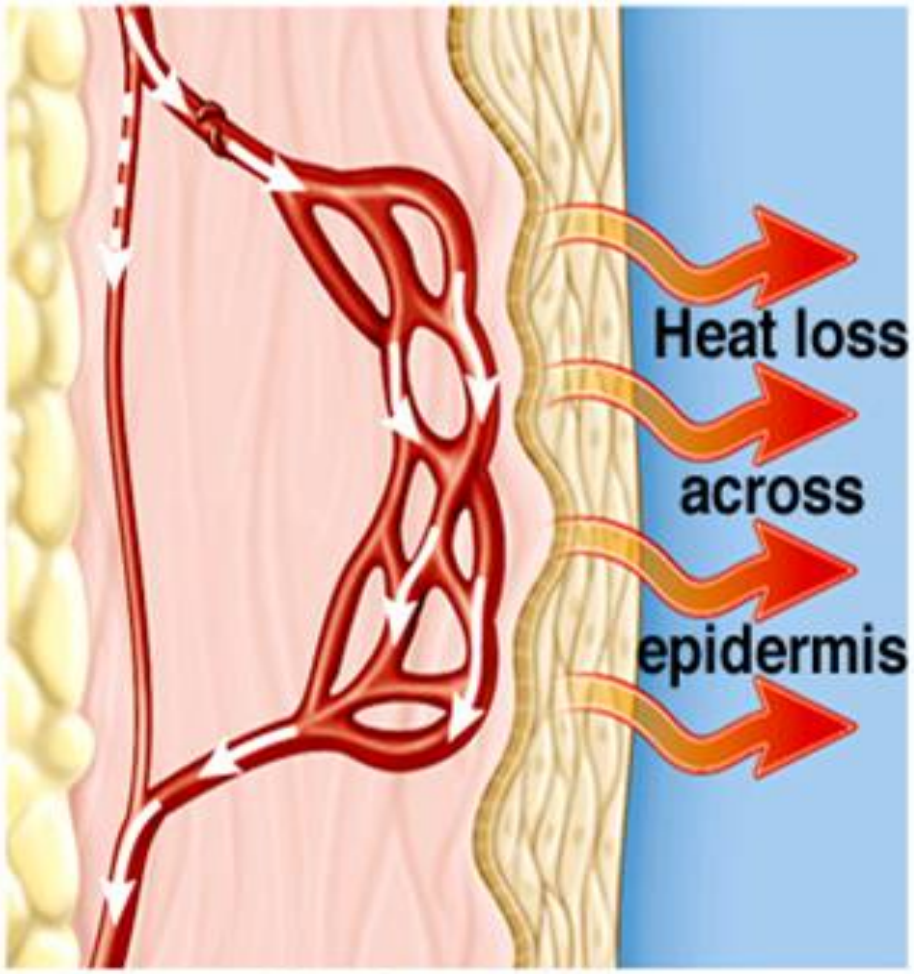
When **body temperature is too high (ie: hot)**:

- **Vasodilation** enhances heat loss through surface capillaries
- **Sweating** reduces body temperature through evaporation of liquid
- **Pilorelaxation** allows hairs to lie flat to the skin and aids in heat loss through skin

Thermoregulation

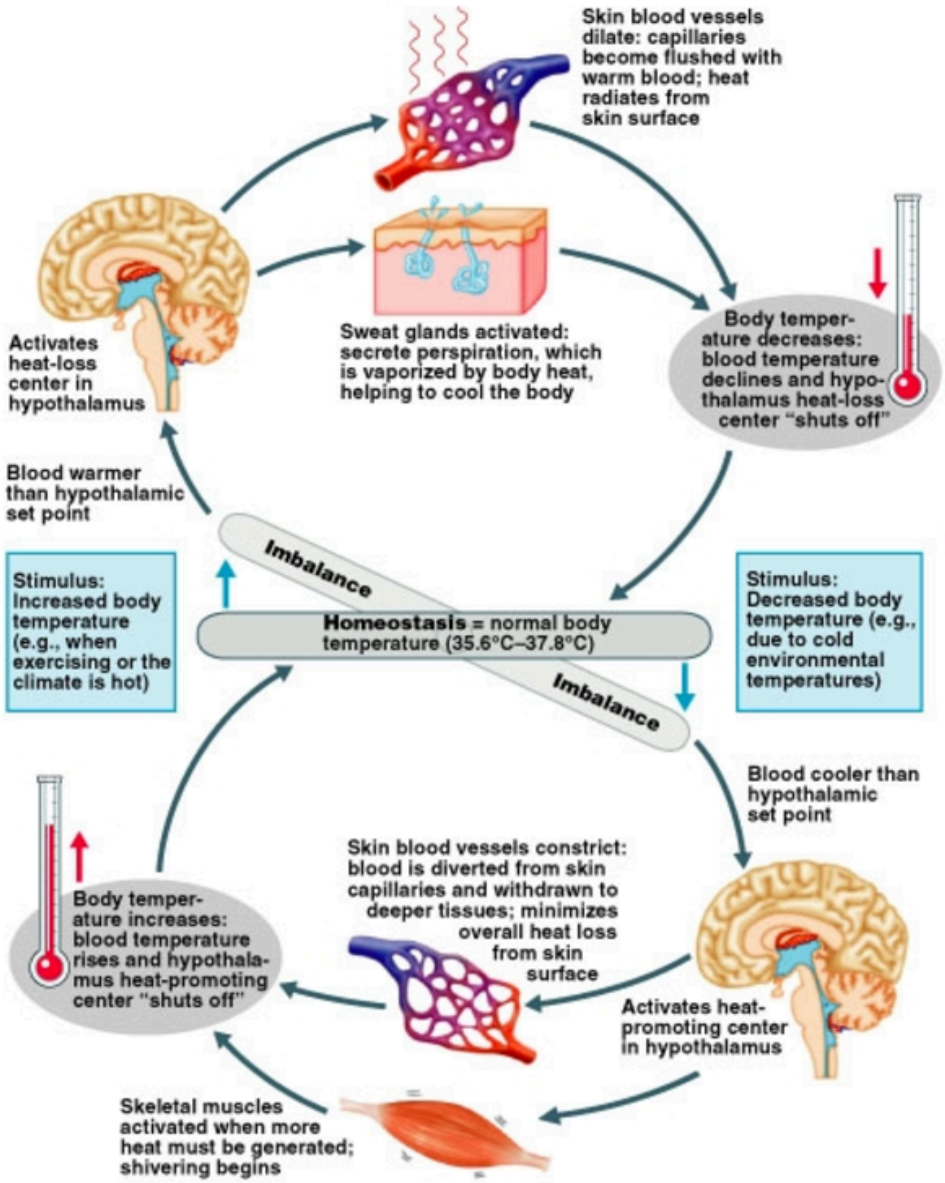


Vasoconstriction



Vasodilation

Thermoregulation



Thermoregulation

Thermoregulation in Animals

Osmoregulation

Already covered - See PPT 3.4

Glucoregulation

Already covered - See PPT 3.4

Chemoregulation

Chemoregulation refers to the regulation of blood pH. During aerobic respiration, some **carbon dioxide** dissolves in the tissue fluid, but most reacts with water to form carbonic acid.

This reaction **increases H^+ ions** in the blood and **decreases blood pH** (more acidic).

Low blood pH is identified by receptor cells and the brain sends signals to the chest and diaphragm to **increase breathing rate**.

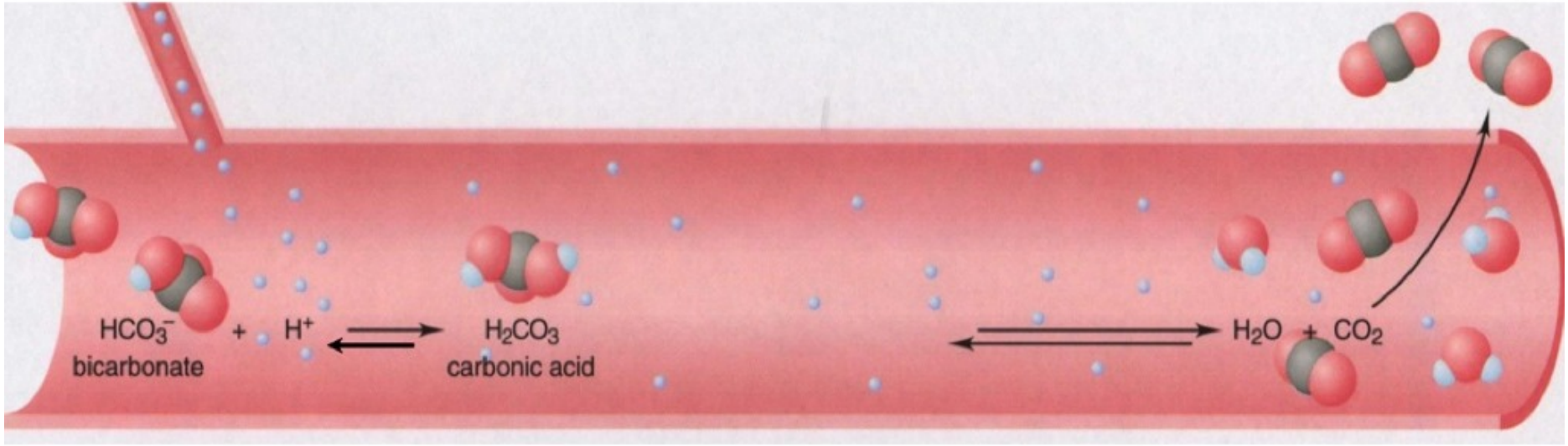
This **lowers carbon dioxide** in the blood and **increases pH**.

This also happens in reverse if blood pH is too high

Chemoregulation

Acid entering the blood stream

Carbon dioxide is exhaled

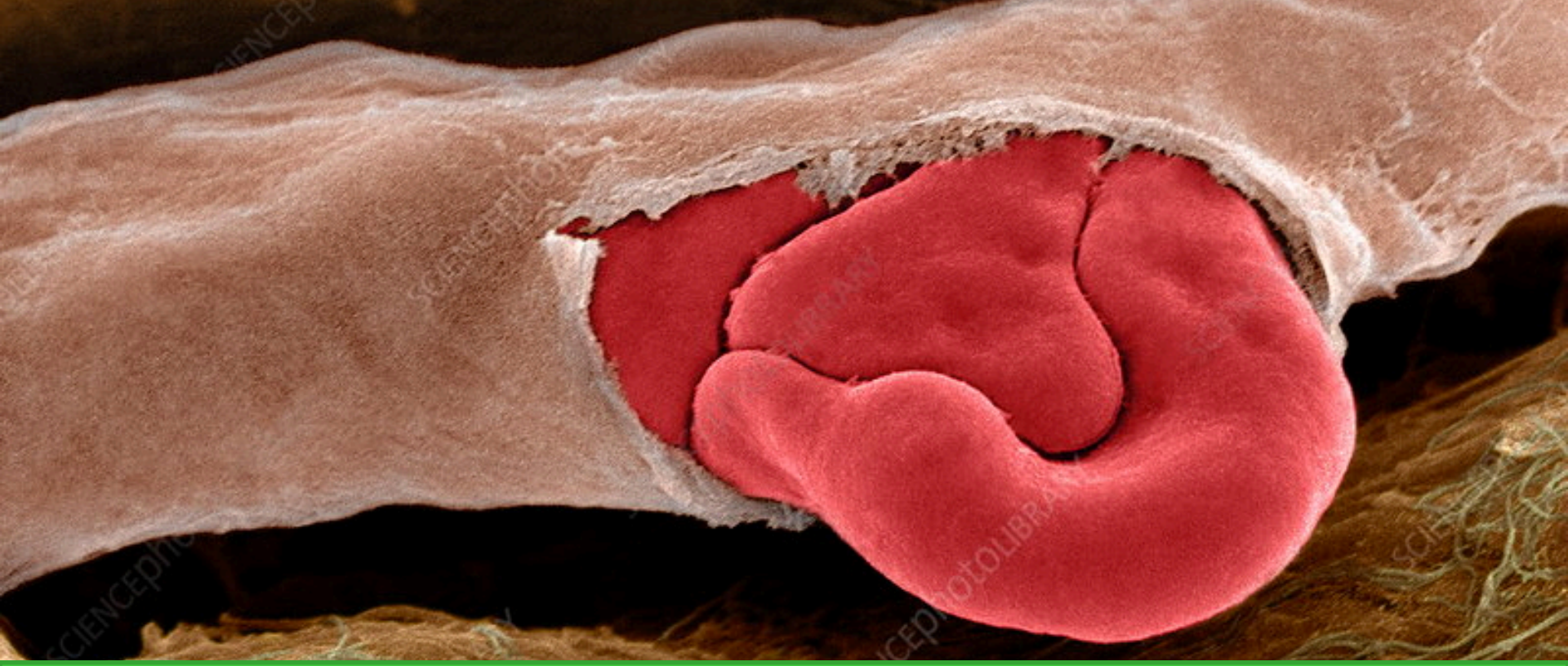


$$HCO_3^{1-} + H^+ \rightleftharpoons H_2CO_3 \rightleftharpoons H_2O + CO_2$$

Acid Base Balance

Summary

Property	Nervous	Endocrine
Thermoregulation	Transmits nerve impulses between thermoreceptors, the hypothalamus and effectors	Secretes adrenalin, insulin, and thyroxine which increases the rate of respiration
Osmoregulation	Transmits nerve impulses between osmoreceptors, the hypothalamus and effector (pituitary gland)	Pituitary gland secretes ADH which regulates osmolarity
Glucoregulation	Transmits nerve impulses from the brain to the effector (pancreas)	Pancreas secretes insulin and glucagon which regulate blood glucose
Chemoregulation	Transmits nerve impulses between chemoreceptors, the medulla and effectors	Secretes adrenalin and thyroxine which increase breathing rate to remove excess carbon dioxide



Explain how the **nervous** and **endocrine systems** work <u>independently</u> or <u>together</u> to:

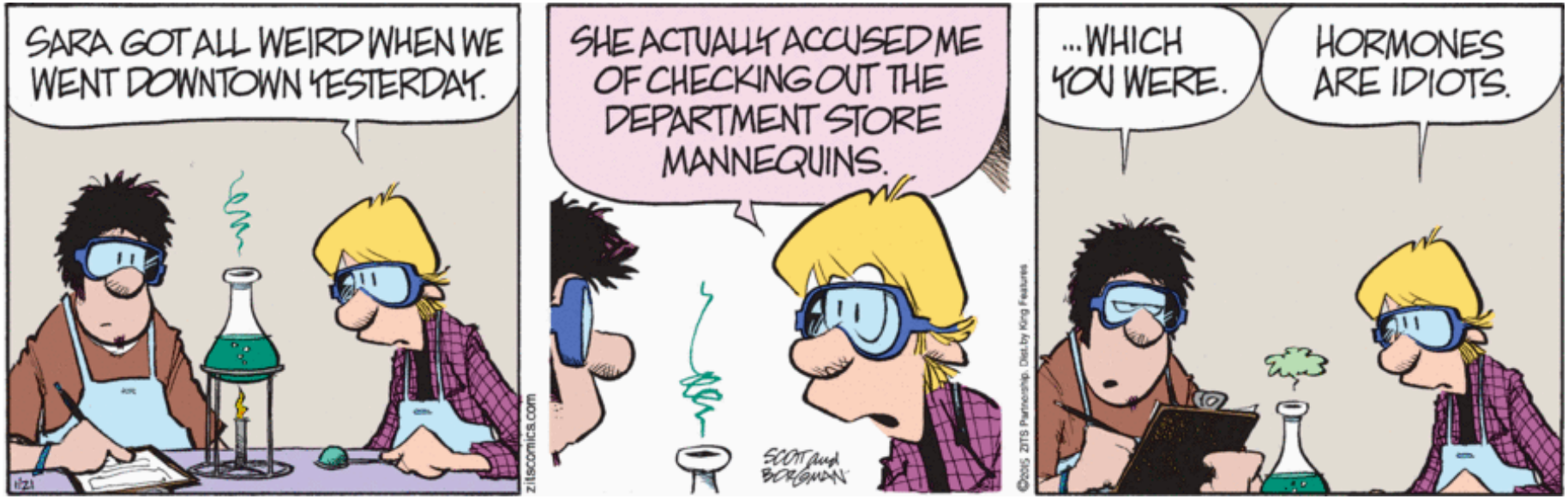
- Control **body temperature**
- Enable **osmoregulation**
- Maintain **blood sugar level**
- Monitor pH in the brain to maintain a constant **carbon dioxide level in the blood**

INTENDED STUDENT LEARNING

Homework

Independent content revision

Workbook questions


SARA GOT ALL WEIRD WHEN WE WENT DOWNTOWN YESTERDAY.
SHE ACTUALLY ACCUSED ME OF CHECKING OUT THE DEPARTMENT STORE MANNEQUINS.
...WHICH YOU WERE.
HORMONES ARE IDIOTS.
zitscomics.com
SCOTT and BORGMAN
©2015 ZITS Partnership. Dist. by King Features

Knowledge Check

Compare the action of the **nervous** and **endocrine systems**.

Explain how the **nervous** and **endocrine systems** work independently or together to:

- Control **body temperature**
- Enable **osmoregulation**
- Maintain **blood sugar level**
- Monitor pH in the brain to maintain a constant **carbon dioxide level in the blood**