

# Hormones and temperature control

Revision notes · How nervous and hormonal communication differ, the main hormones and what they do, and temperature control by the skin.

For Pearson Edexcel International GCSE Biology 4BI1 and Science (Double Award) 4SD0. **Biology only** is not in the Double Award and is only examined on Paper 2.

## Hormones and temperature control Spec 2.86, 2.93-2.95B

### Nervous and hormonal communication compared Spec 2.86

Both the nervous system and the **endocrine system** control responses in the body. The endocrine system is made of **glands** that secrete **hormones** directly into the **blood**. The blood carries the hormone to its **target organ**, where it causes an effect.

| Nervous and hormonal communication compared |                                        |                                                  |
|---------------------------------------------|----------------------------------------|--------------------------------------------------|
|                                             | Nervous communication                  | Hormonal communication                           |
| <b>Message carried by</b>                   | Electrical impulses along neurones     | Hormones (chemicals) in the blood                |
| <b>Speed of response</b>                    | Very fast                              | Slower                                           |
| <b>Length of effect</b>                     | Short-lived                            | Longer-lasting                                   |
| <b>Where it acts</b>                        | Specific effectors (muscles or glands) | Target organs, which can be anywhere in the body |

*Exam tip: Compare in three words: slower, longer, chemical. Hormones travel in the blood, so they reach every part of the body but only affect their target organ.*

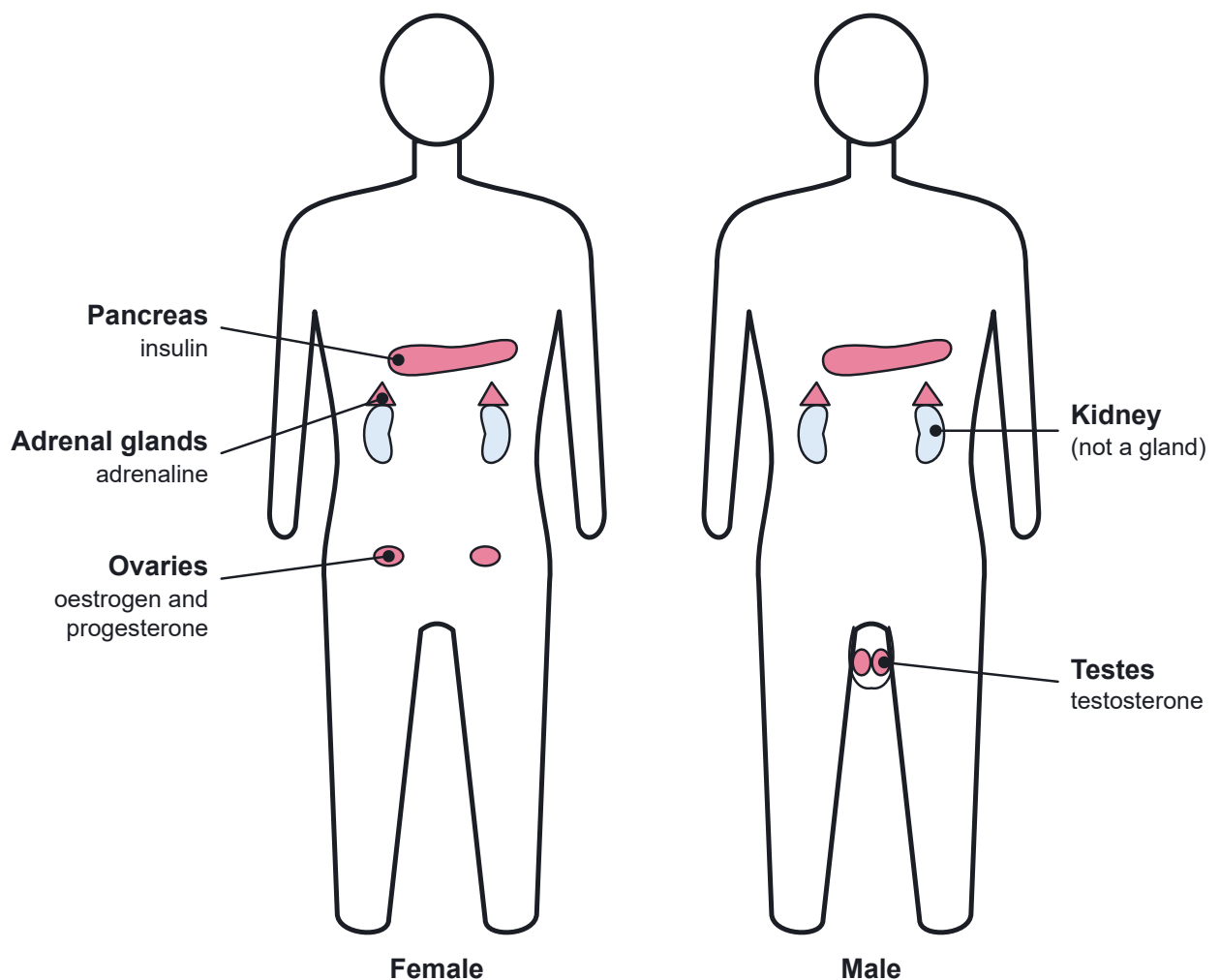
### Adrenaline, insulin and the sex hormones Spec 2.94

You need to know the source, role and effects of five hormones.

### Five hormones: source, role and effects

| Hormone             | Source                                 | Role and effects                                                                                                                                                                                                                                 |
|---------------------|----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Adrenaline</b>   | Adrenal glands (on top of the kidneys) | Prepares the body for <b>fight or flight</b> . Increases heart rate, so more blood (with oxygen and glucose) reaches the muscles for respiration. Stimulates the liver to change glycogen into glucose, raising blood glucose                    |
| <b>Insulin</b>      | Pancreas                               | Controls blood glucose concentration. When blood glucose is high, the pancreas secretes insulin. Insulin makes cells take up glucose from the blood and makes the liver convert glucose into <b>glycogen</b> for storage, so blood glucose falls |
| <b>Testosterone</b> | Testes                                 | Main male sex hormone. Controls the development of male secondary sexual characteristics at puberty and stimulates sperm production                                                                                                              |
| <b>Oestrogen</b>    | Ovaries                                | Main female sex hormone. Controls the development of female secondary sexual characteristics at puberty and helps repair and build up the uterus lining in the menstrual cycle                                                                   |
| <b>Progesterone</b> | Ovaries                                | Maintains the lining of the uterus in the second half of the menstrual cycle and during pregnancy                                                                                                                                                |

*Common mistake: The pancreas makes insulin, but the liver stores glycogen. Do not write that the pancreas stores glucose.*



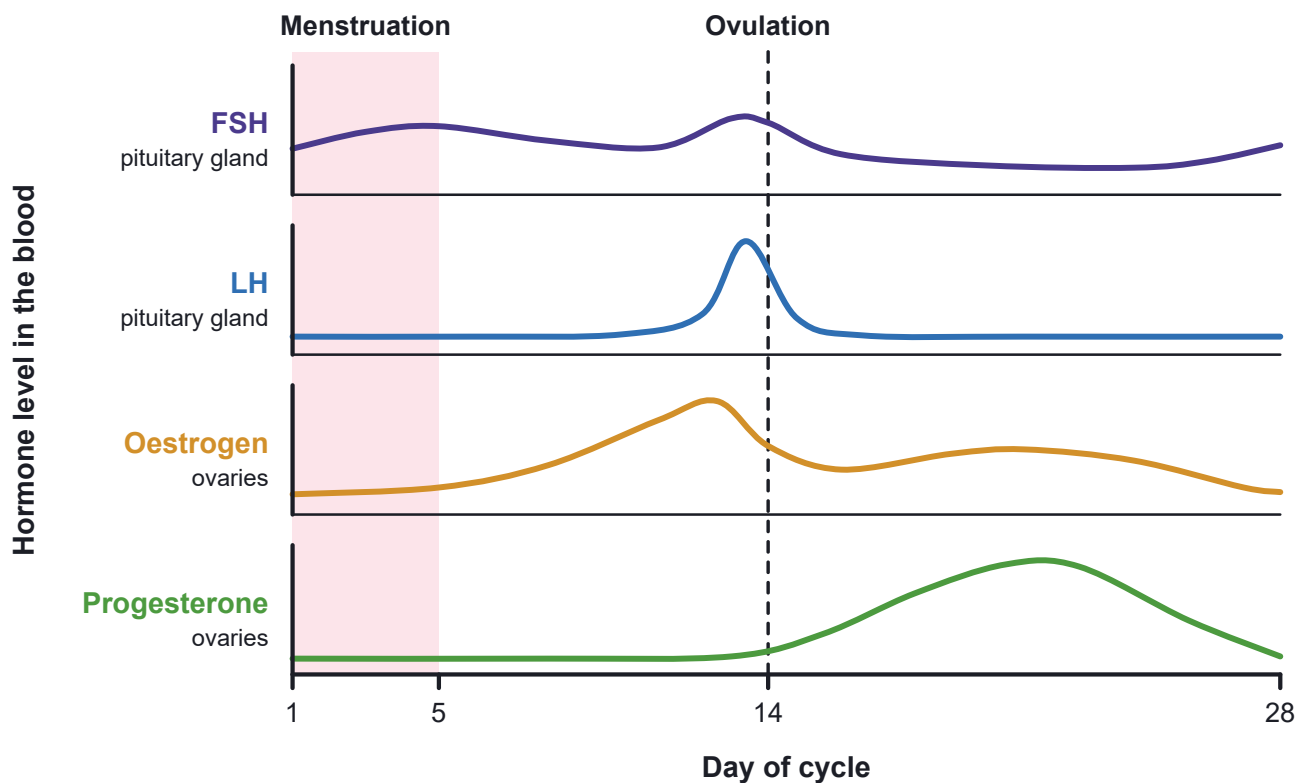
Where the five hormones are made: **adrenal glands, pancreas, ovaries** and **testes**.

## ADH, FSH and LH Spec 2.95B Biology only

Three more hormones are released by the **pituitary gland**, at the base of the brain.

| ADH, FSH and LH |                 |                                                                                                                                                                                        |
|-----------------|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Hormone         | Source          | Role and effects                                                                                                                                                                       |
| <b>ADH</b>      | Pituitary gland | Controls the water content of the blood. It makes the <b>collecting ducts</b> of the kidney more permeable to water, so more water is reabsorbed into the blood and less urine is made |
| <b>FSH</b>      | Pituitary gland | Causes an egg to mature in an ovary. Stimulates the ovaries to produce oestrogen                                                                                                       |
| <b>LH</b>       | Pituitary gland | Stimulates the release of the egg ( <b>ovulation</b> ) from the ovary                                                                                                                  |

| ADH and the water content of the blood |                             |                              |
|----------------------------------------|-----------------------------|------------------------------|
|                                        | Blood water content too low | Blood water content too high |
| <b>ADH released</b>                    | More                        | Less                         |
| <b>Collecting duct</b>                 | More permeable to water     | Less permeable to water      |
| <b>Water reabsorbed into blood</b>     | More                        | Less                         |
| <b>Urine</b>                           | Small volume, concentrated  | Large volume, dilute         |

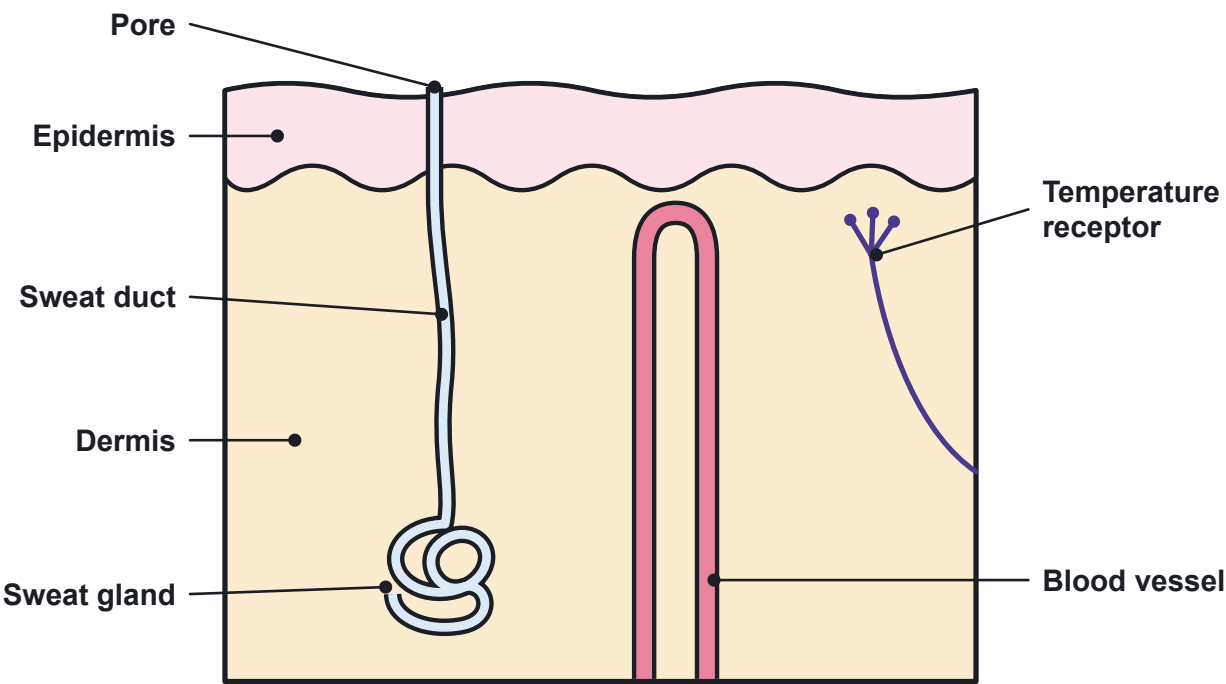


Levels of FSH, LH, oestrogen and progesterone. The **LH surge** triggers ovulation around day 14.

**Common mistake: FSH is not the hormone that releases the egg. FSH makes the egg mature; LH stimulates its release.**

**The skin and temperature control** Spec 2.93

The skin helps to keep the body temperature steady. It has two main layers, the **epidermis** (thin outer layer) and the **dermis** below it. The dermis contains sweat glands, blood vessels and temperature receptors.

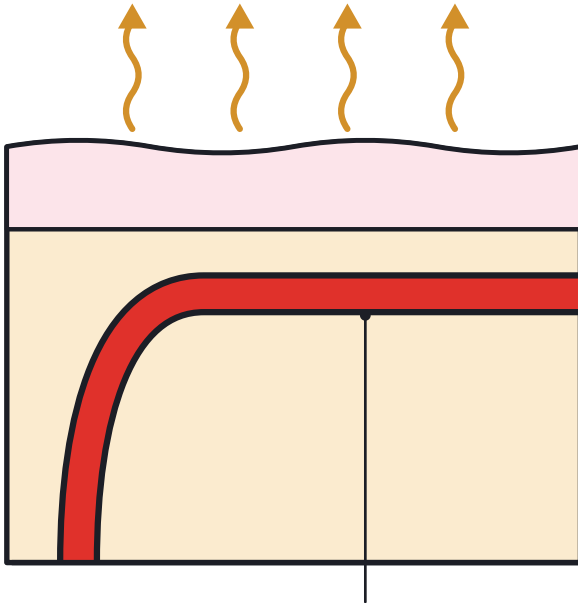


The structures in the skin involved in **temperature regulation**.

| Skin responses to temperature change |                                                                                                                  |                                                                                                |
|--------------------------------------|------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
|                                      | Body too hot                                                                                                     | Body too cold                                                                                  |
| <b>Sweating</b>                      | Sweat glands release <b>sweat</b> onto the skin. Sweat evaporates and takes heat from the skin, cooling the body | Little or no sweat is produced                                                                 |
| <b>Blood vessels in the dermis</b>   | <b>Vasodilation</b> : vessels widen, more blood flows near the surface, more heat is lost                        | <b>Vasoconstriction</b> : vessels narrow, less blood flows near the surface, less heat is lost |
| <b>Overall effect</b>                | More heat is lost, so body temperature falls back to normal                                                      | Less heat is lost, so body temperature rises back to normal                                    |

### Too hot: vasodilation

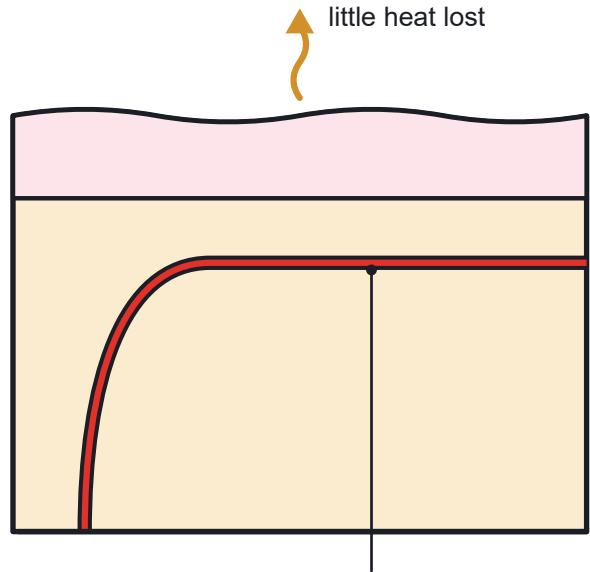
lots of heat lost



**Blood vessel widens**  
more blood near surface

### Too cold: vasoconstriction

little heat lost



**Blood vessel narrows**  
less blood near surface

**Vasodilation** brings more blood near the surface to lose heat; **vasoconstriction** reduces heat loss.

*Common mistake: Blood vessels do not move up or down in the skin. They get wider (vasodilation) or narrower (vasoconstriction).*

#### Quick check

1. Name two differences between nervous and hormonal communication.
2. Which gland makes insulin?
3. Where is adrenaline produced?
4. **Biology only** What does ADH change in the kidney?
5. What happens to skin blood vessels when you are too hot?

## Quick check answers

### Hormones and temperature control

- 1 . Nervous is fast and short-lived using electrical impulses; hormonal is slower and longer-lasting using chemicals in the blood.
- 2 . The pancreas.
- 3 . In the adrenal glands.
- 4 . It makes the collecting ducts more permeable to water, so more water is reabsorbed.
- 5 . They widen (vasodilation), so more heat is lost.