

Chapter 11: Hormonal coordination 1

Knowledge organiser

Human endocrine system

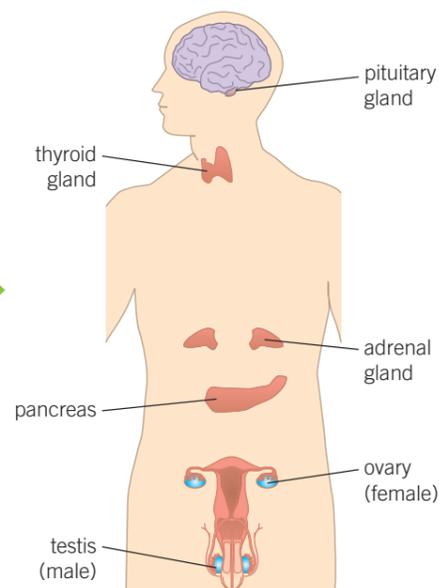
The **endocrine system** is composed of glands that secrete chemicals called **hormones** into the bloodstream.

The blood carries hormones to a target organ, where an effect is produced.

Compared to the nervous system, the effects caused by the endocrine system are slower but act for longer.

The **pituitary gland**, located in the brain, is known as a 'master gland', because it secretes several hormones into the blood.

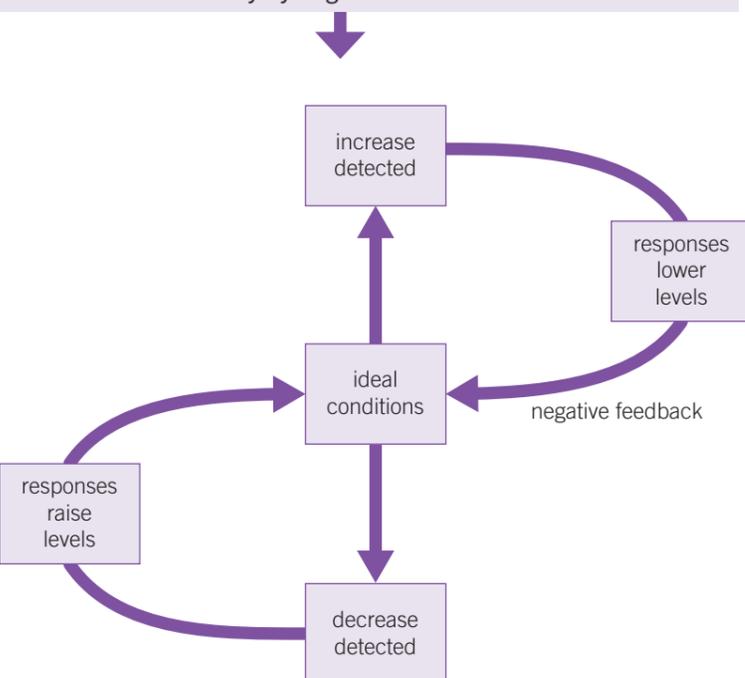
These hormones then act on other glands to stimulate the release of other hormones, and bring about effects.



Endocrine gland	Role of the hormones
Pituitary	<ul style="list-style-type: none"> controls growth in children stimulates the thyroid gland to make thyroxine to control the rate of metabolism in females – stimulates the ovaries to produce and release eggs, and make oestrogen in males – stimulates the testes to make sperm and testosterone
Thyroid	<ul style="list-style-type: none"> controls the rate of metabolism in the body
Pancreas	<ul style="list-style-type: none"> controls blood glucose levels
Adrenal	<ul style="list-style-type: none"> prepares the body for stress involved in the 'fight or flight' response
Ovaries	<ul style="list-style-type: none"> controls the development of female secondary sexual characteristics controls the menstrual cycle
Testes	<ul style="list-style-type: none"> controls the development of male secondary sexual characteristics involved in the production of sperm

Negative feedback (HT only)

Negative feedback systems work to maintain a steady state. For example, blood glucose, water, and **thyroxine** levels are all controlled in the body by negative feedback.



Adrenaline

- produced by **adrenal glands** in times of fear or stress
- increases heart rate
- boosts delivery of oxygen and glucose to brain and muscles
- prepares the body for 'fight or flight' response
- does not involve negative feedback, as adrenal glands stop producing **adrenaline**

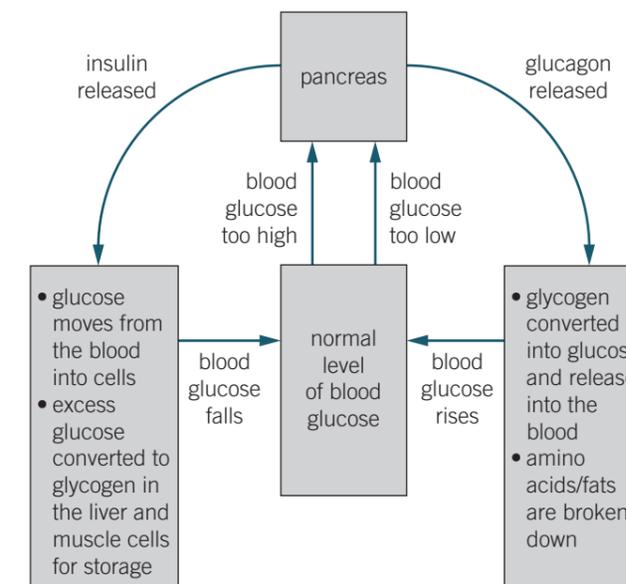
Thyroxine

- produced by the **thyroid gland**
- regulates how quickly your body uses energy and makes proteins (**metabolic rate**)
- important for growth and development
- levels controlled by negative feedback

Control of blood glucose levels

Blood glucose (sugar) concentration is monitored and controlled by the **pancreas**.

This is an example of negative feedback control, as the pancreas switches production between the hormones **insulin** and **glucagon** to control blood glucose levels.



Diabetes

Diabetes is a non-communicable disease where the body either cannot produce or cannot respond to insulin, leading to uncontrolled blood glucose concentrations.

Type 1 diabetes	Type 2 diabetes
early onset	usually later onset, obesity is a risk factor
pancreas stops producing sufficient insulin	body doesn't respond to the insulin produced
commonly treated through insulin injections, also diet control and exercise	commonly treated through a carbohydrate-controlled diet and exercise

Key terms

Make sure you can write a definition for these key terms.

adrenal gland adrenaline diabetes endocrine system glucagon hormone insulin metabolic rate negative feedback pancreas pituitary gland thyroid gland thyroxine

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Knowledge organiser

Hormones in human reproduction

During puberty, reproductive hormones cause the secondary sex characteristics to develop:

Oestrogen

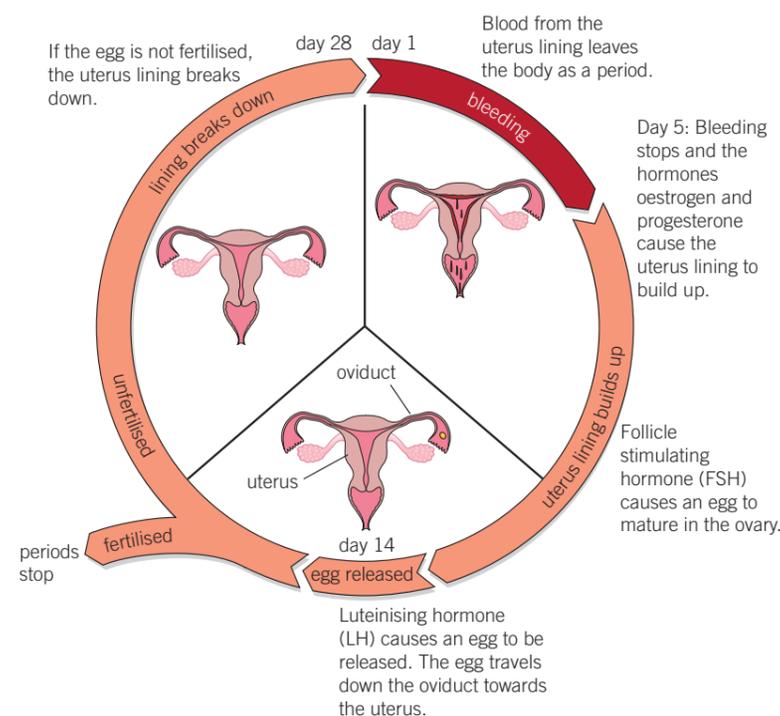
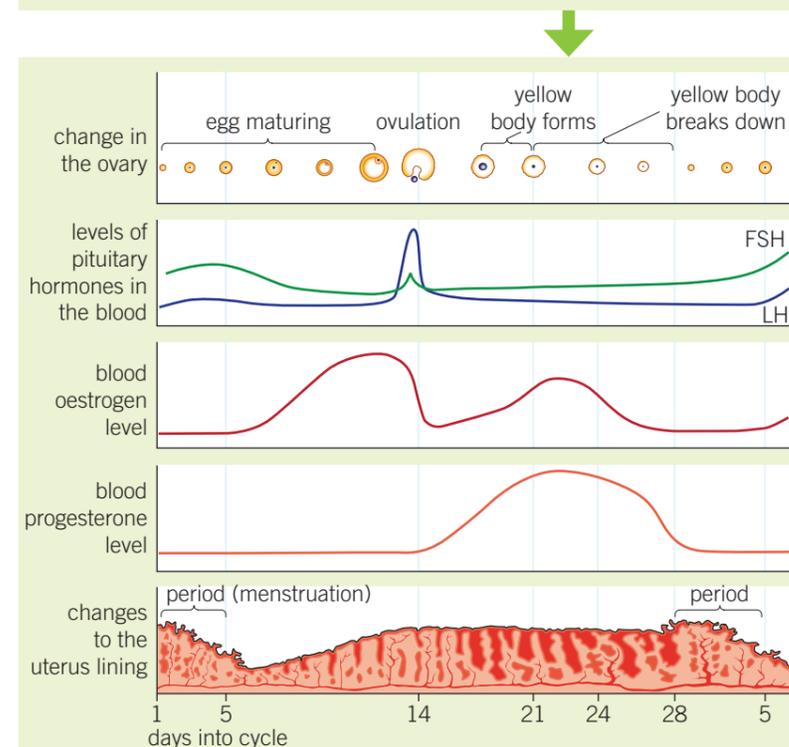
- main female reproductive hormone
- produced in the **ovary**
- at puberty, eggs begin to mature and one is released every ~28 days

Testosterone

- main male reproductive hormone
- produced by the **testes**
- stimulates sperm production

The menstrual cycle

Hormone	Released by	Function
follicle stimulating hormone (FSH)	pituitary gland	
luteinising hormone (LH)	pituitary gland	
oestrogen	ovaries	
progesterone	ovaries	



Treating infertility with hormones (HT only)

Hormones are used in modern reproductive technologies to treat **infertility**.

FSH and LH can be given as a drug to treat infertility, or **in vitro fertilisation (IVF)** treatment may be used.

IVF treatment

- 1 mother given FSH and LH to stimulate the maturation of several eggs
- 2 eggs collected from the mother and fertilised by sperm from the father in a laboratory
- 3 fertilised eggs develop into embryos
- 4 one or two embryos are inserted into the mother's **uterus** (womb) when the embryos are still tiny balls of cells

Fertility treatment has some disadvantages:

- it is emotionally and physically stressful
- it has a low success rate
- it can lead to multiple births, which are a risk to both the babies and the mother.

Contraception

Fertility can be controlled by a variety of hormonal and non-hormonal methods of **contraception**.

Hormonal contraception

- oral contraceptives – contain hormones to inhibit FSH production so no eggs mature
- injection, implant, skin patch, or intrauterine devices (IUD) – slowly release progesterone to inhibit maturation and release of eggs; can last months or years

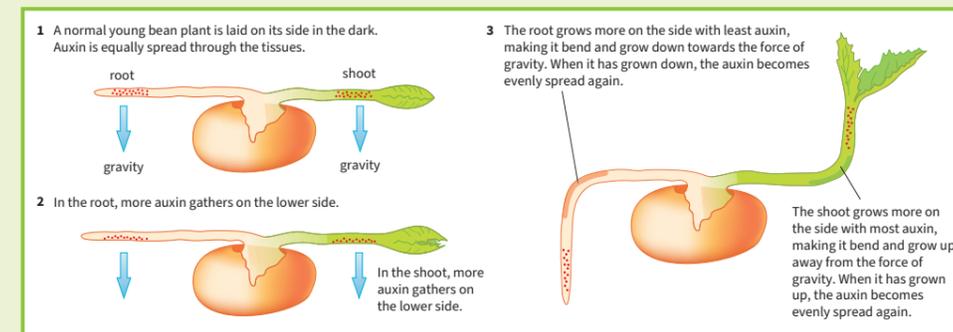
Non-hormonal contraception

- barrier methods, for example, condoms and diaphragms – prevent sperm reaching the egg
- copper IUD – prevents the implantation of an embryo
- surgical methods of male and female sterilisation
- spermicidal agents – kill or disable sperm
- abstaining from intercourse when an egg may be in the oviduct

Plant hormones

A plant's response can be known as **phototropism**, when the shoots bend towards light, and **gravitropism** when the root moves towards gravity. The responses are controlled by the hormone **auxin**. In phototropism, auxin moves from the side of the shoot with light to the unlit side, meaning the cells on that side will grow more. In gravitropism, high levels of auxin means that the growth of root cells is inhibited.

(HT only) **Gibberellins** are also plant hormones which begin the process of seed germination by breaking down the food stores in the seeds and stimulate the growth of stems. Ethene is another hormone which controls cell division.



Key terms

Make sure you can write a definition for these key terms.

auxin contraception follicle stimulating hormone gravitropism infertility in vitro fertilisation oestrogen ovary luteinising hormone menstrual cycle ovulation phototropism progesterone testes uterus

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Retrieval questions

Learn the answers to the questions below, then cover the answers column with a piece of paper and write as many as you can. Check and repeat.

B11 questions

Answers

1	What is the endocrine system?	Put paper here	system of glands that secrete hormones into the bloodstream
2	How do the effects of the endocrine system compare to those of the nervous system?	Put paper here	endocrine system effects are slower but act for longer
3	Where is the pituitary gland located?	Put paper here	brain
4	Which organ monitors and controls blood glucose concentration?	Put paper here	pancreas
5	Which hormones interact to regulate blood glucose levels?	Put paper here	insulin and glucagon
6	What is the cause of Type 1 diabetes?	Put paper here	pancreas produces insufficient insulin
7	What is the cause of Type 2 diabetes?	Put paper here	body cells no longer respond to insulin
8	What is the function of FSH?	Put paper here	causes eggs to mature in the ovaries, and stimulates ovaries to produce oestrogen
9	What is the function of LH?	Put paper here	stimulates the release of an egg
10	What is the function of oestrogen?	Put paper here	causes lining of uterus wall to thicken
11	What are the methods of hormonal contraception?	Put paper here	oral contraceptives, injection, implant, skin patch, IUD
12	What are the methods of non-hormonal contraception?	Put paper here	barrier methods, copper IUD, spermicidal agents, sterilisation, abstinence
13	State the disadvantages of IVF treatment.	Put paper here	<ul style="list-style-type: none">emotionally and physically stressfullow success ratecan lead to risky multiple births
14	What is the function of adrenaline in the body?	Put paper here	increases heart rate and boosts delivery of oxygen and glucose to brain and muscles to prepare the body for 'fight or flight'
15	What is the function of thyroxine in the body?	Put paper here	stimulates basal metabolic rate, so is important for growth and development
16	Name one hormone controlled by negative feedback.	Put paper here	thyroxine
17	Which endocrine glands control secondary sexual characteristics?	Put paper here	ovaries in females, testes in males