Revision Biology Paper 2 – Unit 2 Homeostasis and response

Homeostasis

The human nervous system

- Structure and function
- **The brain (biology only)**
- **The eye (biology only)**
- **Control of body temperature (biology only)**

Hormonal coordination in humans

- Human endocrine system
- Control of blood glucose concentration
- **Maintaining water and nitrogen balance in the body (biology only)**
- Hormones in human reproduction
- Contraception
- **The use of hormones to treat infertility (HT only)**
- *Negative feedback (HT only)*

Plant hormones (biology only)

- Human endocrine system
- Control and coordination
- *Use of plant hormones (HT only)*

LearnIT!
KnowIT!

Homeostasis

Homeostasis

There are many process in the body that keep important substances and the body temperature regulated within narrow limits.

This is called **homeostasis**

homeo = similar **stasis** = standing still

Homeostasis is the regulation (balance) of the **internal conditions** of a cell or organism to maintain **optimum conditions** for enzyme function and all cell functions in response to **internal** and **external changes.**

In the **human body,** homeostasis controls:

- **blood glucose concentration**
- **body temperature**
- **water levels.**

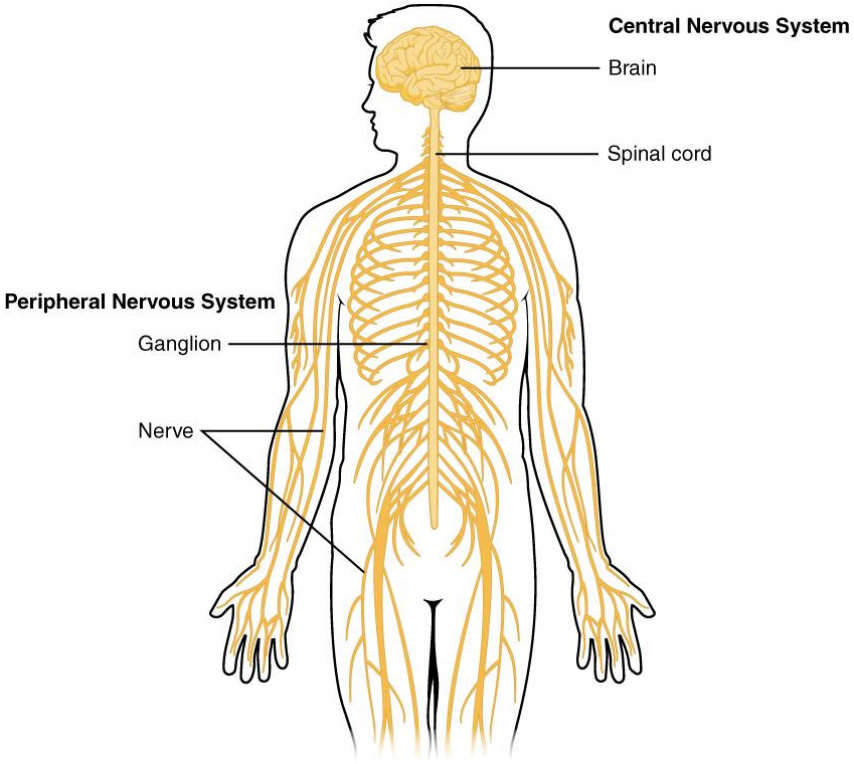
Activity - Homeostasis

Homeostasis

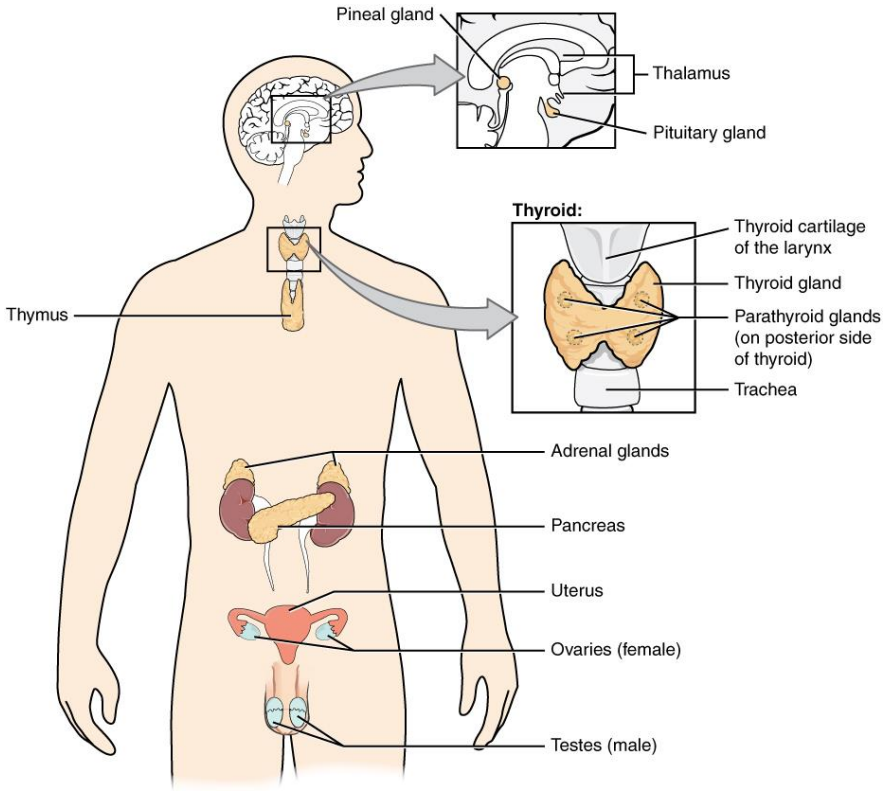
In the human body there are control systems that involve **nervous responses** or **chemical** (hormonal) **responses.**

These are automatic and all control systems include:

Human nervous system



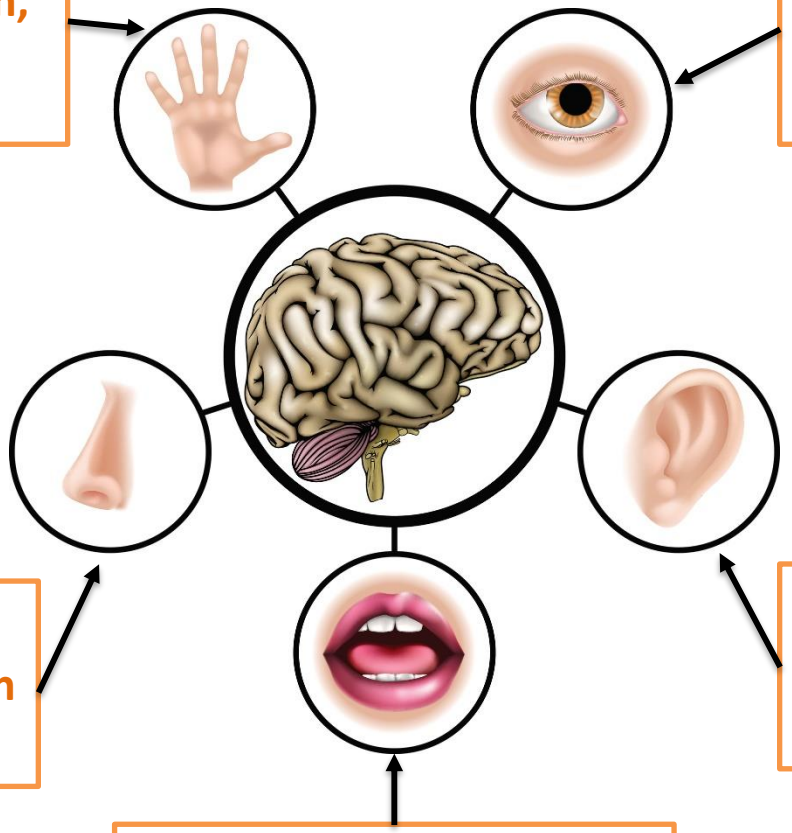
Human endocrine system



Receptor cells - these are specialised cells that detect a stimulus (changes in the environment).

Receptor cells in the skin detect changes in touch, pressure, pain and temperature

Light sensitive cells in the retina of the eye detect changes in light and colour

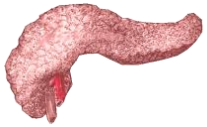


Receptor cells in the nose detect chemicals in the air

Receptor cells in the inner ear detect changes in sound

Receptor cells in the tongue detect chemicals in food

Coordination centres- they receive and process information from receptors.

Brain		Coordinates information from the receptor cells and sends signals to the muscles and glands.
Spinal cord		Coordinates messages from the brain and receptor cells and coordinates reflexes.
Pancreas		Coordinates the glucose levels in the blood.

Effectors are muscles or glands in the body that produce a response to restore optimum levels in the body.

Examples:

- a muscle contracting to lift a leg
- a gland releasing a hormone into the blood.

QuestionIT!

Homeostasis

1. Define homeostasis.
2. Why does homeostasis need to maintain optimal conditions?
3. List three conditions that the body needs to maintain.
4. What do the two automatic response systems involve?
5. Define stimuli.
6. List the receptor cells and state what stimulus they detect.
7. Name the 3 coordination centres in the body and describe what each of them coordinates.
8. What is an effector?

AnswerIT!

Homeostasis

1. Define homeostasis.

The regulation of the internal conditions of a cell or organism to maintain optimum conditions.

2. Why does homeostasis need to maintain optimal conditions?

For enzyme action and all cell functions.

3. List three conditions that the body needs to maintain.

Blood glucose concentration, body temperature and water levels.

4. What do the two automatic response systems involve?

Nervous responses or chemical responses.

5. Define stimuli.

Changes in the environment.

6. List the receptor cells and state what stimulus they detect.

Eye (retina) - light, Ear – sound, Nose – Chemicals in the air, Mouth (tongue) – chemicals in food, Skin - touch, pressure, pain and temperature

7. Name the 3 coordination centres in the body and describe what each of them coordinates.

Brain - coordinates information from the receptor cells and send signals to the muscles and glands.

Spinal cord - Coordinates messages from the brain and receptor cells and coordinates reflexes.

Pancreas - coordinates the glucose levels in the blood.

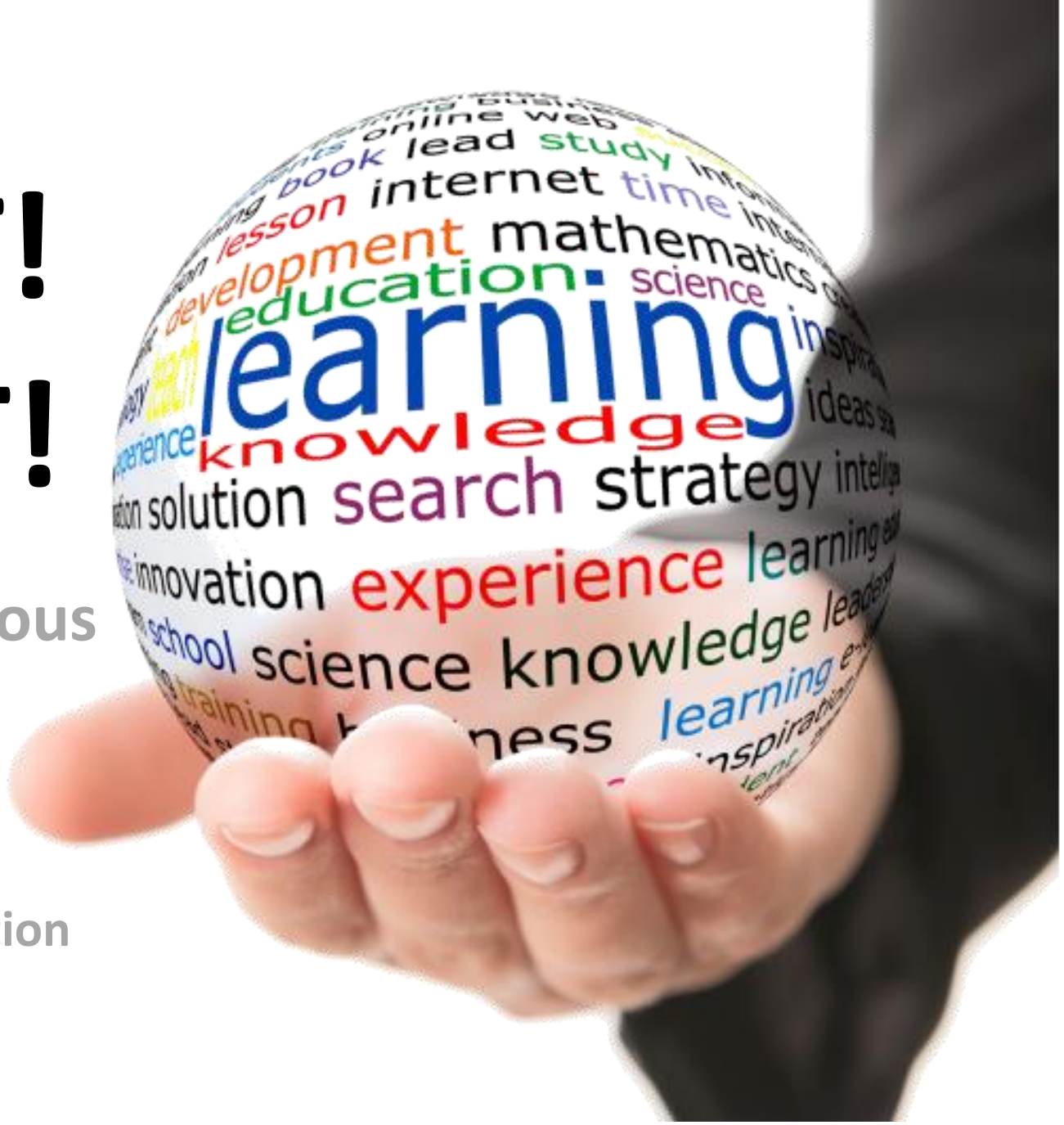
8. What is an effector?

A muscle or gland.

LearnIT!
KnowIT!

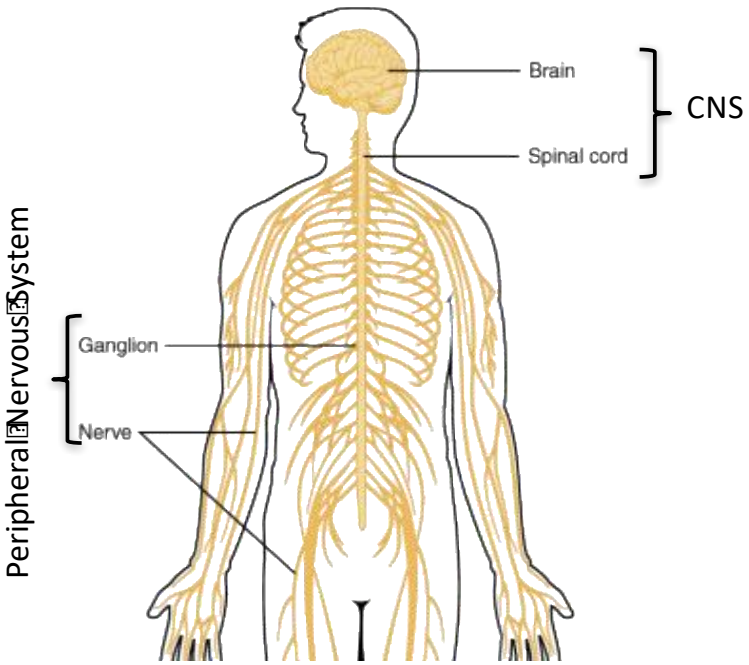
The human nervous system
Part 1

- Structure and function



The human nervous system Part 1 - Structure and function

The nervous system enables humans to react to their surroundings and to coordinate their behaviour.



A **stimulus** is any change in the soundings. These are detected by **receptors** (cells that detect a change) and information passes along cells (neurones) as **electrical impulses** to the **central nervous system** (CNS).

The **CNS** is the **brain** and **spinal cord**.

The **CNS coordinates** the **response of effectors** which may be muscles contracting or glands secreting hormones.

stimulus → receptor → coordinator → effector → response

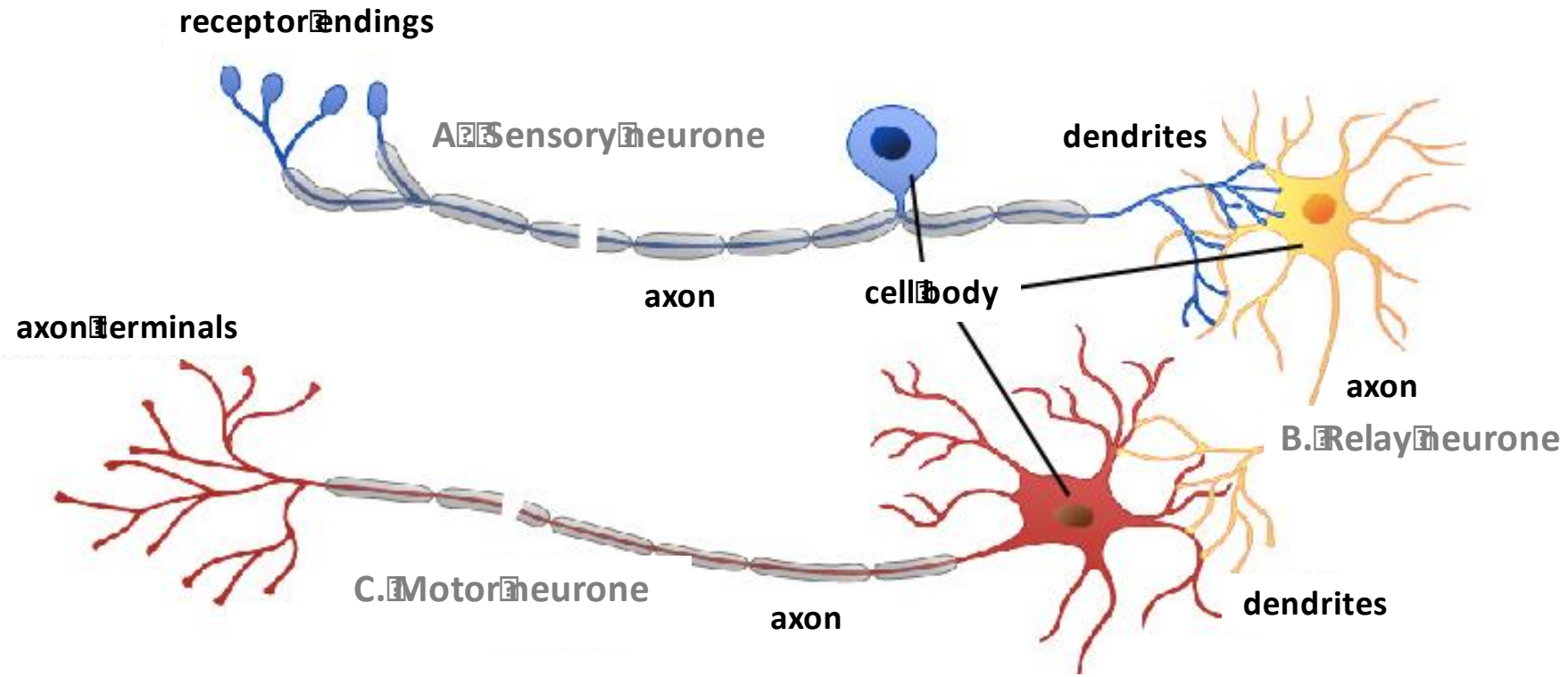
The human nervous system Part 1 - Structure and function

There are **three main types** of neurones:

A. **Sensory neurones** – these carry impulses from the receptors to the central nervous system (CNS).

B. **Relay neurones** – these connect the sensory neurones to the motor neurones in the CNS.

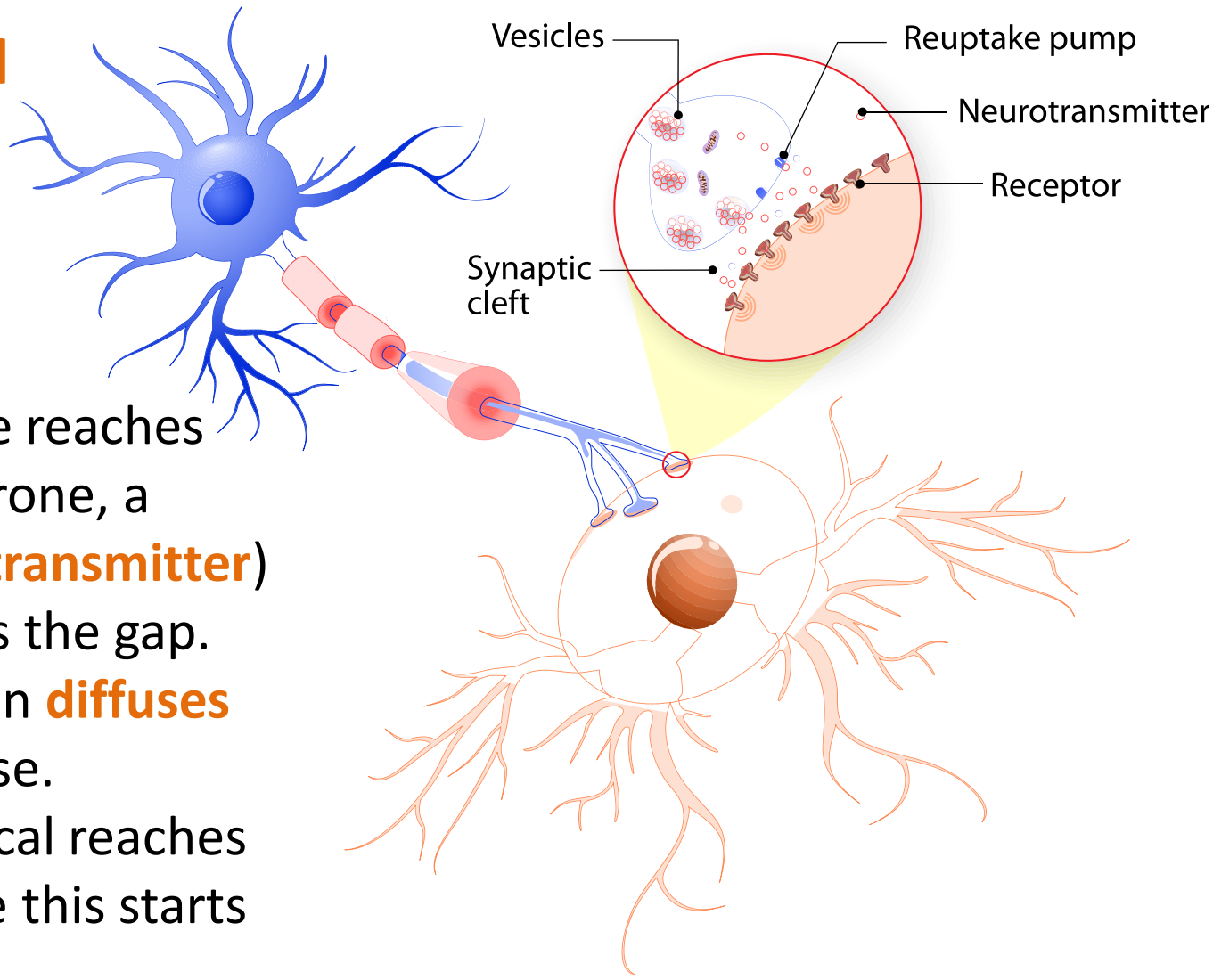
C. **Motor neurones** – these carry impulses from the CNS to an effector.



The human nervous system Part 1 - Structure and function

Neurones are not joined together; they have small gap between them.

The gap is called a synapse

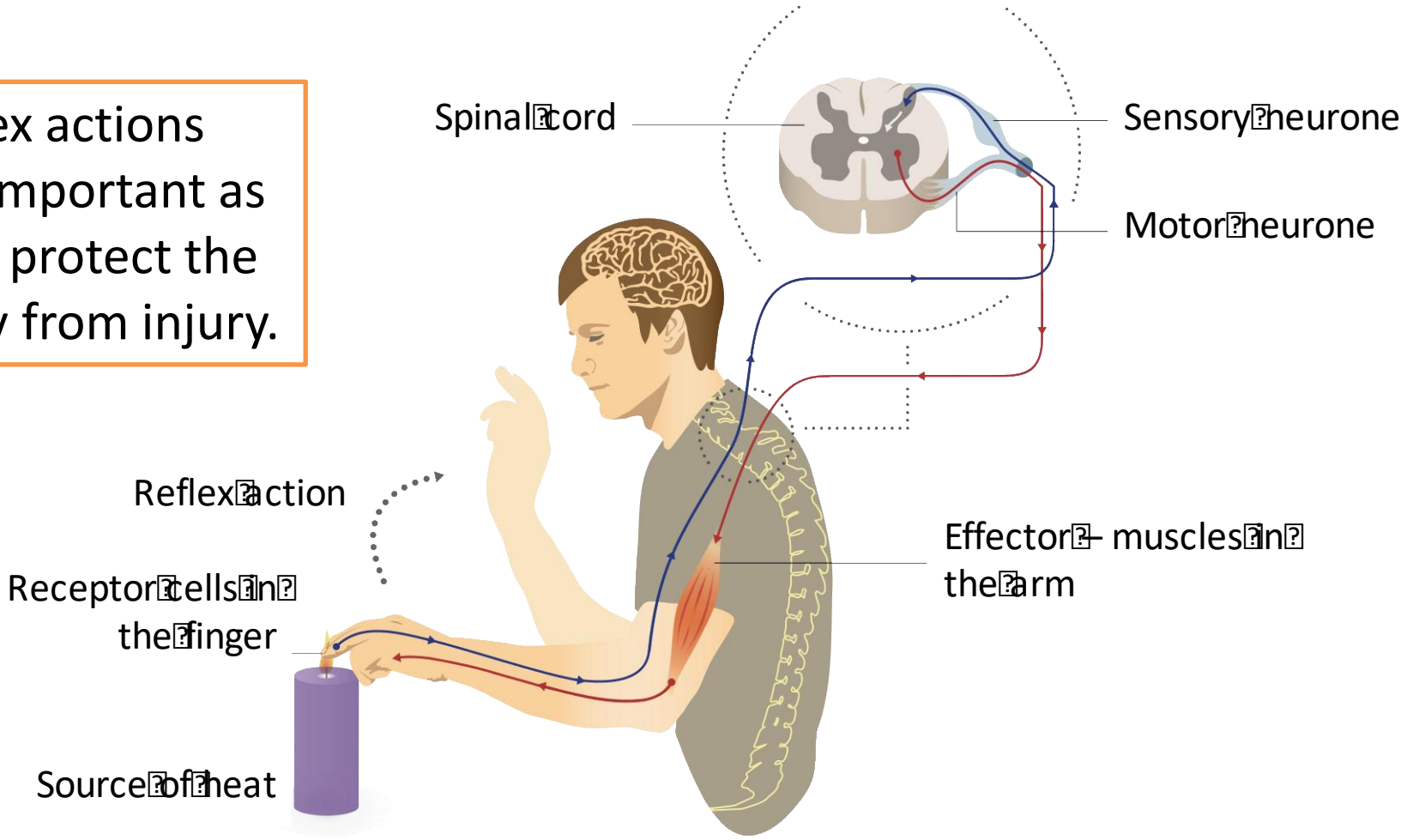


- When an impulse reaches the end of a neurone, a chemical (**neurotransmitter**) is released across the gap.
- The chemical then **diffuses** across the synapse.
- When the chemical reaches the next neurone this starts **another impulse**.

The human nervous system Part 1 - Structure and function

Reflex actions are **automatic** and **rapid**; they do not involve the conscious part of the brain. The path that a reflex action takes is called a **REFLEX ARC**.

Reflex actions are important as they protect the body from injury.



QuestionIT!

The human nervous system
Part 1

- Structure and function

The human nervous system Part 1 -

Question IT

1. What is a stimulus?
2. What is a receptor?
3. Name the two parts of the central nervous system.
4. What is an effector?
5. What does the CNS coordinate?
6. Put these in the correct order: receptor, stimulus, response, coordinator, effector.
7. What is the role of the sensory neurone?
8. What is the role of the relay neurone?
9. What is the role of the motor neurone?
10. What is a synapse?
11. Describe what happens at the synapse.
12. Why are reflex actions important?
13. Recall the pathway of the reflex arc.

AnswerIT!

The human nervous system
Part 1

- Structure and function

The human nervous system Part 1 - AnswerIT

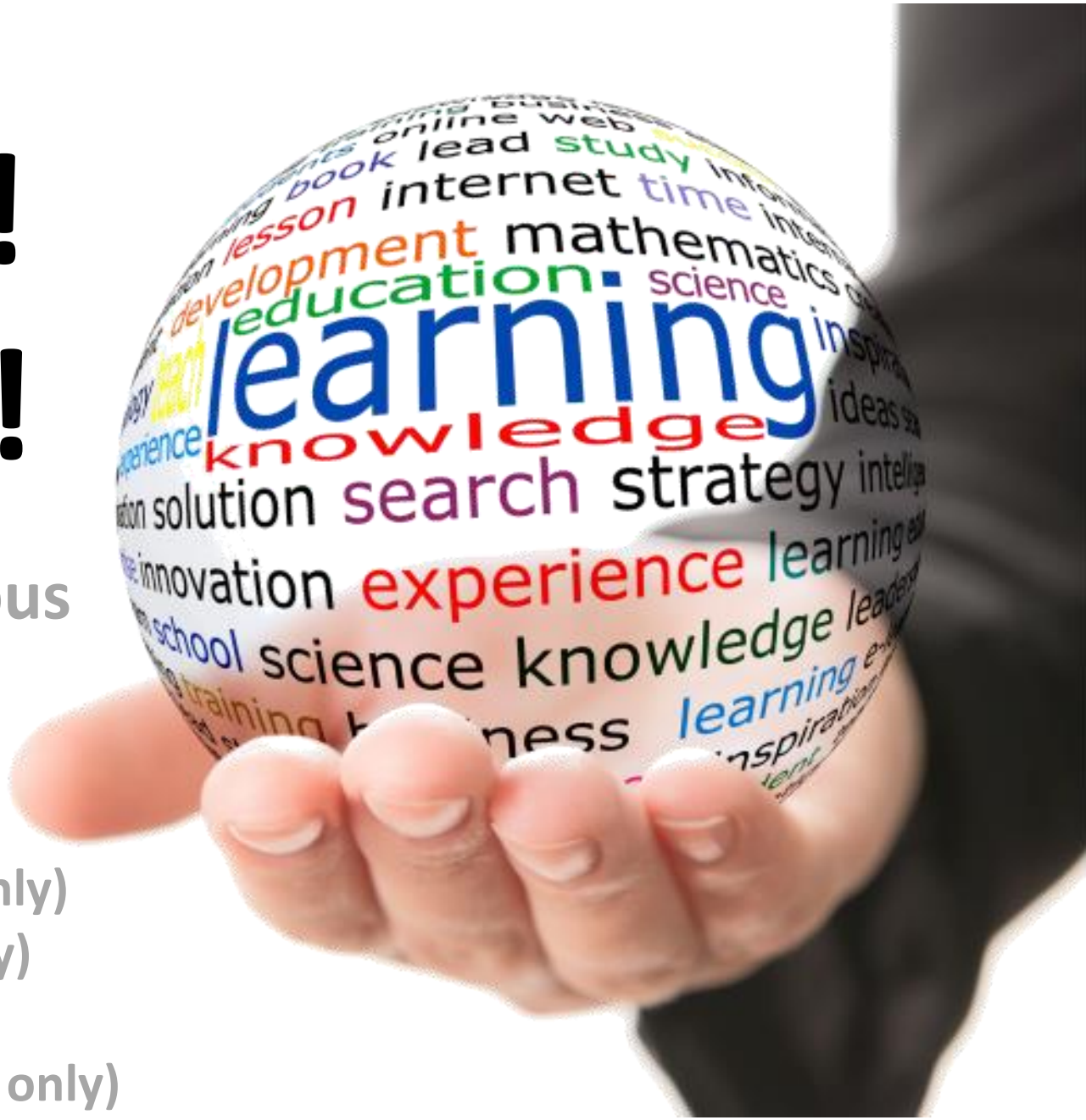
1. What is a stimulus? **Any change in the surroundings**
2. What is a receptor? **Cells that detect a change**
3. Name the two parts of the central nervous system. **Brain and spinal cord**
4. What is an effector? **A muscle or gland**
5. What does the CNS coordinate? **The response of effectors**
6. Put these in the correct order: receptor, stimulus, response, coordinator, effector. **stimulus → receptor → coordinator → effector → response**
7. What is the role of the sensory neurone? **Carry impulses from the receptors to the central nervous system (CNS)**
8. What is the role of the relay neurone? **Connect the sensory neurones to the motor neurones in the CNS.**
9. What is the role of the motor neurone? **Connect the sensory neurones to the motor neurones in the CNS.**

10. What is a synapse? **A gap between two neurones**
11. Describe what happens at the synapse. **An impulse reaches the end of a neurone; neurotransmitter is released across the gap. It then diffuses across the synapse and when it reaches the next neurone this starts another impulse.**
12. Why are reflex actions important? **They protect the body from injury**
13. Recall the pathway of the reflex arc. **receptor → sensory neurone → spinal cord → motor neurone → effector**

LearnIT!
KnowIT!

The human nervous system
Part 2

- The brain (biology only)
- The eye (biology only)
- Control of body temperature (biology only)

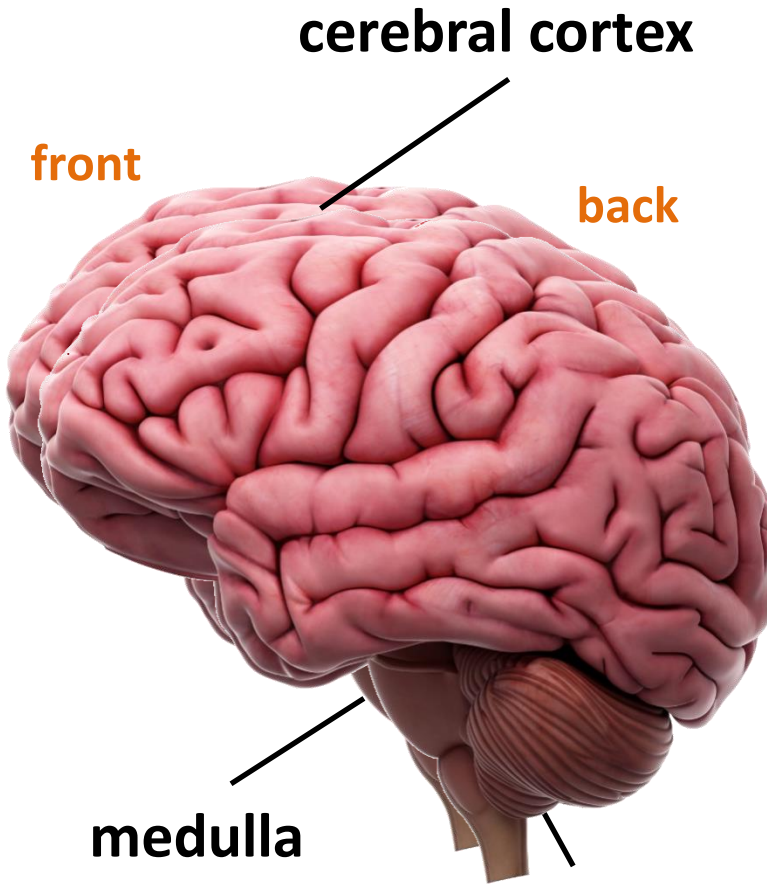


The human nervous system Part 2 - The brain (biology only)

The **brain** controls **complex behaviour**. It is made of **billions** of interconnected neurones and has **different regions** that carry out **different functions**.

Three of the **main structures** in the brain are:

- **cerebral cortex** – is the **outer** 'wrinkled' layer of the brain it is **responsible** for **intelligence, language, memory** and **consciousness**
- **cerebellum** – is located at the lower part of the back of the brain and is **responsible** for **voluntary coordination** of the **muscles**
- **medulla** – is located in the lower part of the brain stem it is **responsible** for **involuntary coordination** such as **breathing, swallowing** and **heart rate**.



Video - The Brain

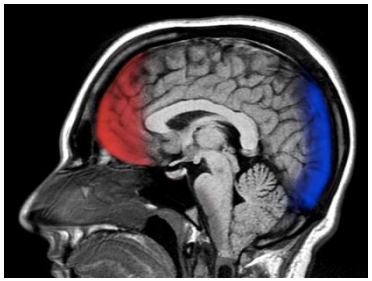
The human nervous system Part 2 - The brain **(HT biology only)**

A **neuroscientist** is a scientist that studies the structure and function of the brain. The complexity and delicacy of the brain makes investigating the brain and treating brain disorders very difficult.

Neuroscientists use different methods to study how the brain works:

- **studying patients with brain damage**
- **electrically stimulating different parts of the brain**
- **using magnetic resonance imaging (MRI) scanning.**

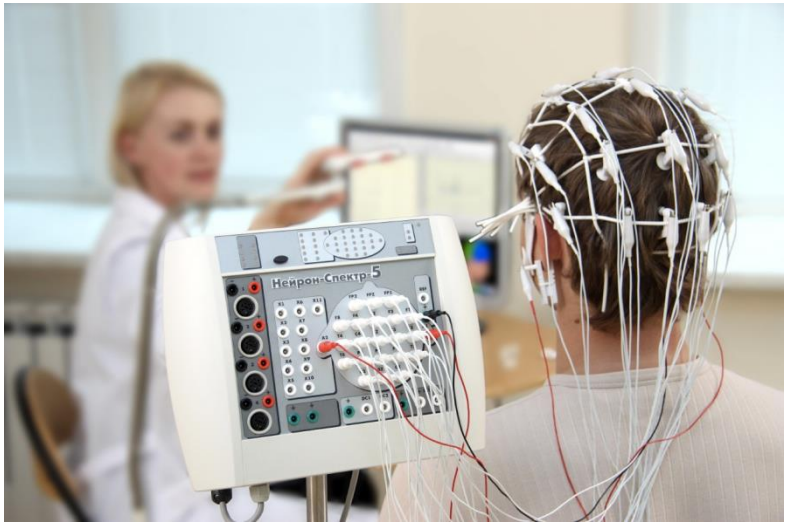
Studying brain damage

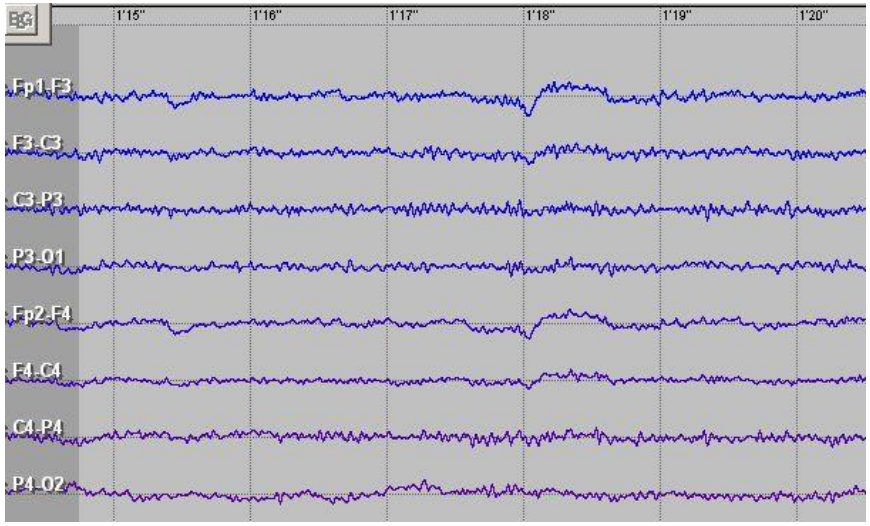


Damage to different brain areas produces different behavioural and psychological effects.
For **example**, damage in the front end of the brain **disturbs the ability** to make decisions, whereas damage to the back of the brain disturbs vision.

The human nervous system Part 2 - The brain (HT biology only)

Electrically stimulating different parts of the brain

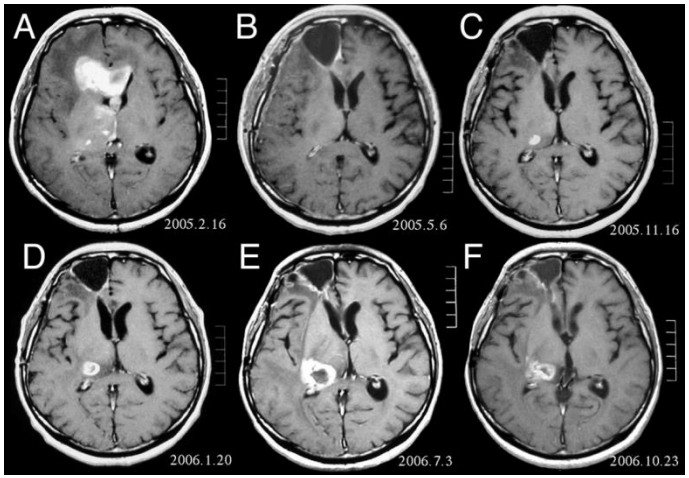




An **electroencephalogram (EEG)** is a test used to find problems related to **electrical activity** of the **brain**. An EEG tracks and records brain wave patterns. By stimulating different parts of the brain and observing what happens, it is possible to get a greater understanding of what different areas of the brain do.

The human nervous system Part 2 - The brain (HT biology only)

Using magnetic resonance imaging (MRI) scanning.

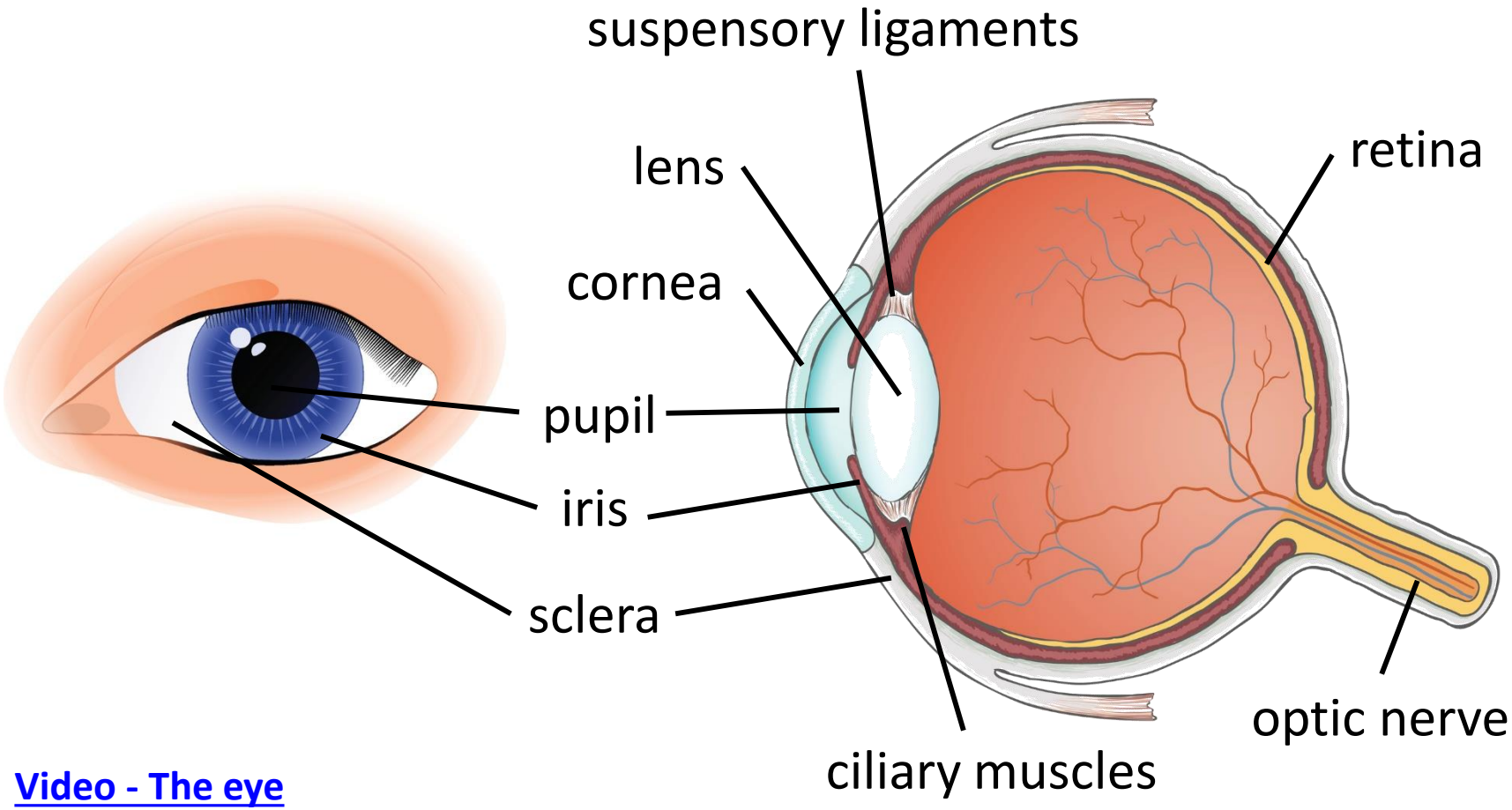


Uses strong **magnetic fields** and **radio waves** to produce detailed images of the brain and spinal cord. It consists of a large tube containing **powerful magnets**. MRI can distinguish between different types of tissues, including detecting cancerous cells. It is a painless and safe procedure, but uses very expensive equipment and needs highly trained staff.

Video - MRI

The human nervous system Part 2 - The eye **(biology only)**

The **eye** is a **sense organ** containing **receptors** sensitive to **light intensity** and **colour**.



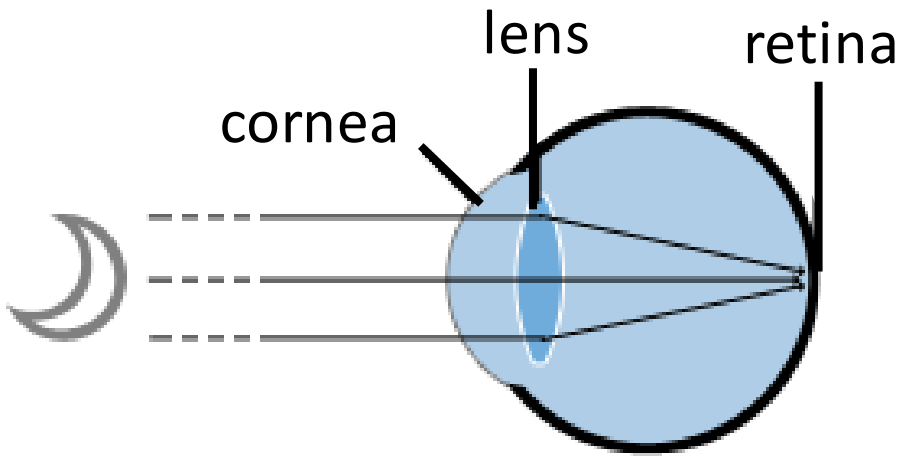
[Video - The eye]

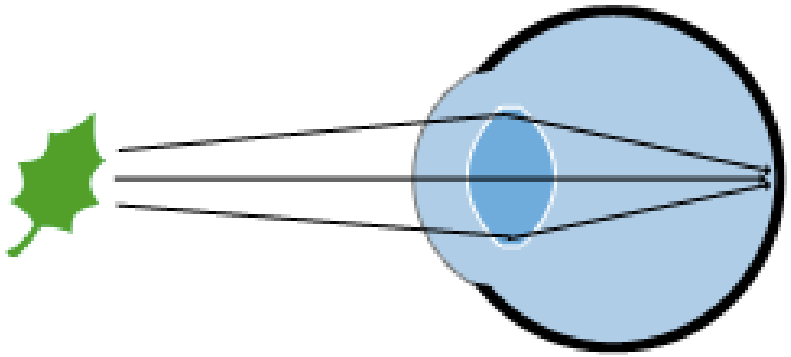
The human nervous system Part 2 - The eye (biology only)

Part of the eye	Description and function
cornea	Transparent layer at the front of the eye, it refracts light into the eye.
iris	The coloured part of the eye, contains muscles that control the amount of light entering the eye.
pupil	The hole in the middle of the iris that lets light in. Its diameter is controlled by the iris.
lens	A transparent, biconvex structure in the eye that refracts light onto the retina.
retina	Thin layer of tissue at the back of the eye that contains receptor cells for light and colour.
sclera	Tough white supporting wall of the eye.
ciliary muscles	Muscles that are connected to the lens by the suspensory ligaments; they change the shape of the lens.
suspensory ligaments	These connect the lens to the ciliary muscles.
optic nerve	Carries impulses from the retina to the brain.

The human nervous system Part 2 - The eye (biology only)

Accommodation is the process of **changing the shape of the lens** to **focus** on **near** or **distant objects**.





To **focus** on a **distant object**:

- the ciliary muscles relax
- the suspensory ligaments are pulled tight
- the lens is then pulled thin and only slightly refracts light rays.

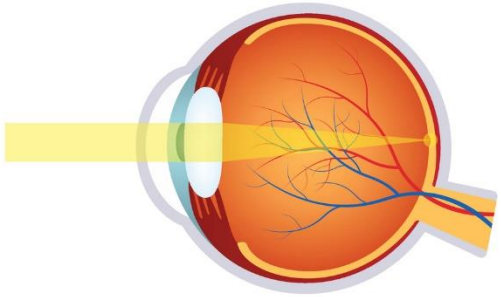
To **focus** on a **near object**:

- the ciliary muscles contract
- the suspensory ligaments loosen
- the lens is then thicker and refracts light rays strongly.

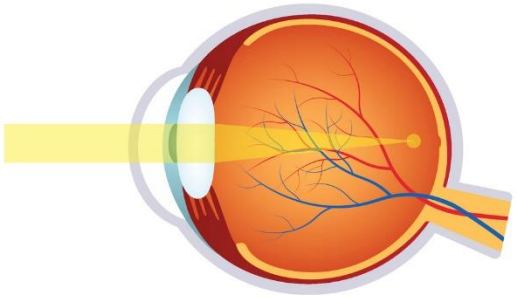
Video - accommodation

The human nervous system Part 2 - The eye **(biology only)**

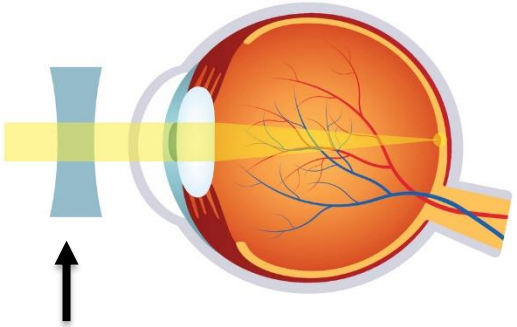
Two common defects of the eyes are **myopia** (short sightedness) and **hyperopia** (long sightedness) in which rays of light do not focus on the retina.



Normal vision



Myopia



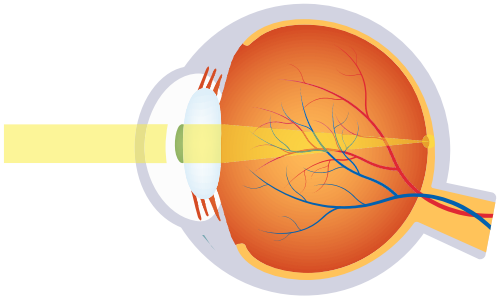
Correction with lens

Concave lens

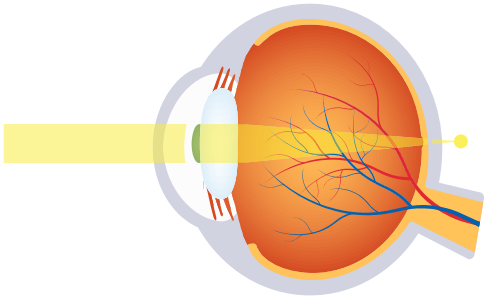
Myopia (short sightedness)

- People who are short sighted **cannot focus** on objects that are **far away**.
- It usually occurs when the **eyeball** is **too long.**
- The light rays from distant objects **focus** in the eyeball **in front** of the **retina**.
- Myopia can be **corrected** with **concave lenses** so that the light rays focus on the retina.

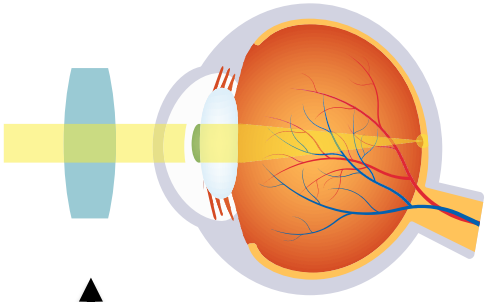
The human nervous system Part 2 - The eye **(biology only)**



Normal vision



Hyperopia



Correction with lens

Convex lens

Hyperopia (long sightedness)

- People who are long sighted **cannot focus** on objects that are **near**.
- It usually occurs when the **eyeball** is **too short.**
- The light rays from distant objects **focus** in the eyeball **behind** the **retina**.
- **Hyperopia** can be **corrected** with **convex lenses** so that the light rays focus on the retina.

The human nervous system Part 2 - The eye (biology only)

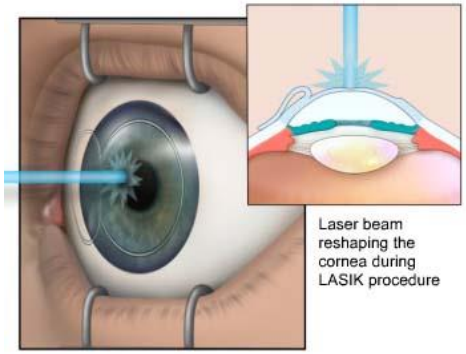
There are new technologies available to correct vision these include:

Contact lenses – these can be **hard** or **soft** and are inserted directly into the eye and sit on the cornea. This then refracts the light rays. **Advantages** - lightweight, almost invisible, good for people playing sports. **Disadvantages** – not a permanent solution and they can cause irritation and infections.

Hard contact lens

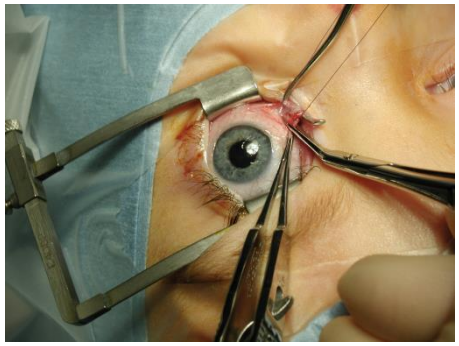
Inserting a soft contact lens

Soft contact lens



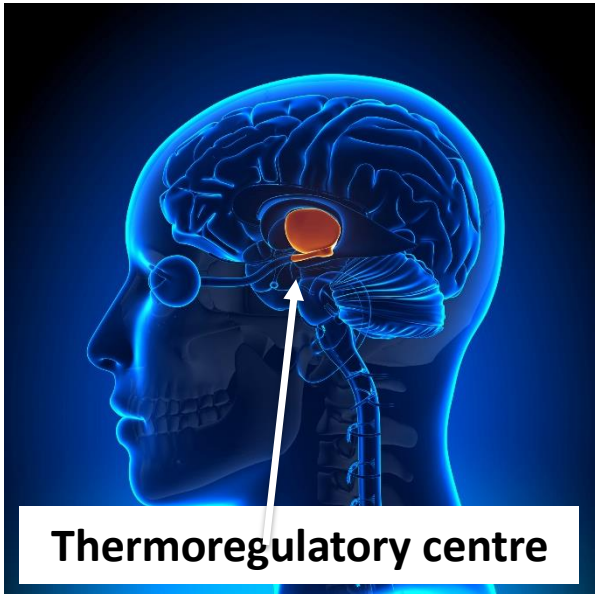
Laser surgery – the other layer of the cornea is peeled back and lasers are used to change the shape of the cornea so that the light rays will refract and form an image on the retina. **Advantages** – permanent solution to correct vision. **Disadvantages** – a surgical procedure, can cause infections.

Lens replacement – surgery refers to a medical procedure where an artificial acrylic or silicone lens is implanted into the eye to correct problems with vision. **Advantages** – permanent solution to correct vision. **Disadvantages** – a surgical procedure, can cause infections.

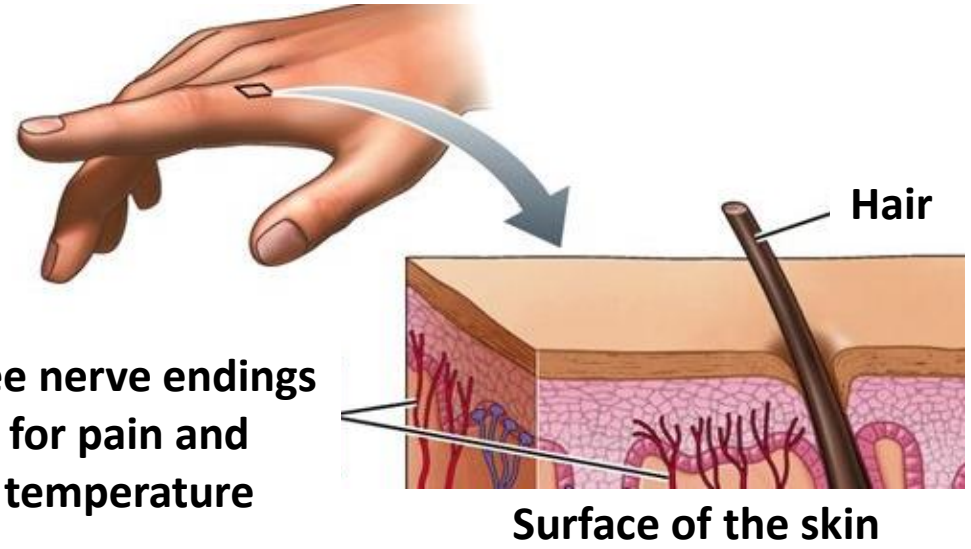


The human nervous system Part 2 - Control of body temperature (biology only)

Human body temperature is **37°C**, this is the **optimum temperature** for **enzymes** to work effectively.
Body temperature is monitored and controlled by the **thermoregulatory centre** (hypothalamus) in the **brain**.

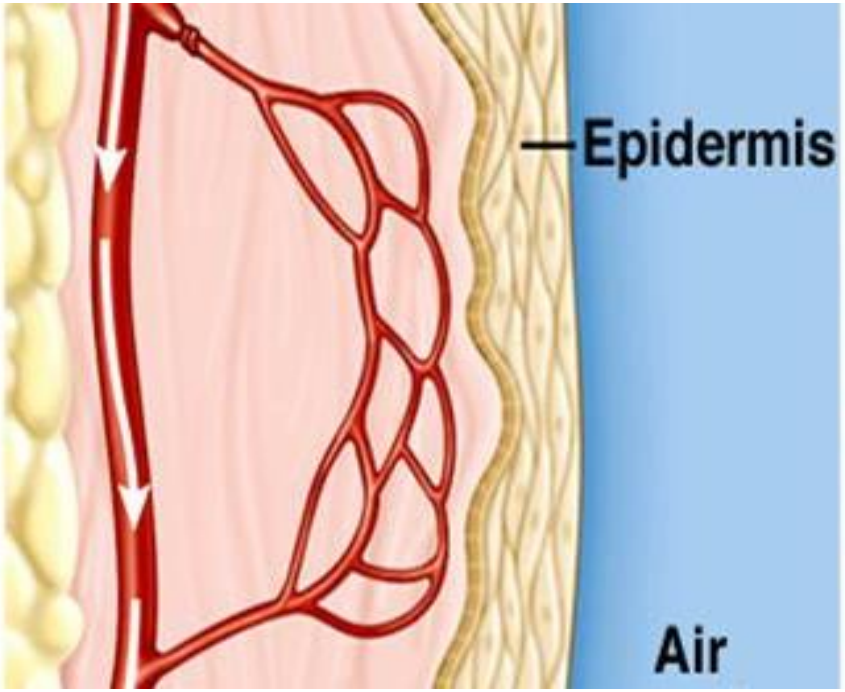


The **thermoregulatory centre** contains **receptors sensitive to the temperature of the blood**. The **skin** contains **temperature receptors** and sends **nervous impulses** to the thermoregulatory centre.



The human nervous system Part 2 - Control of body temperature (biology only)

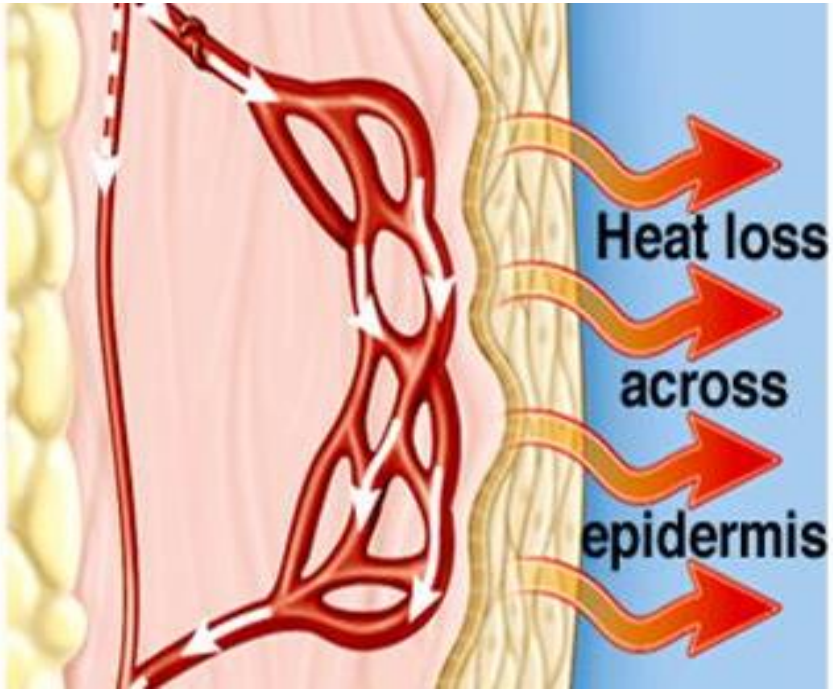
Vasoconstriction



If the body temperature is **too low**, **blood vessels constrict** (vasoconstriction), sweating stops and **skeletal muscles contract** (shiver).

Video - Temperature regulation

Vasodilation



If the body temperature is **too high**, **blood vessels dilate** (vasodilation) and **sweat is produced** from the **sweat glands**. Both these mechanisms cause a transfer of energy from the skin to the environment.

QuestionIT!

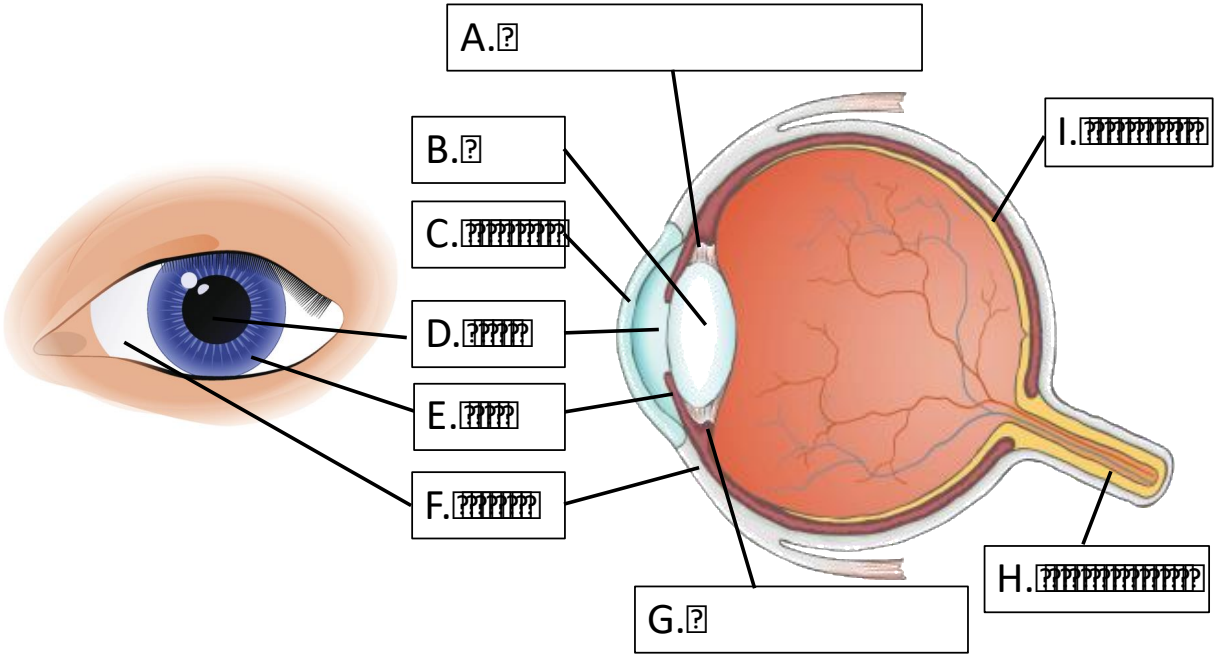
The human nervous system
Part 2

- The brain (biology only)
- The eye (biology only)
- Control of body temperature (biology only)

The human nervous system Part 2 -

Question IT

1. Name the three main parts of the brain and state the role of each.
2. How do neuroscientists study the brain?
3. What is an EEG?
4. What is an MRI?
5. What does an MRI do?
6. Label parts A – I on the diagram below:



Question IT

7. Write the name of each part of the eye in the table below:

Part of the eye	Description and function
	Transparent layer at the front of the eye, it refracts light into the eye.
	The coloured part of the eye, contains muscles that control the amount of light entering the eye.
	The hole in the middle of the iris that lets light in. Its diameter is controlled by the iris.
	A transparent, biconvex structure in the eye that refracts light onto the retina.
	Thin layer of tissue at the back of the eye that contains receptor cells for light and colour.
	Tough white supporting wall of the eye.
	Muscles that are connected to the lens by the suspensory ligaments; they change the shape of the lens.
	These connect the lens to the ciliary muscles.
	Carries impulses from the retina to the brain.

Question IT

8. What is accommodation?

9. How does the eye focus on distant objects?

10. How does the eye focus on near objects?

11. What is myopia? How can it be corrected?

12. What is hyperopia? How can it be corrected?

13. Name three ways that vision can be corrected.

14. State the optimum human body temperature.

15.What part of the brain monitors and controls temperature?

BIOLOGY ONLY:

16. Describe what happens in vasoconstriction and vasodilation.

AnswerIT!

The human nervous system
Part 2

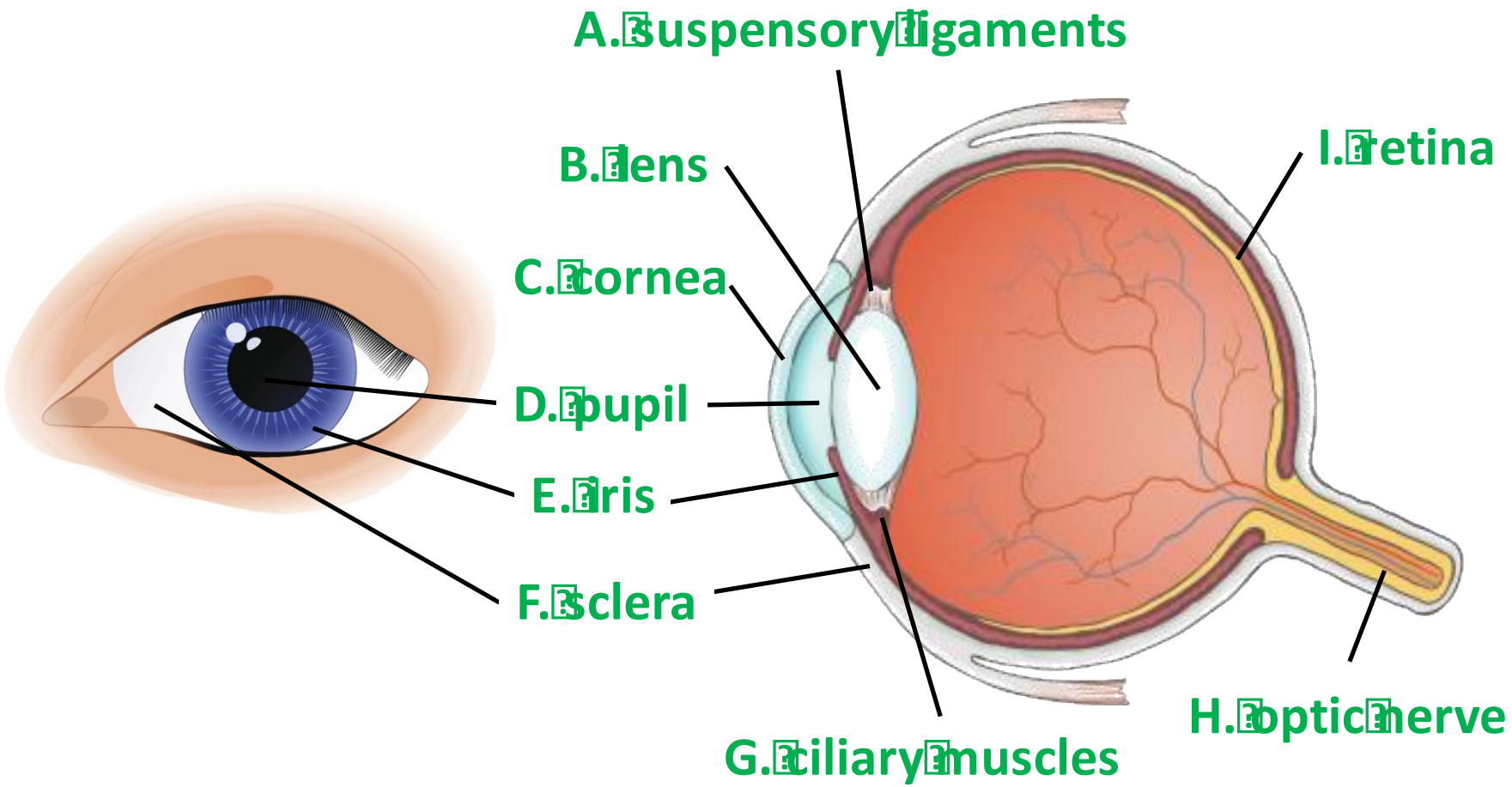
- The brain (biology only)
- The eye (biology only)
- Control of body temperature (biology only)

The human nervous system Part 2 -

AnswerIT

1. Name the three main parts of the brain and state the role of each. ***cerebral cortex*** **– is the outer 'wrinkled' layer of the brain it is responsible for intelligence, language, memory and consciousness;** ***cerebellum*** **– is located at the lower part of the back of the brain and is responsible for voluntary coordination of the muscles;** ***medulla*** **– is located in the lower part of the brain stem. It is responsible for involuntary coordination such as breathing, swallowing and heart rate**
2. How do neuroscientists study the brain? **Studying patients with brain damage, electrically stimulating the brain and using magnetic resonance imaging (MRI) scanning.**
3. What is an EEG? **Electroencephalogram (EEG) is a test used to find problems related to electrical activity of the brain.**
4. What is an MRI? **A device that uses strong magnetic fields and radio waves to produce detailed images of the brain and spinal cord.**
5. What does an MRI do? **MRI can distinguish between different types of tissues, including detecting cancerous cells.**

6. Label parts A – I on the diagram below:



7. Write the name of each part of the eye in the table below:

Part of the eye	Description and function
cornea	Transparent layer at the front of the eye, it refracts light into the eye.
iris	The coloured part of the eye, contains muscles that control the amount of light entering the eye.
pupil	The hole in the middle of the iris that lets light in. Its diameter is controlled by the iris.
lens	A transparent, biconvex structure in the eye that refracts light onto the retina.
retina	Thin layer of tissue at the back of the eye that contains receptor cells for light and colour.
sclera	Tough white supporting wall of the eye.
ciliary muscles	Muscles that are connected to the lens by the suspensory ligaments; they change the shape of the lens.
suspensory ligaments	These connect the lens to the ciliary muscles.
optic nerve	Carries impulses fro the retina to the brain.

The human nervous system Part 2 - AnswerIT

8. What is accommodation? **The process of changing the shape of the lens focus on near or distant objects**
9. How does the eye focus on distant objects? **The ciliary muscles relax, the suspensory ligaments are pulled tight, the lens is then pulled thin and only slightly refracts light rays**
10. How does the eye focus on near objects? **The ciliary muscles contract, the suspensory ligaments loosen, the lens is then thicker and refracts light rays strongly**
11. What is myopia? How can it be corrected? **Short-sightedness, it can be corrected with concave lenses**
12. What is hyperopia? How can it be corrected? **Long-sightedness, it can be corrected with convex lenses**
13. Name three ways that vision can be corrected? **Contact lenses, laser surgery and lens replacement**
14. State the optimum human body temperature. **37^{o}C**
15. What part of the brain monitors and controls temperature? **Thermoregulatory centre**

BIOLOGY ONLY:

16. Describe what happens in vasoconstriction and vasodilation.

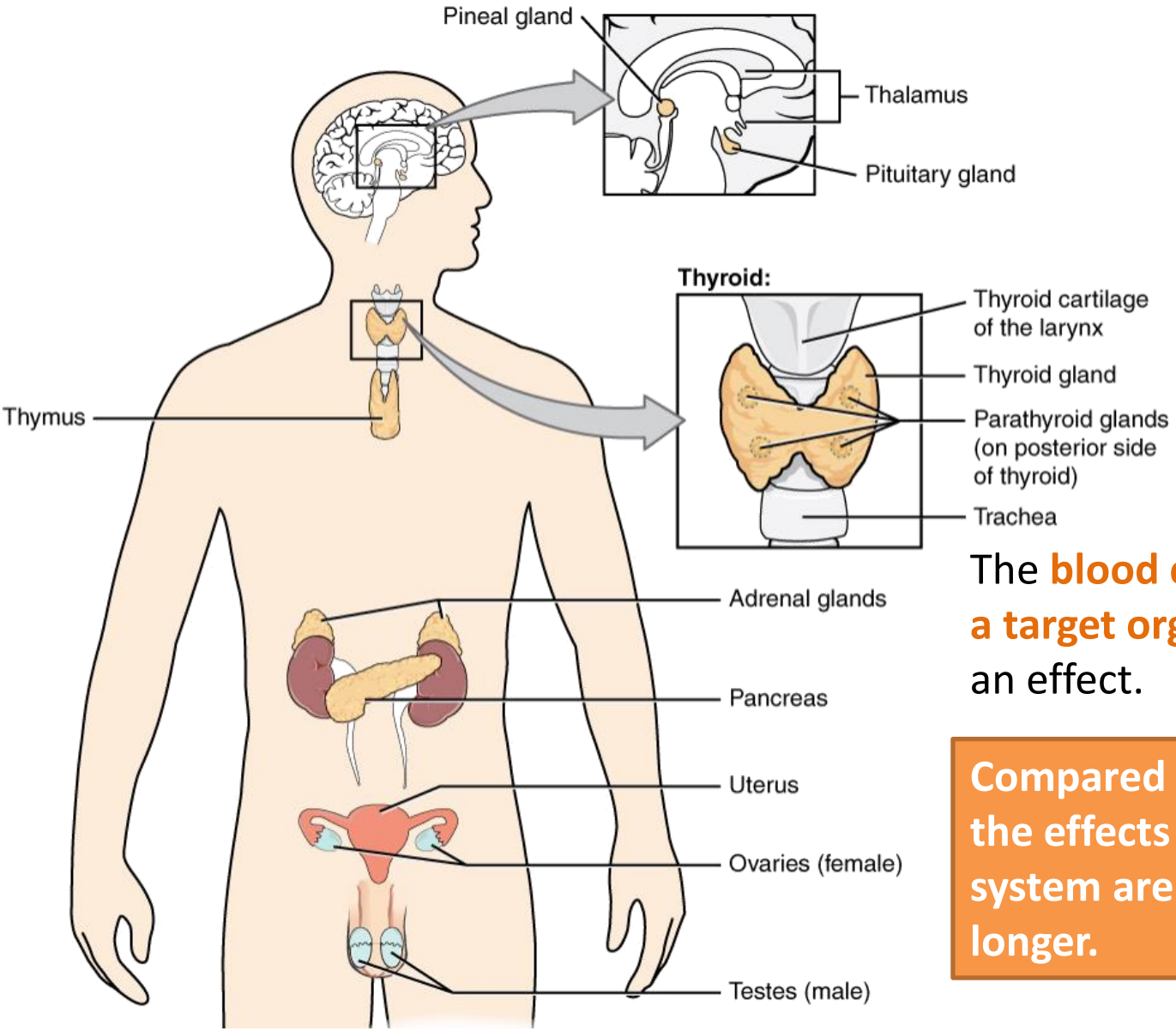
- **If the body temperature is too low, blood vessels constrict (vasoconstriction), sweating stops and skeletal muscles contract (shiver).**
- **If the body temperature is too high, blood vessels dilate (vasodilation) and sweat is produced from the sweat glands. Both these mechanisms cause a transfer of energy from the skin to the environment.**

LearnIT!
KnowIT!

Hormonal coordination in humans Part 1

- Human endocrine system
- Control of blood glucose concentration

Hormonal coordination in humans Part 1 - Human endocrine system

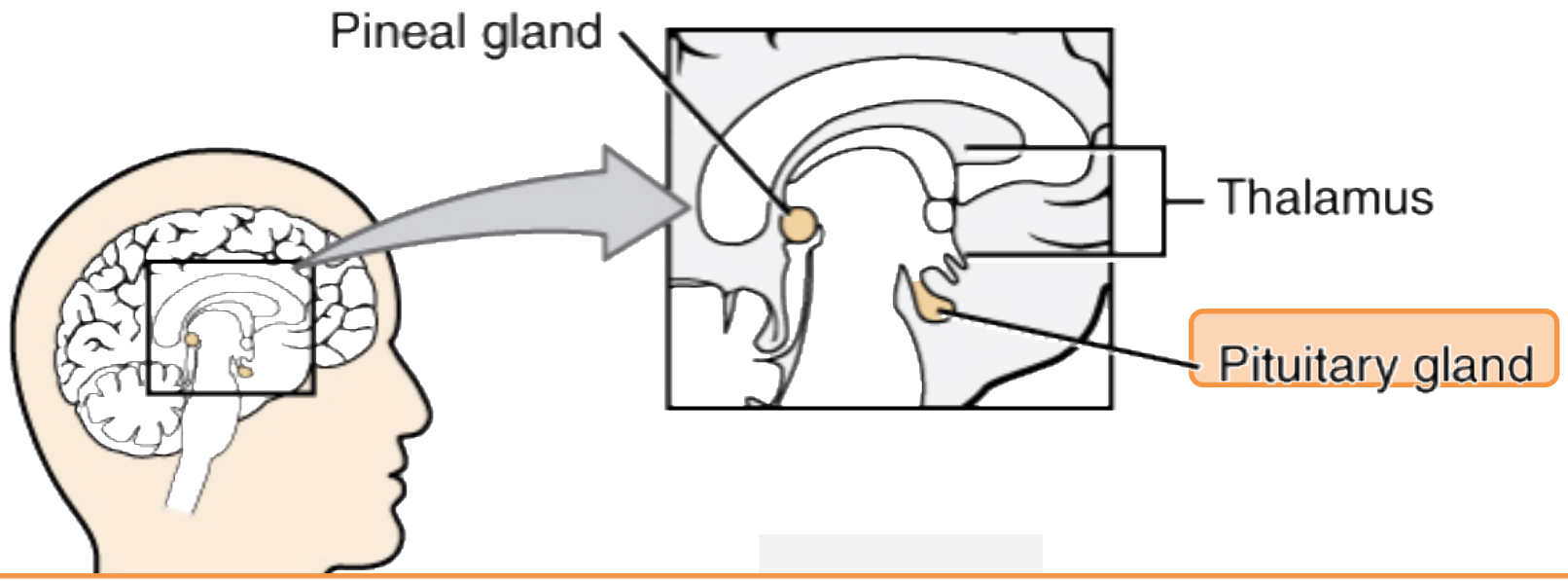


The **endocrine system** is composed of **glands** which **secrete chemicals** called **hormones** directly into the bloodstream.

The **blood carries** the **hormone** to **a target organ** where it produces an effect.

Compared to the nervous system the effects of the endocrine system are slower but act for longer.

Hormonal coordination in humans Part 1 - Human endocrine system

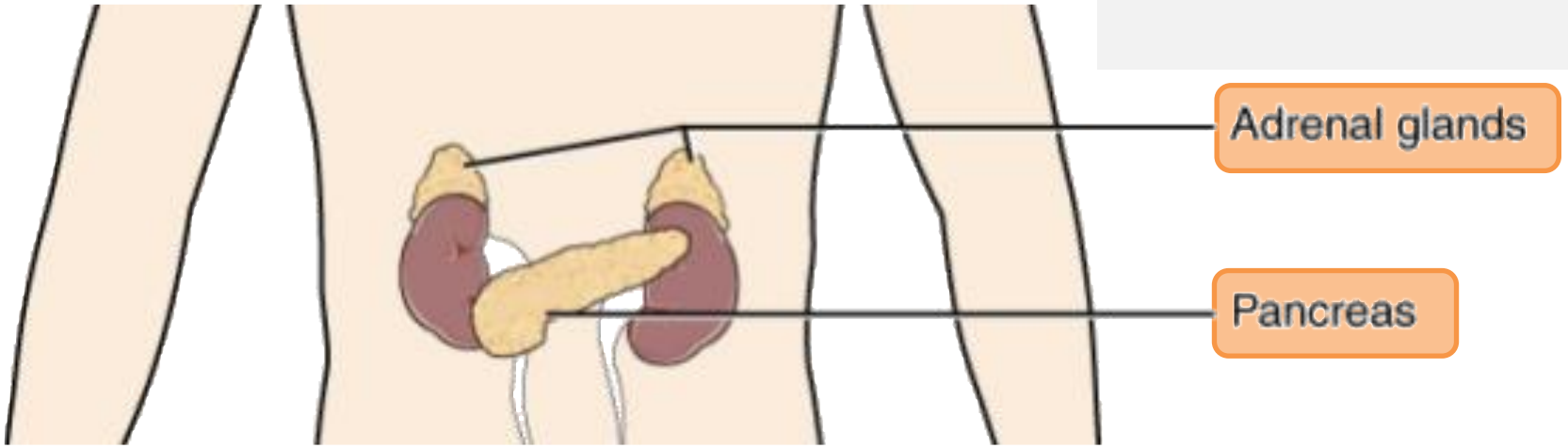


The **pituitary gland** in the brain is often called a 'master gland' as it it **produces** and **secretes many** hormones into the blood.
The hormones are **released** in **response** to **changes** in **body conditions**.
These hormones released act on **other glands** to stimulate other hormones to be released to bring about effects that regulate the body.

Hormones released by the pituitary gland

Hormone	Target	Effect
Anti-diuretic hormone (ADH)	Kidney	Controls water levels in the blood
Thyroid-stimulating hormone (TSH)	Thyroid	Stimulates the thyroid gland to secrete thyroxine
Luteinising hormone (LH)	Ovaries	Stimulates egg release and progesterone production in the ovaries
Follicle-stimulating hormone (FSH)	Ovaries	Stimulates egg ripening and oestrogen production (in ovaries)
Prolactin (PRL)	Breasts	Stimulates the breasts to produce milk
Growth hormone (GH)	All cells in the body	Stimulates growth and repair

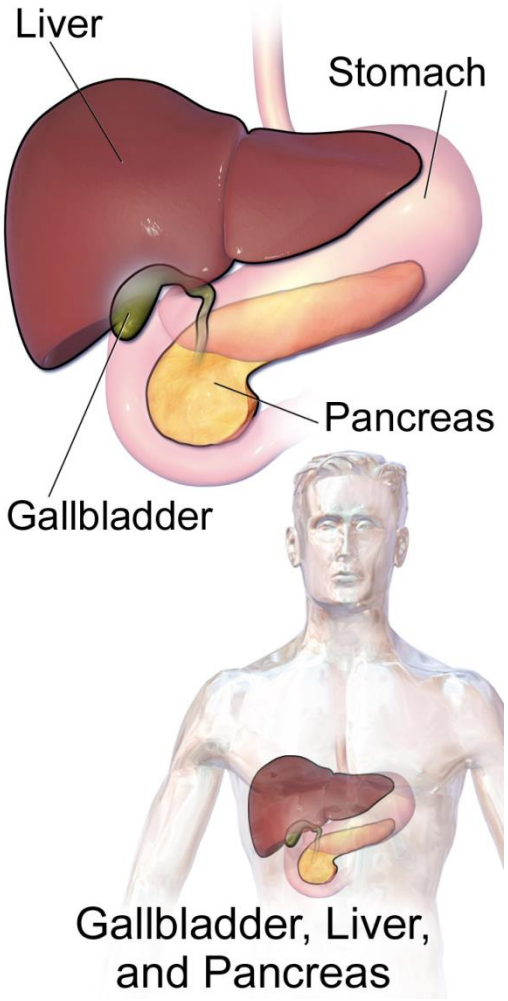
Hormonal coordination in humans Part 1 - Human endocrine system



The **pancreas** produces and secretes the hormones **insulin** and **glucagon.** These hormones **regulate** the **blood glucose** concentration. **Insulin reduces** the concentration and **glucagon increases** the concentration of the glucose in the blood

Hormonal coordination in humans Part 1 - Control of blood glucose concentration

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



[Video - Regulating blood glucose]

Blood glucose concentration TOO HIGH

↓

The PANCREAS releases insulin

↓

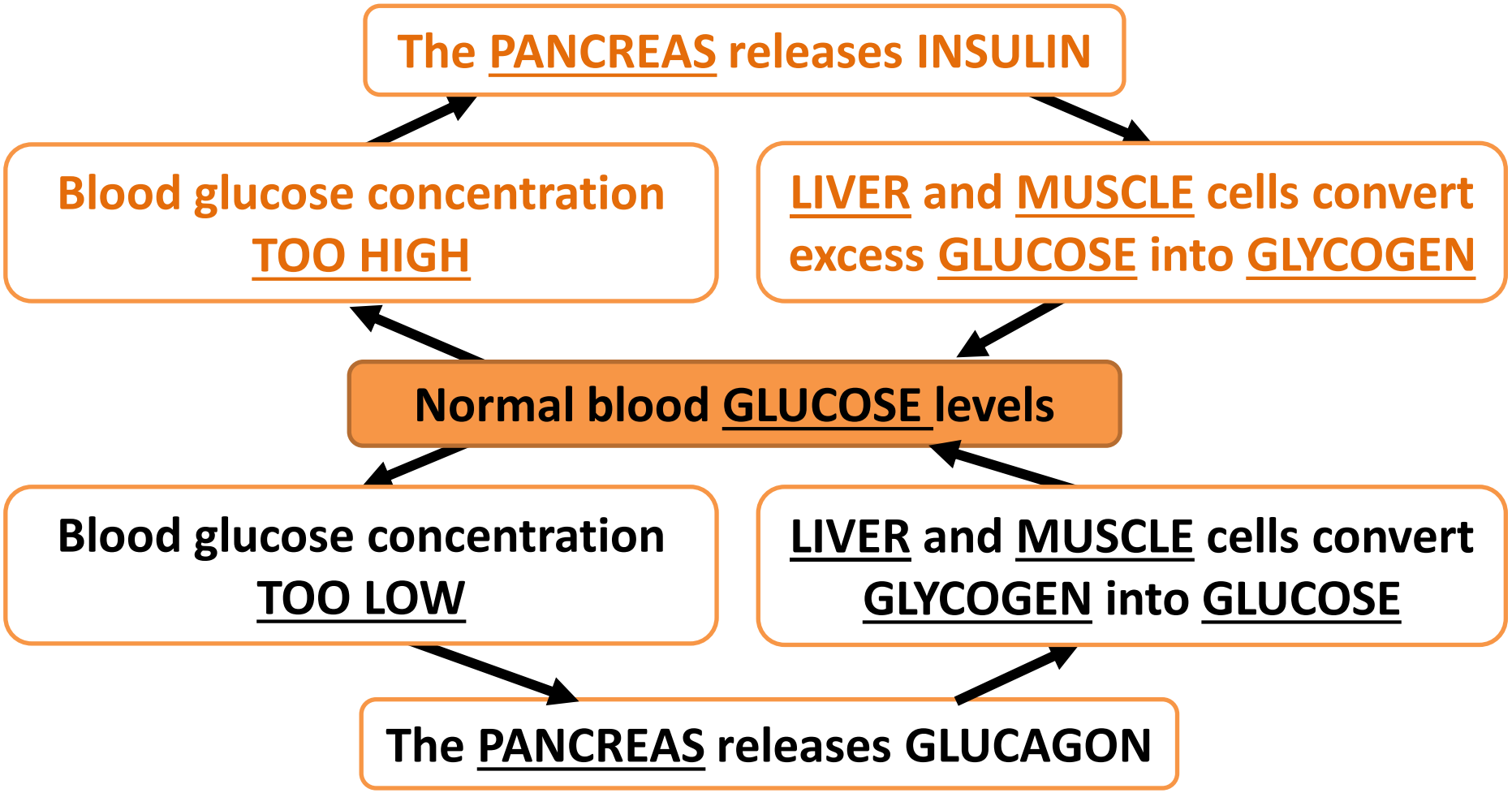
GLUCOSE is moved from the blood into the cells

↓

LIVER and MUSCLE cells convert excess GLUCOSE into GLYCOGEN for storage

Hormonal coordination in humans Part 1 - Control of blood glucose concentration HT ONLY

The control of **blood glucose concentration** is an example of **NEGATIVE FEEDBACK.** This ensures that, in any control system, **changes are reversed** and returned back to the set level.



Hormonal coordination in humans Part 1 - Control of blood glucose concentration

Diabetes is a condition that causes a person's **blood sugar level** to become **too high.**

Type 1 diabetes

- A **disorder** in which the pancreas **fails to produce enough insulin**.
- The lack of insulin **causes uncontrolled high blood glucose** levels.
- **Type 1** is normally **treated with insulin injections.**

Type 2 diabetes

- A **disorder** where the **body cells no longer respond to insulin** produced by the pancreas.
- **Obesity is a risk factor for Type 2 diabetes.**
- **Type 2** is normally **treated by controlling the carbohydrate in the diet and by exercise.**

QuestionIT!

Hormonal coordination in humans
Part 1

- Human endocrine system
- Control of blood glucose concentration

Hormonal coordination in humans Part 1

- Question IT

1. What is the endocrine system composed of?
2. What is a hormone?
3. How are hormones carried around the body?
4. Which acts faster, the nervous system or the endocrine system?
5. Where is the pituitary gland?
6. What is the role of the pituitary gland?
7. Name the hormones released by the pituitary gland.
8. Name the hormones that the pancreas releases.

9. What happens to the glucose in the blood when insulin is released?

10. HT: Describe the role of glucagon in the regulation of glucose?

11. Which type of diabetes is caused when the body cells no longer respond to insulin?

12 . State how Type 1 diabetes is treated.

13. State how Type 2 diabetes is treated.

AnswerIT!

Hormonal coordination in humans
Part 1

- Human endocrine system
- Control of blood glucose concentration

Hormonal coordination in humans Part 1

AnswerIT

1. What is the endocrine system composed of? **Glands**
2. What is a hormone? **A chemical that is released from a gland in response to a change**
3. How are hormones carried around the body? **In the bloodstream**
4. Which acts faster, the nervous system or the endocrine system? **The nervous system**
5. Where is the pituitary gland? **In the brain**
6. What is the role of the pituitary gland? **It secretes many hormones in response to changes in body conditions**
7. Name the hormones released by the pituitary gland. **Anti diuretic, thyroid, luteinising, follicle stimulating, prolactin and growth hormone**
8. Name the hormones that the pancreas releases. **Insulin and glucagon**

AnswerIT

9. What happens to the glucose in the blood when insulin is released? **The glucose is removed from the blood and then converted to glycogen and stored in the liver and muscles**

10. HT: Describe the role of glucagon in the regulation of glucose?

Glucagon is released when the blood glucose concentration is low and it stimulates the liver and muscles to convert glycogen into glucose

11. Which type of diabetes is caused when the body cells no longer respond to insulin? **Type 2**

12. State how Type 1 diabetes is treated. **With insulin injections**

13. State how Type 2 diabetes is treated. **By controlling the carbohydrate in the diet and by exercise.**

LearnIT!
KnowIT!

Hormonal coordination in humans Part 2

- Maintaining water and nitrogen balance in the body (biology only)

Hormonal coordination in humans Part 2 - Maintaining water and nitrogen balance in the body (Biology only)

Water leaves the body via the **lungs** when you **breath out** (exhalation).

There is no control over water, ion or urea loss by the lungs or skin.

Water, ions and **urea** are lost from the **skin** in **sweat**.

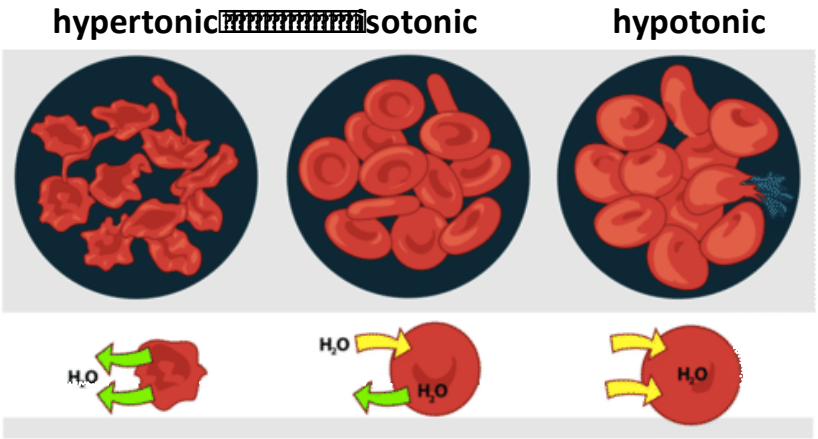
Excess **water, ions** and **urea** are removed via the **kidneys** in the **urine**.

Ions – include sodium, potassium, calcium , nitrogen.

Urea – A waste product produced when proteins are broken down.

Hormonal coordination in humans Part 2 - Maintaining water balance in the body **(Biology only)**

The cytoplasm of body cells is mainly made from water, if cells **lose or gain too much water** by **osmosis** they do not function efficiently.



Hypertonic – **more concentrated** solution than in the cells e.g. concentrated sugar solution
Isotonic – **same concentration** as the solution in the cell.
Hypotonic – **more dilute** than the solution in the cells. e.g. water or dilute sugar solution

- When a **red blood cell** is placed in **hypotonic solutions** e.g. water, **water enters** the cell by **osmosis** and as the volume increases this puts pressure on the cell membrane and it **bursts**. This is **called lysis.**
- When a **red blood cell** is placed in **hypertonic solutions** e.g. concentrated sugar solution, **water leaves** the cell by **osmosis** and the **cells shrink** and the **membrane wrinkles**. This is called **crenation**.
- **Lysis** and **crenation** do not happen in the body if the **kidneys function properly** as the kidneys keep the blood concentration **isotonic**.

Hormonal coordination in humans Part 2 - Maintaining water and nitrogen balance in the body (HT & biology only)

When you have a diet **high in proteins**, the **excess** proteins are **digested** (broken down) into **amino acids** that are absorbed into the **blood**. The **excess amino acids** are then **deaminated** (removal of an amino group from the amino acids) in the **liver** to form **ammonia**. Ammonia is a **very toxic** substance and so it is immediately converted to **urea** for safe excretion from the body in the **urine.**

Diet high in proteins

↓

Digestive system

proteins → amino acids

↓

Liver

amino acids → ammonia (deaminated)

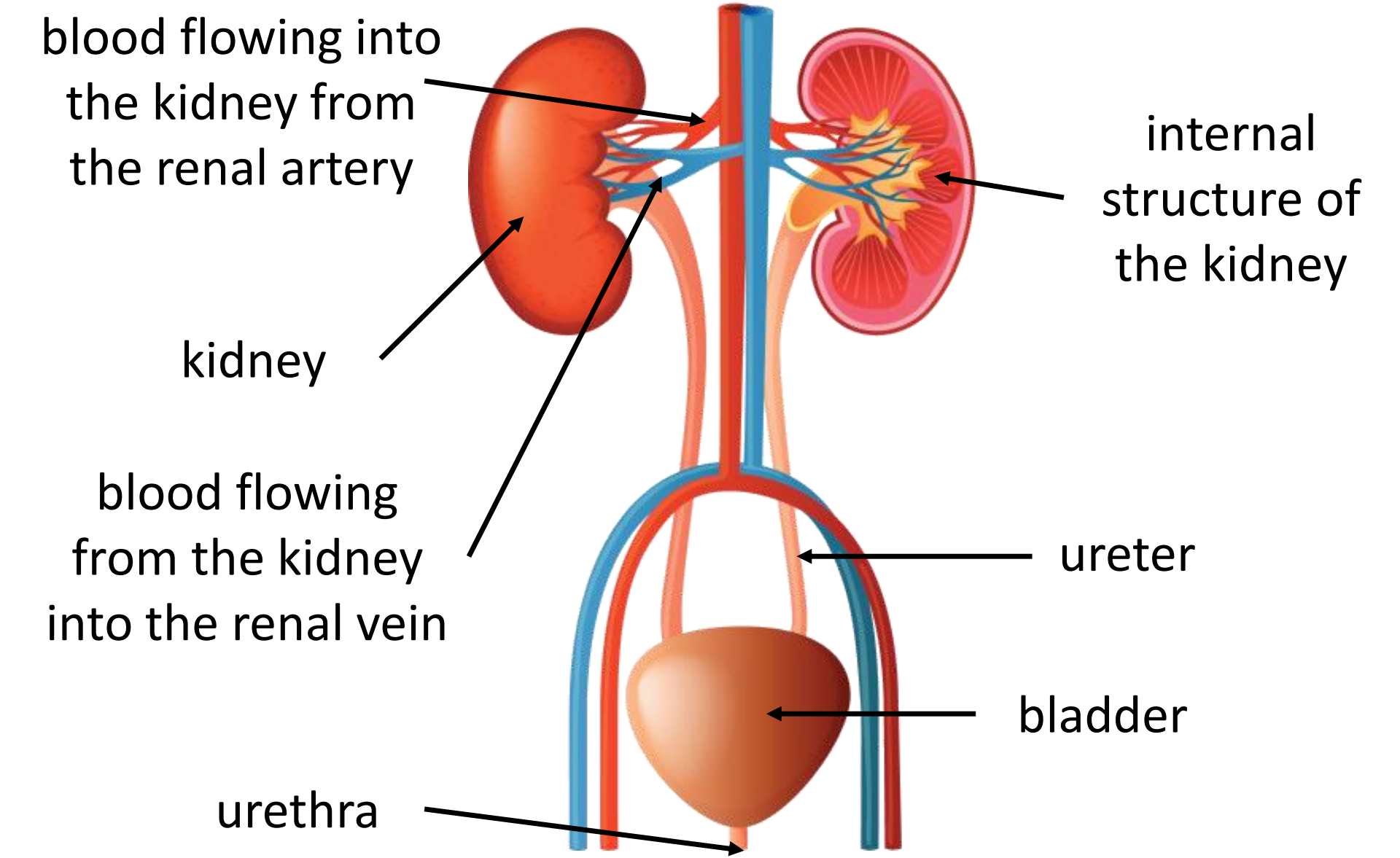
ammonia → urea

↓

Kidneys

Urea is filtered from the blood and excreted from the body in urine

Hormonal coordination in humans Part 2 - Maintaining water – the urinary system **(Biology only)**



Hormonal coordination in humans Part 2 - Maintaining water – the urinary system **(Biology only)**

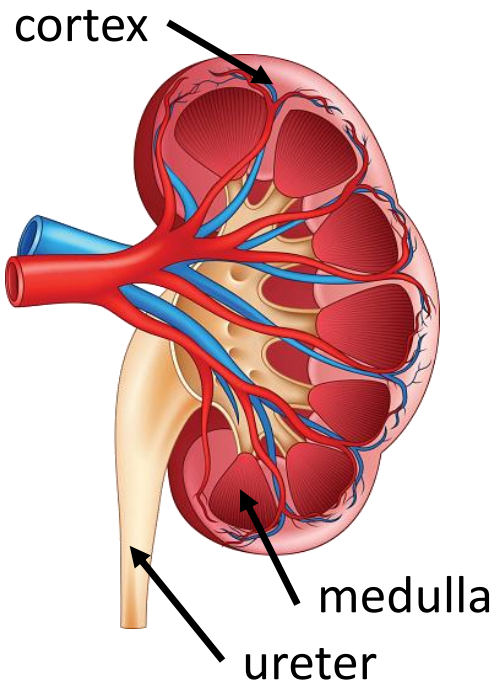
The **kidneys filter the blood** and form **urine** that is stored in the bladder. They are **located in the lower back**. Each kidney has an outer layer called the **cortex** and an inner layer called the **medulla**. There are millions of structures called **kidney tubules** (nephrons) and this is where the blood is filtered.

There are 3 steps to this process:

1. Filtration of glucose, urea, ions (salts) and water from the blood.

2. Selective reabsorption of **ALL** glucose, some ions (salts) and some water into the blood.

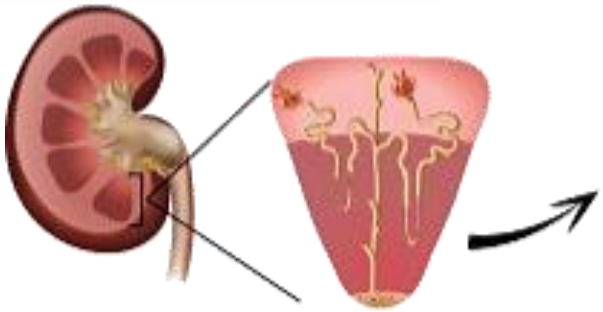
3. Excretion of **ALL** urea, excess ions (salts) and excess water into the urine.

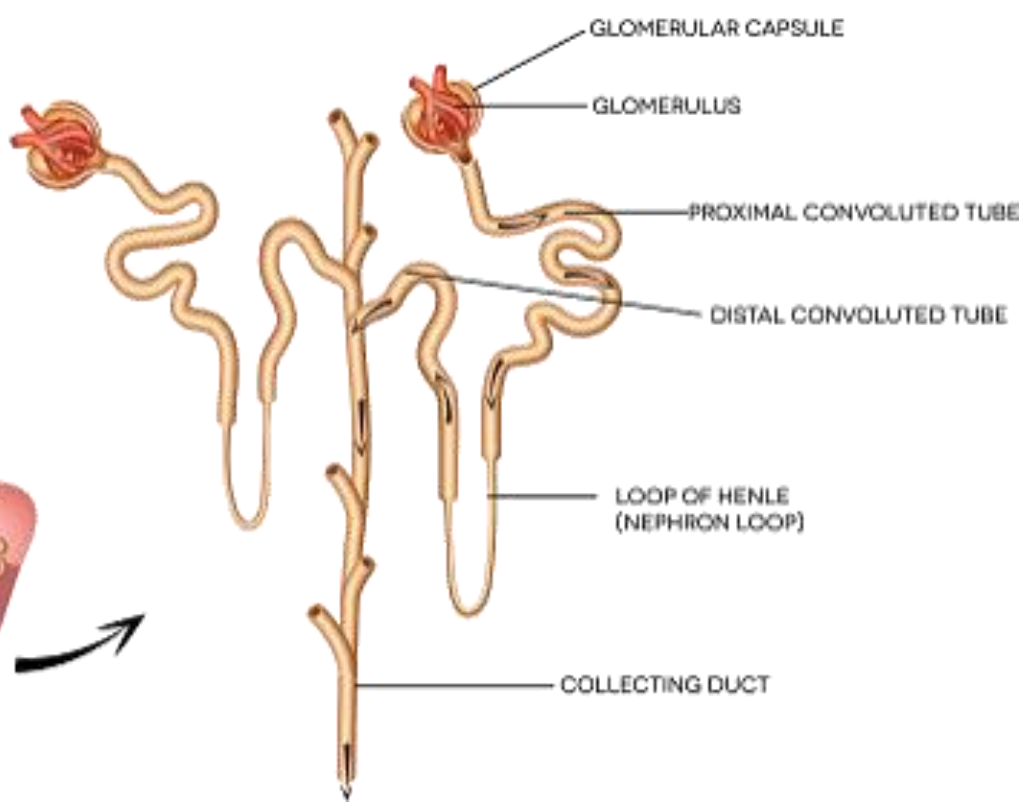


Hormonal coordination in humans Part 2 - Maintaining water – ADH (HT & biology only)

The **pituitary gland** in the brain **monitors** the **water levels** in the **blood**. It **releases** a hormone **called anti-diuretic hormone (ADH).**

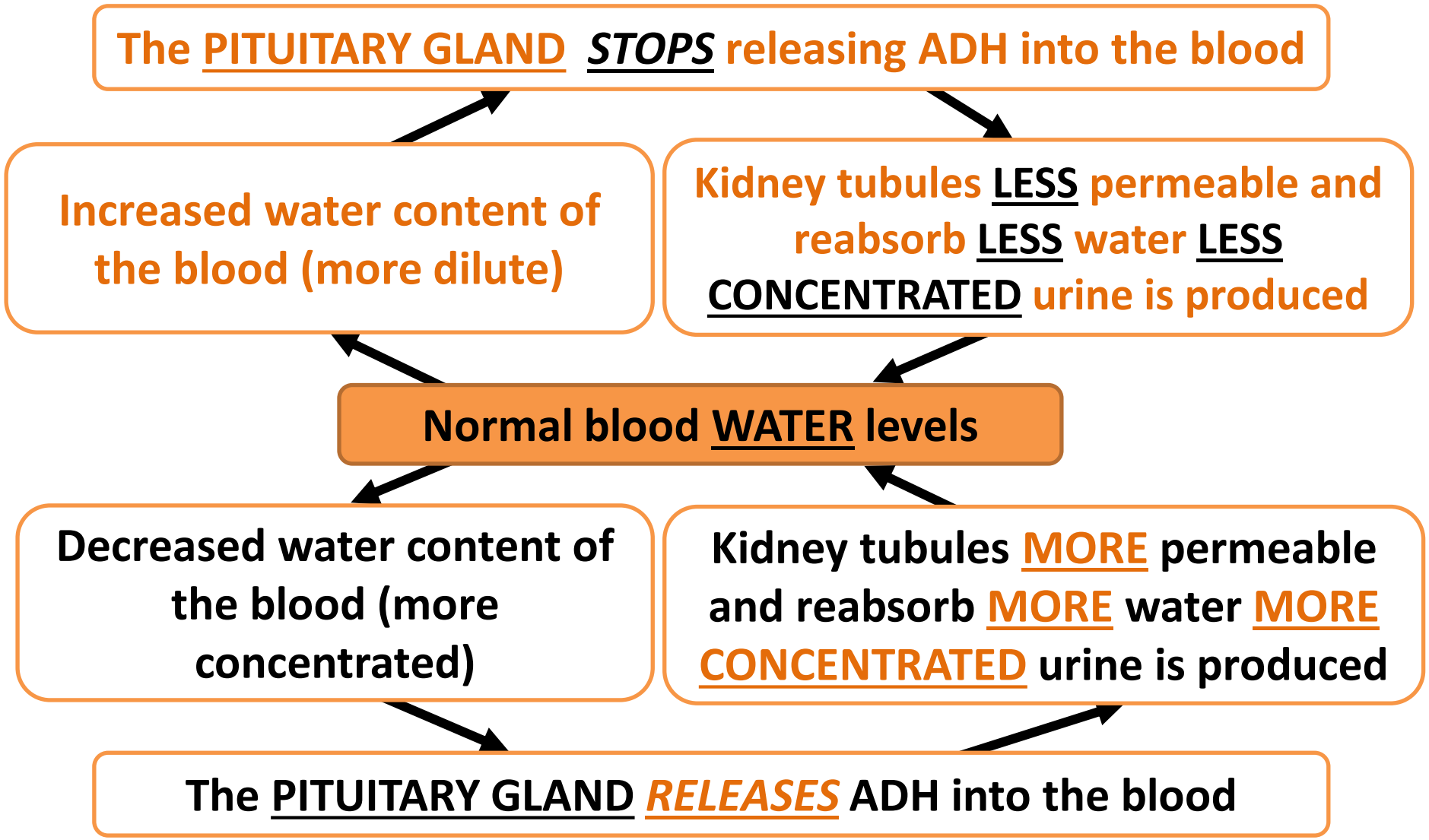
Kidney tubules (nephrons) have some of the structures in both the cortex and the medulla.





ADH causes the **kidney tubules** to become **more permeable to water.** Increased levels of ADH cause the kidneys to **re-absorb more water**.

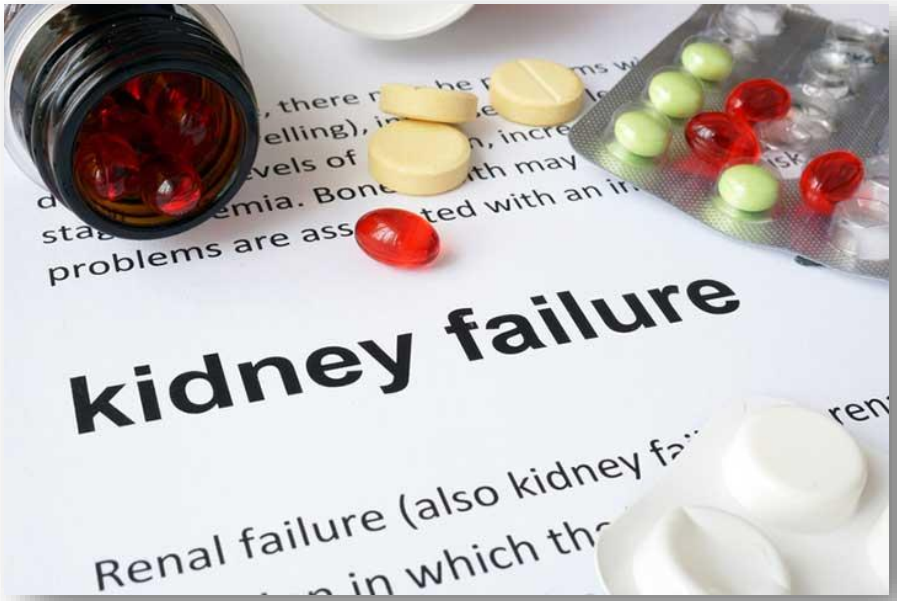
Hormonal coordination in humans Part 2 - Maintaining water – ADH (HT & biology only)



This is an example of a process controlled by NEGATIVE FEEDBACK

Hormonal coordination in humans Part 2 - Maintaining water – kidney failure **(Biology only)**

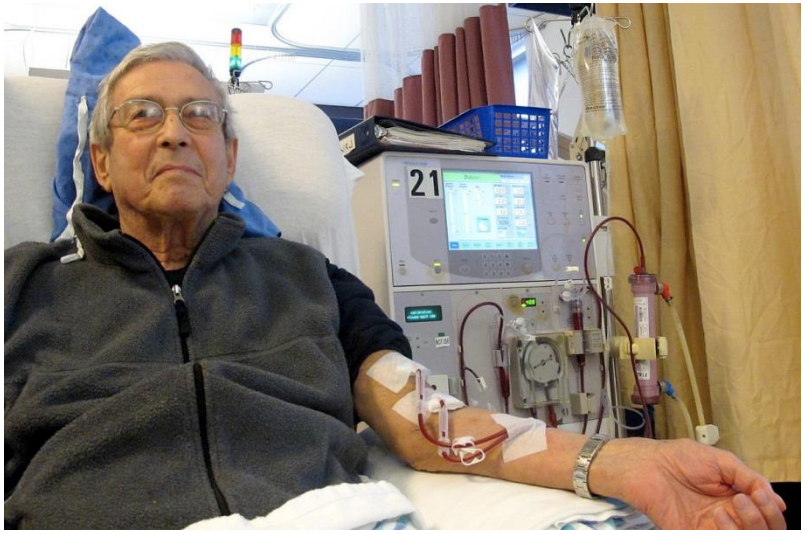
Kidney failure is a medical condition where the **kidneys no longer work.** The **kidneys** are **important** in **homeostasis** and if kidneys fail **toxins can build up** in the blood and the **concentration of ions** (salts) gets out of balance.



The current treatments for kidney failure are Kidney Dialysis and Kidney Transplants

Hormonal coordination in humans Part 2 - Maintaining water – kidney failure (Biology only)

KIDNEY DIALYSIS: Treatment by dialysis restores the concentrations of dissolved substances in the blood to **normal levels** and has to be carried out at regular intervals.



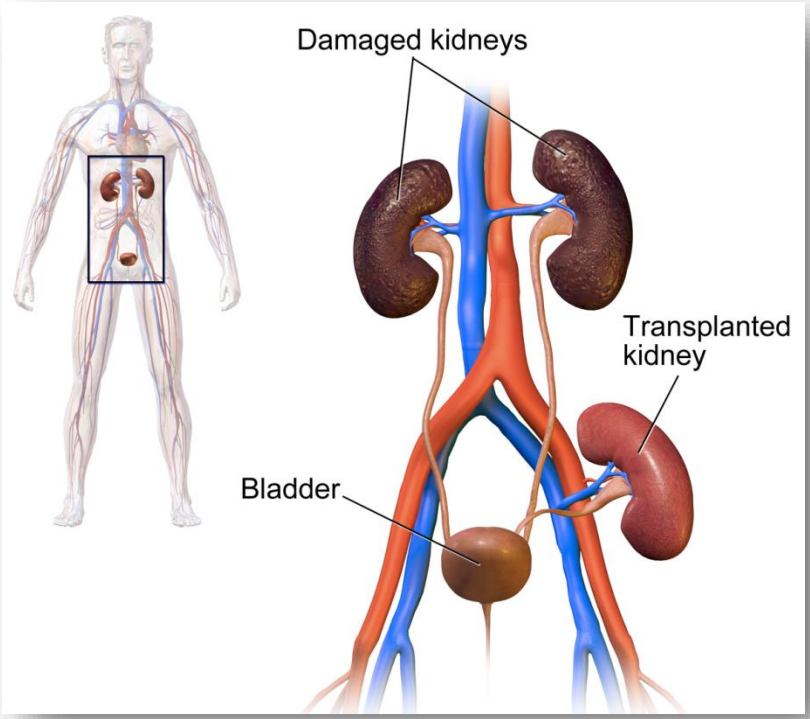
In a dialysis machine:

- Blood **high in urea** flows between **partially permeable membranes** in the opposite direction to the dialysis fluid (maintains the concentration gradient)
- The **dialysis fluid** contains the **same concentration** of **useful** substances as the blood - this ensures that **glucose** and **ions (salts)** are not lost.
- **Urea** passes out from the blood into the dialysis fluid.

Hormonal coordination in humans Part 2 - Maintaining water – kidney failure (Biology only)

KIDNEY TRANSPLANT: A diseased kidney is replaced by a healthy donor kidney. This can be from a live donor or from someone who has died.

Organ rejection is a problem as the **antigens** on the surface of the donor kidney are recognised by the **immune system** as foreign and can be attacked by the patient's **antibodies.**



To **reduce** the chances of this happening two precautions are taken:

- **Immune-suppressant** drugs are given
- **A donor kidney** with a similar 'tissue type' is used

Hormonal coordination in humans Part 2 - Maintaining water – kidney failure **(Biology only)**

Treatment	Advantages	Disadvantages
Kidney Dialysis	• Available to all kidney patients (no shortage) • No need for immune-suppressant drugs	• Patient must limit their salt and protein intake between dialysis sessions • Expensive for the NHS • Regular dialysis sessions (up to 8hrs) – impacts on the patient's lifestyle • Risk of infection
Kidney Transplant	• Patients can lead a more normal life without having to watch what they eat and drink • Cheaper for the NHS overall	• Must take immune-suppressant drugs which increase the risk of infection • Shortage of organ donors • Transplanted kidney only lasts 8-9 years on average • Any operation carries risks

QuestionIT!

Hormonal coordination in humans
Part 2

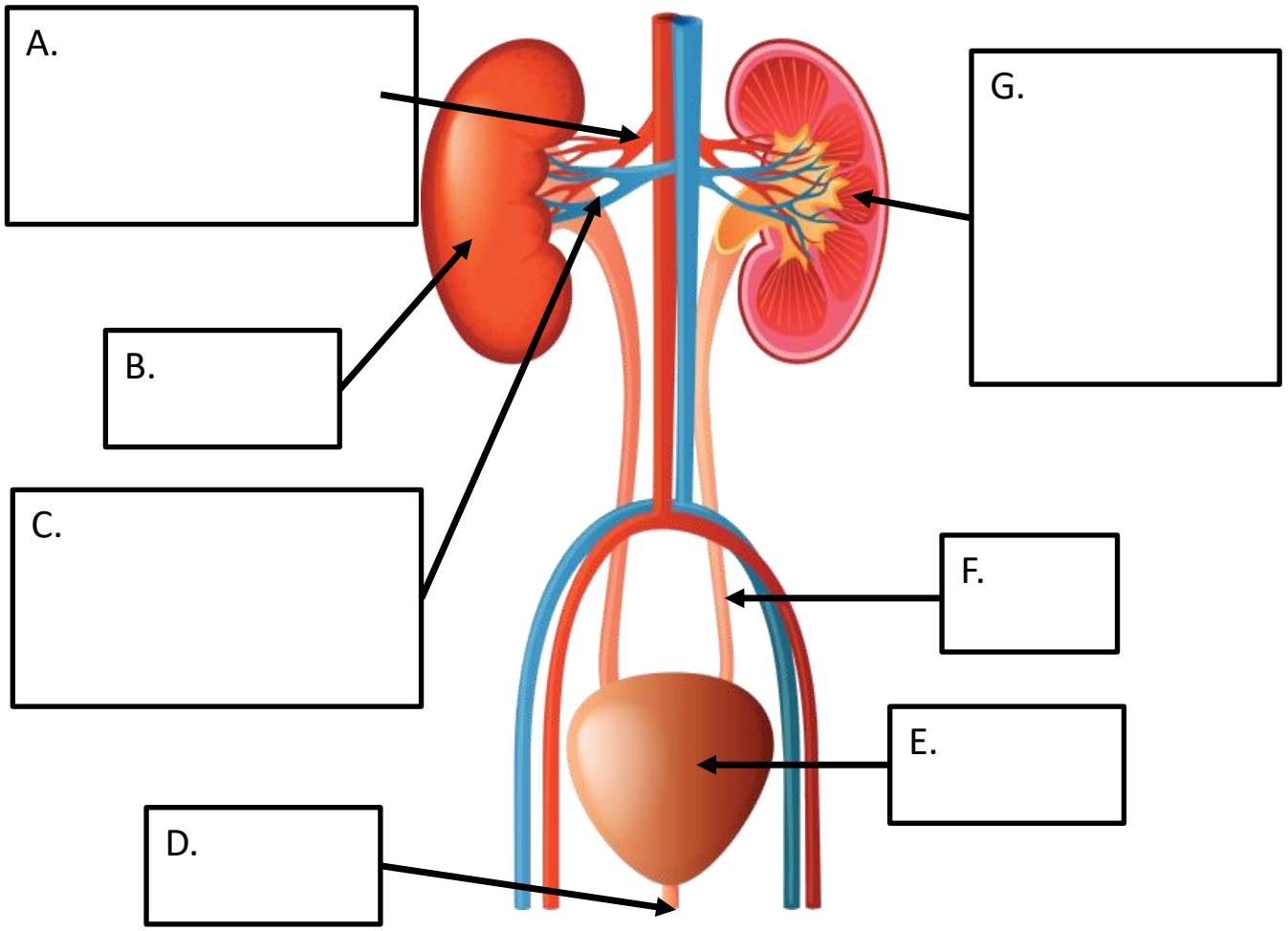
- Maintaining water and nitrogen balance in the body (biology only)

Hormonal coordination in humans Part 2

- Biology only - Question IT

1. State the ways in which water is lost from the body.
2. Sweat contains mostly water. What else can be found in sweat?
3. What is removed via the kidneys in the urine?
4. What is a hypertonic solution?
5. What is an isotonic solution?
6. What is a hypotonic solution?
7. What happens to animal cells when they are put in water?
8. What happens to animal cells when they are put in a concentrated sugar solution?
9. **HT: What happens to excess proteins in the diet?**
10. **HT: What does deaminated mean?**
11. **HT: What is ammonia converted to in the liver?**

12. Label A – G on the diagram below.



Hormonal coordination in humans Part 2

- Question IT

13. Name the structures in the kidneys where the blood is filtered.

14. What are the 3 steps in the blood filtering process?

15. Describe what happens in each of the 3 steps of the blood filtering process.

16. HT: Where in the body are the water levels in the blood monitored?

17. HT: Name the hormone that controls the water levels in the blood.

18. HT: What effect does increased levels of this hormone have on the kidneys?

19. HT: Describe what happens in the body when the water content of the blood is too low?

20. HT: Describe what happens in the body when the water content of the blood is too high?

Hormonal coordination in humans Part 2

- Question IT

21. How does kidney dialysis treat kidney failure?

22. Describe how the dialysis machine works.

23. How does a kidney transplant treat kidney failure?

24. State the advantages and disadvantages of kidney dialysis and kidney transplants.

AnswerIT!

Hormonal coordination in humans
Part 2

- Maintaining water and nitrogen balance in the body (biology only)

Hormonal coordination in humans Part 2

AnswerIT

1. State the ways in which water is lost from the body. **Lungs, urine, skin (sweat)**
2. Sweat contains mostly water. What else can be found in sweat? **Ions and urea**
3. What is removed via the kidneys in the urine? **Excess water, ions and urea**
4. What is a hypertonic solution? **More concentrated solution than in the cells e.g. concentrated sugar solution**
5. What is an isotonic solution? **Same concentration as the solution in the cell**
6. What is a hypotonic solution? **More dilute than the solution in the cells. e.g. water or dilute sugar solution**
7. What happens to animal cells when they are put in water? **Water enters the cell by osmosis and as the volume increases this puts pressure on the cell membrane and it bursts. This is called lysis.**

AnswerIT

8. What happens to animal cells when they are put in a concentrated sugar solution? **Water leaves the cell by osmosis and the cells shrink and the membrane wrinkles. This is called crenation**

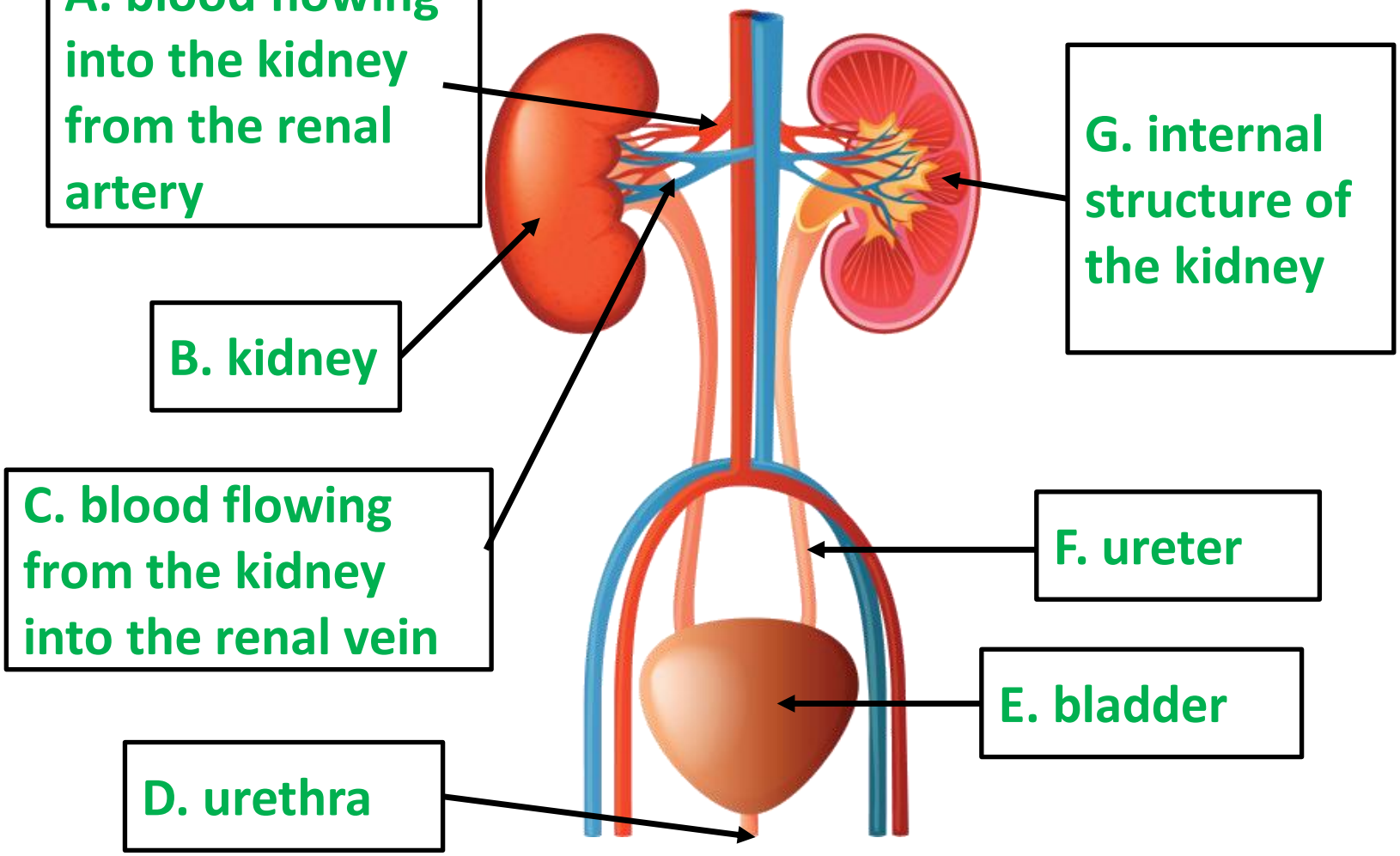
9. HT: What happens to excess proteins in the diet? **They are transported to the liver and converted into urea**

10. HT: What does deaminated mean? **An amino group is removed from an amino acid.**

11. HT: What is ammonia converted to in the liver? **Urea**

AnswerIT

12. Label A – G on the diagram below.



Hormonal coordination in humans Part 2

AnswerIT

13. Name the structures in the kidneys where the blood is filtered. **Kidney tubules (nephrons)**

14. What are the 3 steps in the blood filtering process? **Filtration, selective reabsorption and excretion**

15. Describe what happens in each of the 3 steps of the blood filtering process. **Filtration of glucose, urea, ions (salts) and water from the blood. Selective reabsorption of ALL glucose, some ions (salts) and some water into the blood. Excretion of ALL urea, excess ions (salts) and excess water into the urine.**

16: HT: Where in the body are the water levels in the blood monitored? **The pituitary gland in the brain**

17. HT: Name the hormone that controls the water levels in the blood. **Anti-diuretic hormone (ADH).**

18. HT: What effect does increased levels of this hormone have on the kidneys? **The kidney tubules to become more permeable to water. Increased levels of ADH cause the kidneys to re-absorb more water**

Hormonal coordination in humans Part 2

AnswerIT

19. HT: Describe what happens in the body when the water content of the blood is too low? **The PITUITARY GLAND releases ADH into the blood, Kidney Tubules MORE permeable and reabsorb MORE water MORE CONCENTRATED urine is produced and the blood water levels return to normal**

20. HT: Describe what happens in the body when the water content of the blood is too high? **The PITUITARY GLAND stops releasing ADH into the blood, Kidney Tubules LESS permeable and reabsorb LESS water LESS concentrated urine is produced and the blood water levels return to normal**

21. How does kidney dialysis treat kidney failure? **Filters the blood to restores the concentrations of dissolved substances in the blood to normal levels**

22. Describe how the dialysis machine works. **Blood high in urea flows between partially permeable membranes in the opposite direction to the dialysis fluid (maintains the concentration gradient). The dialysis fluid contains the same concentration of useful substances as the blood - this ensures that glucose and ions (salts) are not lost. Urea passes out from the blood into the dialysis fluid.**

AnswerIT

23. How does a kidney transplant treat kidney failure? **A diseased kidney is replaced by a healthy donor kidney; this can be from a live donor or from someone who has died.**

24. State the advantages and disadvantages of kidney dialysis and kidney transplants. **Kidney Dialysis – Advantages: Available to all kidney patients (no shortage), no need for immune-suppressant drugs Disadvantages: Patient must limit their salt and protein intake between dialysis sessions, expensive for the NHS, regular dialysis sessions (up to 8hrs) – impacts on the patient's lifestyle, risk of infection Kidney Transplant – Advantages: Patients can lead a more normal life without having to watch what they eat and drink, cheaper for the NHS overall**

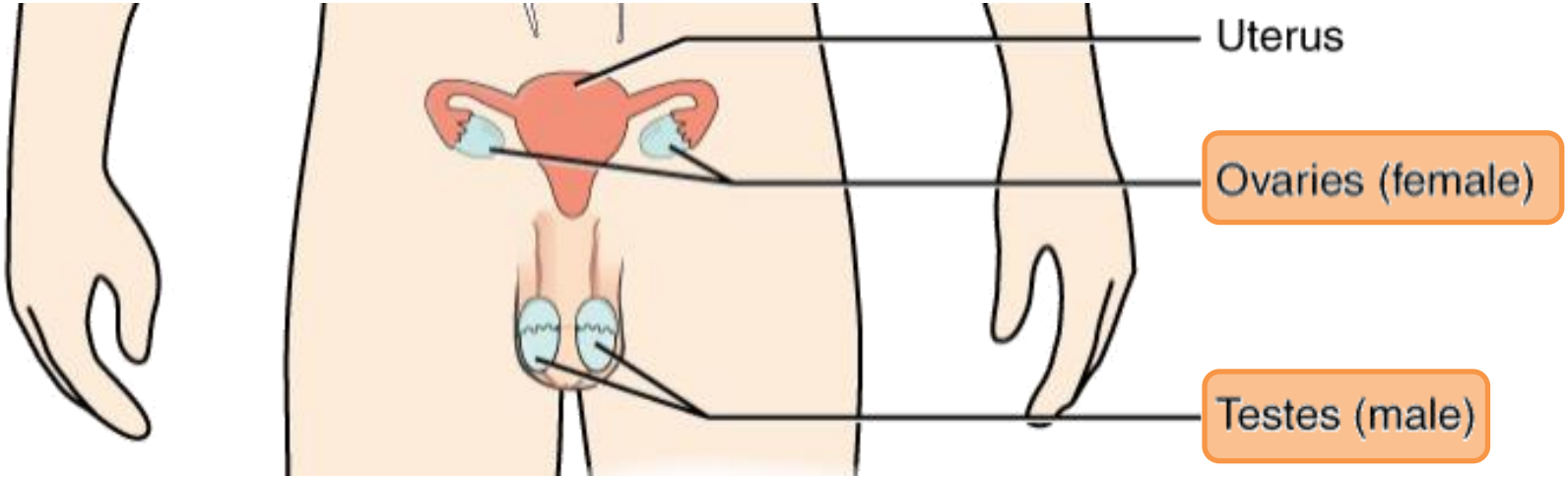
Disadvantages: Must take immune-suppressant drugs which increase the risk of infection, shortage of organ donors, kidney only lasts 8-9 years on average, any operation carries risks

LearnIT!
KnowIT!

Hormonal coordination in humans Part 3

- Hormones in human reproduction
- Contraception
- *The use of hormones to treat infertility (HT only)*
- *Negative feedback (HT only)*

Hormonal coordination in humans Part 3 - Hormones in human reproduction



FEMALE: The **ovaries** produces and secretes the hormones **oestrogen** and **progesterone.**
Oestrogen controls the development of secondary sexual characteristics in females and inhibits FSH and stimulates the pituitary gland to produce LH.
Progesterone maintains the lining of the uterus during the menstrual cycle.

MALE: The **testes** produce and secrete the hormone **testosterone**, it controls the development of secondary sexual characteristics in males

Hormonal coordination in humans Part 3 - Hormones in human reproduction

Puberty is the stage in life when a child's body develops into an adult's body. The **changes take place gradually**, usually between the ages of 10 and 16. Changes occur at puberty because of **hormones:**

Testosterone - produced by the testes - controls the development of male secondary sexual characteristics

Oestrogen - produced by the ovaries - controls the development of female secondary sexual characteristics

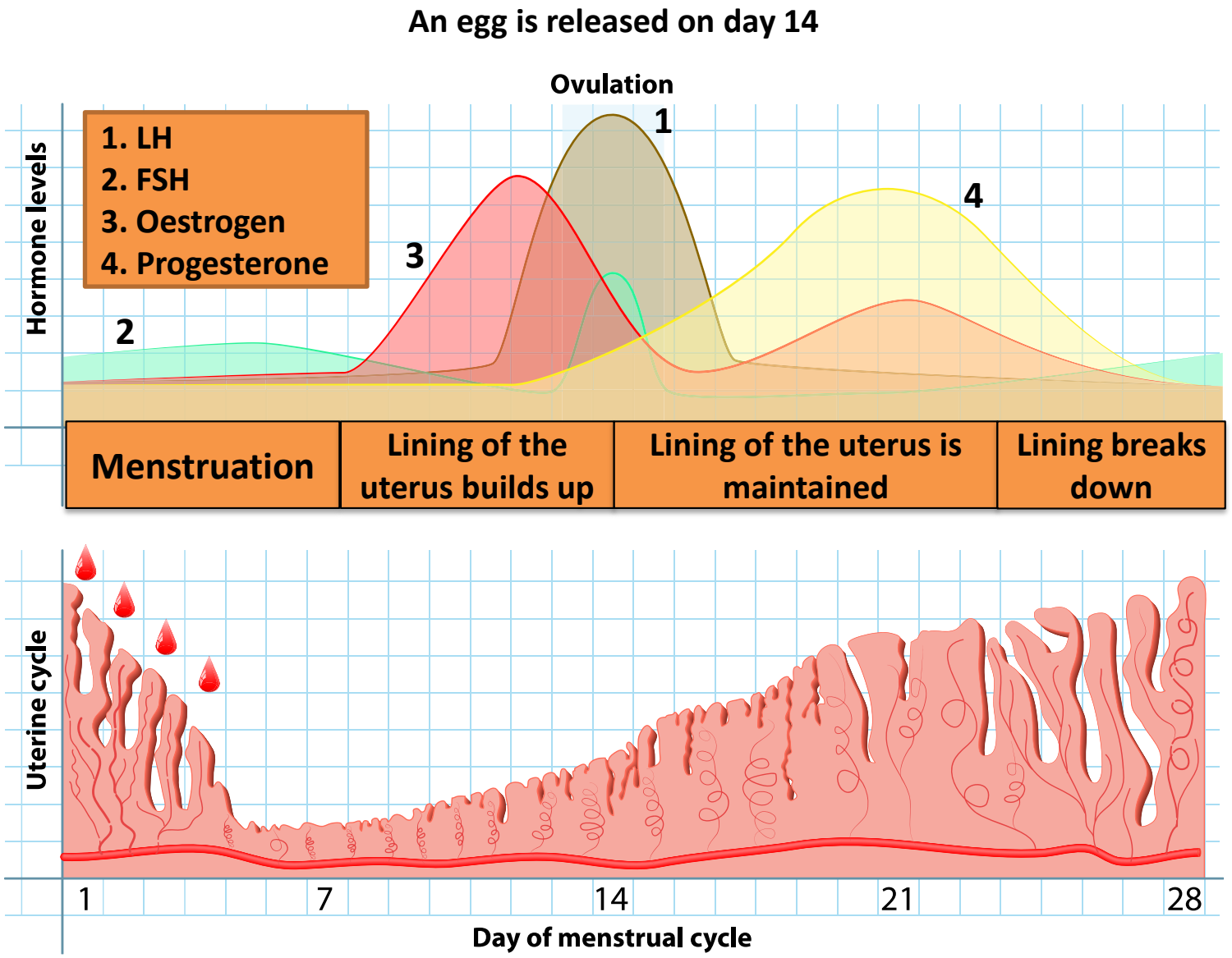
Female secondary sexual characteristics	Male secondary sexual characteristics
Breasts develop	**Voice deepens**
Hips get wider	**Body becomes more muscular**
Ovaries start to release eggs	**Testes start to produce sperm**
Pubic and underarm hair grows	**Facial, pubic, underarm and body hair grows**
Sexual organs grow and develop	**Sexual organs grow and develop**

Hormonal coordination in humans Part 3 - Hormones in human reproduction

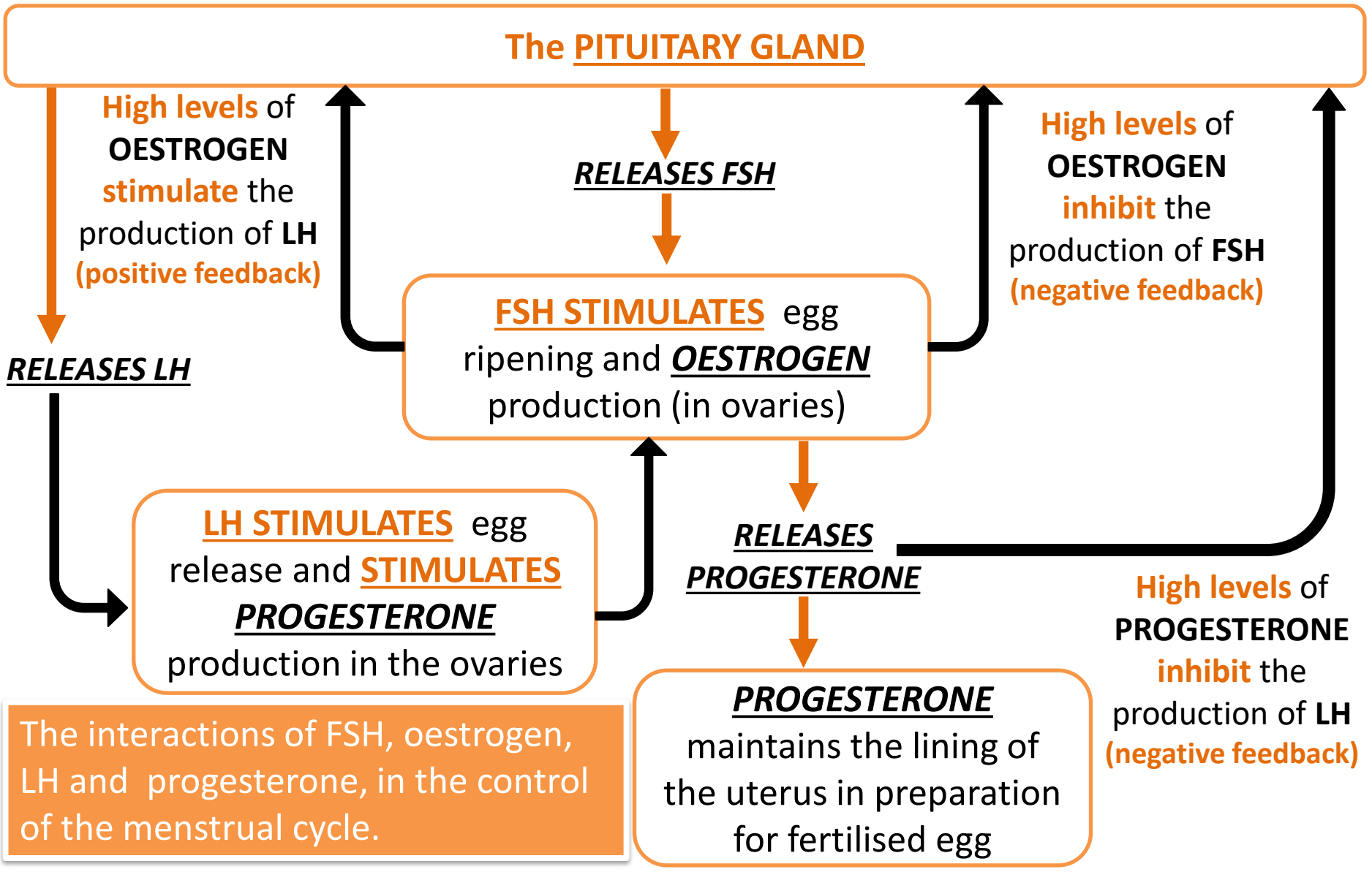
The menstrual cycle lasts 28 days: It is the reproductive cycle in women, it is brought about by ***hormones*****. Oestrogen** is the **main female reproductive hormone.** At puberty eggs begin to mature and one is released approximately every 28 days. This is called ovulation and it occurs half way through the cycle.

Hormone	Produced in...	Causes...
FSH Follicle stimulating Hormone	**Pituitary Gland**	**Stimulates egg ripening and oestrogen production (in ovaries)**
Oestrogen	**Ovaries**	**Lining of the womb to develop. Stimulates pituitary gland to make LH**
LH Luteinising hormone	**Pituitary Gland**	**Stimulates egg release and progesterone production in the ovaries**
Progesterone	**Ovaries**	**Maintains the lining of the womb**

Hormonal coordination in humans Part 3 - Hormones in human reproduction (HT only)



Hormonal coordination in humans Part 3 - Hormones in human reproduction (HT only)



The interactions of FSH, oestrogen, LH and progesterone, in the control of the menstrual cycle.

Hormonal coordination in humans Part 3 - contraception

Controlling fertility – Contraception Fertility can be controlled by a variety of hormonal and non-hormonal methods of contraception.

These include:

- **The pill** - oral contraceptives that contain hormones **(oestrogen)** to **inhibit FSH** production so that **no eggs mature**

- **Injection, implant or skin patch** of slow release **progesterone** to inhibit the **maturation** and **release of eggs** for a number of **months** or **years**

- **Spermicidal agents** which kill or disable sperm

Hormonal coordination in humans Part 3 - contraception

Controlling fertility – Contraception Fertility can be controlled by a variety of hormonal and non-hormonal methods of contraception.

- **Barrier methods** such as **condoms** and **diaphragms** which prevent the sperm reaching an egg

- The 'coil', **intrauterine devices** which prevent the implantation of an embryo or release a hormone

- **Abstaining** from intercourse when an egg may be in the oviduct

- **Sterilisation** or **vasectomy** - surgical methods of male and female sterilisation.

Hormonal coordination in humans Part 3 - The use of hormones to treat infertility **(HT only)**

Some women find it difficult to get pregnant so they need to undergo fertility treatment.

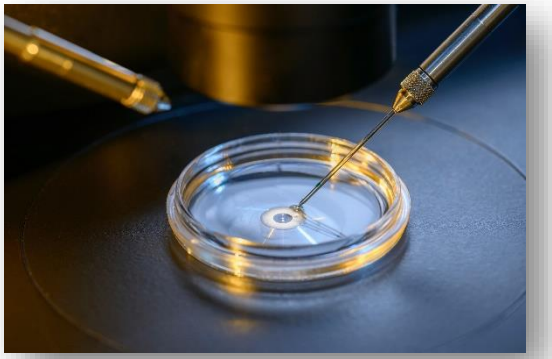
If a woman has naturally low levels of FSH and LH she can be given a **'fertility drug'** containing these hormones. **These can be in tablet form or injection form.**

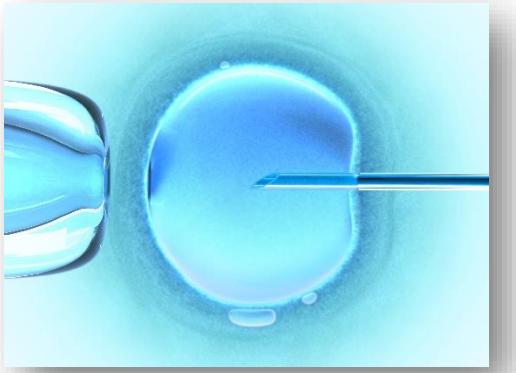
- **FSH stimulates the maturation of the eggs**
- **LH stimulates the release of the egg**

She may then become pregnant in the normal way.

Hormonal coordination in humans Part 3 - The use of hormones to treat infertility **(HT only)**

If she still cannot get pregnant after using the fertility drugs then IVF treatment may work.





In Vitro Fertilisation (IVF) treatment.

- IVF involves giving a mother **FSH and LH to stimulate the maturation of several eggs.**
- The **eggs are collected from the mother** and **fertilised by sperm from the father** in the laboratory.
- The **fertilised eggs develop into embryos.**
- At the stage when they are **tiny balls of cells**, one or two **embryos** are **inserted into the mother's uterus** (womb).

Hormonal coordination in humans Part 3 - The use of hormones to treat infertility (HT only)

Although fertility treatment gives a woman the chance to have a baby of her own:

- it is very **emotionally** and **physically** stressful; the success rates are **not** very high

- **increases** the **risk** of **complications** in pregnancy and childbirth, and may lead to **premature** or underweight babies

- it can lead to **multiple births** which are a risk to both the babies and the mother.

Hormonal coordination in humans Part 3 - Negative feedback (HT only)

Negative feedback is more common than **positive feedback.**

Negative feedback:

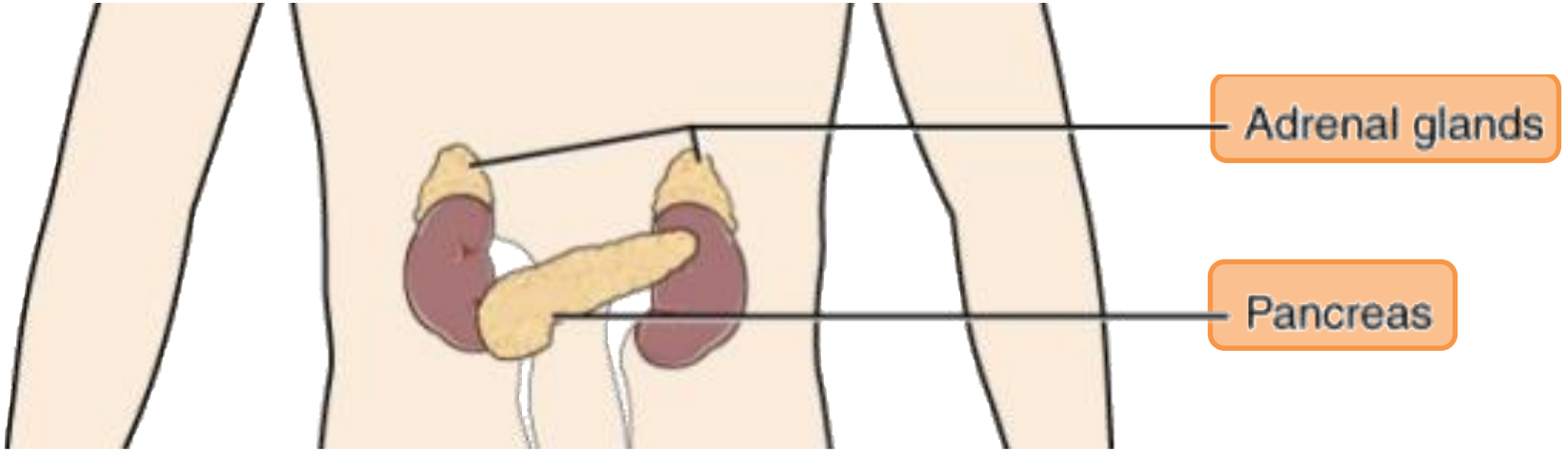
- occurs when there is a change in the body (i.e. blood glucose increases)
- the nervous system detects the change
- this stimulates an opposite hormonal response
- this reverses the effect back to homeostasis.

Positive Feedback: (less common)

- a change starts
- the nervous system detects the change
- then stimulates more hormones to be released to accelerate the change.

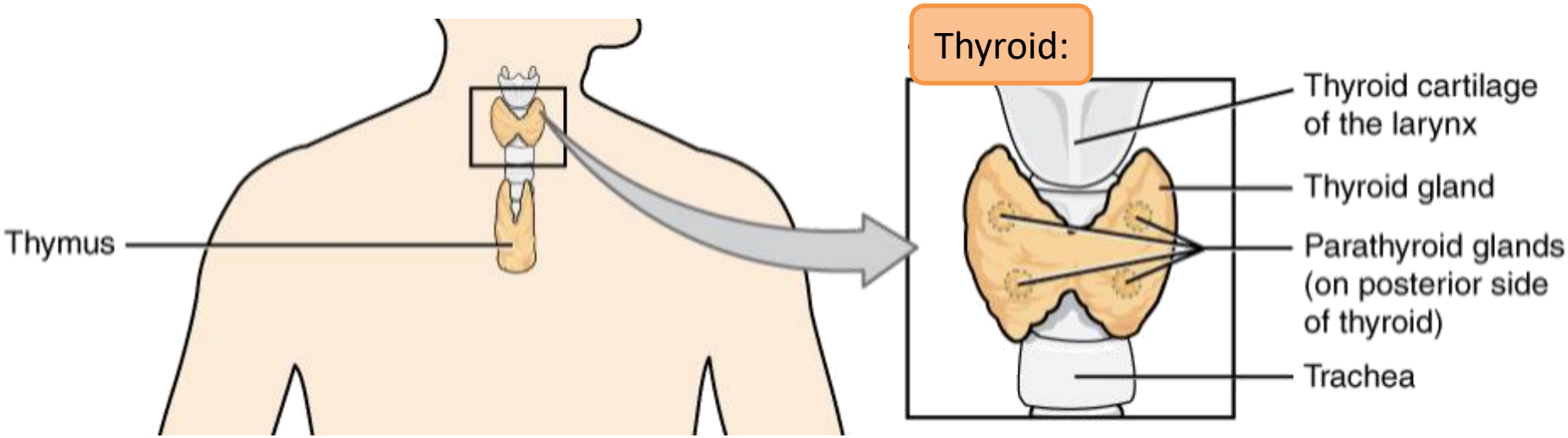
Video - Positive and negative feedback

Hormonal coordination in humans Part 1 - Human endocrine system



The **adrenal glands** produce and secrete the hormone **adrenalin. Adrenalin** prepares the body for **rapid activity** by increasing the **heart rate** and **blood glucose.** It diverts blood flow to the muscles and lungs. It is often called the **'fight or flight'** hormone.

Hormonal coordination in humans Part 1 - Human endocrine system



The **thyroid** produces and secretes the hormone **thyroxine. Thyroxine** regulates the **metabolic rate**, this is the rate at which **energy** is released in the body. Thyroxine **also** regulates **breathing, heart rate,** and **body temperature.**

QuestionIT!

Hormonal coordination in humans Part 3

- Hormones in human reproduction
- Contraception
- *The use of hormones to treat infertility (HT only)*
- *Negative feedback (HT only)*

Hormonal coordination in humans Part 3

- Question IT

1. What is the name of the main female reproductive hormone and where is it produced?

2. What is the name of the main male reproductive hormone and where is it produced?

3. Define the word puberty.

4. Between what ages does puberty usually occur?

5. What are the female secondary sexual characteristics?

6. What are the male secondary sexual characteristics?

7. What is the menstrual cycle and how long is it?

8. At what stage of the menstrual cycle is an egg released?

9. Where is FSH released and what is its role in the menstrual cycle?

10. Where is oestrogen released and what is its role in the menstrual cycle?

Hormonal coordination in humans Part 3

- Question IT

11. Where is LH released and what is its role in the menstrual cycle?

12. Where is progesterone released and what is its role in the menstrual cycle?

13. HT: What do high levels of oestrogen stimulate the release of?

14. HT: What do high levels of oestrogen inhibit the release of?

15: HT: What do high levels of progesterone inhibit the release of?

16. What does the term contraception mean?

17. How does the contraceptive pill work?

18. How do contraceptive implants and injections work?

19. What is a spermicidal agent?

20. Name 2 barrier methods of contraception and say how they work.

21. What is the coil and how does it work?

Hormonal coordination in humans Part 3

- Question IT

22. What does abstaining mean?

23. HT: What is in a fertility drug and how does it work?

24. HT: What is IVF?

25. HT: Describe the IVF process.

26. HT: Describe some issues with IVF treatment.

27. HT: What is negative feedback?

28. Where are the adrenal glands?

29. What is the role of adrenalin?

30. Where is the thyroid gland?

31. What is the role of thyroxine?

AnswerIT!

Hormonal coordination in humans Part 3

- Hormones in human reproduction
- Contraception
- *The use of hormones to treat infertility (HT only)*
- *Negative feedback (HT only)*

Hormonal coordination in humans Part 3

- Answer IT

1. What is the name of the main female reproductive hormone and where is it produced? **Oestrogen and it is produced in the ovaries**
2. What is the name of the main male reproductive hormone and where is it produced? **Testosterone and it is produced in the testis**
3. Define the word puberty. **The stage in life when a child's body develops into an adult's body**
4. Between what ages does puberty usually occur? **10 to 16**
5. What are the female secondary sexual characteristics? **Breasts develop, hips get wider, ovaries start to release eggs, pubic and underarm hair grows, sexual organs grow and develop**
6. What are the male secondary sexual characteristics? **Voice deepens, body becomes more muscular, testes start to produce sperm, facial, pubic, underarm and body hair grows , sexual organs grow and develop**
7. What is the menstrual cycle and how long is it? **It is the reproductive cycle in women, it is brought about by hormones. It lasts around 28 days**

Hormonal coordination in humans Part 3 - Answer IT

8. At what stage of the menstrual cycle is an egg released? **About half way through, usually day 14**

9. Where is FSH released and what is its role in the menstrual cycle? **The pituitary gland, it stimulates egg ripening and oestrogen production (in ovaries)**

10. Where is oestrogen released and what is its role in the menstrual cycle? **The ovaries, helps the lining of the womb to develop and stimulates pituitary gland to make LH**

11. Where is LH released and what is its role in the menstrual cycle? **The pituitary gland, stimulates egg release and progesterone production in the ovaries**

12. Where is progesterone released and what is its role in the menstrual cycle? **The ovaries, helps the lining of the womb**

Hormonal coordination in humans Part 3

- Answer IT

13. HT: What do high levels of oestrogen stimulate the release of? LH

14. HT: What do high levels of oestrogen inhibit the release of? FSH

15: HT: What do high levels of progesterone inhibit the release of? LH

16. What does the term contraception mean? **To prevent pregnancy**

17. How does the contraceptive pill work? **Contain oestrogen to inhibit FSH production so that no eggs mature**

18. How do contraceptive implants and injections work? **They slowly release progesterone to inhibit the maturation and release of eggs for a number of months or years**

19. What is a spermicidal agent? **A chemical that kills sperm**

20. Name 2 barrier methods of contraception and say how they work.
The condom, fits over the penis The diaphragm, covers the cervix in the female and they both and prevent sperm reaching an egg

21. What is the coil and how does it work? **It is a device that is place in the uterus, it stops a fertilised egg implanting in the lining**

22. What does abstaining mean? **Avoiding having sex around ovulation**

Hormonal coordination in humans Part 3

- Answer IT

23. HT: What is in a fertility drug and how does it work? A drug that contains FSH and LH. FSH stimulates the maturation of the eggs and LH stimulates the release of the egg

24. HT: What is IVF? In vitro fertilisation where an egg is fertilised outside the body in a laboratory

25. HT: Describe the IVF process. FSH and LH are given to stimulate the maturation of several eggs. The eggs are collected from the mother and fertilised by sperm from the father in the laboratory. The fertilised eggs develop into embryos. At the stage when they are tiny balls of cells, one or two embryos are inserted into the mother's uterus (womb).

26. HT: Describe some issues with IVF treatment. It is emotionally and physically stressful with low success rates, increases the risk of complications, may lead to premature or underweight babies and multiple births

27. HT: What is negative feedback? It is where a stimulus causes an opposite effect

Hormonal coordination in humans Part 3

- Answer IT

28. Where are the adrenal glands? **On top of the kidneys**
29. What is the role of adrenalin? **To prepare the body for rapid activity**
30. Where is the thyroid gland? **In the neck**
31. What is the role of thyroxine? **It regulates the metabolic rate, this is the rate at which energy is released in the body.**

LearnIT!
KnowIT!

Plant hormones (biology only)

- Control and coordination
- *Use of plant hormones (HT only)*

Plant hormones (biology only) - Control and coordination

Plants produce hormones to coordinate and control growth and responses to light and gravity

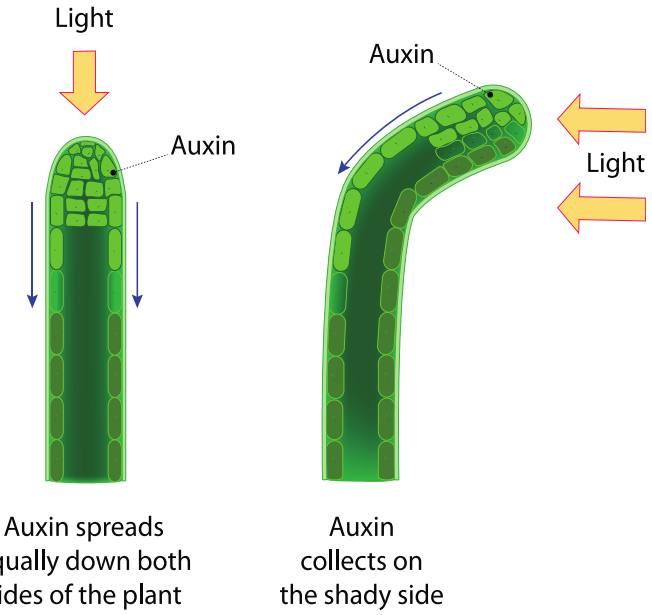
Tropism – Plant growth response to a stimulus
Phototropism – Plant growth response to light
Gravitropism/Geotropism – Plant growth response to gravity
Positive Tropism – Towards the stimulus
Negative Tropism – Away from the stimulus
Auxin - Plant hormone, it causes unequal growth rates in plant roots and shoots

Phototropism

Auxin produced in **the tip of the shoot**

Auxin moves to shaded side of the stem

Auxin causes **cell elongation**

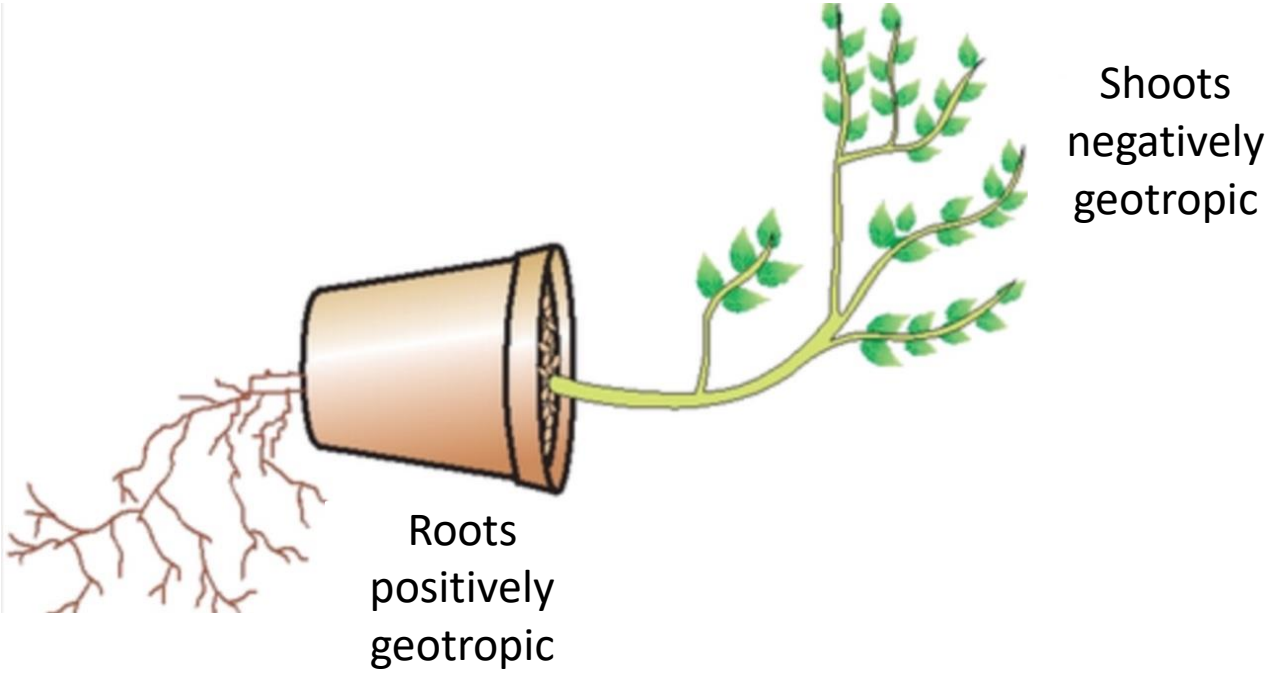


Geotropism/Gravitropism

Auxin produced in the **tip of the root** and move to the side of the root that is towards gravity

Auxins have **opposite effect in the root** compared to shoots

In roots auxins stop cell elongation and roots grow down



Plant hormones (HT & biology only) - Control and coordination

Gibberellins:

- are involved in **plant growth** – they can cause dwarf plants to grow to full size
- **overcome dormancy in seeds** and initiate germination.

Ethene:

- controls **cell division** and ripening of fruits
- helps **flowers** open
- involved in the **dropping of leaves** from plants.

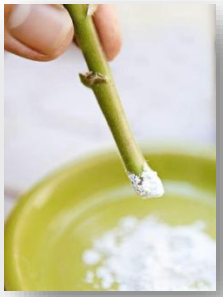
Rotting fruit gives off high concentrations of ethene.

Plant hormones (HT & biology only) - Use of plant hormones

Plant growth hormones are used in agriculture and horticulture.

Auxins are used:

- as weed killers
- as rooting powders
- for promoting growth in tissue culture.



Ethene is used in the food industry to control ripening of fruit during storage and transport.

Gibberellins can be used to:

- end seed dormancy
- promote flowering
- increase fruit size.

QuestionIT!

Plant hormones (biology only)

- Control and coordination
- *Use of plant hormones (HT only)*

Plant hormones (biology only)

- Question IT

1. What is the role of plant hormones?
2. What is a positive tropism? Give an example of a positive tropism.
3. What is a negative tropism? Give an example of a negative tropism.
4. Where is auxin produced in the shoot?
5. If a light is shining on the side of a shoot, where will the auxin move to?
6. What effect does auxin have on the cells in a shoot?
7. Where is auxin produced in the root?
8. What effect do auxins have on the cells in the roots?
9. **HT: What is the effect of gibberellins on plants?**
10. **HT: How are gibberellins used in agriculture and horticulture?**
11. **HT: What is the effect of ethene on plants?**
12. **HT: How is ethene used in agriculture and horticulture?**
13. **HT: How are auxins used in agriculture and horticulture?**

AnswerIT!

Plant hormones (biology only)

- Control and coordination
- *Use of plant hormones (HT only)*

Plant hormones (biology only) AnswerIT

1. What is the role of plant hormones? **To coordinate and control growth and responses to light and gravity**
2. What is a positive tropism? Give an example of a positive tropism.
Where a plant grows towards a stimulus e.g. shoots and light
3. What is a negative tropism? Give an example of a negative tropism.
Where a plant grows away from a stimulus e.g. roots and light
4. Where is auxin produced in the shoot? **The tip**
5. If a light is shining on the side of a shoot, where will the auxin move to?
6. What effect does auxin have on the cells in a shoot? **They cause cell elongation**
7. Where is auxin produced in the root? **The tip**
8. What effect do auxins have on the cells in the roots? **They stop cell elongation**

9. HT: What is the effect of gibberellins on plants? Involved in growth and to overcome dormancy in seeds
10. HT: How are gibberellins used in agriculture and horticulture? To end seed dormancy, promote flowering and increase fruit size
11. HT: What is the effect of ethene on plants? Controls cell division, promotes flower opening and involved in the dropping of leaves
12. HT: How is ethene used in agriculture and horticulture? Used in the food industry to control ripening of fruit during storage and transport
13. HT: How are auxins used in agriculture and horticulture? Used as weed killers, as rooting powders and for promoting growth in tissue culture.