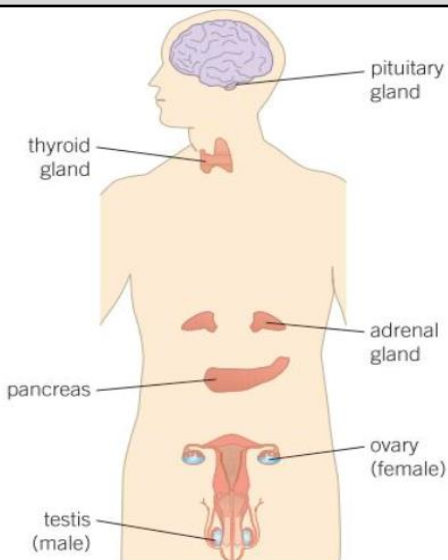


# AQA B5b Homeostasis and Response: Hormonal Control BIOLOGY

## TRIPLE (page 1 of 3) Required practical – Plant growth

The human **endocrine system** is made of glands, which release chemicals called **hormones** directly into the **bloodstream**. The blood carries the hormone to a **target organ** where it produces an effect. Examples of these controls include blood glucose concentration, body temperature and water levels. Compared to the nervous system the effects are slower but act for longer.

Endocrine Gland	Role of its Hormones
pituitary	The 'Master Gland'; secretes several hormones into the blood to stimulate other glands to release hormones
thyroid	Controls metabolic rate
pancreas	Controls glucose levels
adrenal	Prepares body for stress
ovaries	Involved in menstrual cycle
testes	Involved in sperm production



**Homeostasis** is the **regulation** of the **internal conditions** of a cell or organism to **maintain optimum conditions** for function, in response to internal and external changes. Homeostasis maintains optimal conditions for enzyme action and all cell functions. In the human body, these include control of blood glucose concentration, body temperature and water levels. These automatic control systems may involve nervous responses or chemical responses.

Blood glucose concentration is monitored and controlled by the <b>pancreas</b> .	
<b>Blood glucose too High</b>	Pancreas produces the hormone <b>insulin</b> , glucose moves from the blood into the cells. In liver and muscle cells excess glucose is converted to <b>glycogen</b> for storage.
<b>Blood glucose too Low</b>	Pancreas produces the hormone <b>glucagon</b> , causes glycogen to be converted into glucose and released into blood. <b>Negative feedback:</b> Rising glucose levels inhibit the release of glucagon. Insulin is released to reduce glucose levels, which causes the pancreas to release glucagon
<b>Type 1 diabetes</b>	Pancreas fails to produce enough insulin leading to uncontrolled blood glucose levels. <b>Treatment:</b> by insulin injection.
<b>Type 2 diabetes</b>	Obesity is a risk factor. Body cells no longer respond to insulin. <b>Treatment:</b> changing diet and increasing exercise.

### Hormones in Human Reproduction

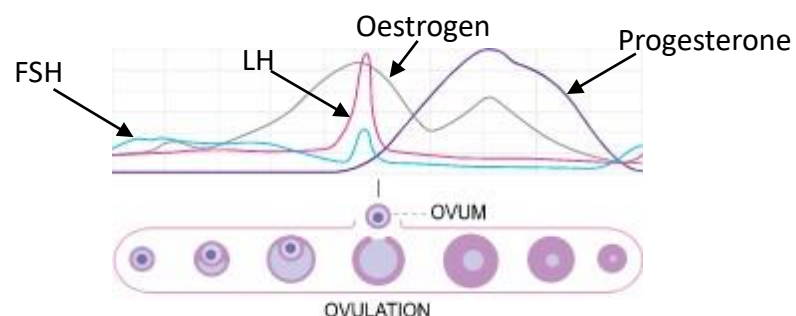
During puberty reproductive hormones cause secondary sexual characteristics to develop

Hormone	Role of the Hormone
testosterone	Main male reproductive hormone. Stimulates sperm production in testes.
oestrogen	Main female reproductive hormone produced in the ovary. At puberty eggs begin to mature and one is released every 28 days approx. This is called ovulation.

Several hormones are involved in the menstrual cycle of women:

follicle stimulating hormone (FSH)	Matures an egg in the ovary. Stimulates ovary to produce oestrogen.
luteinising hormone (LH)	Stimulates release of an egg ( <b>ovulation</b> )
oestrogen	Stimulates uterus lining to develop. Inhibits FSH and stimulates the release of LH.
progesterone	Maintains uterus lining. Inhibits release of FSH and LH.

### The menstrual cycle:



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

Name	How it works
oral contraceptive (pill)	Contains hormones to inhibit FSH so no eggs mature
injection, implant, patch	Releases progesterone slowly to inhibit the maturation and release of eggs
barrier methods - condoms/diaphragms	prevent sperm from reaching egg
intrauterine devices	Prevent implantation of an embryo
spermicidal agents	Kill or disable sperm
abstinence	Avoiding sex when an egg may be in the oviduct
surgery	Male or female sterilisation (surgery to stop you having offspring e.g. vasectomy in males)

### Hormones are used in modern reproductive technologies to treat infertility

FSH and LH are used as fertility drugs to help someone become pregnant in the normal way.

In Vitro Fertilisation (IVF) treatment:

- Eggs are collected from mother (after being given FSH and LH to stimulate maturation of several eggs) → Fertilised by father's sperm in a lab → The fertilised eggs develop into embryos → One or two embryos are inserted into the mother's uterus (womb)

Disadvantages of IVF

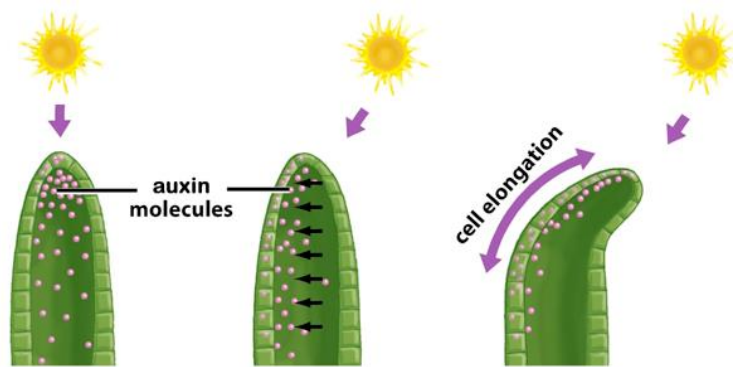
- Emotional and physical stress
- Low success rates
- Multiple births risk to mother and babies

**Plant Hormones**

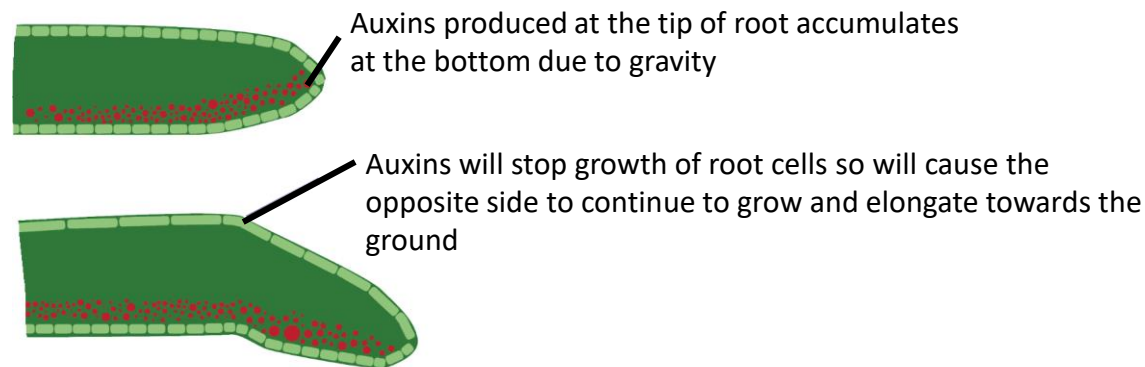
Plants produce hormones to coordinate and control growth and responses to light (phototropism) and gravity (gravitropism or geotropism). Unequal distributions of auxin cause unequal growth rates in plant roots and shoots.

**Response to light (phototropism)**

Light breaks down auxins and they become unequally distributed in the shoot. The side with the highest concentration of auxins (facing away from light) has the highest growth rate and the shoot grows toward the light.



**Response to gravity (gravitropism/geotropism)**



Plant growth hormones are used in agriculture and horticulture.

Hormone	Use in agriculture/horticulture
auxins	Weed killer, rooting powder, promoting growth in tissue culture
ethene	Control ripening of fruit during storage and transport
gibberellins	End seed dormancy by initiating seed germination, promote flowering, increase fruit size

**Negative Feedback**

adrenaline	thyroxine
Produced in adrenal glands. Increases breathing/heart rate and blood flow to muscles. Prepares the body for 'fight or flight'.	Produced in thyroid gland, stimulates basal metabolic rate. Important in growth and development. Increasing thyroxine levels prevent the release of TSH, which stops the release of thyroxine.

**Body Temperature**

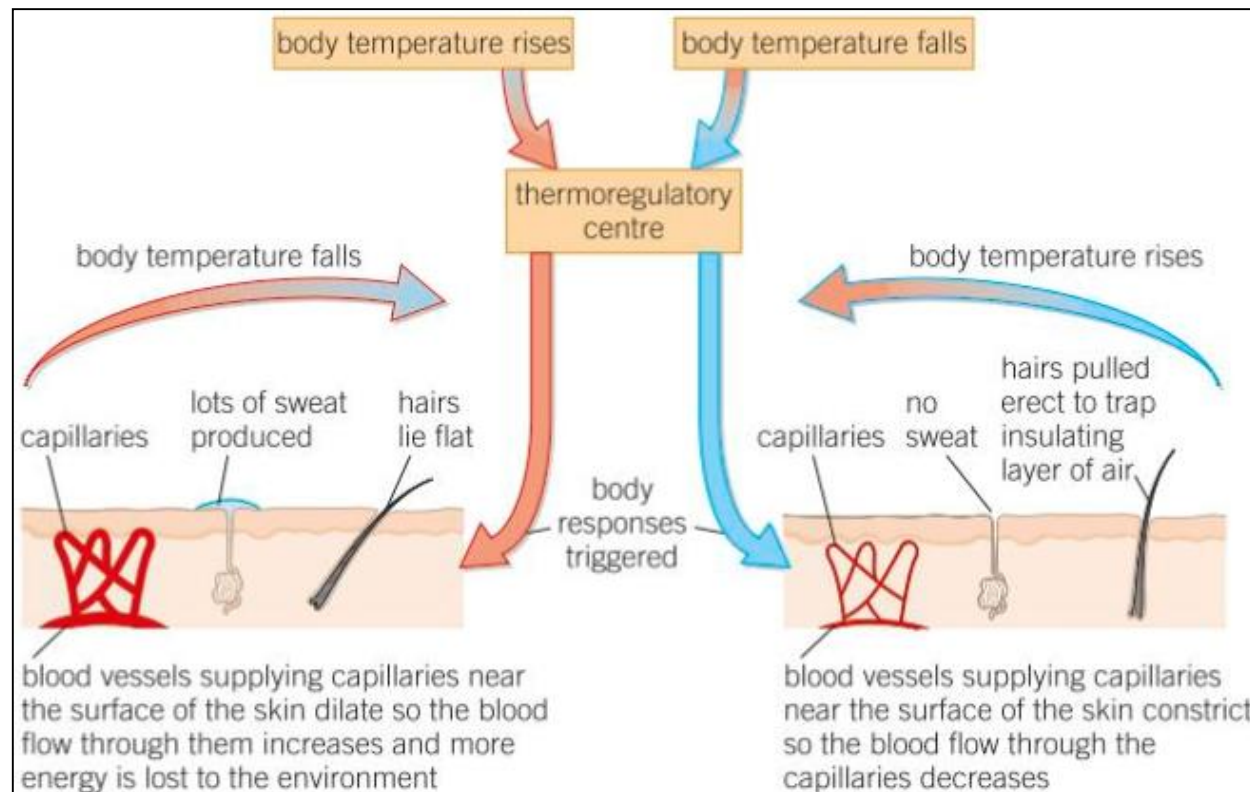
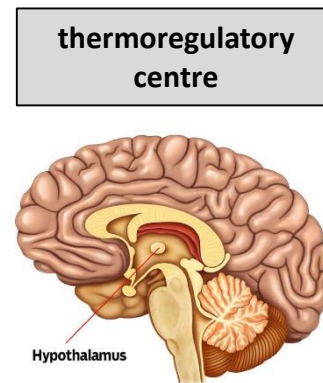
Body temperature is monitored and controlled by the thermoregulatory centre in the brain (the hypothalamus). This contains receptors sensitive to the temperature of the blood. Skin also contains temperature receptors and it sends nervous impulses to the thermoregulatory centre.

**When body temperature is too high:**

- Blood vessels dilate (vasodilation) - get wider
- Sweat produced from sweat glands
- Sweat evaporates from skin surface, transferring thermal energy to the environment from the skin

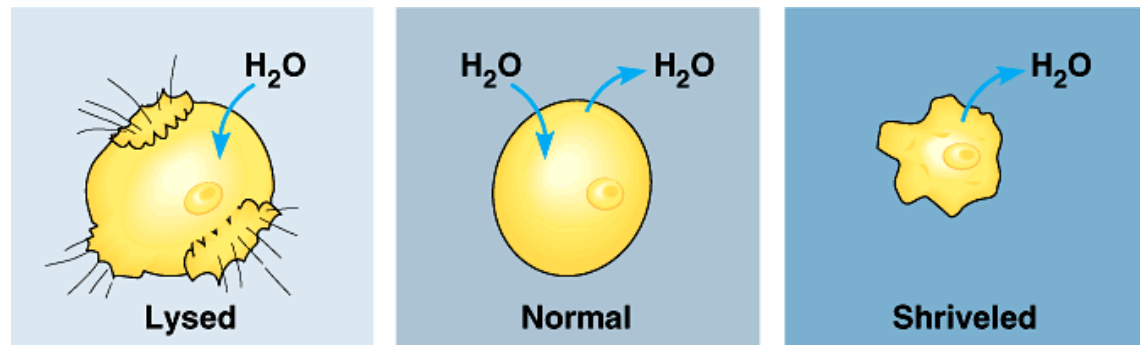
**When body temperature is too low:**

- Blood vessels constrict (vasoconstriction) – get narrower
- Sweating stops, thermal energy loss reduced at skins surface
- Skeletal muscles contract (shivering)



**AQA B5b Homeostasis and Response: Hormonal Control BIOLOGY TRIPLE (page 3 of 3) Required practical – Plant growth**

If body cells lose/gain too much water by osmosis they do not function efficiently. Too much water and they can pop (lysis), too little water and they shrivel up. Both of these states will lead to cell death.



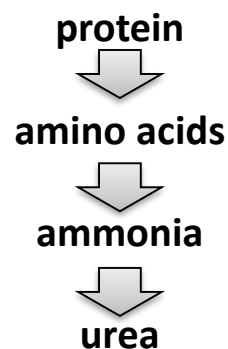
**Water and Nitrogen Balance (The Kidneys)**

Water leaves the body via the lungs during exhalation. Water, ions and urea are lost from the skin in sweat. There is no control over water, ion or urea loss by the lungs or skin.

Excess water, ions and urea are removed via the kidneys in the urine. Kidneys in maintaining the water balance of the body. The kidneys produce urine by filtration of the blood and selective reabsorption of useful substances such as glucose, some ions and water.

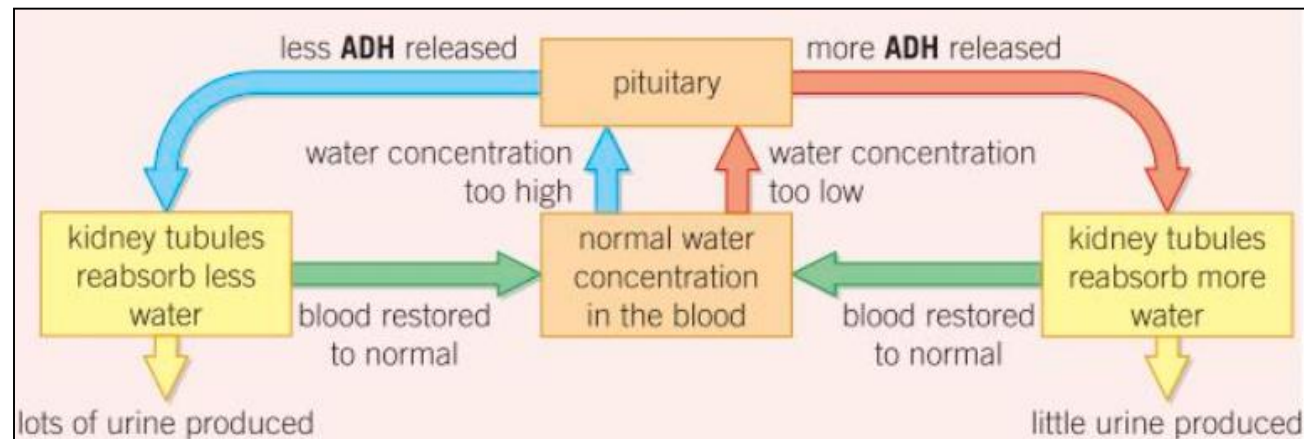
**Deamination**

The digestion of proteins from the diet results in excess amino acids which need to be excreted safely. In the liver these amino acids are deaminated (broken down) to form ammonia. Ammonia is toxic and so it is immediately converted to urea for safe excretion.



**ADH**

The water level in the body is controlled by the hormone ADH which acts on the kidney tubules. ADH is released by the pituitary gland when the blood is too concentrated and it causes more water to be reabsorbed back into the blood from the kidney tubules. This is controlled by negative feedback.



Remember – ADH stands for anti diuretic hormone. This means that if you release this hormone it will stop you going to the toilet as much – less urine will be made.

People who suffer from kidney failure may be treated by organ transplant or by using kidney dialysis. A dialysis machine can be used to remove urea from the blood by diffusion while maintaining ion and glucose levels.

