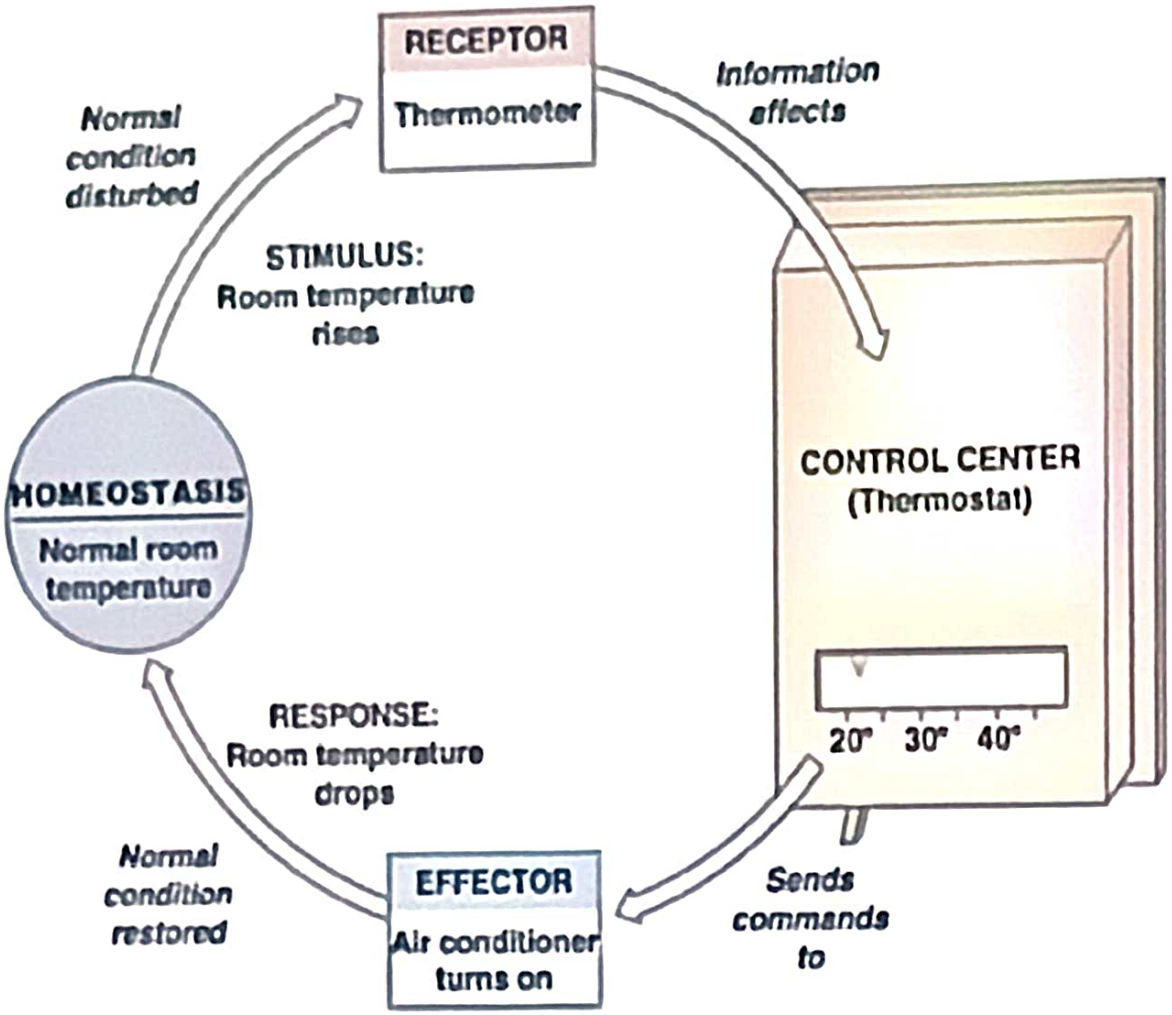
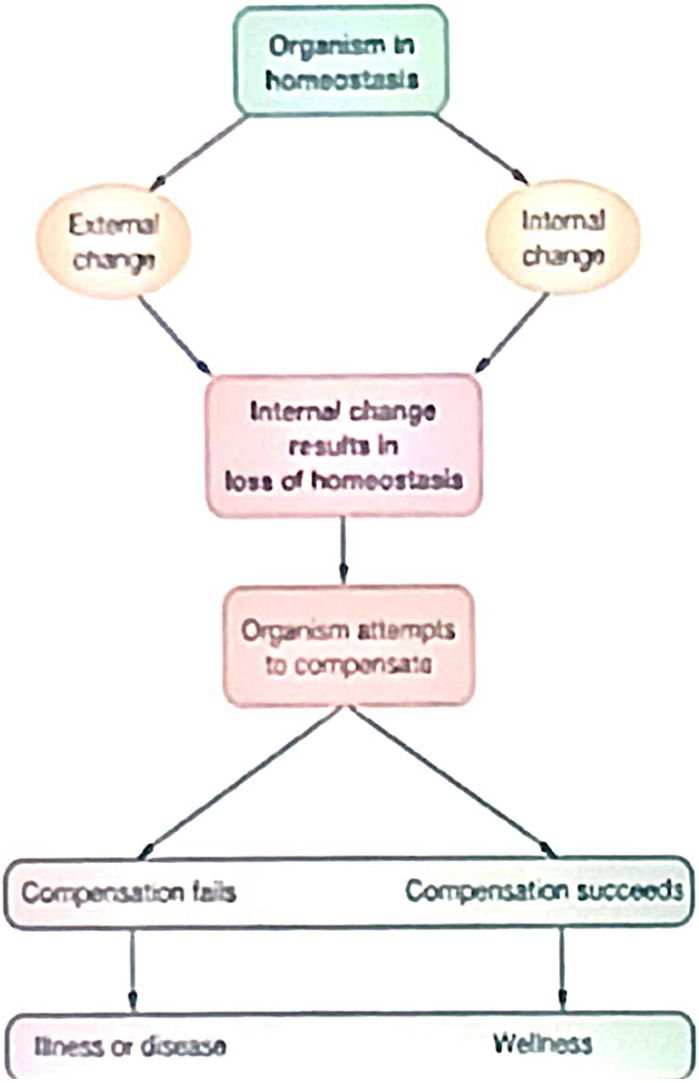
The Thermostat Analogy



Disease is a state of disturbed homeostasis

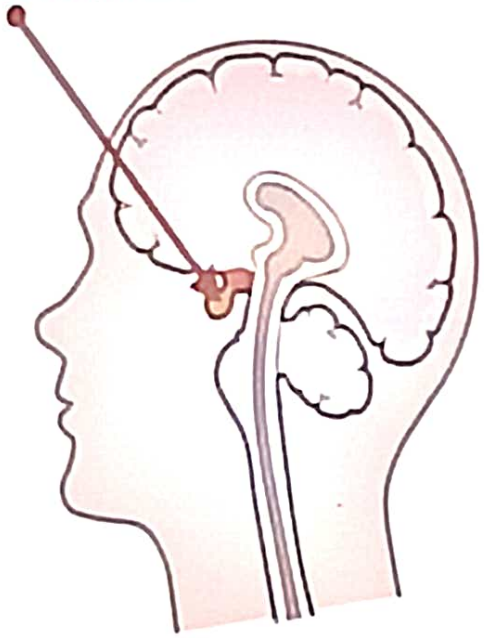


How is temperature controlled?

Body temperature is monitored and controlled by temperature receptors in the skin and brain.

These receptors detect changes in the temperature of blood flowing through those areas.

The thermoregulatory centre in the brain is called the **hypothalamus**.



If body temperature deviates from 37 °C, the hypothalamus and skin receptors send out electrical signals that trigger actions or behaviours that increase or decrease heat loss.

Why do we shiver?

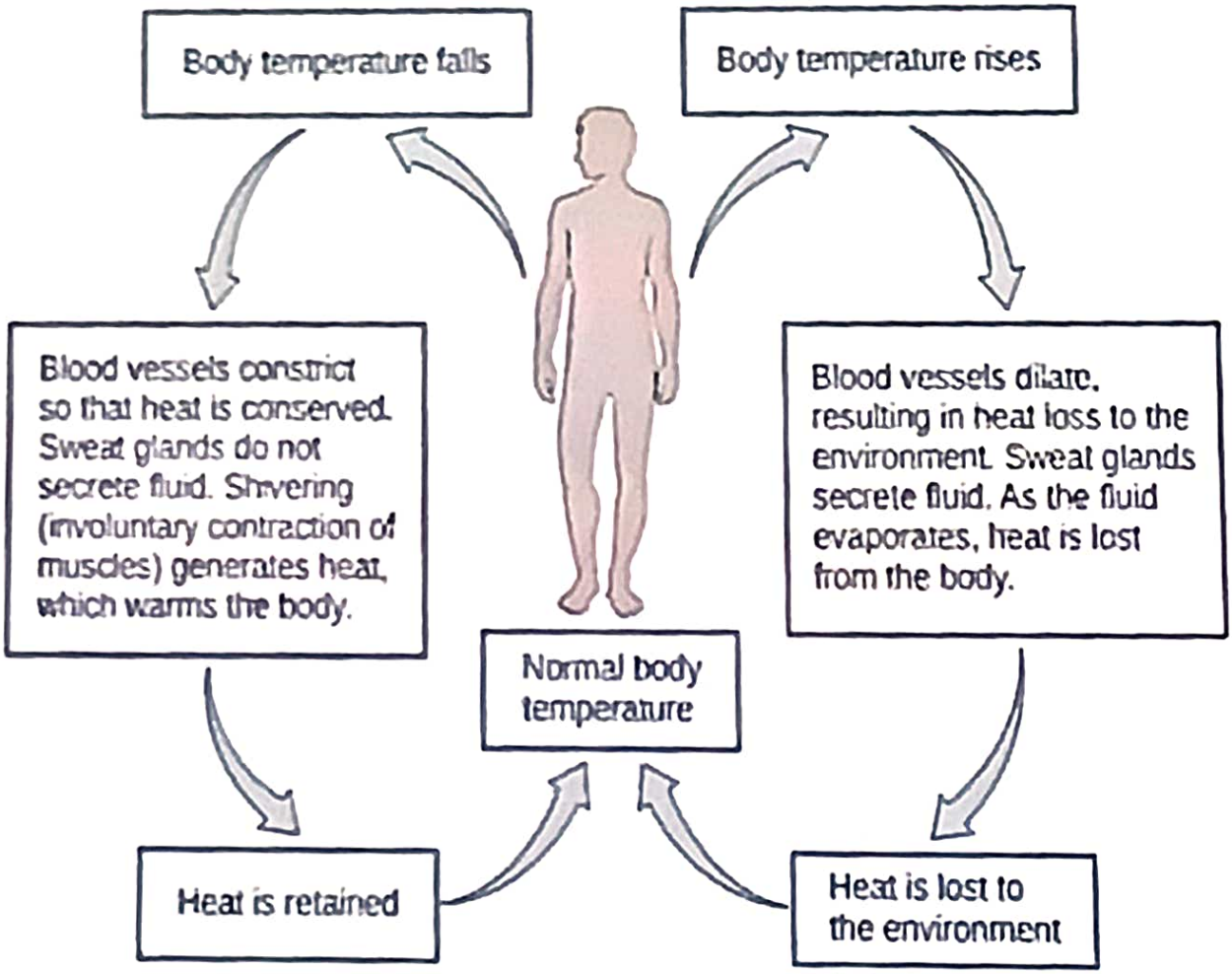
When core body temperature drops, muscles begin to twitch. This rapid and contraction and relaxation of the muscles is called **shivering**.

Shivering generates heat, which raises body temperature.

Goose bumps involuntarily appear when a person becomes cold. Goosebumps are caused by the tiny muscles at the base of body hairs pulling the hairs erect.

The upright hairs trap an insulating layer of air, which helps reduce heat loss.

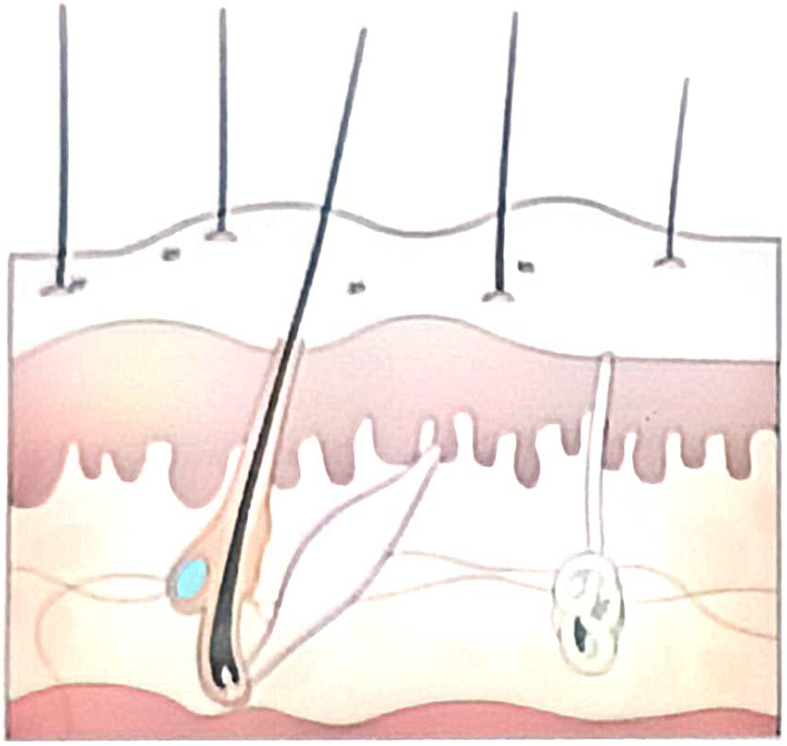
Homeostatic Mechanism – temperature control



Vasoconstriction and warming up

Why do people go pale when they are cold?

When core body temperature falls, blood vessels in the skin get narrower. This is called **vasoconstriction.**



Vasodilation and cooling down

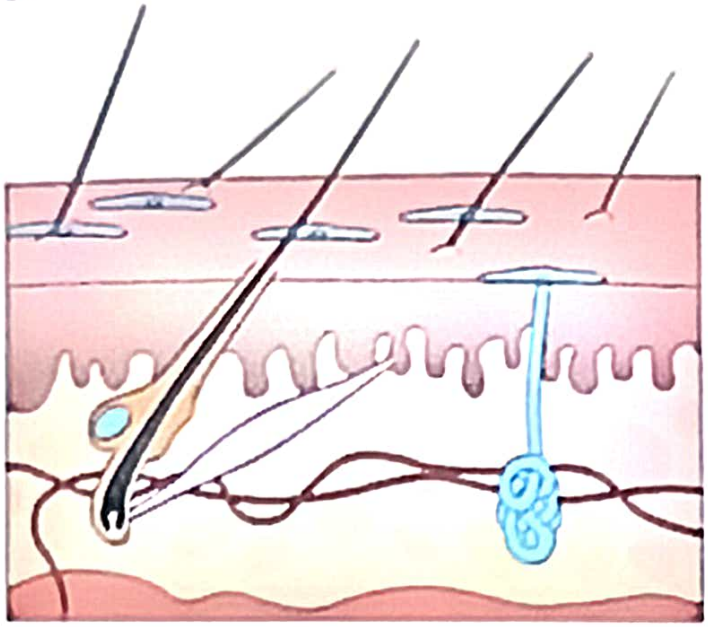
Why do people turn red when they are hot?

When core body temperature rises, blood vessels in the skin get wider. This is called **vasodilation**.

Vasodilation allows a larger volume of blood to flow near the skin surface, transferring heat to the environment. This cools the body down.

Additional cooling occurs with the production of sweat from sweat glands.

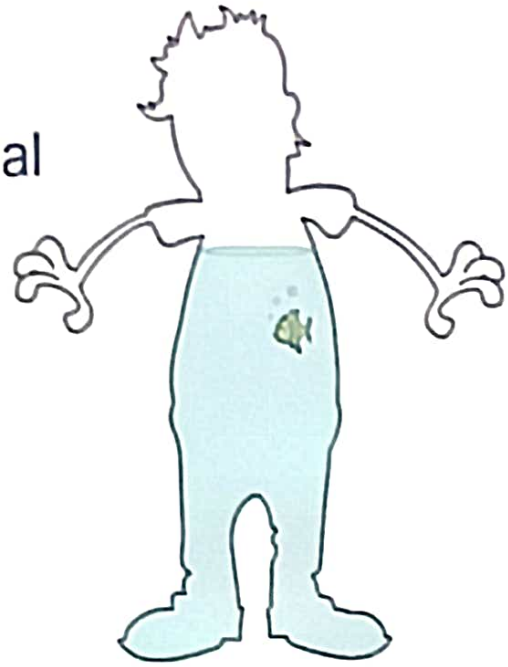
As the sweat evaporates it transfers heat away from the body.



Why is water important?

The human body is about 60-70% water.

Water molecules and ions constantly move in and out of cells, and are essential for all life processes.



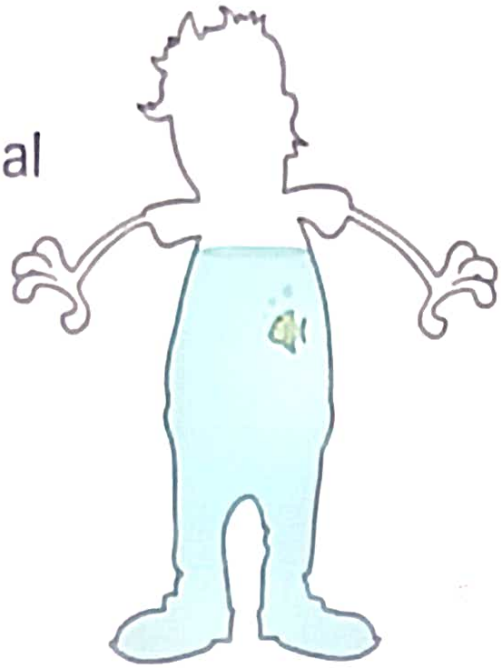
Dehydration (loss of too much water from the body) damages cells.

How is water gained and lost?

Why is water important?

The human body is about 60-70% water.

Water molecules and ions constantly move in and out of cells, and are essential for all life processes.



Dehydration (loss of too much water from the body) damages cells.

How is water gained and lost?

- Water is produced by the body during respiration, and absorbed from food and drink.

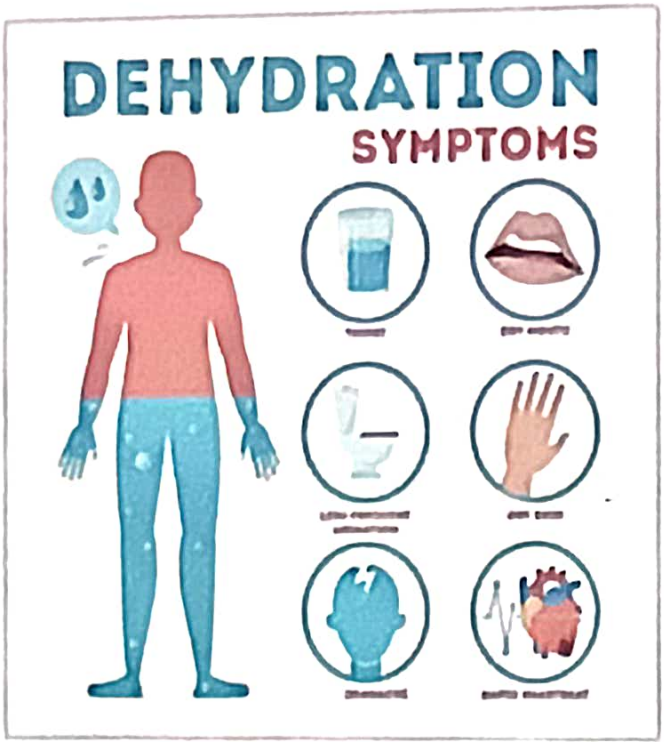
Dehydration and its causes

Just a 1% decrease in body weight due to water loss is enough to cause mild dehydration.

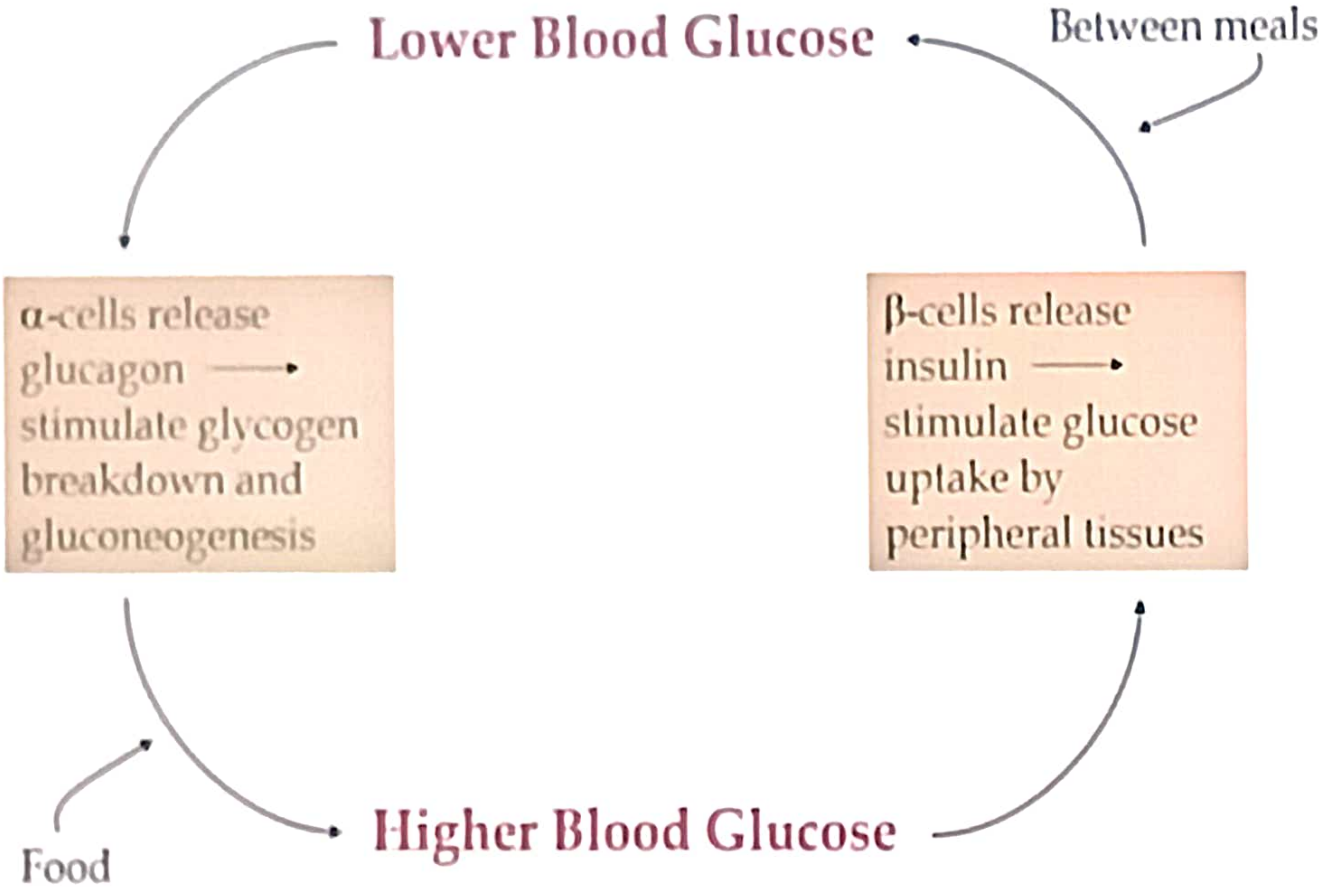
Mild dehydration can cause dizziness, a dry mouth and concentrated urine. Severe dehydration can cause death.

What causes dehydration?

- heavy sweating
- low water intake
- eating salty food
- breathing dry air
- caffeine
- diarrhea.

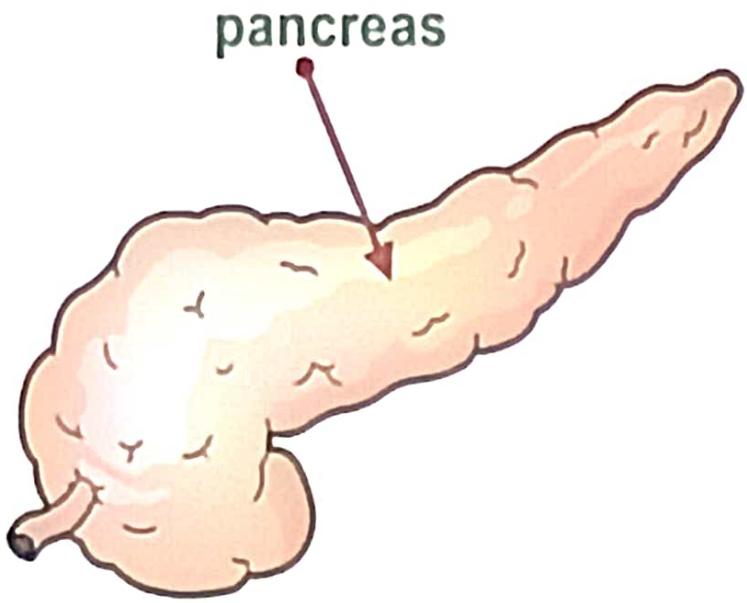


Glucose Homeostasis



The pancreas and blood glucose

Blood glucose levels are monitored and controlled by the **pancreas**.

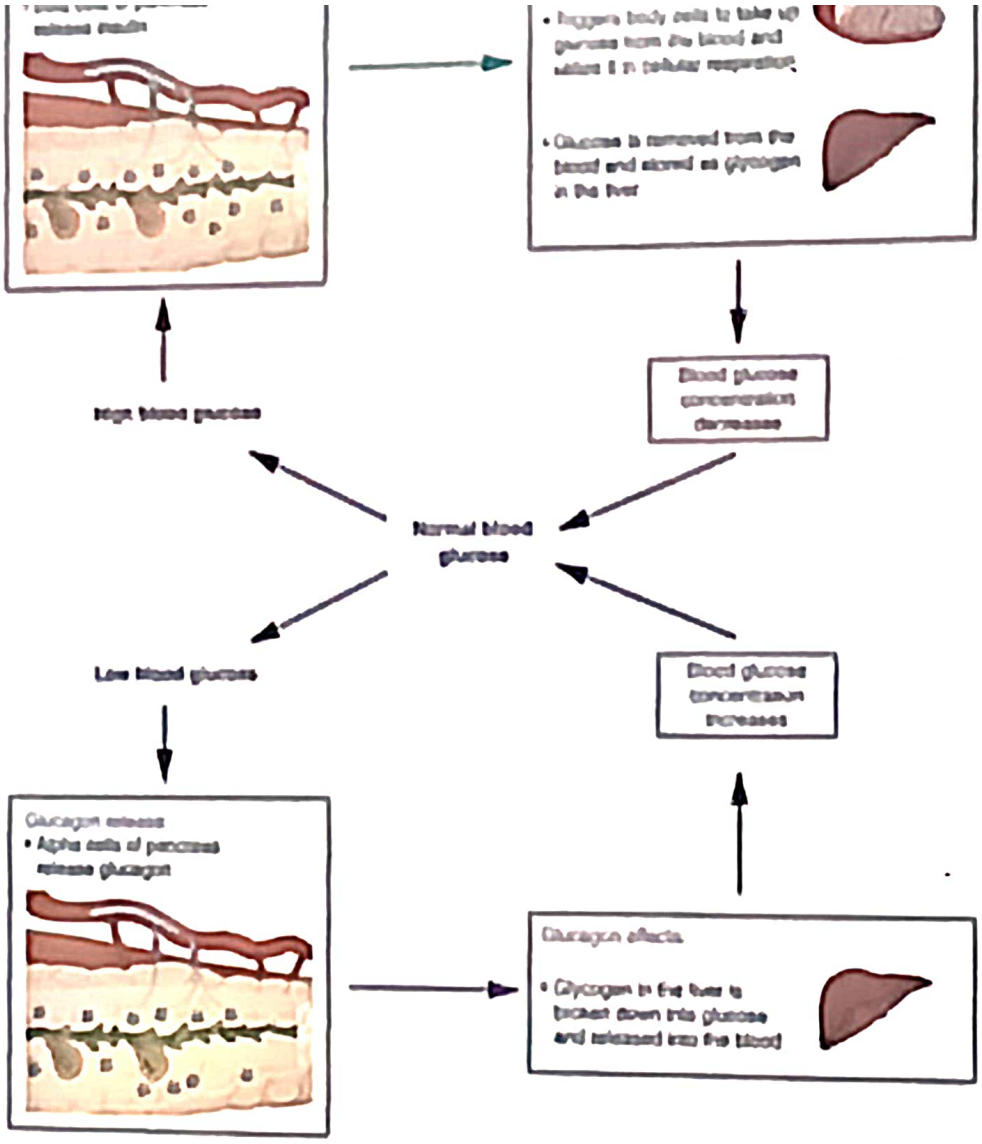


The pancreas produces and releases different hormones depending on the blood glucose level.

- **Insulin** is released when blood glucose levels are **high** – the liver stores excess glucose as glycogen.

- **Glucagon** is released when blood glucose levels are **low** – the liver converts stored glycogen into glucose and releases it into the blood.

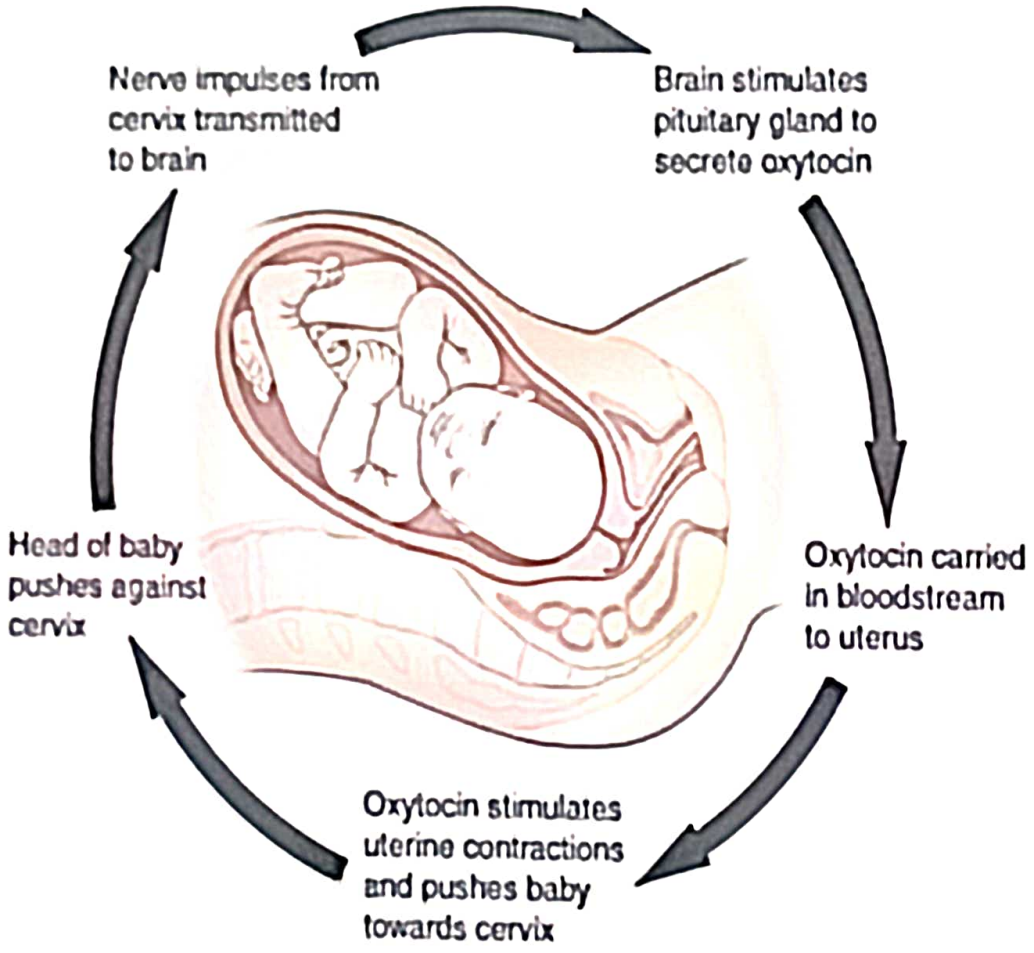
Glucose homeostasis



Glucose Homeostasis Chart

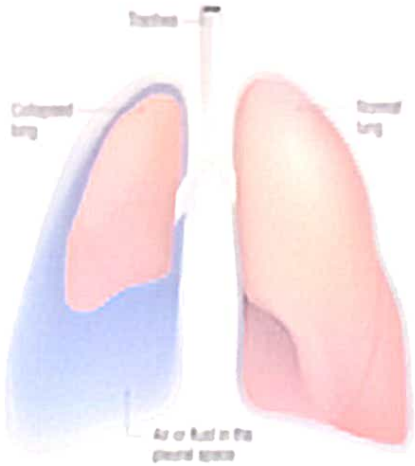
Condition	High Blood Sugar Toxic	Low Blood Sugar Do not meet energy requirements of cell
Receptor	Glucose transporter	Glucose transporter
Control Center	β-cell of the pancreas	α-cell of the pancreas
Effector	Insulin	Glucagon
Result	Glucose uptake by muscle/fat tissue Lowers blood-glucose	Liver breaks down glycogen to create glucose Raises blood-glucose

Homeostatic Mechanism – during child birth

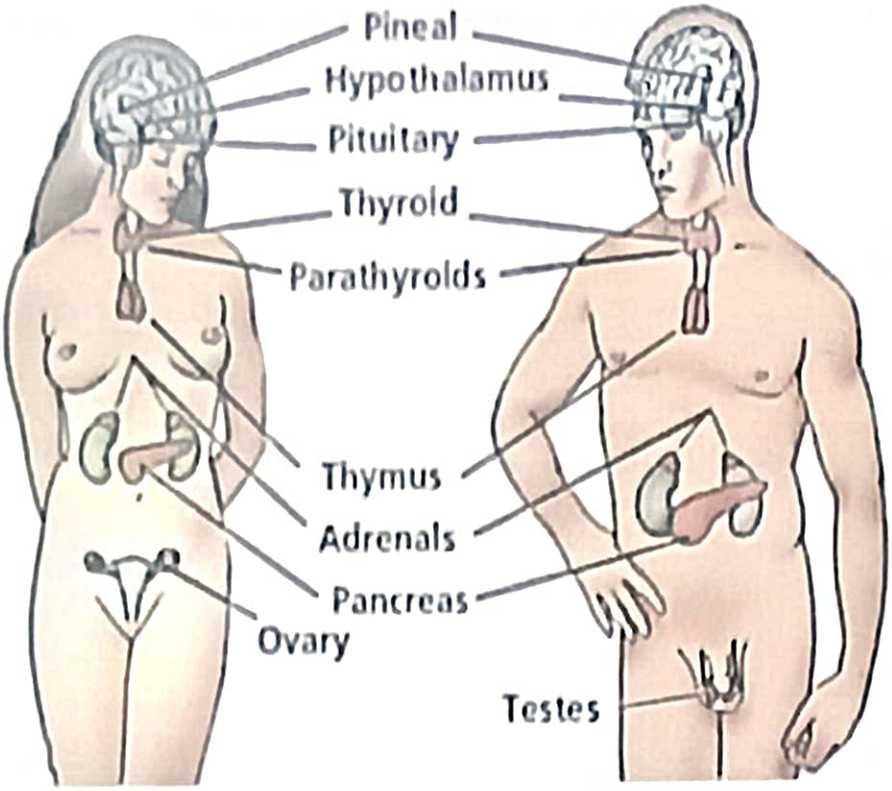


Disruption of Homeostasis

- Injury
  - Punctured Lung
- Illness
  - Flu
- Disease
  - Diabetes
- Death



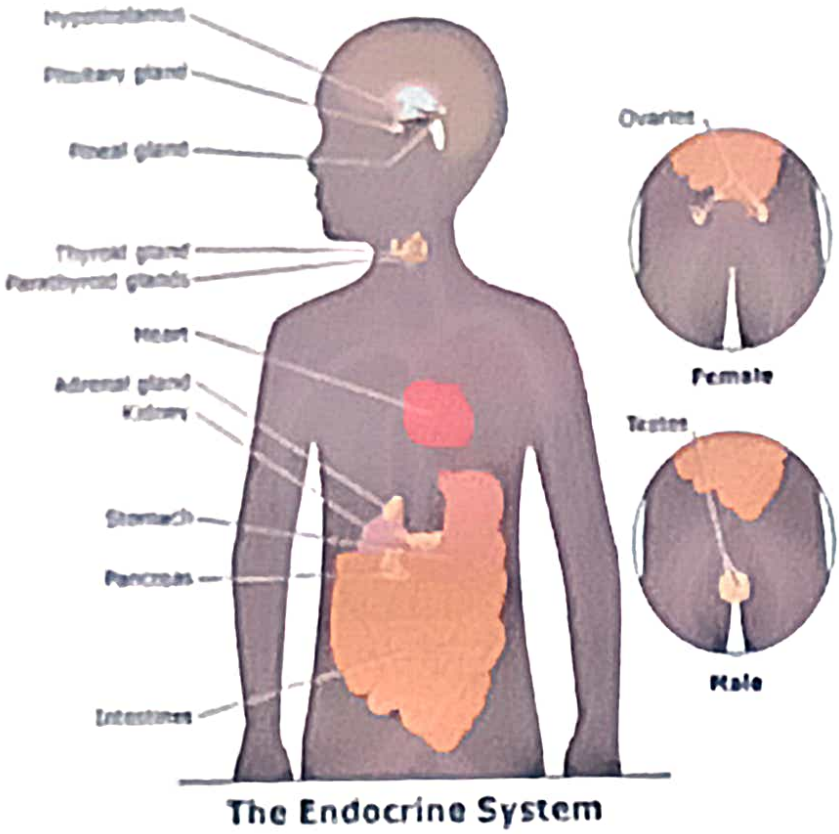
What is the endocrine system?



The endocrine system is made up of glands and the hormones they secrete. Although the endocrine glands are the primary hormone producers, the brain, heart, lungs, liver, skin, thymus, gastrointestinal mucosa, and placenta also produce and release hormones.

What is the endocrine system?

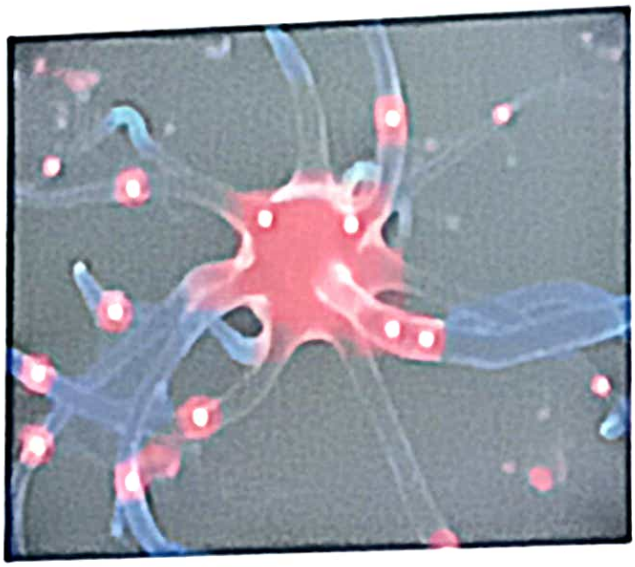
The primary endocrine glands are the pituitary (the master gland), pineal, thyroid, parathyroid, islets of Langerhans, adrenals, ovaries in the female and testes in the male.



The Endocrine System

The function of the endocrine system is the production and regulation of chemical substances called hormones.

Hormones...

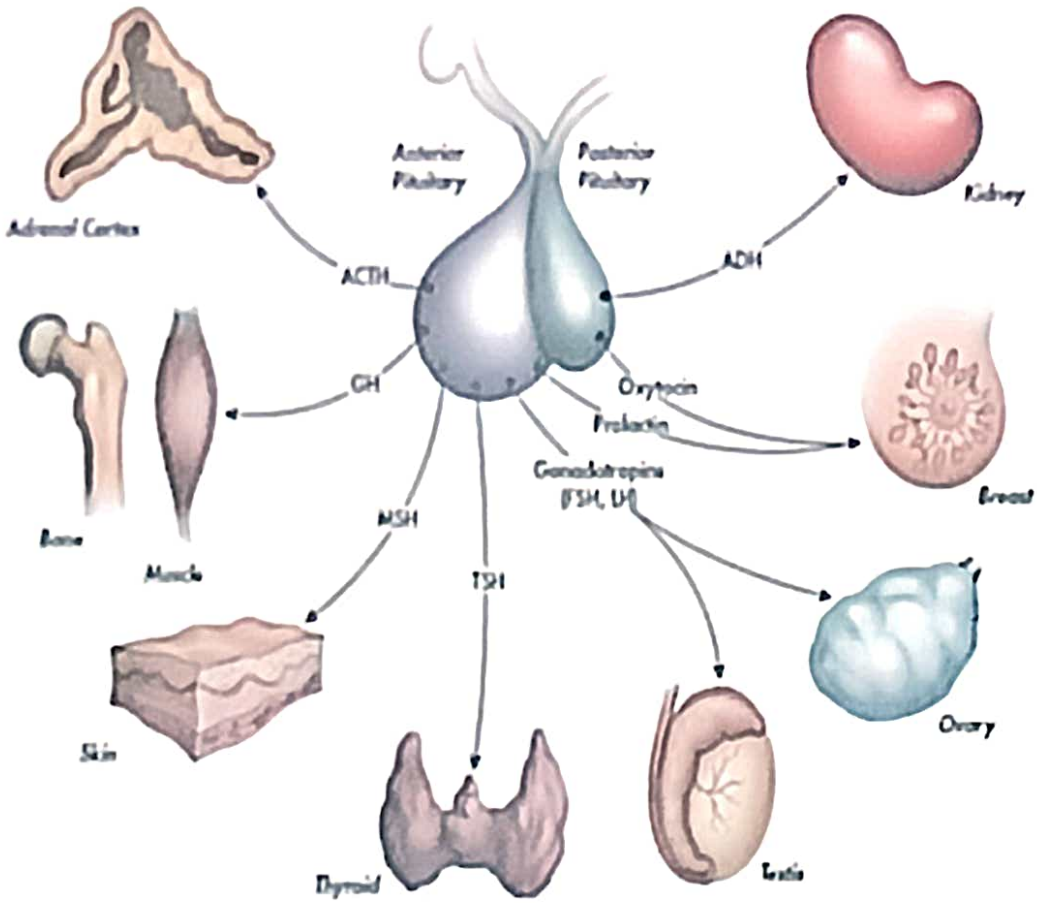


A hormone is a chemical transmitter. It is released in small amounts from glands, and is transported in the bloodstream to target organs or other cells. Hormones are chemical messengers, transferring information and instructions from one set of cells to another.

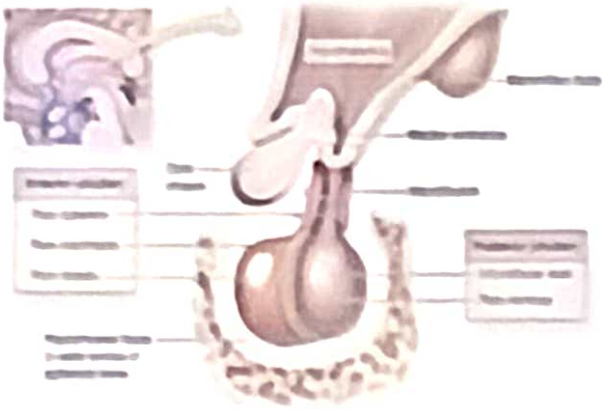
Hormones...

Hyposecretion or hypersecretion of any hormone can be harmful to the body. Controlling the production of hormones can treat many hormonal disorders in the body.

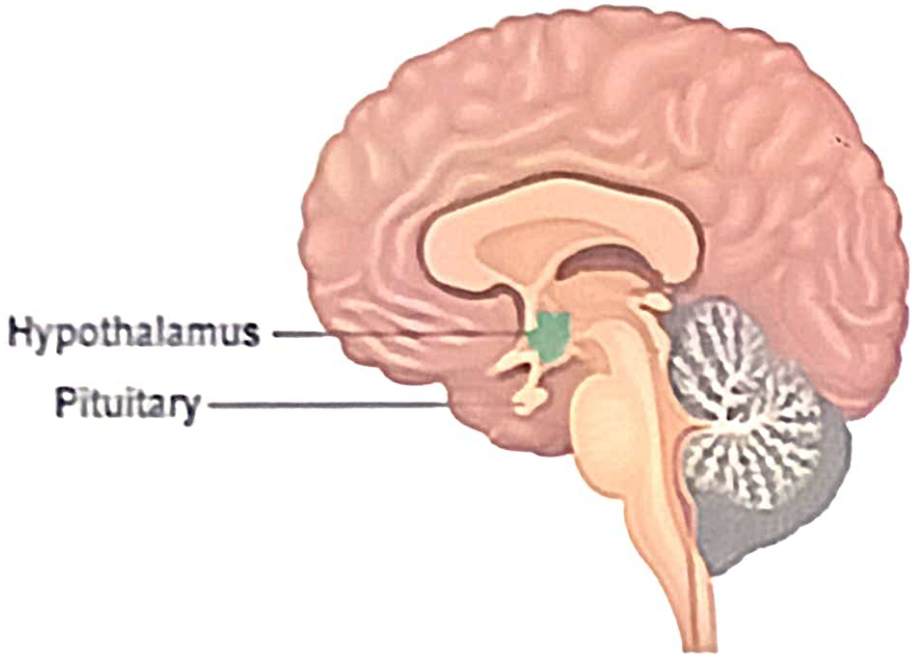
Hormones regulate growth, development, mood, tissue function, metabolism, and sexual function.



Hormones...



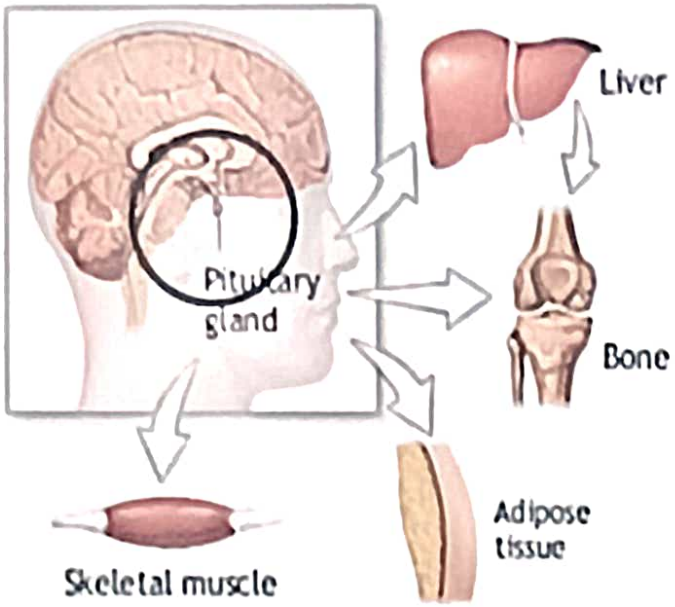
The pituitary gland has 2 lobes...



The endocrine system and nervous system work together to help maintain **homeostasis**... balance. The hypothalamus is a collection of specialized cells located in the brain and is the primary link between the two systems. It produces chemicals that either stimulate or suppress hormone secretions of the pituitary gland.

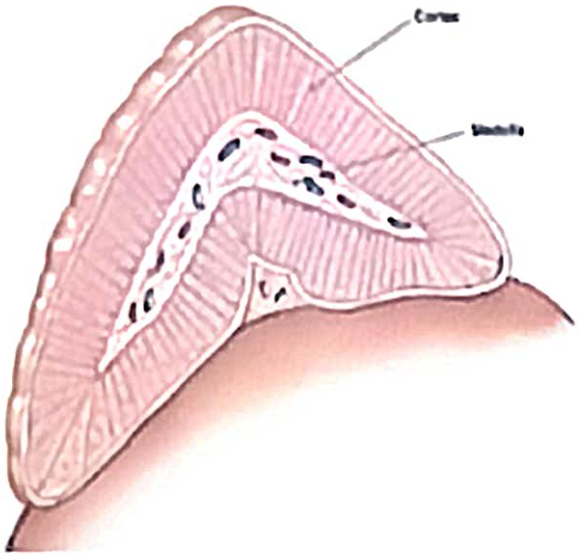
Secretions from the anterior pituitary gland...

Growth Hormone (GH): essential for the growth and development of bones, muscles, and other organs. It also enhances protein synthesis, decreases the use of glucose, and promotes fat destruction.

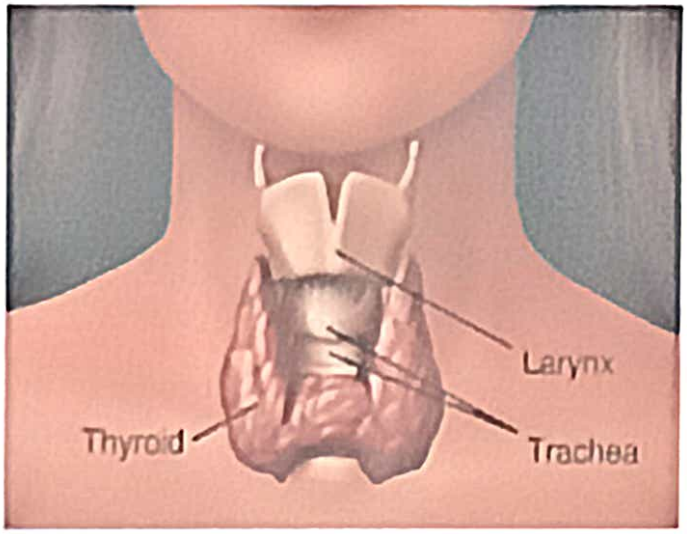


Secretions from the anterior pituitary gland...

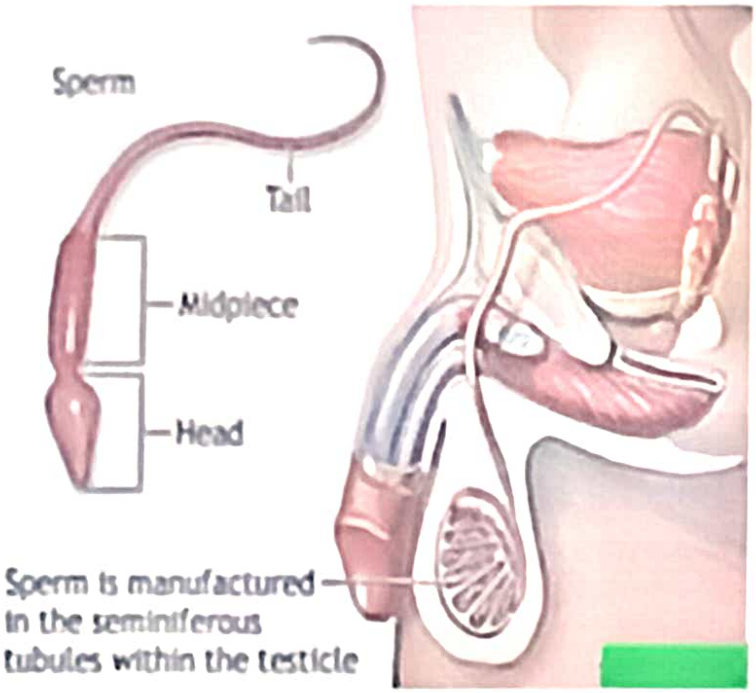
Adrenocorticotropin (ACTH): essential for the growth of the adrenal cortex.



Thyroid-Stimulating Hormone (TSH): essential for the growth and development of the thyroid gland.

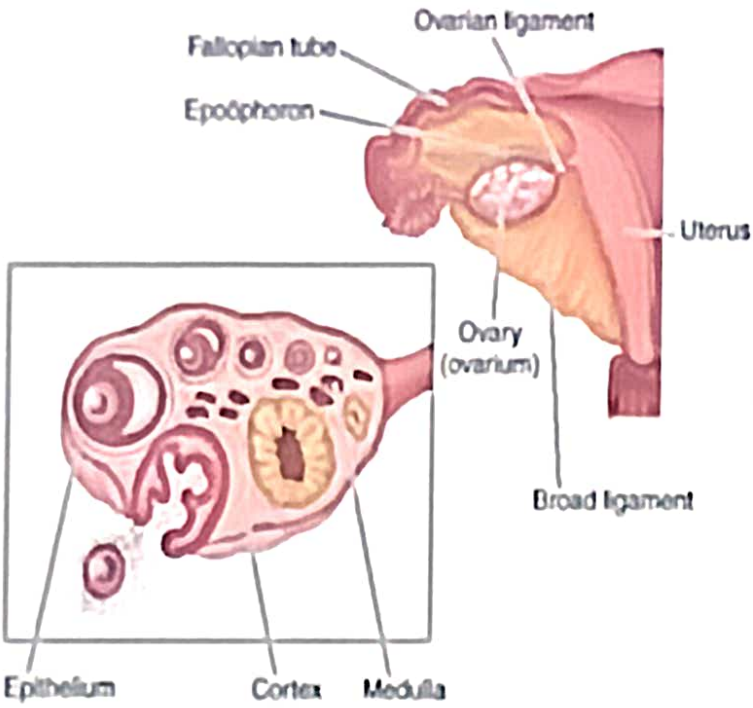


Secretions from the anterior pituitary gland...

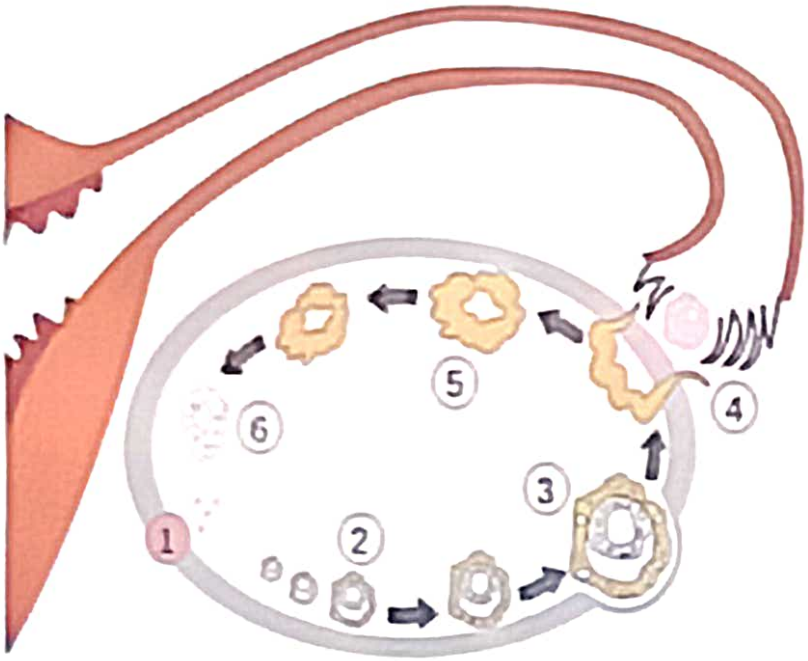


Follicle-Stimulating Hormone (FSH): is a gonadotropic hormone.

It stimulates the growth of ovarian follicles in the female and the production of sperm in the male.



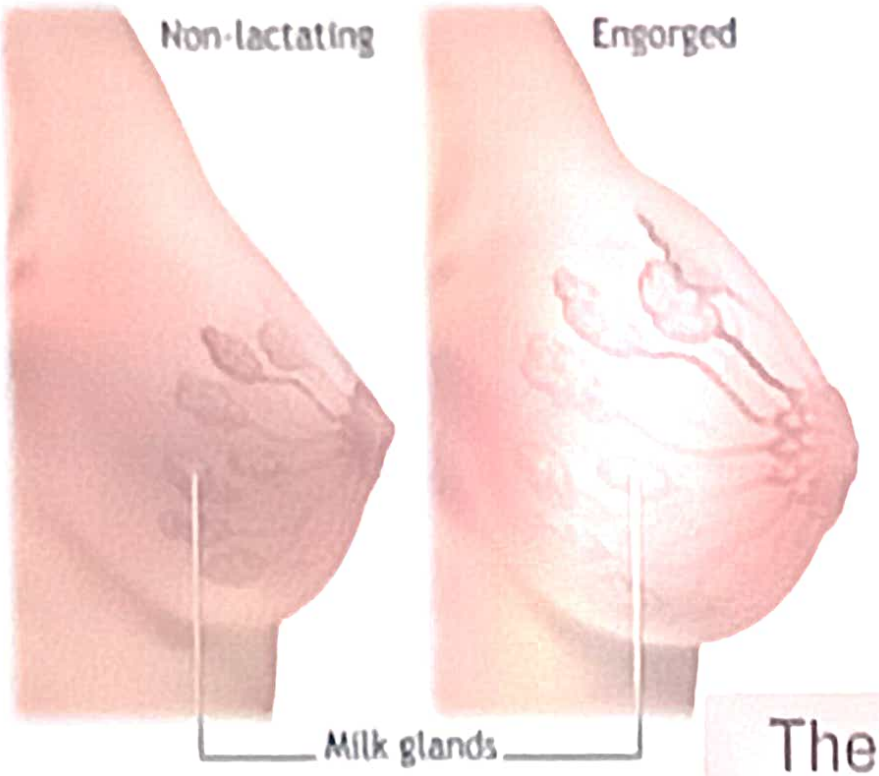
Secretions from the anterior pituitary gland...



The yellow corpus luteum remains after ovulation; it produces **estrogen** and **progesterone**.

Luteinizing Hormone (LH): is a gonadotropic hormone stimulating the development of corpus luteum in the female ovarian follicles and the production of testosterone in the male.

Secretions from the anterior pituitary gland...



Prolactin (PRL): stimulates the development and growth of the mammary glands and milk production during pregnancy.

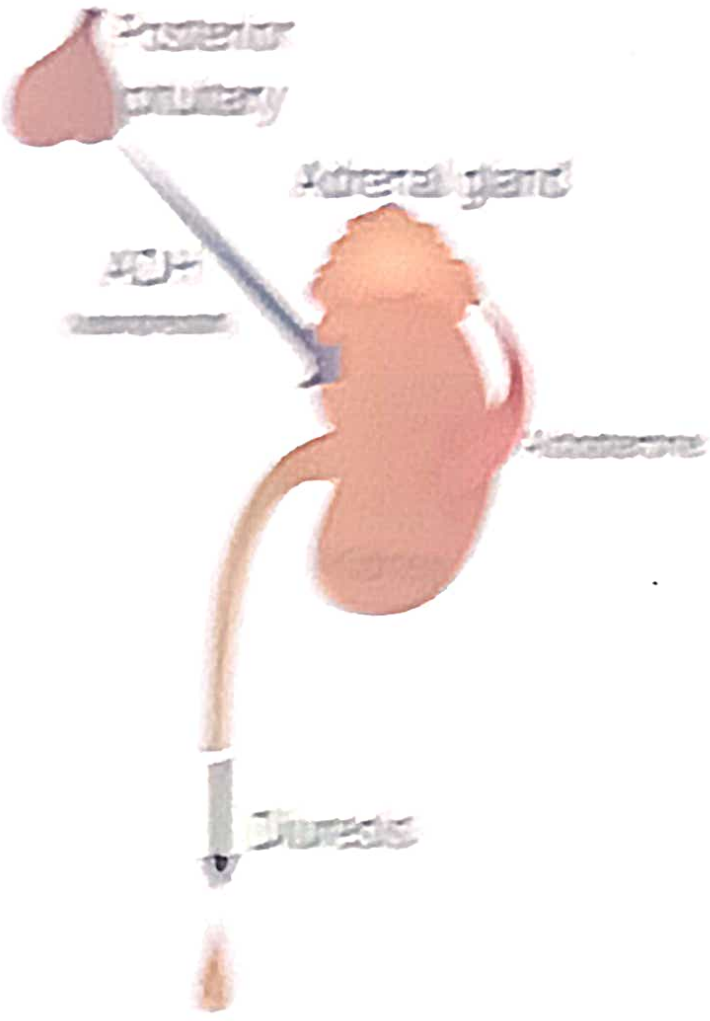
The sucking motion of the baby stimulates prolactin secretion.

Secretions from the anterior pituitary gland...

Melanocyte-stimulating hormone (MSH): regulates skin pigmentation and promotes the deposit of melanine in the skin after exposure to sunlight

Secretions from the posterior lobe of the pituitary gland...

Antidiuretic Hormone (ADH): simulates the reabsorption of water by the renal tubules. Hypersecretion of this hormone can result in diabetes insipidus.



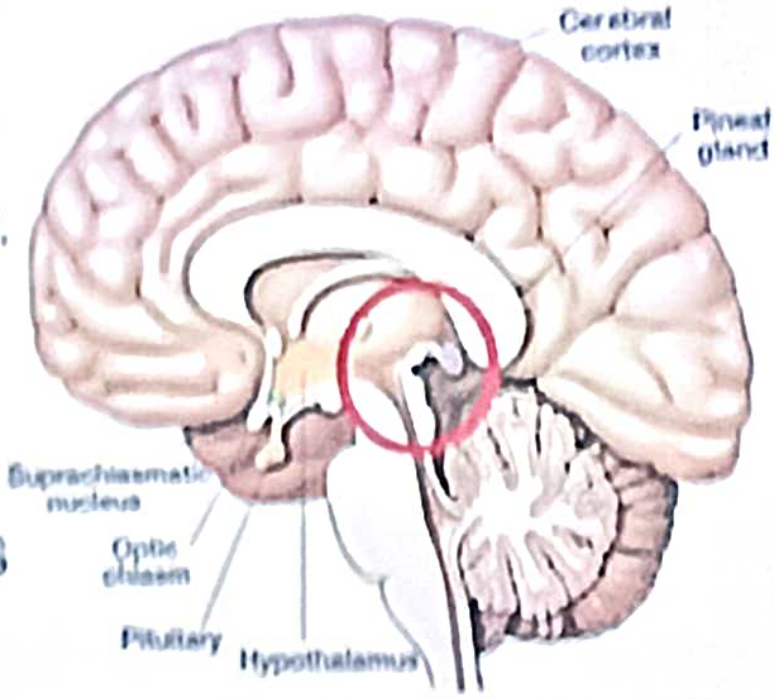
Secretions from the posterior lobe of the pituitary gland...

Oxytocin: stimulates the uterus to contract during labor, delivery, and parturition. A synthetic version of this hormone, used to induce labor, is called Pitocin. It also stimulates the mammary glands to release milk.

Secretions from the pineal gland...

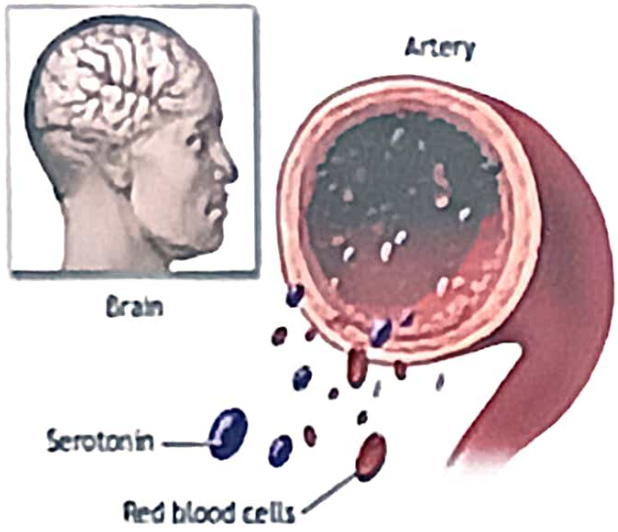
The pineal gland is pine-cone-shaped and only about 1 cm in diameter.

Melatonin: communicates information about environmental lighting to various parts of the body. Has some effect on sleep/awake cycles and other biological events connected to them, such as a lower production of gastric secretions at night.



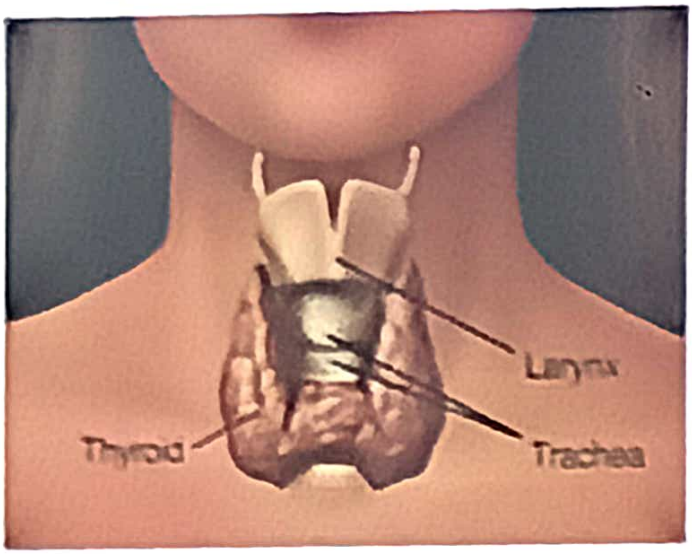
Secretions from the pineal gland...

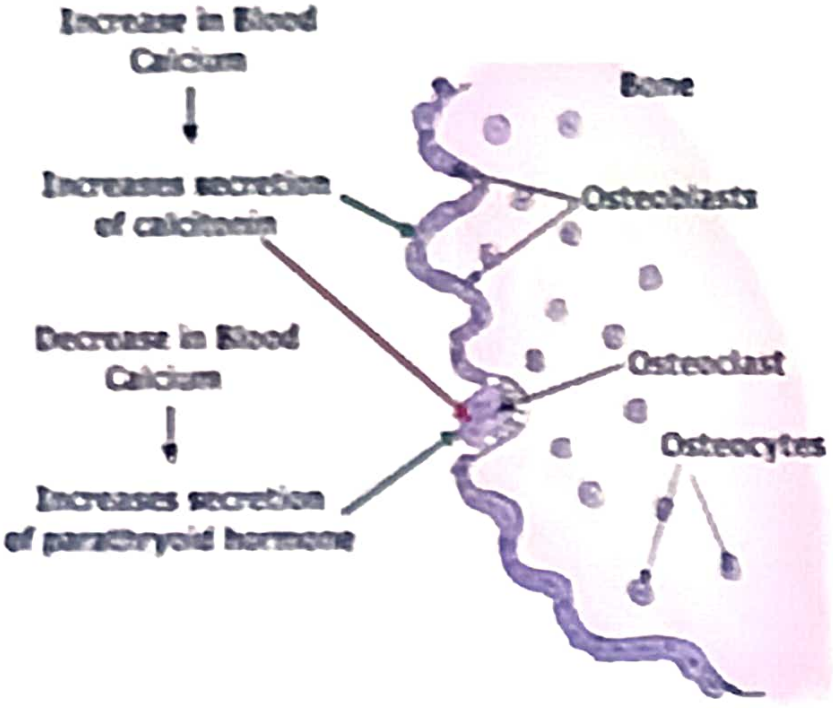
Serotonin: a neurotransmitter that regulates intestinal movements and affects appetite, mood, sleep, anger, and metabolism.



Secretions of the thyroid gland...

The thyroid gland plays a vital role in metabolism and regulates the body's metabolic processes.





Calcitonin: influences bone and calcium metabolism; maintains a homeostasis of calcium in the blood plasma

Secretions of the thyroid gland...

Thyroxine (T4) and **triodothyronine (T3):** essential to BMR – basal metabolic rate (the rate at which a person's body burns calories while at rest); influences physical/mental development and growth

Hyposecretion of T3 and T4 = cretinism, myxedema, Hashimoto's disease

Hypersecretion of T3 and T4 = Grave's disease, goiter, Basedow's disease

Secretions of the parathyroid gland...

The two pairs of parathyroid glands are located on the dorsal or back side of the thyroid gland. They secrete **parathyroid (PTH)** which plays a role in the metabolism of phosphorus. Too little results in cramping; too much results in osteoporosis or kidney stones.