

The Endocrine System

Learning objectives

- To define the term 'hormone' and understand the differences between the endocrine system and the nervous system
- To understand the difference between endocrine and exocrine glands and describe the location of the main endocrine glands in the human body
- To give one example of a hormone for each endocrine gland, and describe its functions
- To describe the deficiency symptoms, excess symptoms and corrective measures for one hormone
- To give two examples of hormone supplements and how they are used
- **HIGHER** To describe the feedback mechanism of one hormone system in animals.

The Endocrine System

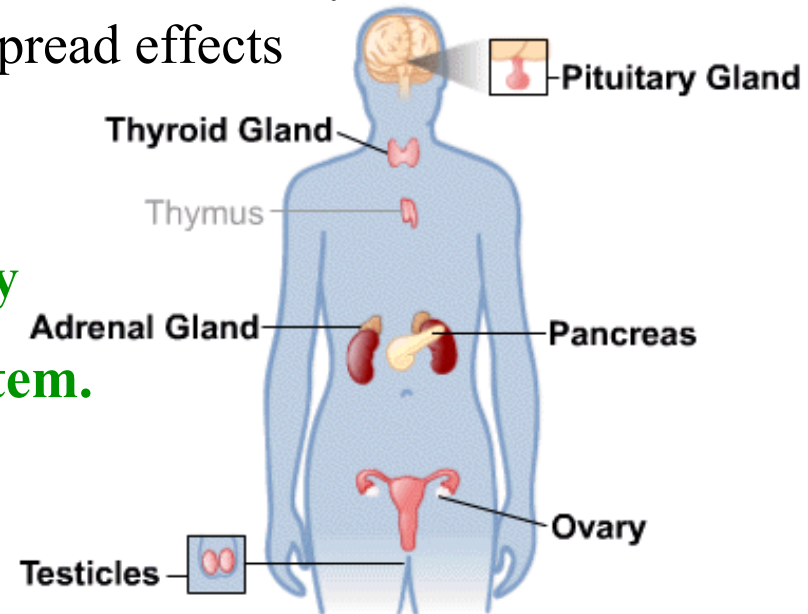
Body Coordination

This is controlled by the **nervous** and **endocrine** systems.

The endocrine system is,

1. **Slow** acting
2. Based on **hormones**
3. Has a slow transmission rate around the body
4. Produces **long-lasting**, widespread effects

The nervous system is basically
the opposite of the endocrine system.



Glands

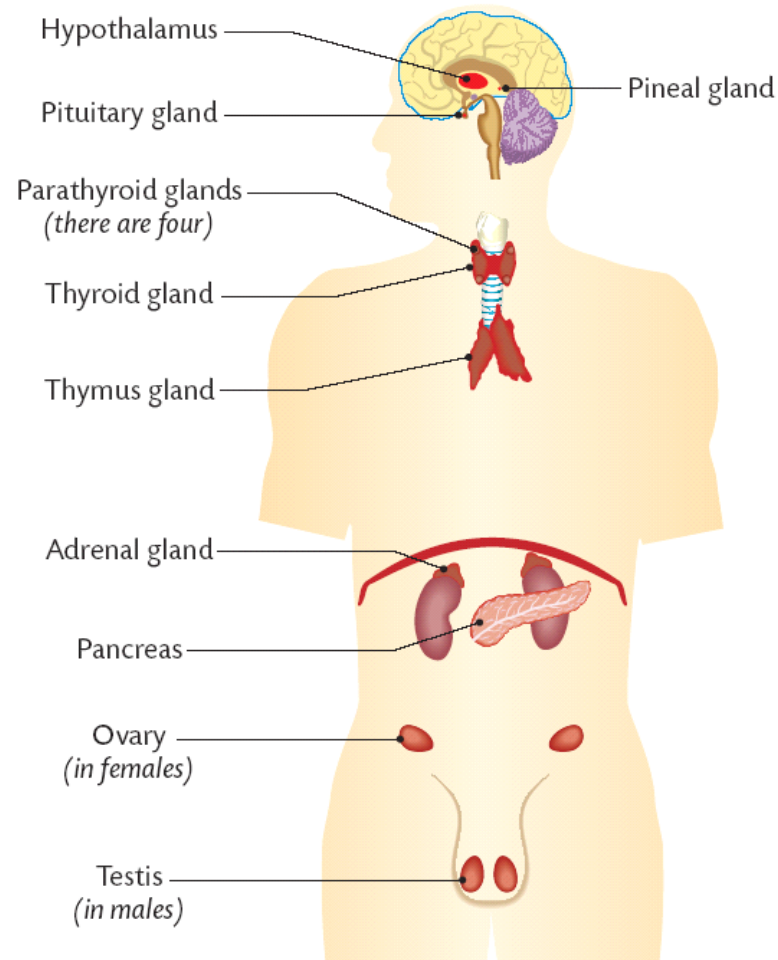
Exocrine glands - have **ducts** into which they secrete hormones.

Endocrine glands - secrete hormones **straight** into body tissues and then to blood.

A ***hormone*** is a chemical messenger produced by an endocrine gland and carried by the bloodstream to another part of the body where it has a specific effect.

Most hormones are made of protein, although some are steroid based. Once produced, hormones remain active for a long time.

There are **10 main endocrine glands** in the body. However, other organs such as the stomach, kidneys, heart and brain also make hormones.



Role of Main Glands

Pituitary Gland

Called the **master** gland. Produces hormones that control all the glands in the body. For example, it produces, FSH, LH, and **GH** (*growth hormone*). It causes the body to absorb more amino acids and so increases growth. Overproduction of this hormone causes gigantism and underproduction causes dwarfism.

Hypothalamus

Links the nervous and endocrine systems.

Controls the pituitary gland in response to messages from brain and other hormones.

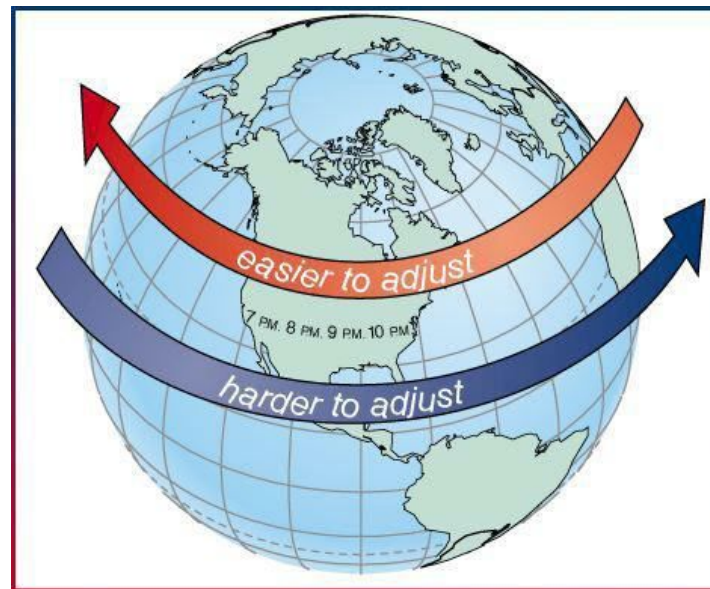
There are 2 types of hormones, '**releasing**' and '**inhibiting**'. Releasing hormones cause **production** of hormones of the pituitary gland. Inhibiting hormones inhibit or **stop** the production of hormones.



Pineal Gland

A tiny gland in the brain produces many hormones such as *melatonin*. This hormone is involved in sleep, ovulation, sexual maturity and activity patterns.

It may also play a role in jet-lag.



Thyroid

A H-shaped gland in the back of the neck.

The hormone **thyroxine** controls the rate of a person's metabolism.

Underactive thyroid gland

Under production in young children produces stunted growth, called **cretinism**. In an adult a deficiency is seen as tiredness, lack of energy, slow mental and physical activity and weight gain. This is known as Myxoedema or **Goitre**.



Goitre

Goitre is an enlargement of the thyroid gland. It normally indicates the underproduction of thyroxine. This is usually caused by a lack of **iodine** in the diet (sources of iodine are **seafood** and iodised table salt). This form of goitre can be treated by increasing the intake of iodine in the diet.

Overactive thyroid gland

Over production of thyroxine increase the metabolic rate by up to 60%. This causes symptoms such as bulging eyes, hunger, loss of weight, heat production, nervousness, irritability, and anxiety.

This is called **Graves** disease.

It can be cured by removing part of the thyroid or by killing part of the gland with radioactive iodine



Parathyroids

The 4 parathyroid glands are embedded in the thyroid gland.

They make *Parathormone*, which stimulates the release of **calcium** from bones into blood plasma. Calcium is lost from the body this way and so adults must keep taking calcium to prevent damage to bones.



Thymus

Located behind the breastbone in the upper chest.

The thymus gland produces a hormone **thymosin**, which causes white bloodcells to mature and become active. The thymus brakes down at puberty and stops work in middle age.

Adrenals

The 2 adrenal glands are on top of the kidneys. They produce adrenalin and other hormones that help the body cope with stress.

The Effects of Adrenaline

- It increases blood flow to the heart, muscles and brain.
- It reduces blood flow to the skin, which makes the skin look pale.
- It opens the bronchioles allowing more oxygen into the lungs.
- It converts glycogen to glucose and adds more glucose to the blood.
- It increases the heartbeat.
- Muscular contractions increase in strength.
- It increases mental alertness.



Pancreas

The pancreas is an exocrine and endocrine gland. The most important hormone produced here is insulin. It is the only hormone that reduces blood glucose levels. Glucose is absorbed from the blood into fat and muscle cells. It is converted to Glycogen and this is stored in the liver and muscles.

Hormone Supplements

Insulin

Low insulin production or an inability of cells to take up insulin results in a disorder called diabetes. In young people it normally causes a failure to produce insulin for life.

The symptoms of diabetes are

- High glucose concentration in the blood and urine,
- Large amounts of urine being made
- Severe thirst,
- Loss of weight and tiredness.

Diabetes is controlled by regular injections (1 to 4 a day). Also the intake of carbohydrates is controlled, physical activity is increased and normal weight is maintained.



Anabolic Steroids

These are drugs that build up **muscle**. They are similar to the male sex hormone **testosterone**. They increase muscle size, strength and speed up the recovery of muscle after exercise.

They also have many **side effects** such as liver and adrenal gland damage, failure of males to have erections and production of male traits in females.

Steroids are sometimes given to **animals** to increase muscle mass and they also produce lean meat. This is banned in the E.U. as the hormones may get into the human food chain.



Control of Thyroxine levels

This is similar to the control of a central heating system.

It is called **negative feedback**

If thyroxine levels are **normal** then it **inhibits** the pituitary gland from releasing thyroid-stimulating hormone, this means no more thyroxine is made.

If the levels of thyroxine are **too low** the pituitary gland **produces** thyroid-stimulating hormone, which causes more thyroxine to be made by the thyroid gland, until thyroxine concentration is returned to normal again.

