

THE HUMAN ENDOCRINE SYSTEM

Refer to the diagram of the Human Endocrine System in your textbook.

- ◆ **Hormone** – A hormone is a chemical secreted by an endocrine gland and carried in the bloodstream to target organs where it performs a specific function.
- ◆ **Functions of Hormones** – The varying actions performed by hormones may be fast-acting (e.g. Adrenaline is a hormone that rapidly speeds up the heart and breathing rates when we get a fright), or may be slow-acting (e.g. Human Growth Hormone regulates the many body processes involved in growing from conception to death).
- ◆ **Endocrine Glands** – These glands are ductless. They produce and secrete hormones directly into the bloodstream.
- ◆ **Pituitary Gland** – This gland lies in the brain and is the master gland of the endocrine system because it controls many other endocrine glands.

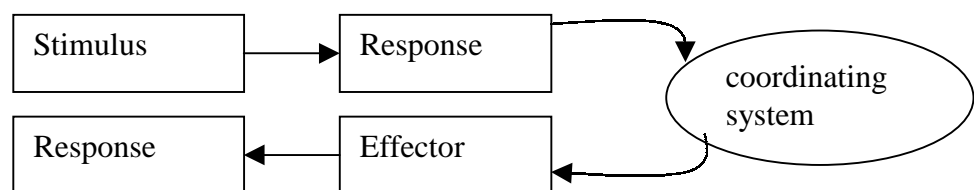
EXAMPLES OF SOME ENDOCRINE GLANDS	HORMONE SECRETED	TARGET ORGAN	EFFECT ON BODY
Pituitary	thyrotrophin	thyroid	controls secretion of thyroxine
	corticotrophin	adrenal glands	controls secretion of cortisol
	gonadotrophin	gonads	controls secretion of sex hormones
	human growth hormone (HGH)	all cells	promotes body growth
	anti-diuretic hormone (ADH)	kidneys	promotes water reabsorption
	oxytocin	uterus	contracts uterus
	prolactin	breasts	controls breast milk secretion
Thyroid	thyroxine	all cells	controls metabolism
Parathyroid	parathyroid hormone	bones, kidneys	increases blood calcium
Adrenal	adrenaline ('fight or flight' hormone)	most cells	controls blood circulation, increases heart rate blood glucose and blood flow
	cortisol	most cells	controls metabolism of fats carbohydrates and proteins
	sex hormones	gonads	development of sex characteristics

Pancreas	insulin	all cells	lowers blood glucose
	glucagon	all cells	increase blood glucose
Gonads (Testes and Ovaries)	oestrogen	sex organs	female sex characteristics
	progesterone	sex organs	regulates menstrual cycle
	testosterone	sex organs, muscle	male sex characteristics, promotes growth

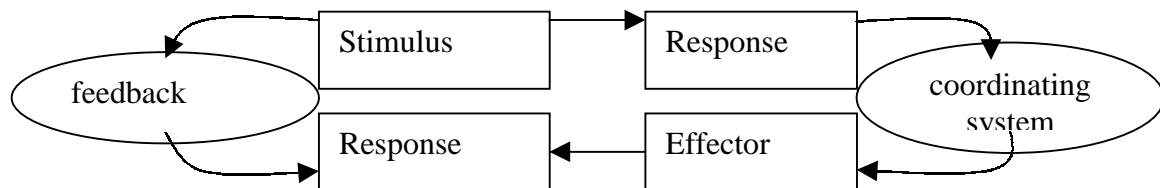
HOMEOSTASIS (or 'BODY BALANCE')

- ◆ Homeostasis – This is the tendency to maintain stability or uniformity in an organism's internal environment. An internal balance is maintained of body temperature, and of chemicals such as water, glucose, urea, salts and carbon dioxide. Homeostasis involves both the nervous and endocrine systems.

A STIMULUS-RESPONSE MODEL



A STIMULUS-RESPONSE MODEL WITH FEEDBACK CONTROL



POSITIVE AND NEGATIVE FEEDBACK

- ◆ Negative feedback mechanisms are the most common. They are stimulus-response mechanisms in which the response produced decreases the original stimulus. For example, if the human body temperature rises above 37°C, the response is sweating to lower the body temperature back to normal.
- ◆ Positive feedback mechanisms are those in which the stimulus causes a change that increases, rather than decreases, the original stimulus. An example of positive feedback is the action potential of a nerve cell.

EXAMPLES OF POSITIVE AND NEGATIVE FEEDBACK

Refer to your textbook for examples of positive and negative feedback. Ensure that you understand and can describe two detailed examples of each type.

- ◆ Maintaining Human Body Temperature (37°C)
 1. If body temperature rises above 37°C – The temperature is measured by the medulla oblongata (also called the hindbrain or the brain stem) as blood passes through it. The skin produces sweat which cools the body by using excess body heat to evaporate it. Also the body can consume cool drinks, find cool shade, radiate heat through the skin or by breathing out warm air, and by defaecation or urination.
 2. If body temperature falls below 37°C – The muscles may shiver to produce heat through friction, skin muscles may contract to produce insulating air pockets next to the skin with ‘goosebumps’ and upright hairs, the body consumes warm drinks or finds warm shelter to increase the body temperature.

- ◆ Regulation of Blood Glucose Level – Soon after a meal, carbohydrates are broken down to simple sugars such as glucose. The glucose is absorbed into the bloodstream from the small intestine. If there is excess blood glucose, the hormone insulin (from the Islets of Langerhans in the pancreas) converts the excess blood glucose to glycogen which is stored temporarily in the liver. However some time after the meal when blood glucose is low, the hormone glucagon (also made in the pancreas) reconverts the stored glycogen into glucose in the blood.

- ◆ Regulation of Carbon Dioxide Level and Breathing

The medulla oblongata measures the amount of carbon dioxide in the blood. If there is too much carbon dioxide, the medulla oblongata relaxes the chest muscles and diaphragm, decreasing the chest cavity and lungs, and expelling excess carbon dioxide out of the lungs.

- ◆ Maintaining Water Balance

Water is essential to the body for chemical reactions to take place within cells. The amount of water consumed in food and drink should equal the amount of water lost through breathing out, sweating, urination and defaecation. If there is too little water in the blood, the pituitary gland produces more anti-diuretic hormone (ADH) which travels to the kidneys permitting more water to be reabsorbed back into the bloodstream. If there is excess water in the blood, the amount of ADH decreases and less water is reabsorbed.

- ◆ Maintaining Salt Balance

Excess salt in humans is excreted in both urine and sweat. Most plants cannot survive in saline soil. Some mangrove plants that live in tidal areas have adapted to salty conditions by having specialised mechanisms for salt removal. Excess salt absorbed from the soil is concentrated in the leaves, either forming salt crystals on the leaves, or by the excessively salty leaves dropping from the tree. Such plants are called halophytes (‘salt-loving’).