

80: THE ENDOCRINE SYSTEM (an overview)

The endocrine system is the name we give to the major glands of the body. Many of these glands cooperate with each other or with other body parts to keep the body in balance (**homeostasis**).

First, we should review the difference between endocrine glands and exocrine glands. The **exocrine glands** secrete their products into ducts. Exocrine glands include sweat and oil glands, salivary glands, milk glands, and digestive glands in the stomach and intestines. **Endocrine glands** don't have ducts, and secrete their products right into the blood stream. The hormones secreted by endocrine glands act as messengers, carrying instructions to other cells, often cells that are quite far away in a different part of the body.

A **hormone** is a messenger molecule. These messenger molecules can be made of amino acids (**peptide hormones**) or cholesterol (**steroid hormones**). Peptide hormones never enter a cell. Their shape fits into a receptor molecule on the surface of a cell. The peptide molecule fits into the receptor like a key fits into a lock. Once locked in, the receptor causes an ATP to lose 2 phosphates, turning it into a molecule called **cyclic AMP (Adenosine MonoPhosphate)**. "cAMP" is now the new messenger molecule, since the hormone has to stay outside the cell. The hormone molecule will eventually be torn apart and its atoms recycled.

Steroid hormones are nonpolar (hydrophobic) because they have cholesterol as part of their structure. The interior of the plasma membrane is also nonpolar (hydrophobic) and even has cholesterol molecules floating in it. So the steroid hormones have chemistry that gets along well with the interior of the plasma membrane. This means that steroids can just slip right through the membrane, with no channel protein needed. Once inside the cell, they will then bind with some kind of receptor molecule, either in the cytoplasm or inside the nucleus. The final result is that this "complex" (receptor and hormone stuck together) will then bind to a certain place on the DNA and allow that section of DNA to be copied into messenger RNA. The mRNA will then go out of the nucleus and find a ribosome that can translate it into a protein. This takes a while, so the effects of steroid hormones are slower but longer lasting. In contrast, peptide hormones act quickly and strongly.

This lesson will just give a list of the glands in the endocrine system, then we'll go into more detail in the next lessons. Also, some of these glands have been covered in past lessons.

PITUITARY GLAND

This has two parts, the anterior and the posterior. The anterior makes TSH (thyroid stimulating hormone), ACTH (adrenocorticotropic hormone), FSH (follicle stimulating hormone), LH (luteinizing hormone) and GH (growth hormone). The posterior pituitary makes ADH (antidiuretic hormone) and oxytocin. More on all of these in the next two lessons.

HYPOTHALAMUS

Makes hormones that affect the pituitary gland.

PINEAL GLAND

Makes melatonin, which helps to regulate the sleep/wake cycle (circadian rhythm).

THYROID

Makes T_3 and T_4 for regulating metabolism (how fast the body burns energy), and calcitonin for lowering calcium in blood by decreasing the activity of the osteoclasts (the cells that dissolve bone).

PARATHYROID

This is actually 4 separate spots on the outside of the thyroid. They make PTH (parathyroid hormone) which increases the calcium level in the blood by stimulating the osteoclasts to dissolve more bone.

THYMUS

Trains T cells during childhood. (Lesson 46)

PANCREAS

The Islets of Langerhans make insulin and glucagon that control glucose level in blood. (Lesson 71)

ADRENAL GLANDS

They have two parts: an inner medulla and an outer cortex. The medulla makes epinephrine (adrenalin) and norepinephrine. The cortex makes aldosterone (which affects the kidneys) and cortisol which affects glucose levels and is also anti-inflammatory.

OVARIES and TESTES

Make sex hormones (estrogen, progesterone, and testosterone) that control development in puberty as well as reproduction in adulthood. More on these in future lessons.