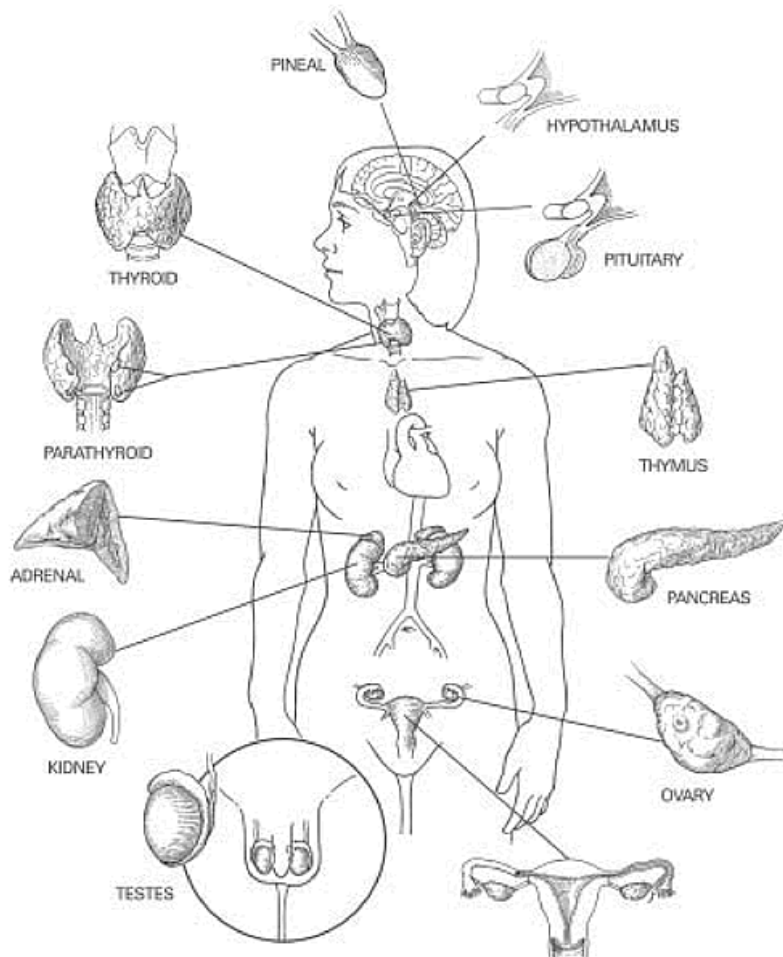


The Endocrine System

This information is provided by The Hormone Foundation at <http://www.hormone.org/endo101/index.html>. The Hormone Foundation is an independent, nonprofit organization established by the international Endocrine Society.

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The endocrine system is one of the body's main systems for communicating, controlling, and coordinating the body's work. The endocrine system - a series of organs called glands - works with other body systems. The glands, which produce substances called hormones, work with the nervous system, reproductive system, kidneys, gut, liver and fat to help maintain and control the following:

- body energy levels
- reproduction
- growth and development

- internal balance of body systems, called homeostasis
- responses to surroundings, stress, and injury

The endocrine system accomplishes these tasks via a network of glands and organs that produce, store, and secrete certain hormones.

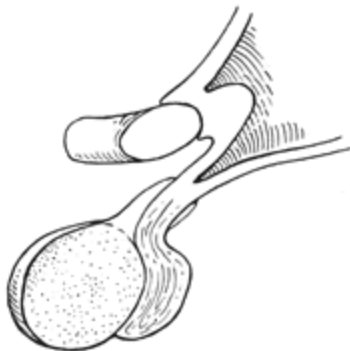
Hormones are special chemicals that move into body fluid after they are made by one cell or a group of cells. Hormones cause an effect on other cells or tissues of the body.

Endocrine glands make hormones that are used inside the body. Other glands make substances like saliva, which reach the outside of the body. Endocrine glands and endocrine-related organs are like factories. They produce and store hormones and release them as needed. When the body needs these substances, the bloodstream carries the hormones to specific targets. These targets may be organs, tissues, or cells. To function normally, the body needs glands that work correctly, a blood supply that works well to move hormones through the body to their target points, receptor places on the target cells for the hormones to do their work, and a system for controlling how hormones are produced and used.

What could go wrong? Endocrine disorders happen when one or more of the endocrine systems in your body are not working well. Hormones may be released in amounts that are too great or too small for the body to work normally. There may not be enough receptors, or binding sites, for the hormones so that they can direct the work that needs to be done. There could be a problem with the system regulating the hormones in the blood stream, or the body may have difficulty controlling hormone levels because of problems clearing hormones from the blood. For example, a person's liver or kidneys may not be working well and this might keep too high a hormone level in the bloodstream.

If you or your primary care physician suspects that you have an endocrine disorder, you may need a specialist called an endocrinologist. An endocrinologist is a specially trained doctor who diagnoses and treats diseases that affect your glands and hormone levels (endocrine system). They know how to treat conditions, which are often complex and involve many systems and structures within your body. Your regular doctor refers you to an endocrinologist when you have a problem with your endocrine system.

Pituitary Gland



The pituitary gland is sometimes called the "master gland" because of its great influence on the other body organs. Its function is complex and important for overall well-being.

The pituitary gland is divided into two parts, front (anterior) and back (posterior).

The **anterior pituitary** produces several hormones:

- **Prolactin** or PRL - PRL stimulates milk production from a woman's breasts after childbirth and can affect sex hormone levels from the ovaries in women and the testes in men.
- **Growth hormone or GH** - GH stimulates growth in childhood and is important for maintaining a healthy body composition. In adults it is also important for maintaining muscle mass and bone mass. It can affect fat distribution in the body. (For more information go to the [Growth](#) section on this site)
- **Adrenocorticotropin or ACTH** - ACTH stimulates production of cortisol by the adrenal glands. Cortisol, a so-called "stress hormone," is vital to survival. It helps maintain blood pressure and blood glucose levels.
- **Thyroid-stimulating hormone or TSH** - TSH stimulates the thyroid gland to make thyroid hormones, which, in turn, control (regulate) the body's metabolism, energy, growth and development, and nervous system activity.
- **Luteinizing hormone or LH** - LH regulates testosterone in men and estrogen in women.
- **Follicle-stimulating hormone or FSH** - FSH promotes sperm production in men and stimulates the ovaries to release eggs (ovulate) in women. LH and FSH work together to allow normal function of the ovaries or testes.

The **posterior pituitary** produces two hormones:

- **Oxytocin** - Oxytocin causes milk letdown in nursing mothers and contractions during childbirth.
- **Antidiuretic hormone or ADH** - ADH, also called vasopressin, is stored in the back part of the pituitary gland and regulates water balance. If this hormone is not secreted properly, this can lead to problems of sodium (salt) and water balance, and could also affect the kidneys so that they do not work as well.

In response to over- or underproduction of pituitary hormones, the target glands affected by these hormones can produce too many or too few hormones of their own. For example, too much growth hormone can cause gigantism, or excessive growth, while too little GH may cause dwarfism, or very short stature.

Hypothalamus

The hypothalamus is part of the brain that lies just above the pituitary gland. It releases hormones that start and stop the release of pituitary hormones. The hypothalamus controls hormone production in the pituitary gland through several "releasing" hormones. Some of these are growth hormone-releasing hormone, or GHRH (controls GH release); thyrotropin-releasing hormone, or TRH (controls TSH release); and corticotropin-releasing hormone, or CRH (controls ACTH release). Gonadotropin-releasing hormone (GnRH) tells the pituitary gland to make luteinizing hormone (LH) and follicle-stimulating hormone (FSH), which are important for normal puberty.

Thymus



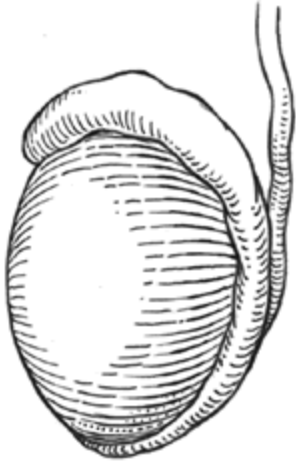
The thymus is a gland needed early in life for normal immune function. It is very large just after a child is born and weighs its greatest when a child reaches puberty. Then its tissue is replaced by fat. The thymus gland secretes hormones called humoral factors. These hormones help to develop the lymphoid system, which is a system throughout the body that help it to reach a mature immune response in cells to protect them from invading bodies, like bacteria.

Pineal Gland



Scientists are still learning how the pineal gland works. They have found one hormone so far that is produced by this gland: melatonin. Melatonin may stop the action of (inhibit) the hormones that produce gonadotropin, which causes the ovaries and testes to develop and function. It may also help to control sleep patterns.

Testes



Males have twin reproductive glands, called testes, that produce the hormone testosterone. Testosterone helps a boy develop and then maintain his sexual traits. During puberty, testosterone helps to bring about the physical changes that turn a boy into an adult male, such as growth of the penis and testes, growth of facial and pubic hair, deepening of the voice, increase in muscle mass and strength, and increase in height. Throughout adult life, testosterone helps maintain sex drive, sperm production, male hair patterns, muscle mass, and bone mass.

Testicular cancer, which is the most common form of cancer for males between ages 15 and 35, may need to be treated by surgical removal of one or both testicles. The resulting decrease or absence of testosterone may cause decreased sexual drive, impotence, altered body image, and other symptoms.

Ovaries



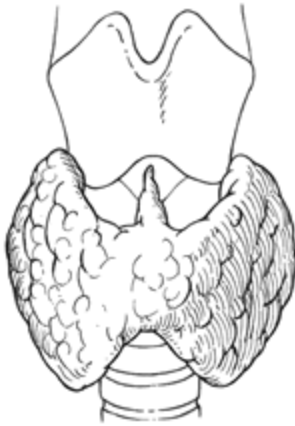
The two most important hormones of a woman's twin reproductive glands, the ovaries, are estrogen and progesterone. These hormones are responsible for

developing and maintaining female sexual traits, as well as maintaining a pregnancy. Along with the pituitary gonadotropins (FH and LSH), they also control the menstrual cycle. The ovaries also produce inhibin, a protein that curbs (inhibits) the release of follicle-stimulating hormone from the anterior pituitary and helps control egg development.

The most common change in the ovarian hormones is caused by the start of menopause, part of the normal aging process. It also can occur when ovaries are removed surgically. Loss of ovarian function means loss of estrogen, which can lead to hot flashes, thinning vaginal tissue, lack of menstrual periods, mood changes and bone loss, or osteoporosis.

A condition called polycystic ovary syndrome (PCOS) is caused by overproduction of male hormones in females. PCOS can affect menstrual cycles, fertility, and hormone levels, as well as cause acne, facial hair growth, and male pattern balding.

Thyroid

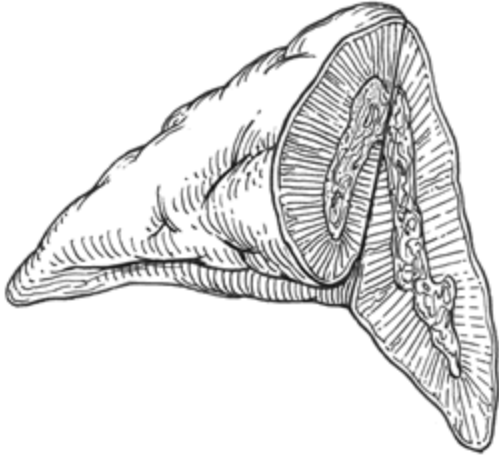


The thyroid is a small gland inside the neck, located in front of your breathing airway (trachea) and below your Adam's apple. The thyroid hormones control your metabolism, which is the body's ability to break down food and store it as energy and the ability to break down food into waste products with a release of energy in the process. The thyroid produces two hormones, T3 (called tri-iodothyronine) and T4 (called thyroxine).

Thyroid disorders result from too little or too much thyroid hormone. Symptoms of hypothyroidism (too little hormone) include decreased energy, slow heart rate, dry skin, constipation, and feeling cold all the time. In children, hypothyroidism most commonly leads to slowed growth. Infants born with hypothyroidism can have delayed development and mental retardation if not treated. In adults, this disorder often causes weight gain. An enlarged thyroid, or goiter, may develop.

Hyperthyroidism (too much hormone) may result in exophthalmic goiter, or Grave's disease. Symptoms include anxiety, fast heart rate, diarrhea, and weight loss. An enlarged thyroid gland (goiter) and swelling behind the eyes that causes the eyes to push forward, or bulge out, are common.

Adrenal Glands



Each adrenal gland is actually two endocrine organs. The outer portion is called the adrenal cortex. The inner portion is called the adrenal medulla. The hormones of the adrenal cortex are essential for life. The hormones of the adrenal medulla are not.

The adrenal cortex produces glucocorticoids (such as cortisol) that help the body control blood sugar, increase the burning of protein and fat, and respond to stressors like fever, major illness, and injury. The mineralcorticoids (such as aldosterone) control blood volume and help to regulate blood pressure by acting on the kidneys to help them hold onto enough sodium and water. The adrenal cortex also produces some sex hormones, which are important for some secondary sex characteristics in both men and women.

Two important disorders caused by problems with the adrenal cortex are Cushing's syndrome (too much cortisol) and Addison's disease (too little cortisol).

The adrenal medulla produces epinephrine (adrenaline), which is secreted by nerve endings and increases the heart rate, opens airways to improve oxygen intake, and increases blood flow to muscles, usually when a person is scared, excited, or under stress.

Norepinephrine also is made by the adrenal medulla, but this hormone is more related to maintaining normal activities as opposed to emergency reactions. Too much norepinephrine can cause high blood pressure.

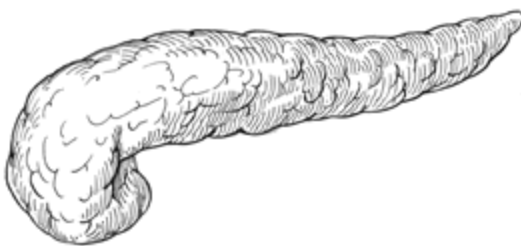
Parathyroid



Located behind the thyroid gland are four tiny parathyroid glands. These make hormones that help control calcium and phosphorous levels in the body. The parathyroid glands are necessary for proper bone development. In response to too little calcium in the diet, the parathyroid glands make parathyroid hormone, or PTH, that takes calcium from bones so that it will be available in the blood for nerve conduction and muscle contraction.

If the parathyroids are removed during a thyroid operation, low blood calcium will result in symptoms such as irregular heartbeat, muscle spasms, tingling in the hands and feet, and possibly difficulty breathing. A tumor or chronic illness can cause too much secretion of PTH and lead to bone pain, kidney stones, increased urination, muscle weakness, and fatigue.

Pancreas



The pancreas is a large gland behind your stomach that helps the body to maintain healthy blood sugar (glucose) levels. The pancreas secretes insulin, a hormone that helps glucose move from the blood into the cells where it is used for energy. The pancreas also secretes glucagon when the blood sugar is low. Glucagon tells the liver to release glucose, stored in the liver as glycogen, into the bloodstream.

Diabetes, an imbalance of blood sugar levels, is the major disorder of the pancreas. Diabetes occurs when the pancreas does not produce enough insulin (Type 1) or the body is resistant to the insulin in the blood (Type 2). Without enough insulin to keep

glucose moving through the metabolic process, the blood glucose level rises too high.

In Type 1 diabetes, a patient must take insulin shots. In Type 2 diabetes, a patient may not necessarily need insulin and can sometimes control blood sugar levels with exercise, diet and other medications.

A condition called hyperinsulinism (HI) is caused by too much insulin and leads to hypoglycemia (low blood sugar). The inherited form, called congenital HI, causes severe hypoglycemia in infancy. Sometimes it can be treated with medication but often requires surgical removal of part or all of the pancreas. An insulin-secreting tumor of the pancreas, or insulinoma, is a less common cause of hypoglycemia. Symptoms of low blood sugar include anxiety, sweating, increased heart rate, weakness, hunger, and light-headedness. Low blood sugar stimulates release of epinephrine, glucagon and growth hormone, which help to return the blood sugar to normal.

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