

ENDOCRINE SYSTEM



Hormones (meaning “to spur on”) are the chemical messengers in the human body. They carry the information that controls the function of almost all of the body’s cells and tissues. The endocrine system consists of glands that produce hormones and work interdependently: the two adrenal glands, located on the top of each kidney; the pancreas, found in the abdominal cavity behind the stomach; the parathyroid and thyroid, located at the base of the neck; the pituitary, located at the base of the brain; and the ovaries and testes, the female and male sex glands. Each hormone is a separate substance that is produced and released into the bloodstream by an endocrine gland. Most of these hormones are controlled by a mechanism called feedback. Feedback is like a thermostat in a heating system. When a gland is working harder than it should, the hormone system switches it off. When the body needs the gland to speed up, the system turns on the switch again.

- ◆ Hormones affect height, weight, metabolism, growth, sexual development, menstruation, hair and bone growth, fertility, pregnancy, and breast milk production, as well as some aspects of personality and behavior.
- ◆ Since the makeup of virtually all hormones is now known by the medical profession, synthetic hormones have been developed to restore normal health and replace hormones that are missing. Other synthetic hormones or medications are used to control the overproduction and release of a hormone. Contraceptive drugs are hormone preparations that allow women to control childbearing.
- ◆ Other hormones are also released by special cells in other body parts such as the heart (to reduce blood volume or blood pressure), the kidney (to produce red blood cells), and the gastrointestinal tract (to produce or release digestive enzymes).



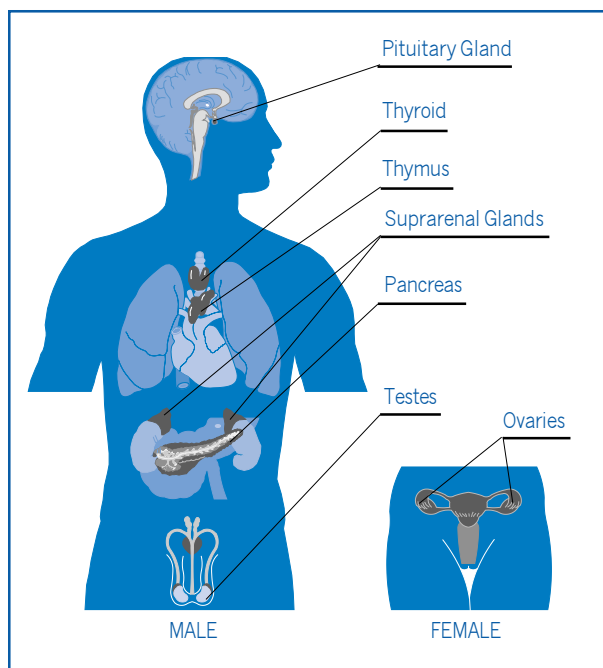


HORMONAL CONTROL

Hormones reach every part of the body and every cell has receptors for one or more hormones that stimulate or slow down a certain body function (eg, sexual development). The hypothalamus, located at the base of the brain, coordinates the hormone production (producing or releasing hormones). It produces neuro-stimulating materials that travel through special blood vessels and serves the pituitary gland, which in turn controls the other endocrine glands.

ADRENAL GLANDS

The two adrenal glands are located at the top of each kidney. Each gland has two parts: the inner layer (medulla) and the outer covering layer (cortex). These release many different hormones. The medullary hormone, adrenaline, provides a rapid response to emergencies such as a cold, fatigue, shock, fear, etc. It causes an increase in pulse rate and blood pressure as well as facilitates an increase in blood sugar by the release of sugar from the liver. The cortex produces a group of hormones called corticosteroids (cortisone is the most prominent one of these) as well as some sex hormones. These consist of male hormones (androgens) and female hormones (estrogens). These affect sexual development and reproduction. Estrogens, produced by the ovaries, are discussed in Female Reproduction and androgens, produced by the testes, are discussed in Male Reproduction. The hormones of the adrenal glands affect virtually every system in the body to some degree.





■ ADDISON'S DISEASE

Addison's disease is caused by partial or complete failure of the adrenal gland. The onset is usually gradual, over a period of weeks or months. The causes of this disease include infection, tumor, bleeding within the adrenal gland (from a trauma), or autoimmune disease, in which the body reacts to the adrenal gland as a foreign object and produces antibodies to attack and destroy it.

SIGNS AND SYMPTOMS

Weakness; anemia; weight loss, decreased appetite; darkening of the skin; low blood pressure, hypoglycemia (low sugar levels); nausea, vomiting, diarrhea, constipation; anxiety, depression, decreased sexual interest, and sensitivity to cold.

TREATMENT

Drinking more fluids, control of salt and potassium, and a diet high in carbohydrates and protein are required.

An identification bracelet should be worn so adequate replacement can be made in the event of an accident or trauma.

DRUG TREATMENT

Replacing the natural hormones with glucocorticoid and mineralocorticoid drugs is often prescribed.

■ CUSHING'S SYNDROME

Cushing's syndrome is the opposite of Addison's disease. This disorder occurs when excess ACTH (hormone made by the pituitary gland) is produced. Another cause is a tumor on the pituitary/adrenal glands or lung, or may be the result of large doses of steroid drugs given over a period of several weeks, or longer, that are prescribed for another illness.

SIGNS AND SYMPTOMS

Roundness of the face, often reddened complexions; hump-like collection of fat between and above the shoulder blades in the back; striations (streaks) in the skin of the lower trunk, easy bruising; fatigue and muscle weakness, mood swings; water retention, hypertension; excessive growth of hair; impotence (male), cessation of menses (women); osteoporosis, diabetes.

TREATMENT

If caused by large doses of steroid drugs, lowering or changing the drug may relieve the symptoms.

DRUG TREATMENT

If caused by a tumor, radiation therapy is often used to shrink the tumor.

SURGICAL TREATMENT

Surgical removal of the tumor may be the best treatment. Once treated, the adrenal glands will be incapable of producing vital hormones and a lifelong replacement therapy may be required.



■ CONGENITAL ADRENAL HYPERPLASIA

This occurs when there is a blockage in the process of changing cholesterol to cortisol. The pituitary gland senses the low cortisol level and produces more of the ACTH hormone, which stimulates the adrenal glands to increase the production. Most forms are found in infancy or childhood. If the blockage is only partial, there may be no problems.

SIGNS AND SYMPTOMS Enlargement of the penis in male infants and the clitoris in female infants; rarely, high blood pressure; growth acceleration in children; growth of hair in women that are typically associated with males, such as the upper lip, chin, breast bone, and below the navel; acne is common; irregular menstruation and infertility may occur.

DRUG TREATMENT Oral corticosteroids are used.

■ TUMORS OF THE ADRENAL GLANDS

Pheochromocytoma is a tumor of the adrenal gland that causes excessive release of two different hormones, epinephrine and norepinephrine. This causes high blood pressure, headache, sweating, high blood sugar, nausea, vomiting and fainting episodes. The tumors are usually benign (noncancerous), likely to run in families, and occur in individuals with hypertension.

Adrenal Tumor (Feminizing and masculinizing syndromes) – The presence of these extremely rare syndromes involve the development of sexual characteristics of the opposite sex.

SURGICAL TREATMENT In most cases adrenal tumors are managed surgically and once removed, whether it is located in the medulla or cortex, symptoms will often reverse with the exception of extremely rare malignant tumors.



PITUITARY GLAND

The pituitary gland is the most important of all of the endocrine glands because it acts as the control center for the body's growth, daily functions, and reproduction. It is located behind the nasal passages at the base of the brain, and responds to hormones from the part of the brain called the hypothalamus. Pituitary disorders in women are caused by one of two types of tumors: a craniopharyngioma that presses against the pituitary as it grows and causes decreased hormone production; or, an adenoma, a benign pituitary tumor that causes increased hormone production.

■ DIABETES INSIPIDUS

This is a disease that develops when too little of the ADH (antidiuretic hormone) is produced by the pituitary gland. ADH is the hormone that balances the water in the body. This should not be confused with diabetes mellitus, which is the result of an insulin deficiency.

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| SIGNS AND SYMPTOMS | Excessive urination; severe thirst. |
| TREATMENT | Increased fluid intake is necessary and may require a salt-free diet. |
| DRUG TREATMENT | Antidiuretic hormones are available as an injection or a nasal spray. |
| SURGICAL TREATMENT | If a tumor is present, surgical removal is necessary. |

■ HYPOPITUITARISM

This is a disorder in which the pituitary gland produces insufficient amounts of one or more of the pituitary hormones. The conditions may occur without explanation, a tumor in the gland, or result from a serious head injury. As a result of insufficient hormone production, "Addison's disease" may occur.

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| SIGNS AND SYMPTOMS | Severe headaches, change in vision; too rapid or too slow growth or sexual development; changes in menstruation; fatigue; weight gain or loss; increase or decrease of body hair; breast milk not related to pregnancy. |
| TREATMENT | Hormone replacement therapy is necessary. |



■ PITUITARY TUMORS

SIGNS AND SYMPTOMS

Acromegaly – The overproduction of growth hormones by the pituitary gland can effect the limbs and internal organs. The cause is usually a tumor and the bones of the face, jaw, arms, and legs get larger. The most striking feature is an overgrowth of the forehead and jaw.

Gigantism – This syndrome is like acromegaly but results in excess height and weight. This is often caused by an excessive release of growth hormone or a genetic disorder. Gigantism with normal body proportions and sexual development usually comes from excess growth hormone in early childhood.

Prolactinoma – This pituitary tumor causes an overproduction of the hormone prolactin. In women, it may cause menstrual irregularity or cessation of menstruation; in men, infertility or impotence.

Craniopharyngioma – This tumor appears most often in children or adolescents. The tumor may expand into the brain and cause water on the brain (hydrocephalus) and disrupt the control of the nervous system. Visual field impairment, headaches, and sexual retardation are symptoms of this pituitary tumor.

TREATMENT

Most tumors are surgically removed. If this is not advisable, radiation therapy is often used to shrink these tumors.



THYROID GLAND

The thyroid gland is located at the base of the neck. The gland secretes a hormone that helps set the rate at which your body functions. It produces thyroid hormone that helps regulate certain aspects of your body's metabolism and determines how fast you burn up calories. When the secretions from the thyroid become dysfunctional, two main syndromes are seen: hyperthyroidism (increased production) and hypothyroidism (decreased production).

■ HYPERTHYROIDISM

Hyperthyroidism is known as an overactive thyroid and occurs when the thyroid gland produces excessive amounts of thyroid hormones, which is more common in women. The thyroid is overstimulated by an abnormal antibody instead of the normal thyroid-stimulating hormone. In older women, the disease can be caused by a thyroid nodule that produces too much of the thyroid hormone.

SIGNS AND SYMPTOMS

Weight loss, despite increased appetite; increased heart rate and blood pressure; hand tremors, sweaty palms; nervousness and sweating; swelling at the base of the neck (a goiter), protruding eyes; muscle weakness; difficulty sleeping.

TREATMENT

A liquid form of radioactive iodine will deliver to the thyroid a concentrated radioactive dose of iodine that will cause the gland to slow the production of the hormone.

DRUG TREATMENT

Antithyroid medication is used to counteract the overproduction of thyroid hormones. When successful, the treatment is continued for about one year and then discontinued.

SURGICAL TREATMENT

Removal of part or all of the thyroid gland is sometimes necessary.

■ HYPOTHYROIDISM

An underactive thyroid gland causes hypothyroidism (the opposite of hyperthyroidism). The gland fails to produce enough hormone, causing the body's metabolic rate to slow down. Since the thyroid hormone has such significant effects on growth and development, the deficiencies can cause various health problems. The causes of hypothyroidism may be a reaction to an antibody that destroys the thyroid gland, an inflammation of the thyroid (thyroiditis), or an insufficiency in the production of thyroid stimulating hormones (TSH) from the pituitary. Hypothyroidism can occur at any age, but is more common in middle-aged women. The symptoms of hypothyroidism often go unrecognized in older people and can be mistaken for the normal signs of aging.

SIGNS AND SYMPTOMS

Slowed physical and mental functions; a slowed heart rate; intolerance to cold temperatures; constipation; dry skin and hair; goiter.

DRUG TREATMENT

A lifelong thyroid replacement supplement is prescribed to control the symptoms.



PARATHYROID GLANDS

The parathyroid glands are small (about the size of a grain of rice) and are located in the four corners of the thyroid gland at the base of the neck. The glands produce parathyroid hormones (PTH) that regulate the amount of calcium in the blood. PTH causes calcium to be released from bone, increases calcium absorbed in the intestines, and stimulates the kidney to make a very potent form of vitamin D. As in thyroid disease, there are two forms of dysfunction: hyperparathyroidism (oversecretion) and hypoparathyroidism (undersecretion), both of which cause difficulties in regulating the calcium in the bloodstream.

■ HYPERPARATHYROIDISM

When there is too much secretion of parathyroid hormone circulating in the body, the calcium concentration becomes high and the phosphorus concentration low. In most cases, the cause is a small growth in one of the glands, or less often, all four of the glands. The growths are localized and unlikely to spread to other organs. About 85 percent of hyperparathyroidism is caused by a benign (noncancerous) parathyroid tumor.

SIGNS AND SYMPTOMS

May have no symptoms; kidney stones; indefinite fatigue; increased urination; indigestion or ulcer symptoms.

TREATMENT

Increased water intake and physical activity may be helpful if the patient is older, has no symptoms, or has other illnesses that make surgery inadvisable.

DRUG TREATMENT

Estrogen replacement and diuretics are recommended.

SURGICAL TREATMENT

Parathyroidectomy (removal of the parathyroid gland) is the treatment of choice to prevent the development of severe hypercalcemia, bone pain, severe osteoporosis, kidney disease, kidney stones, or peptic ulcers.



■ HYPOPARATHYROIDISM

Hypoparathyroidism is the production of too little PTH, preventing the body from using calcium properly. This is rare and far less likely to occur than hyperparathyroidism. The most common cause of hypoparathyroidism is damage to the parathyroids during surgery for hyperthyroidism or neck cancer.

SIGNS AND SYMPTOMS

Muscle spasms or numbness, especially in the hands, feet, and throat; difficulty breathing; dry skin; yeast infections.

In children: vomiting, convulsions, and headaches.

TREATMENT

Vitamin D and calcium supplements can help to alleviate the symptoms. Calcium carbonate is particularly recommended. In an emergency, intravenous calcium is used to control muscle spasms. After the calcium levels are controlled, medications are readjusted and calcium blood levels should be checked about four times each year.

PANCREAS

The pancreas has both a digestive function and an endocrine function. The description and discussion of these two types of functions are found in a separate chapters on Diabetes and the Digestive System.



WHAT TO DO

SEVERITY LEVEL

SYMPTOM

POSSIBLE DIAGNOSIS



Make an appointment to see your doctor

In some of these conditions, after a diagnosis has been made by a physician, self management and/or behavior may help with symptoms. This kind of management should only be recommended by a physician.

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| Excessive urination, severe thirst | Diabetes insipidus |
| Severe headaches, change in vision, too rapid or too slow of growth, fatigue, weight gain or loss, increase or decrease of body hair, breast milk not related to pregnancy | Hypotituitarism |
| Weight loss with increased appetite, increased heart rate, hand tremors, sweaty palms, nervousness, sweating, swelling at base of neck and protruding eyes, muscle weakness | Hyperthyroidism |
| Slowed physical and mental function, slowed heart rate, intolerance to cold, constipation, dry skin and hair, goiter | Hypothyroidism |
| Rounded face, streaks on the skin, fatigue and muscle weakness, water retention, easy bruising, excessive growth of hair, mood swings | Cushing's syndrome |
| Growth acceleration in children, growth of hair in women on upper lip, chin, breast bone, and below the navel | Congenital adrenal hyperplasia |
| Kidney stones, indefinite fatigue, increased urination, indigestion or ulcer symptoms | Hyperparathyroidism |
| Muscle spasm or numbness, difficulty breathing, dry skin, yeast infection; In children: vomiting, convulsions, and headache | Hypoparathyroidism |
| Weakness, anemia, weight loss, decreased appetite, nausea, diarrhea, constipation, anxiety, depression, sensitivity to cold | Addison's disease |