THE ENDOCRINE SYSTEM

1. Study the names of the hormones mentioned in the text. Write down the names of the hormones in Ukrainian.

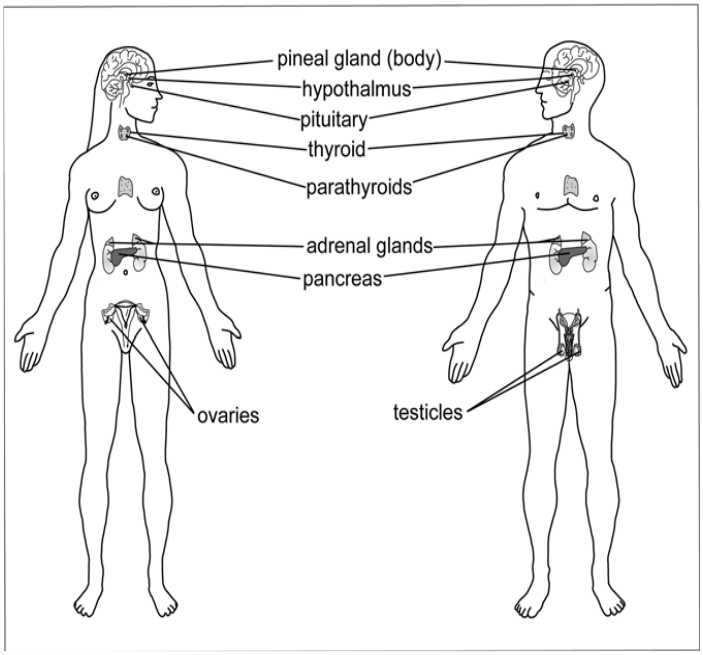
English	Pronunciation	Ukrainian
adrenaline	[ə'drɛnəlɪn]	
adrenocorticotropic hormone	[ə˛dri:nəʊ˛kɔ:təkəʊ'trɒpɪk 'hɔ:məun]	
aldosterone	[alˈdɒstərəʊn]	
androgen	['ændrədʒən]	
antidiuretic hormone	[˛æntɪ˛daɪjʊ'rɛtɪk 'hɔ:məun]	
calcitonin	[˛kælsɪ'təʊnɪn]	
cortisol	[ˈkɔ:tɪsɒl]	
dopamine	['dɒpəmɪn]	
epinephrine	[˛epiˈnefrin]	
estradiol	[˛ɛstrə'daɪɒl]	
estrogen	['i:strədʒ(ə)n]	
follicle-stimulating hormone	['fɔlɪkl 'stɪmjəleɪtɪŋ 'hɔ:məun]	
gastrin	['gæstrɪn]	
glucagon	[ˈglu:kəg(ə)n]	
glucocorticoid	[˛glu:kə(ʊ)ˈkɔ:tɪkɔɪd]	
gonadotropin-releasing hormone	[˛gɒnədəʊ'trəʊpɪn rɪ'li:zɪŋ 'hɔ:məun]	
growth hormone	[grəuθ 'hɔ:məun]	
growth hormone-releasing hormone	[grəuθ 'hɔ:məun rɪ'li:zɪŋ 'hɔ:məun]	
insulin	['ɪnsjəlɪn]	
luteinizing hormone	[ˈlu:tənʌɪzɪŋ 'hɔ:məun]	

melanocyte-stimulating hormone	['mɛlənəʊˌsaɪt 'stɪmjəleɪtɪŋ 'hɔːməun]	
melatonin	[ˌmɛləˈtəʊnɪn]	
mineralocorticoid	[ˌmɪnərələʊ'kɔːtɪˌkɔɪd]	
noradrenaline	[ˌnɔːrəˈdrɛn(ə)lɪn]	
norepinephrine	[ˌnɔːrɛpɪˈnɛfrɪn]	
oxytocin	[ˌɒksɪˈtəʊsɪn]	
parathyroid hormone	[ˌpærə'θaɪrɔɪd 'hɔːməun]	
progesterone	[prəˈdʒɛstərəʊn]	
prolactin	[prəʊˈlaktɪn]	
somatostatin	[ˌsəʊmətə'stætɪn]	
somatotropin	[ˌsəʊmətəʊ'trəʊpɪn]	
testosterone	[te'stɔst(ə)rəun]	
thyroglobulin	[ˌθʌɪrə(ʊ)ˈglɒbjʊlɪn]	
thyroid-stimulating hormone	['θaɪrɔɪd 'stɪmjəleɪtɪŋ 'hɔːməun]	
thyrotropin	[ˌθʌɪrə(ʊ)ˈtrəʊpɪn]	
thyroxine	[θaɪ'rɒksɪn]	
triiodothyronine	[trʌɪˌʌɪədə(ʊ)ˈθʌɪrəniːn]	

2. Read the text.

The endocrine system is made up of a complex network of glands, each of which secretes hormones that coordinate and regulate functions throughout the body. The pituitary, thyroid, parathyroids, adrenals, gonads (testes and ovaries), and endocrine pancreas are considered traditional endocrine glands with the primary purpose of secreting hormones into the bloodstream. But other, nonendocrine organs - including the heart, brain, kidneys, liver, skin, and gastrointestinal tract - can also secrete hormones.

Endocrine glands release their hormones into the bloodstream and should not be confused with exocrine glands, which secrete their substances to the outside of the body, to internal cavities or to other tissues through ducts.



The endocrine system is has several functions, the most important of which are to maintain a constant internal environment (homeostasis); aid in growth, development, reproduction, and metabolism; and coordinate with the central nervous and immune systems. The hypothalamus and pituitary gland together serve as the command centre of the endocrine system, and the core of the relationship between the endocrine and nervous systems. Together, they regulate virtually every physiological activity in the body.

The tiny, cone-shaped region at the base of the brain called the **hypothalamus** coordinates the neuroendocrine system, helps regulate metabolism, and controls the part of the nervous system that oversees a number of involuntary bodily functions (sleep, appetite, body temperature, hunger, and thirst). It also serves as the link between the nervous and endocrine systems. The hypothalamus projects downward, ending at the pituitary stalk, which connects it to the pituitary gland. The hypothalamus is made up of clusters of neurosecretory cells, which both transmit electrical messages and secrete hormones. The hormones secreted by the hypothalamus either travel through the body via the general circulation or go directly to the anterior pituitary gland and signal it to release or stop releasing its hormones. Hypothalamic hormones are releasing or inhibiting hormones, depending upon how they influence the pituitary gland. Releasing hormones trigger hormone secretion, and inhibiting hormones halt hormone secretion. One of the hypothalamic is the

growth hormone-releasing hormone that stimulates the secretion of growth hormone from the anterior pituitary gland.

The pea-shaped **pituitary gland** (also known as the hypophysis) is located at the base of the skull. It is attached to the hypothalamus by the pituitary stalk, through which run the blood vessels and nerves that deliver hypothalamic hormones to the anterior pituitary. The pituitary is often called the “master gland” because it directs the functions of most other endocrine glands. In addition to stimulating other endocrine glands to release their hormones, the pituitary secretes several of its own hormones: growth hormone, prolactin, and oxytocin. The pituitary gland is made up of three lobes: the anterior, intermediate , and posterior.

The anterior pituitary is composed of endocrine cells, which secrete hormones in response to stimulation by hypothalamic hormones. Anterior pituitary hormones, in turn, stimulate the adrenal glands (adrenocorticotropic hormone), thyroid gland (thyroid-stimulating hormone), and ovaries and testes (follicle-stimulating hormone and luteinizing hormone). Thyroid-stimulating hormone, also called thyrotropin, affects cell growth and metabolism in the thyroid gland, and signals the gland to produce and release its hormones thyroxine (T4) and triiodothyronine (T3). Luteinizing hormone (LH) and follicle-stimulating hormone (FSH) promote egg and sperm development and control androgens and estrogen release by the ovaries and testes. The secretion of both hormones remains very low from birth until puberty, when levels rise dramatically. In females, the rate of secretion varies at different times during the menstrual cycle. Secretion of both LH and FSH is controlled by gonadotropin-releasing hormone from the hypothalamus.

The anterior pituitary also produces growth hormone which stimulates growth of bone and muscle and prolactin which initiates milk production following childbirth. Growth hormone, also called somatotropin, plays a significant role in growth and metabolism. It primarily affects bone, muscle, and tissue growth. Without sufficient growth hormone, an individual would suffer from short stature. Too much growth hormone would result in gigantism. For normal growth the body requires energy, which growth hormone provides through protein synthesis and the breakdown of fats.

Cells within the intermediate pituitary produce melanocytestimulating hormone, which controls skin pigmentation. The posterior pituitary stores and releases hormones that are actually produced within the hypothalamus: antidiuretic hormone, which primary role is to conserve water in the body by signalling the kidneys to excrete less fluid; and oxytocin, which stimulates uterine contractions during childbirth and triggers the secretion of milk from the mother's breast when her infant nurses. The release of oxytocin into a new mother's brain also helps forge a bond between her and her new baby. The hormone normally circulates in low levels in both men and women, but it rises in women during ovulation, birth, and lactation, as well as in times of stress.

Pineal gland is a small, cone-shaped gland which extends downward from the third ventricle of the brain, above and behind the pituitary gland. Scientists know very little about the gland and what it does, but they do know that it secretes the hormone melatonin, which responds to light and dark, and communicates that information to the rest of the body. Melatonin influences circadian rhythms and thus plays a role in functions regulated by night/day cycles, including reproduction and sleep/wake patterns. Melatonin release is regulated by the sympathetic nervous system and is stimulated primarily by darkness, but it can also be triggered by hypoglycemia. Melatonin concentration is highest at night and falls to almost undetectable levels during the day.

The thyroid gland is the largest endocrine gland in the body located just below the larynx and around the trachea. It is crucial to nearly all of the body's physiological processes. It produces thyroid hormones, which are needed for growth, development, calcium homeostasis, cell differentiation and a variety of metabolic activities. The thyroid is composed of two types of cells: follicular and parafollicular. Follicles are sacs filled with the prohormone thyroglobulin. Thyroglobulin breaks apart to produce the two thyroid hormones, thyroxine (T4) and triiodothyronine (T3). Lining the sacs are follicular cells, which synthesize and then either secrete or store these hormones. Parafollicular cells fill the spaces in between follicles. They secrete the hormone calcitonin.

What makes the thyroid gland unusual among endocrine organs is that it requires iodine to produce its hormones. Without sufficient iodine, the thyroid reduces its hormone output. Decreased levels of thyroid hormones in the blood stimulate the anterior pituitary to secrete more thyroid-stimulating hormone to make up for the deficit. The thyroid gland swells in size as it tries to increase its output, a condition called goiter.

Most healthy adults have two pairs of oval-shaped **parathyroid glands**, which lie next to the thyroid gland in the neck. Inside the glands are clusters of epithelial cells that produce and secrete parathyroid hormone, which is the most significant regulator of calcium levels in the blood. Calcium is essential for cell function as well as for bone formation. Without this hormone, calcium concentrations in the blood would drop to life-threatening levels. Parathyroid hormone also reduces blood levels of phosphorous.

The adrenal glands secrete hormones involved in the body's stress response. The small, triangular glands sit on top of each kidney, surrounded by a capsule of connective tissue. The substances they produce orchestrate the stress response. Adrenal hormones are also involved in a number of other functions: regulating electrolyte balance, blood sugar levels, and metabolism; and influencing sexual characteristics. Hormones produced in the central, medullary region of the adrenal gland are epinephrine (adrenaline) and norepinephrine (noradrenaline), and dopamine.

As soon as the physical or emotional trauma occurs, the hypothalamus sends out nerve impulses, which race to the adrenal medulla and signal it to release epinephrine and norepinephrine. After this the body undergoes a rapid and dramatic transformation. The heart beats faster and more forcefully, rushing additional blood throughout the body especially to the brain and muscles. At the same time, the arteries constrict, increasing blood pressure. Stored glucose and fatty acids are freed to be used for energy. The metabolic rate increases. Oxygen consumption and body heat rise. In the lungs, small tubules called bronchioles dilate, increasing the flow of air. Smooth muscles in the gastrointestinal tract and sphincters contract, while

muscles in the uterus and trachea relax. Motor activity, gastrointestinal secretion, and other nonessential activities slow to conserve energy for other, more crucial functions.

Dopamine influences the brain processes controlling emotion, movement, and the sensations of pleasure and pain. When dopamine is not produced in large enough quantities (for example, in patients with Parkinson's disease), the body grows rigid, and movement becomes difficult.

The large outer region of the adrenal gland, the cortex is made up of three layers, each of which produces its own group of steroid hormones: mineralocorticoids, glucocorticoids, sex hormones androgens and estrogens. The principal mineralocorticoid, aldosterone, acts upon the kidneys to regulate sodium, potassium, and water reabsorption. Aldosterone also acts upon the salivary glands, sweat glands, and colon to reduce the amount of sodium lost in saliva, sweat, and feces. The principal glucocorticoid, cortisol, helps the body respond during times of stress. Cortisol is essential because it maintains the body's energy supply and regulates fluid balance. Without it, the body could overreact to stress and disrupt the fragile homeostatic balance that it needs to stay alive.

The pancreas is long and soft, and stretches from the duodenum of the small intestine almost to the spleen. It functions both as an endocrine and as an exocrine organ. As an exocrine organ, the pancreas releases digestive enzymes via a small duct into the small intestine. These enzymes break down carbohydrates, fats, and proteins from food that has been partially digested by the stomach. In its role as an endocrine organ, the pancreas secretes the hormones insulin and glucagon, which help the body use and store its primary source of energy - glucose. The endocrine pancreas also secretes somatostatin, which is a primary regulator of insulin and glucagon release. The endocrine pancreas is made up of clusters of cells called the islets of Langerhans, in which the hormones are produced.

Insulin and glucagon are crucial because the body needs energy to survive, and these two hormones regulate the distribution of energy to tissues. Insulin helps the cells take in glucose. It moves glucose into the tissues for energy use and storage. Without insulin, an individual could eat three meals a day and still starve to death

because the cells would be unable to use the energy. Glucagon has the opposite effect of insulin. Whereas insulin lowers blood glucose levels by promoting glucose usage and storage, glucagon raises blood glucose levels. In adipose tissue, glucagon promotes the breakdown and release of fatty acids into the blood, which are used by the cells for energy in the absence of glucose. Somatostatin is primarily an inhibitory agent. In the pancreas, it acts suppressing production of insulin and glucagon. It also acts upon the gastrointestinal tract, inhibiting secretion of hormones, prolonging gastric emptying time; decreasing gastric acid and gastrin production; and slowing intestinal motility.

The sex glands (ovaries in the female and testes in the male) serve as both reproductive and endocrine organs. They produce the eggs and sperm that form the basis of human life. They also synthesize and secrete the sex steroids - testosterone, estrogen, and progesterone. These hormones are involved in sexual maturation, differentiation, and function, as well as metabolism and bone growth. They give males and females their individual sexual characteristics, and play a key role in reproduction.

The two bean-shaped **ovaries** are located on either side of the female uterus, just below the openings to the fallopian tubes. Like the adrenal glands, the ovaries contain an outer cortex and an inner medulla. The medulla consists primarily of connective tissue containing blood vessels, smooth muscle, and nerves. The real activity occurs in the larger outer cortex, which holds the follicles in which the eggs develop. Also inside the cortex are specialized cells that produce and secrete the steroid hormones estrogen and progesterone, as well as less potent male hormones (androgens). Ovarian sex hormones are produced and released in response to follicle-stimulating hormone and luteinizing hormone from the anterior pituitary.

The primary female sex hormones produced in the ovaries, estrogens play a role in the development of sexual characteristics and help regulate the reproductive cycle. The three estrogens are produced in the developing follicles. Estradiol is the most powerful and most plentiful of the estrogens. At the onset of puberty, estradiol influences maturation of the reproductive organs and redistributes fat to the hips,

buttocks, thighs, and breasts to produce a more feminine shape. Estradiol also influences the menstrual cycle. Progestins are primarily designed to maintain and support a pregnancy. The most significant progestin is progesterone. Progesterone prepares the mother's body for pregnancy by thickening the uterine lining to nourish the growing embryo. It then maintains the viability of the pregnancy by stopping additional follicles from becoming mature and by preventing uterine contractions.

The testes, like the female ovaries, serve both reproductive and endocrine functions. They are made up of a network of seminiferous tubules that produce and carry sperm, interspersed with cells in which androgens are produced. The testes produce a number of hormones; testosterone is by far the most plentiful, and most important, of these hormones.

The human body must have centre that coordinates the function of all of its organs, muscles, nerves, and tissues. There are actually two communication centres in the human body - the nervous system and the endocrine system. While the nervous system communicates through electrical impulses travelling throughout the body, the endocrine system communicates through chemicals called hormones, which travel through the bloodstream. In fact, hormones actually control how the nervous system behaves through stimulation or inhibition.

3. Answer the questions.

1. Where can hormones be produced?
2. What is the difference between endocrine glands and exocrine ones?
3. What are releasing and inhibiting hormones?
4. Why is the pituitary called the "master gland"?
5. What does the abnormal level of growth hormone cause?
6. What is the release of melatonin stimulated by?
7. What is necessary for the production of thyroid hormones?
8. What is the function of parathyroid hormone?
9. What parts do the adrenal glands consist of?
10. Why are insulin and glucagon crucial?

11. What is the role of sex steroids?
12. What is the structure of thyroid gland?
13. What involuntary bodily functions does the hypothalamus regulate?
14. What happens with the human body in stressful situations?
15. What parts of the pituitary are there?

4. Define if the statements are true or false. Correct the false ones.

1. The thyroid gland is often called the "master gland" because it directs the functions of most other endocrine glands.
2. The larger outer cortex of the ovaries holds the follicles in which the eggs develop.
3. The hypophysis is made up of clusters of cells called the islets of Langerhans, in which the hormones are produced.
4. Somatostatin is primarily an inhibitory agent.
5. Without sufficient iodine, the thyroid increases the production of hormones.
6. The adrenal cortex produces sex hormones androgens and estrogens.
7. Melatonin concentration is highest during the day, at night and falls to almost undetectable levels.
8. The pituitary gland is made up of three lobes: the anterior, intermediate , and posterior.
9. Inhibiting hormones stimulate hormone secretion, and releasing hormones stop hormone secretion.
10. The heart, brain, kidneys, liver, skin, and gastrointestinal tract can secrete hormones.

5. Match the following words with their definitions:

gigantism, medulla, hormone, lactation, glucose, gonad, stress, goiter, homeostasis, hypoglycemia.

1. A regulatory substance produced in an organism and transported in tissue fluids such as blood or sap to stimulate specific cells or tissues into action.

2. The physiological process by which the internal systems of the body (e.g. blood pressure, body temperature) are maintained at equilibrium, despite variations in the external conditions.

3. The inner region of any organ or tissue when it is distinguishable from the outer region, particularly the inner part of the kidney, adrenal glands, or lymph nodes.

4. Abnormal growth causing excessive height, most commonly due to oversecretion during childhood of growth hormone by the pituitary gland.

5. The secretion of milk by the mammary glands of the breasts, which begins normally at the end of pregnancy.

6. Deficiency of glucose in the bloodstream.

7. A swelling of the neck resulting from enlargement of the thyroid gland.

8. A simple sugar which is an important energy source in living organisms and is a component of many carbohydrates

9. A male or female reproductive organ that produces the gametes.

10. A state of mental or emotional strain or tension resulting from adverse or very demanding circumstances.

6. Complete the table:

Gland	Hormones
hypothalamus	growth hormone-releasing hormone
pituitary	
thyroid	
parathyroid	
adrenal gland	
pancreas	
ovaries	
testes	

7. Match the two parts of the sentences:

1. Estradiol influences maturation

2. Progesterone prepares the mother’s body
3. Insulin lowers blood glucose levels
4. Somatostatin acts upon the gastrointestinal tract,
5. Dopamine influences the brain processes and controls
6. Without parathyroid hormone, calcium concentrations
7. The thyroid hormones are needed
8. Melatonin influences circadian rhythms and plays a role
9. Luteinizing hormone and follicle-stimulating hormone promote
10. Thyroid-stimulating hormone affects cell growth and metabolism in

a). for growth, development, calcium homeostasis, cell differentiation and a variety of metabolic activities.

b). in functions regulated by night/day cycles, including reproduction and sleep/wake patterns.

c). the thyroid gland, and signals the gland to produce and release its hormones thyroxine and triiodothyronine.

d). in the blood would drop to life-threatening levels.

e). of the reproductive organs and redistributes fat to the hips, buttocks, thighs, and breasts.

f). prolonging gastric emptying time, decreasing gastric acid and gastrin production, and slowing intestinal motility.

g). emotions, movement, and the sensations of pleasure and pain.

h). for pregnancy by thickening the uterine lining to nourish the growing embryo.

i) egg and sperm development and control androgens and estrogen release.

j). by promoting glucose usage and storage.

8. Underline the diseases of the endocrine system:

Parkinson’s disease, ulcerative colitis, Addison's disease, tuberculosis, asthma, hepatitis, Cushing's syndrome, gastric ulcer, diabetes mellitus, heart failure, nephritis, goiter, pancreatitis, hyperthyroidism, malaria, Alzheimer’s disease, pneumonia,

hypothyroidism, cold, measles, thyroiditis, bronchitis, angina pectoris, diabetes insipidus, endometriosis, acromegaly, dermatitis, gastritis, polycystic ovary syndrome, hypertension, arthritis, neuralgia.