Anatomy and Physiology Unit 6 Review Sheet Name **KEY**

Endocrine System (Chapter 9) Hour _____ Date _____

For the test
- be able to label all endocrine glands on a human diagram
- study & review your notes, homework, and the case study
- understand and be able to explain the information covered in the following questions.

1. Describe the function of the Endocrine System.

   Along with the nervous system, it coordinates and directs the activity of the body's cells. Specific functions include: Second messenger system of the body that uses chemical messages (hormones) that are released into the blood to carry out: Reproduction, Growth and development, Mobilization of body defenses, Maintenance of much of homeostasis, Regulation of metabolism

2. Describe the difference in how Nervous and Endocrine Systems control the human body.
   Nervous control is very fast using neurons to relay electrical messages to target tissues and endocrine control is much slower because it employs chemical messengers which are most often released into the blood to be transported to target tissues. Nervous control only works on a small area or target tissues, whereas endocrine control can be widespread because it uses the bloodstream and only a small amount of hormone is needed.

3. What are hormones? Describe the different types, actions, and functions.
   Hormones are chemical messengers that are produced by specialized cells that secrete these hormones into extracellular fluids, and then the blood transfers hormones to target sites where they regulate the activity of other cells. Types of hormones include:
   a. **Amino acid-based hormones**
      i. **Proteins**
      ii. **Peptides**
      iii. **Amines**
   b. **Steroids – made from cholesterol (androgens, estrogens, and progesterone)**
      Steroid action is as follows: Diffuse through the plasma membrane of target cells, Enter the nucleus, Bind to a specific protein within the nucleus, Bind to specific sites on the cell's DNA, Activate genes that result in synthesis of new proteins
   c. **Prostaglandins – made from highly active lipids**

   Non-steroid hormones use this pathway: Hormone binds to a membrane receptor, Hormone does not enter the cell, Sets off a series of reactions that activates an enzyme, Catalyzes a reaction that produces a second messenger molecule, Oversees additional intracellular changes to promote a specific response

   All of the following are effects of hormones in general:
   A. **Changes in plasma membrane permeability or electrical state**
   B. **Synthesis of proteins, such as enzymes**
   C. **Activation or inactivation of enzymes**
   D. **Stimulation of mitosis**

4. What is meant by "target cell"?
   The specific tissue or cell that is only affected by a certain hormone.

5. What is a tropic hormone? What is a non-tropic hormone?
   A tropic hormone is a hormone that comes from an endocrine gland and has action upon another gland to release another hormone to exert effects on other body organs and tissues.

   A non-tropic hormone is a hormone that comes from an endocrine gland and has direct action upon target cells and tissues in the body which are not glandular (not part of the endocrine system).

6. Explain how a negative feedback system works. How does this illustrate actions of the endocrine system?
   In the endocrine system, a negative feedback system would be when hormone secretion is triggered by some internal or external stimulus; one hormone levels rise to a certain level, other hormone release is inhibited even while responses in cells are being promoted. Hint: Think of your furnace, it kicks on when it is cold and shuts off when it is warm. All the while, a relatively constant temperature is being maintained. In the same way, hormone concentration has a small range too.

7. What is the difference between an endocrine gland and an exocrine gland? Give examples.
   Exocrine glands have ducts through which their secretions are carried to a particular site; endocrine glands release their chemical messengers (hormones) directly into the bloodstream for transport.

   Exocrine examples: salivary glands, pancreas, liver, sweat & oil glands of skin
   Endocrine examples: adrenal glands, anterior pituitary gland, thyroid gland, pancreas, etc.

8. Fill in the following charts by filling in the requested information with regards to studied glands. Fill in the location, type of hormone released and its action.

Name of the Endocrine Gland	**Location in the body**	**Name of the released hormone**	**Action of the hormone**
Pituitary Gland Anterior or Adenohypophysis **Glandular Tissue**	**In the "Turk's saddle" of the sphenoid bone.**	**Growth Hormone (GH) or somatotropin**	**Stimulates growth (especially of bones and muscles) and metabolism. Causes fats to broken down into energy and amino acids to be built into proteins.**
		Prolaction (PRL)	**Stimulates milk production and maintains following childbirth**
		FSH or Follicle-Stimulating Hormone	**Stimulates production of ova (eggs) and sperm**
		LH or Luteinizing Hormone	**Stimulates ovary and testes to produce sex hormones. Triggers ovulation in females.**
		Adrenocorticotropic hormone (ACTH)	**Regulates endocrine activity of the adrenal cortex**
		Thyroid Stimulating Hormone (TSH)	**Influences growth and activity of the thyroid**
Pituitary Gland Posterior or Neurohypophysis **Nervous Tissue**	**In the "Turk's saddle" of the sphenoid bone**	**Oxytocin**	**Stimulates contractions of the uterus during labor and Causes milk ejection**
		ADH or Anti-diuretic Hormone	**Can inhibit urine production by retaining water and electrolytes. In large amounts, causes vasoconstriction leading to increased blood pressure (vasopressin)**

Thyroid Gland	**At the base of throat, just inferior to adam's apple**	**Thyroid Hormone (made of T_3 and T_4)**	**<u>Major</u> metabolic hormone that requires iodine for healthy function.**
		Calcitonin	**Decreases blood calcium levels by causing its deposition on bone; Antagonistic to parathyroid hormone; Produced by C (parafollicular) cells**
Parathyroid Gland	**Tiny mass on the posterior side of thyroid gland**	**Parathyroid Hormone**	**Secretes parathyroid hormone; Stimulate osteoclasts to remove calcium from bone; Stimulate the kidneys and intestine to absorb more calcium; Raise calcium levels in the blood**
Adrenal Cortex	**On the top of the kidneys**	**Mineralcorticoids (aldosterone)**	**Regulate mineral content in blood, water, and electrolyte balance; Target organ is the kidney Production stimulated by renin and aldosterone Production inhibited by atrial natriuretic peptide**
		Glucocorticoids (Cortisone/cortisol)	**Produced in the middle layer of the adrenal cortex Promote normal cell metabolism; Help resist long-term stressors; Released in response to increased blood levels of ACTH**
Adrenal Cortex	**On the top of the kidneys**	**Androgens (sex hormones)**	**These hormones prepare the body to deal with sex/reproduction**
Adrenal Medulla	**On the top of the kidneys**	**Epinephrine/ norepinephrine**	**These hormones prepare the body to deal with short-term stress; stimulate Fight or Flight Response in Sympathetic NS.**

Pancreas	**Close but Behind and lateral to the stomach**	**Insulin**	**allows glucose to cross plasma membranes into cells from beta cells; lowers glucose level in blood**
		Glucagon	**allows glucose to enter the blood from alpha cells; raises blood levels of glucose**
Pineal Gland	**In roof of 3rd ventricle of brain**	**Melatonin**	• **Establishes the body's day/night (awake/sleep) cycle (circadian rhythm)** • **Secretion is triggered by darkness and inhibited by light (in most humans)**
Gonads Female (Ovaries)	**In abdominal cavity**	**Estrogen**	• **Produced by Graafian follicles or the placenta**

Gonads Female (Ovaries) cont'd			• **Stimulates the development of secondary female characteristics** • **Matures female reproductive organs** • **Helps prepare the uterus to receive a fertilized egg** • **Helps maintain pregnancy** • **Prepares the breasts to produce milk**
		Progesterone	• **Produced by the corpus luteum** • **Acts with estrogen to bring about the menstrual cycle** • **Helps in the implantation of an embryo in the uterus**
Gonads Male (Testes)	**In abdominal cavity or scrotum**	**Testosterone**	• **Responsible for adult male secondary sex characteristics** • **Promotes growth and maturation of male reproductive system** • **Required for sperm cell production**

9. How do hormones help the body maintain homeostasis? Give several specific examples.
   They alter cellular activity by increasing or decreasing the rate of normal metabolic processes rather than stimulating a new one. They also stimulate:
   A. **Changes in plasma membrane permeability or electrical state**
   B. **Synthesis of proteins, such as enzymes**
   C. **Activation or inactivation of enzymes**
   D. **Stimulation of mitosis**

   Homeostasis examples: regulation of blood sugar levels, regulation of blood calcium levels, and regulation of metabolism/energy levels in the body

10. What is BMR or basal metabolic rate? Which hormone is involving in maintaining this rate?

    The rate at which energy is expended (heat produced) by the body per unit of time under controlled (basal) conditions 12 hours after a meal, at rest. Thyroid hormone (TH)

11. What is goiter? What causes this endocrine disorder? How is it treated?
    A benign enlargement of the thyroid gland that is caused by deficiency of iodine. Goiter is caused by the thyroid gland's inability to produce thyroid hormone (TH) in the absence of iodine, the gland enlarges as a result. Goiter is treated with iodine supplements. Goiter is prevented by a diet rich in iodine from iodized salt or seafood.

12. Explain the differences between gigantism, acromegaly, and pituitary dwarfism. Which hormone is related to all three disorders?
    Gigantism—hypersecretion of growth hormone (GH) during childhood, extreme tallness due to excessive long bone growth
    Acromegaly—hypersecretion of growth hormone (GH) during adulthood, excessive growth of hands, feet, lower jawbone, and bony ridges under eyebrows
    Pituitary dwarfism—hyposecretion of growth hormone (GH) during childhood, normal body proportions, but miniature (4 feet tall max)

    Growth hormone (GH) is related to all three disorders.

13. What is Grave's Disease? What are the symptoms?
Hyperthyroidism—overproduction of thyroid hormone (TH) which results in high basal metabolic rate. Other symptoms: exopthalmos (eyes bulging anteriorly), intolerance of heat, rapid heart rate, weight loss, nervous and agitated behavior, and general inability to relax.

14. What is diabetes insipidus?
A disease characterized by passage of large amounts of dilute urine plus intense thirst and dehydration; it is a hypothalamic condition where insufficient amounts of ADH or anti-diuretic hormone is the cause.

15. What is diabetes mellitus? Explain the difference between Type I and Type II diabetes.
Diabetes mellitus is where the body is not producing enough insulin or is unresponsive to the insulin being made in the body, therefore causing persistent hyperglycemia or high glucose blood levels. Type I is something someone is born with usually and Type 2 is adult onset and because of insulin resistance.

Symptoms include:
Weight loss, polyuria (high urine production), polydipsia (excessive thirst), and polyphagia (excessive hunger)

16. What is Cushing's disease? What causes it? What are the symptoms?
Caused by a tumor in the adrenal cortex. Results in the excessive outputs (hypersecretion) of glucocorticoids, which in turns causes Moon Face (excessively rounded face), buffalo hump of fat between shoulders, high blood pressure, hyperglycemia, depressed immune system.

17. Explain how steroid hormones trigger changes in our cells.
    1. **The steroid hormone diffuses through the plasma membrane of their target cells**
    2. **The hormone then enters the nucleus**
    3. **The hormone binds to a specific receptor protein within the nucleus**
    4. **the resulting hormone-receptor complex binds to specific sites on the cell's DNA**
    5. **this activates certain genes to transcribe messenger RNA (mRNA)**
    6. **The mRNA is then translated in the cytoplasm resulting in the synthesis of new proteins**

18. Explain how non-steroid hormones utilize a second messenger system. What is the first messenger?
    a. **Hormone binds to a membrane receptor**
    b. **Hormone does not enter the cell**
    c. **Sets off a series of reactions that activates an enzyme**
    d. **Catalyzes a reaction that produces a second messenger molecule**
    e. **Oversees additional intracellular changes to promote a specific response**

    1st messenger would be the non-steroid hormone itself

19. Explain the difference between humoral, hormonal, and neural stimulation of the endocrine system. Give an example of each type of stimulus.
Hormonal – endocrine organs are prodded into action by other hormones.
Example: Thyroid-stimulating hormone (TSH) stimulates the thyroid gland to release thyroid hormone (TH)

Humoral – changing blood levels of ions and nutrients stimulating hormone release.
Example: low blood sugar stimulates the pancreas to release glucagon into the bloodstream
Neural – nerve fibers stimulate hormonal release and the target cells respond to neural stimuli.
Example: the adrenal medulla is stimulated by the sympathetic nervous system to release epinephrine and norepinephrine

20. List the other tissue types in the human body that also have an endocrine function.
    a. **Parts of the small intestine**
    b. **Parts of the stomach**
    c. **Kidneys**
    d. **Heart**
    e. **Many other areas have scattered endocrine cells**
    f. **Placenta**
        i. **Produces hormones that maintain the pregnancy**
        ii. **Some hormones play a part in the delivery of the baby**
        iii. **Produces HCG in addition to estrogen, progesterone, and other hormones**

21. What is menopause? How is it related to the endocrine system?
    Menopause is brought about by lack of efficiency of the ovaries. Reproductive organs start to atrophy (weaken and lose mass) and a woman cannot bear children. It is related to the endocrine system because it involves the ovary's production of sex hormones.

22. Looking back to the nervous system unit, what are the normal functions of the hypothalamus?
    regulates body temperature, water balance, and metabolism.

    Typo—this question is not required for the Endocrine System Test! You will need to know the role that the hypothalamus plays in the endocrine system.

23. Explain the relationship between the posterior pituitary gland and the hypothalamus.
    - **Release of hormones is controlled by releasing and inhibiting hormones produced by the hypothalamus**
    - **Hypothalamus produces two hormones that are transported to neurosecretory cells of the posterior pituitary**
    - **The posterior pituitary is not strictly an endocrine gland, but does store and release hormones**

24. What kind of endocrine problems did our case study, "Chemical Eric," exhibit? Which of the glands, hormones, and target tissues/organs were involved with his issues?

    Major gland affected was the pituitary which in turn affected the thyroid, the gonads (testes), and the adrenal glands.

    - **He had high amounts of GH which caused acromegaly**
    - **He had low amounts of FSH and LH and was therefore hairless at first and sterile**
    - **He had low amounts of TSH and therefore had low thyroid function**
    - **He had low amounts of ACTH and therefore had differing pain responses because of altered epinephrine and norepinephrine**
    - **He had low amounts of ADH and therefore had diabetes insipidus**
    - **He had to receive hormone replacement therapy (cortisone, testosterone, thyroid hormone, ADH) throughout his life because doctors irradiated his pituitary gland and destroyed it.**

25. Label the diagram below with the various endocrine glands.