

Anatomy Study Guide

Endocrine System:

- Together the nervous and endocrine systems are responsible for integration and coordination to maintain homeostasis
- Endocrine system is chemical, slow to react (seconds to days), most tissues in body, continues for days, stimulates/inhibits neurons
- Nervous system is electrochemical, very fast (milliseconds), only muscles/glands, ends quickly, may stimulate hormone release
- Plays a major role in growth and development, full body metabolism, and reproduction
- Hormones are mostly controlled by negative feedback, sometimes positive (blood clotting, oxytocin)
- paracrine**- local hormones, secrete their fluids into the tissues of nearby cell
- autocrine**-affect itself

Transport of Hormones: endocrine glands are highly vascularized, release hormones into extracellular fluid via exocytosis, hormones travel in blood vessels and are transported to target organ

-Hypothalamus and Pituitary have a closely integrated relationship

Hypothalamus- major link between the nervous and endocrine systems, hormones control the pituitary, derived from neural tissue

- part of diencephalon of cerebrum
- hormones are produced in 2 nuclei (paraventricular and supraoptic)
- Hypothalamic Hormones:

Anterior Pituitary:

- Growth hormone-releasing hormone (GHRH)
- Growth hormone-inhibiting hormone (GHIH)
- Corticotropin-releasing hormone (CRH)
- Thyrotropin-releasing hormone (TRH)
- Gonadotropin-releasing hormone (GNRH)
- Prolactin-releasing hormone (PRH)
- Prolactin-inhibiting hormone (PIH)

Posterior Pituitary:

- Oxytocin- produced in paraventricular nucleus
- Anti-diuretic hormone (ADH)- produced in supraoptic nucleus

Pituitary- "master" endocrine gland, suspended from hypothalamus by infundibulum

-together they have 16 different hormones that regulate growth, development, metabolism, and homeostasis

- anterior pituitary* (adenohypophysis)
 - derived from glandular epithelium
 - 5 types of cells
 - 3 produce tropic hormones

1. *Corticotropes*- Adrenocorticotrophic hormone (ACTH), targets adrenal cortex, promotes the growth of adrenal cortex and the secretion of glucocorticoids (regulates glucose, protein and fat metabolism)
2. *Thyrotropes*- Thyroid Stimulating Hormone (TSH), targets thyroid gland, promotes growth of thyroid and secretion of thyroid hormone

3. *Gonadotropes*- Follicle Stimulating Hormone (FSH)- secretion of estrogen and sperm, and Luteinizing Hormone (LH), both target ovaries and testes, ovulation/secretion of testosterone

-2 produce effects on non-endocrine tissues

1. *Somatotropes*- Growth Hormone (GH), targets liver, bone, cartilage, muscle and fat. Widespread tissue growth

2. *Lactotropes*- Prolactin (PRL), targets mammary glands and testes, female: milk synthesis, male: increased luteinizing hormone sensitivity

-*posterior pituitary* (neurohypophysis)

-derived from neural tissue

-2 hormones are synthesized in hypothalamus, transported to Posterior pituitary where they are stored until they are released on demand, travel down hypothalamic-hypophyseal tract as a nerve impulse from the the hypothalamus, released into ECF then capillaries

1. Oxytocin-targeted to uterus and mammary glands, labor contractions and milk release

2. Antidiuretic Hormone (ADH)-targets kidneys, water retention

-**hypothalamic-hypophyseal tract**- nerve tract connecting to posterior pituitary

-**hypophyseal portal system**-vascular connection to anterior pituitary

-primary capillary plexus → hypophyseal portal vein → secondary capillary plexus

Thyroid:

-Largest gland, located on neck above trachea, 2 winglike lobes connected by an isthmus, very large blood flow, only gland to store hormones in large quantity (3 months worth)

-major metabolic hormone of body, primarily increases metabolic rate, affects virtually every cell except adult brain, spleen, testes, uterus, and thyroid gland

-*Follicular cell hormones*- (thyroid hormones) formed from iodine and thyroglobin, transported by thyroxin-binding globulin

-T3- (3 iodines), most active thyroid hormone

-T4- (4 iodines) aka thyroxin, most abundant but converted to T3 once absorbed by target cells

-*Calcitonin*- produced in parafollicular cells, promotes deposition of calcium into bone matrix (decreases blood Calcium levels), and stimulates osteoblasts (promotes bone growth)

Parathyroid Glands:

-at least two pairs on back of thyroid gland

-secretes Parathyroid Hormone (PTH) which counteracts calcitonin, raise blood calcium levels and inhibits osteoclasts

Thymus Gland:

-Large and conspicuous in children, diminishes through adulthood

- plays a role in endocrine, lymphatic, and immune system

- secretes T-cells (T-lymphocytes) which play a large role in immunity (affected during AIDS)

-Thymosin and thymopoietin regulate and activate the T-cells

Adrenal Glands:

-Structurally and functionally two glands

-Major function is to help body cope with stress

-*Adrenal Cortex*- surrounds the medulla, produces more than 25 steroid hormones known collectively as corticoids (all synthesized from cholesterol)

-Mineralcorticoids- produced in zona glomerulosa, regulate body's electrolyte balance

-Aldosterone is a mineralcorticoid that maintains blood volume and pressure

-Glucocorticoids- produced in zona fasciculata, regulate the metabolism of glucose and other organic fuels

-Cortisol aids in chronic stress, excess of cortisol affects immune system

-Gonadocorticoids- produced in zona reticularis, various developmental/reproductive functions

-Androgen (sex hormones)

-*Adrenal Medulla*- made of cells that are modified postganglionic neurons (no axons), sympathetic innervation, hormones prolong the effects of sympathetic stimulation

-epinephrine (80%)

-norepinephrine (20%)

Pancreas:

-an elongated, spongy gland located below and behind the stomach

-mainly an exocrine digestive gland, but 1-2% of pancreatic cells are endocrine

-Islets of Langerhans- very important in regulation of blood glucose concentration

-Alpha cells- secrete glucagon between meals when blood glucose concentration falls

-Beta cells- secrete insulin during and after a meal when blood nutrient levels are rising

-Delta cells- secrete somatostatin (inhibits growth hormone) concurrently with the release of insulin, inhibits some digestive enzyme secretion and nutrient absorption

Gonads:

-testes and ovaries

-estrogen and progesterone predominantly secreted by females

-testosterone predominantly secreted by males

Pineal Gland:

-has both nervous system and endocrine system functions

-Produces melatonin which regulates sleep/wake cycles

-changes in response to light cycles

-possible role in sexual maturation

Endocrine Functions of Other Organs:

-Stomach/Small Intestine- secretes enteric hormones which coordinate digestion

-Kidney- calcitriol affects calcium handling, erythropoietin stimulates RBC production

-Heart- atrial natriuretic factor affects the blood pressure, secreted when rising blood pressure stretches the heart wall

Modes of Stimulation:

-Humoral stimulation- changing blood levels of ions and nutrients (insulin/glucagon from pancreas)