

endocrine glands secrete hormones that control target cells

hormone = messenger molecule that regulates specific body functions
integrate the functions of other organs and organ systems
regulate processes such as metabolism, growth, and reproduction

target cell = cell that contains specific receptors for a hormone

receptor = protein located in the cell membrane or nucleus to which the hormone binds

general mechanism of action of hormones:

1. endocrine glands secrete hormones into blood
2. blood carries hormones to target cells
3. hormones bind to a receptor in the target cell and alter the target cell's physiological activity

A. hypophysis = pituitary gland

location: lies in hypophyseal fossa in sella turcica of sphenoid bone

- neurohypophysis = posterior pituitary gland, extension of nervous tissue of brain
- adenohypophysis = anterior pituitary gland, epithelial origin from roof of mouth

1. relationship between hypothalamus and pituitary:

a. adenohypophysis

the hypothalamus secretes several hormones that control the release of adenohypophysis hormones (releasing hormones or release-inhibiting hormones)

the hypothalamic neurons that produced the hormones have axon terminals that end at the walls of the a capillary plexus in the median eminence

when the hormones are released by the neurosecretory neurons they diffuse into the blood in the capillaries

the hormones are carried from the hypothalamus to the adenohypophysis by a portal system:

superior hypophyseal artery

primary capillary plexus in median eminence of hypothalamus

hypophyseal portal veins

secondary capillary plexus in anterior pituitary

veins

hormones diffuse out of the capillaries and bind to receptors in anterior pituitary cells, stimulating or inhibiting the secretion of anterior pituitary hormones

b. neurohypophysis

the hypothalamus secretes 2 hormones that enter the blood stream in the neurohypophysis

the hypothalamic neurons that produce these 2 hormones are located in the supraoptic and paraventricular nuclei of the hypothalamus

their axons leave the hypothalamus and project inferiorly into the neurohypophysis, forming the hypothalamic-hypophyseal tract

their axon terminal end at the walls of capillaries in the neurohypophysis

when the hormones are released they diffuse into the capillaries and circulate to their target cells

2. neurohypophysis (neural tissue, inferior extension of brain)

gross structure: pars nervosa, infundibular stalk, median eminence

microscopic structure: nervous tissue containing unmyelinated fibers and neuroglia

hormones: antidiuretic hormone (ADH) and oxytocin (OT)

3. adenohypophysis (glandular tissue, not neural tissue)

gross structure: pars distalis, pars intermedia, pars tuberalis

microscopic structure: composed of epithelial-derived glandular tissue from the roof of the fetal mouth

each cell type secretes a different hormone:

somatotropic cells - growth hormone (GH) / somatotropin

lactotropic cells - prolactin (PRL)

thyrotropic cells - thyroid stimulating hormone (TSH)

corticotrophic cells - adrenocorticotrophic hormone (ACTH) and melanocyte stimulating hormone (MSH)
gonadotrophic cells - follicle stimulating hormone (FSH) and luteinizing hormone (LH)

B. thyroid gland

located anterior to trachea, anterior and inferior to larynx

gross structure: left and right lobes connected by anterior isthmus

microscopic structure:

1. spherical follicles

simple cuboidal e. = follicular cells

thyroglobulin = colloid that fills lumen, made by follicle cells

thyroid hormone is made in several steps that occur in the follicular cells and thyroglobulin, then stored in the thyroglobulin until needed

thyroid hormone consists of 2 molecules:

T3 = triiodothyronine

T4 = tetraiodothyronine or thyroxine

thyroid hormone controls metabolic rate and is required for normal development of the skeletal, muscular, nervous and reproductive systems

2. parafollicular cells

- project outwards from follicular epithelium
- secrete calcitonin, which helps to control calcium levels in body fluids

C. parathyroid glands

- are embedded in posterior surface of thyroid gland
- usually 2 pairs, number can vary between individuals
- microscopic structure:
 - chief cells - secrete parathyroid hormone (PTH), which raises blood calcium levels
 - oxyphil cells

D. pineal gland or body - located in epithalamus

- cells called pinealocytes

- have branching processes
- secrete melatonin (secreted in response to changing day length, suppresses reproduction)
- pineal sand = calcium particles

E. adrenal glands

location: superior to kidneys

gross structure:

cortex = outer gland, 3 layers, derived from epithelium

medulla = inner gland, derived from sympathetic ganglion tissue

1. cortex - secretes corticosteroids

a. zona glomerulosa - outer layer of cortex
cells arranged in clusters
main source of mineralocorticoids

b. zona fasciculata - middle layer of cortex
cells arranged in parallel sheets
main source of glucocorticoids

c. zona reticularis - inner layer of cortex
cells arranged in branching network
main source of gonadocorticoids
secondary source of glucocorticoids

2. adrenal medulla - secretes catecholamines (epinephrine/norepinephrine)

chromaffin cells = modified sympathetic postganglionic neurons

no axons

release chemicals into blood vessels instead of onto another cell at a synapse

F. pancreas

endocrine portion = pancreatic islets (islets of Langerhans)

alpha cells secrete glucagon

beta cells secrete insulin

delta cells secrete somatostatin

F (PP) cells secrete pancreatic polypeptide