### Endocrine system (chapter 11) Page 1

Endocrine system

A system of communication between body parts by signal molecules (hormones) secreted into the bloodstream

• The endocrine system regulates functions such as growth,

development, metabolism, and reproduction

• Endocrine gland = An organ that sends a signal by secreting a

hormone into the bloodstream

• Hormone = A molecule that functions as a chemical signal that

travels in the blood

√ There are dozens of hormones; each has a unique molecular

structure and unique functions in the body

√ There are three types of hormone molecules:

- Amine hormones = Hormones that are modified amino

acids

- Peptide/Protein hormones = Hormones that are

polymers of amino acids

- Steroid hormones = Hormones that have a backbone of

four fused carbon rings

• Target organ = The organ that receives the signal by binding the

hormone with a receptor specific for the hormone

√ The target organ is preprogrammed to take a specific action

when its receptor binds the hormone

Fig 11. 1 and tables 11.1 and 11.2

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Tropic hormones (releasing hormones)

Hormones that stimulate endocrine glands to secretes hormones

The pituitary gland

An endocrine gland located under and connected to the brain’s

hypothalamus region

• The hypothalamus controls the secretion of hormones from the

pituitary glands

• The pituitary gland is composed of two parts: The anterior pituitary

and posterior pituitary

√ The anterior pituitary secretes the hormones growth

hormone, prolactin, and tropic hormones that control the

thyroid gland, the adrenal gland, and the gonads

√ The posterior pituitary secretes the hormones oxytocin

and antidiuretic hormone

Figs 11.1, 11.12 - 11.17, tables 11.6 and 11.7

Endocrine system disorders

Disorders caused by over secretion or under secretion of hormones

• Over secretion can be caused by a tumor in an endocrine gland

√ The tumor can be in the gland that controls the target organ or

in a gland that secretes tropic hormones to control the gland that

controls the target organ

• Under secretion can be caused by damage to an endocrine gland

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Growth hormone (GH)

A hormone that causes growth of bone and muscle but decreases fatty

tissue

• GH is necessary for normal growth from infancy to adulthood

√ After puberty, bones lose their ability to grow in response to

GH

• GH over secretion before puberty = Giantism

√ GH over secretion after puberty causes growth in cartilage but

no increase in height (acromegaly)

• GH under secretion before puberty = Dwarfism

Fig 19.16, 19.17

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The thyroid gland

An endocrine gland at the base of the throat

• The thyroid secretes thyroid hormone

√ Thyroid hormone (Thyroxine, T4) = An iodine-containing hormone that increases the body’s BMR (basal metabolic rate, calories used per hour) by increasing each cell’s use of glucose for energy

√ Graves Disease (hyperthyroid) = Over secretion of thyroid

hormone. Symptoms include nervousness/fidgeting, weight

loss, high temperature, and bulging of eyes

√ Hypothyroid = Under secretion of thyroid hormone.

Symptoms in adults include weight gain, low energy and low

temperature, and apathy. In infants, hypothyroid causes

stunted growth and mental retardation (cretinism)

- One cause of hypothyroid is lack of iodine in diet. This

type of hypothyroid also causes a goiter (a swollen

thyroid gland)

• The thyroid also secretes the hormone calcitonin

√ Calcitonin = A hormone that decreases calcium levels in

the blood

Figs 11.1, 11.3, 11.24 - 11.28, and table 11.8

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The parathyroid glands

Small endocrine glands located on the thyroid gland

• The parathyroids secrete parathyroid hormone (PTH)

√ PTH = A hormone that increases calcium levels in the blood

Figs 11.27 and 11.28

Calcium levels in the blood are controlled by the mutually antagonistic effects of the hormones calcitonin and PTH

• High blood Ca2+ = More calcitonin released = Stimulates bone

cells to construct more bone, lowering calcium levels

• Low blood Ca2+ = More PTH released = Stimulates bone cells

to dissolve bone, raising calcium levels

Figs 11.28, 19.20, 19.22, and 19.23

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Adrenal glands

A pair of endocrine glands, one atop each kidney

• Each adrenal gland has two parts, the cortex (outer region) and the

medulla (inner region)

• The cortex releases several steroid hormones: Aldosterone (regulates

blood Na+ concentration), glucocorticoids (regulate the body’s

response to long-term stress), and very small amounts of

testosterone and estrogen (the male and female sex hormones)

• The medulla releases epinephrine and norepinephrine (regulate the

body’s response to short-term stress)

Figs 11.18, 11.19, and 11.20

The glucocorticoids (cortisone and cortisol)

Steroid hormones released from the adrenal cortex in response to

long-term stress

• They cause stored fats and proteins to be converted into blood

glucose

• They also decrease the immune system’s activity

√ Synthetic glucocorticoids are given to reduce immune system

activity (examples: To treat inflammation and autoimmune

diseases)

• Cushing’s syndrome = Over secretion of glucocorticoids. Symptoms

include high blood sugar, muscle degeneration, and fatty deposits on

neck and face.

• Addison’s disease = Under secretion of all steroid hormones from

the adrenal cortex. Symptoms include sodium imbalance, low blood

sugar, dehydration, and weakness.

Fig 11.20

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Epinephrine and norepinephrine

Two substances released form the adrenal medulla in response to short-term stress (the “fight or flight” response)

• The adrenal medulla is nervous tissue; it releases epinephrine and

norepinephrine when stimulated by the sympathetic division of the

nervous system

• Epinephrine (a hormone, formally known as adrenaline) and norepinephrine (a neurotransmitter) prepare that body for an immediate crisis situation

√ They increase heart rate, breathing rate, and blood glucose

√ They dilate the air passages and the blood vessels in the

muscles, heart, and lungs

√ They decrease digestive system activity

Figs 9.8 and 11.18, table 9.4