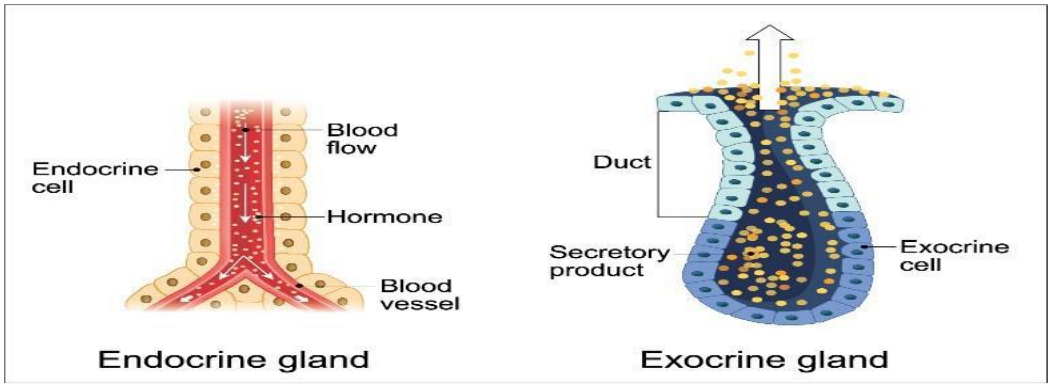
INTRODUCTION TO ENDOCRINOLOGY

Introduction

Most glands of the body deliver their secretions through ducts. These are called exocrine glands. Few other glands produce chemical substances that they directly secrete into the blood stream for transmission to various target tissues. These are ductless or endocrine glands. The secretions of endocrine glands are called ***hormones.***



Definition of Hormones

It is ***a chemical substance produced in one part of the body, which enters the circulation and is carried to distant target organs*** **and** ***tissues to modify their structures and functions.***

Hormones are stimulating substances that act as body catalysts. They catalyze and control diverse metabolic processes despite their varying actions and specificities depending on the target organ.

Similarities of Hormone and Enzyme

The hormones have several characteristics in common with enzymes:

- They act as body catalysts similar to enzymes in some aspects.
- They are required only in small quantities.
- They are not used up during the reaction.

Dissimilarities of Hormone and Enzyme

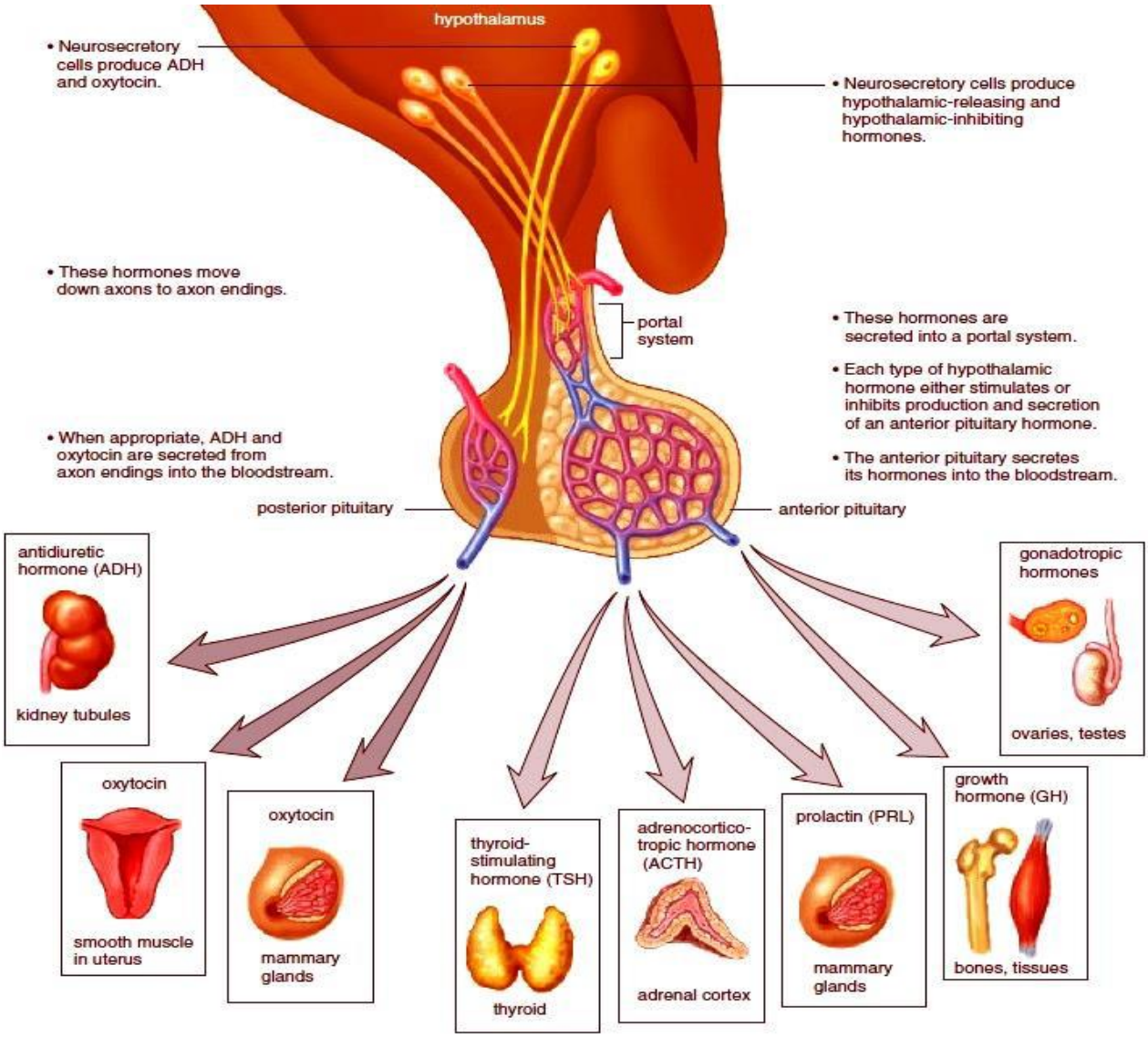
They differ from enzymes in the following ways:

- They are produced in an organ other than that in which they ultimately perform their action.

• They are secreted in blood prior to use.
• Thus, the circulating levels of hormones can give some indication of endocrine gland activity and target organ exposure. Because of the small amounts of the hormones required, blood levels of the hormones are extremely low. In many cases, it is ng/µg or mIU, etc.
• Structurally, they are not always proteins. Few hormones are protein in nature, and few are small peptides. Some hormones are derived from amino acids, while some are steroids in nature.

The major hormone-secreting glands are:

• Pituitary• Thyroid • Parathyroid • Adrenal • Pancreas • Ovaries • Testes.



Classification of Hormones

Hormones can be classified chemically into **three major groups:**

1. ***Steroid hormones*:** These are steroid hormones in nature, such as adrenocorticosteroid hormones, androgens, estrogens, and progesterone.
2. ***Amino acid derivatives*:** These are derived from the amino acid tyrosine, e.g., epinephrine, norepinephrine, and thyroid hormones.
3. ***Peptide/Protein hormones:*** These are either large proteins or small or medium-sized peptides, e.g., Insulin, glucagon, parathormone, calcitonin, pituitary hormones, etc.

Several other glandular tissues are considered to secrete hormones, viz.:

- **Juxtaglomerular *(JG) cells of the kidney*** May produce the hormone erythropoietin, which regulates erythrocyte maturation and erythropoiesis.
- ***Thymus*:** This produces a hormone that circulates from this organ to stem cells in lymphoid organs, inducing them to become immunologically competent lymphocytes.
- ***Pineal gland:*** It produces a hormone that antagonizes the secretion or effects of ACTH. It also produces factors called glomerulotrophins that regulate the adrenal secretion of aldosterone.
- **GI tract*:*** Certain specialized cells of the GI tract also produce a few hormones, which are called GI Hormones.

Factors Regulating Hormone Action

Four factors regulate the action of a hormone at a target organ:

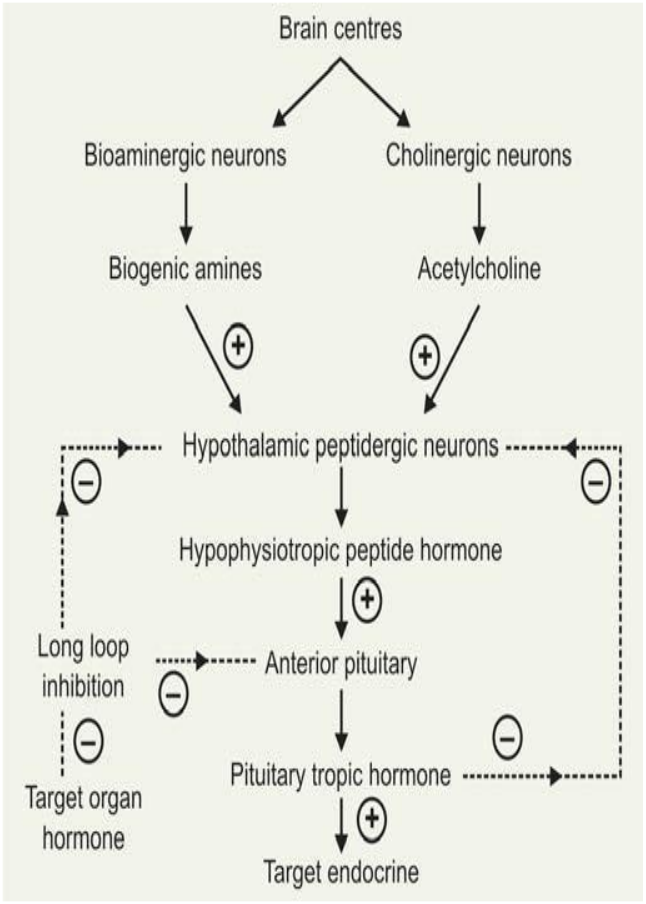
1. ***Rate of synthesis and secretion*:** The hormone is stored in the endocrine gland.
2. in some cases, ***specific transport systems in plasma.***
3. ***Hormone-specific receptors in target cell membranes*,** which differ from tissue to tissue.
4. ***Ultimate degradation*** of the hormone, usually by the liver or kidneys.

REGULATION OF HORMONE SECRETION

Hormone secretion is strictly under the control of several mechanisms.

A. Neuroendocrinal control mechanism: Nerve impulses control some endocrine secretions. Cholinergic sympathetic fibers stimulate catecholamine secretion from the adrenal medulla. Centers in the midbrain, brainstem, hippocampus, etc., can send nerve impulses that react with the hypothalamus

through cholinergic and dopaminergic neurons. At the terminations of these neurons, they release acetylcholine and biogenic amines to regulate the secretions of hypophysiotropic peptide hormones from hypothalamic peptidergic neurons. Some of the endocrine releases are controlled by either stimulatory or inhibitory hormones from a controlling gland, e.g., corticosteroids are controlled by corticotropin and thyroid hormones are controlled by thyrotropin from the anterior pituitary. Hypothalamic-releasing hormones further regulate the tropins.



B. Feedback control mechanism: It is mainly due to negative feedback that such control is brought about. When there is a high blood level of a target gland hormone, it may inhibit the secretion of the tropic hormone stimulating that gland. The adrenal cortex secretes a hormone called cortisol, which inhibits the secretion of corticotropin from the anterior pituitary and corticotropin-releasing hormone from the Hypothalamus by long-loop feedback. This leads to a reduction in cortisol secretion.

C. Endocrine rhythms: There are certain cyclic rhythms associated with the secretion of hormones over a period of time. When there is a cyclic periodicity of 24 hours, it is called a ***circadian rhythm***. However, if it is more than 24 hours, it is named infradian rhythm, and when it is less than 24 hours, it is called ***ultradian rhythm***. Due to such rhythms, the highest and lowest conc. of corticotrophin is normally found in the morning and around midnight. Growth hormone and prolactin rise in the early hours of deep sleep. ***Cortisol peak is found between 4 AM and 8 AM. Endocrine rhythms result from cyclic activities of a biological clock in the limbic system, supplemented by the diurnal light-dark and sleep activity cycles and mediated by the hypothalamus***