REPRODUCTIVE HORMONES

Hormones are chemical substances serve as a messenger that transport signals from one cell to the other cell, or organ or a gland or any body part of plants and animals that functions in the regulation of physiological activities and to maintain homeostasis.

Hormones are released in very little quantities. A little quantity of hormones carries out functions inducing responses from the target organs or tissues. Hormones are transmitted to their target organs in the bloodstream after they are discharged from the glands secreting them. Cells express a specific receptor molecule to the hormone particles to which they respond. An endocrine secretion is the mode of discharge directly into the bloodstream.

Characteristics of Hormones

1. Hormones are secreted by endocrine glands.
2. Hormones are chemical messengers.
3. The hormones regulate the behavior of the target cells.
4. They are secreted only when needed.
5. Hormones may be proteinaceous or non-proteinaceous (amino-acids or steroids).
6. The secretion of hormones is regulated by a feedback effect.
7. Function of the hormones is to stimulate or inhibit the target organs.

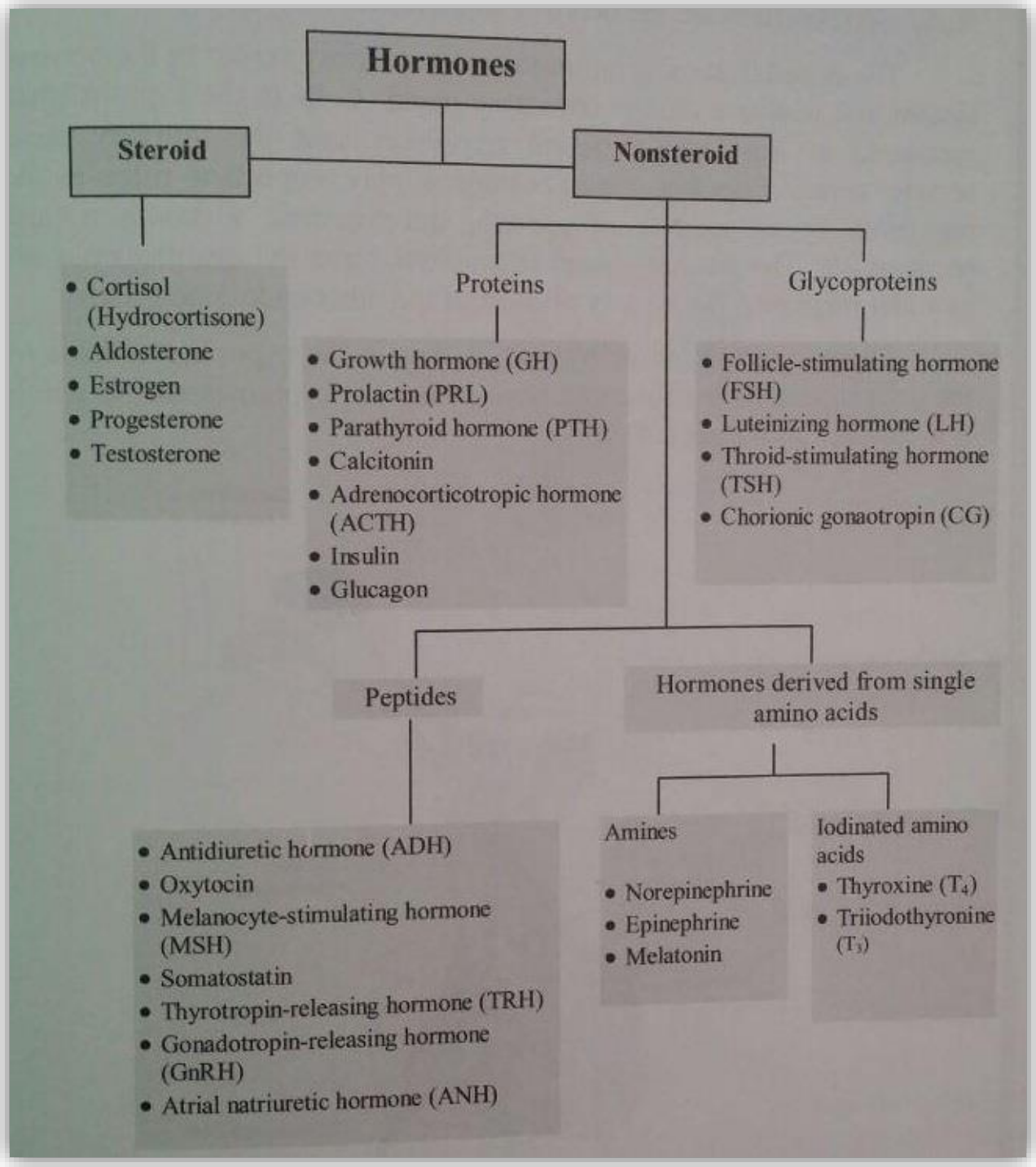
Classification of Hormones

A. According to function:

1. **Tropic hormones**: hormones that target other endocrine glands and stimulate their growth and secretion (GnRH).
2. **Sex hormones**: hormones that target the reproductive tract (estrogen, progesterone, testosterone, LH, FSH).
3. **Anabolic hormones**: hormones that stimulate anabolism in their target cells (growth hormone, insulin, glucagon).

B. According to the chemical Structure:

1. **Steroid hormones**: are derived from cholesterol and are soluble in lipids, and includes the sex hormones (androgens, estrogens, and progesterone), adrenal gland hormones (mineral-corticosteroids and gluco-corticosteroids).
2. **Non-steroid hormones**:
   - Proteins (GH).
   - Glycoproteins (LH, FSH).
   - Peptides (GnRH, Oxytocin).
   - Single amino acids:
   - Amines (Melatonin).
   - Iodinated amino acids (Thyroxin T4, Tri-iodo-thyronine T3).



Chemical classification of hormones

List of hormones and the secretory organs

Secretory Organ	Hormone
Ovary	Estrogens, ß-estradiol, Estrole, Estrone, Androgens, Relaxin
Testes	Testosterone, Aldosterone
Adrenal Cortex	Corticosteroids, Aldosterone, Cortisone, Cortisol, Corticosterone
Adrenal Medulla	Epinephrine, Non-epinephrine
Corpus Luteum	Progesterone
Islets of Langerhans (ß-cells)	Insulin
Islets of Langerhans (α- cells)	Glucagon
Hypothalamus gland	Hormones called factors: Gonadotropin releasing hormone (GnRH) Prolactin releasing factor (PRF) Prolactin inhibiting factor (PIF) Corticotrophin releasing factor (CRF)
Anterior pituitary gland	Thyrotropin, Corticotropin, Gonadotropins FSH, LH, Somatotropin (GH)
Posterior pituitary gland	Oxytocin, Vasopressin
Gastrointestinal Tract	Secretin, Pancreozymin, Gastrin
Parathyroid	Parathormone
Thyroid	T_3, Thyroxin, T_4

Control of hormone secretion

Three mechanisms are controlling the secretion of hormones:

1) **Hypothalamus regulation:**

The hypothalamus controls the release of the anterior pituitary hormones that stimulate other endocrine glands to release hormones. The hormones of the anterior pituitary are released in response to releasing hormones (also called releasing factors) secreted by the hypothalamus.

2) **Internal body environment:**

Another group of glands responds directly to changes in the composition of the internal environment. For example. Hyperglycemia (rise blood glucose level), the pancreas secretes insulin (ß-cells) to reduce blood glues levels, and in hypoglycemia (falls blood glucose levels), the pancreas secretes glucagon (α-cells) to raise blood glucose level.

3) **Nervous control:**

Some glands are stimulated directly by the nervous system. For example, the adrenal medulla secretes its hormones (adrenalin) in response to nervous stimulation such as during flight, fright, fight, and surprise.

Mechanisms of hormone action

A. The action of non-steroid hormones (the two-messenger theory):

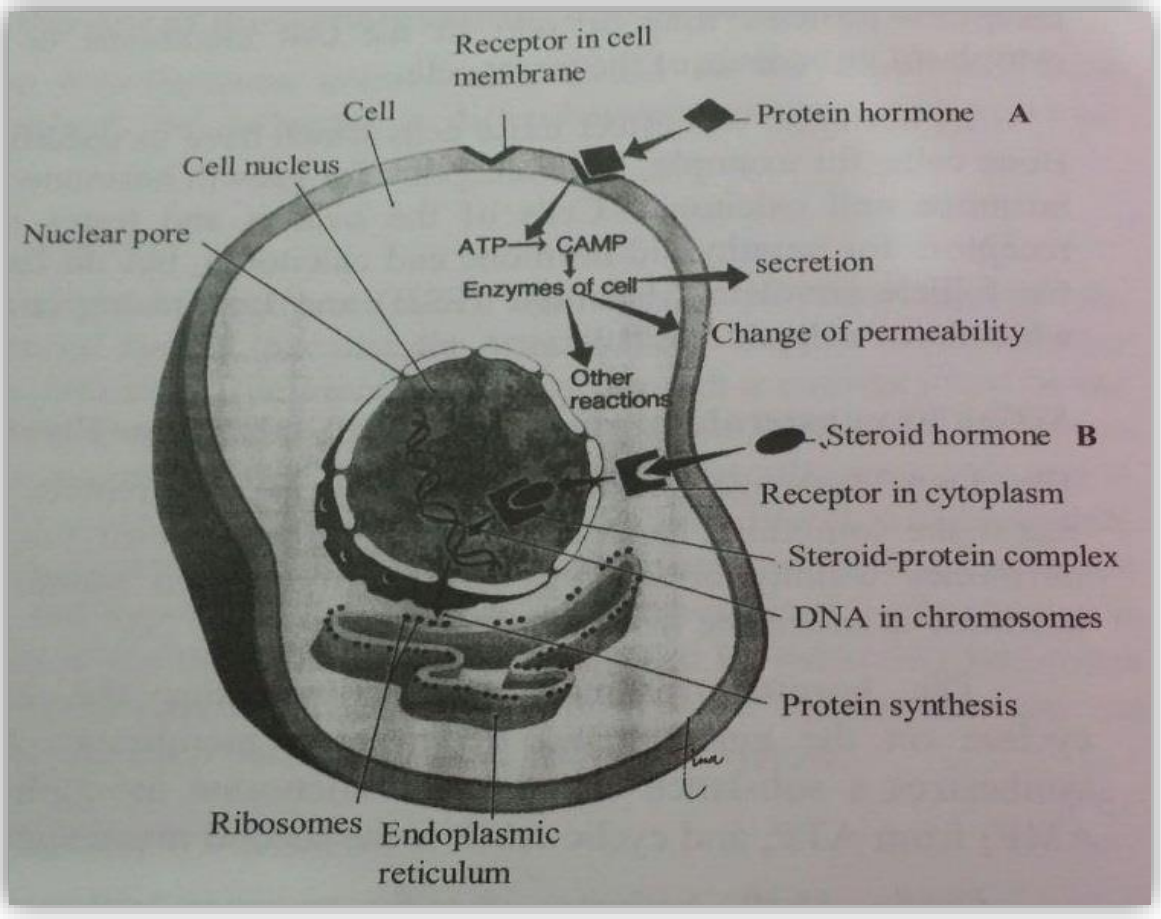
The two-messenger theory of hormone action involves "messengers" that make something happen and stimulate specific reactions.

- Protein hormones usually bond to receptors on the cell membrane, and the hormone-receptor was called the **"first messenger"**.
- The hormone-receptor binding activates the enzyme adenyl cyclase on the inner surface of the cell membrane.

- Adenyl cyclase synthesizes a substance called cyclic adenosine monophosphate (cyclic AMP) from ATP, and a cyclic AMP is a **"second messenger"**.
- Cyclic AMP activates specific enzymes within the cell, which bring about the cell's characteristic response to the hormone (change in the permeability of the cell membrane to a specific substance, an increase in protein synthesis, activation of other enzymes, or the secretion of a cellular product).

B. The action of steroid hormones:

- Steroid hormones are soluble in the lipids of the cell wall.
- Once inside the cell, the steroid hormone combines with a protein receptor in the cytoplasm, and this steroid-protein complex enters the nucleus of the cell.
- Within the nucleus, the steroid-protein complex activates specific genes, which begin the process of protein synthesis. The enzymes produced bring about the cell's characteristics, response to the hormone.



Mechanism of hormones action

Negative Feedback Mechanism:

Mostly hormone regulation is done by a negative feedback mechanism. In this mechanism hormone causes an effect, the cells that make hormones detect this effect, and the production of hormones is ceased.

An example of a negative feedback mechanism is with the hormone insulin. Insulin hormone is produced by ß-cells of the pancreas. The release of insulin by the pancreas is the response to the consumption of glucose. A rise in the glucose levels in the blood is detected by the pancreas and secretes insulin into the blood.

Insulin increases the uptake of glucose in the target cells. Some of the glucose is used by the cells and the other is converted and stored in the form of glycogen.

The uptake of glucose by the cells decreases glucose levels, this decrease is detected by the pancreas, and as a response to the decrease in glucose levels, and it stops secreting insulin into the bloodstream. A decrease in insulin levels in the blood decreases glucose uptake by the cells. This negative feedback mechanism helps to maintain normal blood glucose levels and prevents extremities.

Positive Feedback Mechanism:

A few hormones are regulated through a positive feedback mechanism. In the positive feedback mechanism, the effect of hormones, make the gland secrete more hormones. This is the opposite of the negative feedback mechanism.

An example of a positive feedback mechanism is the hormone that causes childbirth. The hormone is oxytocin which is made by the pituitary gland. The onset of labor stretches the muscles in the cervix, the nerves here send signals to the pituitary.

This signal makes the pituitary release more oxytocin. The oxytocin hormone causes the muscles of the uterus to contract which causes more stretching in the cervix. This stretching causes even more secretion of oxytocin. The level of oxytocin keeps rising until the contractions lead to childbirth.