

Tikrit University

College of Nursing

Basic Nursing Sciences



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Biochemistry

(Lecture (7) Hormones)

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Classification Based on Mechanism of Hormone Action

Hormones can be classified according to mechanism of hormone action to:

1. Group I hormones
2. Group II hormones.

This classification is based on location of the hormone receptors.

1-The hormones of Group I are lipophilic which readily pass through the lipophilic plasma membrane of the target cells and interacts with receptors which are located intracellular in either the cytosol or the nucleus. The receptors for the different steroid hormones are found mainly in the cytoplasm and the receptors for the thyroid hormones are found in the nucleus.

2- The hormones of group II are water-soluble . Hormones which do not penetrate lipophilic cell membrane readily. The receptors for such hormones are located on the outer surface of the target cell (cell surface receptors).

<i>Class</i>	<i>Second messenger or mediator</i>	<i>Examples</i>
Group I Cytosolic or nuclear receptor	Hormone-receptor complex	Androgens Estrogens Glucocorticoids Mineralocorticoids Progesterol Thyroid hormones (T ₃ and T ₄)
Group II Cell membrane receptor	c-AMP	Epinephrine Norepinephrines Glucagon Parathyroid hormone
	Calcium or phosphatidylinositol or both	Vasopressin Oxytocin

Mechanism of hormone action

The first step of hormone action is binding of hormone to specific receptors of the target cell. Hormone receptor complex activates the hormonal effects. Hormonal receptors are large proteins, which are highly specific for a single hormone. Due to this specificity a particular hormone will act on a particular tissue.

Mechanism of hormone action at Systolic nuclear level

Several hormones, e.g. steroid hormones (adrenal and gonadal) and thyroid hormones bind with receptors inside the cell rather than in the cell membrane. Because these hormones are lipid soluble, they readily cross the cell membrane and interact with receptors in the cytoplasm or nucleus. The receptors for the steroid

hormones are found mainly in the cytoplasm and the receptors for the thyroid hormones are found in the nucleus.

Cell membrane receptor of hormone action

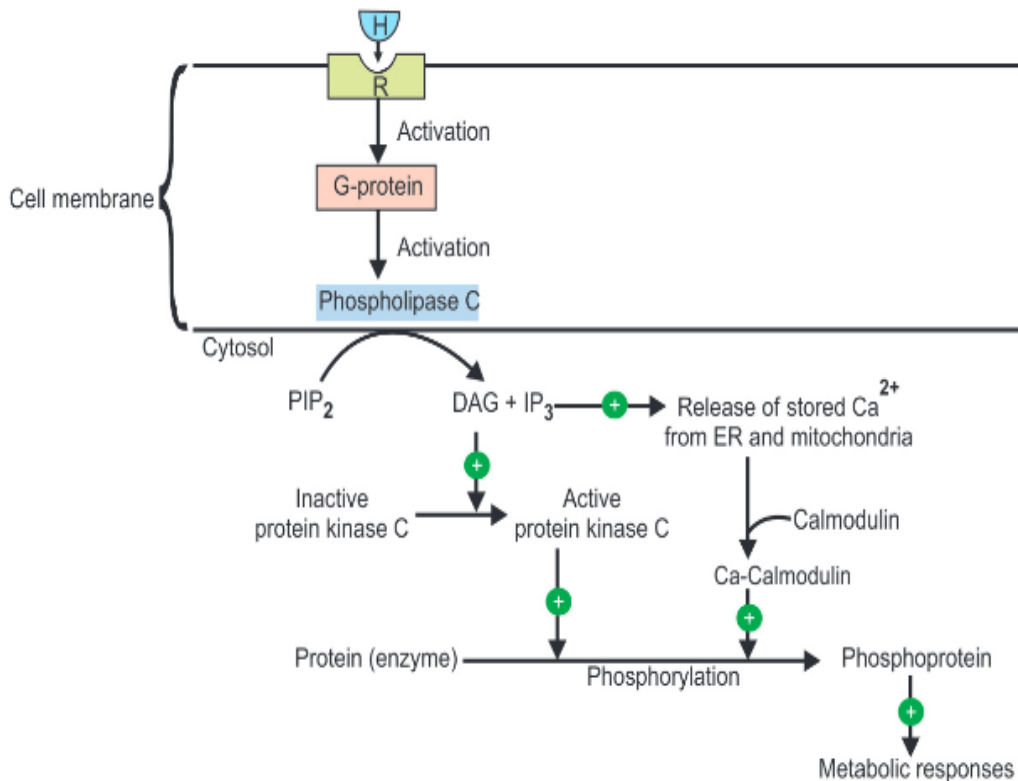
The receptors for group II hormones are located on the outer surface of the target cell because these hormones are water soluble which do not enter lipophilic cell membrane. Hormones that bind to surface receptors of the cells communicate their action through intermediary molecules called second messenger (the hormone itself is the first messenger) . On binding of the hormone to the receptor, a conformational change occurs in the receptor, that causes activation of the G-protein that consist of three subunits α , β , γ . GDP (Inactive G-protein) convert to GTP (active G-Protein) interacts with other intracellular signaling enzymes such as adenylate cyclase which generates c-AMP for many hormones, e.g. epinephrine, glucagon, calcitonin, PTH, etc

Phosphatidylinositol/calcium second messenger

•Certain hormone-receptor interaction result in the activation of the enzyme phospholipase C through a specific G-protein . Phospholipase C enzyme catalyzes the breakdown of phospholipids in cell membrane especially phosphatidylinositol bisphosphate (PIP₂) into:

1. Inositol triphosphate (IP₃): that liberates stored intracellular calcium ions from mitochondria and endoplasmic reticulum. The calcium in turn acts as a third messenger which influences a variety of biochemical processes.

2. Diacylglycerol (DAG): the other second messenger, activates the enzyme kinase C which then alter physiological processes. The hormones thyrotropin releasing hormone (TRH) gastrin, cholecystinin act through this second messenger.



Gland

A gland is an organ in an animal's body that synthesizes a substance such as hormones for release into the bloodstream (endocrine gland) or into cavities inside the body or its outer surface (exocrine gland). The following glands make up the endocrine system and some of hormone secretion:

- **Pituitary Gland secretion each of :** (growth hormone, prolactin, adrenocorticotrophic hormone, thyroid stimulating hormone, luteinizing hormone, oxytosin)

- **Hypothalamus gland secretion each of :**

- **Thyrotrophic-releasing hormone - Growth hormone-releasing hormone - Corticotrophin-releasing hormone - Gonadotropin-releasing hormone**

- **Thymus:** this gland secretes hormones that are commonly referred to as humoral factors and are important during puberty. The role of these hormones is to make sure a person develops a healthy immune system.

- **Pineal Gland:** The pineal gland releases melatonin, which helps the body recognize when it is time to go to sleep.

- **Testes:** this gland produces testosterone.

- **Ovaries:** this gland produces both estrogen and progesterone. secreted by the ovarian follicles of the ovaries.

- **Thyroid:** of Thyroid-Stimulating hormone (TSH) with T3 (Triiodothyronine) and T4 (Thyroxine)

- **Adrenal Glands:** norepinephrine, epinephrine, cortisol

- **Parathyroid:** Calcitonin

- **Pancreas:** insulin, glucagon, which secretes digestive enzymes