Dr. Sujan Kumar Sarkar
Lecturer
Department of Anatomy, Histology & Physiology
Sher-e-Bangla Agricultural University, Dhaka

Transport of Hormones

- Hormones synthesized by the endocrine glands are transported throughout the body by the **bloodstream.**
- Hormones secreted into systemic circulation.
- Some are secreted into portal systems
- Can exist freely in systemic circulation, but the majority are bound with transport proteins.
- Transport proteins hold hormones inactive in systemic circulationand create a reservoir within the circulation that facilitates an even distribution of hormones throughout the tissue or organ.
- **Transport protein**: A protein that binds with a hormone in systemic circulation that facilitates its efficient transport.
- Portal system rather than the systemic circulation: Hormones secreted by the **pancreas** pass into the hepatic portal vein that transports them directly to the liver.
- Most peptide hormones **circulate unbound to other proteins**, Exceptions exist; for example, **insulin-like growth factor-1**
- Steroids bind to some extent to **plasma proteins**. This binding is often low affinity and non-specific (e.g. to albumin), But some steroids are transported by specific binding proteins.

Hormone receptor:

- A molecule that binds to a specific hormone that triggers alterations in cell activity.

Half-life:

- The time it takes for a substance (drug, radioactive nuclide, or other) to lose half of its pharmacological, physiological, or radiological activity.

Hormone Signaling

- The glands of the endocrine system secrete hormones directly into the extracellular environment.
- The hormones then diffuse to the bloodstream via capillaries and are transported to the target cells through the circulatory system.
- This allows hormones to affect tissues and organs far from the site of production or to apply systemic effects to the whole body.

Steps of Hormonal Signaling

- Biosynthesis of a particular hormone in a particular tissue.
- Storage and secretion of the hormone.
- Transport of the hormone to the target cells, tissues, or organs.
- Recognition of the hormone by an associated cell membrane or an intracellular receptor protein.
- Relay and amplification of the received hormonal signal via a signal transduction process.
- Potential feedback to a hormone-producing cell.

Mechanisms/ Mode of Action of Hormone Action

Key Points in Mechanism/ Mode of Action of Hormones

- Hormones are released into the bloodstream through which they travel to target sites.
- The target cell has receptors specific to a given hormone and will be activated by either a lipid-soluble (permeable to plasma membrane) or water-soluble hormone (binds to a cell-surface receptor).
- Lipid-soluble hormones diffuse through the plasma membrane to enter the target cell and bind to a receptor protein.
- Water-soluble hormones bind to a receptor protein on the plasma membrane of the cell.
- Receptor stimulation results in a change in cell activity, which may send feedback to the original hormone-producing cell.

Key Terms

- **Water-soluble hormone**: **A lipophobic hormone** that binds to a receptor on, or within, **the plasma membrane**, to initiate an intracellular signaling cascade.
- **Hormone**: A molecule released by a cell or a gland in one part of the body that sends out messages affecting cells in other parts of the organism. (A hormone is a secreted chemical messenger that enables communication between cells and tissues throughout the body)
- **Lipid-soluble hormone**: A lipophilic hormone that passes through the plasma membrane of a cell, binds to an intracellular receptor, and changes gene expression.
- **Secondary messenger**: These are molecules that relay signals from receptors on the cell surface to target molecules inside the cell, in the cytoplasm, or the nucleus.

[Hormone-producing cells are typically specialized and reside within a particular endocrine gland, such as thryocytes in the thyroid gland. Hormones exit their cell of origin through the process of exocytosis or by other means of membrane transport.

Cellular recipients of a particular hormonal signal may be one of several cell types that reside within a number of different tissues. This is so in the case of insulin, which triggers a diverse range of systemic physiological effects. Different tissue types may also respond differently to the same hormonal signal. As a result, hormonal signaling is elaborate and hard to dissect.

Hormones activate target cells by diffusing through the plasma membrane of the target cells (lipid-soluble hormones) to bind a receptor protein within the cytoplasm of the cell, or by binding a specific receptor protein in the cell membrane of the target cell (water-soluble proteins). In both cases, the hormone complex will activate a chain of molecular events within the cell that will result in the activation of gene expression in the nucleus.

The reaction of the target cells may then be recognized by the original hormone-producing cells, leading to a down-regulation in hormone production. This is an example of a homeostatic negative feedback loop.**]**

Mode of Action of Protein/ Peptide Hormone

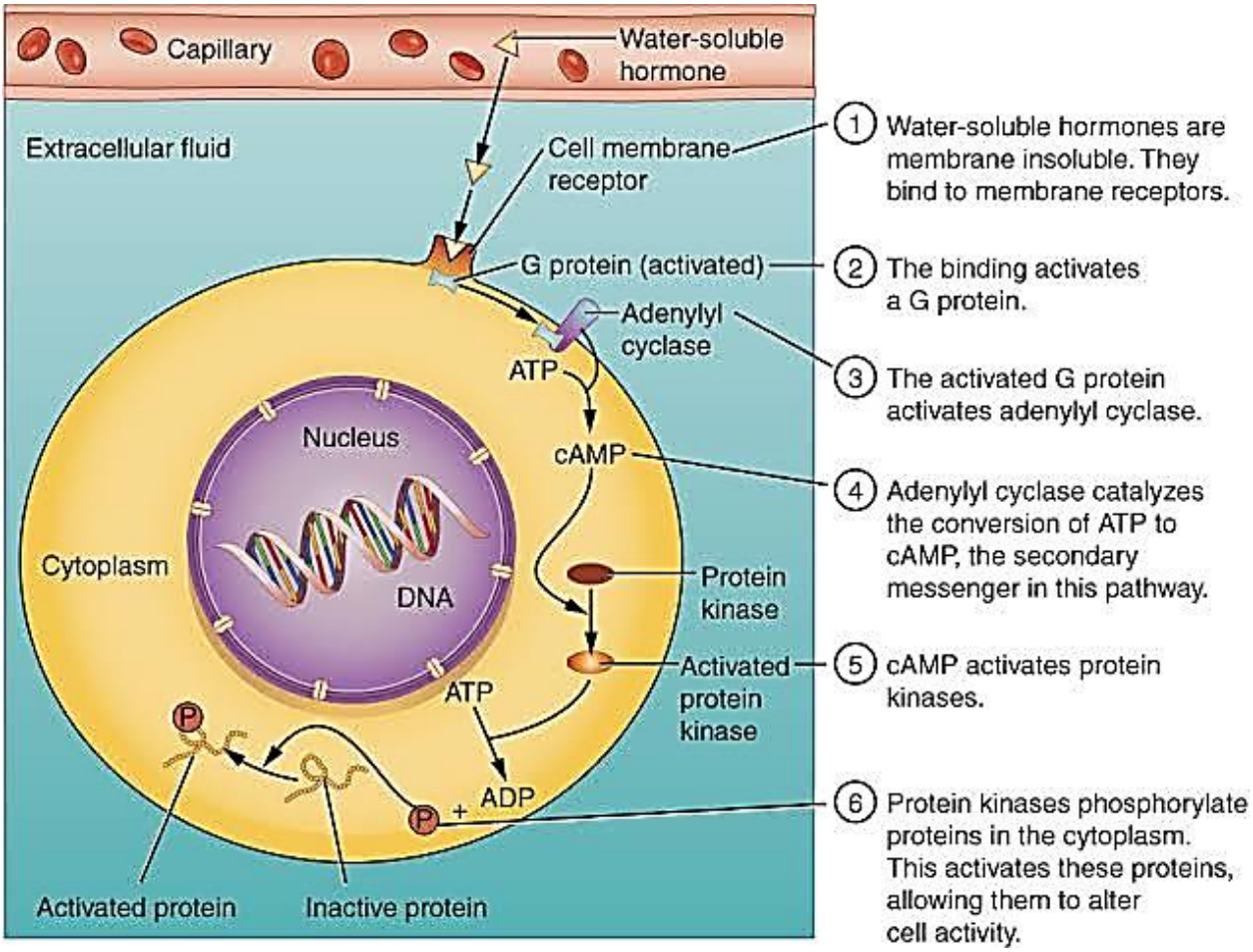

Fig: Mode of Action of Protein/ Peptide hormone

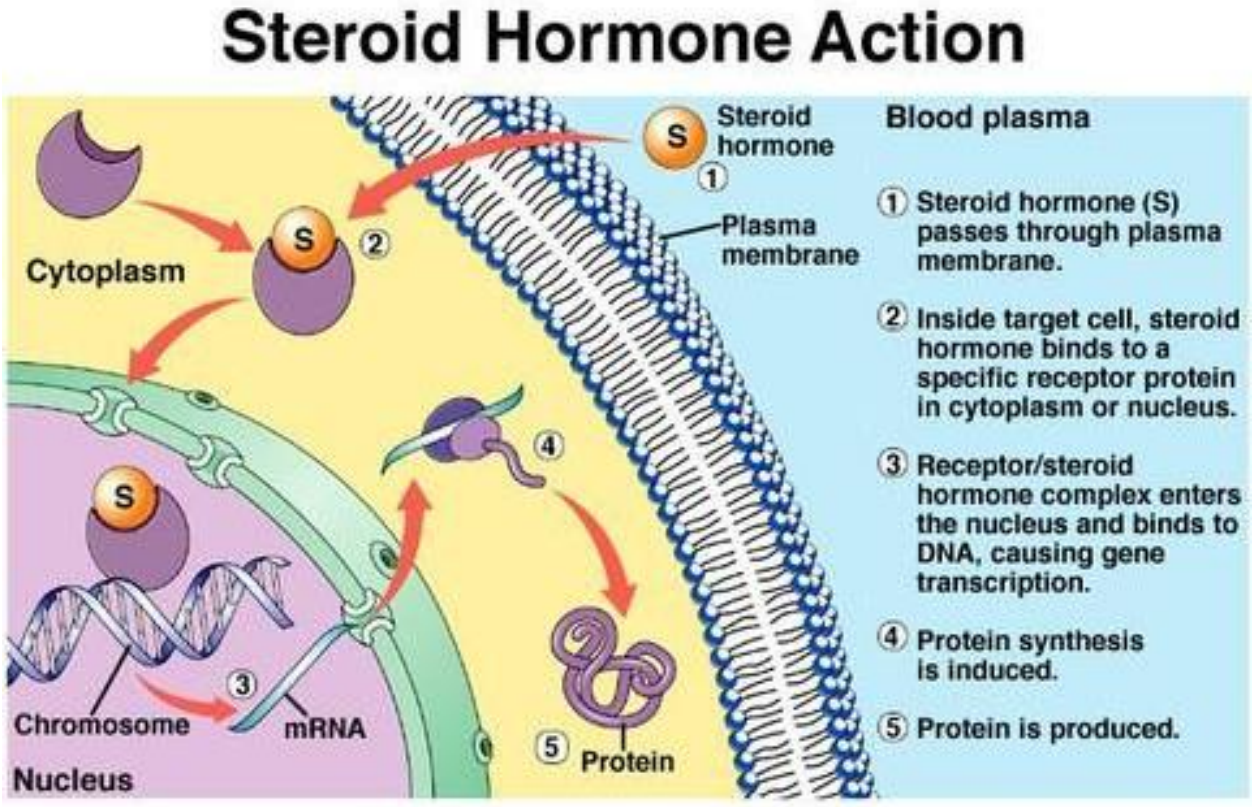

Fig: Mode of Action of Steroid Hormone

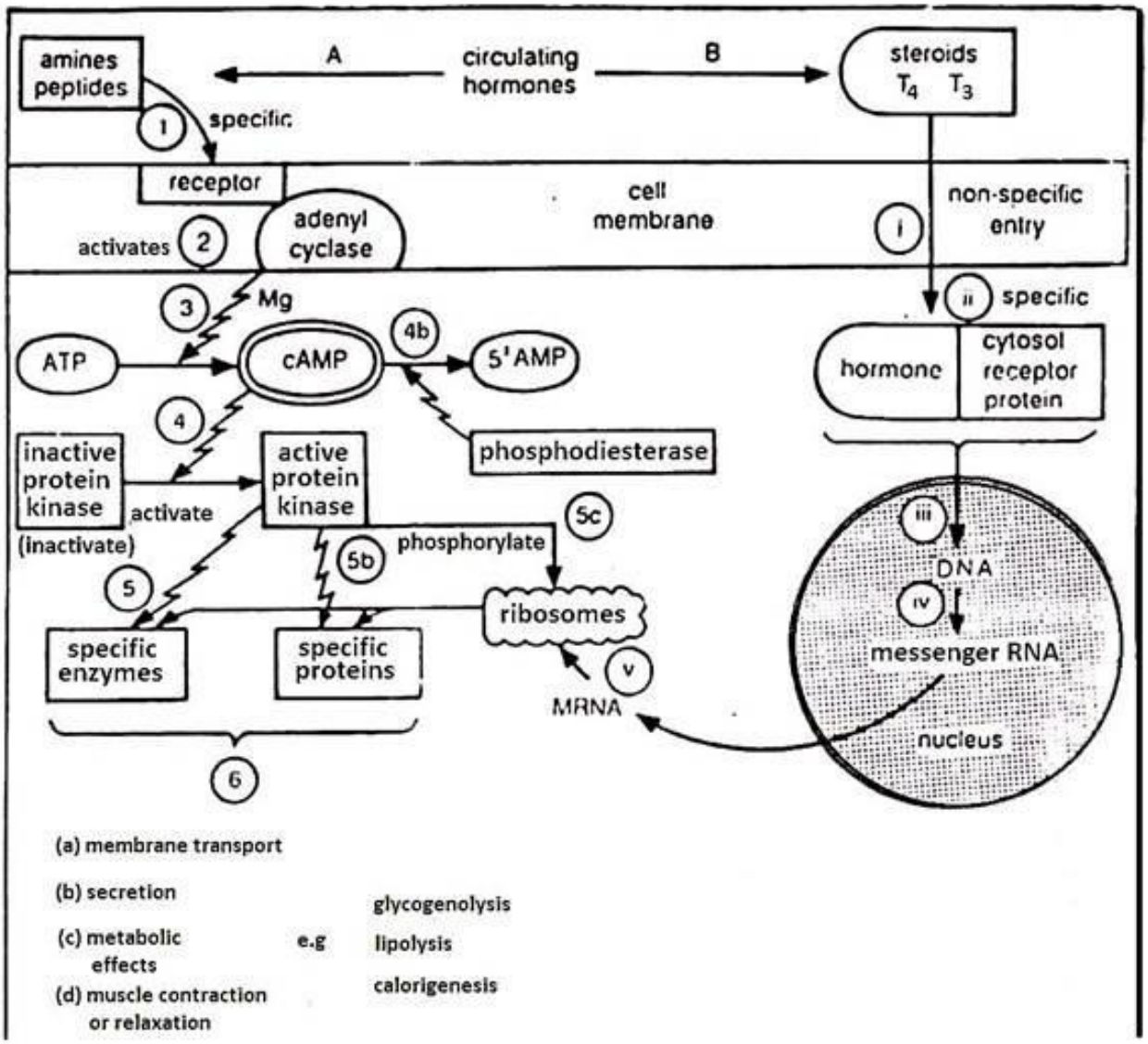

Fig. 1 Diagram to illustrate the basic pathways by which; A. Amine and peptide hormones and B, steroid and thyroid hormones regulate the synthesis of specific proteins and thereby modulate cell function For detailed explanation see text. ATP = adenosine triphosphate, AMP = adenosine monophosphate, cAMP = cyclic adenosine -3' 5'-monophosphate ('cyclic AMP'), T_4 = thyroxine, T_3 = triiodothyronine

Fig: Summary [Mode of Action of Hormone (Both Peptide & Steroid)]