بسم الله الرحمن الرحيم
Mechanism Of Hormonal Action

Dr. Hani Alrefai
Hormone

- A hormone is chemical regulatory substance, secreted by ductless glands (endocrine glands).
- It passes through blood stream to reach the tissues on which it acts. These tissues are called “target tissues”.

Dr. Hani Alrefai - 2014
General functions of hormones:

- Hormones regulate different metabolic pathways.
- Hormones co-ordinate activities of different organs of the body.
- Some hormones control the rate and type of growth of the body.
Target tissue

- Target tissue of a certain hormone is the tissue, which contains the specific receptors of that hormone
Hormone receptors

**Definition:**
Cell-associated recognition molecules which are protein in nature.

**Functional sites:**
Two functional sites:
- **Recognition site:** It binds the hormone specifically.
- **Signaling site:** It couples hormone binding to intracellular effect.
Hormone receptors

**Location:**
Receptors may be:

- **Intracellular receptors:** (in the cytosol or in the nucleus)
- **Cell-membrane receptors:** (in the plasma membrane).
(a) Intracellular receptors

Hydrophobic hormone

Intracellular receptor

Nucleus

Receptor with bound hormone

Receptor with bound hormone in nucleus

mRNA

Altered transcription of gene
Cell surface receptors

Low concentration of second messengers

High concentration of second messengers

Growth Factors

Hormones

Extracellular hydrophilic hormones, neurotransmitters, growth factors

Intracellular second messenger
Classification of Hormones

Hormones can be classified according to:

- Chemical nature.
- Mechanism of action
Classification according to chemical nature

Protein

Amino Acid Derived

Steroid
Classification according to chemical nature

- **Protein Hormones:**
  - Large polypeptides: e.g. **insulin** and **parathyroid hormone**
  - Small polypeptides: e.g. **ADH** (9a.a.), **oxytocin** (9a.a.)
  - Glycoprotein hormone: e.g. **FSH**, **LH**, **TSH**, **HCG**.
Classification according to chemical nature

- **Amino Acid Derived Hormones:**
  - Thyroid hormones and catecholamines are derived from **tyrosine**.
  - Melatonin is derived from **tryptophan**.

Dr. Hani Alrefai - 2014
Classification according to chemical nature

- **Steroid hormones:**
  
  These hormones are derived from **cholesterol**. e.g.
  - Glucocorticoids.
  - Mineralocorticoids.
  - Sex hormones.
Classification according to mechanism of action

- Hormones, which bind to intracellular receptors.

- Hormones, which bind to membrane receptors.
<table>
<thead>
<tr>
<th>Hormones bind to intracellular RCs</th>
<th>Hormones bind to cell membrane RCs</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Lipophylic</td>
<td>• Hydrophilic</td>
</tr>
<tr>
<td>• Need transport proteins to reach target tissues</td>
<td>• Do not need transport protein</td>
</tr>
<tr>
<td>• Long plasma half-life (hours to days).</td>
<td>• Short plasma half-life (minutes).</td>
</tr>
<tr>
<td>• Action is mediated by forming hormone-receptor complex.</td>
<td>• Action is mediated by Second Messenger.</td>
</tr>
<tr>
<td>• Include: Steroid hs, Thyroid hs, Calcitriol, Retinoids</td>
<td>• All other hormones.</td>
</tr>
</tbody>
</table>
The Second Messenger

- Is the signal produced as a result of hormone binding to its cell membrane receptor.
- It mediates the effects of the hormone.
- The second messenger may be:
  - Cyclic Adenosine Monophosphate (cAMP).
  - Cyclic Guanosine Monophosphate (cGMP).
  - Calcium or phosphatidyl inositol or both.
  - Protein kinase cascade.

N.B. The hormone is considered to be the first messenger
Mechanism of Hormonal Action

A) Hormones which bind to intracellular receptors
1. Lipid-soluble hormone diffuses through plasma membrane.

2. Hormone binds with receptor in cytoplasm, forming a receptor–hormone complex.

3. Receptor–hormone complex enters the nucleus and triggers gene transcription.

4. Transcribed mRNA is translated into proteins that alter cell activity.
Thank you