

Ch 7: Introduction to the Endocrine System

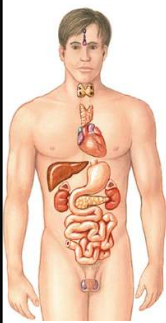
Hormones (classification & control of)

Endocrine Pathologies

Running Problem: Grave's Disease

The endocrine system

- A. releases chemicals into the bloodstream for distribution throughout the body.
- B. releases hormones that alter the metabolic activities of many different tissues and organs simultaneously.
- C. produces effects that can last for hours, days and even longer.
- D. Both A and B are correct.
- E. A, B and C are correct



Endocrinology

- = The study of hormones, their receptors, the intracellular signaling pathways they invoke, and the diseases and conditions associated with them.
- What are hormones?
 - Where do they come from?
- Major endocrine glands?
- Physiological processes controlled by hormones?

Fig 7-2

Hormones:

- Known since ancient times
- Secreted by cells into the blood
 - Not always a gland
 - Pheromones?
- Transported to distant targets
- Effective at very low concentration
- Bind to receptors
 - (differing effects on some tissues)
- Hormone action must be of limited duration
- Some are stored, others are manufactured as needed.



Chemical Classification of Hormones

4 main types:

1. Peptides and proteins
 1. Most common
2. Steroids
3. Amines
4. Eicosanoids

Differ on basis of synthesis, storage, release, transport and cellular mechanism of action (review Table 7-1)

1. Peptide (Protein) Hormones

- Synthesis as **preprohormone** → **post-translational modification to prohormone** → then **hormone**
- Storage – release?
- Short half-life (mins.)
- Most common type

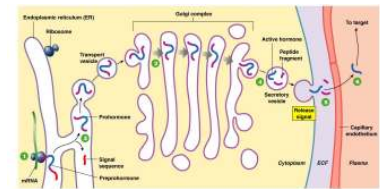


Fig 7-3

Peptide Hormone Processing

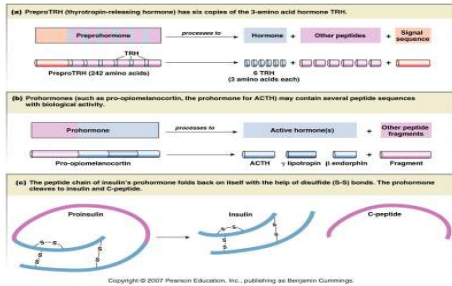
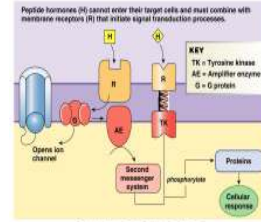


Fig 14-4

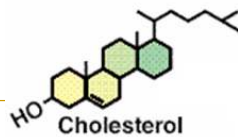
Cellular Mechanism of Action for Peptide Hormones

- Peptides are lipophobic \Rightarrow how does message get into cell?
- Usually rapid cellular response because existing proteins are modified
- cAMP 2nd messenger system most common



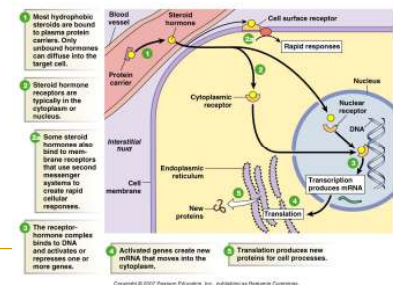
2. Steroid Hormones

- Only gonads, adrenals, placenta
- Derived from cholesterol (lipophilic)
 - Cross membranes (no storage)
- SER, on-demand synthesis
- Usually Bound to **Carrier** proteins
 - May extend $t_{1/2}$
 - May block entry to target cell
- Activity is intracellular
 - Next slide



Steroid Hormone Mechanism of Action

- Lipophilic when unbound
 - Cross membranes
- New DNA Replication
- De novo* synthesis or response



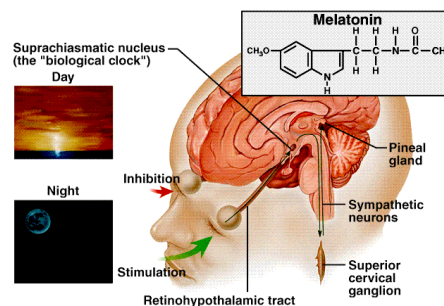
3. Amine Hormones

- Derived from tyrosine or tryptophan
- 3 groups
 - Tryptophan \Rightarrow **Melatonin**
 - Tyrosine \Rightarrow **Catecholamines** behave like peptide hormones
 - Tyrosine \Rightarrow **Thyroid hormones** behave like steroid hormones

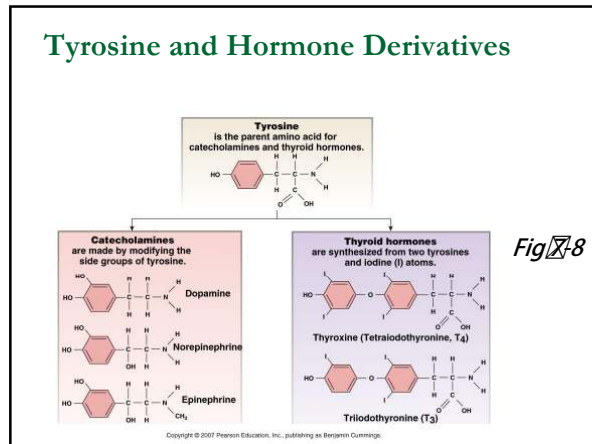
Fig 14-8

Melatonin

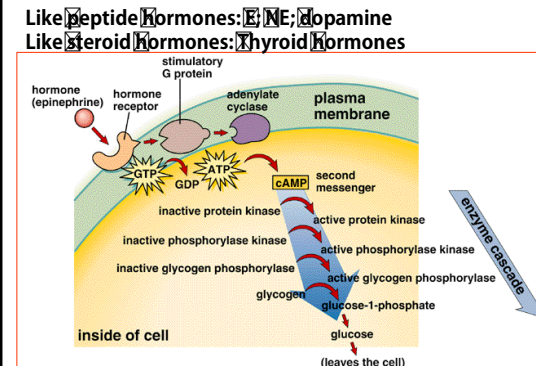
Read Focus on Pineal Gland in textbook Fig. 14-22



Tyrosine and Hormone Derivatives



Mechanism of Action of Amine Hormones



4. Eicosanoids (Fig 6-16)

- Derivatives of arachidonic acid
 - Unsaturated FA
- Produced by MANY cells
- Unclear if hormone is the proper term
 - May be autocrine/paracrine, too
- Produced by COX in response to cell damage
 - Mediators of inflammation
 - NSAIDs are COX inhibitors
 - Many other activities

Control of Hormone Release (p 222)

All endocrine reflex pathways have similar components

- Similar to PNS/CNS reflex pathway
 - Stimulus / input signal
 - Integration (where?)
 - Output signal (hormone / neurohormone)
- Physiological action
- Negative feedback – turns off reflex