Endocrine Pharmacology

Basic principles

- Endocrine pharmacology vs endocrine physiology
- 2nd in importance to CNS
- Endocrine System
- Uses chemical signals (hormones) for cell to cell communication
- Coordinates the function of cells
- Response to an endocrine signal occurs within minutes to hours (ductless glands)

■ Hormonal regulation ↑↓

- Growth & development
- Reproduction, fertility, sexual function
- Response to environmental situations (stress...)
- Maintenance of normal homeostasis

Hormones

- Chemical substances synthesized in and released from highly specialized cells collectively known as endocrine glands, immediately secreted into blood stream and act at some other place
- Considered cell to cell communication molecules
- Transported by blood
- Distant or local target tissue receptors
- Activates physiological response

Hormones are secreted by endocrine glands or cells into the blood. Only target cells with receptors for the hormone will respond to the signal.





Biological response

****** Glands **Ductless** Hypothalamus **Pituitary** Thyroid Parathyroid **Pancreas** Adrenals **Ovaries** Testes



Chemical nature of hormones

- a. a derivatives:

T3; T4; Dopamine (precursor=Tyrosine) - Small peptides; polypeptides; large proteins or glycoproteins:

Hypothalamic hormones; GH; PRL; Insulin; Glucagon; LH; FSH; TSH...

- Steroids

Cortisol; Aldosterone; Estrogen; Progesterone; Androgens

Amine Hormones

- Derived from the amino acid tyrosine
- Include the catecholamine dopamine &
- thyroid hormones
- Stored until secreted
 - * Receptor locations
 Surface (Dopamine)
 Intracellular (nuclear; T₃ & T₄)

Protein and Polypeptide Hormones: Synthesis and Release







Protein and Polypeptide Hormone Receptors

- Bind to surface receptor
- Transduction
 - System activation
 - Open ion channel
 Enzyme activation
 - Second messenger systems
 - Protein synthesis



Steroid Hormones Receptors



Hormone receptors are subject to 2 important





Basal conditions...minimal release

- Stimuli:
- Nerve impulse
- Change in composition of ECF
- Another hormone (trophic hormone)
 → blood → target cells → receptors → initial change → cascade of reactions → recognizable change...

Change in cell permeability
Stimulation or inhibition of protein synthesis

** Transcription or translation

Stimulation or inhibition of mediator release

(second messenger)
** cAMP; DAG; Ca⁺⁺; ITP (IP₃)...

How long a hormone stays high in blood?
Depends on:

- Extent of protein binding

- Efficiency of degradable enzymes & clearance

Metabolism & excretion

- Efficiency of negative feedback mechanisms





 Sources of hormones:
 Natural Human (GH; LH & FSH; hCG); Animal (Insulin, T₃ & T₄)

- Synthetic

Most hormones and their antagonists

Disorders affecting endocrine glands: Deficiency states (Hypothalamus)

HRT



- Excess production of a specific hormone

Inhibitors to the synthetic machinery or Release inhibitors or Specific antagonists or Surgery

- Clinical pharmacology of hormones:
 Major clinical use of hormones
 HRT (physiological doses)
 Supra-physiological doses (pharmacological doses)
- Anti-inflammatory effects (non-endocrinerelated diseases)...
- Use as diagnostic tool (TRH test ...)

- The use of some drugs which are not hormones, but used in the management of diseases of endocrine origin

Antithyroid drugs, oral hypoglycemic agents...

 Some drugs are used to treat diseases not related to the endocrine system but affecting it

Anticancerous drugs $\rightarrow \stackrel{\frown}{O} \& \stackrel{\frown}{P}$ infertility - The use of hormones as contraceptives???