

2406 Lecture Summaries

Lecture 1: Introduction to Endocrinology

Hormone Actions/Interactions

- Hormone secretion occurs through stimuli, which present a need for the hormone. *Insulin and Glucagon* are essential hormones in the regulation of *Blood Glucose Level (BGL)*.
- α cells release the hormone Glucagon, which increases BGL. β cells release Insulin, which decreases BGL. These hormones are released as endocrine (within tissue), and are secreted in the Pancreas.
- *Plasma Electrolyte* levels also prompt the release of hormones.
- *Parathyroid Glands* release *PTH*, which increases Plasma Ca^{2+} . *Thyroid C cells* release *Calcitonin*, which decreases Plasma Ca^{2+} levels.

Homeostasis and Negative Feedback

- Negative feedback control occurs in the secretion of *Cortisol*.
- Stress triggers *CRH* release from the *hypothalamus*, which triggers *ACTH* release from the *Anterior Pituitary*. The *Adrenal Cortex* then releases *Cortisol*.
- *Cortisol* has a *suppressive function on the immune system*, *gluconeogenesis on the liver*, *catabolism on muscle* and *lipolysis on adipose tissue*.

Positive Feedback in Reproduction

- Positive feedback can be observed in the *Oxytocin* release from the *pituitary gland during labor*.
- Uterine contractions push the fetus against the cervix. Through the neuroendocrine reflex, *Oxytocin* is secreted which further increases uterine contractions and increases prostaglandin production. The prostaglandins further increased the uterine contractions.

Processes affected by hormones

- *Stress*
- *Intermediary metabolism of carbohydrates, fats and proteins*
- *Electrolyte and fluid metabolism*
- *Growth and development (GH)*
- *Reproduction*

Characteristics of a hormone

- Characteristics include: *chemical messenger*, *specific nature*, *specific cell*, *endocrine gland*, *blood transport*, *trace amount*, *distant target*, *specific receptor*, *specific change* and *catalytic action*.

Chemistry of Hormones

- There are three types of hormones: *Peptide/Protein*, *Steroid* and *Amines (Catecholamine and Thyroid hormones)*

			Amine	Amine
	Peptide Hormones	Steroid Hormones	Catecholamine	Thyroid Hormones
Synthesis and Storage	Made in advance, stored in secretory vesicles	Synthesized on demand from precursors	Made in advance, stored in secretory vesicles	Made in advance, stored in secretory vesicles
Release from parent cell	Exocytosis	Simple Diffusion	Exocytosis	Simple Diffusion
Transport in Blood	Dissolved in Plasma	Bound to carrier Proteins	Dissolved in Plasma	Bound to carrier Proteins
Half-Life	Short	Long	Short	Long
Location of Receptor	Cell Membrane	Cytoplasm or Nucleus	Cell Membrane	Nucleus
Response to Receptor-Ligand Binding	Activation of 2 nd messenger systems, may activate genes	Activation of genes for transcription/translation	Activation of 2 nd messenger systems	Activation of genes for transcription and translation
General Target Response	Modification of existing proteins and new protein synthesis	New protein synthesis	Modification of new proteins	New protein synthesis
Examples	Insulin, PTH	Estrogen, Androgens, Cortisol	Epinephrine, Norepinephrine	Thyroxin

Mechanisms of Hormone Action

- Different hormones take different routes of action to produce different effects. These can be differentiated with the above table.
- Take *Cortisol* for example.
 - o Cortisol is a steroid hormone, which is made on demand from precursors. It exits the parent cell via simple diffusion and binds to a carrier protein in order to travel through the blood.
 - o It binds to the receptor in either the cytoplasm or nucleus and activates genes for transcription and translation.
 - o Transcription produces mRNA which synthesizes new proteins
- *Insulin* is a peptide hormone and differs in mechanism
 - o It is made in advance and stores in secretory vesicles. It leaves the vesicles via exocytosis and travels through the blood bound to plasma.
 - o It binds to the receptor on the membrane and activates 2nd messenger systems in the Peptide Hormone – Receptor complex.
 - o It produces modification of existing proteins and synthesis of new proteins.

Patterns of Secretion

- *Hypo secretion* is a deficient release of hormones into the body. It can lead to dwarfism with GH, and hotness and loss of weight in Thyroid Hormones.
- *Hyper secretion* is an over secretion of hormone. It can lead to gigantism in the case of GH or coldness and weight gain with Thyroid Hormones.
- *Treatment options include;* Administration for hypo secretion, removal of gland for hyper secretion and gene therapy for abnormal receptors.