

Introduction to Endocrinology

Introduction to Endocrinology

The study of hormones, their glands, and the physiological processes they regulate.

1. What Is Endocrinology?

Aspect	Description
Definition	Branch of physiology and medicine that deals with the endocrine system – the network of glands that secrete hormones into the bloodstream.
Goal	Understand how hormones control growth, metabolism, reproduction, stress response, and homeostasis, and how disorders arise when this system malfunctions.
Key Disciplines	- Basic science (cellular & molecular biology) - Clinical medicine (diagnosis & treatment of endocrine diseases) - Pharmacology (hormone analogs, antagonists, and modulators)

2. Core Concepts

Concept	Explanation	Example
Hormone	Chemical messenger produced by endocrine cells; travels through blood to target cells.	Insulin, cortisol, estrogen
Receptor	Protein (membrane-bound or intracellular) that binds a specific hormone, triggering a cellular response.	Insulin receptor (tyrosine kinase)
Signal Transduction	Cascade of intracellular events (often phosphorylation) that convert hormone binding into a functional outcome.	cAMP pathway activated by glucagon
Feedback Regulation	Mechanisms (negative or positive) that maintain hormone levels within a narrow range.	Negative feedback: high thyroid hormone → ↓ TSH
Target Specificity	Hormones affect only cells that express the appropriate receptor.	Testosterone acts on muscle cells expressing androgen receptors

Introduction to Endocrinology

3. Major Endocrine Glands & Their Primary Hormones

Gland	Location	Principal Hormones	Primary Functions
Hypothalamus	Base of brain	CRH, TRH, GnRH, ADH, oxytocin (via posterior pituitary)	Regulates pituitary, autonomic functions, water balance
Pituitary (Anterior)	Sella turcica	GH, ACTH, TSH, LH, FSH, PRL	Growth, adrenal stimulation, thyroid regulation, reproduction, lactation
Pituitary (Posterior)	Sella turcica	ADH, Oxytocin	Water reabsorption, uterine contraction, milk ejection
Thyroid	Neck (C5-T1)	T ₃ (triiodothyronine), T ₄ (thyroxine), calcitonin	Metabolic rate, calcium homeostasis
Parathyroid	Posterior thyroid	PTH (parathyroid hormone)	↑ serum Ca ²⁺ , ↑ phosphate
Adrenal Cortex	Upper kidney	Cortisol, aldosterone, androgens	Stress response, sodium/potassium balance, sexual development
Adrenal Medulla	Inner adrenal	Epinephrine, norepinephrine	"Fight or flight" sympathetic response
Pancreas (Islets)	Abdomen	Insulin, glucagon, somatostatin	Blood glucose regulation
Gonads	Testes / Ovaries	Testosterone, estrogen, progesterone	Sexual development, reproduction, secondary sex traits
Pineal	Brain (epithalamus)	Melatonin	Circadian rhythm, seasonal reproduction
Kidney (Juxtaglomerular cells)	Renal cortex	Renin (enzyme → angiotensin II)	Blood pressure