

# Pharmacology of drugs acting on endocrine system

## Basic Concepts in Endocrine Pharmacology

### Endocrine System Overview

#### Definition:

- The endocrine system consists of glands that secrete hormones directly into the bloodstream to regulate various bodily functions such as metabolism, growth, reproduction, and stress responses.

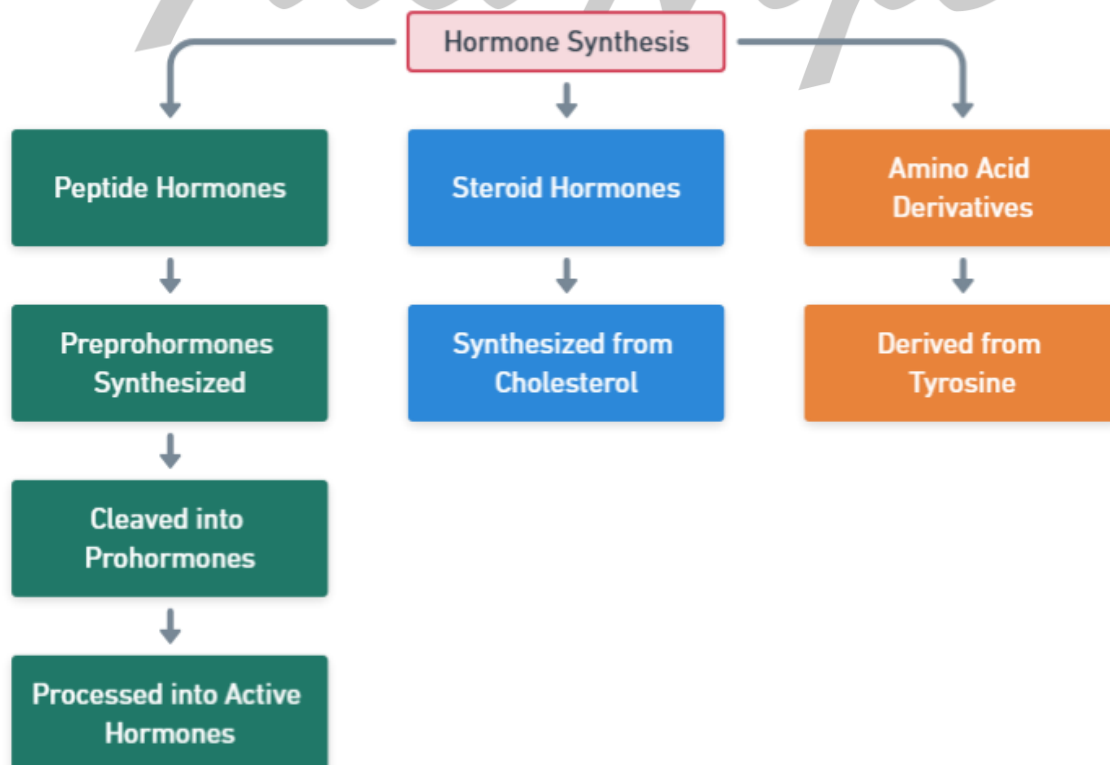
#### Major Endocrine Glands:

- Pituitary, thyroid, parathyroid, adrenal glands, pancreas, gonads (testes/ovaries).

### Hormone Synthesis and Secretion

#### Synthesis:

- Hormones are synthesized in specific endocrine cells. For example:
  - **Peptide hormones** (e.g., insulin) are synthesized as preprohormones, cleaved into prohormones, and finally processed into active hormones.
  - **Steroid hormones** (e.g., cortisol) are synthesized from cholesterol.
  - **Amino acid derivatives** (e.g., thyroid hormones) are derived from tyrosine.



#### Secretion:

- Typically regulated by feedback loops (negative or positive). Example: Hypothalamic-pituitary-end organ axis.

## Mechanisms of Hormone Action

- **Cell Surface Receptors:** Peptide hormones bind to membrane receptors, triggering second messenger pathways (e.g., cAMP, IP3/DAG).
- **Intracellular Receptors:** Steroid and thyroid hormones diffuse into cells to bind cytoplasmic or nuclear receptors, altering gene transcription.

## Principles of Endocrine Drug Therapy

- **Hormone Replacement:** For deficiencies (e.g., insulin for diabetes).
- **Hormone Inhibition:** To reduce excess hormone levels (e.g., methimazole for hyperthyroidism).
- **Receptor Modulation:** Agonists or antagonists modulate receptor activity (e.g., selective estrogen receptor modulators).

## Pharmacokinetics and Pharmacodynamics

### Pharmacokinetics (PK):

- Involves the absorption, distribution, metabolism, and excretion (ADME) of endocrine drugs.
- For example, oral thyroid hormones are absorbed in the gastrointestinal tract and may require conversion in the liver.

### Pharmacodynamics (PD):

- Relates to the drug's mechanisms of action and its effects on the body.
- Endocrine drugs often act as hormone analogues or antagonists, binding to specific receptors to mimic or inhibit natural hormone actions.

## Receptor Types, Agonists, and Antagonists

- **Receptors:** Intracellular (e.g., steroid) or membrane-bound (e.g., peptide).
- **Agonists:** Mimic hormones (e.g., levothyroxine for thyroid hormone replacement).
- **Antagonists:** Block hormones (e.g., somatostatin analogues inhibit GH).

## Feedback Mechanisms and Homeostasis

- **Feedback Mechanisms and Homeostasis** Endocrine systems use primarily negative feedback to maintain balance.
- Drugs often restore or modulate feedback mechanisms (e.g., cortisol suppresses ACTH via negative feedback).

## Therapeutic Uses and Side Effects

- **Uses:** Treat hypothyroidism, diabetes, adrenal insufficiency, and hormonal cancers.
- **Side Effects:** Systemic effects like osteoporosis (corticosteroids) or hypoglycemia (insulin).

# Anterior Pituitary Hormones: Analogues and Their Inhibitors

## Physiology of the Anterior Pituitary

- The anterior pituitary secretes several key hormones regulated by hypothalamic-releasing and inhibiting factors.

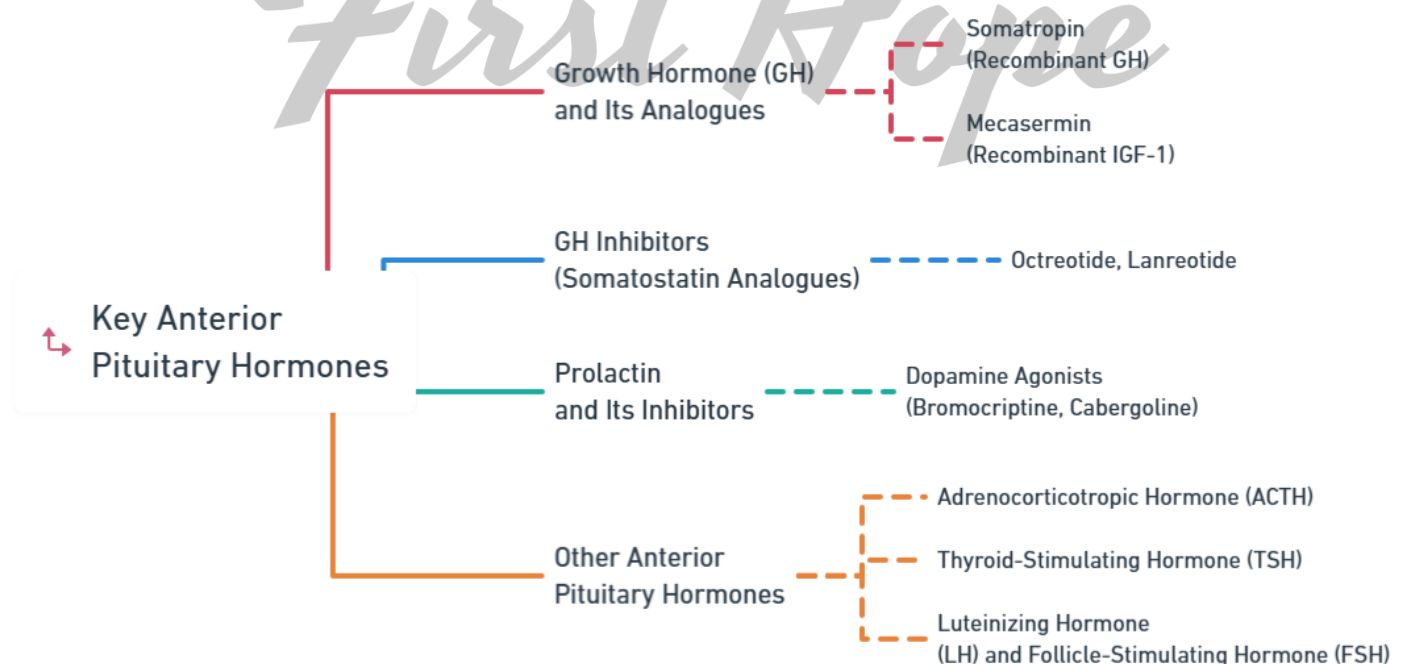
### Hormones Produced:

- Growth Hormone (GH)
- Prolactin
- Thyroid-Stimulating Hormone (TSH)
- Adrenocorticotrophic Hormone (ACTH)
- Luteinizing Hormone (LH)
- Follicle-Stimulating Hormone (FSH)

## Regulation:

- Stimulation:** Releasing factors such as **GHRH** stimulate GH secretion.
- Inhibition:** Inhibitory factors like **somatostatin** suppress GH release.

## Key Anterior Pituitary Hormones



### 1. Growth Hormone (GH) and Its Analogues

#### Somatropin (Recombinant GH):

- **Uses:** GH deficiency (children/adults), Turner syndrome, chronic kidney disease.
- **Adverse Effects:** Edema, arthralgia, hyperglycemia.

#### Mecasermin (Recombinant IGF-1):



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