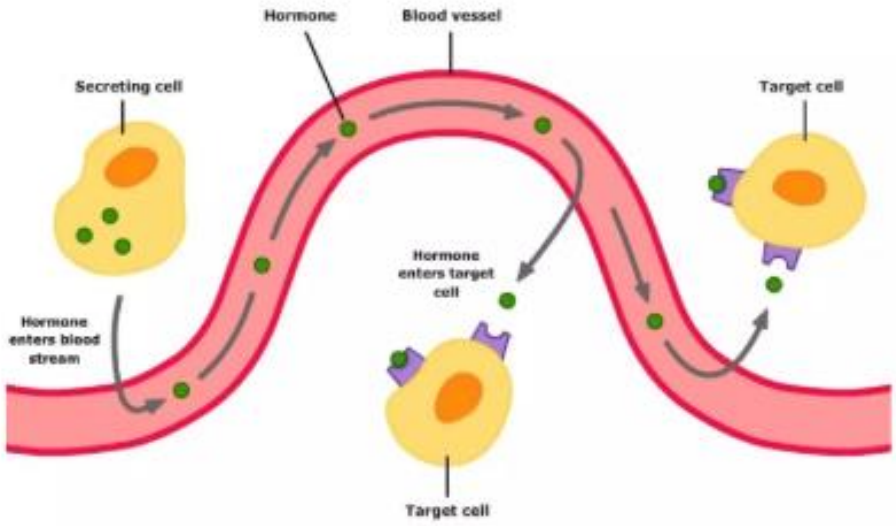
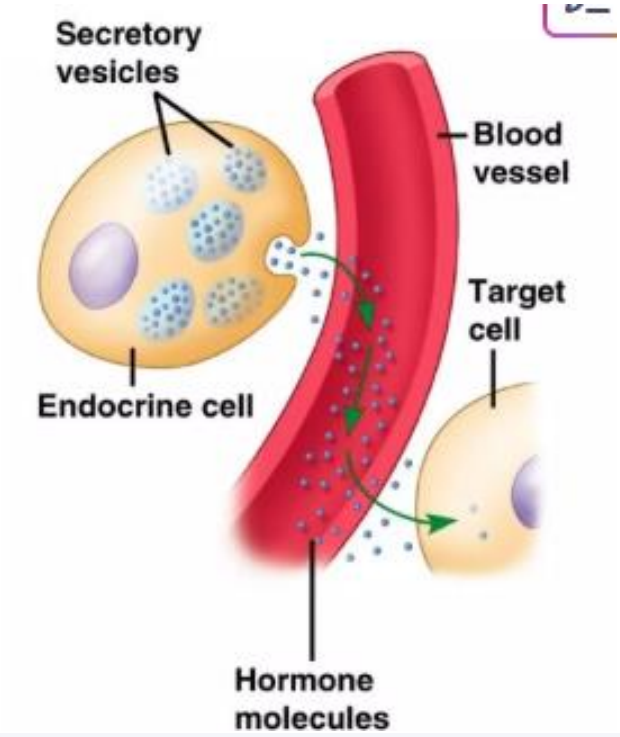
**Endocrine system:**

**Classification of hormones**




**What's a Hormone?**

• Hormones are chemical messengers secreted directly into the bloodstream. Once released, the blood transports these messengers to various organs and tissues throughout the body, where they bind to specific receptors and trigger precise biological responses.
• These substances are organic compounds produced in very small quantities by specialized tissues known as endocrine glands. Despite their minute amounts, hormones have powerful effects on the body's functions.
• Hormones regulate a wide range of metabolic and biological activities, including growth, development, mood, metabolism, and reproduction. They achieve this by targeting specific cells, called target cells, which have receptors designed to recognize and respond to particular hormones.
• The secretion and action of hormones are tightly controlled through feedback mechanisms to maintain the body's internal balance, or homeostasis, ensuring that physiological processes operate smoothly and adapt to changing conditions.




**Properties of Hormones**

1. Hormones are produced by specialized glands and secreted directly into the bloodstream. **Hormones originate from endocrine glands such as the pituitary, thyroid, adrenal glands, and pancreas. Unlike exocrine glands that release substances through ducts, endocrine glands release hormones directly into the blood, allowing them to travel throughout the body efficiently.**

**2. Hormones are transported by the bloodstream from endocrine cells to act as chemical messengers on target cells or organs, regulating specific metabolic reactions.** Once secreted, hormones circulate in the blood until they reach specific target cells that have receptors sensitive to that hormone. By binding to these receptors, hormones can initiate or modify cellular activities, influencing processes like growth, metabolism, and reproduction.

**3. Hormones exert their effects not where they are produced, but on other tissues of the body.** This characteristic distinguishes hormones from local signaling molecules. Hormones can affect distant organs and tissues, coordinating complex physiological responses across the entire organism, such as regulating blood sugar levels or stress responses.

**4. Hormones are required in very small amounts, and their effects may be excitatory or inhibitory depending on their concentration and the physiological state of the responding tissue.** Even minute quantities of hormones can trigger significant biological effects. Their action can stimulate or suppress cellular functions, and the outcome depends on factors like hormone concentration, receptor sensitivity, and the current condition of the target tissue.

**5. Hormones belong to different chemical classes, including steroids, proteins, peptides, and amino acid derivatives.** The chemical nature of a hormone influences

its mechanism of action. Steroid hormones, derived from cholesterol, typically pass through cell membranes to interact with intracellular receptors. Protein and peptide hormones bind to surface receptors, triggering signaling cascades inside the cell. Amino acid derivatives, such as thyroid hormones and catecholamines, have unique pathways and effects.

## Functions

Hormones are diverse chemical messengers that regulate numerous vital processes throughout the body. They influence a wide range of physiological functions, including:

- Development and growth: Hormones such as growth hormone and thyroid hormones are crucial for normal physical development, cellular growth, and maturation from infancy through adulthood.
- Metabolism of food items: Hormones like insulin and glucagon help regulate how the body processes nutrients, controls blood sugar levels, and manages energy storage and expenditure.
- Sexual function and reproductive growth and health: Sex hormones such as oestrogen, progesterone, and testosterone govern reproductive system development, sexual maturation, fertility, and secondary sexual characteristics.
- Cognitive (mental) function and mood: Hormones including cortisol and serotonin influence brain function, affecting memory, mood regulation, stress response, and overall mental well-being.
- Maintenance of body temperature and thirst: Hormones like antidiuretic hormone (ADH) and those involved in thermoregulation help maintain homeostasis by regulating fluid balance and body temperature.

## Hormone Classification

Hormones are categorized based on several criteria:

- Their chemical composition,
- The way they exert their effects,
- The type of biological response they trigger,
- The specific endocrine glands that activate them,
- And the overall impact they have on the body.

## Chemical Nature of Hormones

Hormones are chemical messengers that regulate various physiological processes in the body. Based on their chemical structure, hormones can be broadly categorized into three main groups:

1. **Protein or Peptide Hormones**: These hormones are composed of chains of amino acids. They are generally water-soluble and cannot pass through the lipid membranes of cells, so they bind to receptors on the cell surface to exert their effects. Examples include insulin, which regulates blood glucose levels; glucagon, which raises blood glucose; antidiuretic hormone (ADH), which controls water balance; and oxytocin, which is involved in childbirth and lactation.

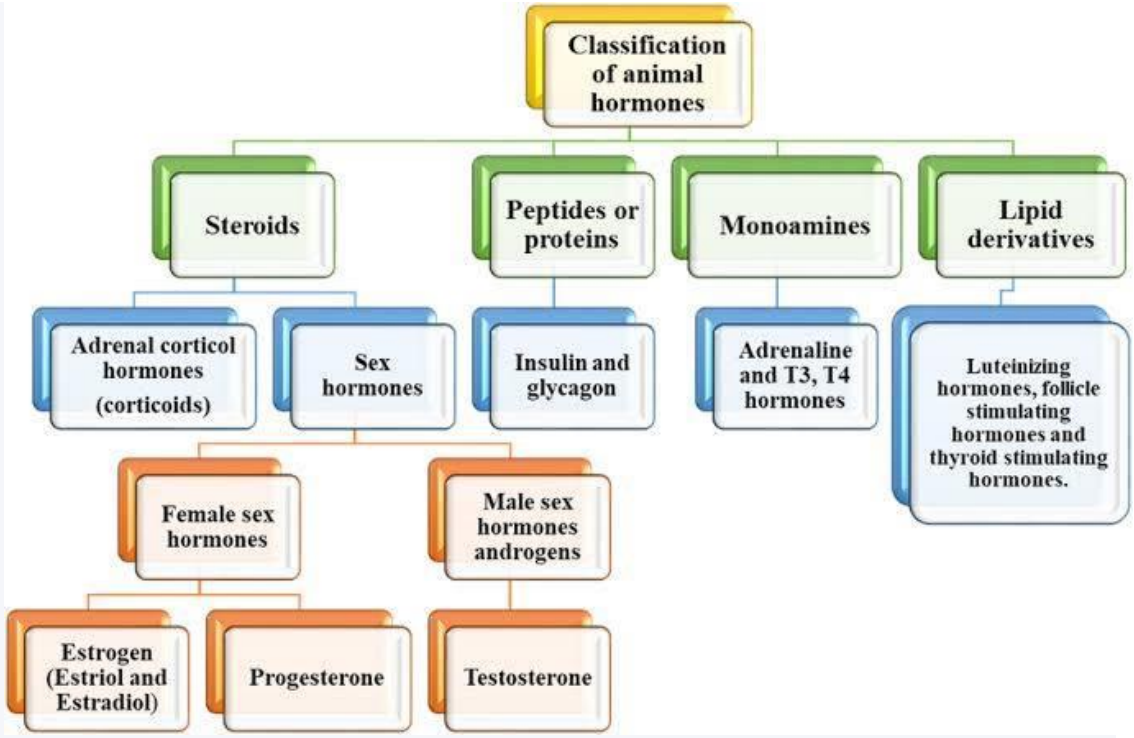



Fig: Classification of Hormones

2. **Steroid Hormones**: Derived from cholesterol, steroid hormones are lipid-soluble molecules that can easily cross cell membranes to bind with intracellular receptors, influencing gene expression directly. Examples include glucocorticoids (like cortisol, which helps regulate metabolism and immune response), mineralocorticoids (such as aldosterone, which controls salt and water balance), and sex hormones (like estrogen, progesterone, and testosterone, which regulate reproductive functions).

3. **Amino Acid Derivatives**: These hormones are synthesized from single amino acids, mainly tyrosine or tryptophan. They include catecholamines such as epinephrine and norepinephrine, which are involved in the fight-or-flight response, and thyroid hormones like thyroxine (T4) and triiodothyronine (T3), which regulate metabolism.

More specifically, hormones can be divided into six classes based on their chemical nature:

- **Steroid Hormones**: Lipid-soluble hormones derived from cholesterol.
- **Amines**: Hormones derived from single amino acids, including catecholamines and thyroid hormones.
- **Peptides**: Short chains of amino acids, often acting as signaling molecules.
- **Proteins**: Larger chains of amino acids that function as hormones.
- **Glycoproteins**: Protein hormones with carbohydrate groups attached, such as follicle-stimulating hormone (FSH) and luteinizing hormone (LH), which play key roles in reproduction.
- **Eicosanoids**: Lipid-derived signaling molecules, such as prostaglandins, which have diverse roles including inflammation and blood flow regulation.