

Unit 4: Excretory and Endocrine Systems - Notes

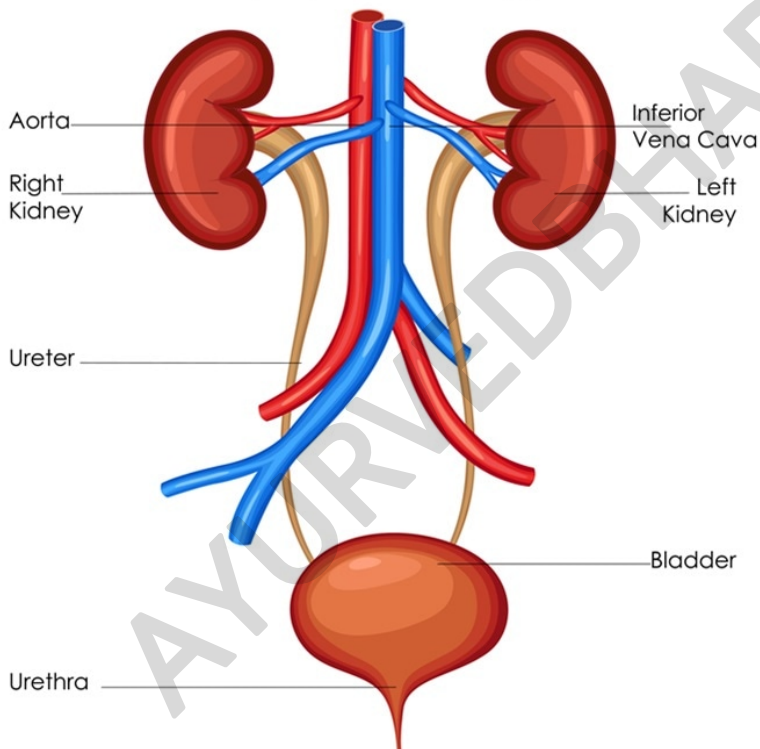
PART A · EXCRETORY SYSTEM (URINARY SYSTEM)

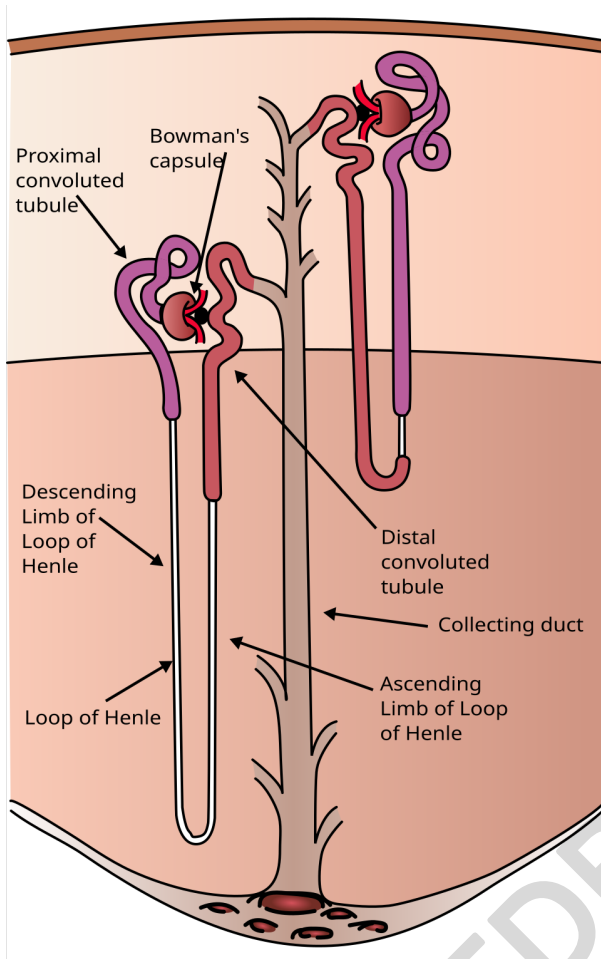
1 · Introduction

The excretory system maintains **internal homeostasis** by eliminating metabolic wastes and regulating **fluid, electrolyte, and acid-base balance**. The kidneys are the central organs performing these functions with remarkable precision.

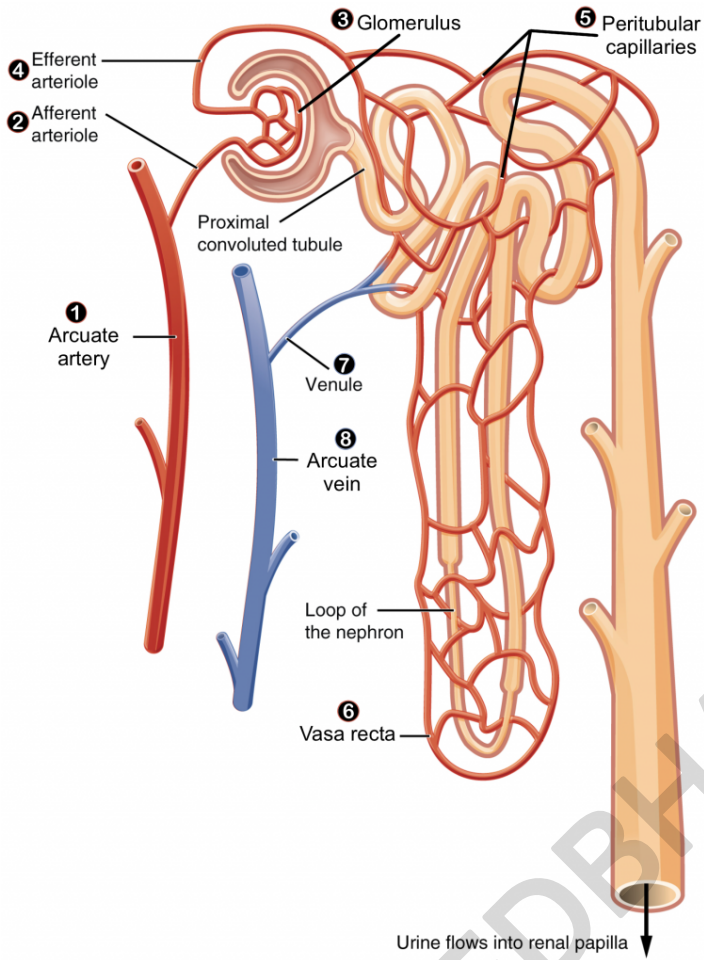
2 · Components of the Excretory System

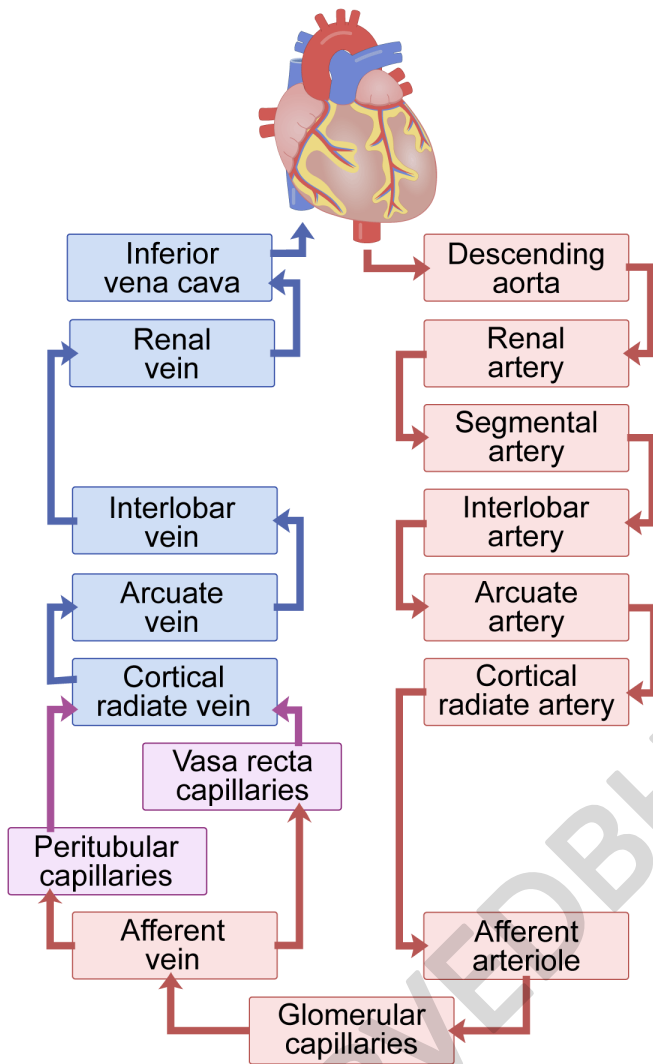
Urinary System Diagram





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Organ	Function
Kidneys	Filtration of blood, urine formation
Ureters	Transport urine to bladder
Urinary bladder	Storage of urine
Urethra	Excretion of urine

3 · Functional Unit: Nephron

Each kidney contains ~1 million nephrons.

Structure:

- **Glomerulus** → filtration
- **Bowman's capsule**
- **Proximal tubule**
- **Loop of Henle**
- **Distal tubule**
- **Collecting duct**

4 · Mechanism of Urine Formation

4.1 Glomerular Filtration

- Filtration of plasma into Bowman's capsule
- **GFR ≈ 125 mL/min**

4.2 Tubular Reabsorption

- Reabsorption of glucose, amino acids, water, electrolytes

4.3 Tubular Secretion

- Secretion of H⁺, K⁺, creatinine, drugs

5 · Regulation of Kidney Function

Mechanism	Function
Autoregulation	Maintains GFR constant
RAAS (Renin-Angiotensin-Aldosterone System)	↑ BP, Na ⁺ retention
ADH (Vasopressin)	Water reabsorption
Atrial Natriuretic Peptide (ANP)	↓ BP, ↑ Na ⁺ excretion

6 · Functions of Kidney

- Excretion of nitrogenous waste (urea, uric acid, creatinine)
- Regulation of fluid & electrolytes
- Acid-base balance
- Hormone production:
 - Erythropoietin
 - Renin
 - Activation of Vitamin D

7 · Micturition Reflex

- Controlled by spinal cord and brain
- Involves coordination of:
 - Detrusor muscle
 - Internal & external sphincters

8 · Clinical Correlation

Condition	Mechanism
Renal failure	Reduced filtration
Nephrotic syndrome	Protein loss in urine

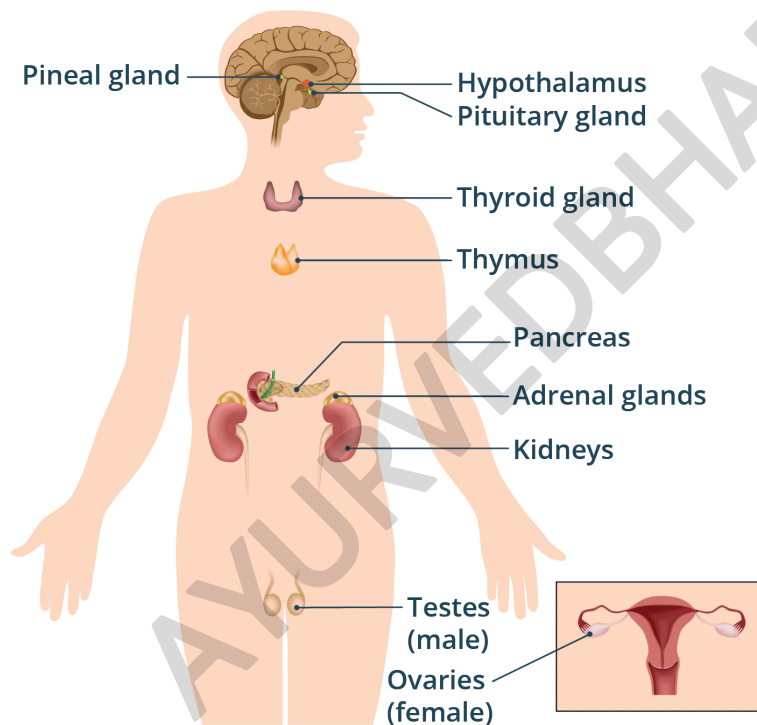
Condition	Mechanism
Diabetes insipidus	ADH deficiency
Acidosis/Alkalosis	pH imbalance

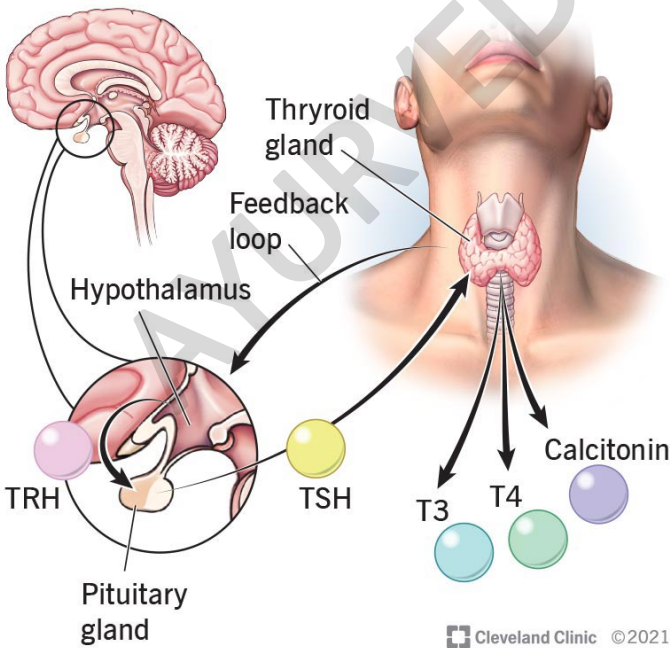
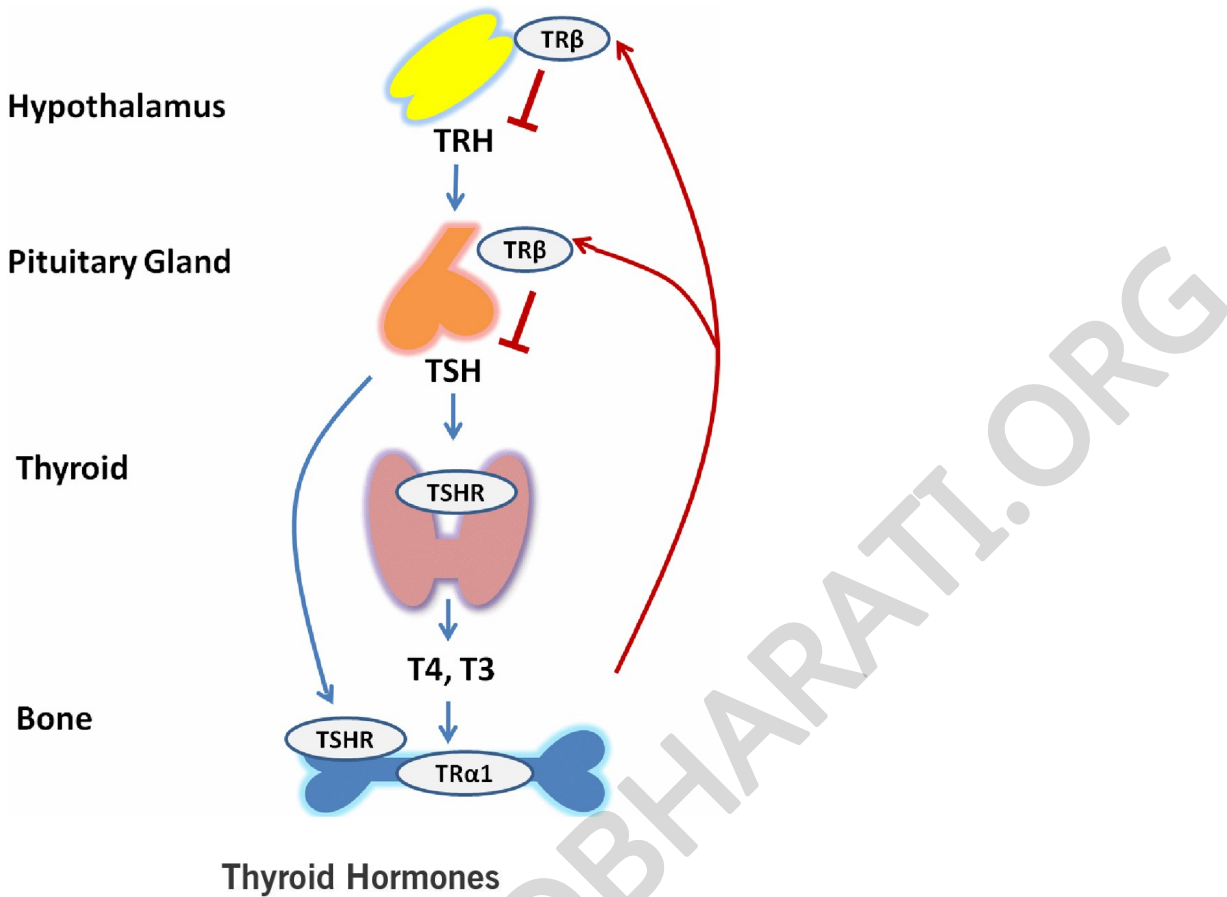
PART B · ENDOCRINE SYSTEM

9 · Introduction

The endocrine system regulates body functions through **hormones**, which are chemical messengers released into the bloodstream.

10 · Major Endocrine Glands





Gland	Hormones	Function
Hypothalamus	Releasing hormones	Controls pituitary



Gland	Hormones	Function
Pituitary	GH, TSH, ACTH, LH, FSH	Master gland
Thyroid	T3, T4	Metabolism regulation
Parathyroid	PTH	Calcium regulation
Adrenal	Cortisol, aldosterone, adrenaline	Stress response
Pancreas	Insulin, glucagon	Glucose regulation
Gonads	Estrogen, testosterone	Reproduction

11 · Mechanism of Hormone Action

11.1 Lipid-Soluble Hormones

- Steroid hormones, thyroid hormones
- Act via **nuclear receptors**
- Affect gene expression

11.2 Water-Soluble Hormones

- Peptides, catecholamines
- Act via **second messengers (cAMP, IP3)**

12 · Feedback Mechanisms

Type	Example
Negative feedback	Thyroid hormone inhibits TSH
Positive feedback	Oxytocin during childbirth

13 · Hypothalamus-Pituitary Axis

- Hypothalamus → releasing hormones
- Pituitary → tropic hormones
- Target glands → final hormones

Example:

TRH → TSH → Thyroid → T3/T4

14 · Hormonal Regulation of Metabolism

Hormone	Effect
Insulin	Decreases blood glucose
Glucagon	Increases blood glucose
Cortisol	Increases glucose, stress hormone
Thyroxine	Increases metabolic rate
Growth hormone	Growth & protein synthesis



15 · Clinical Correlation

Disease	Cause
Diabetes mellitus	Insulin deficiency/resistance
Hypothyroidism	Low T3/T4
Hyperthyroidism	Excess T3/T4
Cushing's syndrome	Excess cortisol
Addison's disease	Adrenal insufficiency

16 · Integration of Excretory & Endocrine Systems

Interaction	Explanation
Kidney hormones	Renin, erythropoietin
Endocrine control of kidney	ADH, aldosterone
Electrolyte balance	Controlled by both systems
Blood pressure	RAAS + hormones

17 · Key Takeaways

1. Kidneys are vital for **waste removal and homeostasis**
2. Nephron is the **functional unit**
3. Endocrine system controls body via **hormones**
4. Feedback mechanisms maintain **balance**
5. Both systems are deeply interconnected

Self-Assessment

1. Explain the steps of urine formation.
2. Describe RAAS mechanism.
3. Differentiate lipid-soluble and water-soluble hormones.
4. Explain hypothalamus-pituitary axis.
5. Describe integration of endocrine and excretory systems.