

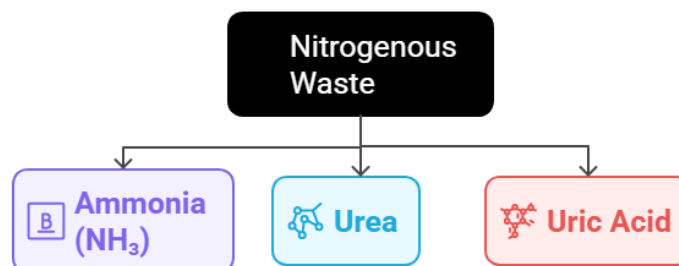
Excretory Products and Their Elimination

Excretory Products and Their Elimination

- Animals, through metabolic activities and processes such as excessive ingestion, accumulate various waste substances that need to be removed from the body.
- These excretory products include:
 - Nitrogenous wastes:** Ammonia, urea, uric acid
 - Gaseous wastes:** Carbon dioxide
 - Water and inorganic ions:** Na^+ , K^+ , Cl^- , phosphate, sulphate, etc.
- These waste products must be eliminated completely or partially to maintain internal balance and proper functioning of the body.

Types of Nitrogenous Wastes and Excretion Methods

- Nitrogenous wastes are primarily produced from the breakdown of **proteins** and **nucleic acids**.
- The **three** main forms of nitrogenous waste are:



1. Ammonia (NH₃)

Toxicity:

- Ammonia is **the most toxic** nitrogenous waste product.
- Even in small amounts, it can damage tissues and disrupt cell function, so it must be removed from the body quickly.

Water Requirement:

- Ammonia is **highly soluble** in water, which helps in its removal.
- However, it needs to be diluted heavily to avoid harming the animal's body.
- Therefore, a large amount of water is required to excrete ammonia safely.

Excretion Process: Ammonotelism

- The process of directly excreting ammonia (without converting it into urea or uric acid) is called **Ammonotelism**.

- Animals that use this method are called **ammonotelic**.

Examples of Ammonotelic Animals:

- **Bony fishes** (e.g., rohu, tuna)
- **Aquatic amphibians** (e.g., tadpoles, frogs in water)
- **Aquatic insects** (e.g., mosquito larvae)

Excretion Method:

- Ammonia is produced during the breakdown of proteins in the body.
- It is then excreted directly through:
 - The **skin**
 - The **gill membranes** (especially in fish)
- In water, ammonia dissolves and is lost easily from the body.
- **Kidneys** have little or no role in removing ammonia in these animals.

2. Urea

Toxicity:

- Urea is **less toxic** than ammonia.
- It can remain in the body for some time without causing harm, allowing it to be safely transported in the blood.

Water Requirement:

- Urea is moderately soluble in water.
- It needs **less water** for excretion compared to ammonia, making it more efficient for land-dwelling animals.

Excretion Process: Ureotelism

- The process of converting ammonia into urea (before excretion) is called **Ureotelism**.
- Animals using this method are called **ureotelic**.

Examples of Ureotelic Animals:

- Mammals (e.g., humans, dogs, elephants)
- Terrestrial amphibians (e.g., toads)
- Marine fishes (e.g., cartilaginous fishes like sharks)

Excretion Method:

- **Ammonia** (produced during protein metabolism) is converted into **urea** in the **liver** via the urea cycle (also called the ornithine cycle).
- Urea is then released into the **bloodstream**.

- The kidneys filter the urea from the blood and excrete it in the **urine**.
- Some animals retain a small amount of urea in the kidney to help maintain **osmotic balance** in the body.

3. Uric Acid

Toxicity:

- Uric acid is the least toxic of the nitrogenous wastes.
- It does **not dissolve easily** in water and causes **no harm** even if it stays in the body for longer periods.

Water Requirement:

- Very **minimal water** is needed.
- It is excreted as a solid or semi-solid paste, which helps in **maximum water conservation**.

Excretion Process: Uricotelism

- The process of converting nitrogenous wastes into uric acid is called **Uricotelism**.
- Animals that excrete uric acid are called **uricotelic**.

Examples of Uricotelic Animals:

- Reptiles (e.g., lizards, snakes)
- Birds (e.g., pigeons, eagles)
- Insects (e.g., grasshoppers, ants)
- Land snails

Excretion Method:

- Ammonia is converted into **uric acid** in the **liver**.
- Uric acid is **not highly** soluble, so it forms crystals or paste.
- It is excreted along with solid waste from the **cloaca** (in birds and reptiles) or through other specialized structures (e.g., Malpighian tubules in insects).

Excretory Structures in Animals

- The animal kingdom shows a wide variety of excretory organs adapted to different environments and lifestyles.
- These structures range from simple tubular systems in invertebrates to complex organs like kidneys in vertebrates.

1. Invertebrate Excretory Structures:

Protonephridia (Flame Cells)

- Found in: Platyhelminthes (**e.g., Planaria**), rotifers, some annelids, and cephalochordates (**e.g., Amphioxus**)
- Function: Primarily for osmoregulation (ionic and fluid volume regulation)

Nephridia

- Found in: Earthworms and other annelids
- Function: Elimination of nitrogenous wastes and maintenance of **fluid and ionic balance**

Malpighian Tubules

- Found in: **Insects (e.g., cockroaches)**
- Function: Removal of nitrogenous wastes and **osmoregulation**

Antennal Glands (Green Glands)

- Found in: **Crustaceans (e.g., prawns)**
- Function: Excretion of metabolic wastes

2. Vertebrate Excretory Structures:

Kidneys

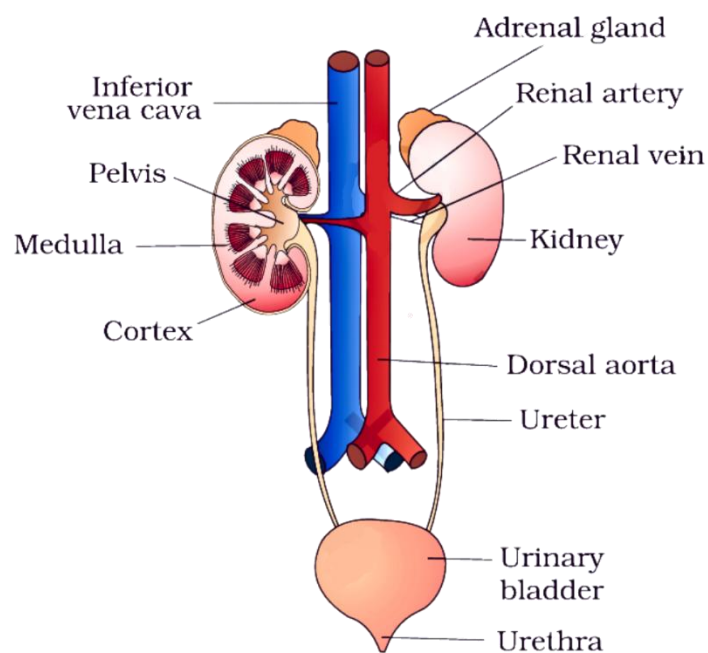
- Complex tubular organs responsible for **filtration of blood** and **removal of wastes** such as urea and excess ions.

Human Excretory System

- The human excretory system is responsible for the removal of nitrogenous wastes and maintaining fluid and electrolyte balance.
- It consists of the following main components:

Main Organs of the Excretory System

- **Kidneys (2)**
- **Ureters (2)**
- **Urinary Bladder (1)**
- **Urethra (1)**



Human Urinary system

Kidneys

Location:

- Situated between the **last thoracic (T12)** and **third lumbar (L3)** vertebrae, close to the dorsal inner wall of the abdominal cavity.

Structure:

Color and shape:

- Reddish-brown, bean-shaped.

Dimensions:

- Length: 10–12 cm
- Width: 5–7 cm



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