

## EXCRETORY SYSTEM

**Excretory System:** The removal or elimination of waste products in the form of solid, liquid or gas) of metabolism from the body, is called **excretion**.

- The major excretory products are carbon dioxide, excess water and nitrogenous compounds like ammonia, uric acid, urea, etc.

**Modes of Excretion:** Depending upon the nature of excretory products, animals exhibit different processes of nitrogenous excretion.

Different animals excrete different nitrogenous compounds.

Thus, there are mainly three modes of excretion

- Ammonotelism:** Excrete **ammonia** ( $\text{NH}_3$ ), which is highly toxic and highly soluble in water, e.g. aquatic animals like Amoeba, Paramecium, Sycon, Hydra, prawn, etc.
- Ureotelism:** Excrete **urea** ( $\text{NH}_2\text{CONH}_2$ ), which is less toxic than ammonia, e.g. human, whales, seals, kangaroo, frog, toad, etc.
- Uricotelism:** Excrete **uric acid**, occur in animals living in dry conditions to conserve water, e.g. snakes, lizard, birds, insects, snail, etc.

### Excretory Organs in Different Animals:

Plasmalemma	Protozoans like Amoeba
General body surface	Porifera (sponges) and coelenterates (Hydra)
Flame cells	Platyhelminthes (Taenia and Fasciola)
Nephridia	Annelida (earthworm)
Malpighian tubules	Arthropods (cockroach)
Coxal gland	Spiders
Kidney	Main excretory organs in all vertebrates
Antennae/green gland	Crustaceans (prawn)

**Excretion in Human:** Blood contains both useful and harmful substances. Hence, we have kidneys which separate useful substances by reabsorption and toxic substances by producing urine.

- Human excretory system includes the following structures
  - A pair of kidney:** Each human adult kidney has a length of 10-12 cm, a width of 5-7 cm and weighs around 120-170g.
  - A pair of ureter:** A thin muscular tube called the ureter comes out of each kidney extending from the renal pelvis. It carries urine from the kidney to the urinary bladder.

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3. **Urinary bladder:** It is a sac-like structure that stores urine until micturition. Micturition is the expulsion of urine from the body. The urine is carried to the bladder through the ureters.
  4. **Urethra:** This tube arises from the urinary bladder and helps to expel urine out of the body. In males, it acts as the common route for sperms and urine. Its opening is guarded by a sphincter.
- In human beings, kidneys are the main organs of excretion. Each bean - shaped kidney is made up of highly coiled similar units called **nephron**.
  - Each nephron consists of:
    - Blood vascular component consisting of **glomerulus**.
    - Tubular component comprises of **Bowman's capsule. Distal Convoluted Tubules (DCT)** and a **collecting duct**.
  - Capillaries of kidneys filter the blood and the essential substances like glucose, amino acids, salts, and the required amount of water are reabsorbed. Meanwhile, the pureblood circulates back to other parts.

### Mechanism of Excretion in Humans:

- **Glomerular Filtration:** The process of urine formation in kidney involves **Glomerular Filtration** movement of blood and minerals from glomerulus to Bowman's capsule through filtration silts. The fluid after filtration is called **ultrafiltrate**.
- **Tubular Reabsorption:** 99% of water filtered through glomerulus is reabsorbed. Solutes like vitamin, glucose, etc., are also reabsorbed and they enter the blood stream. **Tubular Secretion** Some ions ( $K^+$ ,  $NH_4^+$ ), molecules like drugs/ etc., from blood get secreted into urine.
- **Antidiuretic hormone (ADH):** ADH opposes urine formation and helps kidney to excrete concentrated urine and hence, conserve water from scarcity. Formation of concentrated urine is carried out by counter current mechanism.
- Urine is the ultimate excretory product. It is pale yellow in color (**urochrome pigment**) and contains nitrogenous waste products.

### Dialysis:

- Under certain circumstances such as poor blood flow to the kidneys, infections, injuries, etc. the kidneys fail to perform their functions. In such situations, artificial kidneys are used for blood filtration and this process is called dialysis.

### Some General points:

- Other than the urinary system, skin, lungs, and even eyes help in excreting waste products in different forms.
- Sweating is a mode of excretion where water, urea, and other salts are excreted through the skin.
- Lungs help us to exhale gaseous wastes such as carbon dioxide, nitrogen, etc.

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