EXCRETION

CONTENTS

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Excretion is the elimination of metabolic waste products from the body.

WASTE PRODUCTS

- **Nitrogenous Waste Products.** They are the **major waste products** which are formed during breakdown of extra amino acids, nucleic acids and alkaloids. The important nitrogenous waste products are urea, uric acid, creatine, creatinine and ammonia.
- **Non-nitrogenous Waste Products -** Oxalic acid, lactic acid.
- **Excess Chemicals -** Excess minerals, drugs, pigments, vitamins, hormones, cholesterol, etc.
- **Bile Pigments -** Bilirubin, biliverdin and urochrome.
- CO_2
- Excess water.

EXCRETION IN HUMAN BEING

A pair of kidney is the main excretory organ in human.

◈ Structure and Function of Kidney in Human :

- There are two bean shaped, dark red coloured kidney placed just below the stomach, one on each side of the mid dorsal line.
- The depression is called hilus from where the ureter originates and the renal artery and renal vein go in and out here.

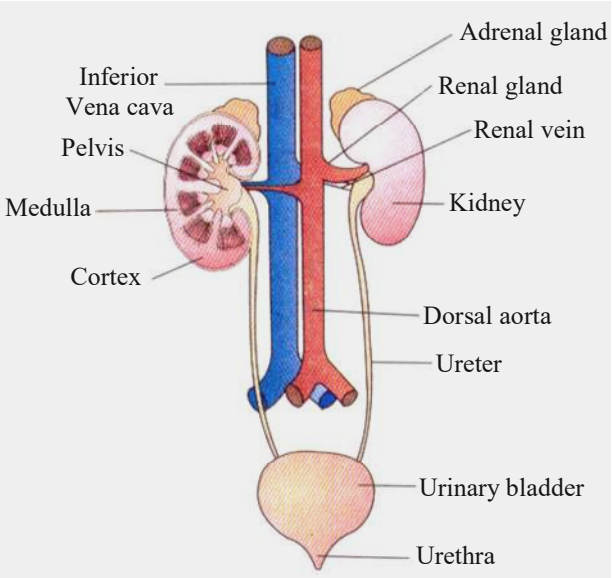


Figure : HUMAN URINARY SYSTEM

- Ureter entering through hilus expands. Medula on inner side has cone like structure called renal pyramids. Each kidney contains about one million nephrons. The functional unit of the kidney is the nephron.

STRUCTURE OF NEPHRON

- Each nephron consists of a round malpighian body formed by **Bowman's capsule** filled with capillary net work afferent and efferent arterioles. Afferent means incoming, Efferent means outgoing called **Glomerulus** or **Malpighian corpuscles**. The malpighian tubule is divided into 3 parts forming a shaped convoluted tubule.

  (A) The proximal tubule - Nearest Bowman's capsule.

  (B) Henle loop - It is a 'U' shape thin tube like structure.

  (C) Distal tubule - Join collecting tuble.

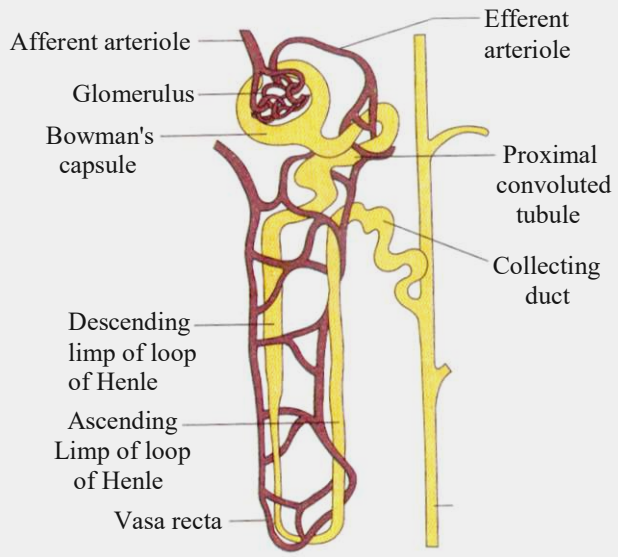


Figure : REPRESENTATION OF A NEPHRON

The ascending limb of Henle's loop again gives second convoluted tubule opening into collecting tubule and finally into lager tubule known as **duct of Bellini**, which opens into the pelvis of ureter at the apex of renal pyramids. The entire kidney tubule is surrounded by blood capillaries called vasa recta.

MECHANISM OF URINE FORMATION

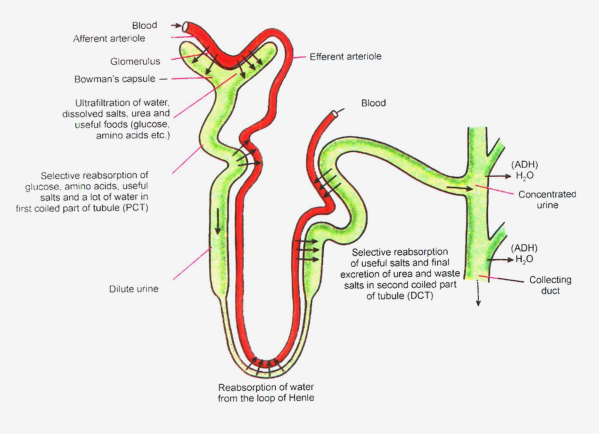
It has four steps - ultra filtration, selective reabsorption, secretion and concentration.

(i) Ultra Filtration. Blood flows inside glomerulus under pressure due to narrowness of efferent arteriole. As a result it undergoes pressure filtration or **ultrafiltration.** All small volume solutes (e.g., urea, uric acid, amino acids, hormones, glucose, ions, vitamins) and water are filtered out and enter the Bowmans' capsule. The product is called **nephric** or **glomerular filtrate**. Its volume is 125 ml/min (180 litres/day).

(ii) Reabsorption. Nephric filtrate is also called primary urine. It passes into proximal convoluted tubule. The same is surrounded by peritubular capillaries. The latter reabsorb all the useful components of nephric filtrate, e.g, glucose, amino acids, vitamins C, calcium, potassium, sodium, chloride, bicarbonate and water (75%). Selective absorption also occurs in the region of distal convoluted tubule.

(iii) Secretion (Augmentation). It occurs mostly in the distal convoluted tubule which is also surrounded by peritubular capillaries. Smaller amount of tubular secretion also takes palce in the area of proximal convoluted tubule. **Tubular secretion** is active secretion of waste products by the blood capillaries. It cause removal of all the waste products from blood, viz. urea, uric acid, creatinine. Extra salts, K^+ and H^+ are also secreted into urinary tubule to maintain a proper concentration and pH of the urine.

(iv) Concentration of the Urine. 75% of water content of nephric filtrate is reabsorbed in the region of proximal convoluted tubule. Some 10% of water passes out of the filtrate through osmosis in the area of loop of Henle. It is because loops of Henle are immersed in hyper-osmotic interstitial fluid. Further concentration takes place



in the area of collecting tubule in the presence of hormone called **antidiuretic hormone** (ADH) or **vasopressin.** Absence of Antidiuretic hormone produces a dilute urine. Hormone action, therefore, maintains osmotic concentration of body fluids. Deficiency of ADH causes excessive, repeated dilute urination (diabetes insipidus).

The process of passes urine in called **Micturition**.

EXCRETION IN PLANTS

Plants do not produce nitrogeneous wastes like urea and uric acid because extra amino acids and nucleotides are not formed. They produce other types of waste products, called secondary metabolites, e.g., alkaloids, tannins, aromatic oils.

(i) **Nitrogenous Waste Products.** They are byproducts of general metabolism. The common ones are alkaloids, e.g., quinine, morphine, atropine.

(ii) **Organic Acids.** They are metabolic intermediates. Some of them are without any other use. Rather on accumulation they may prove toxic, *e.g.*, oxalic acid.

(iii) **Tannins.** They are complex aromatic compounds which are formed as secondary metabolites.

(iv) **Latex.** It is an emulsion of varied composition which is exereted by special tubular cells called laticifers.

(v) **Resins.** They are oxidation products of aromatic oils.

(vi) **Gums.** They are degradation products of cell wall.

◈ Mechanism of Excretion in Plante:

Plants do not have any mechanism to collect, transport and throw out their waste products. They have adopted varied strategies to protect their living cell from waste products.

(i) **Old Leaves.** Waste products are stored in older leaves which soon fall off.

(ii) **Old Xylem.** Resins, gums, tannins and other waste products are deposited in the old xyem which soon becomes nonfunctional e.g. Hard wood.

(iii) **Bark.** Bark consists of dead cells which is peeled off periodically. Tannins and other wastes are deposited in the bark. Incidentally, tannins are raw material for dyes and inks.

(iv) **Central Vacuole.** Most plant waste products are stored in central vacuole of their cells. They are unable to influence the working of cytoplasm due to presence of a selectively permeable membrane called tonoplast.

(v) **Root Excretion.** Some waste substances are actually excreted by the plants in the region of their roots.

(vi) **Detoxification.** The toxi oxalic acid is detoxified by formation of calcium oxalate which gets crystallized into needles (raphides), prism (prismatic crystals), stars (sphaeraphides) and crystal sand. Excess of calcium is also precipitated as calcium carbonate crystals, e.g. cystolith.

(vii) **Salt Glands.** They excrete excess salts obtained from the habitat.