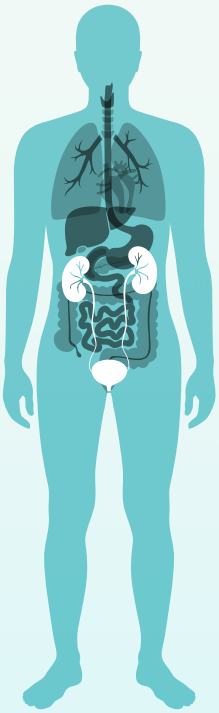


EXCRETION



Key Points



1

The biological process of removal of harmful nitrogenous wastes from the body is called excretion.

2

Urea is the main nitrogenous waste in our body which formed by the breakdown of surplus amino acids and nucleic acids in the liver.

3

Blood transports urea to the kidneys for filtration and removal in the form of urine.

On the basis of principal nitrogenous waste product excreted from the body, animals can be divided into three categories

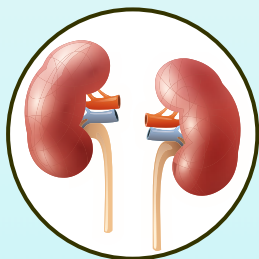
Category	Product formed	Example
Ammonotelic	Ammonia (highly toxic)	Aquatic animals e.g., <i>bony fishes, Amoeba</i> and <i>tadpoles of frog</i> .
Ureotelic	Urea (less toxic)	<i>Cartilagenous fishes</i> like <i>sharks, frogs,</i> <i>mammals</i> .
Uricotelic	Uric acid (least toxic)	<i>Birds, reptiles</i> and <i>insects</i> .

Excretory structures and waste products in animals

Amoeba Cellular surface Ammonia	Hydra Body surface Ammonia	Flatworm Protonephridia (flame cells) Mainly ammonia
Earthworm Nephridia Ammonia or urea	Insects e.g. cockroach Malpighian tubules Uric acid	All vertebrates Kidneys Ammonia, urea or uric acid

Excretory organs in humans

Primary/major excretory organs



Kidney

Accessory excretory organs



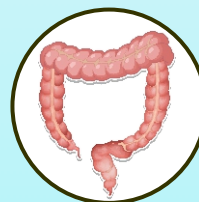
Salivary Glands



Liver



Lungs



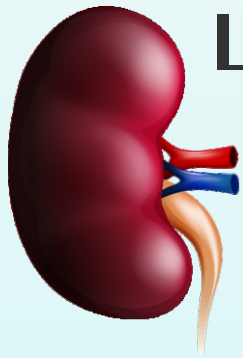
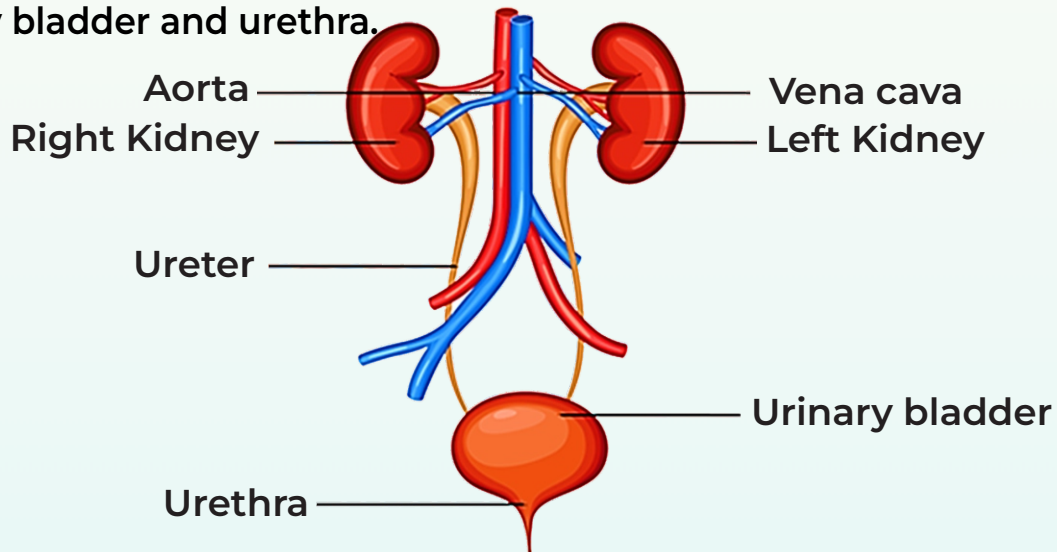
Large Intestine



Skin

Human Excretory System

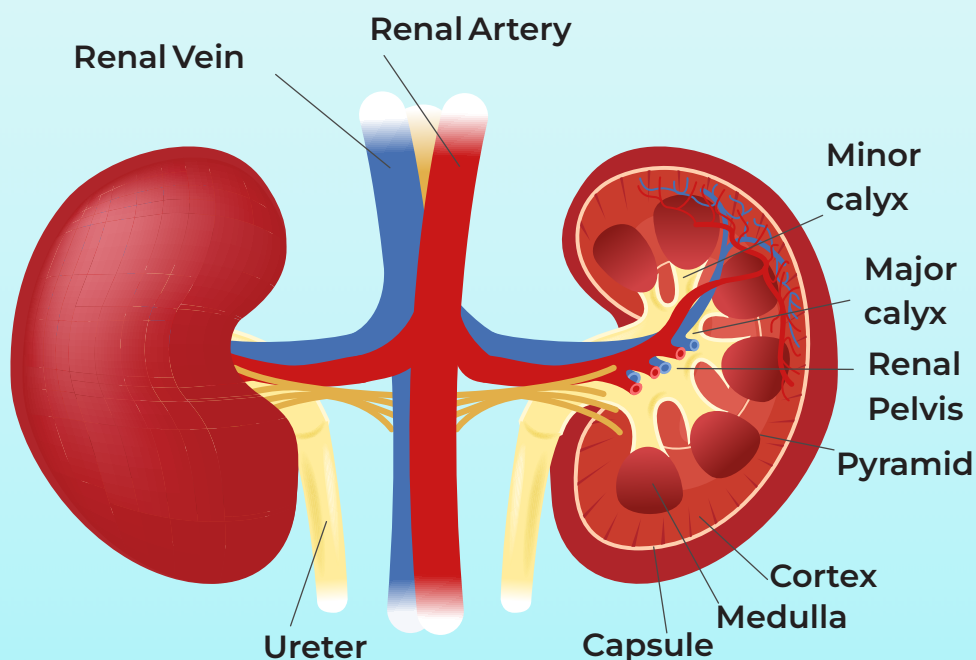
The human excretory system comprises of a pair of kidneys, a pair of ureters, a urinary bladder and urethra.



External Structure of Kidney

- Kidneys are bean shaped organs located on either side of the vertebral column in the lower abdominal cavity.
- Each kidney is surrounded and covered by a tough, fibrous, capsule of connective tissue. This capsule is called renal capsule.

Internal Structure of Kidney

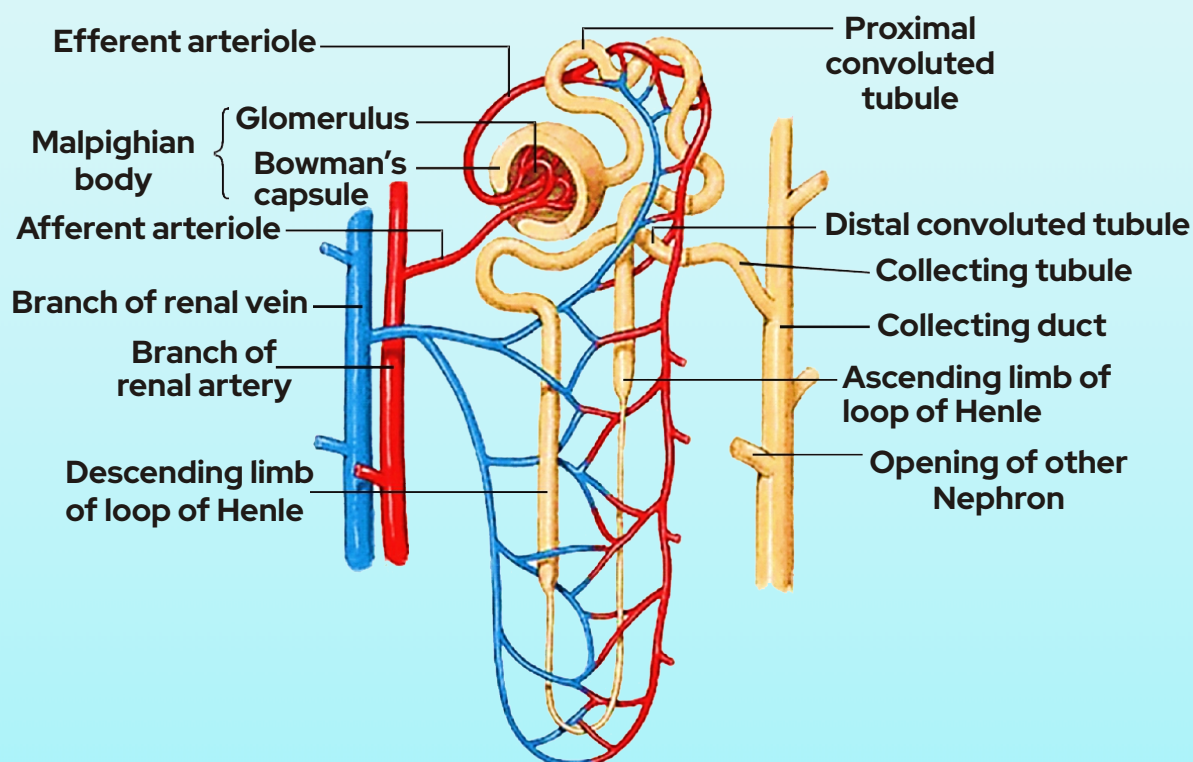
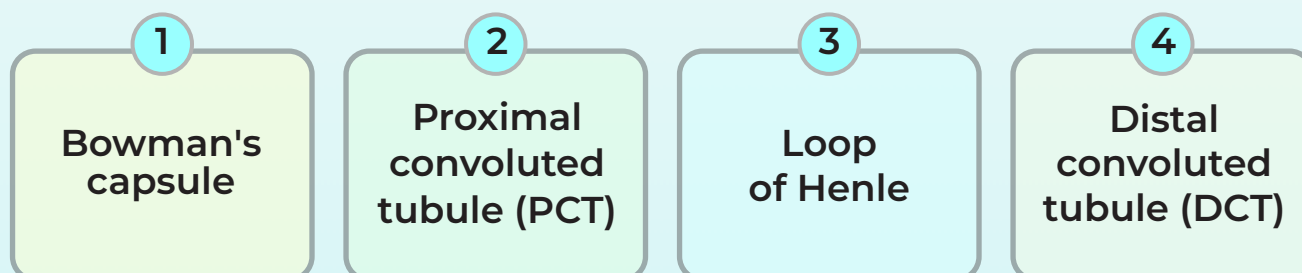


Note

- Urinary bladder has thick distensible wall lined by transitional epithelium that allows its expansion.
- The process of passing out urine from the urinary bladder is called micturition or urination.
- Pale yellow colour of urine is due to the urochrome pigment. It is formed in the liver due to breakdown of haemoglobin.

Nephron

- Structural and functional unit of kidney.
- Each kidney of human is formed of about one million nephrons.
- The nephron cleans all your body blood in 45 minutes.
- Everyday nephron sends about six cups of urine to urinary bladder.
- Each nephron has a length of about 3 cm.
- It is differentiated into 4 regions



Bowman's capsule

1

- The Bowman's capsule and the glomerulus together constitutes the renal corpuscle or malpighian body.
- Lies in the renal cortex.

PCT

2

- Highly convoluted which lies in the renal cortex. The wall consists of a single layer of cuboidal cells
- bearing a lot of microvilli on the surface i.e. brush bordered cuboidal epithelium.

Loop of Henle

3

- Located in the renal medulla.
- Consists of two straight parallel limbs, a descending limb which is a continuation of the PCT and enters into the renal medulla.
- An ascending limb which re-enters the renal cortex and joins the DCT.

DCT

4

- Twisted like the PCT and lies in the renal cortex.
- It opens into the collecting duct

Collecting ducts

Larger tubes which receive the DCT of several nephrons.
All the collecting ducts then open into pelvis which leads into ureter.

Physiology of excretion

Kidney filter all of the blood that comes from the heart forming the urine. The process of urine formation occurs in the nephrons present in kidneys and is completed in following stages.

1 Ultrafiltration

- The first step in clearing the blood is filtration under pressure, the passage of a liquid through a filter to remove impurities.
- Filtration occurs in the glomeruli.
- Blood pressure helps plasma (the liquid portion of the blood) to pass through the capillary walls in the glomerulus.
- Glomerular capillaries are more permeable than other capillaries.
- The filtrate contains water, glucose, amino acids, ions and urea.

2 Reabsorption

- During reabsorption, substances considered necessary in the filtrate are reabsorbed by renal tubules which then travel back into the bloodstream.
- Maximum reabsorption occurs in PCT because of the presence of microvilli.

3 Tubular secretion

- Passage of unwanted substances out of the capillaries directly into the renal tubules is called as tubular secretion. This is an additional way of getting waste materials into the urine.

Note

Kidney stones (Nephrolithiasis) are formed due to crystallization or precipitation of uric acid or oxalate of minerals and waste materials found in urine. They grow & become a painful irritant that may require surgery or ultrasound treatments.

Working of Nephron

In winter, less water used for metabolism

↓
More blood volume

↓
Less conc. of ADH

↓
Less permeability of DCT

↓
Less reabsorption of H_2O into blood capillaries

↓
More urine formed

In summer, more water used for metabolism

↓
Less blood volume

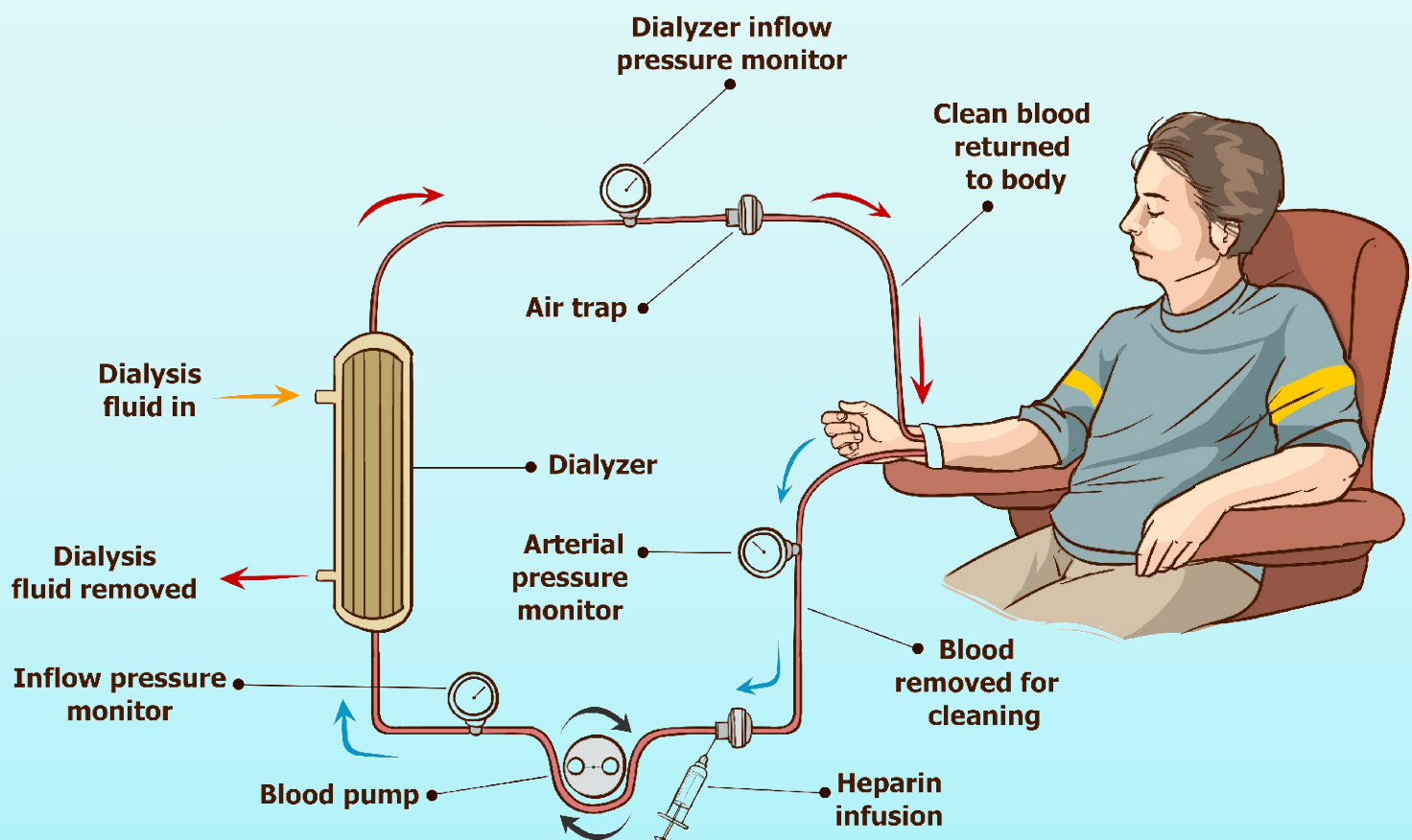
↓
More conc. of ADH

↓
More permeability of DCT

↓
More reabsorption of H_2O into blood capillaries

↓
Less urine formed

Artificial kidney or Hemodialysis



Kidneys are vital organs for survival.

- Nitrogenous waste products remain in the blood when kidney reduce its activity due to several reasons.
- Blood is not filtered, survival becomes difficult, so it is filtered through an artificial kidney. The process is called Hemodialysis.
- Artificial kidney called hemodialyzer, is a machine that is used to filter the blood of a person whose kidneys are damaged.

Excretion in plants

- No definite excretory system or organ is present for removal of wastes.
- Easily diffusible excretory products are removed by way of diffusion or osmosis.

Waste In Plants	
CO ₂ and water	Waste during respiration
O ₂	Waste during photosynthesis

- The gaseous wastes of respiration and photosynthesis-
 - (i) Through the stomata in leaves
 - (ii) Lenticels - In woody stem.
 - (iii) Excess water - Transpiration.
- Many plant waste products are stored in cellular vacuoles. The waste products in their body parts (leaves, bark and fruits) e.g. Tannins, essential oils, latex, gums, resins.
- The plant get rid of stored solid and liquid wastes by the shedding of leaves, peeling of bark and falling of fruits.
- Aquatic plants loose most of their metabolic wastes by direct diffusion into water surrounding them.

Note

- The kidneys provide a slower but more powerful means to regulate pH. They excrete or absorb hydrogen ions (H⁺) and bicarbonate ions (HCO₃⁻) as necessary for adjusting pH of blood.