

EXCRETORY PRODUCTS AND THEIR ELIMINATION

BIOLOGY HANDBOOK



Get Free Counselling

MBBS | BDS | BAMS | BHMS | BUMS

NURSING | PARAMEDICAL | PHARMACY



Register at
www.shikshaview.com

ADMISSION HELPLINE

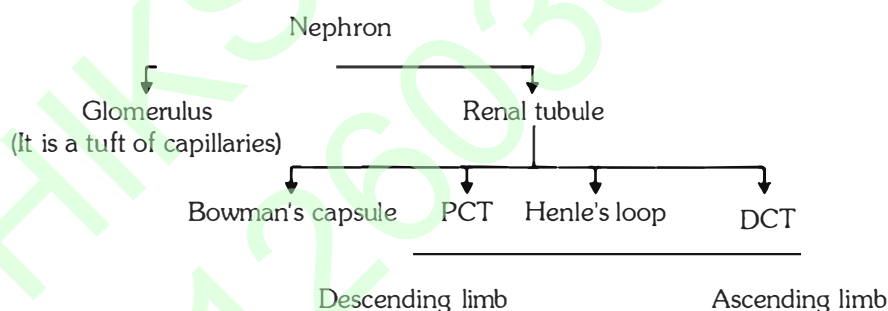
+91-8126030103

EXCRETORY PRODUCTS AND THEIR ELIMINATION

- Ammonia, Urea and Uric acid are the major forms of nitrogenous wastes excreted by the animals.
- Toxicity sequence = Ammonia > Urea > Uric acid.
- Ammonotelic animals = Many bony fishes, aquatic amphibians, aquatic insects.
- Ureotelic animals = Mammals, Marine fishes, terrestrial amphibians.
- Uricotelic animals = Reptiles, birds, insects, land snails.
- A survey of animal kingdom presents a variety of excretory structures.

S.No.	Excretory structures	Examples
1	Protonephridia (Flame cells)	Platyhelminthes, Rotiferes, Some annelids and Cephalochordate (<i>Amphioxus</i>).
2	Nephridia	Earthworms and other annelids
3	Malpighian tubules	Most insects
4	Antennal/Green glands	Crustaceans (Prawn)
5	Vertebrates	Kidney

- In humans, the excretory system consists of a pair of kidneys, one pair of ureters, a urinary bladder and a urethra.
- The outer layer of kidney is a tough capsule. Inside the kidney, there are two zones, an outer cortex and an inner medulla. The medulla is divided into a few conical masses (medullary pyramids) projecting into the calyces. The cortex extends in between the medullary pyramids as renal columns called "Columns of Bertini".
- Each kidney has nearly one million complex tubular structures called nephrons which are the functional units.



- Glomerulus + Bowman's capsule = Malpighian body or Renal corpuscle.
- The malpighian corpuscle, PCT and DCT of the nephron are situated in the cortical region of the kidney whereas the loop of Henle dip into the medulla.

Type of Nephron

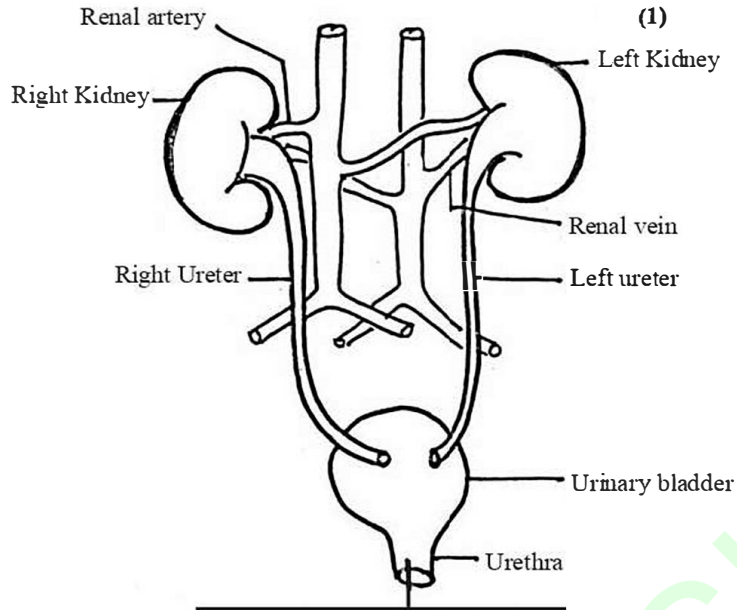
Cortical nephron

- Loop of Henle is too short
- Vasa recta is absent
- 85% of total nephron

Juxta medullary nephron

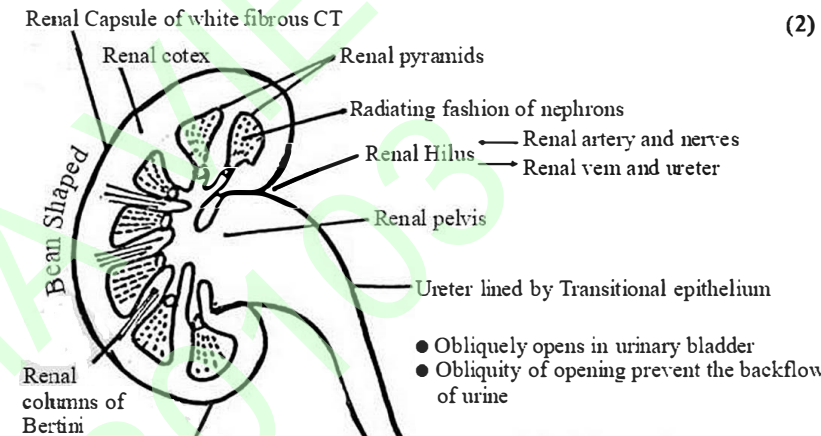
- Loop of Henle is very long
- Vasa recta is present
- 15% of total nephron

2

HUMAN EXCRETORY SYSTEM consist of

1. One pair of Kidneys
2. One pair of Ureters
3. One urinary bladder
4. One urethra
5. Renal vessels - renal artery and renal vein

- Renal artery carry oxygenated blood towards Kidney.
- Renal vein carry deoxygenated blood away from Kidney.



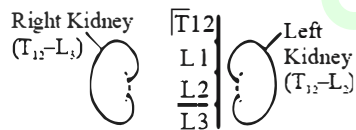
- Obliquely opens in urinary bladder
- Obliquity of opening prevent the backflow of urine

- In ♂ opens into penis
- Parts of ♂ urethra
 - Prostatic
 - Membranous
 - Penile

- In ♀ opens into vulva
- Parts of ♀ urethra
 - Prostatic - absent
 - Membranous
 - Penile - absent

PASSAGE OF URINE Nephron → Collecting duct → Duct of Bellini
 Ureters ← Renal Pelvis ← Renal Calyx ← Renal Papilla

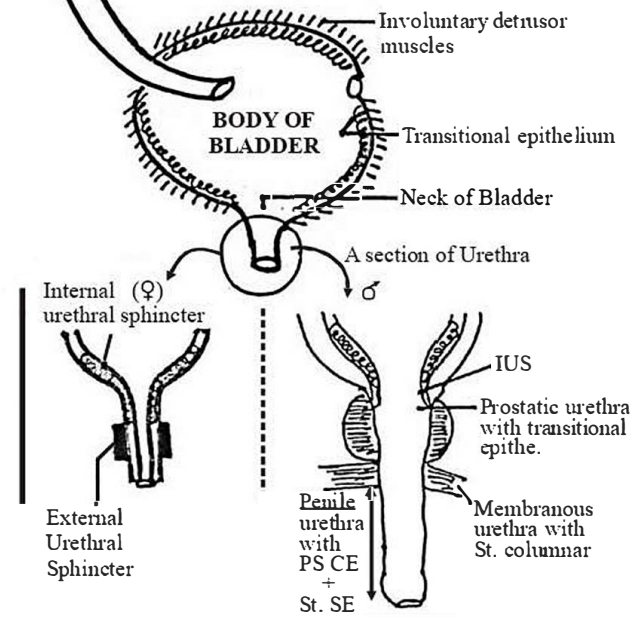
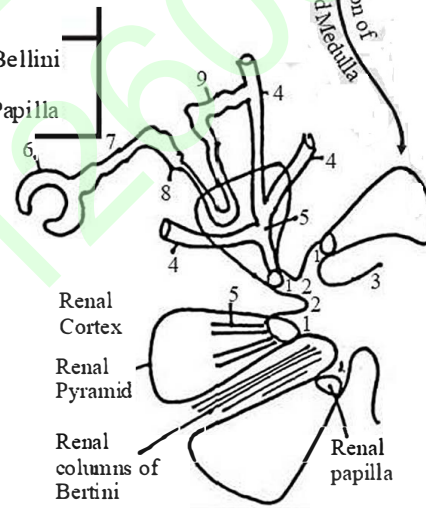
Urinary bladder → Urethra (3)

POSITION OF KIDNEYS IN BODY (4)

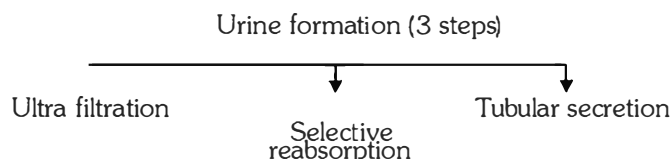
- On dorsal side of the body
- Human Kidneys are retroperitoneal as ventral part of kidneys are lined by visceral peritoneum

6. Bowman's capsule
7. PCT
8. Loop of Henle
9. DCT
4. Collecting duct
5. Duct of Bellini

1. Minor calyx
2. Major calyx
3. Renal pelvis



SV



- Glomerular filtration takes place in Bowman's capsule and glomerular filtrate is formed which is protein less plasma.
- On an average 1100-1200 ml of blood is filtered by the kidney per minute.
- Glomerular filtration rate (GFR) in a healthy individual is 125 ml/minute or 180 litres per day.
- Nearly 99 percent of the filtrate has to be reabsorbed by the renal tubules. This process is called reabsorption.
- Substances like glucose, amino acids, Na^+ etc. in the filtrate are reabsorbed actively whereas the nitrogenous wastes and water are absorbed by passive transport.
- During urine formation, the tubular cells secrete substances like H^+ , K^+ and ammonia into the filtrate. This tubular secretion is an active process.

- **Functions of the tubules :**

1. **PCT :**

- Maximum reabsorption occur
- All the essential nutrients, 70-80% of electrolytes and water, HCO_3^- are reabsorbed.
- Selective secretion of hydrogen ions, ammonia and potassium ions.

2. **Henle's loop :**

- Descending limb reabsorb water passively and ascending limb reabsorbed electrolytes actively or passively.

3. **DCT :**

- Conditional reabsorption of Na^+ and water takes place.
- Reabsorption of HCO_3^- occur.
- Selective secretion of K^+ and H^+ ions.

4. **Collecting duct :**

- Large amount of water and small amount of urea reabsorbed.
- Selective secretion of H^+ and K^+ ions.

Mechanism of concentration of the Filtrate :

- Mammals have the ability to produce a concentrated urine. The Henle's loop and Vasa recta play a significant role in this.
- Counter current mechanism helps to maintain a concentration gradient in the medullary interstitium. This gradient is mainly caused by NaCl and Urea.
- NaCl is transported by the ascending limb of Henle's loop which is exchanged by the ascending portion of vasa recta.
- Human kidney can produce urine nearly four times concentrated than the initial filtrate formed.

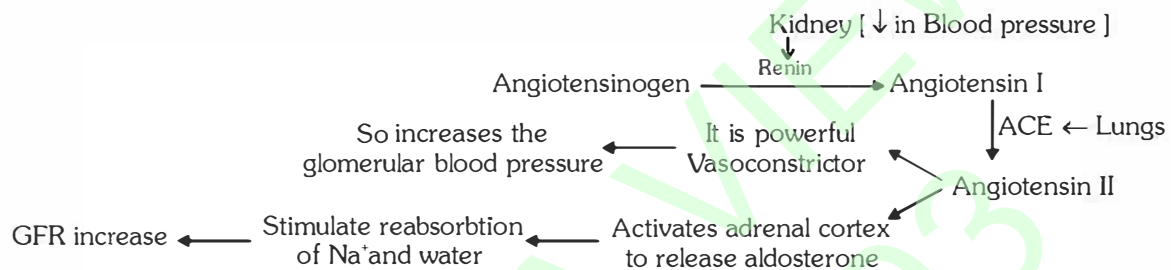
Regulation of kidney function :**1. ADH (Anti diuretic hormone)/Vasopressin**

- It is secreted by neurohypophysis.
- It facilitates water reabsorption from later parts of the tubule, thereby preventing diuresis.

Body fluid volume ↑, ADH secretion ↓,
 Water reabsorption ↓
 Urine volume ↑

2. Renin - Angiotensin mechanism :

When glomerular blood pressure or GFR decreases then JG cells of kidney releases **Renin**.

**3. ANF (Atrial Natriuretic factor) :**

- An increase in blood flow to the atria of the heart can cause the release of ANF.
- It is vaso dilator so decrease the blood pressure.
- ANF inhibits the Renin angiotensin mechanism.

Micturition :

- The process of release of urine is called micturition and the neural mechanisms causing it, is called the micturition reflex.
- Contraction of smooth muscles of the bladder and relaxation of the urethral sphincter causing micturition.
- An adult human excretes on an average 1-1.5 litres of urine per day. Urine is slightly acidic (pH = 6.0). On an average 25-30 gm. urea excreted out per day.
- Other than the kidney, Lungs, Skin and Liver also help in the elimination of excretion wastes.

Lungs → CO₂, Water

Skin → Sweat, Sebum

Liver → Billirubin, Billiverdin, Cholesterol.