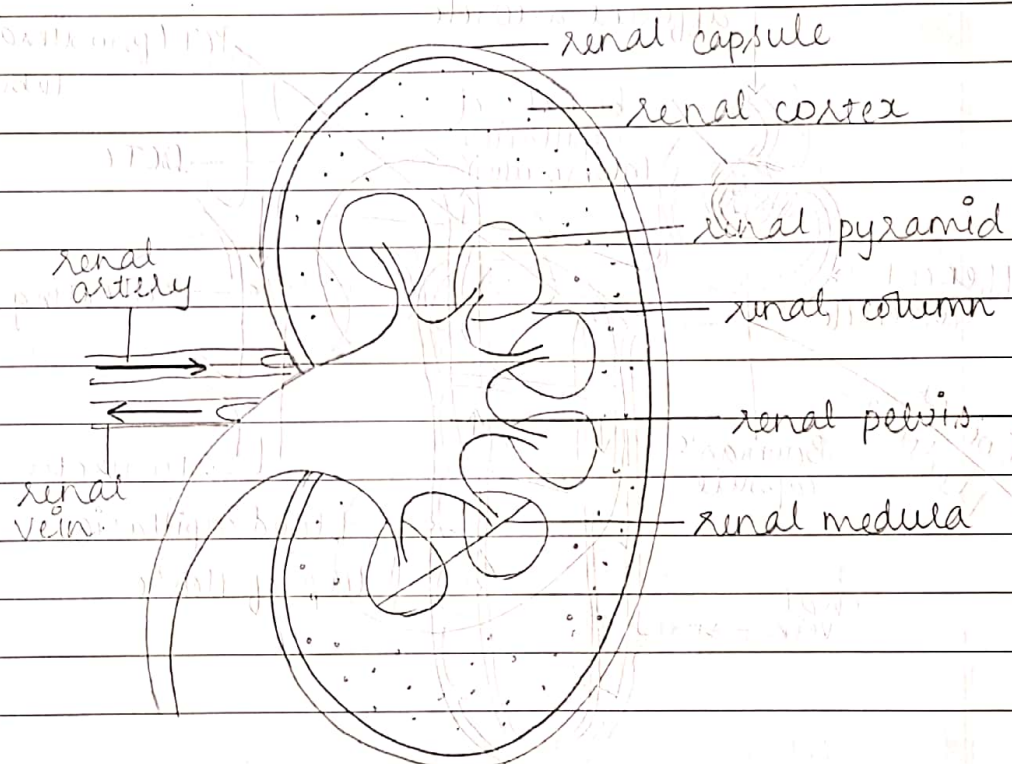


- Organ: Urinary Bladder
Function: Temporary storage of urine.
- Organ: Urethra
Function: Passageway for the urine to move out of the body from urinary bladder.

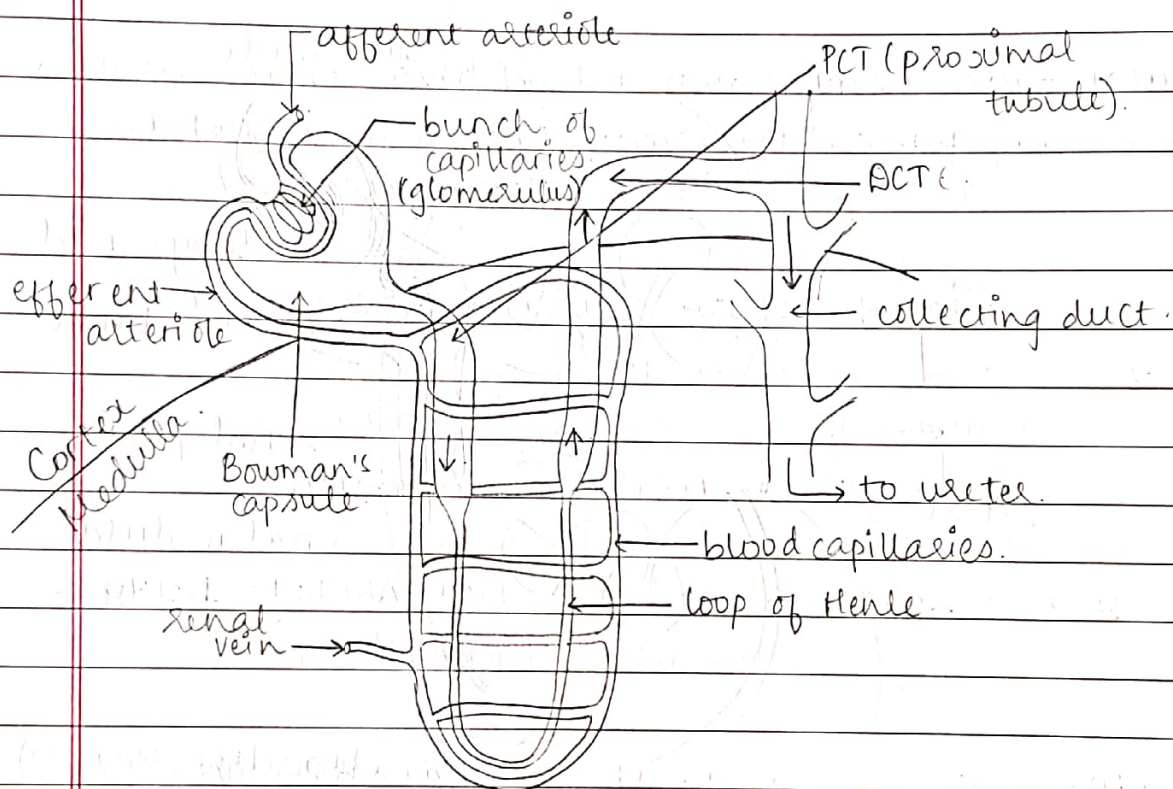
⇒ THE KIDNEY:



- STRUCTURE:
- The kidney has 3 main parts →
 - Cortex
 - Medulla
 - Pelvis.
- The pelvis leads to the ureter.
- Between the cortex & the medulla, there is a structure called the nephron.

- The nephron is where filtration of toxic materials from the blood takes place.
- Each nephron begins in cortex, loops down into the medulla, back into the cortex & then goes down again through the medulla to the pelvis. In the pelvis, the nephron join up with the ureter.

⇒ NEPHRON:



→ Nephron is structural & functional unit of the kidney.

→ STRUCTURE:

- The nephron starts with a cup shaped structure called BOWMAN'S CAPSULE. The capsule is also known as renal capsule & is responsible for ultrafiltration.

- Inside the capsule, there is a very dense network of blood capillaries called GLOMERULUS. Its function is to deliver blood.
- The rest of the nephron is long coiled tube where materials filtered from the blood flow in. At some point, the coiled tube is bent in U-shape. This part is called LOOP OF HENLE & it balances the amount of water & concentration of ions (osmoregulation).
- Loop of Henle is surrounded by network of capillaries from renal vein. Here reabsorption takes place.
- All nephrons end at a large tube called COLLECTING DUCT where contents of nephron are transported to pelvis, to be secreted in the ureter.
- PCT is responsible for selective reabsorption.
- DCT is responsible for secretion of toxins into the veins.

⇒ URETER:

- Extended from renal pelvis to urinary bladder.
- 10-12 inches length, half an inch diameter.
- Urine drains from renal pelvis into ureter.
- It is lined with mucus membranes.

⇒ URINARY BLADDER:

- It is pear-shaped, sac-like reservoir.
- Location - pelvic region.
- Opening to the urethra is guarded by sphincter muscles.
- Capacity - 400cm³ of urine.

→ URETHRA:

→ It is a narrow tube from bladder to the exterior.

→ FORMATION OF URINE:

→ It includes:

— URIC FORMATION — that takes place in liver (by deamination)

- Surplus amino acids in the bloodstream cannot be stored.

- They are removed by the liver & broken down into urea (which is the nitrogen-containing part of AA) & a sugar residue which can be respired to release energy.

- The breakdown of AA is called deamination.

- Urea is returned to the bloodstream (into the hepatic vein) & filtered out when it reaches the kidneys.

— URINE FORMATION — that takes place in kidneys.

- Main steps: (In brief)

① ULTRAFILTRATION:

Where? → Between glomerulus & Bowman's capsule

What? → Filtrate is produced & it enters renal tubules.

② TUBULAR REABSORPTION:

Where? → As filtrate moves through renal tubules.

What? → Useful material reabsorbed from the filtrate.

③ TUBULAR SECRETION:

Where? → As filtrate moves through renal tubules.

What? → Additional waste products removed from blood.

→ Added to filtrate in renal tubules.

⇒ FILTRATION:

→ Blood is brought to the renal capsule by the renal artery.

→ The blood is under high pressure, so molecules like that of water, urea, glucose mineral salts etc. are squeezed / forced out of the holes in the capillary walls. Only large protein molecules remain behind along with blood cells (WBCs & RBCs).

⇒ REABSORPTION:

→ The fluid in the renal capsule is a solution of glucose, salts & urea.

→ The capsule leads to the PCT which reabsorbs all glucose via active transport & returns it into the blood.

→ The PCT leads to the Loop of Henle which reabsorbs the water by osmosis.

→ The loop leads to the DCT which reabsorbs all minerals, amino-acids & other 'useful' substances by active transport.

→ The fluid that remains contains excess water, urea & dissolved mineral salts. This is called urine. It passes to the collecting duct now.

→ The collecting ducts from other nephrons join & form the ureter, which leads to the bladder.

→ Urine is stored in the bladder for excretion.

→ The bladder takes urine out via the urethra.

⇒ WATER BALANCE & OSMOREGULATION:

→ Kidneys adjust the concentration of blood flowing through them.

→ If the blood is too dilute, less water is absorbed from the renal tubule.

→ This is detected by hypothalamus. (low blood water).

→ The pituitary gland is stimulated / signalled to release ADH into the blood stream.

→ The ADH travels all over the body.

→ Only the cells of the collecting duct of the nephrons have receptors of ADH, so only they respond to the hormone.

→ In response, the collecting duct becomes more permeable.

→ As a result, water is drawn out of the collecting duct back into the blood. Water level returns to normal.

* Osmoregulation is one example of homeostasis.

- DIALYSIS:
- If a person gets a kidney failure, which means his kidneys can't function anymore, they have to wash their blood on regular basis that is an alternative to the damaged kidneys.
- This is called Dialysis. It is the method of removing one or more components from a solution using the process of diffusion.
- During this process, a tube is attached to the patient's vein; the tube is attached to the dialysis machine on the other end.
- There is another tube coming out of the machine to the patient's vein.
- The blood is sucked from the patient's vein, it goes through the machine & again to the patient's vein.
- The tubes inside the dialysis machine are partially permeable to allow diffusion.
- The tubes are also surrounded by with dialysis fluid which is the same as blood plasma.
- As the blood moves through the machine:
- Concentration of urea decreases
 - Water content increases/decreases.
 - Concentration of salt decreases.
 - Glucose increases/decreases/remains the same

→ The dialysis fluid needs to be renewed continuously to keep the concentration gradient of waste products higher in the blood so that they diffuse out.

⇒ KIDNEY TRANSPLANTS:

→ ADVANTAGES:

- Long term solution
- Better quality of life
- Person can have wider diet options.
- Dialysis machines are expensive & difficult to maintain.

→ DISADVANTAGES:

- Transplants require a suitable donor.
- Risks might be associated with major surgery.
- Risk of rejection.
- Daily medications required.
- Susceptibility to infection.
- Possibility of changes in appearance due to medication side effects.