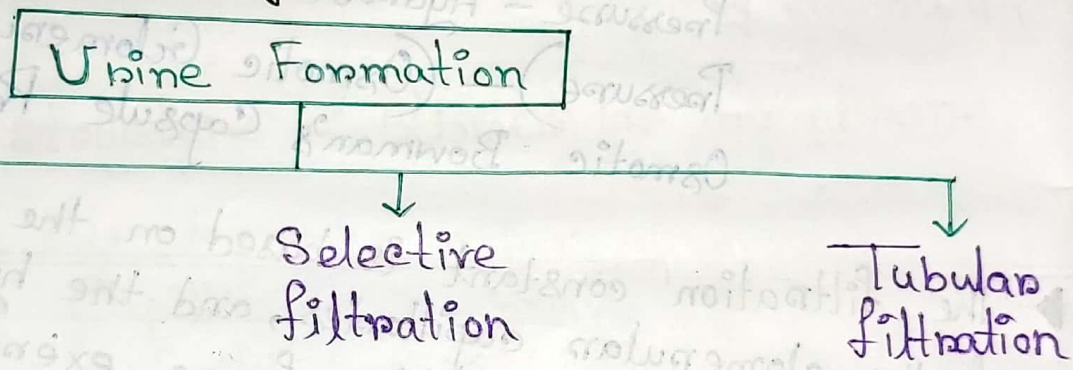
9. URINE FORMATION :

Urine is one of the body's waste products. It's primarily composed of water and urea. Urea is a special nitrogenous waste compound that the body must routinely remove. Urine formation occurs in the kidney in three stages:



① Glomerular filtration :

- This takes place through the semi-permeable walls of the capillaries and Bowman's capsule.
- The afferent arterioles supplying blood to glomerular capsule carries useful as well as harmful substances. The useful substances are glucose, amino acids, vitamins, hormones, electrolytes, ions etc and the harmful substances are metabolic wastes such as urea, uric acids, creatinine, ions etc.
- The diameter of efferent arterioles is narrower than afferent arterioles. Due to this difference in diameter of arteries, blood leaving

Scanned by CamScanner

the glomerulus creats the pressure known as hydrostatic pressure.)

- The glomerulus hydrostatic pressure forces the blood to leaves the glomerulus, resulting in filtration of blood. A capillary hydrostatic pressure of blood of about 45 mmHg (GHP) builds up in the glomerulus. However this pressure is opposed by the osmotic pressure of the blood, provided mainly by plasma proteins, about 25mmHg in the glomerular capsule.)
- The net filtration pressure is:

  Therefore; 45-(25+10) = 10 mmHg
- By the net filtration pressure of 10mmHg, blood is filtered in the glomerular capsule.)
- Water and other small molecules readily pass through the filtration slits but blood cells, plasma proteins and other large molecules are too large to filter through and therefore remain in the capillaries
- The filtrate containing large amount of water glucose, amino acids, uric acid, urea, electrolytes etc in the glomerular capsule is known as nephric filtrate of glomerular filtrate.

Scanned by CamScanner

② Selective reabsorption:

- As the filtrate passes to the renal tubules, useful substances including some water, electrolytes and organic nutrients such as glucose, amino acids, vitamins, hormones etc are selectively reabsorbed from the filtrate back into the blood in the proximal convoluted tubule. tubule. Water is reabsorbed by osmosis, and small proteins are reabsorbed by pinocytosis.

- Reabsorption of some substance is passive, while some substances are actively transported. Major portion of water is reabsorbed by Osmosis.

- Only 60-70% of filtrate reaches the Henle loop. Much of this, especially water sodium and chloride, is reabsorbed in the loop, so that only 15-20% of the original filtrate reaches the distal convoluted tubule, More electrolytes are absorbed here, especially sodium, so the filtrate entering the collecting ducts is actually quite dilute.

③ Tubular secretion:

- Tubular secretion takes place from the blood in the peritubular capillaries to the filtrate in the renal tubules and can ensure that wastes such as creatinine or excess H^+ or excess K^+ ions are actively secreted into the filtrate to be excreted.

- Excess K^+ ions is secreted in the tubules and in exchange Na^+ ion is reabsorbed otherwise it causes a clinical condition called Hyperkalemia.

Scanned by CamScanner

- Tubular secretion of hydrogen ions (H^+) is very important in maintaining normal blood pH.
- Substances such as, e.g. drugs including penicillin and aspirin, may not be entirely filtered out of the blood. Because of the short time it remains in the glomerulus. Such substances are cleared by secretion from the peritubular capillaries into the filtrate within the convoluted tubules.
- The tubular filtrate is finally known as urine. Human urine is usually hypertonic.

Scanned by CamScanner