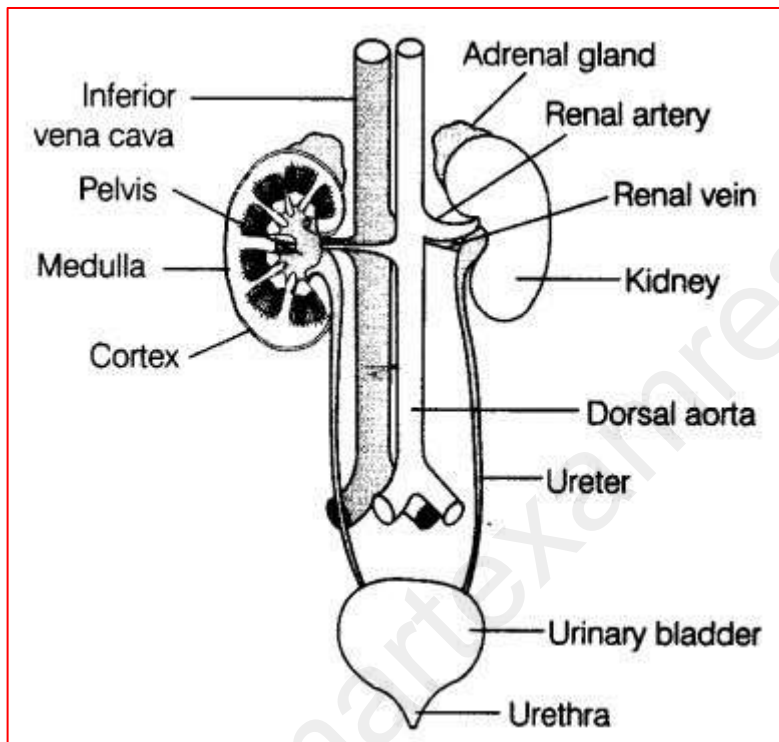


EXCRETION

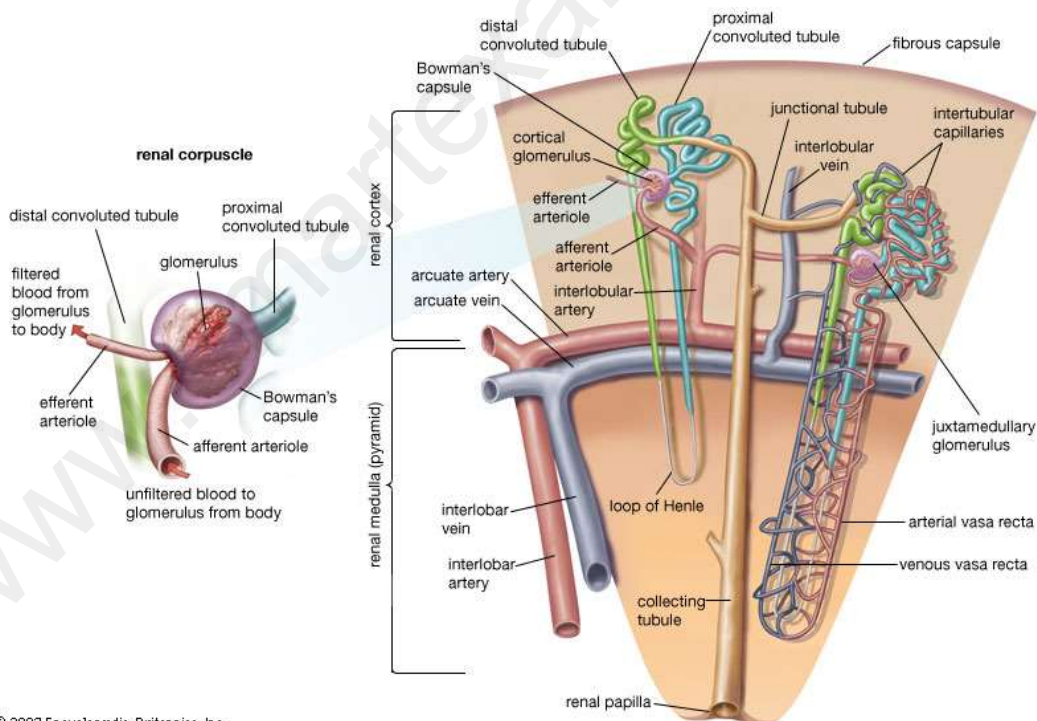
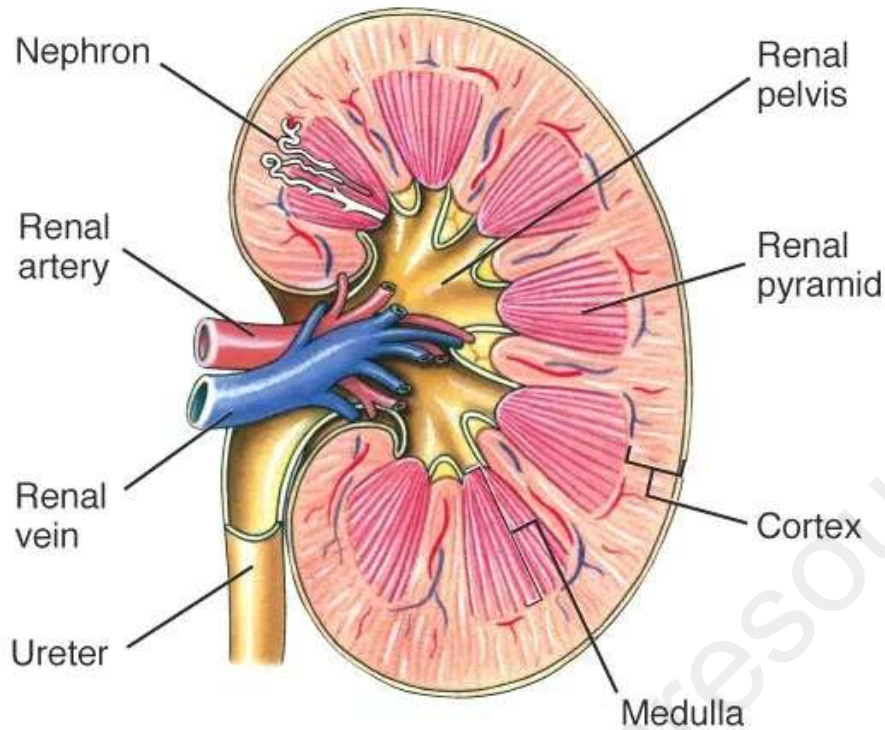
Excretory system

Excretory system: Structure



- The kidneys remove metabolic waste from the liquid part of the blood called as plasma.
- This process of removing metabolic waste from the body is called as excretion.

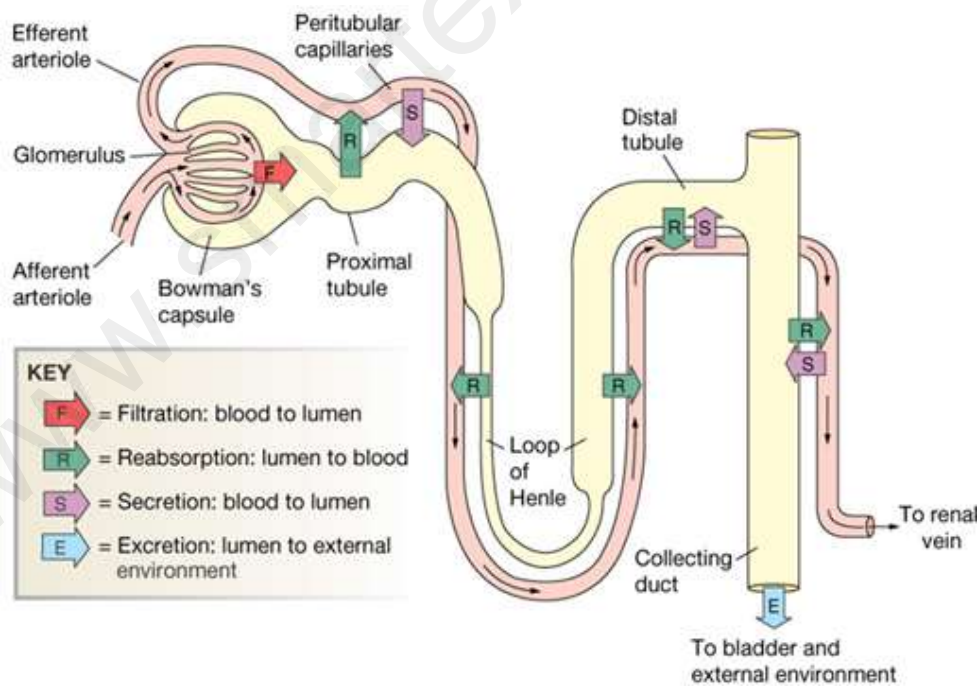
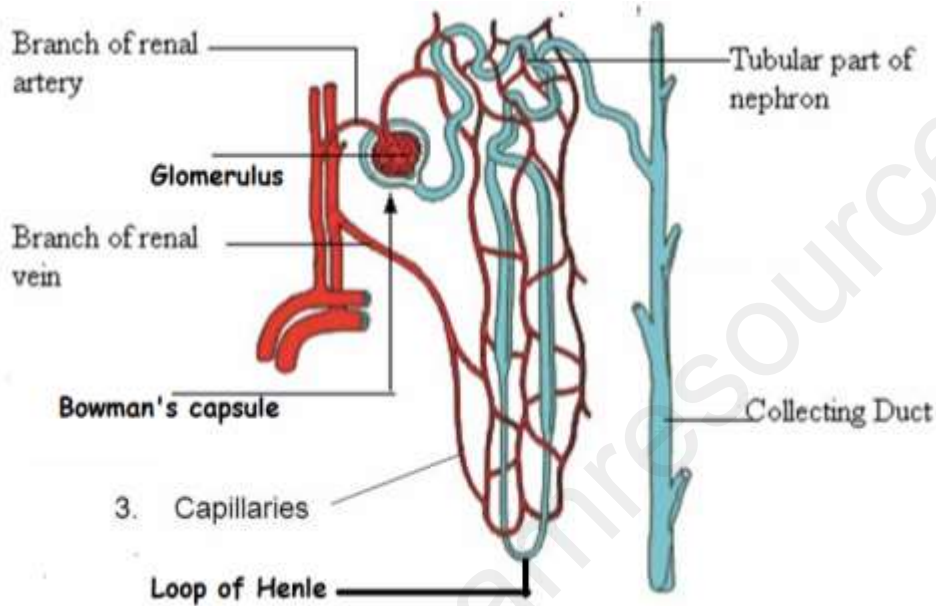
Excretory system: Internal structure of a kidney:

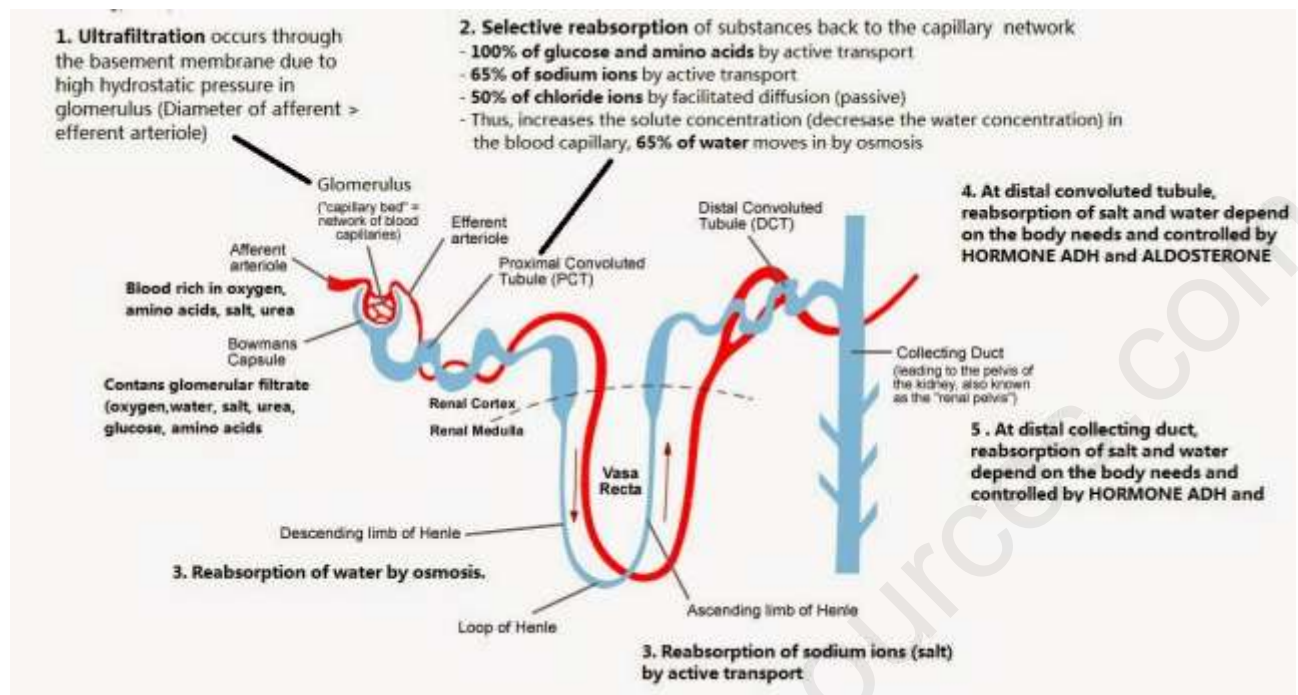


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Structure of a nephron:

A nephron is a basic unit of structure in a kidney. It consists of a single glomerulus, renal capsule(Bowman's capsule), renal tubule and blood capillaries.





Process of Filtration:

The first step in making urine is to separate the liquid part of your blood (plasma), which contains all the dissolved solutes, from your blood cells. Each nephron in the kidneys has a microscopic filter, called a glomerulus that is constantly filtering your blood. Glomerular capillaries have small pores in their walls. The efferent arterioles are smaller in diameter than afferent arterioles. As a result, pressurized blood enters the glomerulus through a relatively wide tube, but is forced to exit through a narrower tube. Also the blood from the heart is already at a very high pressure. This high pressure forces the molecules larger than the protein molecules to leave the capillaries and enter into the Bowman's capsule.

Glomerulus:

The glomerulus filters blood and produces glomerular filtrate. This filtrate contains water, glucose, salts and urea, uric acid, spent hormones, ions and minerals. Large molecules such as protein are too large to fit through the blood capillary walls.

The Bowman's capsule (Renal capsule)

The Bowman's capsule collects the filtrate and it enters the tubules. All glucose is reabsorbed immediately into the blood capillaries.

Renal tubules:

As the rest of the filtrate travels through the tubules water, glucose, amino acids and salts needed by the body are selectively reabsorbed by the blood capillaries surrounding the nephron tubule.

The collecting duct:

The collecting duct collects the urine, consisting of excess water, excess salts and urea. It is then transported in the ureters to the bladder.

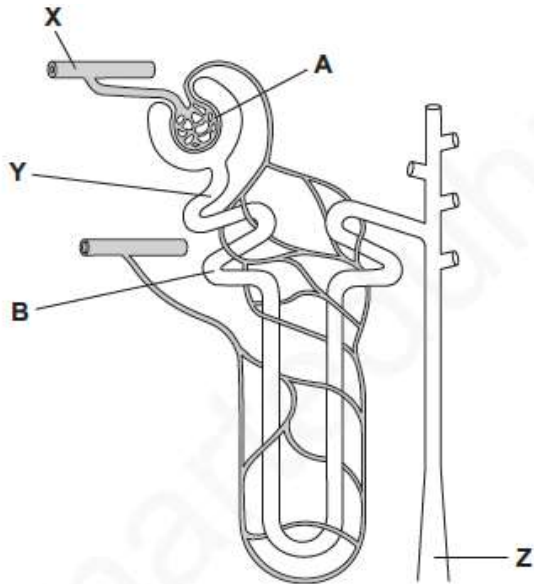
The bladder:

The bladder stores urine until the body is ready to expel it through the urethra.

-
- Thus the formation of urine involves 2 main processes: Ultrafiltration: and Selective reabsorption.
 - Also glucose is reabsorbed via diffusion and water is reabsorbed via diffusion.
 - Note: Ultrafiltration (UF) is a type of membrane filtration in which forces like pressure or concentration gradients lead to a separation through a semipermeable membrane.
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Application based example:

Following is a table showing you the concentration of substances during and after filtration by kidneys.



substance	concentration / g per 100cm ³		
	blood at X	fluid at Y	urine at Z
glucose	0.1	0.1	0.0
protein	7	0	0
sodium ions	0.35	0.35	0.5
urea	0.03	0.03	2.0

Note:

- Glucose is present in X and Y hence it indicates that glucose is small enough to pass through glomerular capillary walls.
- Protein molecules are absent in Y and Z indicating that they are too large to be present in the filtrate. Hence the presence of proteins indicates malfunctioning of the kidneys.
- Concentration of sodium ions and urea increases at Z. This indicates that water has been reabsorbed by osmosis.

Factors affecting the volume and the concentration of urine:

- **Water intake :**

If water intake is less, then the volume of urine produced will be less and the concentration of urine will be high.

- **Temperature :**

High temperature will result in more sweat and hence more water loss from the body. Hence less volume of urine will be produced while the concentration of urine will be high.

- **Exercise:**

Exercise will cause a lot of sweating hence will result in water loss from the body. As a result the volume of urine produced will be less while its concentration will be high.
