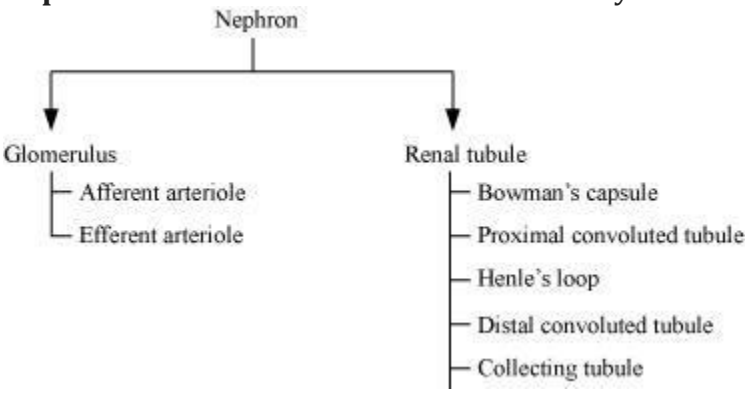
Excretory Products and their Elimination

- **Kidney** is divided into outer cortex and inner medullary region.
- The cortical portion that projects between the medullary pyramids are known as **columns of Bertini.**
- **Nephrons** are basic functional units of kidney.



- **Malpighian body or renal corpuscle** comprises of Bowman's capsule and glomerulus.
- **Malpighian body, Proximal Convoluted Tubule (PCT), and Distal Convoluted Tubule (DCT)** are located in the **cortical region** of kidney.
- **Loop of Henle's** is found in the medullary region of kidney.
- **Vasa recta** – It is a loop of capillaries that runs parallel to Henle's loop.
- **Afferent arteriole:** The arterioles that breaks into numerous capillaries to form glomerulus present inside the Bowman's capsule.
- **Efferent arteriole:** Emerging from the Bowman's capsule these capillaries combines together and travels a short distance and break up into the secondary capillary network.

Excretory organ in various animals

- **Protonephridia (flame cells):** Examples, platyhelminthes, rotifers and some annelids

Amphioxus is a chordate that has flame cells.

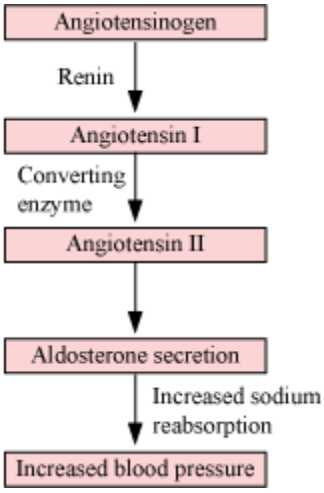
- **Nephridia:** Example, earthworm
- **Malpighian tubules:** Examples, insects such as cockroach
- **Antennal glands (green gland):** Examples, crustacean such as prawns

- **Urine formation**
- **It involves three process:**
  - **(i) Glomerular filtration -** Filtration of water and dissolved substances out of the blood in the glomeruli and into Bowman's capsule
  - **(ii) Reabsorption -** Reabsorption of water and dissolved substances out of the kidney tubules back into the blood. This process prevents substances required by the body from being lost in the urine.
  - **(iii)Secretion -** Secretion of hydrogen ions (H+), potassium ions (K+), ammonia (NH3), and certain drugs out of the blood and into the kidney tubules, where they are eventually eliminated in the urine
- **Glomerular filtration rate:** It is the amount of glomerular filtrate formed in all nephrons of both kidneys per minute.
- It is about 125 mL/ minute in a healthy individual.
- Regulation of glomerular filtration rate is auto regulative. It is carried out by **juxtaglomerular apparatus.**
- About 99% of filtrate is reabsorbed by renal tubule.
- Glucose, amino acids, and sodium are actively absorbed.
- Nitrogenous wastes and water are reabsorbed passively from filtrate.
- **Descending limb of Henle's loop** is permeable to water and impermeable to electrolytes.
- **Ascending limb of Henle's loop** is impermeable to water.
- **Distal convoluted tubule** involves reabsorption of sodium ions.
- **Counter current mechanism**
  - It is an adaptation for conservation of water.
  - Two current mechanisms operating in kidney are – Henle's loop and vasa rectae. They both help in maintaining a concentration gradient in the medullary interstitium.

Regulation of Kidney

- Juxtaglomerular apparatus contains juxtaglomerular cells that release renin.

- **Renin – Angiotensin mechanism**



- **Anti-diuretic hormone (Vasopressin)** secreted by neurohypophysis facilitates water reabsorption from distal convoluted tubule and collecting duct. Hence, it is quite important for the process of osmoregulation.

- **Atrial natriuretic factor (ANF)** keeps a check on renin-angiotensin mechanism.

Uremia – Accumulation of urea in blood. It can be cured by performing haemodialysis.

- **Renal failure –** It is the condition when the kidney loses the ability to form urine and concentrate it. It can be corrected by kidney transplantation method.

- **Renal calculi –**Accumulation of insoluble crystallised salts within the kidney

- **Glomerulonephritis –** Inflammation of glomeruli
- **Glycosuria –** Presence of glucose in urine
- **Ketonuria –** Presence of ketone bodies in urine