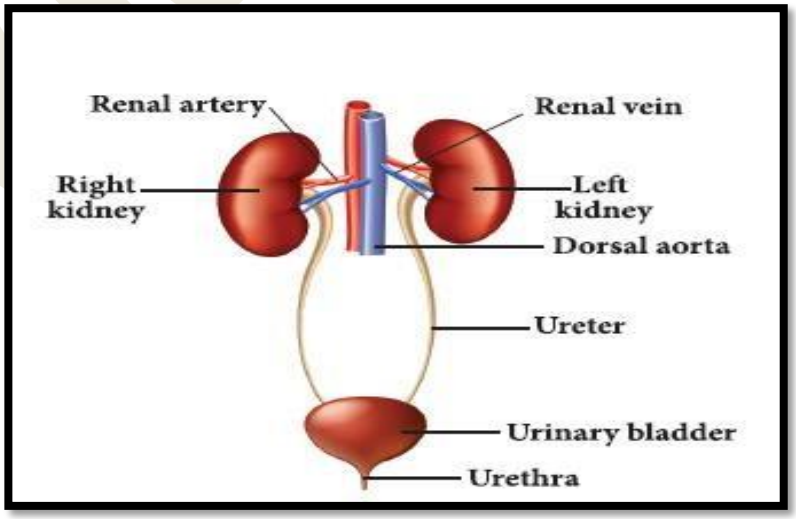
# HUMAN EXCRETORY SYSTEM

- Metabolic activities continuously take place in living cells.
- All metabolic products produced by the biochemical reactions are not utilized by the body because certain nitrogenous toxic waste substances are also produced. They are called excretory products.
- In human beings **urea** is the major excretory product.
- The tissues and organs associated with the removal of waste products constitute the excretory system.
- The human excretory system consists of a pair of kidney, which produce the urine, a pair of ureters which conduct the urine from kidneys to the urinary bladder, where urine is stored temporarily and urethra through which the urine is voided by bladder contractions.
- If the waste products are accumulated and not eliminated, they become harmful and poisonous to the body. Hence, excretion plays an important role in maintaining the homeostatic condition of the body.
- Some of the excretory organs other than kidneys are **skin** (removes small amounts of water, urea and salts in the form of sweat) and **lungs** (eliminate carbon-dioxide and water vapour through exhaling).

Excretory system




## SKIN

- Skin is the outer most covering of the body. It stretches all over the body in the form of a layer.
- It accounts for 15% of an adult's human body weight.

- There are many structures and glands derived from the skin. It eliminates metabolic wastes through perspiration.
- The human body functions normally at a temperature of about 37 0C.
- When it gets hot sweat glands start secreting sweat, which contains water with small amounts of other chemicals like ammonia, urea, lactic acid and salts (mainly sodium chloride).
- The sweat passes through the pores in the skin and gets evaporated.

## KIDNEYS

- Kidneys are bean-shaped organs reddish brown in colour.
- The kidneys lie on either side of the vertebral column in the abdominal cavity attached to the dorsal body wall.
- The right kidney is placed lower than the left kidney as the liver takes up much space on the right side.
- Each kidney is about 11 cm long, 5 cm wide and 3 cm thick.
- The kidney is covered by a layer of fibrous connective tissue, the renal capsules, adipose capsule and a fibrous membrane.
- Internally the kidney consists of an outer dark region, the **cortex** and an inner lighter region, the **medulla**.
- Both of these regions contain **uriniferous tubules** or **nephrons**.
- The medulla consists of multitubular conical masses called the medullary pyramids or renal pyramids whose bases are adjacent to cortex.
- On the inner concave side of each kidney, a notch called **hilum** is present through which blood vessels and nerves enter in and the urine leaves out.

## `URETERS

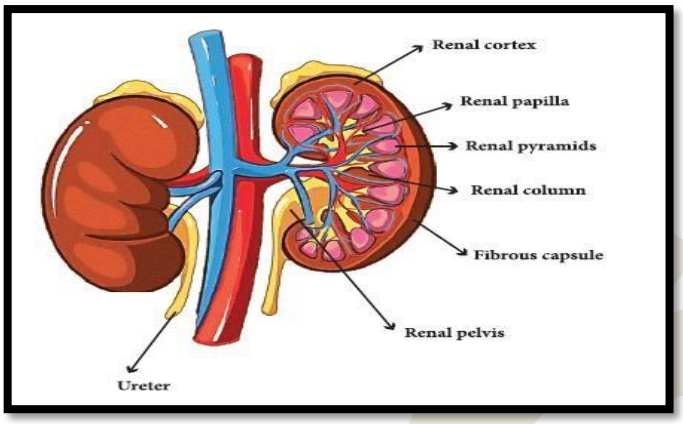
- Ureters are thin muscular tubes emerging out from the hilum.
- Urine enters the ureter from the renal pelvis and is conducted along the ureter by peristaltic movements of its walls.
- The ureters carry urine from kidney to urinary bladder.

## URINARY BLADDER

- Urinary bladder is a sac-like structure, which lies in the pelvic cavity of the abdomen.
- It stores urine temporarily.

## URETHRA

- Urethra is a membranous tube, which conducts urine to the exterior.
- The urethral sphincters keep the urethra closed and opens only at the time of **micturition** (urination).




## FUNCTIONS OF KIDNEY

- Maintains the fluid and electrolytes balance in our body.
- Regulates acid-base balance of blood.
- Maintains the osmotic pressure in blood and tissues.
- Helps to retain the important plasma constituents like glucose and amino acids.

## STRUCTURE OF NEPHRON

- Each kidney consists of more than one million nephrons.
- **Nephrons or uriniferous tubules** are structural and functional units of the kidneys.
- Each nephron consists of **Renal corpuscle** or **Malphigian corpuscle** and **renal tubule**. The renal corpuscle consists of a cup-shaped structure called **Bowman's capsule** containing a bunch of capillaries called **glomerulus**.
- Blood enters the glomerular capillaries through **afferent** arterioles and leaves out through **efferent** arterioles.
- Bowman's capsule continues as the renal tubule which consists of three regions **proximal convoluted tubule**, U-shaped hair pin loop, **the loop of Henle** and the **distal convoluted tubule**.
- The distal convoluted tubule opens into the **collecting tubule**.
- The nitrogenous wastes are drained into renal pelvis which leads to ureters and stored in the urinary bladder.
- Urine is expelled out through the urethra.

## MECHANISM OF URINE FORMATION

The process of urine formation includes the following three stages.

- ✓ Glomerular filtration
- ✓ Tubular reabsorption

✓ Tubular secretion

## GLOMERULAR FILTRATION

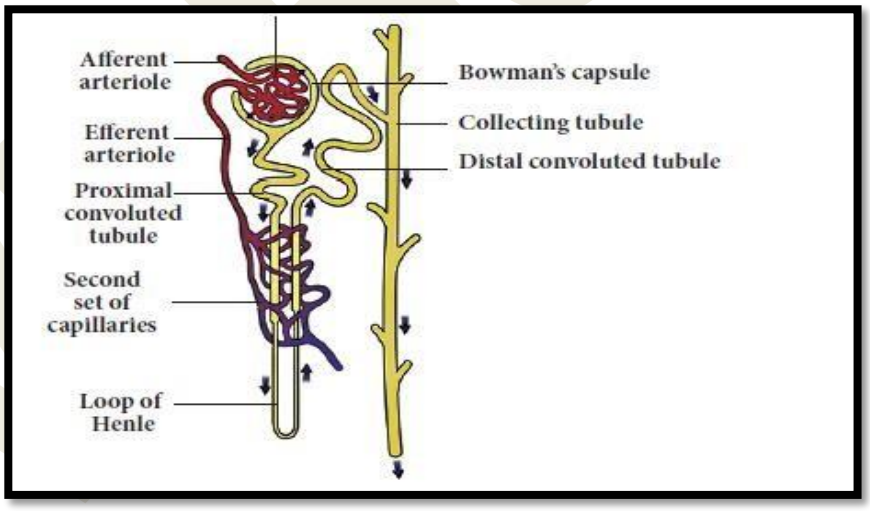
- Urine formation begins with the filtration of blood through epithelial walls of the glomerulus and Bowman's capsule.
- The filtrate is called as the glomerular filtrate.
- Both essential and non-essential substances present in the blood are filtered.

## TUBULAR REABSORPTION

- The filtrate in the proximal tubule consists of essential substances such as glucose, amino acids, vitamins, sodium, potassium, bicarbonates and water that are reabsorbed into the blood by a process of **selective reabsorption**.

## TUBULAR SECRETION

- Substances such as H+ or K+ ions are secreted into the tubule.
- This tubular filtrate is finally known as urine, which is **hypertonic** in man.
- Finally the urine passes into collecting ducts to the pelvis and through the ureter into the urinary bladder.
- When the urinary bladder is full the urine is expelled out through the urethra.
- This process is called **micturition**. A healthy person excretes one to two litres of urine per day.

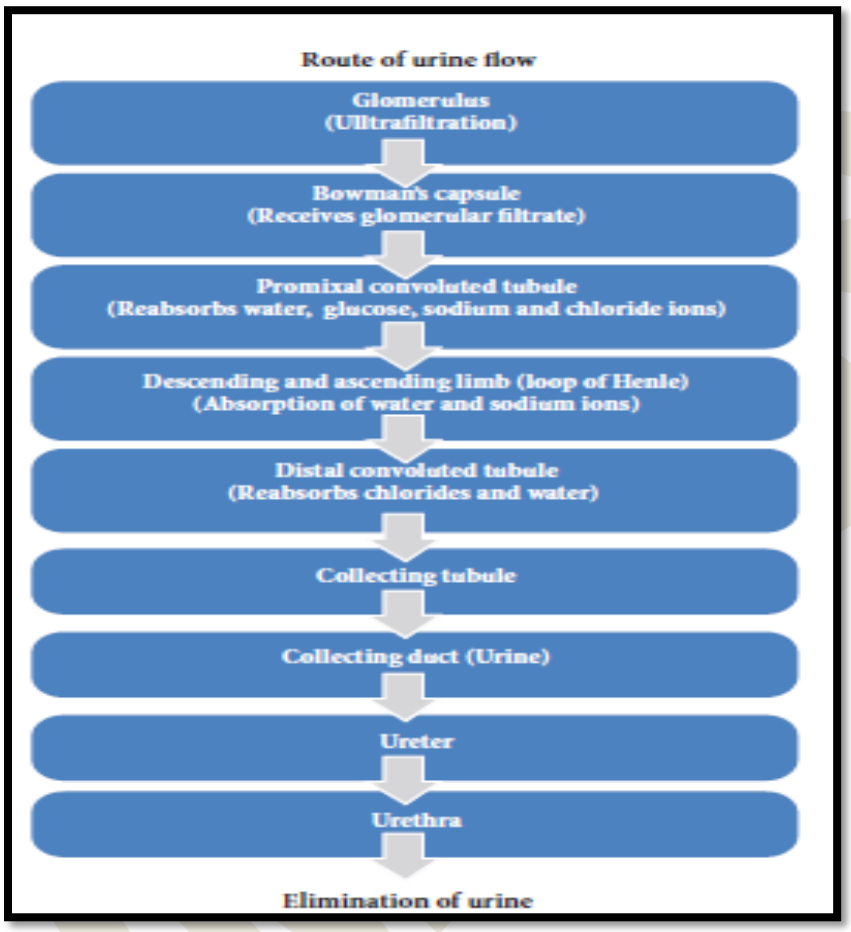



## STRUCTURE OF NEPHRON

Two healthy kidneys contain a total of about 2 million nephrons, which filter about 1700-1800 litres of blood.

- The kidneys reabsorb and redistribute 99% of the blood volume and only 1% of the blood filtered becomes urine
- In 1954, Joseph E.Murray and his colleagues at Peter Bent Brigham Hospital in Boston, USA performed first succesful kidney transplant between Ronald and Richard Herrickwho were

identical twins.




- The recepient Richard Herrick died after 8 years of transplantation

## DIALYSIS OR ARTIFICIAL KIDNEY

- When kidneys lose their filtering efficiency, excessive amount of fluid and toxic waste accumulate in the body.
- This condition is known as **kidney** (renal) **failure**.
- For this, an artificial kidney is used to filter the blood of the patient. The patient is said to be put on dialysis and the process of purifying blood by an artificial kidney is called **haemodialysis**.
- When renal failure cannot be treated by drug or dialysis, the patients are advised for kidney transplantation.