

# The Human Excretory/Urinary System

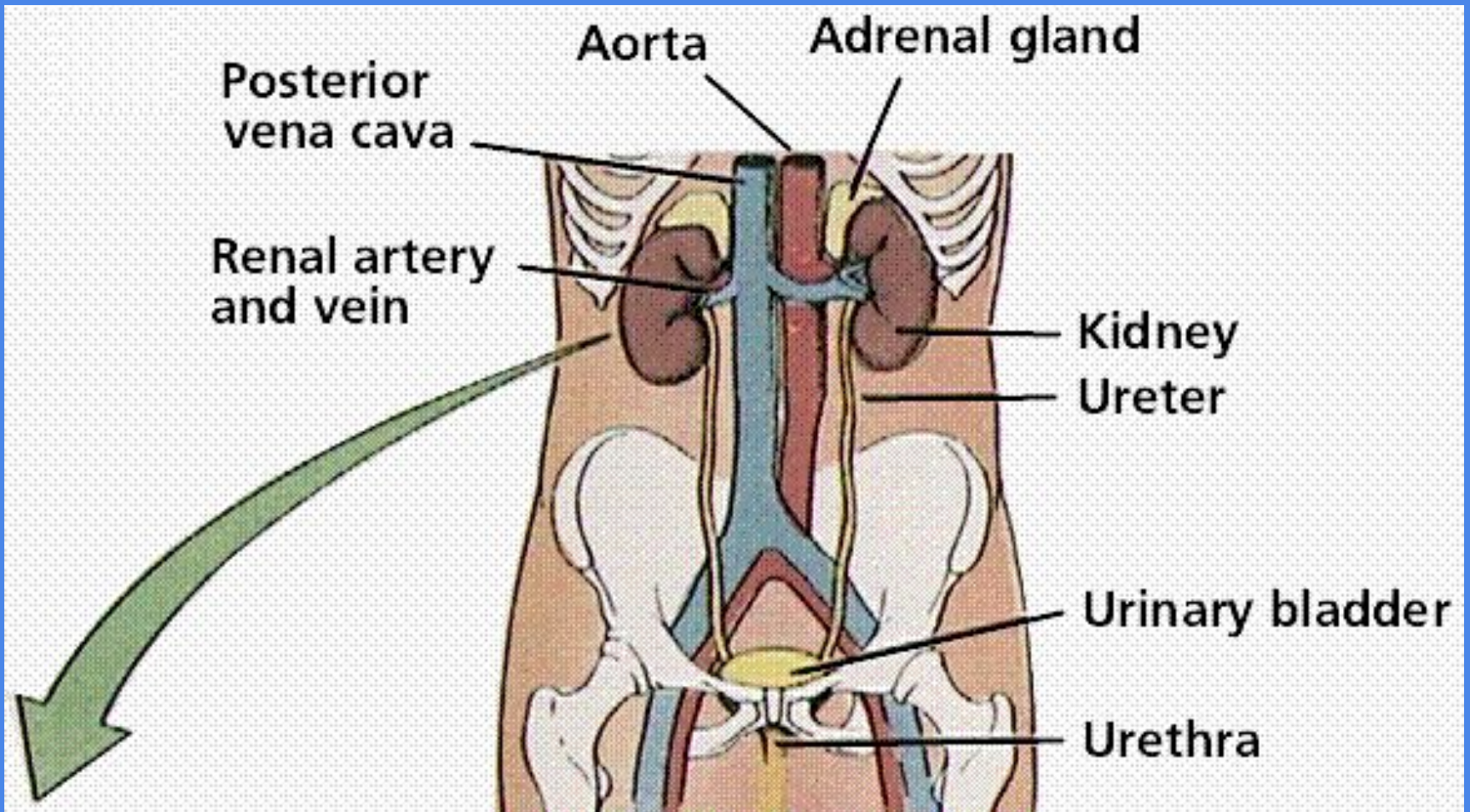
# Function of the Kidney

- The principal function of the kidney is to filter blood in order to remove cellular waste products from the body.
- If one ceases to work, the other increases in size to handle the workload.

# Excretory System

- The *kidneys* regulate the amount of water, salts and other substances in the blood.
- The kidneys are fist-sized, bean shaped structures that remove nitrogenous wastes (urine) and excess salts from the blood.
- The *ureters* are tubes that carry urine from the pelvis of the kidneys to the urinary bladder.
- The *urinary bladder* temporarily stores urine until it is released from the body.
- The *urethra* is the tube that carries urine from the urinary bladder to the outside of the body.
- The outer end of the urethra is controlled by a circular muscle called a sphincter.

# Excretory System

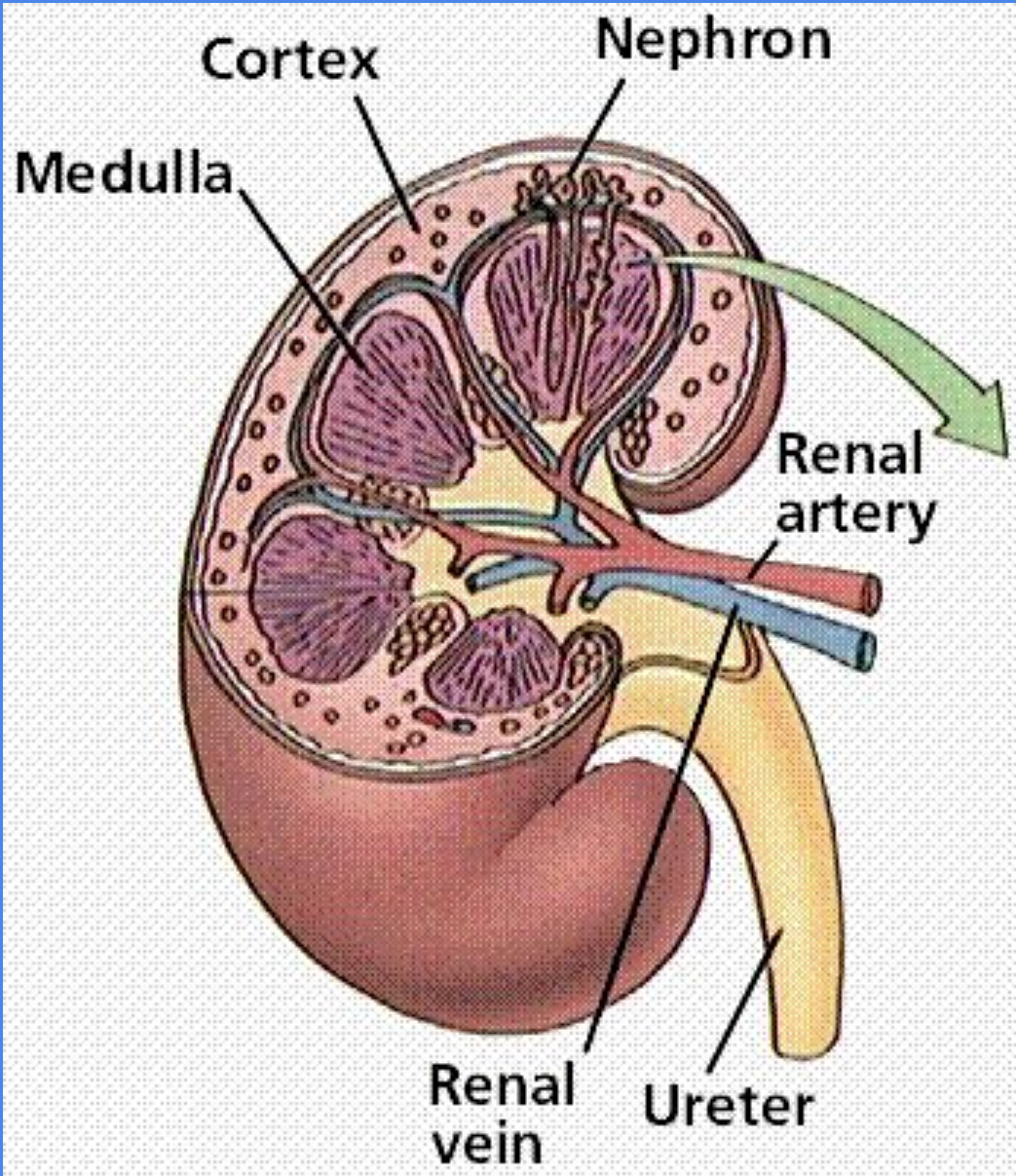


- The kidney has other functions but it is usually associated with the excretion of cellular waste such as :
- 1) **urea** (a nitrogenous waste produced in the liver from the breakdown of protein. It is the main component of urine) ;
- 2) **uric acid** (usually produced from breakdown of DNA or RNA) and
- 3) **creatinine** (waste product of muscle action).

- All of these compounds have nitrogen as a major component.
- The kidneys are more than excretory organs.
- They are one of the major homeostatic organs of the body.
- They control water pH, secrete erythropoietin (a hormone that stimulates red blood cell production) and activate vitamin D production in the skin.
- **That is why a doctor can tell so much from a urine sample.**

# The Kidney

- Each kidney is composed of three sections:
  - the outer (renal) cortex, the (renal) medulla (middle part) and the hollow inner (renal) pelvis.
    - The **cortex** is where the blood is filtered.
    - The **medulla** contains the collecting ducts which carry filtrate (filtered substances) to the pelvis.
    - The **pelvis** is a hollow cavity where urine accumulates and drains into the ureter.



# The Parts of the Kidney

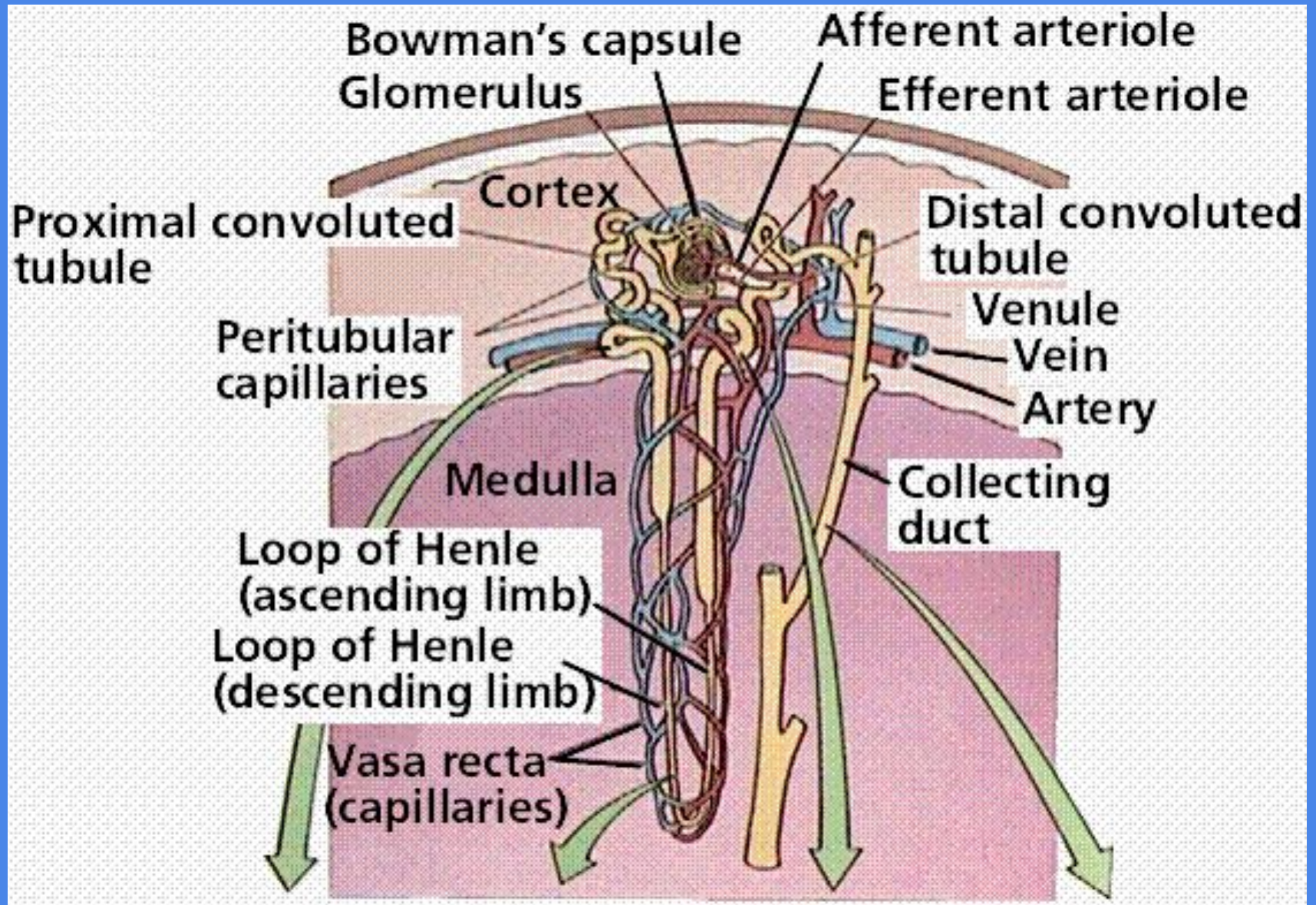


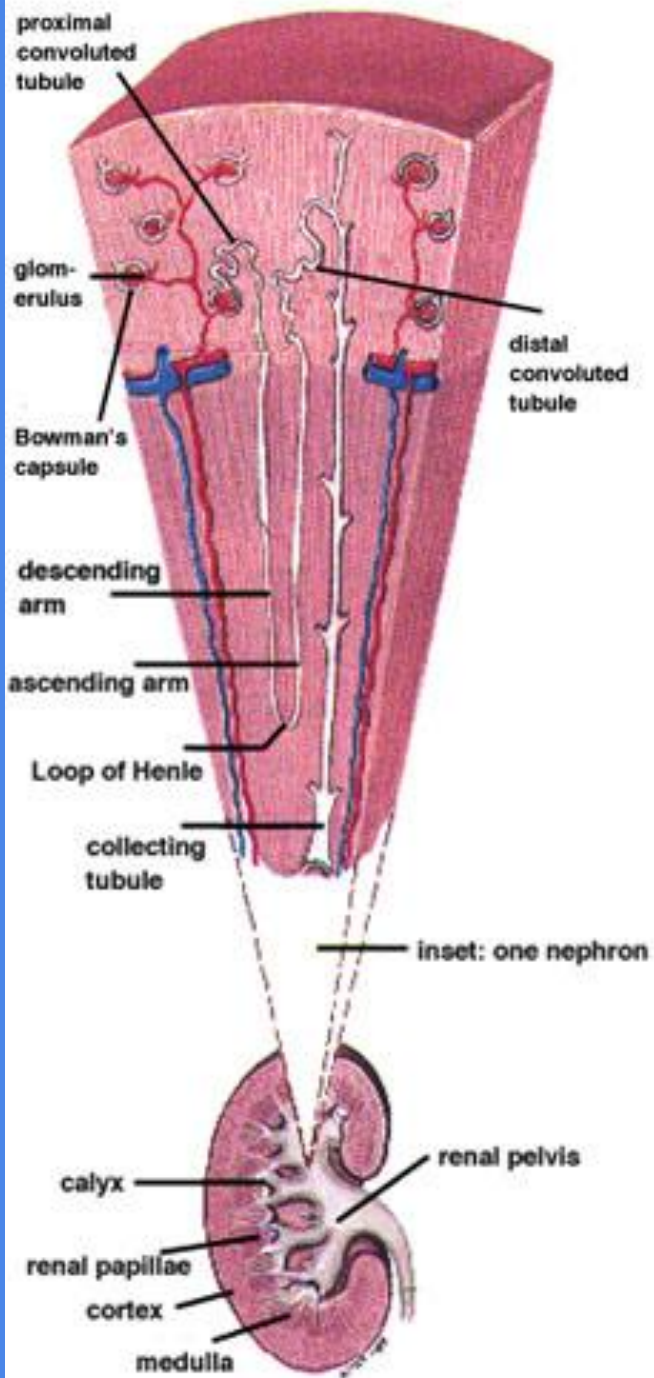
# How blood is Filtered

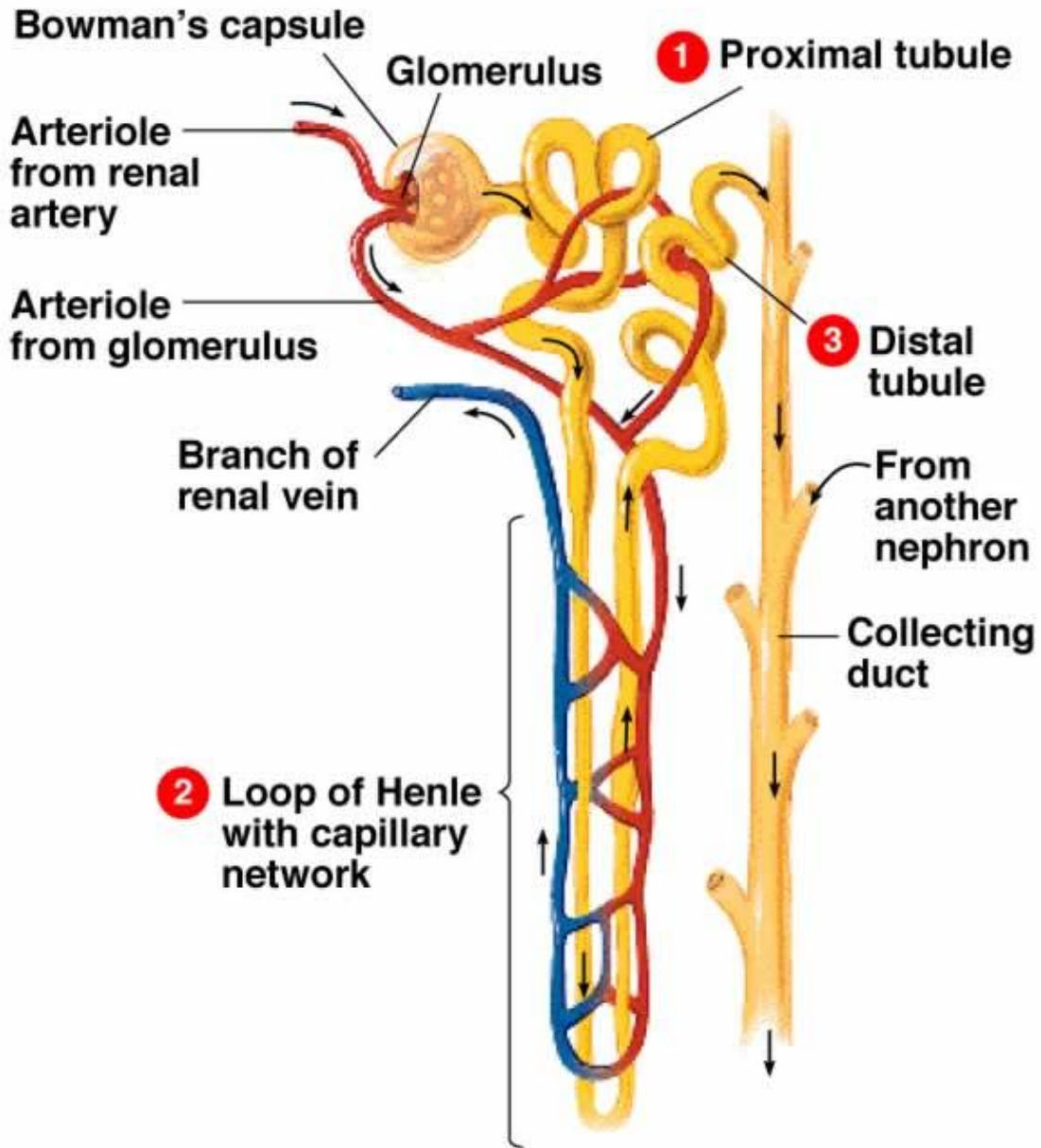
- The filtering units of the kidneys are the *nephrons*.
- There are approximately one million nephrons in each kidney.
- The nephrons are located within the cortex and medulla of each kidney.
- The nephron perform 4 tasks: Filtration, reabsorption, secretion & excretion

# Parts of the Nephron

- Each nephron consists of the following parts:
  - 1) glomerulus ;
  - 2) Bowman's capsule ;
  - 3) proximal tubule ;
  - 4) loop of Henle ;
  - 5) distal tubule ;
  - 6) collecting duct.







- The ***glomerulus*** is a mass of thin-walled capillaries.
- The ***Bowman's capsule*** is a double-walled, cup-shaped structure.
- The ***proximal tubule*** leads from the Bowman's capsule to the Loop of Henle.
- The ***loop of Henle*** is a long loop which extends into the medulla.
- The ***distal tubule*** connects the loop of Henle to the collecting duct.

# Filtration

- **Kidney Action**
- Blood enters Bowman's capsule through a tiny artery — (*the renal artery*).
- The artery branches to form a *glomerulus*.
- Blood pressure forces some blood plasma and small particles into the surrounding capsule — (this is waste is called the *filtrate*).
- Large particles such as blood cells and proteins remain in capillaries.
- The filtrate is pushed out of the capsule and into the **proximal tubule** .
- This is where reabsorption begins.

# Reabsorption

- Only materials needed by the body are returned to bloodstream — for example, 99% of water, all glucose and amino acids and many salts are reabsorbed.
- From here, these components return to the bloodstream.
- The filtrate becomes more concentrated as it moves through the **loop of Henle** whose primary function is to remove water from the filtrate by osmosis.



## Secretion

- The filtrate moves to the *distal tubule* where tubular secretion occurs.
- Fluid from a number of nephrons moves from the distal tubules to a common **collecting duct** which carries what can now be called **urine** to the **renal pelvis**.

## Excretion

- Excretion only happens when the urine leaves the **urethra**

# NOTE

- ***Since the kidneys control what leaves and what remains in the nephrons, they maintain the levels of water, ions and other materials nearly constant and within the limits to maintain homeostasis.***

# Disorders of the Excretory System

- Our excretory system is very important in maintaining homeostasis. There are certain conditions which can affect the excretory system. We will discuss some of these common disorders.

# Kidney Stones

- Are also a common kidney disorder. They form when chemicals in the urine precipitate out and form crystals.
- The most common crystals are from calcium, while others could be from uric acid.
- Kidney stones are more common in men than women and can reoccur at any time.
- Factors such as recurrent urinary bladder infections, insufficient water intake and consumption, low levels of physical activity, and too much Vitamin C and D intake can lead to kidney stones.
- One of the best ways to decrease the occurrence of stones is to drink lots of water and to change your dietary habits.



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## Kidney Stones (cont)

- Symptoms include severe back or abdomen pain, blood in the urine, nausea and vomiting.
- Diagnosis involves a complete medical examination, including X-rays.
- Treatment may vary from letting the stones pass through the urinary tract to ultrasound shock (or lithotripsy) to disintegrate the stones to a small size that can be passed through the urinary tract.
- Real large stones require surgery for removal.

# UTI (Urinary Tract Infection)

- Is a very common disorder. If the bladder has become infected, it is known as ***cystitis***. If the urethra is infected., it is called ***urethritis***.
- UTI is more common in women than men because of differences in anatomy.
- Symptoms include painful urination (burning sensation), frequent urination (even if no urine present) and bloody or brown urine.
- This can lead to chills, fever, nausea, vomiting and upper abdomen tenderness.

## NOTE :

- If left untreated, UTI's can lead to permanent kidney damage and possible kidney failure.
- The general treatment is by antibiotics. A person needs to maintain good personal hygiene when eliminating wastes (liquid and solid forms) from the body.
- Also, a person should drink lots of water.



# Dialysis

