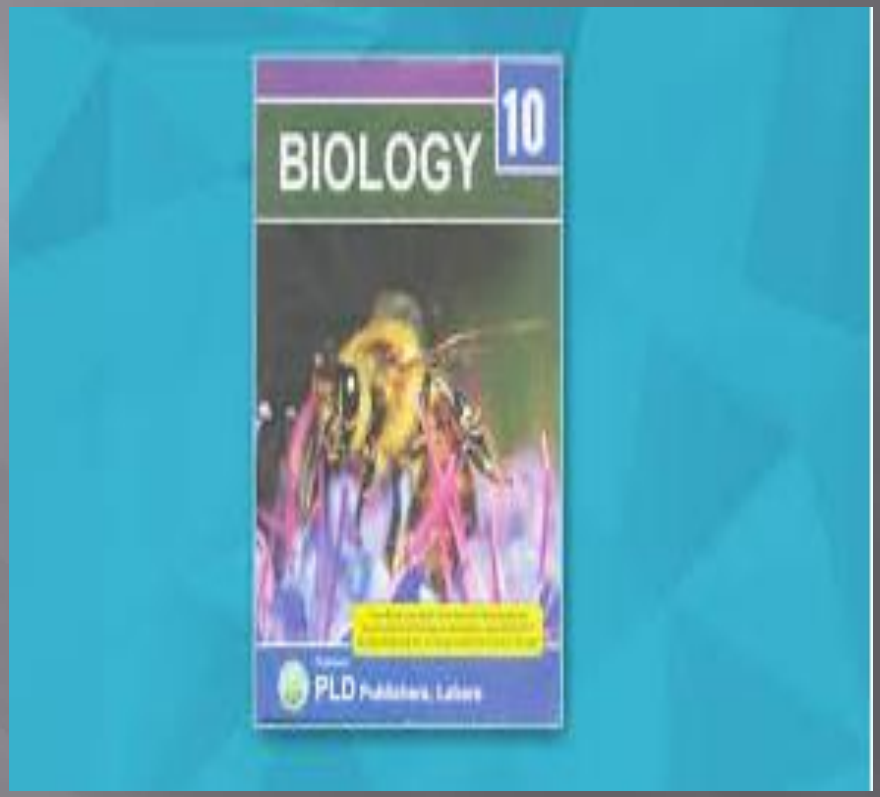
Pakistan School
Kingdom of Bahrain

BIOLOGY LESSON


BIOLOGY
10
PLD Publishers, Lahore

Ch. 2. Homeostasis

- **Topic.** **Functioning**
  of
  Kidney

(pages.23,24,25)

Objectives of the Lesson.

- At the end of this lesson students will be able to

- Describe the structure and function of a nephron.

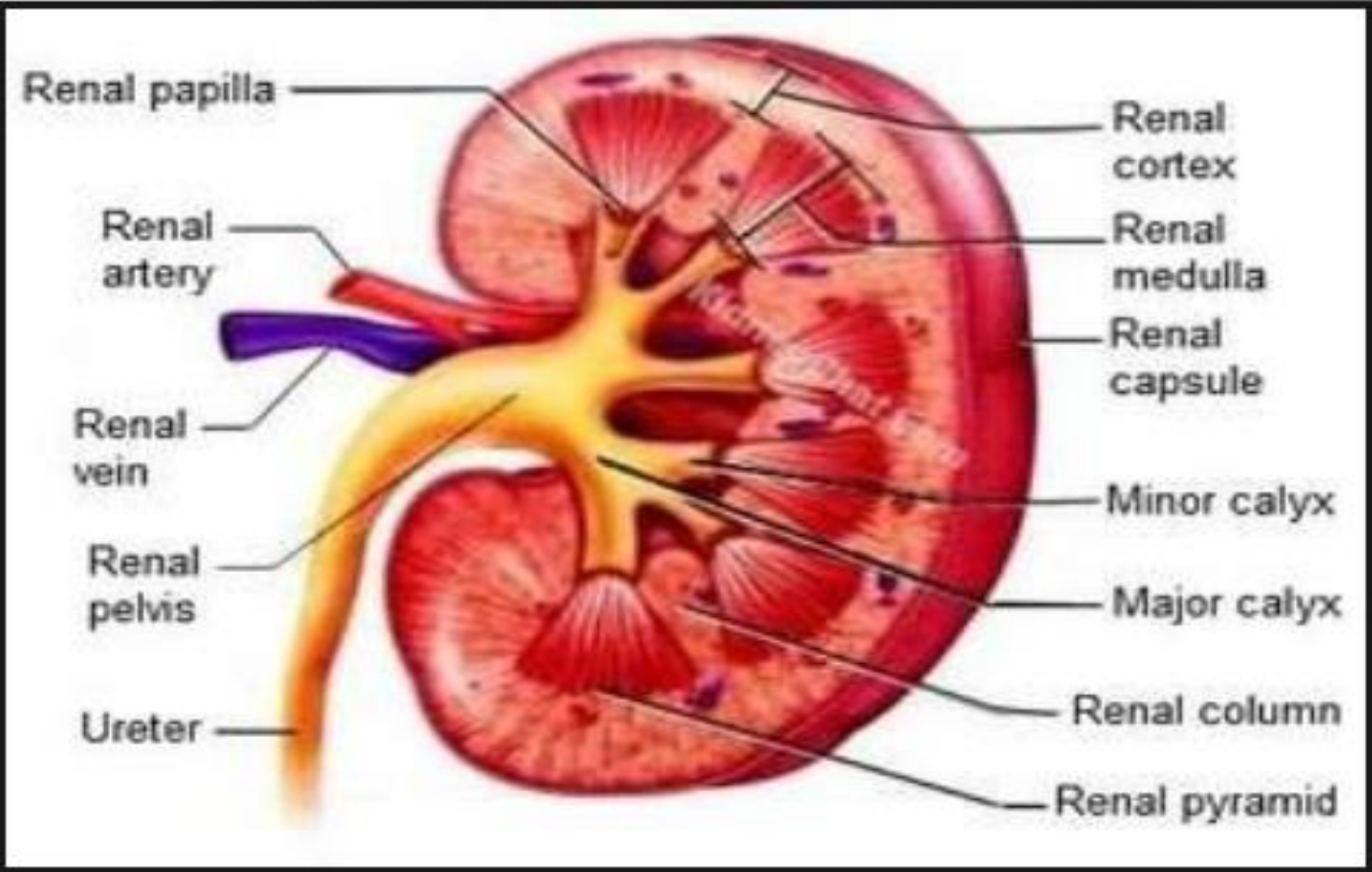
&

- Recognize the main function of kidney.

Introduction

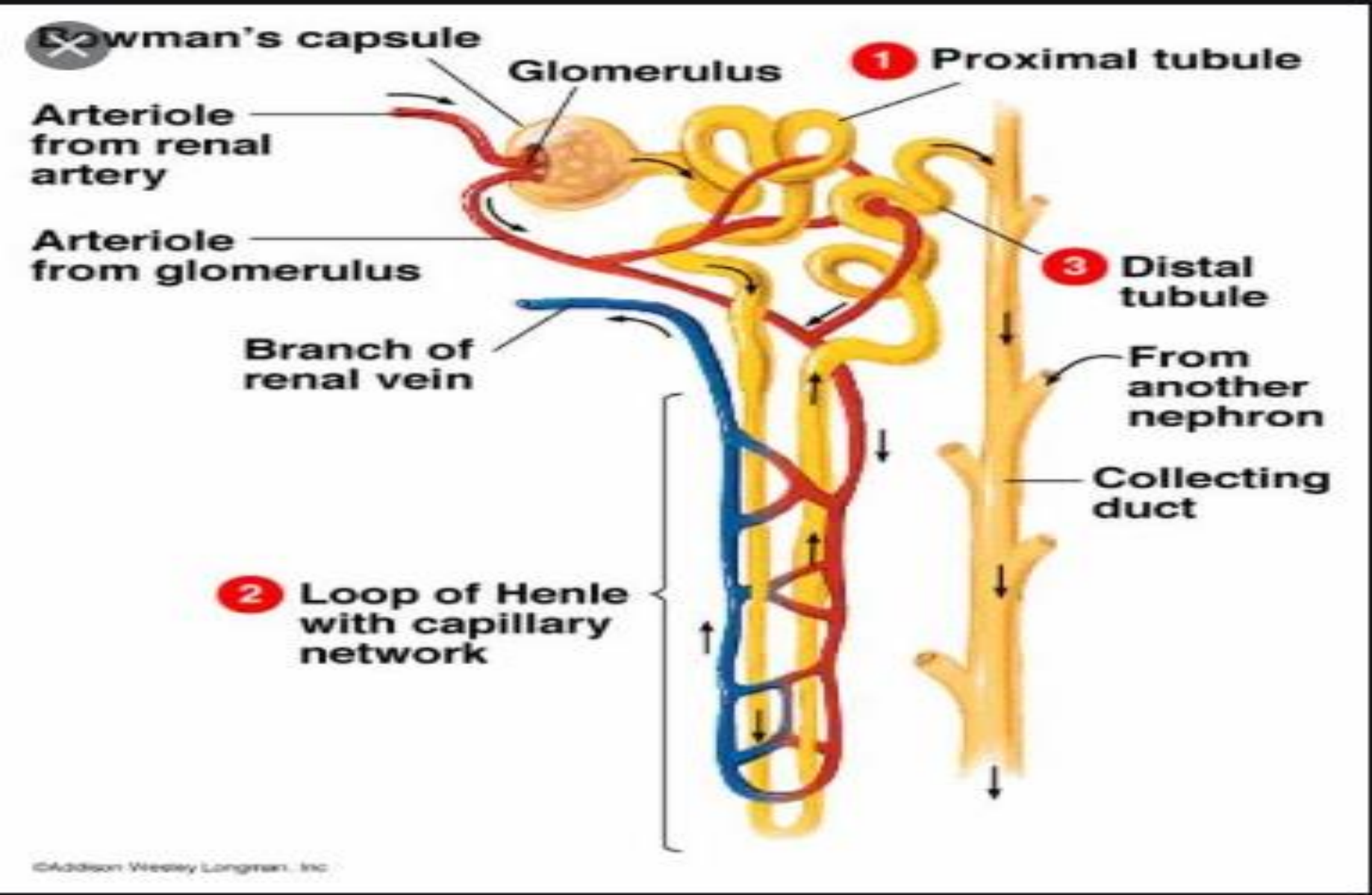
- The main function of kidney is urine formation. We have studied the main parts of human urinary system and anatomy of kidney.
- The functional unit of kidney is called nephron. There are over one million nephrons in each kidney.
- Today we are going to discuss the structure and function of a nephron and steps involved in urine formation.

ANATOMY OF A KIDNEY



STRUCTURE & FUNCTIONS OF NEPHRON

Labeled pic. of a Nephron



Nephron

- Functional and structural unit of the kidney
- Approximately 1 million nephrons/kidney
- Each nephron has two components
  - **Vascular component**
  - **Tubular component**

Nephron (Vascular component)

- Dominant part is the glomerulus
- **Glomerulus** is a tuft of glomerular capillaries.
- large amounts of fluid & solutes are filtered from the blood.

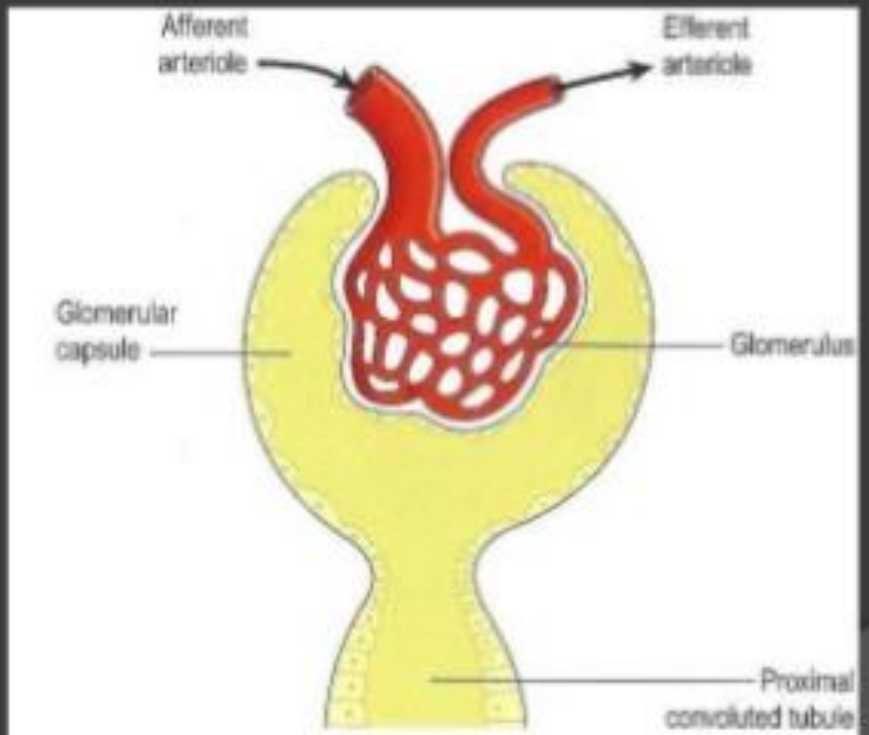


Figure 13.10 The glomerulus and glomerular capsule.

Vascular Component

- Renal Artery enters the kidney and forms afferent arteriole, which supplies each nephron.
- Afferent arteriole delivers blood to the glomerulus.
- Glomerular capillaries rejoin to form another arteriole – the efferent arteriole.
- The blood that was not filtered in the glomerulus goes to efferent arteriole.

Nephron (Tubular component)

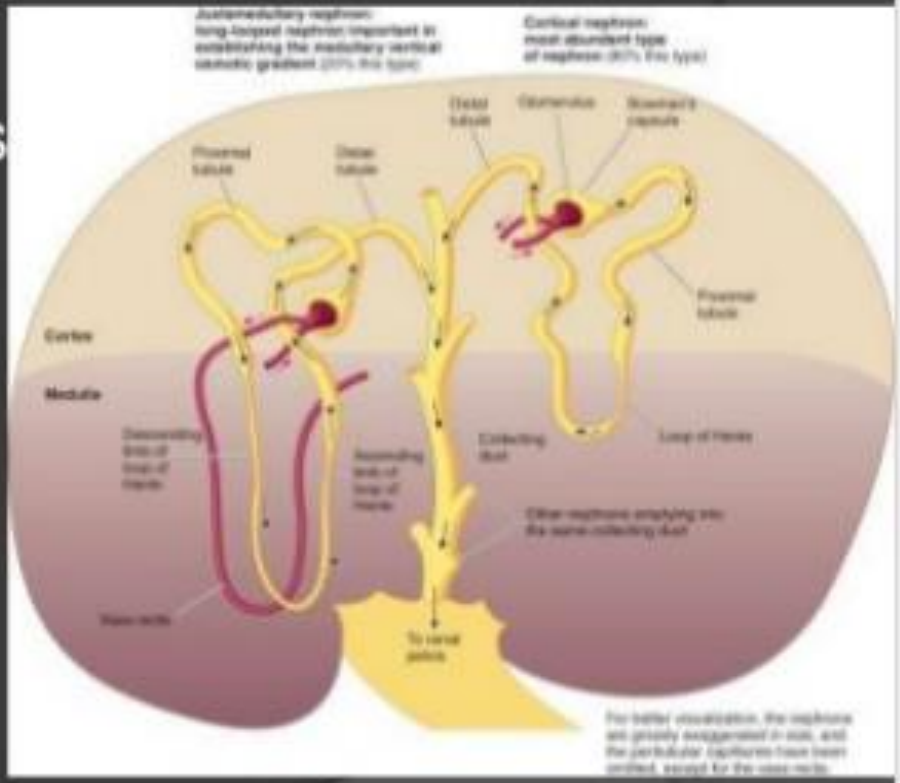
- Hollow, fluid-filled tube
  - single layer of epithelial cells
- **Components**
  - Bowman's capsule
  - Proximal convoluted tubule
  - Loop of Henle
    - Descending limb (thin)
    - Ascending limb (thin and thick part)
  - Distal convoluted tubule
  - Collecting duct or tubule
  - Juxtaglomerular apparatus

- Bowman's capsule – expanded double walled invagination that cups around the glomerulus to collect fluid from the glomerular capillaries.
- From bowman's capsule, filtered fluid passes into PCT. PCT lies entirely in the cortex.
- From PCT, fluid passes into loop of Henle [LH].

- Loop of Henle – form U-shaped or hair pin loop, LH dips into renal medulla.
- LH – descending limb of LH goes from cortex to medulla, and ascending limb of LH passes from medulla to cortex.
- Ascending limb of LH, forms distal convoluted tubule (DCT), DCT lies in cortex.

Nephron

- Two types of nephrons
- Distinguished by location and length of their structures
  - Juxtamedullary nephrons
  - Cortical nephrons

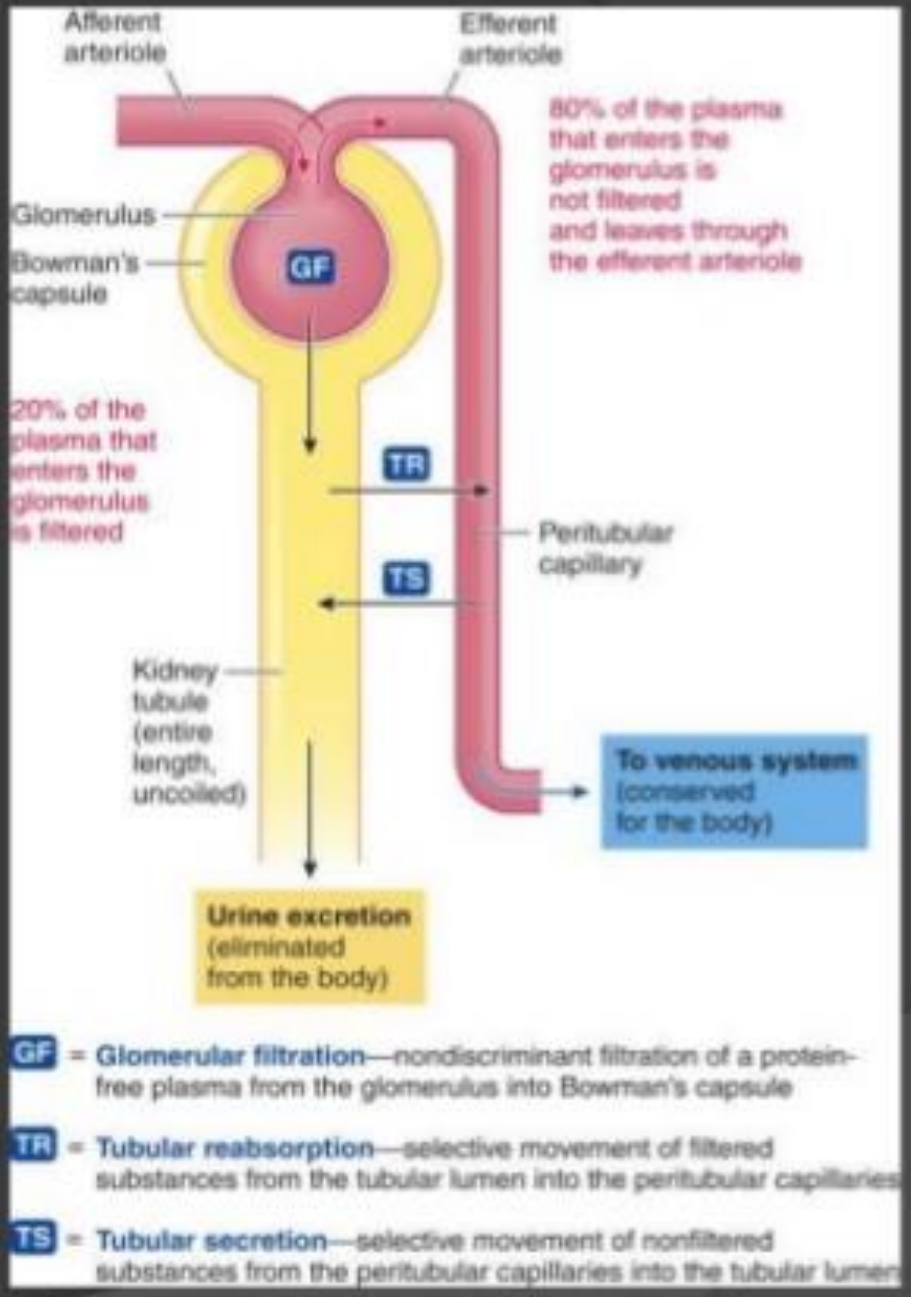


URINE FORMATION

Basic Renal Processes

- Glomerular filtration
- Tubular reabsorption
- Tubular secretion

Urine results from these three processes.



Excretion = Filtration – Reabsorption + Secretion

FUNCTIONING OF KIDNEY

- There are following three steps which are involved in functioning of kidneys.

i. Pressure filtration

ii. Selective re- absorption

iii. Tubular secretion

The main function of kidney is urine formation, which takes place in three steps

Formation of urine:

i. Pressure filtration:

The first step is pressure filtration. When blood enters the kidney via the renal artery. it goes to many arterioles, and then to the glomerulus. The pressure of blood is very high and so most of the water, salts, glucose and urea of blood is forced out of glomerular capillaries. This material passes into the Bowman's capsule and is now called glomerular filtrate.

ii. Selective re-absorption:

The second step is the selective re-absorption. In this step about 99% of the glomerular filtrate is reabsorbed into the blood capillaries surrounding renal tubule. It occurs through osmosis, diffusion and active transport. Some water and most of the glucose is reabsorbed from the proximal convoluted tubule Here salts are reabsorbed by active transport and then water follows by Osmosis. The descending limb of loop of Henle allows the reabsorption of water while the ascending limb of Loop of Henle allows the reabsorption of salts. The distal convoluted tubule again allows the reabsorption of water into the blood.

iii. Tubular secretion:

The third step is the tubular secretion. Different ions, creatinine, urea etc are secreted from blood into the filtrate in renal tubule. This is done to maintain blood at a normal pH (7.35 to 7.45)

Urine:

After the above-mentioned steps, the filtrate present in renal tubules is known as urine. It moves into collecting ducts and then into pelvis.

IMPORTANT

- All nephron originate in the cortex.
- Glomeruli of cortical nephron lie in the outer layer of cortex and glomeruli of Juxta medullary nephron lie in the inner layer of the cortex near the medulla
- The kidney cannot regenerate new nephrons.
- Aging causes a gradual decrease in nephron number.

Normal chemical composition of urine

Normal chemical composition of urine (Source: NASA Contractor Report)	
Water	95%
Urea	9.3 g/l
Chloride ions	1.87 g/l
Sodium ions	1.17 g/l
Potassium ions	0.750 g/l
Other ions and compounds	Variable amounts

Activity. 1.

- **Give short answers of the following.**

i. Define a nephron.
ii. Name the parts of a nephron.
iii. What is Loop of Henle?
iv. State the function of a collecting duct.
v. How many steps are there of urine formation?

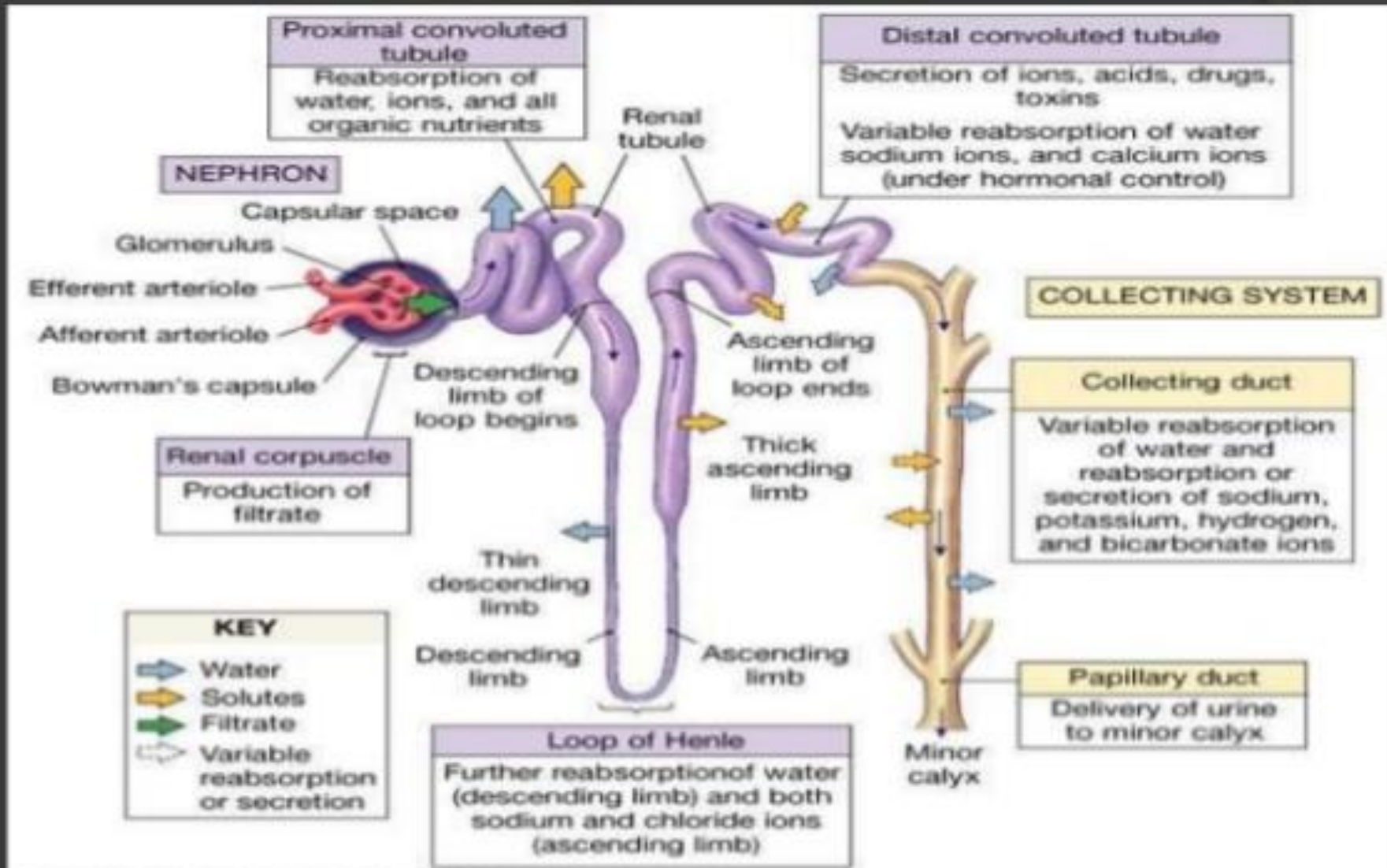
Activity. 2.

- **Fill in the blanks**.

i. There are more than----------million nephrons in each kidney.
ii. Each nephron consists of ----------main parts.
iii. Urine formation takes place in ----------steps.
iv. Different ions, urea etc. are secreted from---------into the filtrate in ----------.

CLOSURE

Nephron (Tubular component)



Home Work

- Draw the labeled diagram of a nephron and discuss the function of each part.

- Predict how the kidney helps to overcome the problem of dehydration.


THANK
You!


THE END