



**SNS COLLEGE OF ALLIED HEALTH SCIENCES**  
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**DEPARTMENT OF CARDIOPULMONARY PERFUSION CARE**  
**TECHNOLOGY**

**COURSE NAME: PATHOLOGY II**

**II YEAR**

**UNIT III : PATHOLOGY OF KIDNEY**  
**TOPIC 1 : KIDNEY FUNCTION TEST**



# Anatomy of Kidney



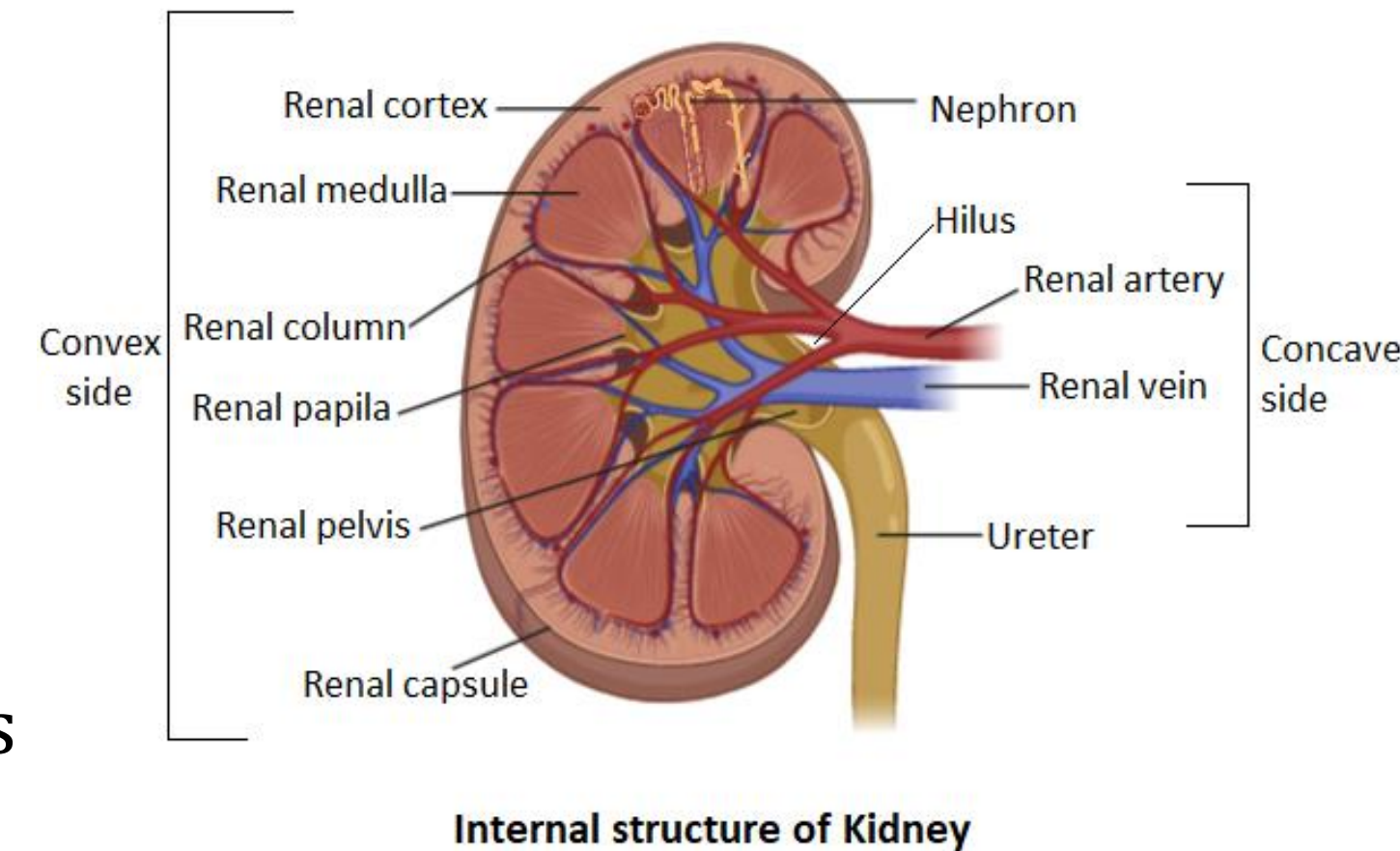
- The kidneys are *bean-shaped paired organs*
- Each weighing about 150 gm in the adult male and about 135 gm in the adult female.
- *Hilum* – where artery, vein, lymphatics and ureter are located

## Three main structure of kidneys

*renal cortex* - outer rim of kidney, contains nephron (glomeruli and tubules)

*renal medulla* - (inner region) 8-18 cone-shaped renal pyramids – for passage of urine

*renal pelvis* - funnel-shaped collection area of the urine

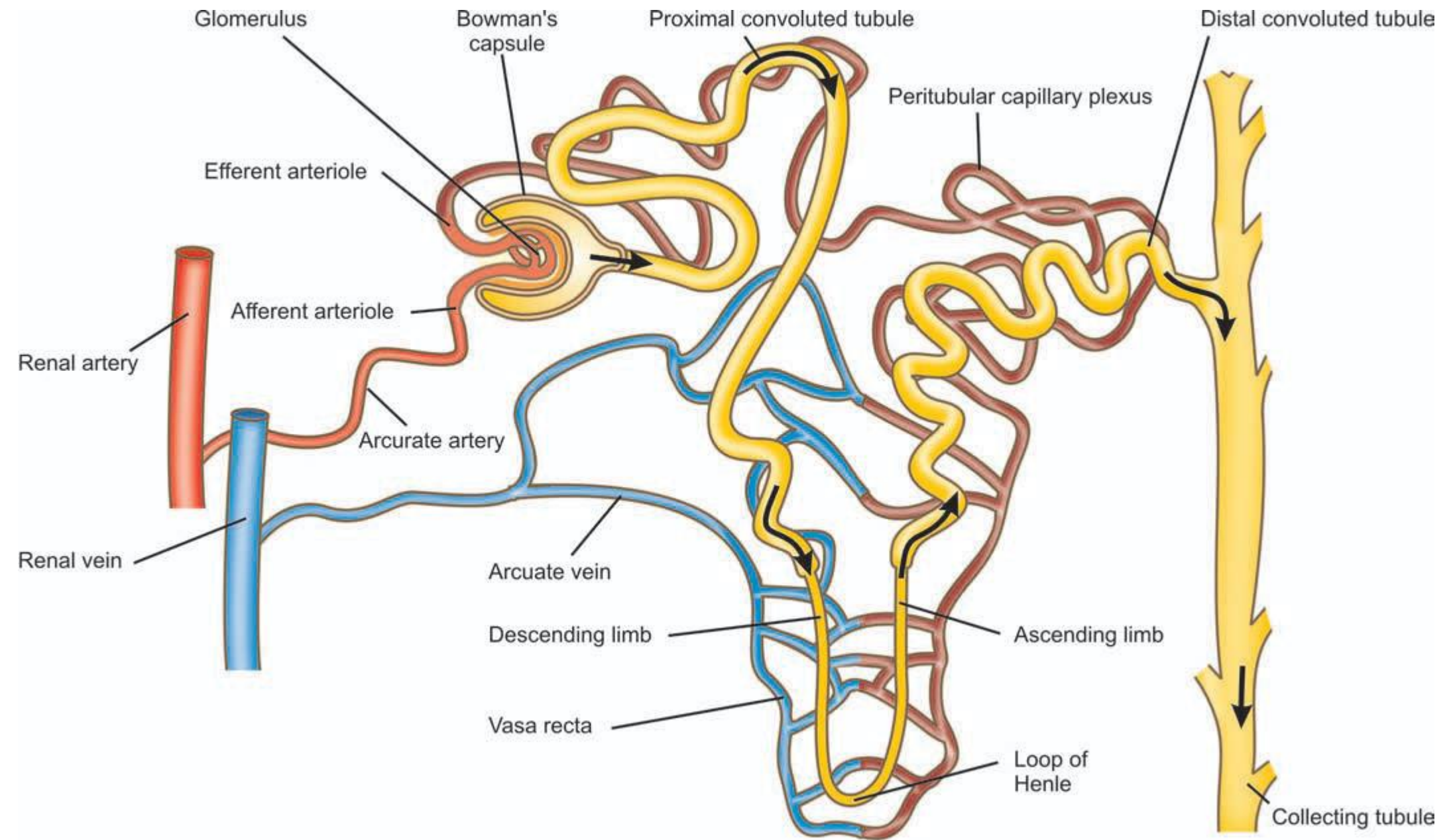


# Histology of Kidney

- The functional unit of kidney is called as *nephron*
- There are *one million microstructures* present in each kidney

## Parts of Nephron

- Glomerular capsule (glomerulus and Bowman's capsule)
- The proximal convoluted tubule (PCT)
- The loop of Henle
- The distal convoluted tubule (DCT)
- The collecting ducts.

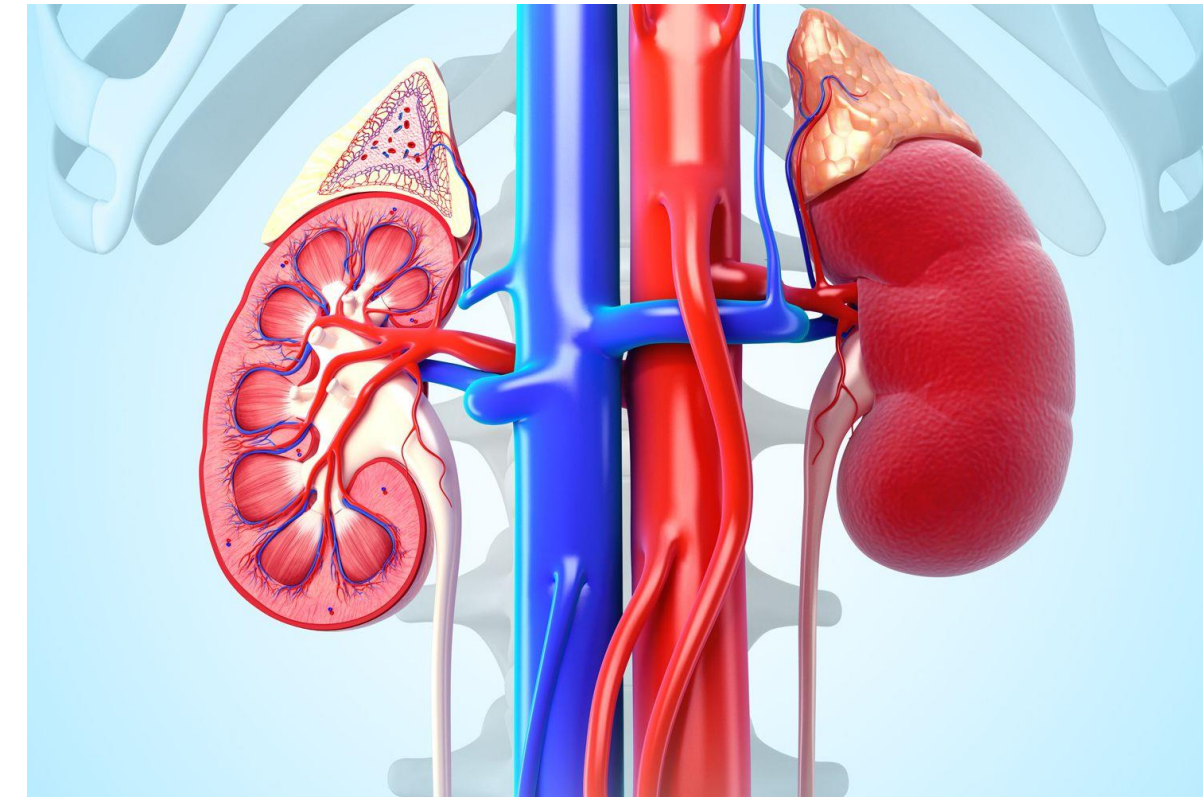




# Physiology of Kidney



- *Excretion of waste* products resulting from protein metabolism.
- Regulation of *acid-base balance* by excretion of H<sup>+</sup> ions (acidification) and bicarbonate ions.
- *Regulation of salt-water* balance by hormones secreted both intra- and extra-renal
- *Formation of renin and erythropoietin* and thereby playing a role in the regulation of blood pressure and erythropoiesis





# Renal Function Test

## Urine analysis

- Physical examination
- Chemical constituents
- Bacteriologic examination
- Microscopy

## Concentration and dilution tests

- Concentration test (fluid deprivation test)
- Dilution test (excess fluid intake test)

## Blood chemistry

- Urea
- Blood urea nitrogen (BUN)
- Creatinine
- $\beta$ 2-microglobulin

## Renal clearance tests

- Inulin or mannitol clearance test
- Creatinine clearance
- Urea clearance



# Urine Analysis



## *Physical Examination*

- Normally urine is clear, pale or straw-coloured due to pigment urochrome
- 700-2500 ml (average 1200 ml) of urine is passed in 24 hours

## *Chemical tests*

- detect the presence of protein, glucose, red cells and haemoglobin to assess the permeability of glomerular membrane
- *Bacteriologic examination* - midstream specimen of urine.

## *Urine microscopy*

- red cells, pus cells, epithelial cells, crystals and urinary casts





# Concentration and dilution tests



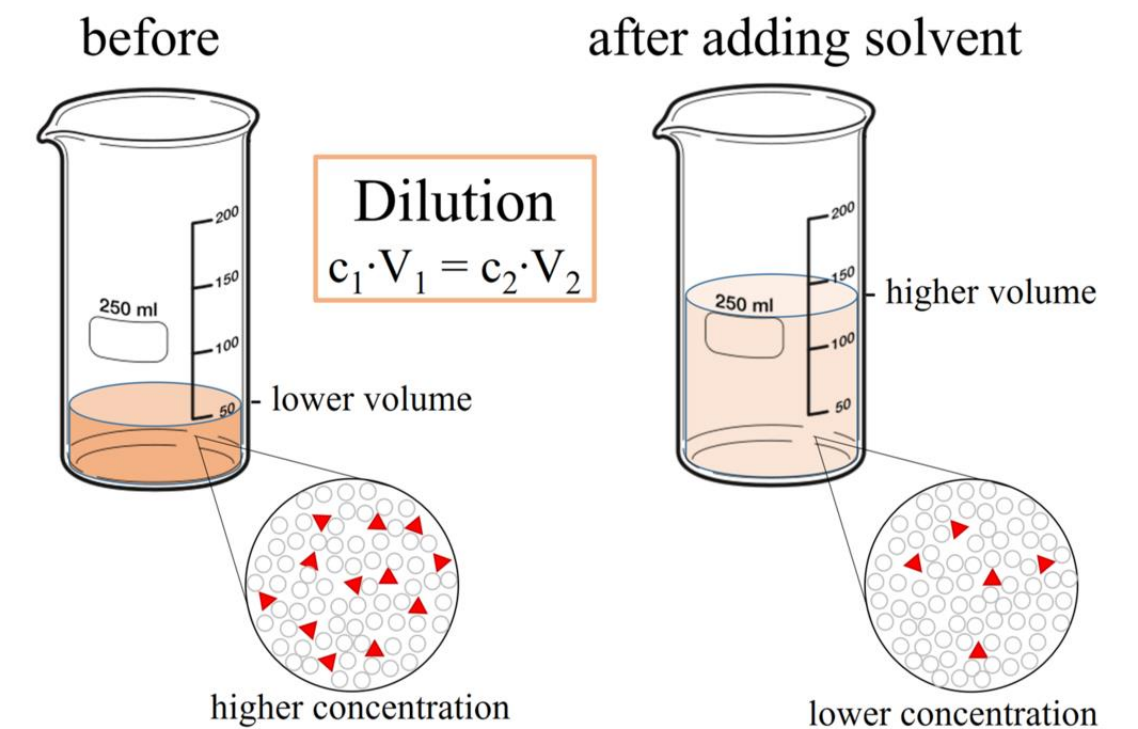
- It is to evaluate *functional capacity of the renal tubules.*

## concentration test

- an artificial fluid deprivation is induced in the patient for more than 20 hours
- water is selectively reabsorbed in this patient
- high solute concentration is present

## dilution test

- excess of fluid is given to the patient.
- renal compensation should result in excretion of urine with high water content and lower solute concentration





# Blood chemistry



- Impairment of renal function results in elevation of end-products of protein metabolism.

The End products are,

- *Urea* (normal range 20-40 mg/dl),
  - *Blood Urea nitrogen* (BUN) (normal range 10-20 mg/dl) and
  - *Creatinine* (normal range 0.6-1.2 mg/dl). An increase of these
- 
- End-products in the blood is called *azotaemia*.
- 
- High levels of  *$\beta$ 2-microglobulin* in the serum as well as urine, a low molecular weight protein filtered excessively in the urine due to glomerular disease







# Renal clearance tests



- A clearance test is employed to *assess the rate of glomerular filtration and the renal blood flow.*
- The glomerular filtration rate normal - **120 ml/minute** in an average adult

$$C = \frac{uV}{P}$$

- $C$  is the clearance of the substance in ml/ minute;
- $U$  is the concentration of the substance in the urine;
- $V$  is the volume of urine passed per minute; and
- $P$  is the concentration of the substance in the plasma.





# Renal clearance tests

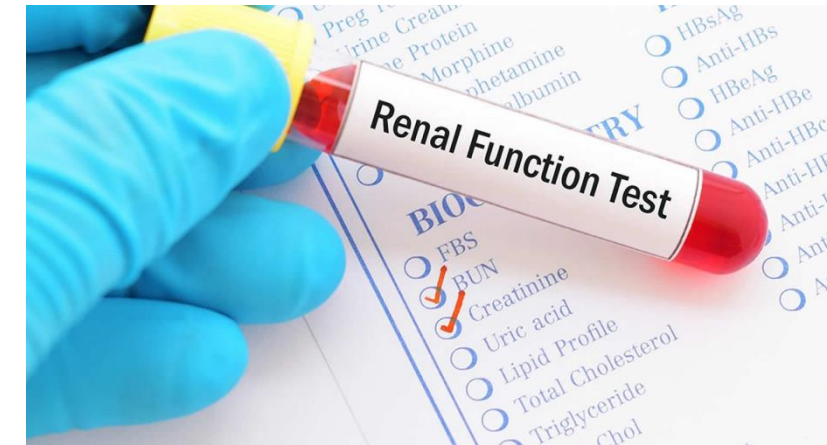


## Inulin or mannitol clearance tests

- An intravenous infusion of the substance inulin or mannitol is given to patient
- Maintain constant plasma concentration and Urine sample collected
- Inulin is filtered from the glomerulus and is excreted unchanged in the urine.

## Creatinine clearance test

- Creatinine released into plasma by muscle metabolism
- The clearance of creatinine is determined by collecting urine over 24-hour period and a blood sample is withdrawn during the day.



## Urea clearance test

- Urea test is affected by a number of factors (e.g. dietary protein, fluid intake, infection, trauma, surgery, and corticosteroids)



THANK YOU



### References:

- Text book of Pathology Harsh Mohan
- Textbook of Pathology for Allied Health Sciences, Ramadas Nayak