UNIT-III

✱ Respiratory System:-

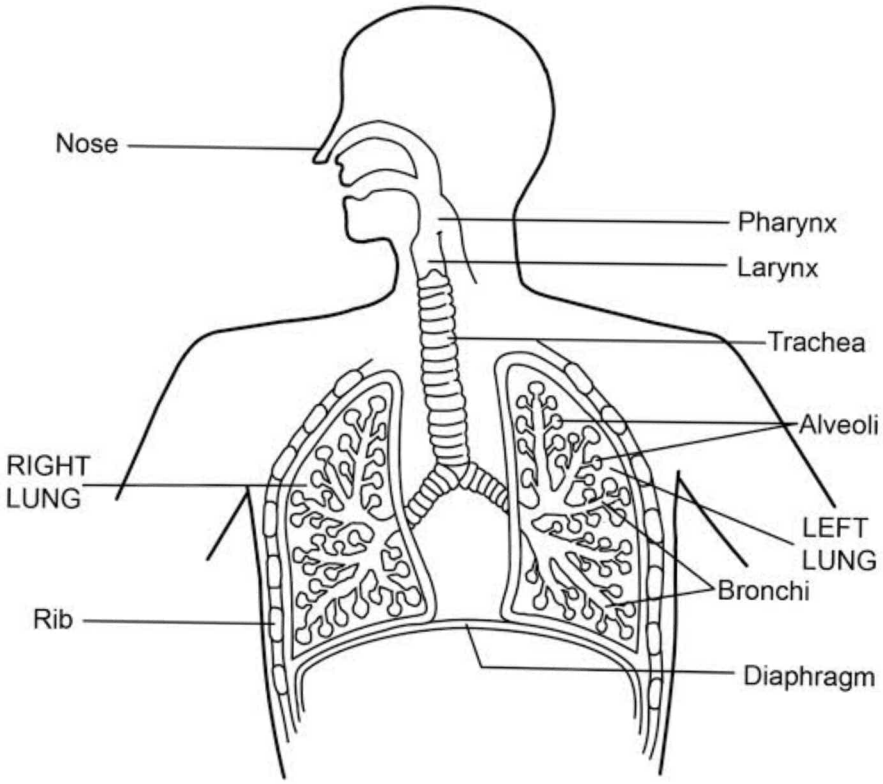
→ Respiration is defined as the "Exchange of gases between body tissue and the external environment".

→ Supply of oxygen to the tissue and excretion of Carbondioxide occur only through respiration.

✱ Anatomy of Respiratory System :-

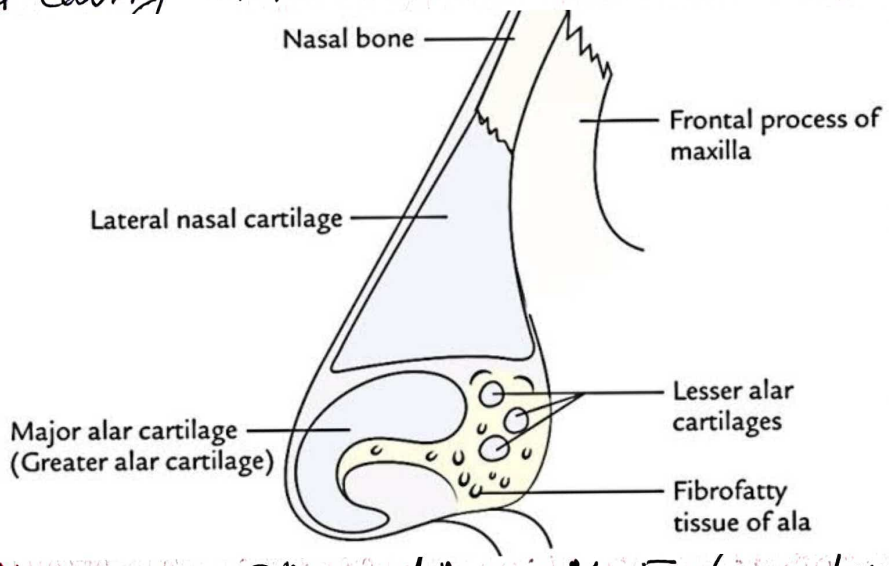
The human respiratory system consist of the following organs.

1. Nose
2. Pharynx (throat)
3. Larynx (Voice box)
4. Trachea (wind pipe)
5. Bronchi and bronchioles
6. Lungs
7. Alveoli.



① Nose :-

→ Nose found positioned blw the forehead and the upper lip.
→ It is the first organ of the respiratory tract which receives the inhealed air and forms a passage for the air in to reach the Nasal Cavity or Nasal Chamber.



② Phyarynx :- Note - Discussed in Unit-II (Anatomy of digestive syst)

③ Larynx :-

It lies blw Phyrynx and trachea. It is formed by the following Cartilages.
(i) Thyroid Cartilage, which is the Largest
(ii) Cricoid Cartilage
(iii) Two artenoid Cartilages
(iv) Epiglottis, attached to the top of thyroid Cartilage.

Functions of Larynx :-

→ Larynx produces Sound. It facilitates respiration.
→ Epiglottis prevent food from entering the ~~Layr~~ Larynx and trachea.
→ Act as a passageway of air.
→ Warming and humidifying the air, filtration.

④ TRACHEA (wind pipe) :-

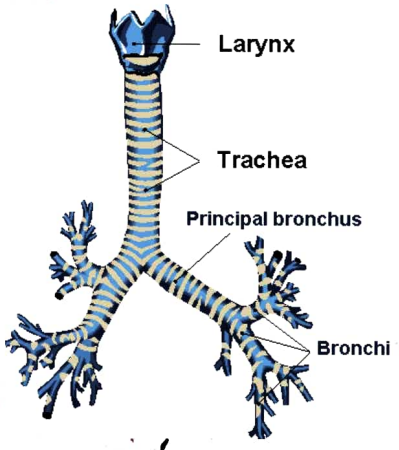
- It is a cylindrical tube which is 12 cm in length and 2.5 cm in diameter.
- It is begins at the lower end of pharynx.
- At the level of 5th thoracic vertebra it divides into two bronchi.
- It is made of Sixteen to twenty C-shaped incomplete cartilages.
- These cartilages are connected by fibrous tissue at the back.

Functions of TRACHEA :-

1. It provides clear and unhindered way for air to enter and exit the Lungs.
2. Small hairs present in the inner walls of trachea. Catches dust and other contaminats from inhaled air, which are later expelled via coughing.
3. Cough relax, warming and humidifying.

⑤ BRONCHI :-

- The trachea ends by dividing into two bronchi namely the right and left bronchi
- They pass into the corresponding Lungs.
- The right bronchus is shorter and wider than the left.
- They are made up of Complete ring of cartilage.



Note :- Bronchioles :-

Bronchi divide into Smaller branches known as bronchioles.

Functions of Bronchi :-

- It Connects the wind pipe to the Lungs.
- It allows air from external respiratory openings to pass efficiently into the Lungs.
- The bronchi is to carry air blw the trachea and lungs.

⑥ ALVEOLI (Air Sacs) :-

- Alveoli are Called functional units of the lungs and Consists of small hollow area of gas exchange.
- They are lined with simple squamous epithelium.

Functions of ALVEOLI :-

- The alveoli are where the lungs and the blood exchange oxygen and Carbon dioxide during the process of breathing in and breathing out.

- Oxygen breathed in from the air passes through the alveoli and into the blood and travels to the tissues throughout the body.

⑦ ANATOMY OF LUNGS :-

→ Lungs are the principle organ of respiration.
→ The lungs are a pair of spongy, air-filled cone Shaped organs located on either of the Chest (thorax).

- The Left lungs is slightly Smaller than the right lungs.
- The right lungs is thicker and broader than Left lungs.
- The lungs is Surrounded by two Layer of delicate Serous membrane Called as pleural Membrane.
- The inner membrane Called which Covers the Lungs is Called as visceral pleura.

→ The outer layer which is attached to the wall of thoracic cavity is called as parietal pleura.

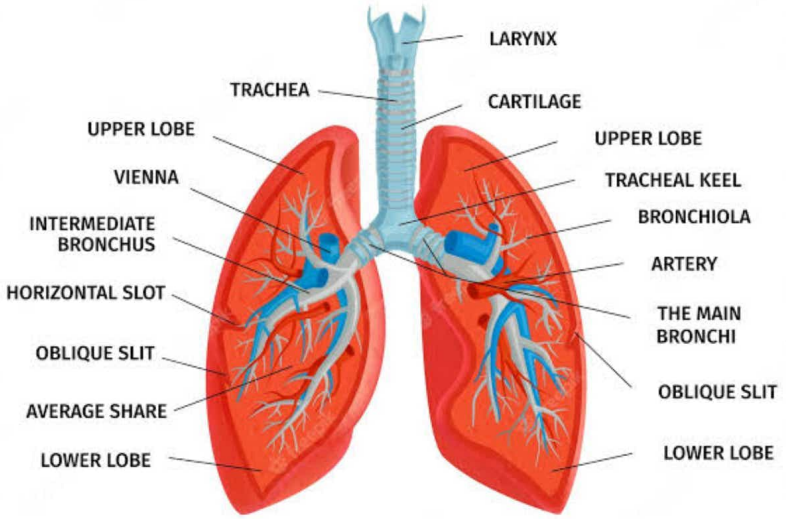
Lobes of Lungs :-

The right lung is subdivided into 3 lobes :

- Superior Lobe
- Middle lobe
- Inferior Lobe

The Left lung is subdivided

- Superior lobe
- Inferior lobe



Mechnism of Respiration :-

1. Breathing (pulmonary ventilation)
2. External Respiration.
3. Internal Respiration
4. Transport of oxygen and Carbon Dioxide

① Breathing :-

It has two phases - Inspiration and expiration.
It is a mechnical process that depends on volume change in the chest cavity. Rate of Respiration 16 to 18 per min in adult.

② External Respiration :-

- Exchange Gases (CO_2 and O_2) between the air spaces Lungs and the Blood stream in pulmonary Capillaries.

③ Internal respiration :-

- It is the exchange of gases between the blood in Systemic capillary and Systemic.
- Systemic Capillary gains Co_2 and loses O_2.
- Internal respiration Conversion of oxygenated blood to deoxygenated blood.

④ Transport of oxygen and Carbon dioxide :-

- When O_2 and Co_2 enter the blood, certain Chemical reaction occur that transport and gas exchange.
- Transport of gases between the Lungs and body tissue is a function of blood.

Lung Volumes & Capacities :-

Lung Volumes :-

- Lung volume are also known as Respiratory Volumes.
- It refers to the volume of gas in the Lungs at a given time during the respiratory cycle.
- Lungs Capacities are derived from a Summation of different lung volumes.
- The average total Lung Capacity of an adult human male is about 6 liters of air.

Types of Lungs Volume :-

1. Tidal Volume (Tv) :-
   The amount of gas inspired or expired with each normal breath. About 500ml.
2. Expiratory Reserve volume (ERV)
   The Maximum volume of additional air that can be expired from the end of a normal expiration. ERV ~ 12,00 ml.
3. Inspiratory Reserve Volume (IRV)
   Maximum amount of additional air that can be inspired from the end of a normal inspiration. IRV ~ 3,000 mL.

4. Residual Volume (RV) :-

- The volume of air remaining in the Lung after a maximal expiration. This is the only Lung volume which Cannot be Measured with a Spirometer.

5. Closing Volume :-

The Volume towards end of a forced expiration.

✱ Lung Capacities :-

1. Total Lung Capacity :-

- It represent the total volume of air that a person Can hold in its Lungs after a forced inhalation.
- It is the Sum of all volumes
- It is about 6000 ml in males and 4500 ml in females.

2. Vital Capacity :-

- It is the amount of air that a person Can move in or and out of the Lungs.
- It is the Sum of tidal Volume, inspiratory reserve Volume and expiratory reserve Volume.
- It is 4800 ml in males and 3400 ml in females.

③ Inspiratory Capacity :-

- It is the amount of air that Can be inhaled after a tidal expiration.
- It is a Sum of tidal Volume and inspiratory reserve Volume.

④ **Expiratory Capacity :-**

- Normal inspiration the amount of air is exhaled by a person is called expiration capacity (EC).

⑤ **Functional Residual Capacity :-**

- It is the amount of air that remaining in Lungs after normal tidal expiration.
- It is the Sum of expiratory reserve volume and residual volume.

✱ ARTIFICIAL RESPIRATION :-

- Artificial respiration, breathing induced by some Manipulation technique when natural respiration has decreased or is faltering.
- Artificial repiration must be given immediately when respiration fails.
- Most methods employed are designed to increase and decrease the Capacity of thorax.
- It Can prevent Some deaths from drowing, choking, Strangulation, Seffocation, Carbon monoxide poisoning and electric Shock.
- Two main methods of artificial respiration.

① Manual Method
② Instrumental method.

① Manual Methods :-
- Schafer's Method
- Sylvester's Method
- Holger-Nielson Method
- Mouth to mouth Method
- EVE's Rocking method

② Instrumental Method :-
- Drinking Method
- Tracheal intubation
- Cricothyrotomy
- Tracheotomy

☆ Artificial Resuscitation Method :-
- Resuscitation by including artificial respiration Consists chiefly of two actions.

(1) Establishing and Maintaining an open air passage from the Upper respiratory tract (mouth, throat, and pharynx) to the Lungs

(2) Exchanging air and Carbon dioxide in the terminal air Sacs of the Lungs while the heart.

CPR Techniques :-
- High-frequency Chest Compressions.
- High-frequency chest Compression (typically at a frequency >120 per minute) has been studied as a technique for improving resuscitation from Cardiac arrest.

Step in Resuscitation:-

(a) (Airway) - Ensure open airway by prevention the falling back of tongue, tracheal intubation if possible

(b) (Breathing) - Start artificial ventilation of lung.

(c) Circulation :- Restore the Circulation by external Cardiac Massage.

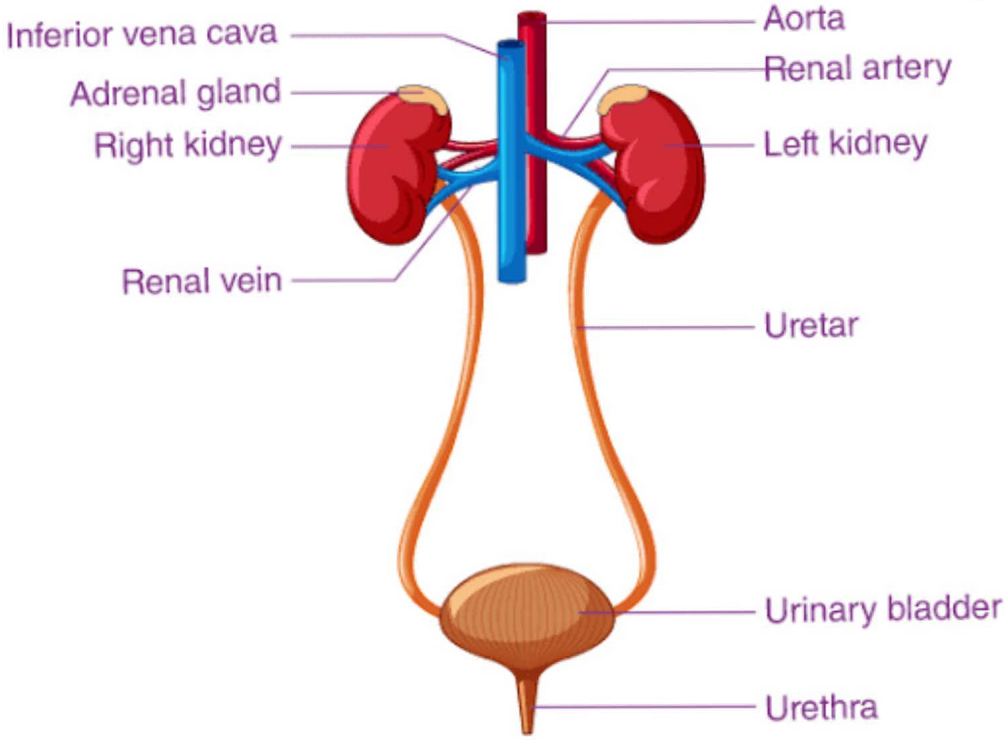
(d) Differentiation, drug, defibrillation) - quickly perform differential diagnosis of Cardiac arrest.

✱ Urinary System:-

- Excreation is the process by which the Unwanted Substance and Metabolic wastes are eleiminated from the body.
- Various organs are involved in removal of wastes from the body, their excretory capacity is limited.
- But Urinary System has maximum excreatory capacity and so it plays a major role in homeostasis.

Parts of Urinary System:-

(1) A pair of kidneys
(2) Ureters
(3) Urinary bladder
(4) Urethra



① Kidney :-

→ They are the Two bean Shaped organ lying on the Posterior abdominal wall, on each side of the Vertebral Column.

- kidney is a Compound tubular gland Covered by a Connective tissue Capsule.

- There is a depression on the Medial border of kidney Called hilum. through which renal artery, renal veins,

Different Layer of kidney :-

- Outer Cortex (which is reddish-brown in Colour)
- Inner Medulla (which Contains pyramids of the kidney)
- Renal pelvis (An upper expanded part of ureter).

→ kidney is made up of closely arranged tubular structures Called Urinijerous tubules.

→ It includes

① Nephrons (Formation of urine)
② Collecting ducts (transporter of urine from nephrons to pelvis of ureter.

Note :- Nephron is defined as the structural and functional unit of kidney.

Functions of kidney :-

1. Role in homeostasis →
   - → Excreation of waste product
   - → Maintenance of water-electrolyte balance
   - → maintenance acid-base balance

(2) Hemopoietic functions :-
→ Erythrocytes by secreting erythropoietin that stimulate erythropoiesis.

(3) Endocrine function :- It Secrets :-
- Renin
- 1,25-dihydroxycholecalciferol (Calcitriol)
- prostaglandin.

(4) Regulation of blood pressure
(5) Regulation of blood Calcium Level.

(2) URETERS :-

- The ureters are narrow tubes that carry Urine from the kidney to the bladder.
- There are Two ureters one for each kidney.
- The ureter wall has Three Layers
  - Inner Mucous Layer
  - Outer fibrous Layer
  - Middle Muscular layer

③ URINARY BLADDER :-

- It is a pear shaped muscular Sac which acts as a reservoir for urine.
- It Lies the pelvic Cavity behind Symphysis pubis.
- The Lowest Part of bladder is called as base and upper part is called Fundus.
- It has three openings two for Ureter and one for Urethra and the triangular area blw these three opening is the Trigone of the bladder.

④ Urethra :-

- It is a Canal through which urin passes from the bladder to outside.
- It differs in male and female.
- A Sphincter is present in both.

☆ Physiology of urine formation :-

- Urin formation is a Blood Cleansing function.
- Normally, about 1,300 ml of blood (26% of Cardiac output) enters the kidneys.
- kidneys excrete the unwanted Substances along with water from the blood as urin.
- Normal urinary output is 1L/day to 1.5 L/day.

Formation of urine :-

It involves three steps/processes

① Glomerular filtration :-

- It is the process by which the blood is filtered while passing through the glomerular capillaries by filtration membrane.

#. process of glomerular filtration :-

- When blood passes through glomerular Capillaries the plasma is filtered into the Bowman Capsule.
- All the Substance of plasma are filtered except the plasma proteins. The filtered fluid is Called glomerular filtrate.

Note:- Glomerular filtration rate:-

It is defined as the total quantity of filtrate formed in all the nephrons of both the kidneys in the given unit time, Normal GFR is 125 ml/minute or about 180L/day.

Factors affecting GFR:-

- Renal blood flow
- Tubuloglomerular feedback
- Glomerular Capillary pressure
- Colloidal osmotic pressure
- Hydrostatic Pressure in bowman Capsule.

② Tubular reabsorption:-

→ It is the process by which water and other substance are transported from renal tubules back to the blood.

→ When the glomerular filtrate flows through the tubular portion of nephron, Large quantity of water (More than 99%) electrolyte and other substance are reabsorbed by the tubular epithelial cells.

— Tubular reabsorption is known as selective reabsorption because the tubular cells reabsorb only the substance necessary for the body.

③ Tubular Secretion :-

- It is the process by which the substances are transported from blood into renal tubules.

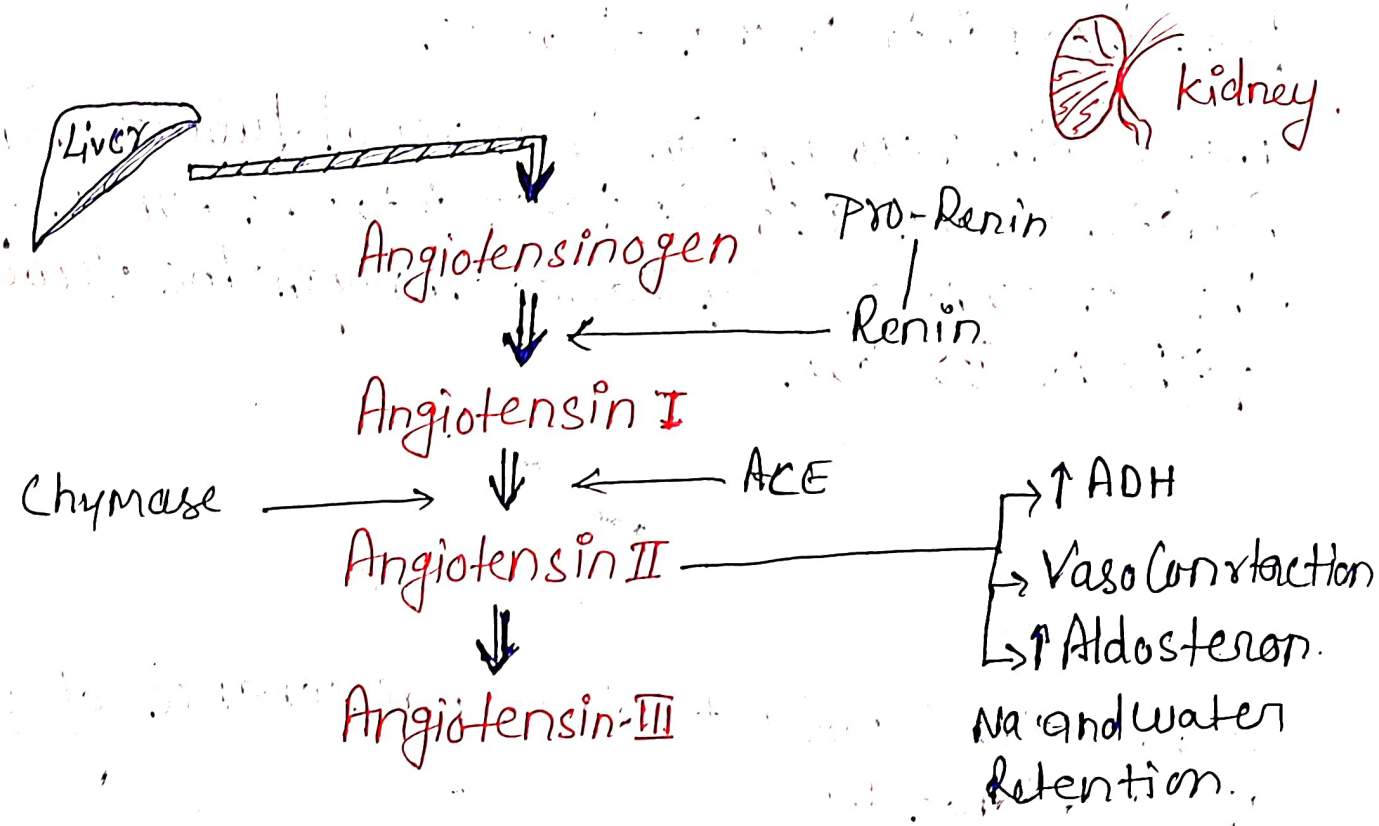
→ Along with reabsorption from renal tubules, some substance are also secreted into the lumen from the peritubular capillaries through the tubular epithelial cells.

★ Role of kidney in acid base balance :-

- kidney play important role in maintenance of acid base balance by -
  - excreting hydrogen ion
  - Retaining bicarbonate ions.
  - Normally urine is acidic in nature with pH of 4.5 to 6.
  - The metabolic activites in the body produce lot of acids (with hydrogen ions) which threaten to push the body towards acidosis.
  - kidney prevent this by excreting hydrogen ions and conserving bicarbonate ions.

✱ Role of Renin-Angiotensin System :- in kidney

- When renin is released into the blood, it acts on a Specific Plasma protein Called Angiotensinogen or renin Substrate.



→ Renin and angiotensinogen is Converted into a angiotensin I.

→ Angiotensin I is Converted into angiotensin-II, by the activity of angiotensin-Converting enzyme (ACE) Secreted from Lungs.

- Angiotensin II (short half life) and rapidly degrades into angiotensin III by angiotensinase, which are present in RBCs and vascular beds in Many tissues.

- Angiotensin III is Converted into angiotensin IV

*Disorder of kidney :-

① Urinary tract infections :-

- UTIs are Caused by Pathogenic Microorganism in the Urinary tract (the normal urinary tract is Sterile above the urethra).
- Urinary tract Infection are more Common in Women.
- They are usually occur in the bladder or urethra, but more Serious infections involve the kidney.

② Nephrotic Syndrome :-

- Type of renal failure with Increase glomerular Permeability and Massive proteinuria
- Nephrotic Syndrom is a kidney disorder that Causes your body to pass to much protein in your urine.

③ Kidney Stone :-

- kidney Stones (also Called renal Calculi, Urolithiasis) are hard deposits made of minerals and Salts that from inside your kidney.
- Diet, excess body weight, Some medical Conditions, and Certain Suppliments and medication are among they many Causes of kidney Stones.

④ Urinary Incontinence :-

- The loss of bladder control - is a common and often embarrassing problem.

→ The severity ranges from occasionally leaking urine when you cough or sneeze to having an urge to urinate that's so sudden and strong you don't get to a toilet in time.

⑤ polycystic kidney disease :-

- Enlargement of kidney because of the presence of many cysts with in them, slow, progressive disease.

Thanks