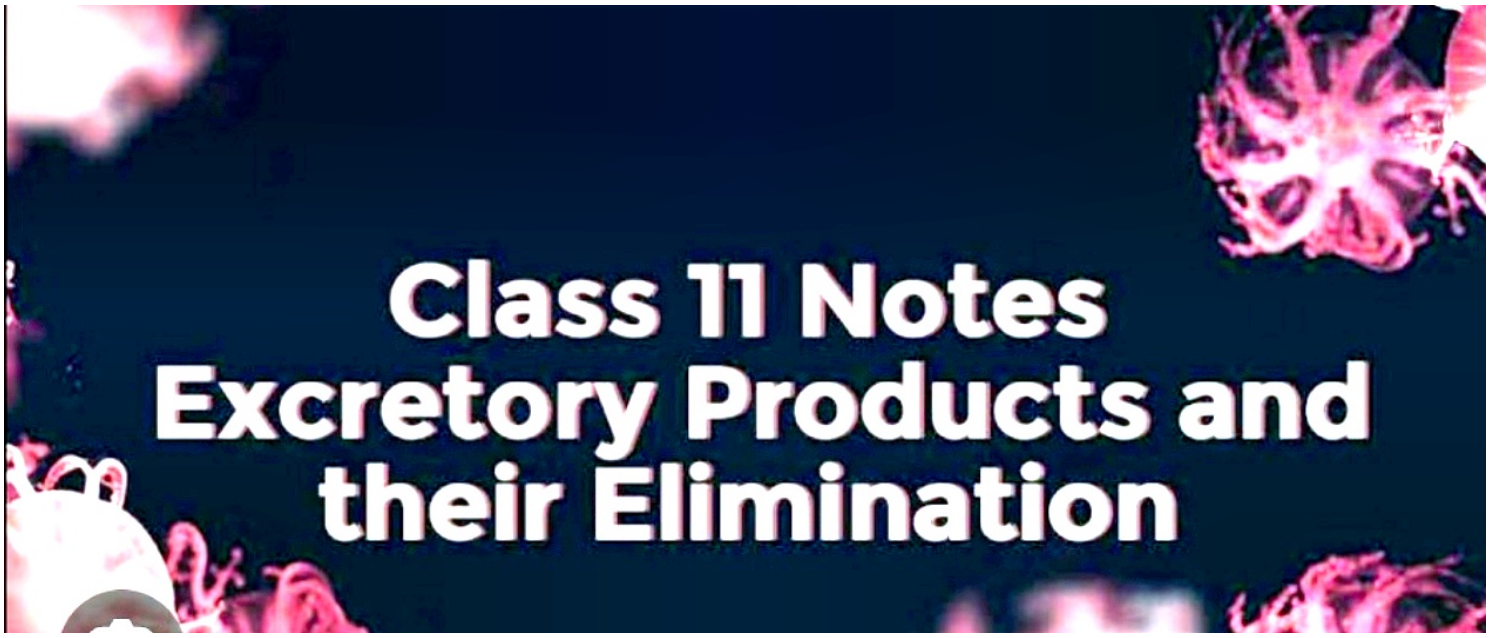

Class 11 Notes
Excretory Products and
their Elimination

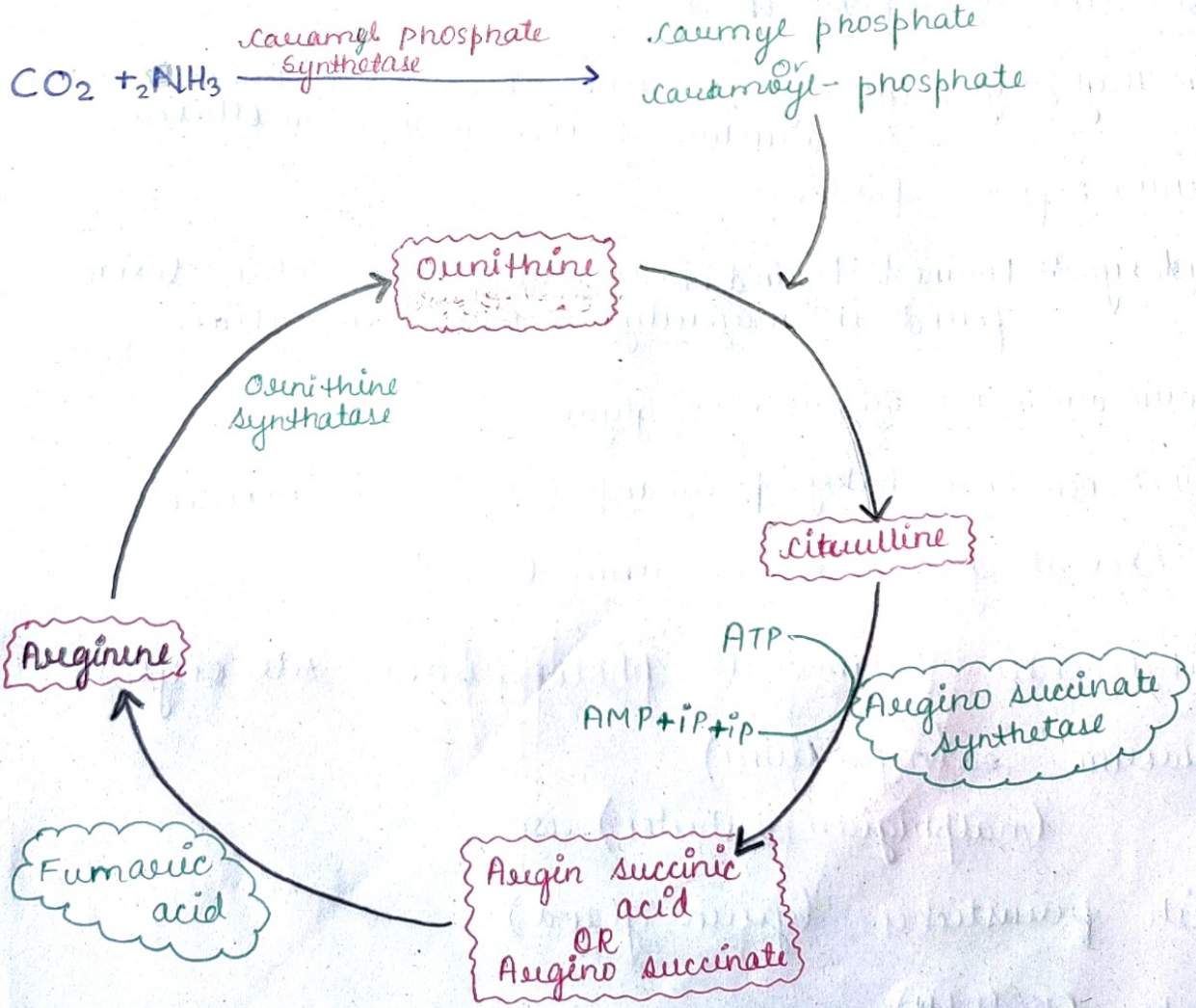
Excretory Products & Their Elimination

The process of removal of harmful product from body specially nitrogenous waste through excretory organ called excretion.

3 common mode of excretion :-

1. Urea — Ureotelic (Ureotelism)
2. Ammonia — Ammiotelic (ammoniotelism)
3. Uric acid — Urecotelic (Urecotilism)

- **Ureotelism:-**
  if urea is nitrogenous wastages then it is considered as ureotelism
  → It is moderately toxic.
  → approx 50 ml H_2O required to remove 1g of urea.
  → It is secreated by mammalians many terrestrial amphibians, marine fishes & aquatic reptiles.
  → In mammalians urea is eliminated by liver through Ornithin cycle or Urea cycle or Krab meinled cycle.



Ammonotelic :- If ammonia has nitrogenous wastage comes out then it is consider as ammonotelic
→ highly toxic Nitrogenous waste
→ secreted by aquatic animal like: • aquatic insect
• freshwater bony fish (teleost)
• larva of aquatic amphibians & crocodiles.

→ 50 hundred ml H_2O required to remove 1g of ammonia

Uricotelic :- If uric acid as Nitrogenous waste then it is called Uricotelic Organism & process is called Uricotelism
→ least toxic among all three.
→ It require 10 ml of water to remove 1g of uric acid.
→ secreted by tresstial insect land snails by mostly reptiles & Birds.

Some other nitrogenous waste

trimethyl anyl oxide :- it is found in some fishes, marine crustius & some marine molluca

guanine :- found spider.

allantoxyn :- Purine & Pyrimdine converted into allen toxin found in majority of ~~matt~~ mammalian.

Hipporic acid :- Benxoic acid + ~~by~~ Glycine

Creatine :- new born baby, pregnant & lactating women

Excreating Organ in animals

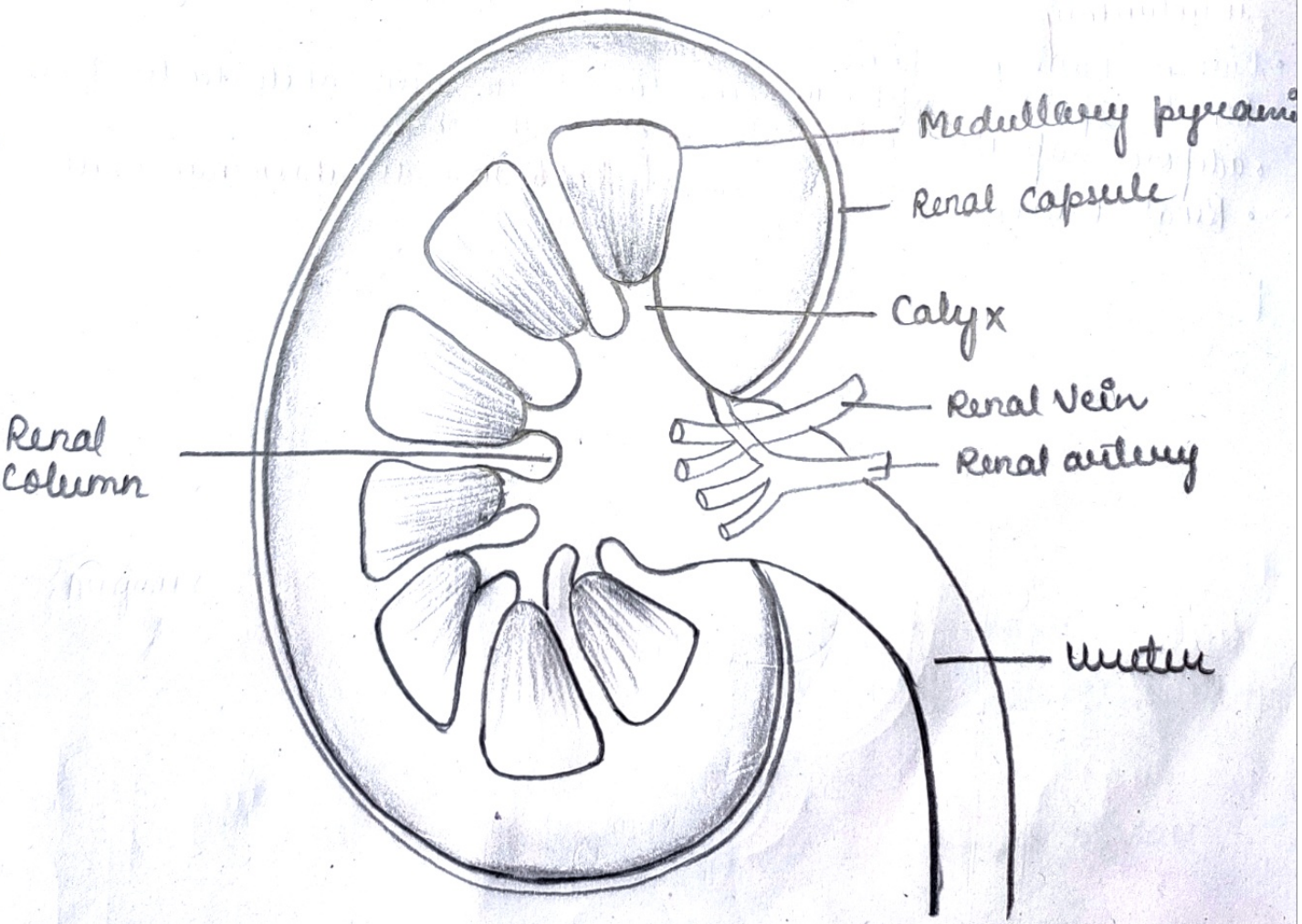
- Platihelmentis (flame cell photonefridia solenocyte)
- Earthworm ~~co~~ (nefridium)
- insect (malphigian tubules) ~~co~~
- Crustaceans (green gland)
- Bony fish
- Chordata (kidney).

Human Excretory System

KIDNEY :-

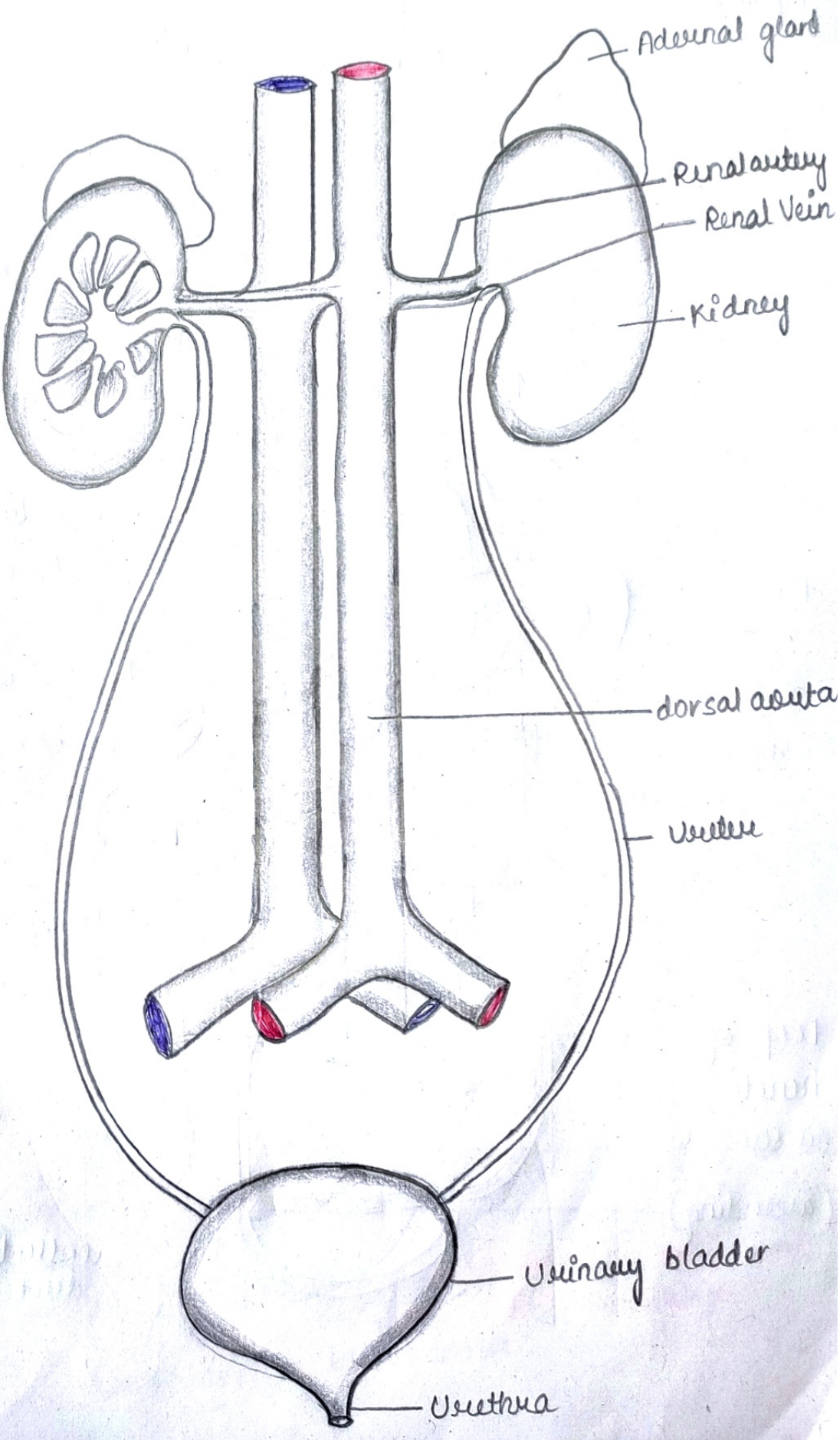
* excretory organ in human
* consist of 1 pair
* 1 pair of ureter
* 1 urinary bladder
* 1 urethra
* Mesodermal origin
* 10-12 cm.
* Width 5 to 7 cm.
* Thickness 2 to 3
* Weight 120 to 170.
* Reddish Brown
* Bean shape

Structure of Kidney



- Kidney situated b/w thoracic & lumbar, 3rd lumbar vertebral dorsal inner wall. near abdominal cavity.
- Right kidney is slightly lower compare to left kidney.
- lateral surface of kidney is convex while medial surface is concave
- Opening of concave surface of kidney is Notch Hilum
- Through hilum ureter blood capillary & Nerves enter.
- Hilum further transform into funnle shape structure called renal pelvis & projection is called calyx.
- Tissue of kidney divided into two
  (i) outer — Renal cotex
  (ii) inner — Medulla.
- cotex is standed b/w medullary pyramid as renal colum or column of Bertini
- Structual & functional of kidney nephron.
- Urine passes through ureter & store in urinary bladder.
- Urinary bladder opening by Urethra.
- Urethra gaurded by two spincter outer voluntary inner involuntary
- Kidney having 3 layer.
- Renal capsule — fibrous connective tissue with white elastic fiber
- adipose capsule — ddipose tissue, shock absorber.
- Renal Fasica — fibrous cover & link kidney with abdominal wall.

URINARY SYSTEM

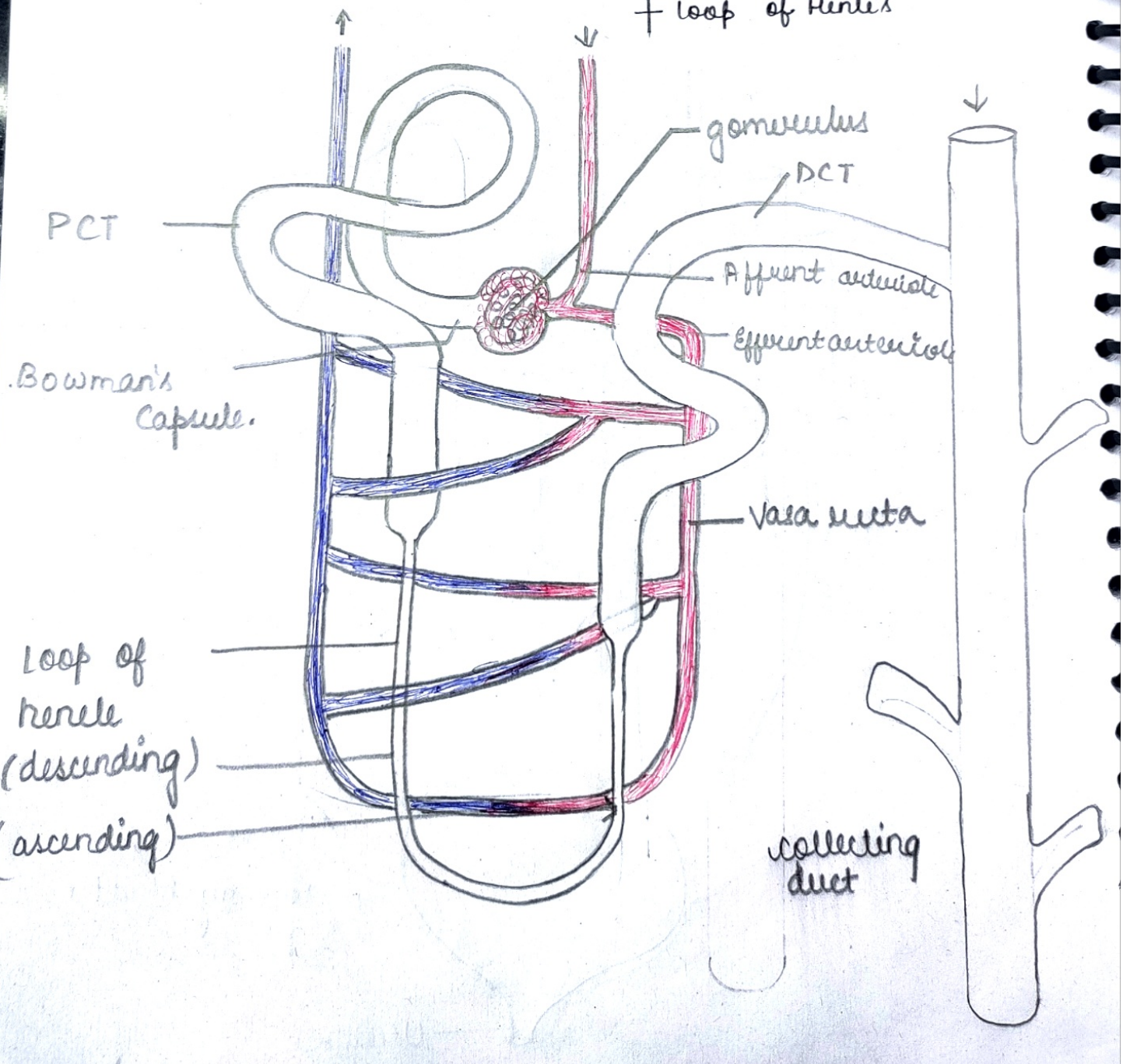


NEPHRON

- Str. functional unit of Kidney.
- each Kidney having 1M nephron.
- nephron is divided into 2 parts.

Nephron

- Glomerulus
- Renal tubules
  - Bowman's capsule
  - PCT
  - DCT
  - loop of Henle's



• glomerulus :-
Bunch of network of blood capillaries formed by afferent artioles.

• Renal tubules (tuft) :-
Renal tubules having four tubules like proximal convulate tubules distal convulated tubules & loops of henles.

• ~~Renal~~ Bowmen capsule :-
double wall structure inclose the glomerus.
→ glomerulus along bowmen capsule called malphigian body or renal corpscels.
→ outer wall of bowmen capsule is squamous epithelium & inner wall special type of cell called podocytes.

• PCT :- lined by cuboidal epithelium, specialized transportation sugar, Na, Cl^-, for the glomerular filtrate.
→ It lies b/w bowens capsule & loop of henle.

• loop of henle :-
hair pin like str made up of 2 parts.
1. DLH (desending limb of loop of henle)
2. ALH (ascending " " " ")
→ the fluid contain by ALH Nacl, othersalt, urea & other chemical that have bun filtre out from blood.

DCT :-
also lined by cuboidal Epi. and having microvilli, it open into collecting duct.
→ glomerulus PCT, DCT & bowen capsules are located toward cortex while loop of henle & collecting duct is situated in medulla.
→ It required for reabsorbtion of calcium, sodium chloride, regulate the PH of urine by secreting H^+ ions & absorbing bicarbonates.

TYPES OF NEPHRON

1. Superficial cortical nephron or cortical nephron
2. Juxta medulary nephrons

1. Cortical nephron:-

their maximum ~~&~~ portions are situated in cortex region & their loop of henle & their are accumulated ~~collecting duct~~ in smaller amount & both are slightly depicted in medulla.

→ 2/3 part in cortex & 1/3 part in medulla
→ 70 to 85% of total nephron is cortical nephron.
→ peritubular capillaries network are present but Vasa recta is absent.
→ peritubular vessels are blood vessle & it supplied by the effirent arterioles.
→ that moves along with moves along with nephrons & allowing reabsorption & secretion b/w the blood & the inner lumen of nephrons.

Vasa recta:- straight artery that coming from arcades in the miscentary (inner side intestine) of the jejunum & ilium)

→ Rate of filteration ↓ low
→ excreation of waste product in urine.

2. Juxta nephrons:-

→ it found 15% to 20% nephron.
→ loop of henle longer.
→ present in inner glomerulus cortex.
→ peritubular capillaries network is not very well develop but Vasa recta is U shape.
→ Vasa recta runs likely to loop of henle.
→ rate of filteration ↑
→ conc of urine flow by counter mechanism

URINE FORMATION

* it is complete in 3 steps:-

1. Ultra filtration or GFR.
2. Reabsorbtion or selective tubular reabsorption.
3. Selective tubular secretion.

1. U.F

→ occur in malphigian capsule or body of nephron by glomerulus so it is consider
→ filtration of blood occur & carried out by glomerular.
→ Ultra filtration is glomerular capillary blood pressure.
cause filtration of blood through 3 layer.

1. endothelium of glomerular
2. Basement Membrane
3. squamous epithelium of bowmen capsule

→ average 1100 to 1200 ml blood is filter out by kidney per minute rough 1/5th of blood by Ventricle of heart.
→ ~~average~~ affecting filtration process cause ultrafiltration.
→ affecting filtration pressure is determine by 3 pressure

a) glomerular hydrolytic pressure.
b) Colloidal Osmotic pressure.
c) Capsular hydrolytic pressure.

$$EFP = GHP - (GOP + CHP)$$

BP in glomerular cappilary main and determinant of GHP = 62 mmhg pressure.

COP :-
it is osmotic pressure in blood of glomerular capillary due to plasma protein.
→ it resist filtration of fluid from capallires.

$$COP = 30 \text{ to } 32 \text{ mmhg.}$$

CHP :- pressure caused by fluid that reactions is the bowmen capsule.

$$CHP = 10 + 20 \text{ mmhg pressure.}$$

** → The plasma fluid that filter out the glomerular to bowen capsule is called filtrate.

→ all the constuent of plasma except the protein part of lumen of bowen capsule is constituent ultra filtration

GFR :-

The amount of filtrate ie formed out by the kidney per min is ~~called~~ 6 ie 180 litres per day.

→ 99% of has to reabsorbt by the renal tubules & only 1% is release as urine & its about ie 1½ litres per day Selective tubular reabsorbtion glomerulus per

due to this contain nutrient like glucose, amino acid salt & Potassium, Chlorine HCO_3 & Proton ions & nitrogenous waste, urea, uric acid, creatinine

→ Exchange of material occur b/w filtrate on renal tubules & blood of peritubular capillary network it involve selective reabsorption & usefull material into blood from filtrate & absorption of remaing excreation from blood to filtrate.

→ substance like gulcose amino acid sodium ions etc o absorb actively nitrogenous waste are absorb partially.

→ tubular secretion during sub. like H^+ K^+ & NH_3 help in ionic & ~~AB~~ ~~B~~ acid base in our body fluid.

Function of tubules

PCT :- simple cubiodal Brush border epithelium (microvilli) to increase the reabsorbative surface area.

→ Reabsorption is max 70% to 80% filterate is reabsorb here

→ 70 to 8% electrolytes and water reabsorb.

→ if water is reabsorb here then it is called obligatory reabsorbtion

→ PCT helps to maintain PH & ionic balance of body fluid by (i) absorbtion of bicarbonate

(ii) Taking H^+, K^+ H_3 filtrate.

→ glucose amino acid & sodium is reabsorb through active transportion.

GAN active tranportion

→ Cl^-, Urea, H_2O reabsorb through passive transportion

Loop of henle :- reabsorbtion is minimum ~~the~~ in ascending
→ Their reason play significant of maintaining high Osmolarity.
→ Cortical osmolarity is appox 300 ml per liter and medullary Interstitial osmolarity is about 300 to 200 ml per litre.
→ loop of H has two part.

a) descending LOH :-
→ Permeable to water but almost impermeable for solute & electrolyte.
due to this filtdate conc as it move down.

b) ascending LOH :-
→ impermeable to water by permeable to electrolyte Nacl & other like Kcl & this get transported.
→ during transportation process electrolyte support both active & passive to the medullary fluid.
→ decrease in osmolarity of interstitial medullary toward cortex.
→ But when filtrate loses potassium ion & Cl^- by diffusing in medullary fluid that become dilute.

~~Ascending~~ :-

DCT :-
→ conditional reabsorption of Na^+ & water occur
→ it is capable to reabsorb HCO_3^- & selectively secretion of H^+ & potassium ions. as well as NH_3 to maintain the PH and Sodium Potassium balance in blood.

collecting duct :-
→ permeable to water impeable for salt
→ long duct extended from cortex of kidney to inner part of medual
→ large amount of water & looses to produce a concentrate.
→ It allow passage for small amount of urea into the medullary interstitial to keep the

Osmolarity of duct.

→ play role in maintaing of PH & ionic balance of blood by the selective secreation of H^+ ion & K^+ ion.

Mechanism of conc urine foumation on of the filtrate

→ mammalian having ablity to produce conc urine.

→ LOH & Vasarecta play significant role in this process ie conc of urine is foumed by counter current mechanism. It means flow of fluid in oppo dirn in two arms of U shape tubular str. ie two limbs of loop of henle & 2 limbs of Vasa recta. through counter current flow.

→ This C.C flow & gradient b/w loop of henle & Vasa recta increase transportation from interstitial medullary osmolarity. ie 300 ml per litre (300 Osml/litre) & it ranges to 1200 Osml from cotex to medulla.

→ This gradient is mainly get conc due to Nacl & Urea. ie we can say that kidney produce nearly 4 times conc then initial filtrate foum.

□ Regulation of kidney function

→ function of kidney regulated by hormonal feedback mechanism

→ in this mechanism hypothalamus, juxta glomerular appratus & heart play a determinative role.

→ how thalamus regulate ????

- excessive loss of body fluid can active the hypothalamus to release ADH (Antidiuretic hormone) & from the posterior pituatry release neurohypophysis
- after that ADH faliciate reabsorption of water from later part of tubules ie DCT which prevent the diuresis ie (excessive production of urine)
- increase in blood fluid Vol. can switch off the release of ADH & thus complete the feedback circulation.

· ADH is a vasoconstrictor ie ↑ BP & GFR.

Osmoreceptor found in body are sensitive to change in blood volume, blood fluid Vol & ionic conc.

body fluid reduction actiate osmoreceptor which stimulates the hypothalamus for release of ADH from posterior pituatory

→ When ADH ↑ permeability of DCT & CT for water & increase the reabsorbtion of water.
→ Once water reabsorb it restore the normal Volume of body fluid.

★ how JGA regulate

→ JGA is a stimulate when ↓ glomerular blood flow pressure of GFR. then JG Cells release renin.
→ GJA is a special renon that is foumed by cellular modification in DCT & affuent arterioles.
→ JGA play complex role in RAS Renine angiotensin aldosteron System.
→ Angiotensii found in liver ↓ in BP cause ↓ in GFR that can activate GI cell to release renine at the same time liver start secretion of angiotensinogen.
→ angiotensinogen is of 2 types ie angiotensnogen 1 & angiotensnogen 2 influence of hormone renine
→ Angiotensnogen 2 stimulate cortex secretion of aldosterone.
→ aldosterone ↑ permeablity of DCT for minerals ie sodium ion & water due to this ↑ in BP & GFR.
→ aldosteron is Vasoconstrictor so ↑ the BP & GFR

★ how heart help in regulation

→ increase in blood flow in auricle of the heart cause release of ANF (Astrial Netri Uretic factor) that is excretion of excessive amount of sodium in Urine
→ ANF is Vasodilater decrease the BP & GFR because ANF is a antagonistic (againt) to RAAS.
→ ANF mechanism act as a check out the renin angiotensine mechanism

Role of other organ in excretion

Lungs:-

It remove approx 18 litre of CO_2 & Quantative amount of water per day. ie 1 litre to 1.4 litre in a day.

Skin:-

Skin having two types of gland.

1. sweat gland.
   * Secrete sweat contain 99.5 % water, Nacl, latic acid, Urea, amino acid & $C_6H_{12}O_6$
   * facilitate cooling effect on body surface helps in removal of little amount of waste.

2. Sebaceous gland
   * secrete sebum (contain estrol hydrocarbon & waxes)
   * provide oily & waxy covering for skin.
   * Prevent from skin burning & control transpiration

Liver:-

It eliminate cholestrol, bile containing substance like bilirubin, biliverdin, degraded estrols, some vitamins & drugs.
these are carry with bile & excrete with feacal & stool.

Disorder of excretory system

Uremia:- malfunctioning of kidney can lead to accumulation of Urea in blood called Uremia.
* Very harmful.
* Leads to failure of kidney.
* in this condition heamodylisis is process through which urea can remove out from body.
* during heamodylisis we ned convinent artery to pump out into dylysis unit called artificial kidney
* anti blood congulate like heparin is also use during heamodialysis

Oligourea:-
* less production of Urea or Urine.

anurea:-
* NO production of urea.

polyurea:-
* excess production of Urine & it is mainly occur in diabetes.

glycosuria :-

* excreation of glucose through urine
* present in diabetes malitus patient less secreation of insuline.

Renal calculi :-

Renal Stone

* It occure due to deposition of calcium oxate in kidney.
* also cause due to insoluble mas of crystalline salt foum with in kidney.
* less urination, urination cause burn sensation & other problem created related to urine.

glomerulanephrusis :-

* inflamation of glomeruli of kidney.