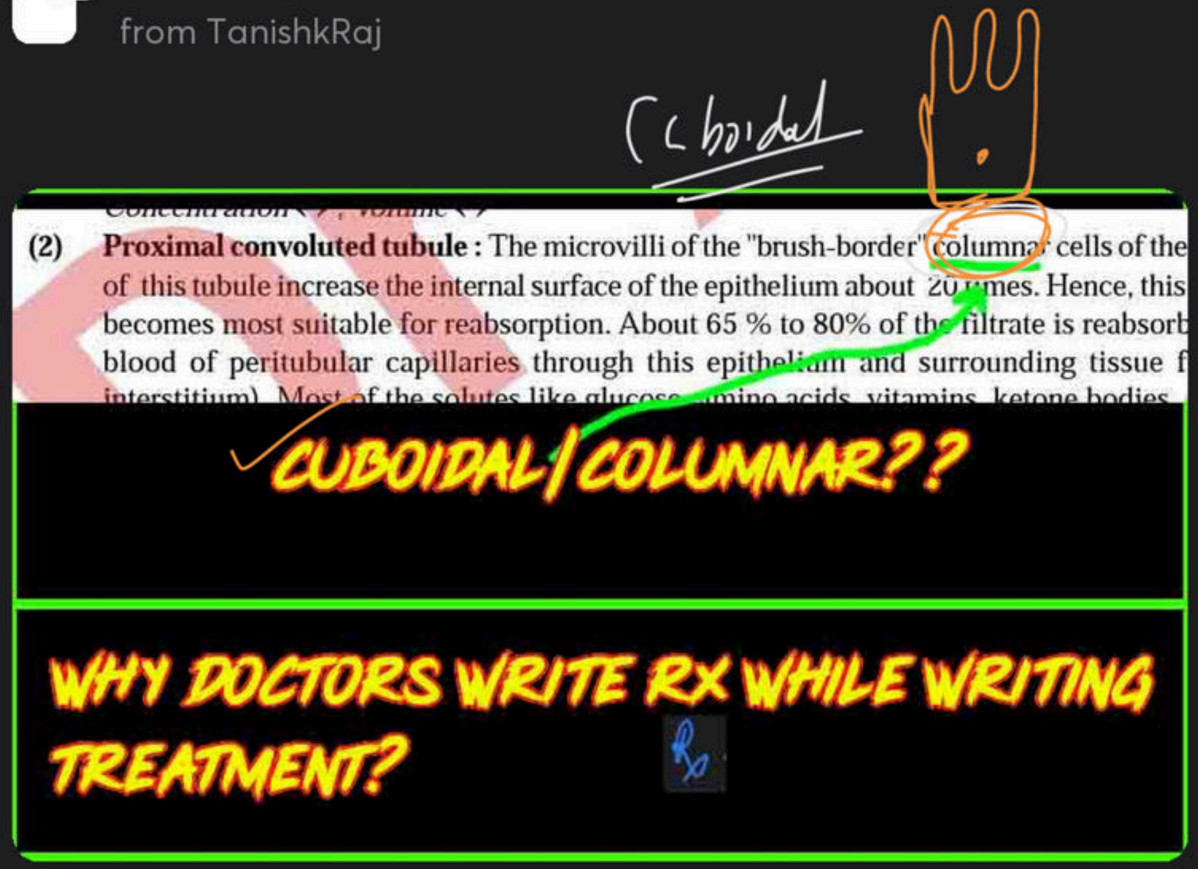
Doubt Clearing Session

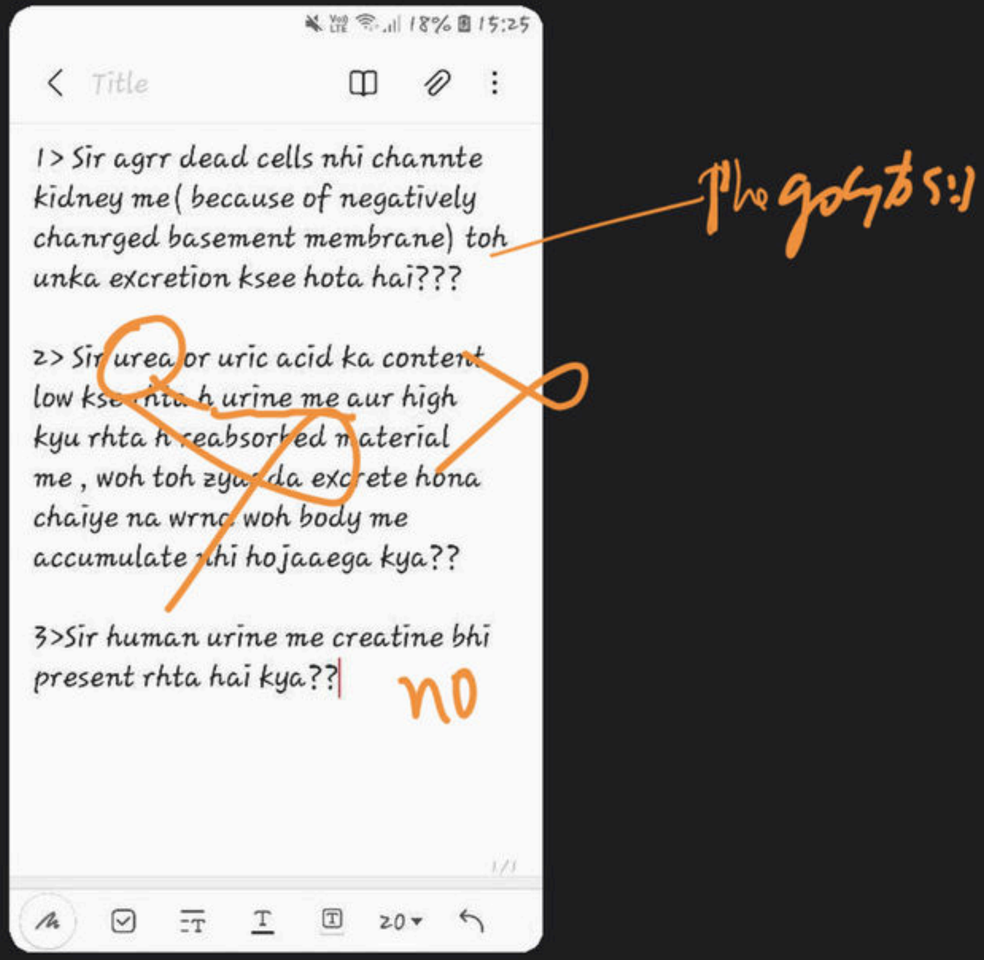
Course on Human Physiology: Excretory Products & their Elimination

Dr Amit Gupta • Lesson 8 • Aug 26, 2021

Question
from TanishkRaj

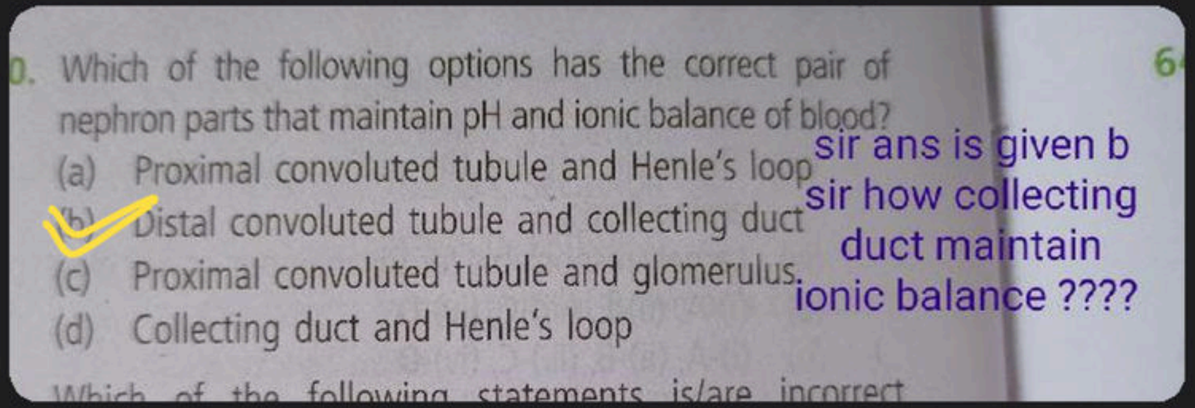


Question
from Lavesh

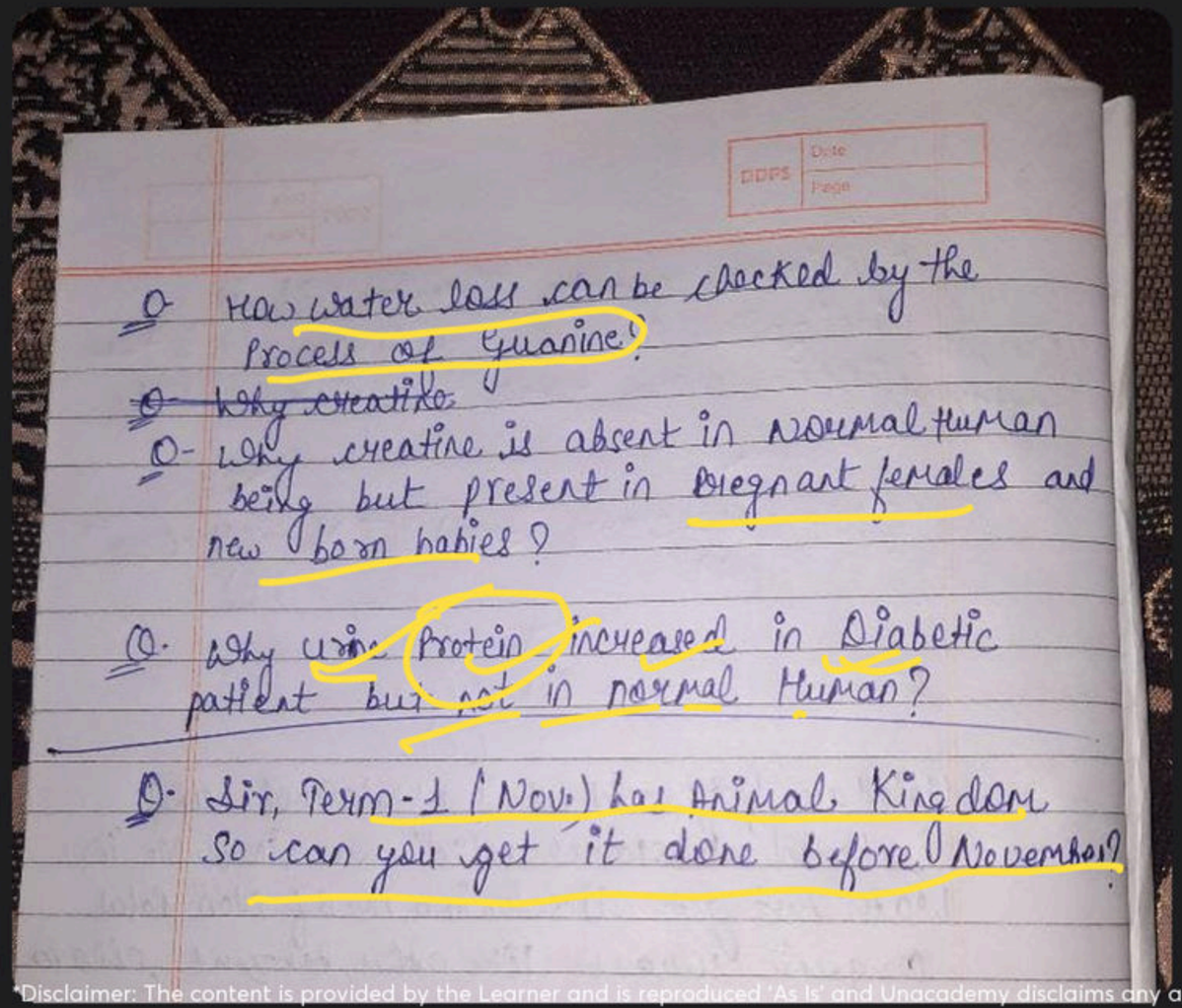


Question

from Shrutibodk...



Question
from Nitya



Q. How water loss can be checked by the Process of Guanine?

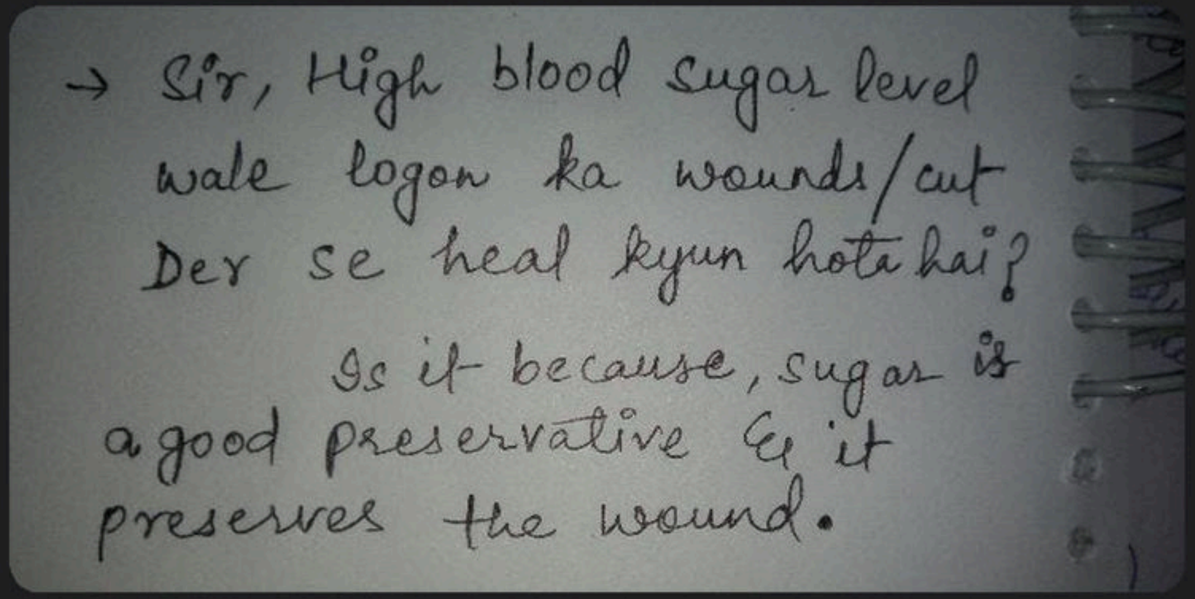
~~Q. Why creatine~~

Q. Why creatine is absent in normal human being but present in Pregnant females and new born babies?

Q. Why urine Protein increased in Diabetic patient but not in normal Human?

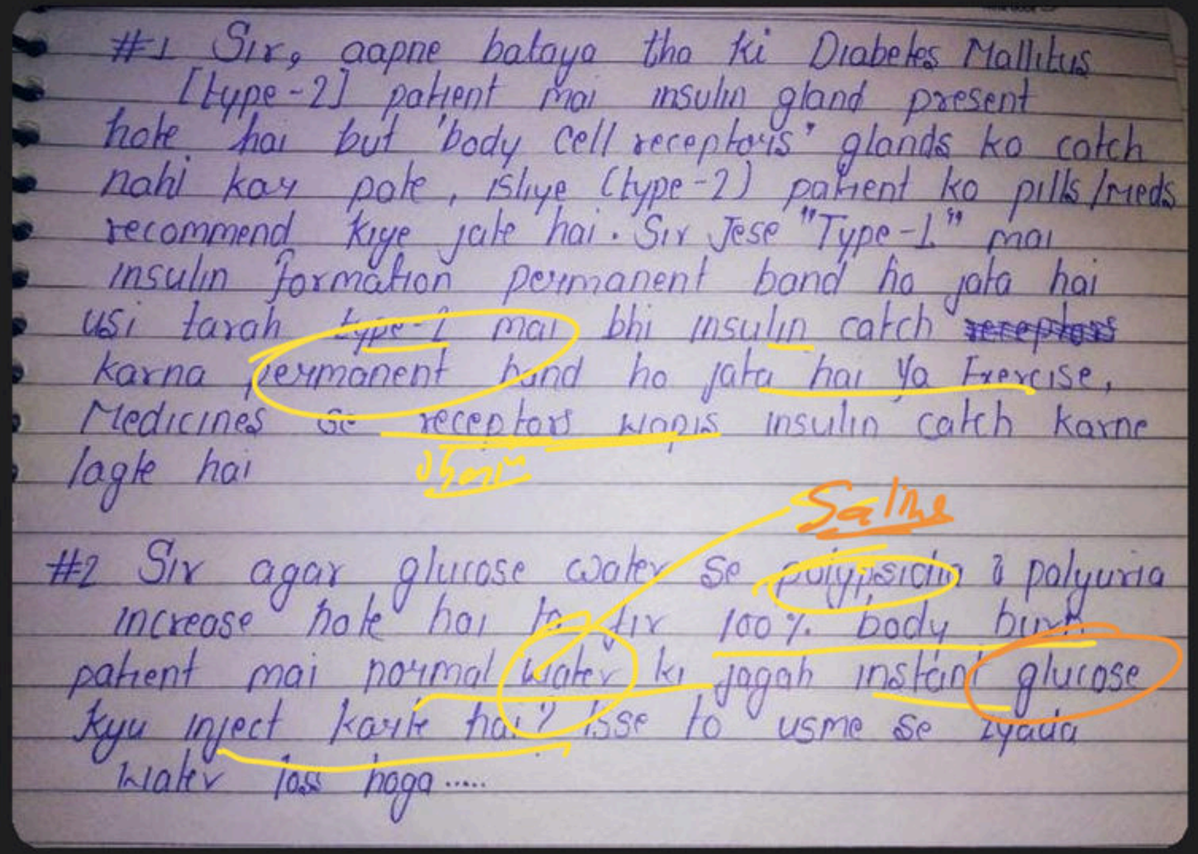
Q. Sir, Term-1 (Nov.) ka Animal Kingdom So can you get it done before November?

Question
from Aasfa Eqba...



High Sugar
↓
Nutrition
for Microorganisms
↓
Growth

Question
from YashSharma



#1 Sir, aapne bataya tha ki Diabetes Mallitus [type-2] patient mai insulin gland present hote hai but 'body cell receptors' glands ko catch nahi kar pate, isliye (type-2) patient ko pills/meds recommend kiye jate hai. Sir jese "Type-1" mai insulin formation permanent band ho jata hai usi tarah ~~type-2~~ mai bhi insulin catch ~~receptors~~ karna permanent band ho jata hai ya Exercise, Medicines se receptors wapis insulin catch karne lagte hai

#2 Sir agar glucose water se polyphagia & polyuria increase hote hai to fir 100% body burn patient mai normal water ki jagah instant glucose kyu inject karte hai? isse to usme se zyada water loss hoga.....

Question

from Simran Sod...

Sir please underlined wali line smja do

urine is excreted in larger volumes a condition called **diuresis.** When due to the inefficient regulation, the kidneys fail to adequatly dilute the uine, the body fluids are diluted and their increased volume cause hypertension (↑ BP).

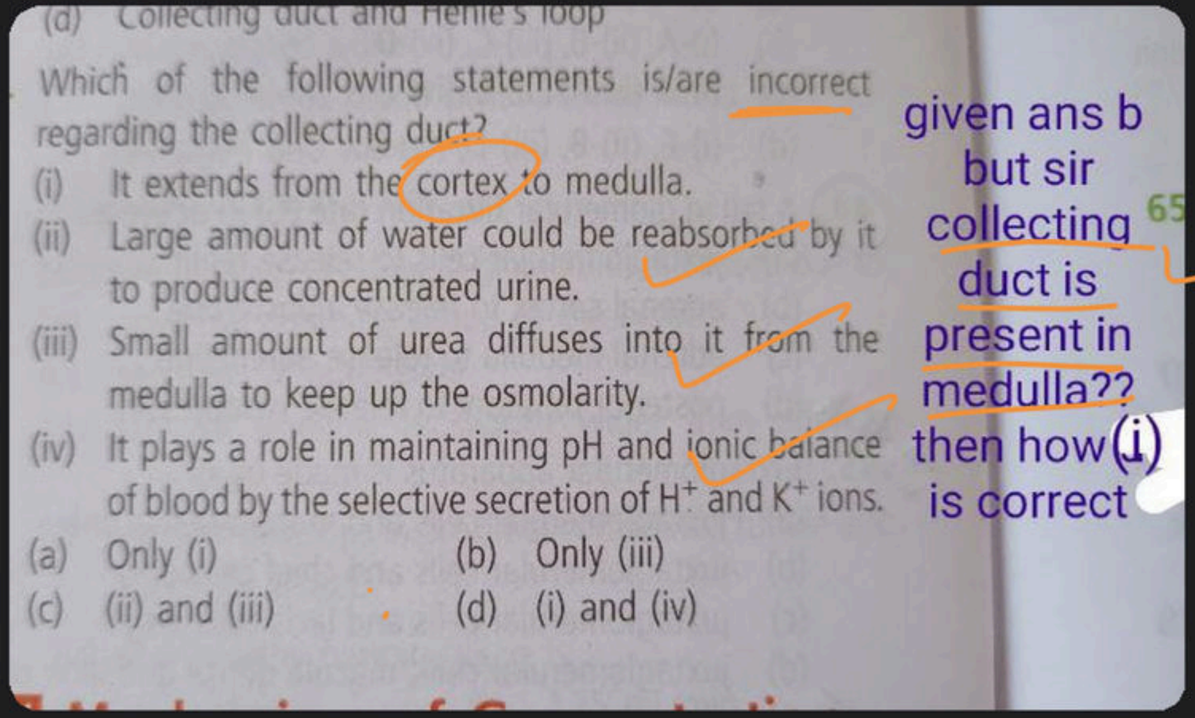
↑ H_2O in Blood

↓

(↑) Blood volume

Question

from Shrutibodk...



(d) Collecting duct and Henle's loop

Which of the following statements is/are incorrect regarding the collecting duct?

(i) It extends from the cortex to medulla.

(ii) Large amount of water could be reabsorbed by it to produce concentrated urine.

(iii) Small amount of urea diffuses into it from the medulla to keep up the osmolarity.

(iv) It plays a role in maintaining pH and ionic balance of blood by the selective secretion of H^+ and K^+ ions.

(a) Only (i) (b) Only (iii)

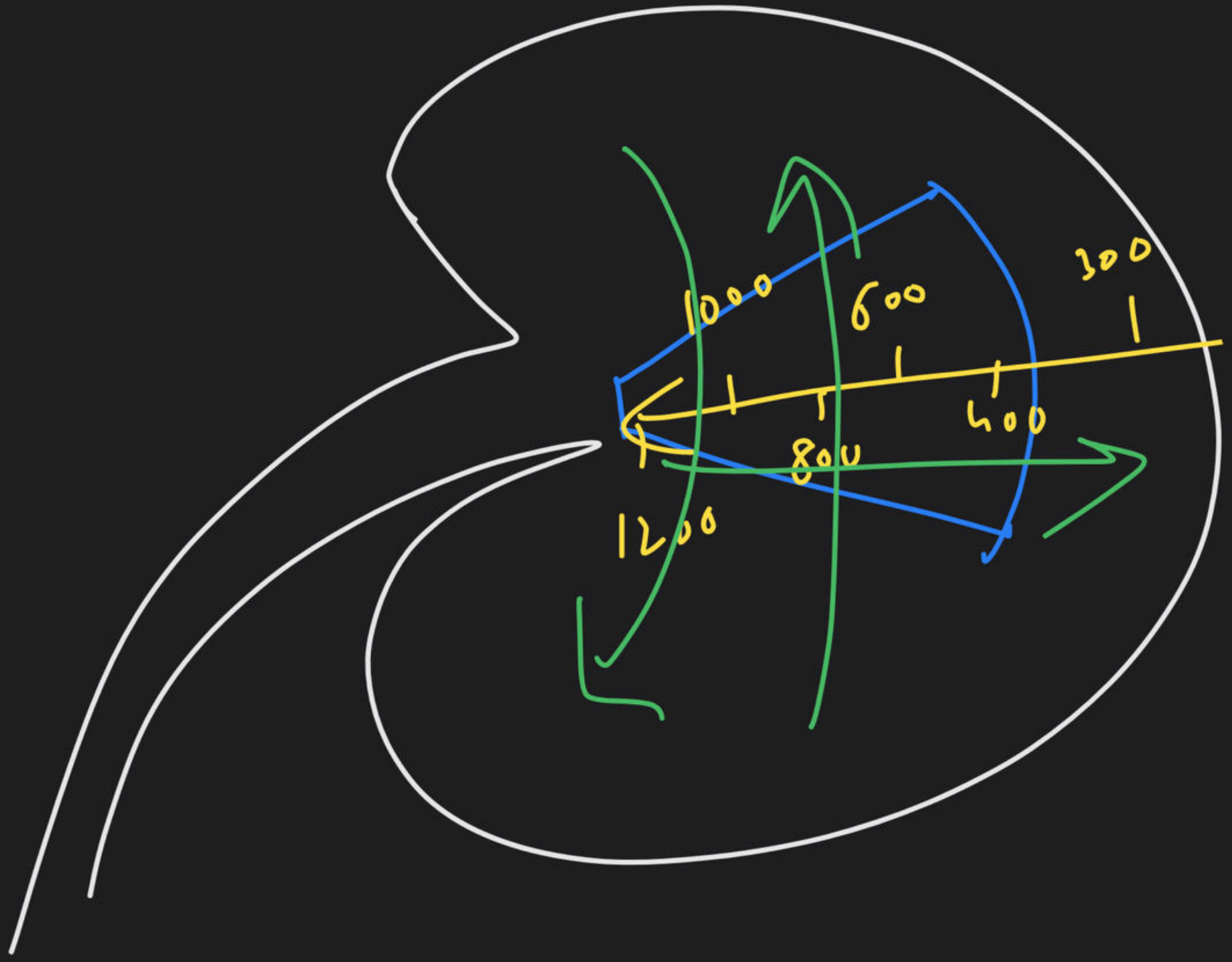
(c) (ii) and (iii) (d) (i) and (iv)

given ans b but sir collecting duct is present in medulla?? then how (i) is correct

Question
from Deep

Good Afternoon Sir..

Sir ..which part of the nephron plays a vital role in the maintenance of PH and Ionic balance of blood.??


1000
600
300
400
800
1200

(A) one

(B) two

(C) three

(D) four

300 → ×4 → 1200

CONCENTRATION MECHANISM (JUXTAMEDULLARY NEPHRONS)

During times of low water intake or excessive water loss, for example, due to heavy perspiration, diarrhoea, vomiting, etc the kidneys must conserve water while still eliminating wastes and excess ions. The kidneys accomplish this by producing concentrated urine. It is primarily the long-looped juxtamedullary nephrons which establish the conditions for producing concentrated urine which may be four to five times more concentrated (1200 to 1400 osmol/litre) than plasma. concentrating the urine is under regulation of ADH and depends on presence of a steep gradient of increasing hyperosmolarity in the interstitial fluids of medullary pyramids.

Deficit of water in Body ⇒ To Reduce water loss in urine ⇒ Urine: Conc^{n} ↑, volume ↓.

Blood Osmolarity >300 → Concentration of URINE (J.M. Nephrons)

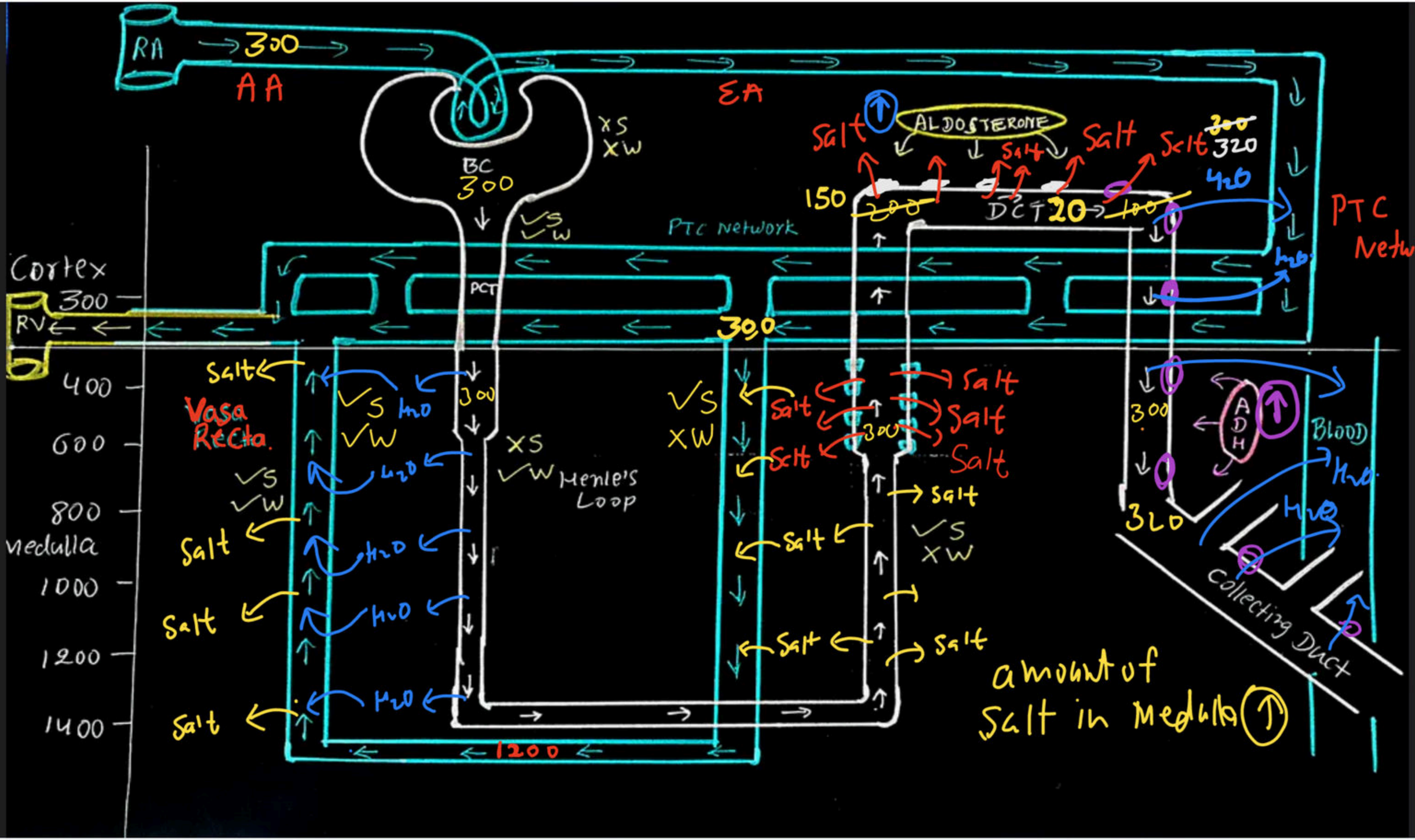
Objective :- To Excrete very very Low Volume of Highly Hypertonic Urine

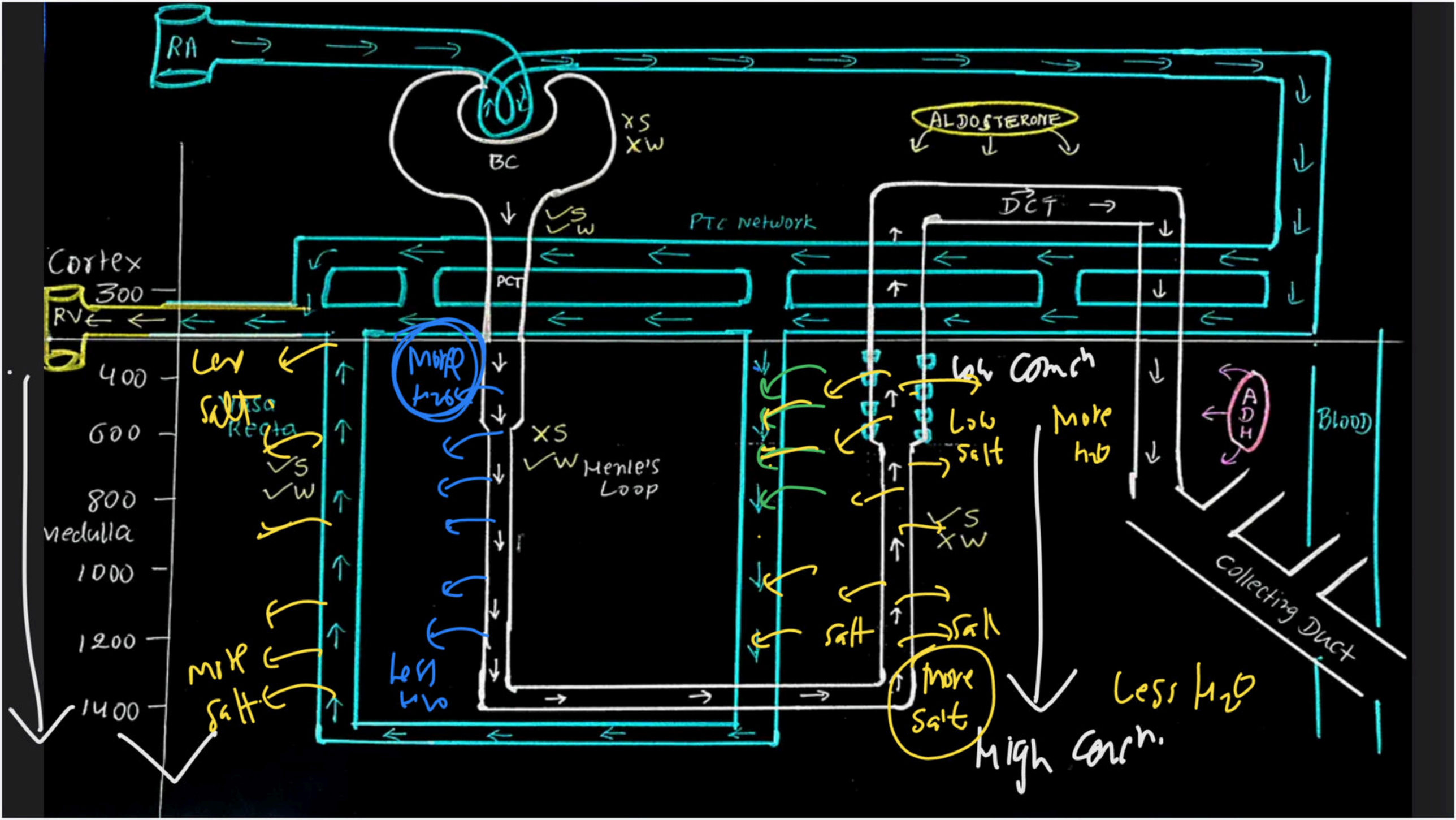
I > COUNTER CURRENT System — Reduces the Urine Volume

Henle's Loop
CC Multiplier
To Create a Highly Hyperosmotic Renal Medulla

Vasa Recta
CC Exchanger
To maintain this Hyperosmolarity & water conservation

II > Role of ↑ ADH on DCT & C.D. ← ↑ Aldosterone
To further reduce the urine Volume and make urine Highly Hypertonic


RA
300
AA
EA
XS
XW
BC
300
VS
VW
PTC Network
Cortex
300
RV
PCT
300
Salt
ALDOSTERONE
Salt
Salt
Salt
150
300
DCT
20
100
320
H2O
PTC
Network
H2O
400
600
800
Medulla
1000
1200
1400
Salt
Vasa Recta.
VS
VW
H2O
300
XS
VW
Henle's Loop
VS
XW
Salt
Salt
Salt
Salt
300
Salt
Salt
Salt
VS
XW
Salt
Salt
Salt
Salt
H2O
H2O
H2O
H2O
1200
300
ADH
Blood
H2O
320
H2O
Collecting Duct
amount of
Salt in Medulla ↑


RA
BC
XS
XW
ALDOSTERONE
DCT
PTC Network
PCT
Cortex
300
RV
400
600
800
Medulla
1000
1200
1400
Less salt
Less H2O
Henle's Loop
XS
XW
Less H2O
Low salt
Low Conch
More H2O
ADH
Blood
Collecting Duct
salt
salt
More salt
More salt
High Concn.

Medullary hyperosmolality : The osmolality of renal cortical interstitium is the same (300 mL osmol/ litre) as in other tissues, but that of the interstitium of renal medulla is hypertonic with a gradient of hyperosmolality from renal cortex to the tips of medullary papillae. Under the conditions in which a concentrated urine is to be produced the hyperosmolality of medullary interstitium near the tips of the papillae is as high as 1200 to 1400 mL osmol/litre.

Countercurrent mechanism to maintain medullary hyperosmolality : The gradient of increasing hypersomolality of medullary interstitium is maintained by a peculiar countercurrent mechanism operated by the Henle's loops of juxtamedullary nephrons and vasa recta. About 15% to 20% of the nephrons in mammalian kidney are situated at the level where cortex and medulla meet and, hence called **juxtamedullary nephrons.**

The Henle's loops of these nephrons are thin and long and extend almost upto the tips of medullary papillae. The peritubular capillaries associated with these Henle's loops are also very thin and in the form of thin loops extending almost upto the tips of medullary papillae. These capillary loops are called **vasa recta.** A counter current can be defined as the flow of a fluid in opposite directions in the two arms of a U-tube if the arms are rather very close together. Thus, the Henle's loops of juxtamedullary nephrons and vasa recta are anatomically ideal for the operation of countercurrent mechanism.There are two aspects of this mechanism, **(1) countercurrent multiplication** and **(2) countercurrent exchange.** The Henle's loops play the role of contercurrent multipliers

The vasa recta plays the role of countercurrent exchanger.

Since the concentration of tubular fluid in descending limb reflects the concentration of medullary interstitium, and since the concentration in the interstitium is raised by extrusion of salt from ascending limb, a positive feedback mechanism is created. *The more salt the ascending limb extrudes, the more concentrated will be the fluid that enters into it from descending limb.* Obviously, this feedback mechanism is the key point in the **countercurrent multiplier system.**

Countercurrent exchange : In order for the countercurrent multiplier system to be effective in creating the gradient of medullary hyposmolality, most of the salt extruded by the ascending limb of Henle's loopmust remain in medullary interstitium, while most of the water coming out of the descending limb must be drained off into the blood. This is accomplished by the vasa recta by means of the mechanism known as countercurrent exchange. **Salt** is thus recirculated and trapped within the medullary interstitium, But contrarily, the **water** diffuses into the blood of ascending limb of vasa recta and is carried away into general blood circulation.

Role of distal convoluted tubule, collecting duct and ADH : As described above, the role of countercurrent mechanism is to proudce a small volume of highly hypotonic (osmolality only about 100 mL osmol/litre) tubular fluid which enters from the thick ascending limb of Henle's loop into the distal convoluted tubule and, thereafter into the collecting duct. To finally produce a very small volume of highly concentrated urine from this hypotonic tubular fluid is the role of distal convoluted tubule and collecting duct under the influence of the antidiuretic hormone (ADH). ADH triggers synthesis of a large number of molecules of a specific protein, named **aquaporin,** in the epithelial cells of distal convuled tubule and more particularly of collecting duct. Molecules of aquaporin become incorporated in the plasma membrane of these cells as integral proteins and act as water channels. Consequently some water is lost from hypotonic tubular fluid by exosmosis while it flows through the distal convoluted tubule, but most of the water of tubular fluid is lost across the wall of collecting duct via aquaporin as this duct traverses through the medullary interstitium to empty into a calyx, Due to this, the osmolality of the urine emptied into the calyx becomes 1200 to 1400 mL osmol/litre.