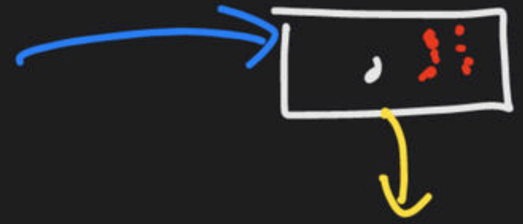
Excretory Products & their Elimination - II

Course on Human Physiology: Excretory Products & their Elimination

Dr Amit Gupta • Lesson 2 • Aug 12, 2021



Animal Cell

NH_3 & CO_2.

A) Lungs → fowl Air

B) Skin → Sweat

C) Large intestine → faeces

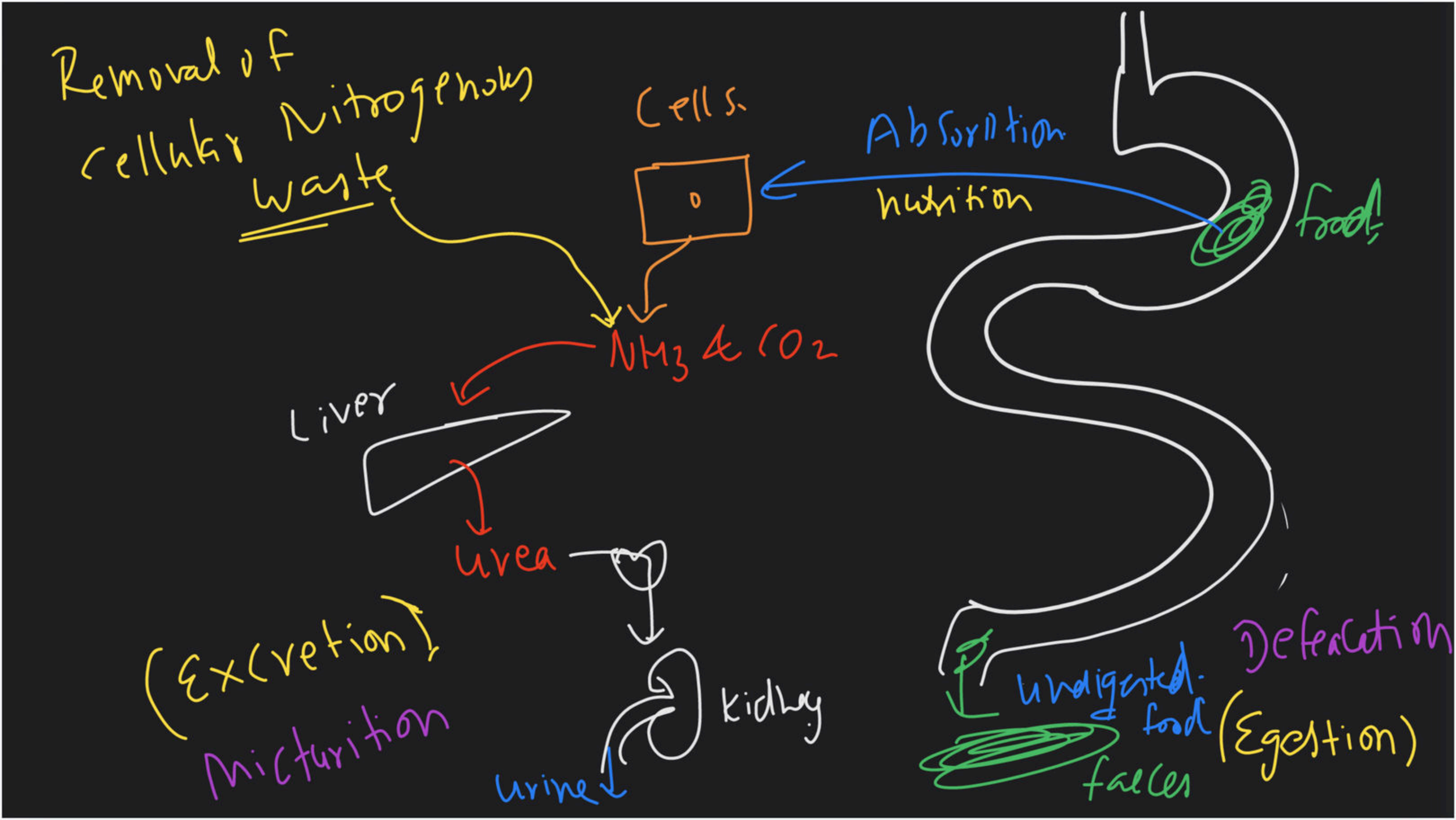
D) Kidney → Urine

E) other organ's secretion → waste products

A) Micturition (Urine)

B) Defecation (faeces)

Bigger Excretion ?


Removal of cellular Nitrogenous waste
Cells
Absorption
nutrition
food
NH3 & CO2
Liver
Urea
(Excretion)
Micturition
kidney
urine
undigested food
faeces
Defecation
(Egestion)

Kidneys are Main Excretory organs

But

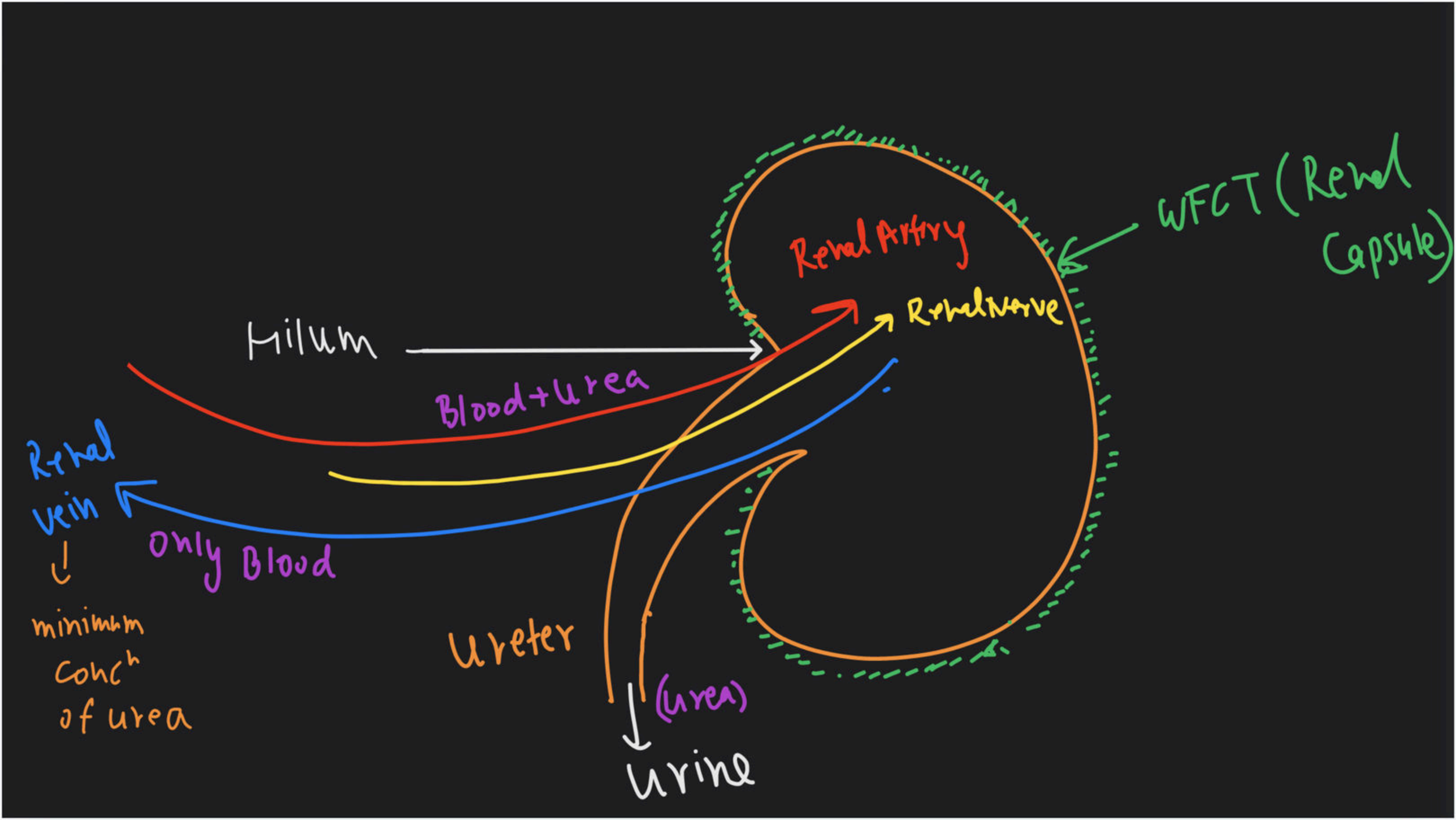
Main function of Kidney is Homeostasis

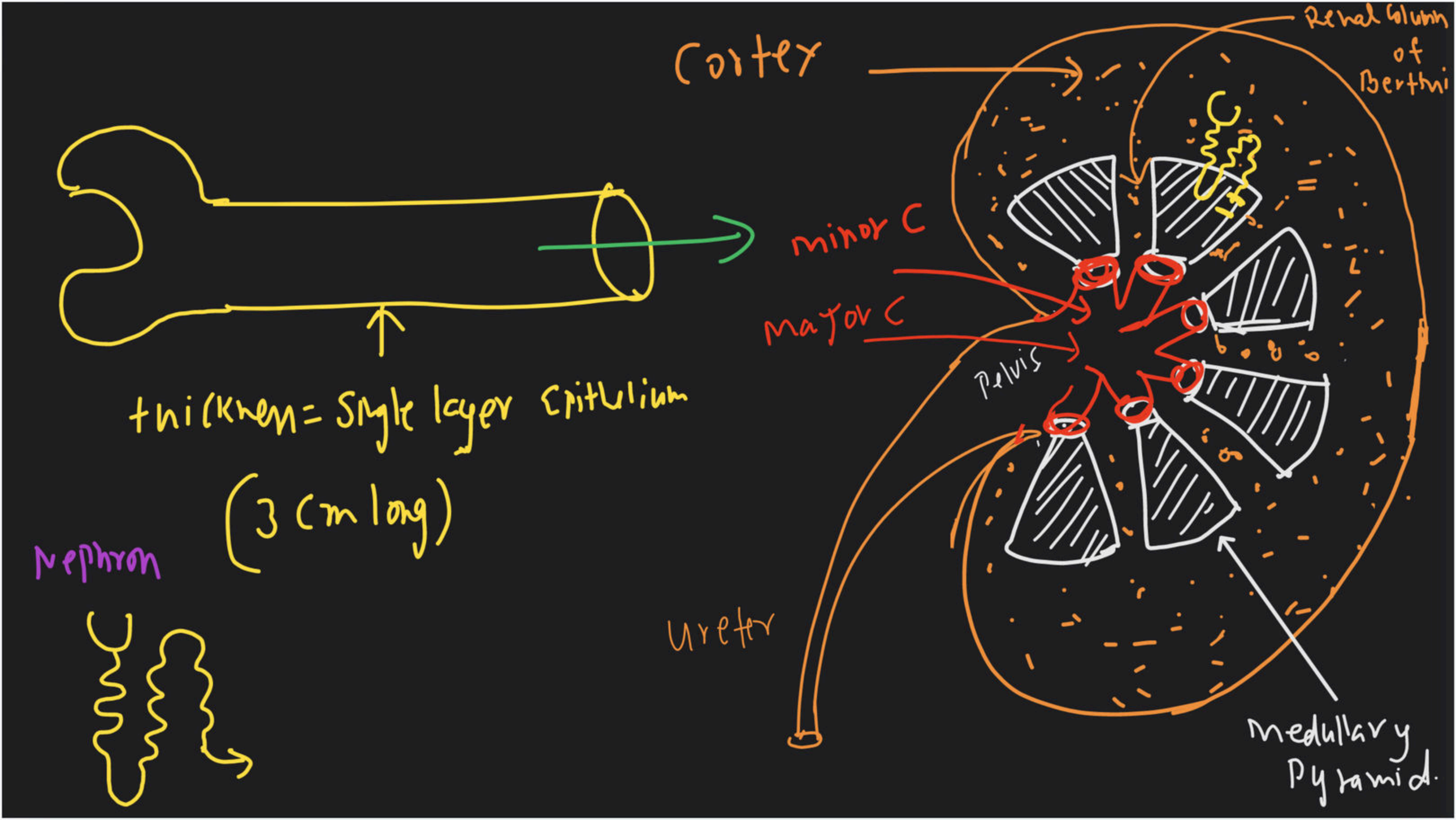
LOCATION AND STRUCTURE OF KIDNEYS

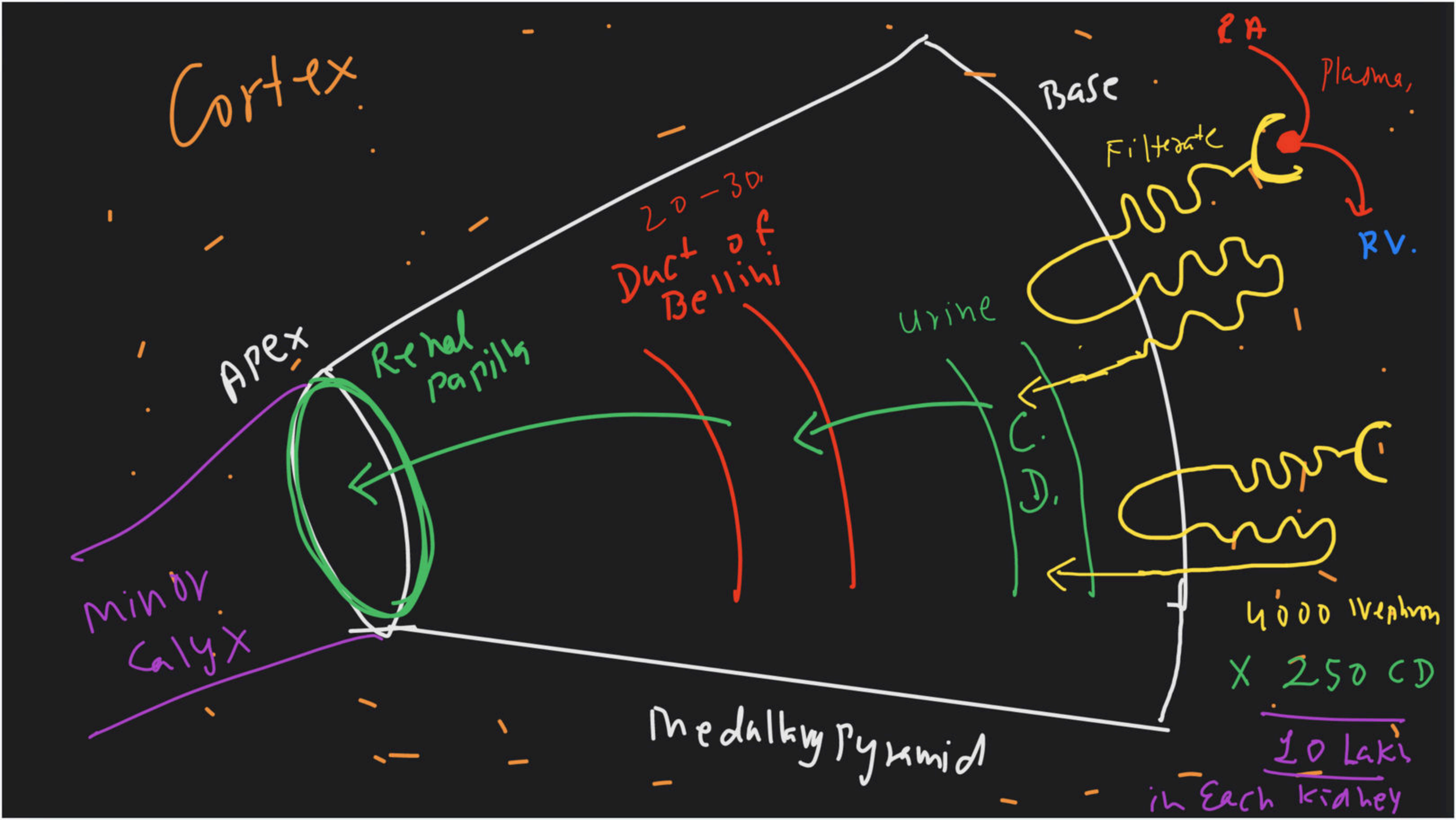
Each individual normally has two kidneys located lateraly on either side of vertebral column at the level of T_{12}, L_1 & L_2.

In humans right kidney is at slightly lower level than left kidney while in rabbit the right kidney is at slightly higher level (2.5 cm) than left kidney.

Dorsal surface of the kidney is attached to the dorsal abdominal wall, so only its ventral surface is covered by visceral, peritoneum, therefore this type of kidney is called **retro-peritoneal kidney** or extra peritoneal kidney. Mammalian kidneys are **bean shaped**, Dark brown coloured with a tough fibrous connective tissue covering capsule.


WFCT (Renal Capsule)
Renal Artery
Renal Nerve
Hilum
Blood + Urea
Renal Vein
Only Blood
minimum Conc^n of urea
Ureter
(Urea)
Urine


Cortex
Renal Column of Berthi
minor C
major C
Pelvis
Ureter
Medullary Pyramid.
thickness = Single layer Epithelium
(3 cm long)
Nephron

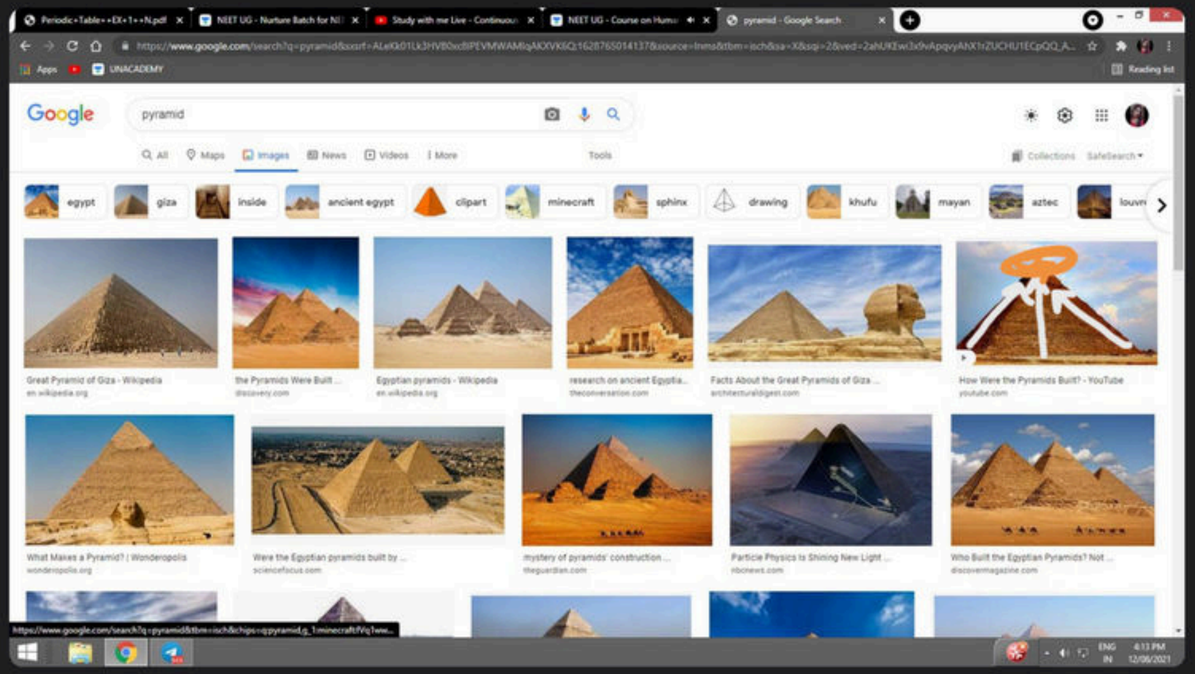

Cortex
Base
RA
Plasma,
Filtrate
RV.
20-30
Duct of Bellini
Urine
Apex
Renal papilla
C.D.
Minor Calyx
Medullary pyramid
4000 Nephron
X 250 CD
10 Lakh
in Each kidney

Nephron → Collecting Duct → Duct of Bellini → Renal Papilla → Minor Calyx → Major Calyx → Pelvis → Ureter → U. Bladder → Urethra

Passage of Urine

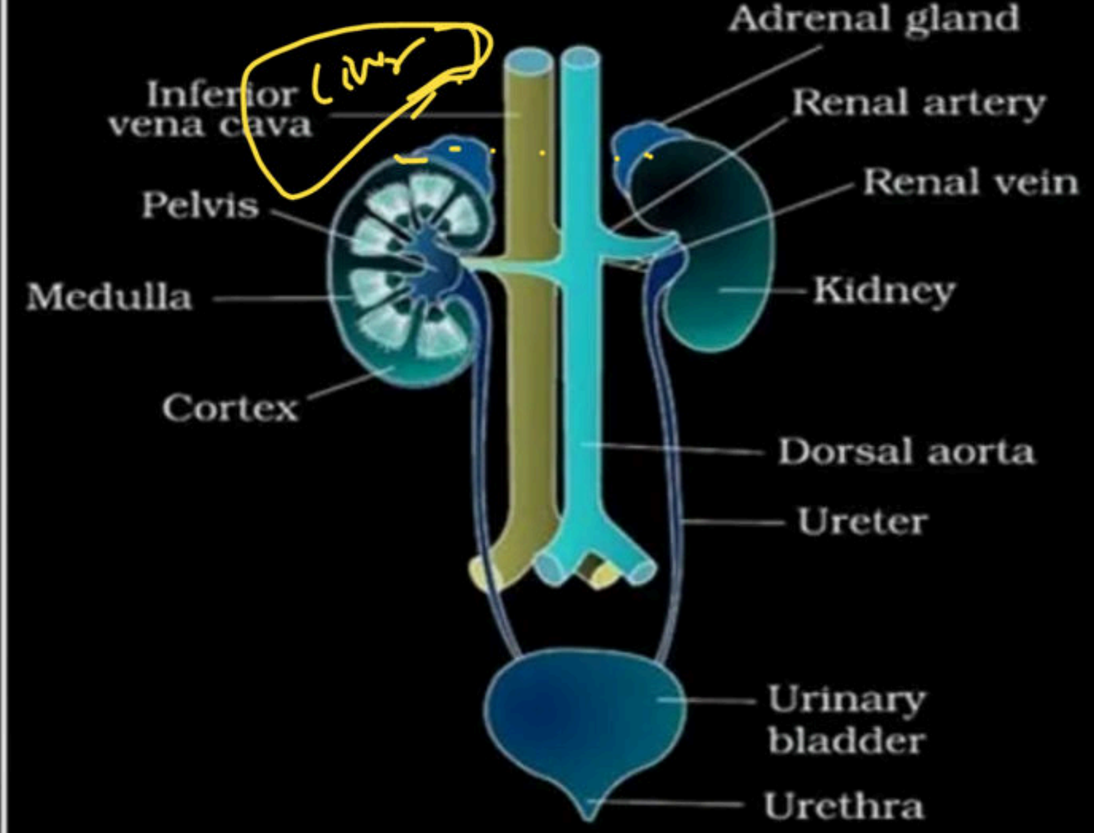
Question

from Himanshida...

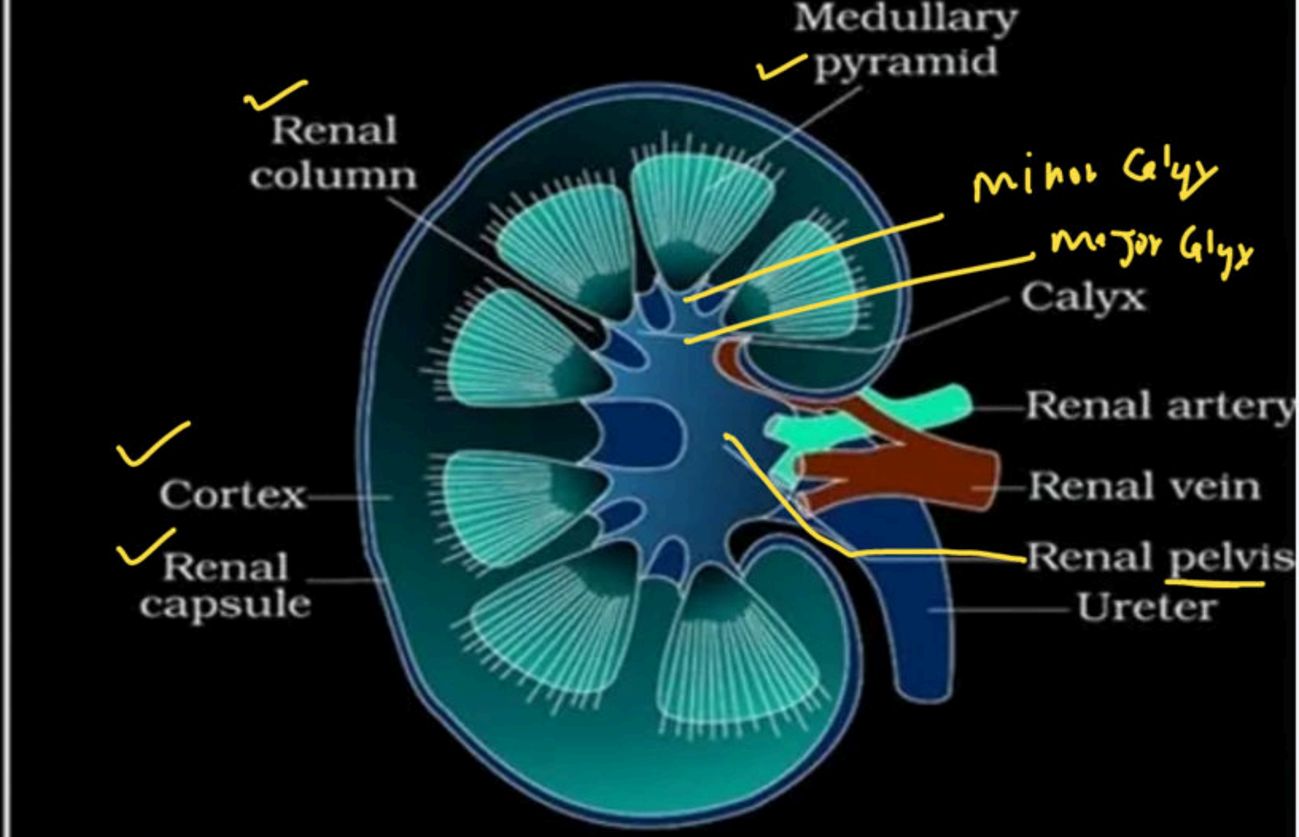


Convergence

150 gm



Human Urinary system



Longitudinal section (Diagrammatic) of Kidney

Each kidney measures 10 cm in length, 5 cm in breadth and 3 cm in thickness, weighing about 125-170 gm in an adult. Lateral surfaces of kidney are convex while medial surfaces are concave. On the concave margins of the kidney longitudinal opening called **Hilum** (Hilus renalis) is present. Through this, renal artery and nerve enter while renal vein and ureter leave the kidney.

The Hilum leads to a funnel shaped space called the **renal pelvis**.

The kidney tissue surrounding the pelvis is arranged in an outer functional layer **renal cortex** and inner functional layer **renal medulla.** Projections of renal cortex into medulla are termed **renal columns of Bertini**.

The renal medulla forms conical pyramid shaped masses which project into the renal pelvis. These are called as **medullary pyramids** or **renal pyramids** (8 to 12 in humans, while only one pyramid is present in kidney of rabbit)

The functional units of mammalian kidney are called **Nephrons**.

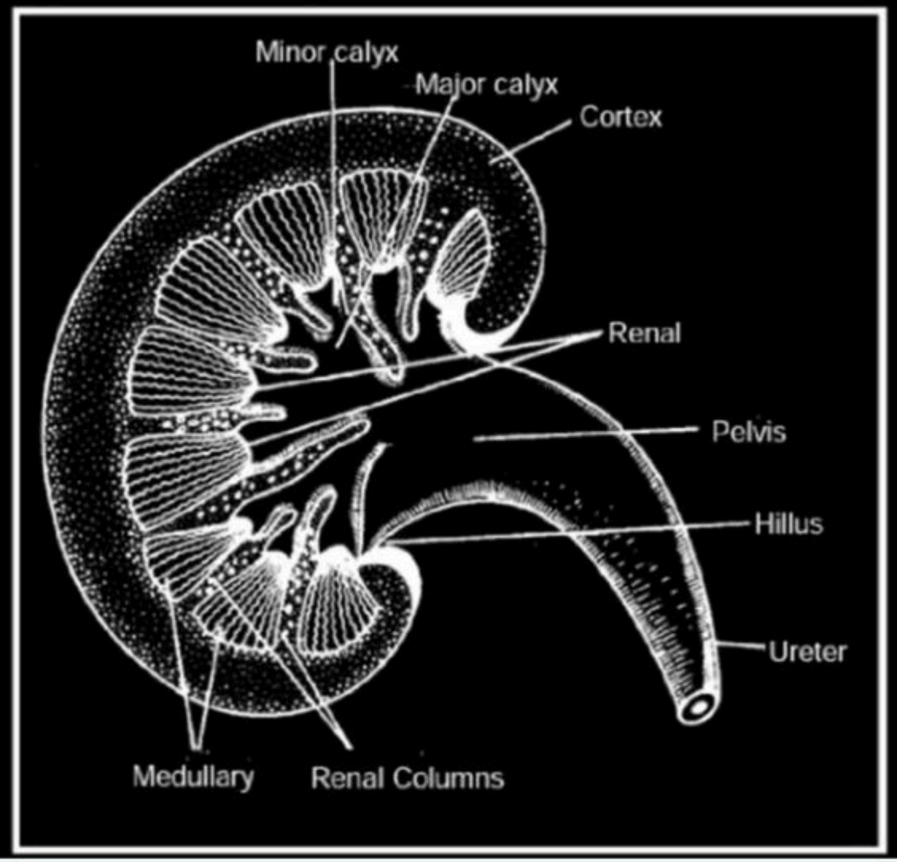
These nephrons are arranged in a radiating fashion within the renal pyramids.

Urine produced by each nephron empties into **collecting duct**.

The collecting duct passes through a **papilla** into the **renal calyx** (Pleural - calyces).

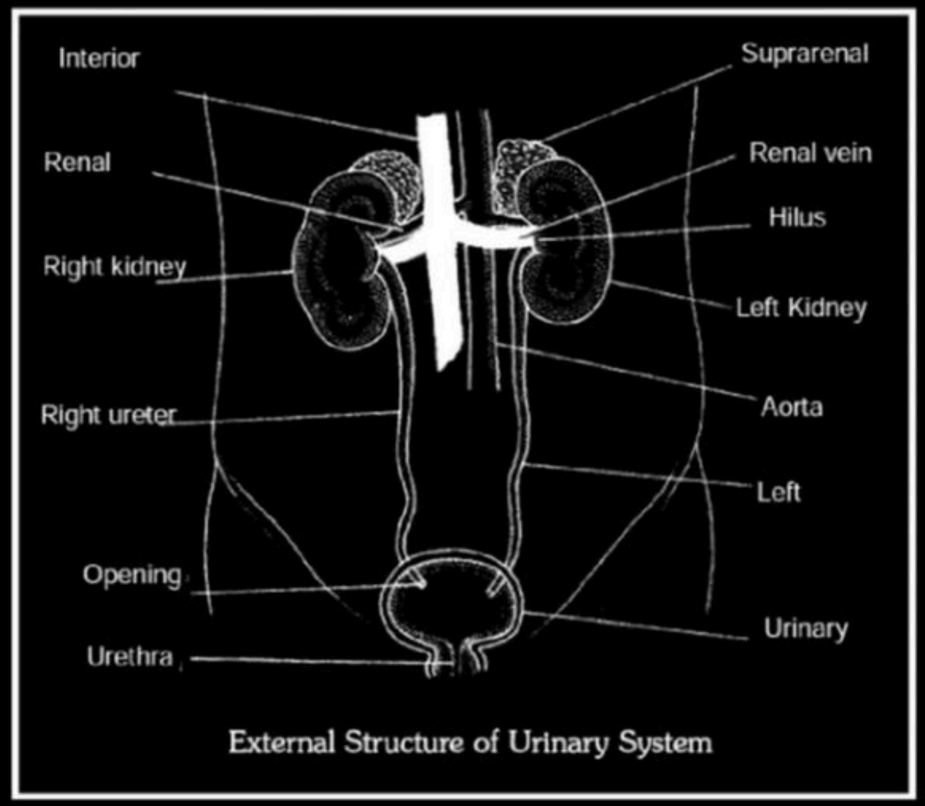
The renal calyces drain urine in the central cavity of renal pelvis.

In rabbit, renal pelvis is unbranched, so the calyces and renal column of Bertini are absent.



POST RENAL URINARY TRACT

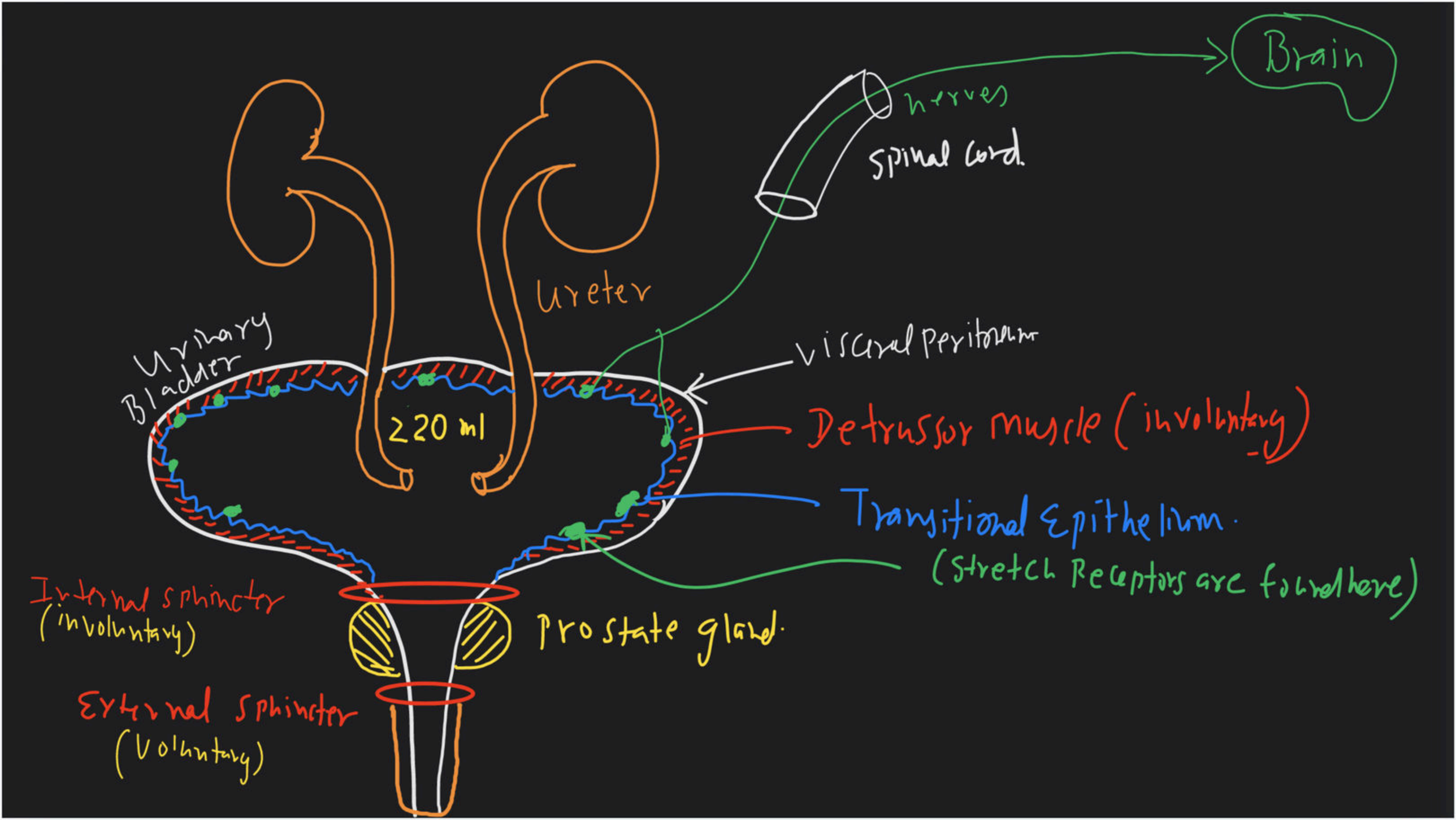
- Urine passes from the pelvis into the **ureter**. Both the ureters open through separate oblique openings into the **urinary bladder**. The obliquity of the openings prevent the backflow of urine.
- Externally, the bladder is lined by detrusor muscle, it is involuntary in nature while internally the bladder is lined by transitional epithelium or urothelium. This epithelium has great capacity to expand so that large volume of urine can be stored if required. In human two sphincters present. Inner = Internal sphincter (made up of involuntary muscle) Outer = External sphincter (Voluntary nerve). Opening of urinary bladder is controlled by sphincters made of circular muscles. These normally remain contracted and during micturition these relax to release urine.



External Structure of Urinary System

Nephron→Collecting duct→Papilla→Renal calyx→ Renal pelvis →Ureters→Urinary bladder→Urethra

- Urinary bladder opens into a membranous duct called Urethra.
- The urethra leads to end of the penis in males and into the vulva in females. In males the urethra has three parts, prostatic, membranous & penile urethra respectively. In Females both sphincters are present in membranous urethra.


Brain
nerves
spinal cord.
Ureter
Urinary Bladder
220 ml
Visceral Peritoneum
Detrussor muscle (involuntary)
Transitional Epithelium.
(Stretch Receptors are found here)
Internal sphincter (involuntary)
Prostate gland.
External sphincter (Voluntary)

Question
from TanishkRaj

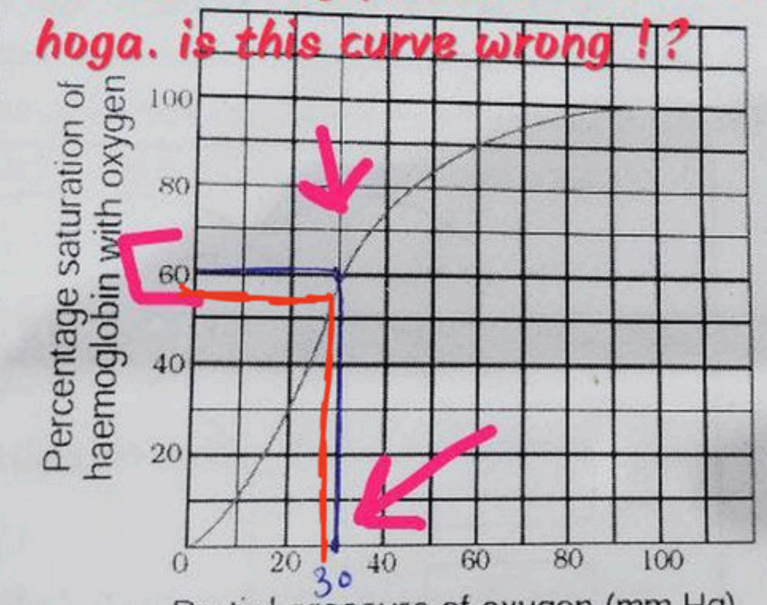
SIR YADI HUM DISTILLED WATER PI LE TO BHI HUMARI RBC PHUT JAYEGI?

Question
from Vanya Grov...

centration and
n with oxygen
called

urve. As the
saturation of
At higher CO_2
ifts towards
fect.
ociation curve
haemoglobin

sir 30 mmHg pr saturation 50% hoga. is this curve wrong !?



also according to this graph saturation is 100% !??

Question
from Arjuna Muk...

Title

1. Sir According to module " Most terrestrial reptiles excrete uric acid but crocodiles excrete ammonia in addition to uric acid".....Then how their embryo is safe in eggs?!
As They are aquatic so mature crocodile's Excretory organ is safe from NH3 discharge. But what about the Embryo in egg?

2. Sir does the fumaric acid Originated during ornithine cycle can produce ATP through crebs cycle?

Question

from SUMIT KUMA...

pathological shunt and patho;ogical dead space

???????????/

Bronchial Tree

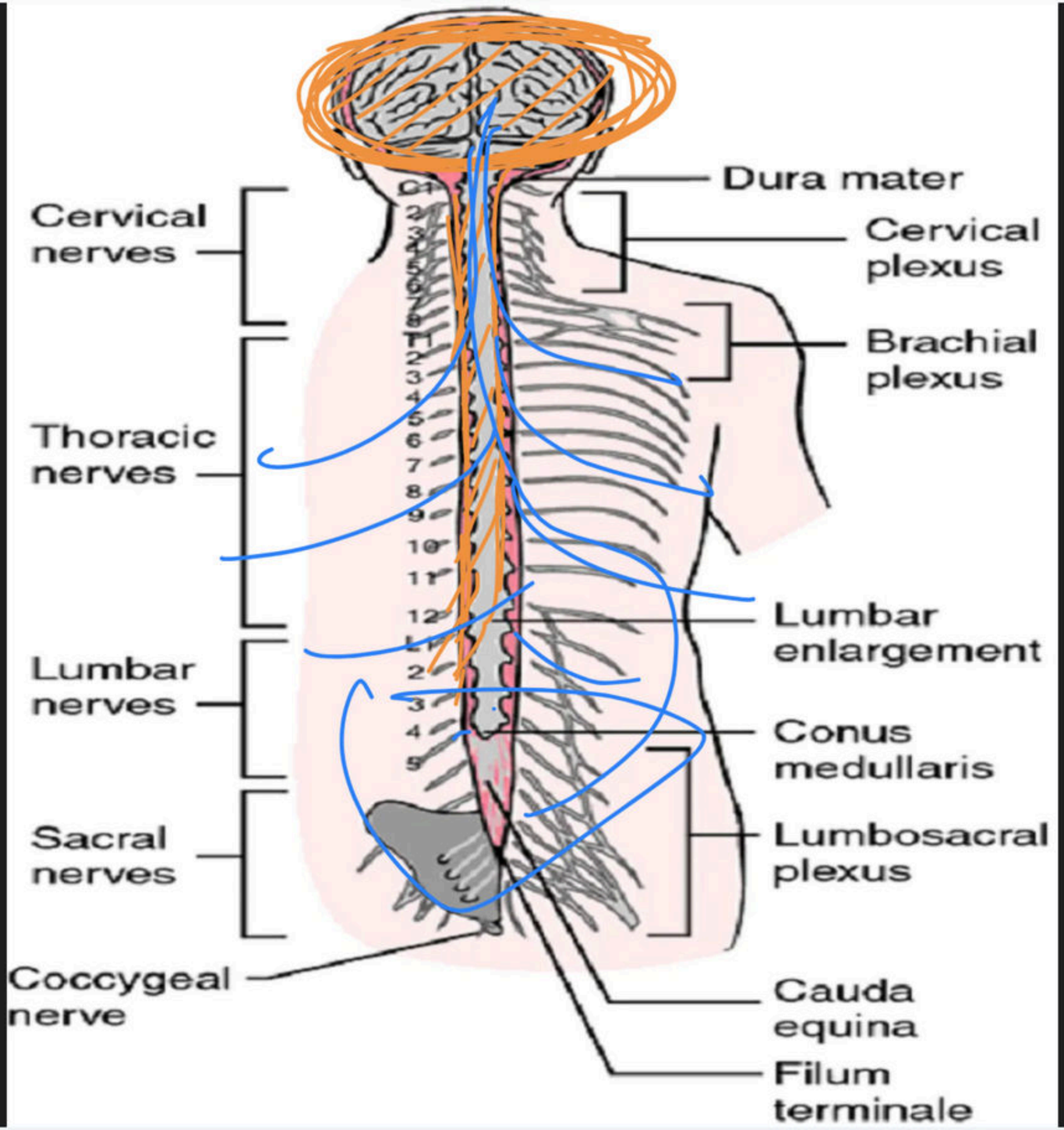
2:1. Physiological

2:1

Pathological

2:1

Shunt > 2:1


Dura mater
Cervical plexus
Brachial plexus
Cervical nerves
Thoracic nerves
Lumbar nerves
Sacral nerves
Coccygeal nerve
Lumbar enlargement
Conus medullaris
Lumbosacral plexus
Cauda equina
Filum terminale

Physiology of micturition

Sympathetic — S = Stop — urethral sphincter contracts.

Parasympathetic — P = Pass — urethral sphincter relaxes.

Physiology of Micturition

- The process of relaese of urine is called micturition and the neural mechanism causing it is called micturition reflex. This reflex is initiated when interoceptors, present in the wall of urinary bladder, get stimulated by the tension created due to stretching of bladder wall as the bladder gradually fills with urine brought into it by the ureters.
- In response, the stretch receptors on the walls of the bladder send signals to the CNS. The CNS passes on motor messages to initiate the contraction of smooth muscles of the bladder and simultaneous relaxation of urethral sphincter causing the release of urine.