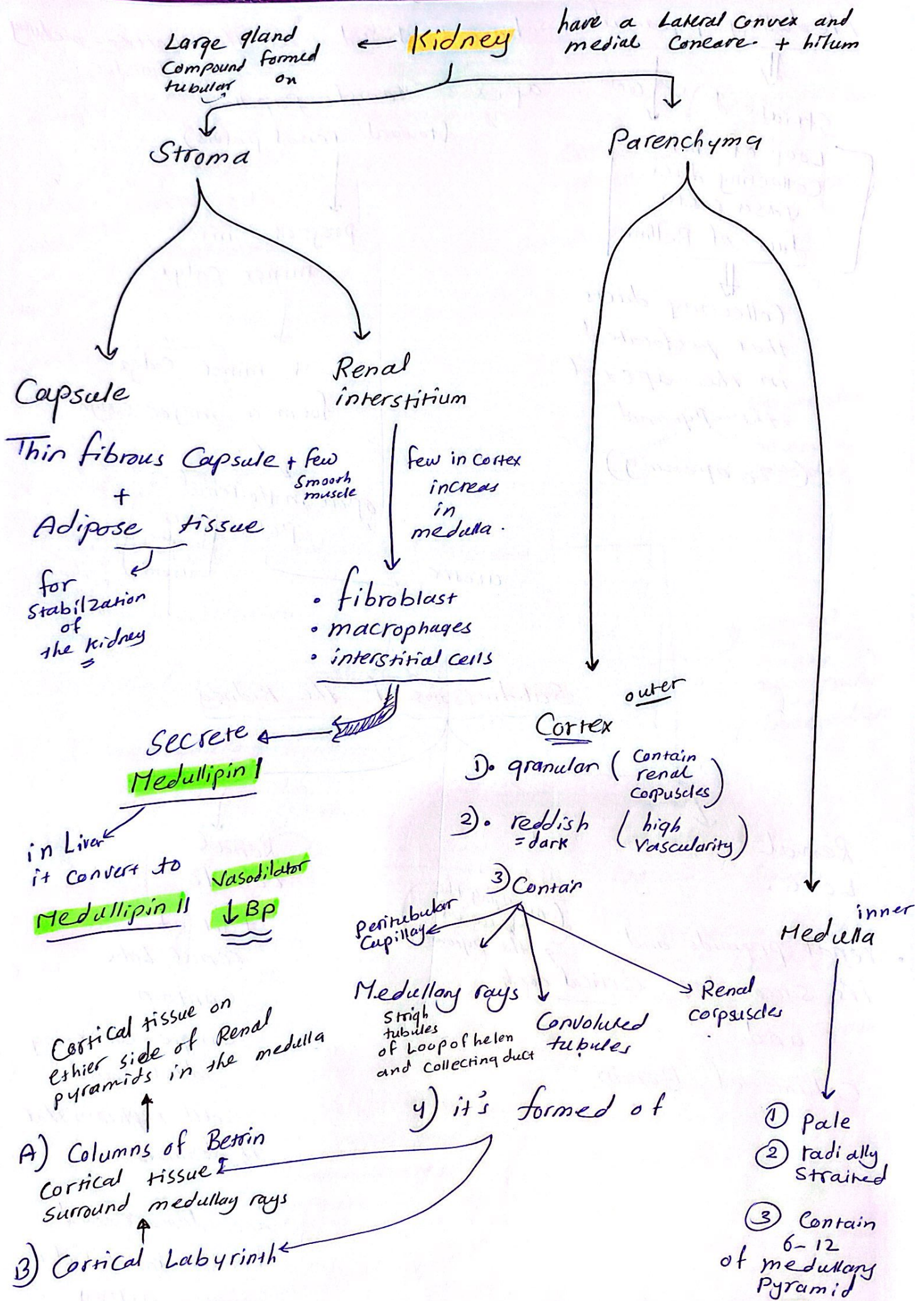




Medullary pyramid

base: broad at the Cortico-medullary border.

apex: renal papilla.
(toward renal pelvis)

Striated
[Loop of heln
Collecting duct
Vasa recta
duct of Bellini]

Collecting ducts
that perforated
in the apex of
the Pyramid
(20 opening)

project into
minor Calyx

3-4 minor Calyx
form a major Calyx

open in the renal
pelvis [upper
border
of ureter]

ureter

Subdivisions of the kidney

Renal
Lobe

- renal pyramids and
its surrounding Cortical arch
and
Columns of Berrin

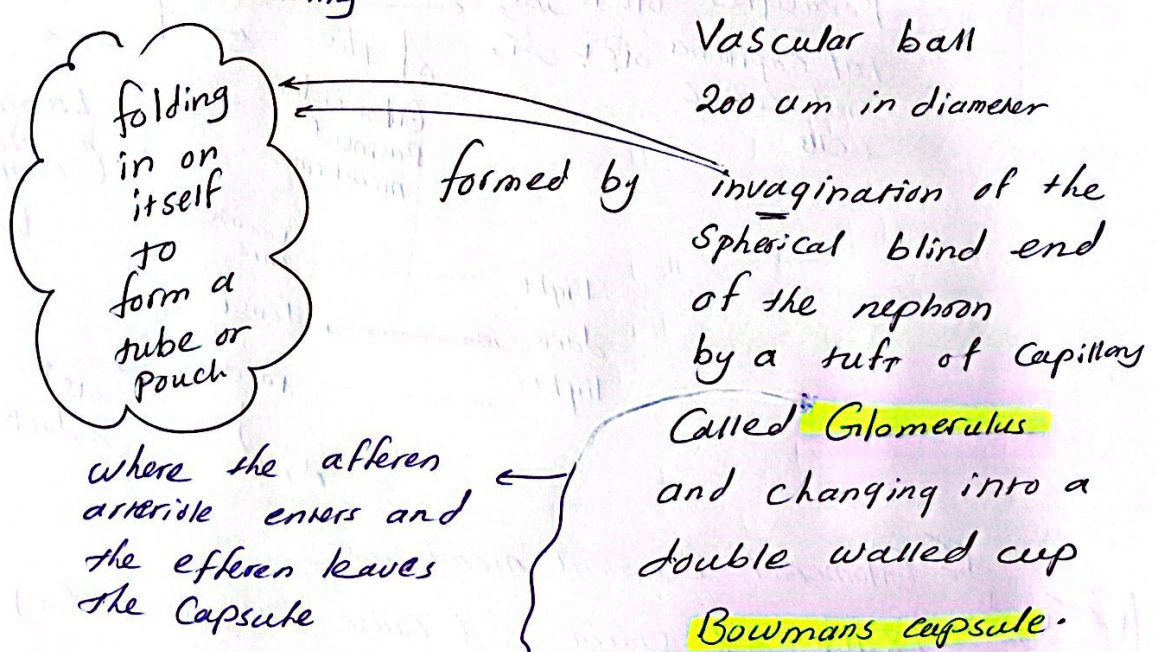
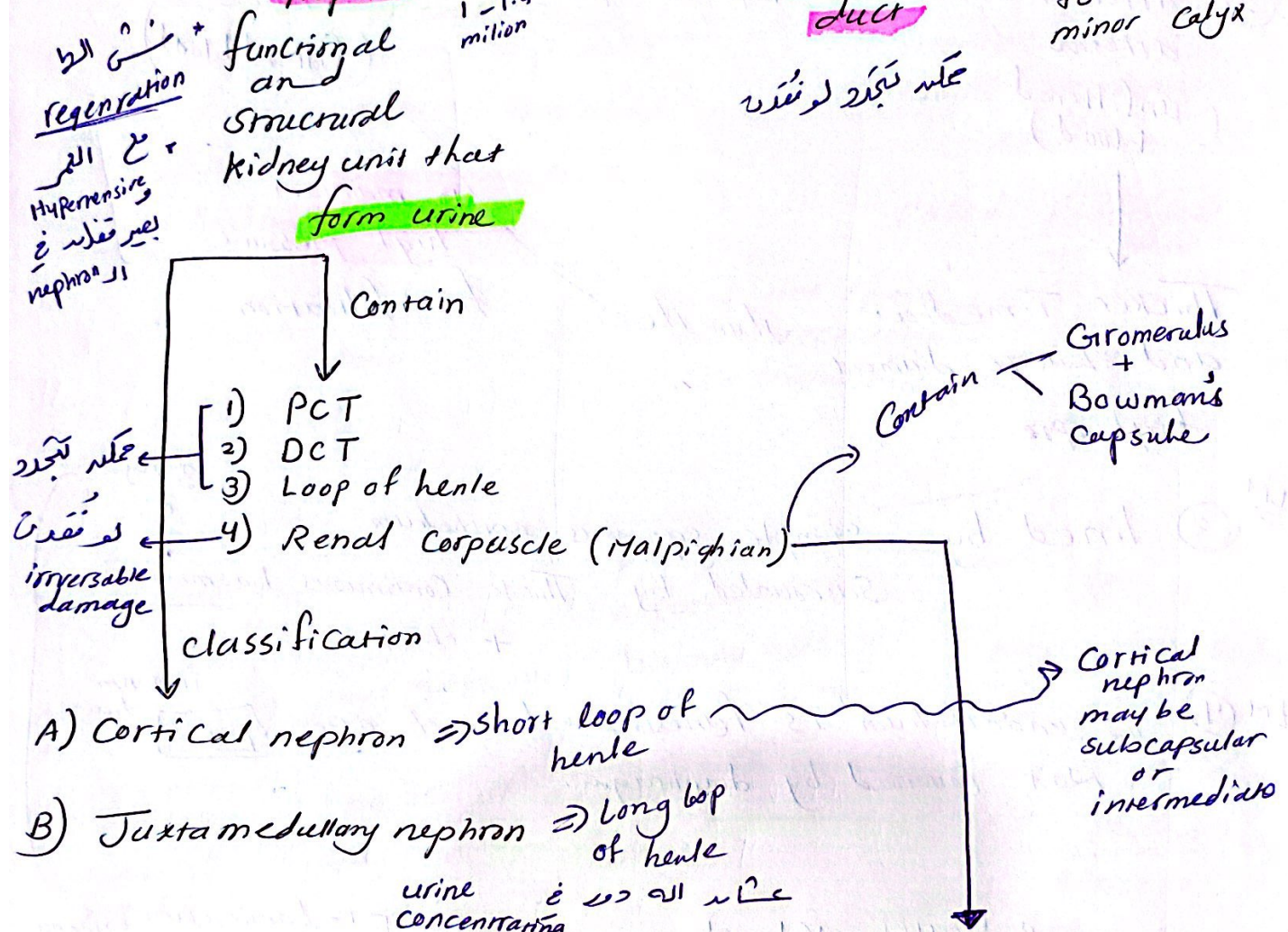
(overlying the
base of
the pyramid)

Renal
Lobule

Part of
renal Lobe
Contain
Single collecting
duct and
all nephrons that
it drains

are demarcated
by the interlobular
artery

uriniferous tubule
 embryology B + A
 functional and structural kidney unit that form urine
 1-1.4 million
 Collecting duct
 Concentrates and carries urine to minor calyx



So it has 2 poles $\leftarrow$ vascular $\rightarrow$ urinary $\rightarrow$ that continuous with PCT

Glomerulus

① Vascular pole of renal corpuscles.

② Afferent arterial (unfiltered blood) → tuft of capillary → efferent arteriole (filtered blood) ^{carry outside the nephron}

Thicker T-media. and Large diameter ^{than the} to maintain high pressure for filtration

LM ③ lined by simple squamous epithelium surrounded by thick continuous basement mem + charge. ^{3 layers}

EM ④ The endothelium is fenestrated with open spores ^{100 nm diam} Not covered by diaphragm.

Podocytes ^{واحد با كس} of the Glomerular Basement membrane ^{مرفر با كس}
 tuft capillaries endothelial cells

1- Lamina rara externa
 2- " " interna
 3- Lamina densa. (electron-dense central layer between 1-2)

Light ——— Lamina rara
 dark ——— densa
 light ——— rara

1 light
 2 dark

EM Glomerular Basement membrane
 (H and E stain) (cause it is very thin)
 special stain as PAS
 = Periodic acid-schiff stain

Bowmans Capsule

Continuous Layers

Separated by

Bowman's Space

Outer Parietal

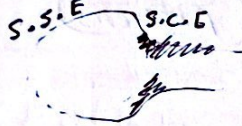
inner visceral

lined by Flat cells
Simple Squamous epithelium
Continuous with simple cuboidal epithelium of PCT

modified Simple Squamous epithelium

Called Podocytes

urine or capsular space collecting space and receive glomerular filtrate



its cytoplasm

- Contain 1 free ribosome
- 2 SER
- 3 Mitochondrion
- 4 prominent golgi complex

+ 5 Microfilament processes (contractile capacity)

Podocyte cell separated from basement membrane by subpodocyte space

major of adjacent leave a gap between them

Have a cell body from which arise several Long primary (Major) processes

Pedicles = Secondary (minor)

embrace a portion of glomerular capillary

Called

Filtration slit covered by diaphragm

Filtration slit diaphragm

Zipper-like sheet struc formed by trans membran protein nephron.

central dense bar Pores on both sides.

Function of podocyte.

involved in blood renal barrier

Renewal of basement membrane of glomerular capillary

لبنی
لورانی
100 M
بنی
RBCs
WBCs
منی

Glomerular basement membrane is Collagen type 4 → network عاتد
بشیع، خنوع له 30 نانو

Blood - Renal Barrier

$$= \underline{\underline{GFB}}$$

separate blood inside the glomerular capillary from the glomerular filtrate inside Bowman's Capsule $\Rightarrow$ through which blood fil-

blood filtration
occur

3 Layers

- ① Fenestrated endothelial cells of glomerular capillary filtration selectivity depends on size. ^{MW}
allow passage molecules smaller than blood cells + platelets (proteins)

between
Podocytes
and
capillaries
there's a
basement
membrane

and the capillary
endothelial
has a basement
membrane
↓
They fused
and form
GBM

2. Glomerular Basement membrane (GBM)

The only Continuous + effective

filtrate depends on size MW charge

Laminar flow - charge

So $x = -$
 $\checkmark +$

prevent
 > 11600 D
 as priors

How
Small
molecules?

A.A
Simple Sugars

- ③ Filtration slit diaphragm

selectivity depends on

MW $\rightarrow$ Low MW < 400000

M charge $\rightarrow$ $\begin{matrix} X - \\ \checkmark + \end{matrix}$

secretion

Collagen
Fibronectin
Chondroitin sulphate
mesangial matrix.
- Supportive for

DM or nephritis → allow passage of album → albuminuria.
BM renewal → due to the barrier disruption.

due to the
Barrier disrupts.

2- Contractile
3- phagocytic
between
function
blood flow
regulation
Mes

Mesangial cells

between
endothelial
lining and
phagocytes
foreign or
residues
leaves

regulation

Mesangial cells

Stellate shaped cells + Multiple process.
have small darkly stained nuclei + basophilic cytoplasm
rich in lysosomes.

during
BM removal

Lacis cells = extraglomerular

located at vascular pole

Part of
Taxitaglone
apparatus

2 types

intraglomerular

located in renal
Corpuscle in between
the glomerular capillary

Podocytes اور بننے کی
Capillaries اور

Difference between proximal and distal convoluted tubules

	2. Proximal convoluted tubule	3. Distal convoluted tubule
Shape and size	✓ More convoluted. ✓ Longer (15mm). ✓ Larger diameter (60um). ✓ Very narrow lumen.	✓ Less convoluted. ✓ Shorter (5mm). ✓ Smaller diameter (40um). ✓ Wider lumen.
Site: start end	✓ Urinary pole of renal corpuscle. ✓ The beginning of descending limb of loop of Henle.	✓ Start at ascending loop of Henle. ✓ Ends by collecting tubules.
L.M of lining epithelium	✓ 3-5 cell in cross section. ✓ High cuboidal (pyramidal). ✓ Ill defined cell boundaries. ✓ Apical brush border. ✓ Basal acidophilic striations.	✓ 5-8, up to 20 in macula densa. ✓ Cuboidal cell (wide lumen). ✓ Clear cell boundaries. ✓ Less apparent. ✓ Less basal striations.

	✓ Cytoplasm is deeply acidophilic and granular. ✓ Nuclei are rounded and basal.	✓ Cytoplasm is less acidophilic and less granular. ✓ Nuclei are rounded and central.
EM of cells: Apical surface	Has microvilli : Many, long brush border	Few short
Lateral surface	Has interdigitation: Extensive indistinct cell boundaries	Less apparent and clear cell boundaries
Basal surface	Show parallel striation due to: Basal infoldings active ion transport Parallel mitochondria (many)	Less apparent
Function	✓ Active reabsorption of glucose and amino acid. ✓ Reabsorption of Na, Cl, K and H₂O.	✓ Reabsorption of Na and H₂O under the effect of aldosterone and ADH. ✓ Excretion of H₂ and NH₃.

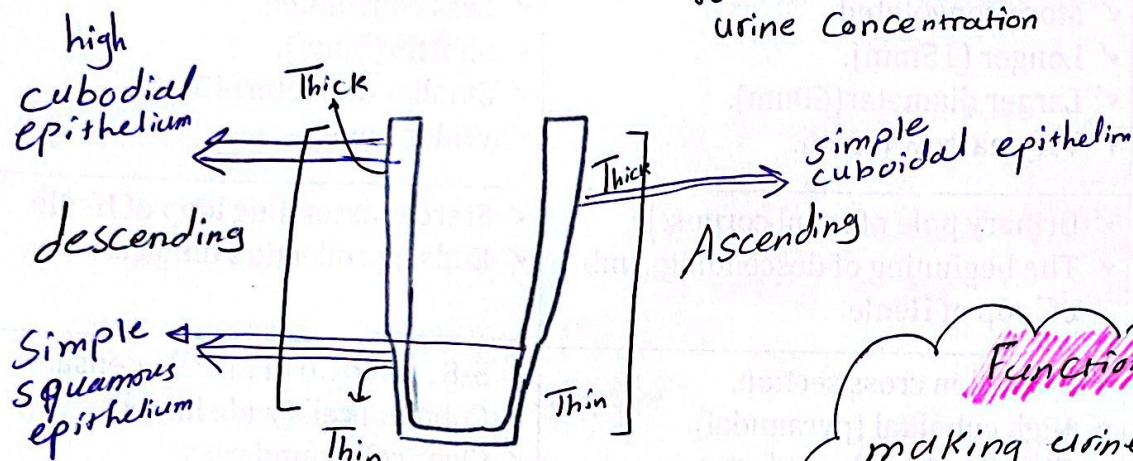
Loop of Henle

- U shaped + Connect $\leftarrow$ PCT with DCT
- In medulla and medullary ray of cortex

Loop of Henle

- Long in Juxtamedullary nephrons
- Short in Cortical nephrons

role in urine Concentration



Function:
making urine hypertonic and conserving water

Collecting tubules.

- They are the excretory portion of uniferous tubules.
- lined with **Simple cuboidal** epithelium. (CT)
- each nephron drains into arched collecting tubule

duct of Bellini
open into the tips
of the medullary pyramid
"Papilla"

open into **Collecting duct** [duct of Bellini] each 6-8

more than 1 cells $\uparrow$ in Cortex $\uparrow$ medullar
Principal cells p cells
regulate Na/water reabsorption and K secretion

- CT or CD contain 2 types of cells $\leftarrow$ Intercalated cells
- Play a role in urine Concentration under the **ADH effect**

As the CD penetrate deeper into medulla their lining epithelial increases the height till they become **Columnar**

Few scattered dark stained in medullary rays

+ K⁺ reabsorption + maintain acid-base balance

Juxta medullary apparatus JGA

Located in Vascular pole of renal corpuscle.

Contain (Macula densa & Juxtaglomerular cells & Extraglomerular mesangial cells)
(JG)

- part of DCT fits between afferent and efferent arteriole with changes

- 1- Length of cells increases → become columnar
- 2- The nuclei of cells become 1. apical
- 3- Golgi complex is basal 2. deeply-stained 3. closely packed] ⇒ by L.M upper macula or dark spot
(infra-nuclear)

- 4- Basement membrane is lost
- So they are in contrast with JG cells

Function: act as osmoreceptors monitor the level of Na in the DCT lumen

extraglomerular mesangial cells

= Lacis cells

= Pole cushions

Small 1
Pale 2

occupy the space bounded 3 by the afferent and efferent arteriole and macula densa.

- x Modified smooth muscle cells
- x present in the T. Media of the adjacent afferent arteriole (sometimes in efferent)

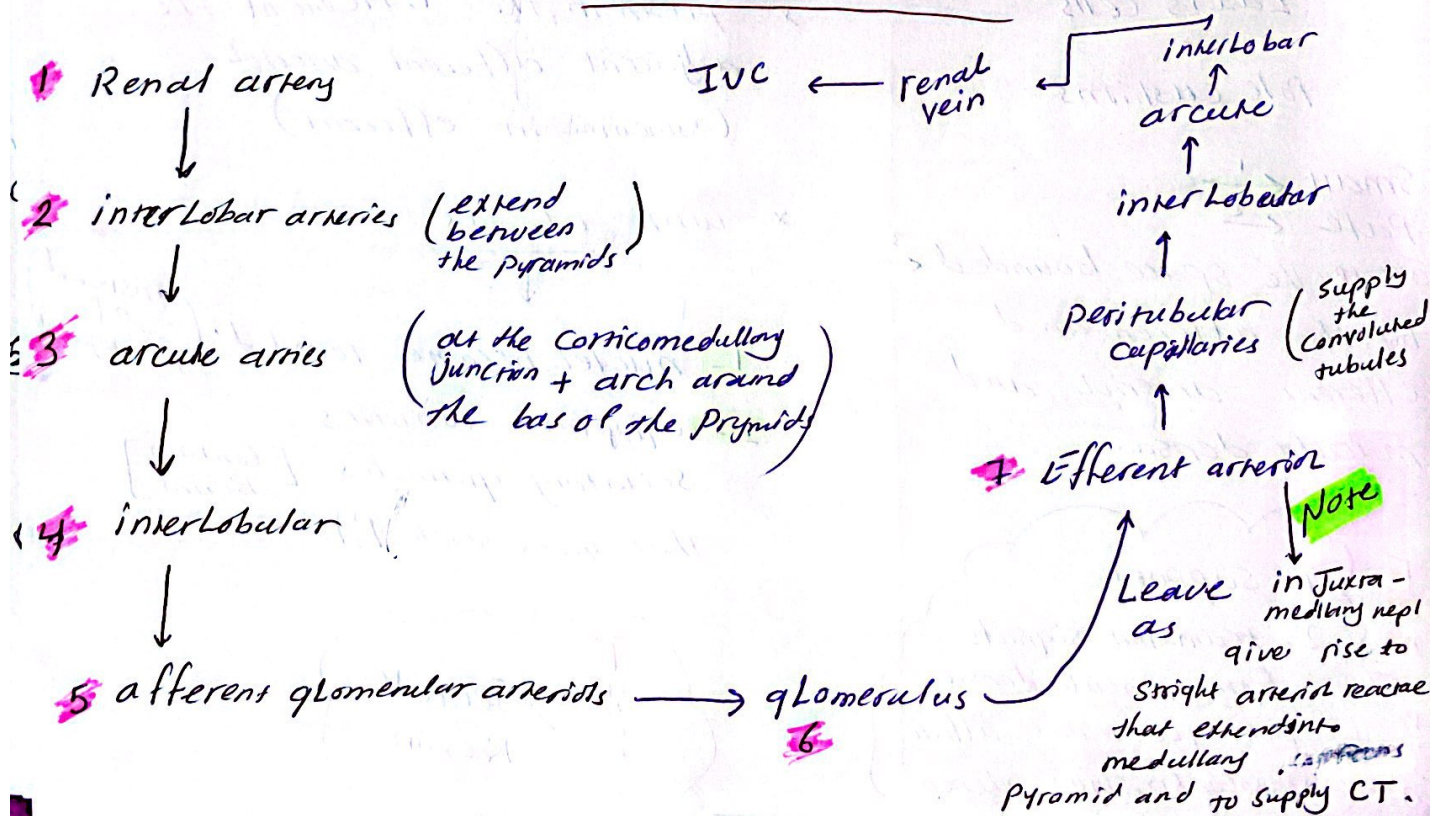
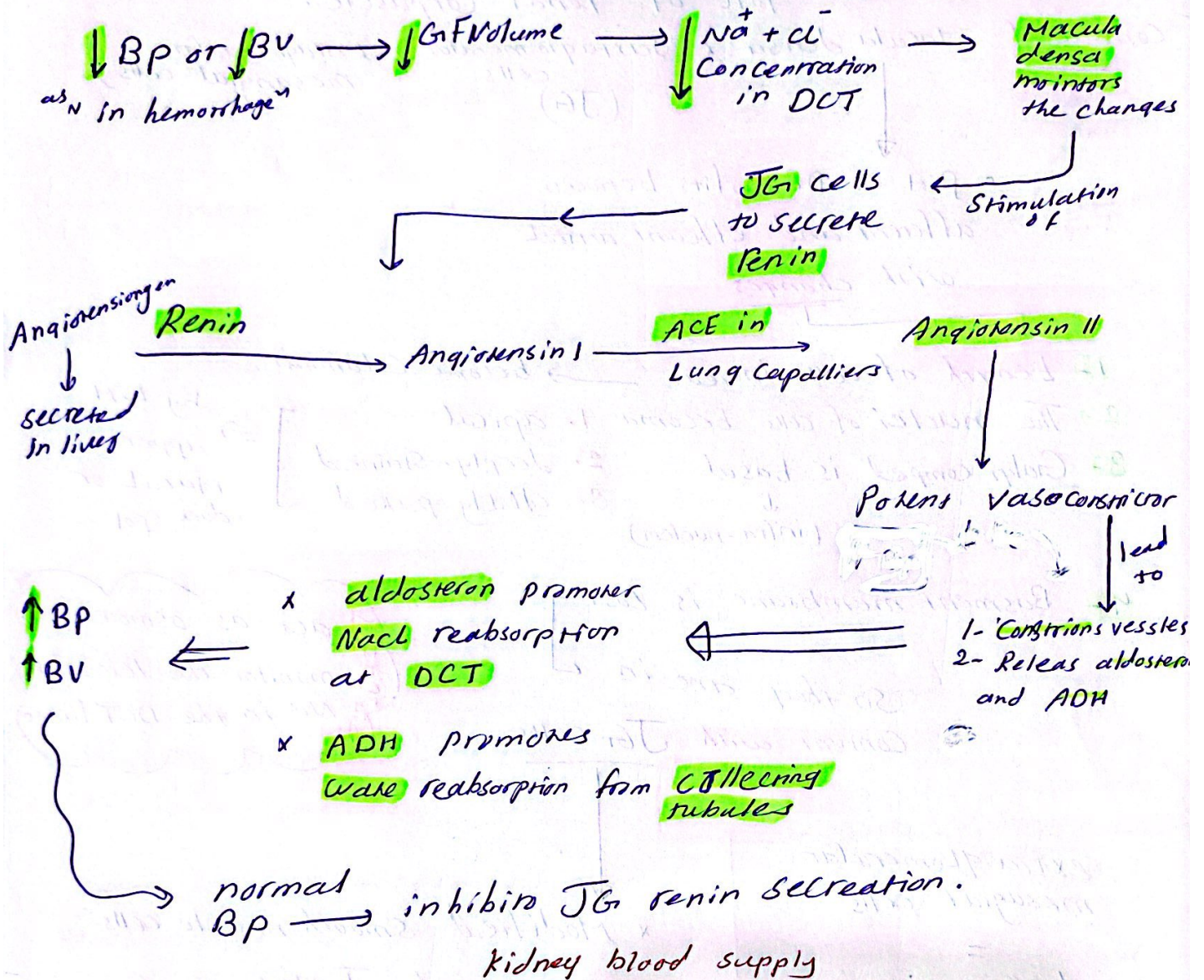
x with changes

- 1- nuclei become rounded (instead of elongated)
- 2- cytoplasm contains secretory granules [contain Renin] that stains with PAS

Function: 1- Support
2- transmit signals from macula densa into glomerulus affect vasoconstriction there

Function: ⇒ Secrete Renin

Functions of JGA $\rightarrow$ regulation GFR and blood pressure by (RAAS)



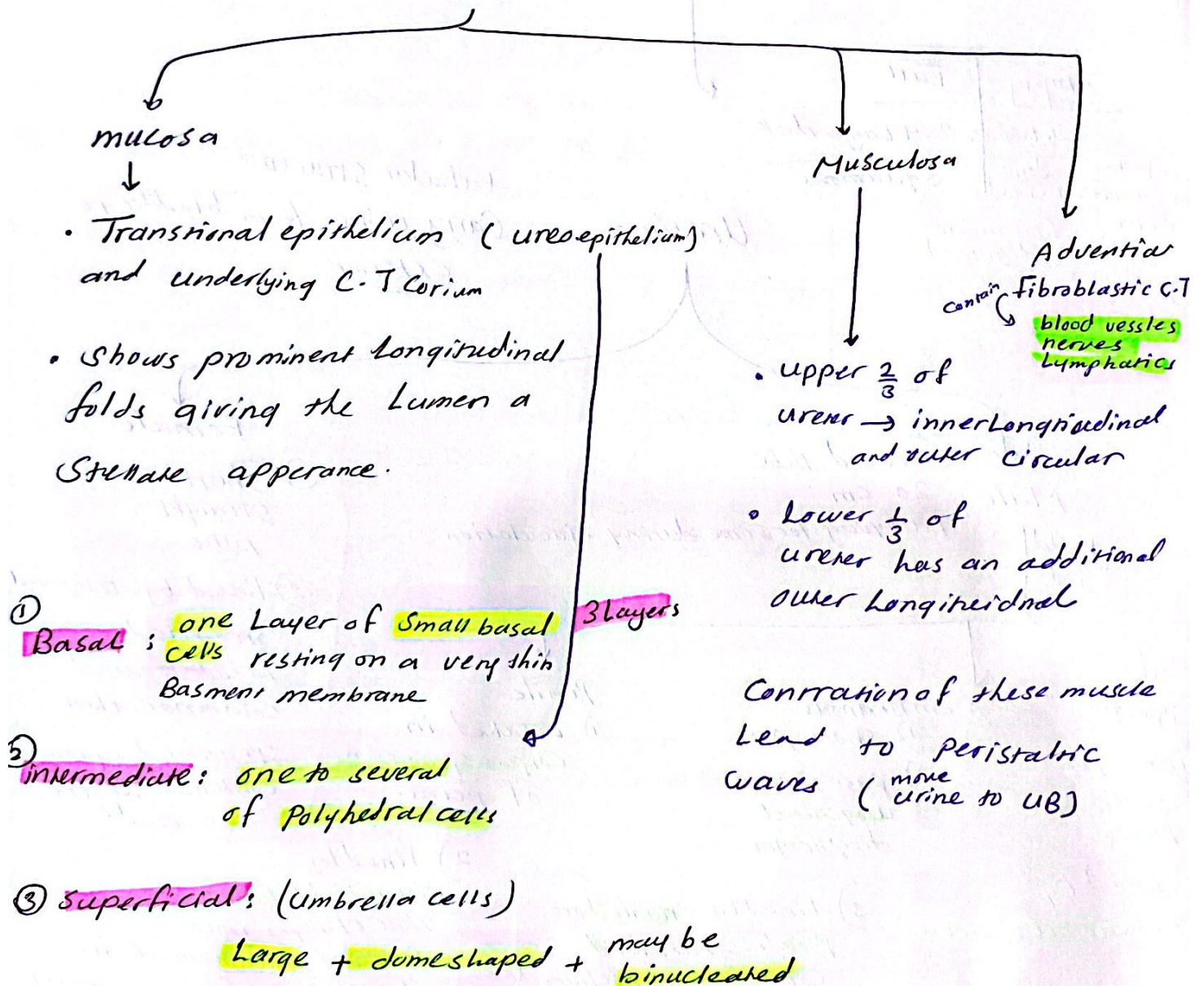
Urinary Passage

- Calyces + renal pelvis + ureter + urinary bladder + urethra. (uB)
- all have a mucosa contain uroepithelia. + Lamina propria of (Transitional epithelium) $\downarrow$ connective (fibroblastic C.T.)
- + muscularis + adventitia.

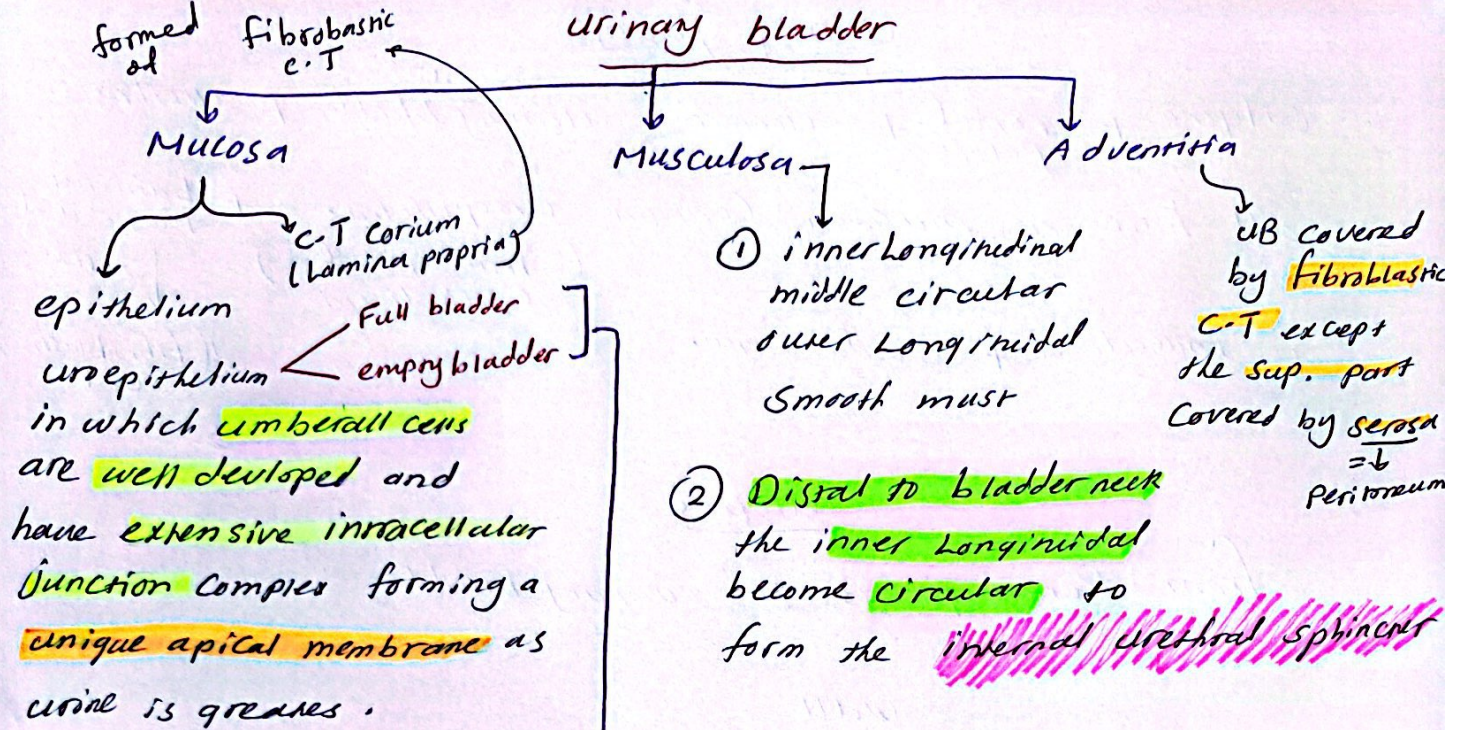
ureters

from Renal pelvis to urinary bladder

Wall



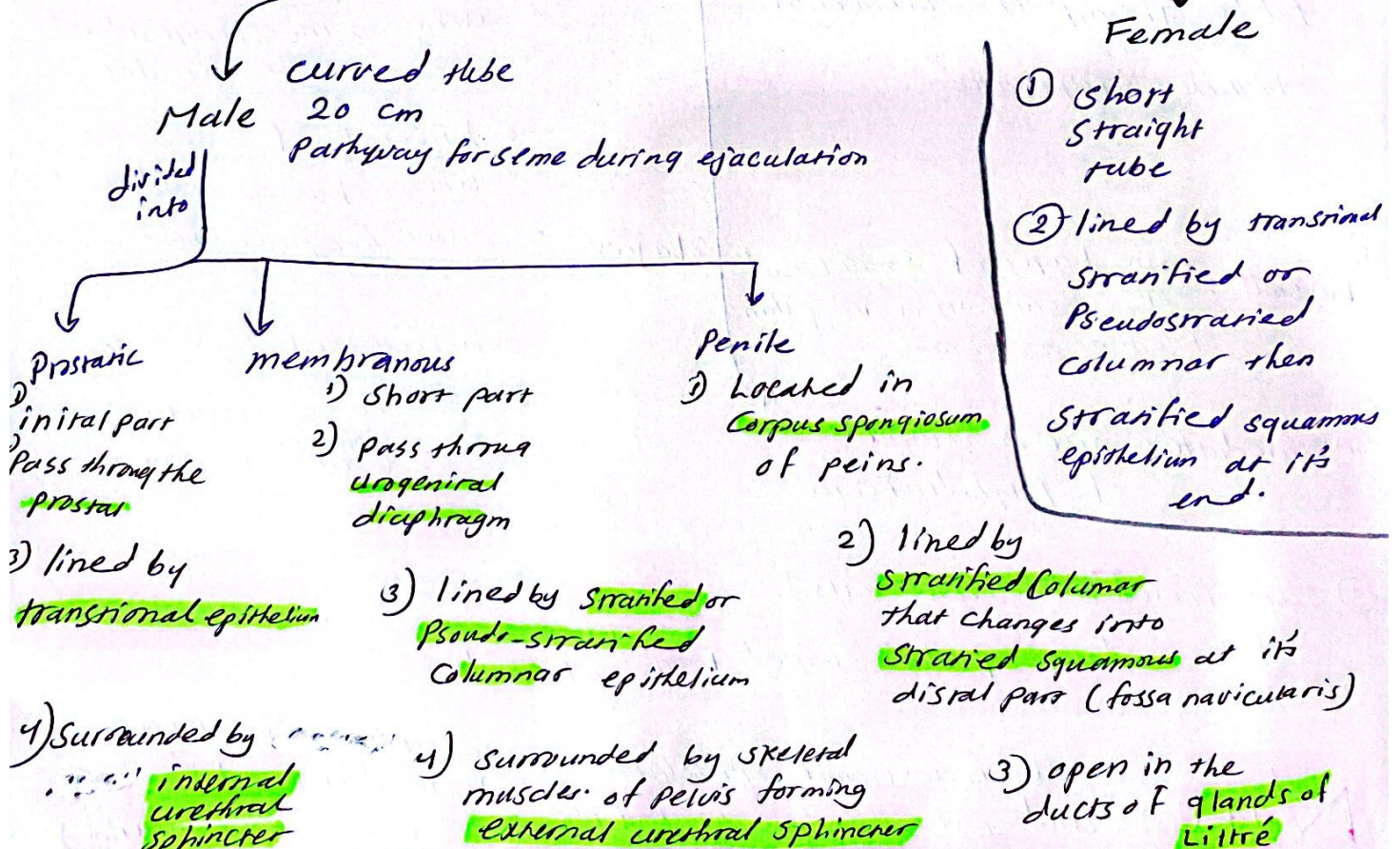
Note: the transitional epithelium and extensive longitudinal folds $\Rightarrow$ allow the ureter to distended (small stones voided in urine)



empty		Full
5-6 Layers		3-4 Layer thick
umbrella of superficial shaped cells (100 um in diameter)		Squamous

Urethra

tubular structure
Carry urine from bladder to exterior



صنفة 1

• Tumor in medulla and not in cortex may be the in the CD

صنفة 2

• Polycystic kidney disease :
استناد في الجزء الى بربط CD مع ال nephron
فيلتر ال nephron ← filtration لانه ال filtrate
فيه صيرع ؟! فنتيج مع مرور السواء صيركون PKD

• No Juxtamedullary nephron in (Monkeys)
So the urine is diluted

• CD + Loop of henle + PCT + DCT
لواضحة لوضاى بتجد
Renal corpuscle ما بتجد

شلولي فيه
هوان

• efferen → part peritubular surrounds PCT
artery and part is vasa recta surrounds
the Loop of henle then in DCT
it become a vein

* For of Renal corpusle cortex will
be reabsorped

لور من حير reabsorption حيرن المرضي dehydration
↓
حير خلاص دني اعلى ال media
لي hyperosmotic