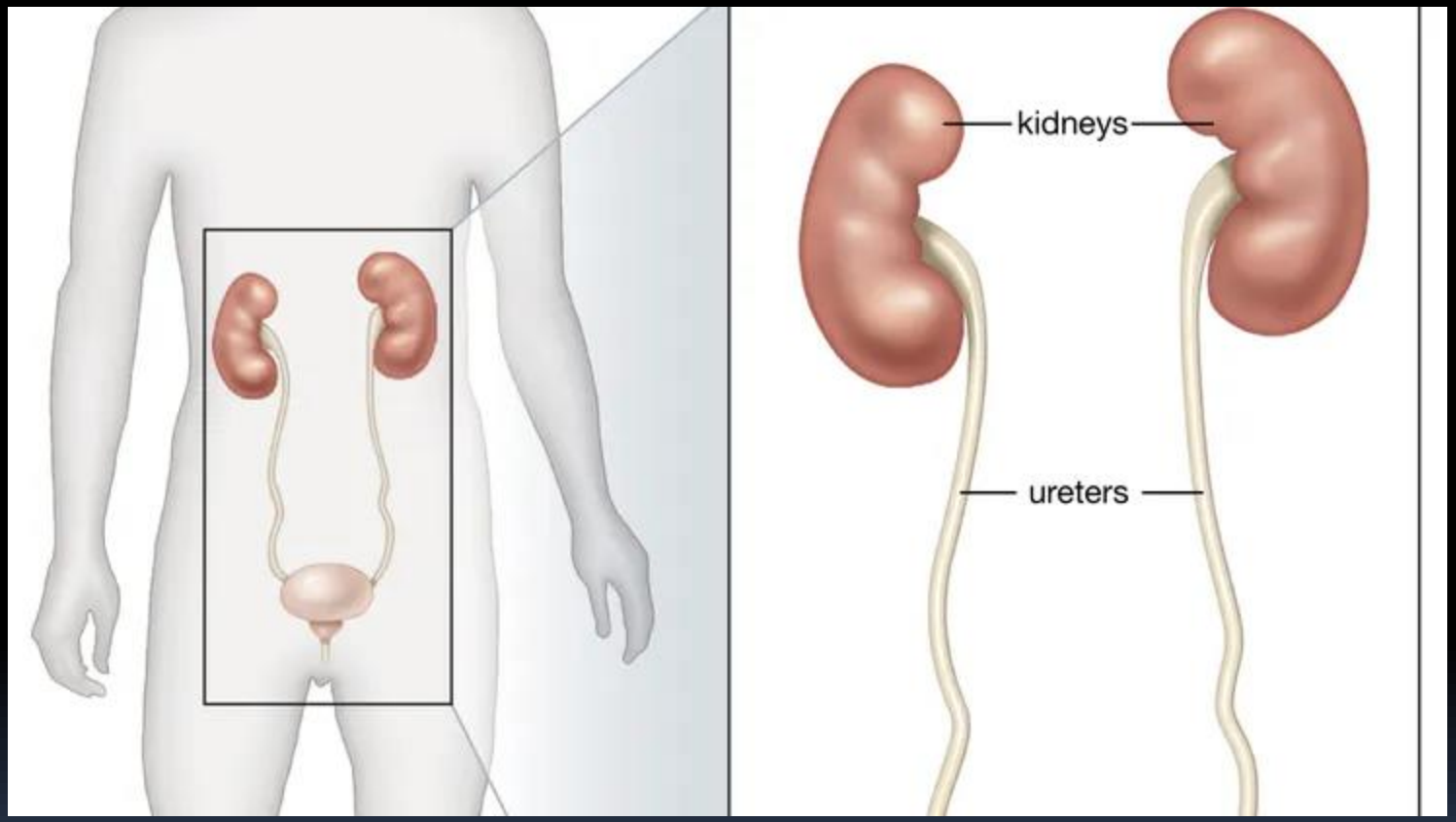
Physiology of Renal System

7th Lecture

2nd Term


kidneys
ureters

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Nephrons

The structural and functional units of the kidneys

Over 1 million

Responsible for forming urine

Consist of renal corpuscle and renal tubule

- **Renal corpuscle composed of a knot of capillaries called the Glomerulus (a.k.a. Bowman's Capsule)**
- **Renal tubule- enlarged, closed, cup-shaped end giving rise to the PCT, dLOH, aLOH, DCT, and CD.**

Glomerulus

A specialized capillary bed fed and drained by arterioles.

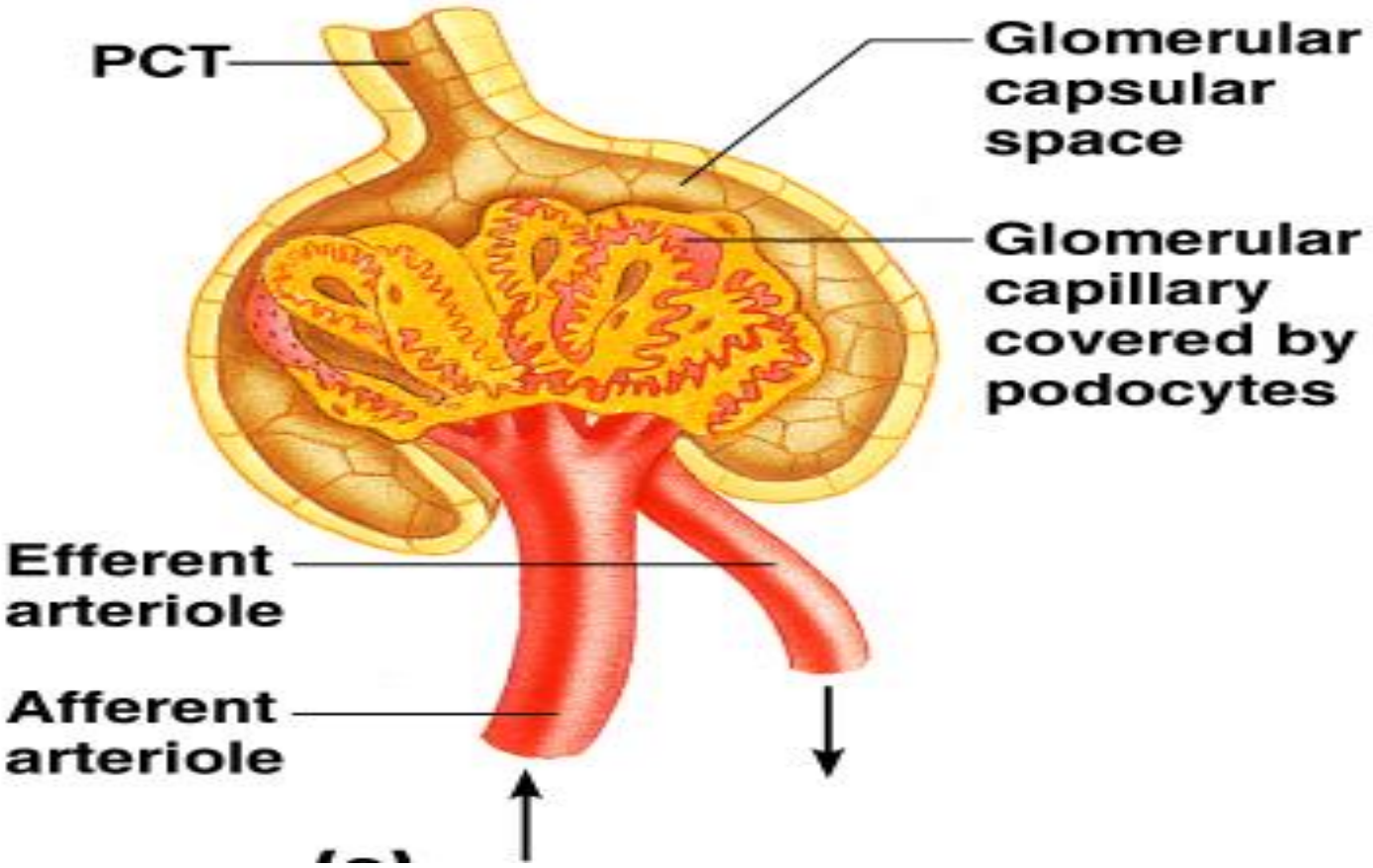
- **Glomerular capillaries filter fluid from the blood into the renal tubule**

GC is attached to arterioles on both sides in order to maintain high pressure

- **Large afferent arteriole-arises from interlobular artery (feeder vessel); large in diameter, high resistance vessels that force fluid & solutes (filtrate) out of the blood into the glomerular capsule.**
  - **99% of the filtrate will be reclaimed by the renal tubule cells and returned to the blood in the peritubular capillary beds(blood vessels surrounding renal tubule)**
- **Narrow efferent arteriole-merges to become the interlobular vein; draining vessel.**

Glomerulus

- Glomerular capillaries are covered with podocytes from the inner (visceral) layer of the glomerular capsule.
  - Podocytes have long, branching processes called pedicels that intertwine with one another and cling to the glomerular capillaries.
  - Filtration slits between the pedicels form a porous membrane around the glomerular capillaries.
- The glomerular capillaries sit within a glomerular capsule (Bowman's capsule)
  - Expansion of renal tubule
  - Receives filtered fluid
  - Renal tubule coils into the PCT, then the dLOH, aLOH, DCT and finally, the CD.
  - Along the PCT, much of the filtrate is reclaimed


PCT
Glomerular capsular space
Glomerular capillary covered by podocytes
Efferent arteriole
Afferent arteriole

Renal Tubule

Glomerular (Bowman's) capsule enlarged beginning of renal tubule

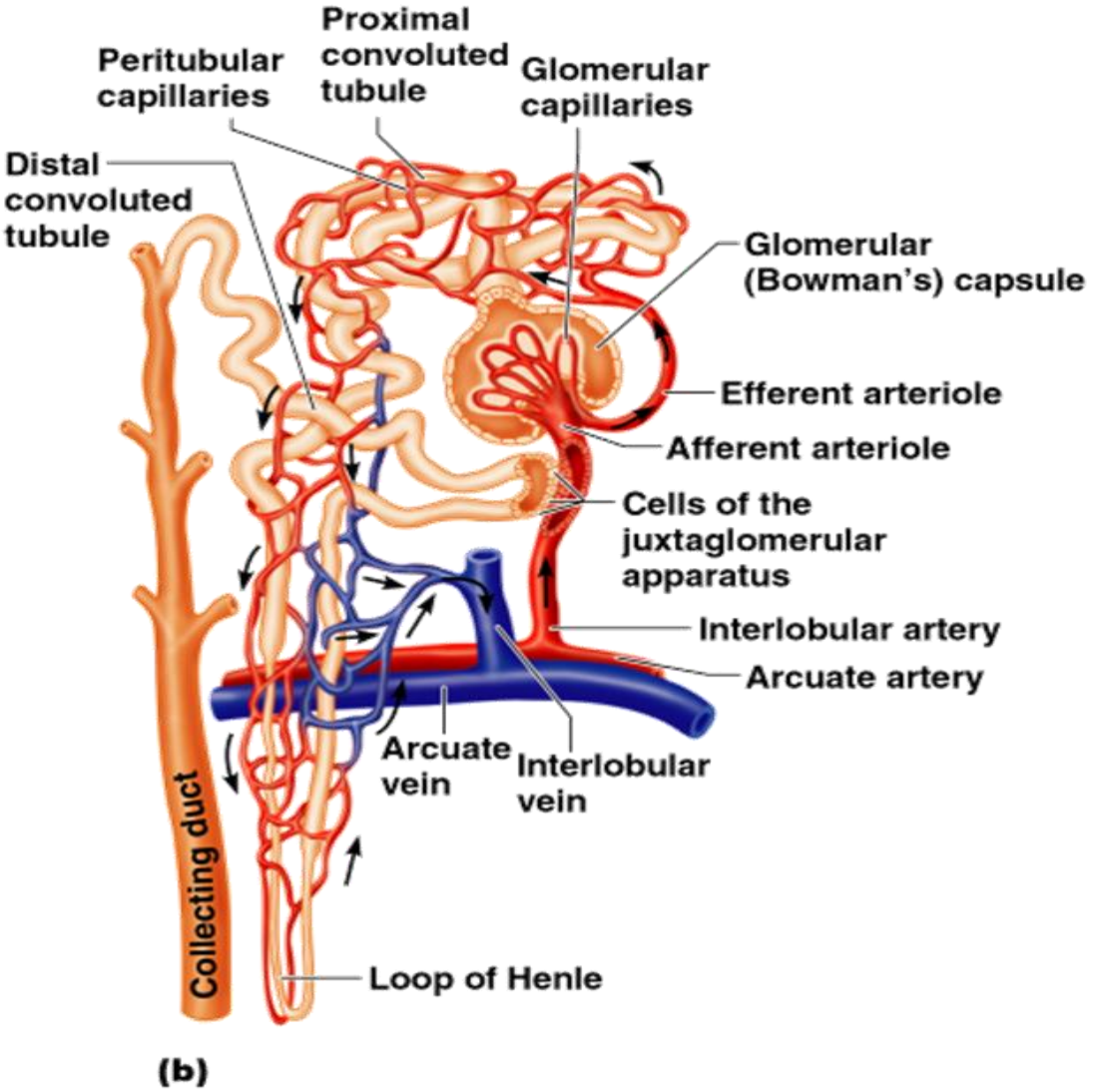
Proximal convoluted tubule- lumen surface (surface exposed to filtrate) is covered with dense microvilli to increase surface area.

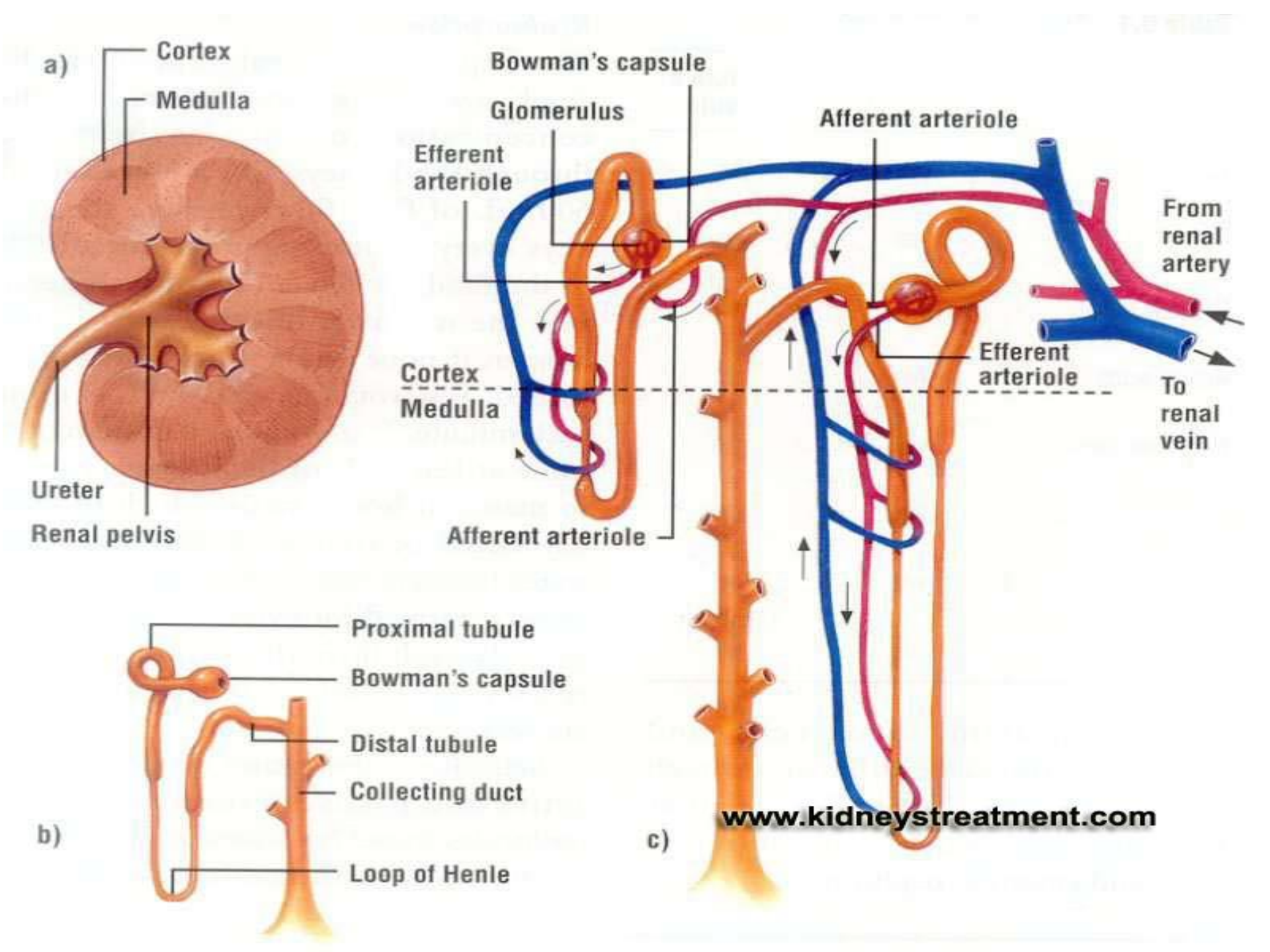
The descending limb of the nephron - Loop of Henle

The ascending limb of the nephron coils tightly again into the distal convoluted tubule

Many DCT's merge in renal cortex to form a collecting duct

- **Collecting ducts not a part of nephron**
- **Collecting ducts receive urine from nephrons and deliver it to the major calyx and renal pelvis.**
- **CD run downward through the medullary pyramids, giving them their striped appearance.**


Proximal convoluted tubule
Peritubular capillaries
Glomerular capillaries
Distal convoluted tubule
Glomerular (Bowman's) capsule
Efferent arteriole
Afferent arteriole
Cells of the juxtaglomerular apparatus
Interlobular artery
Arcuate artery
Arcuate vein
Interlobular vein
Collecting duct
Loop of Henle
(b)


a)
Cortex
Medulla
Ureter
Renal pelvis
Bowman's capsule
Glomerulus
Afferent arteriole
Efferent arteriole
From renal artery
Efferent arteriole
Cortex
Medulla
To renal vein
Afferent arteriole
Proximal tubule
Bowman's capsule
Distal tubule
Collecting duct
Loop of Henle
b)
c)
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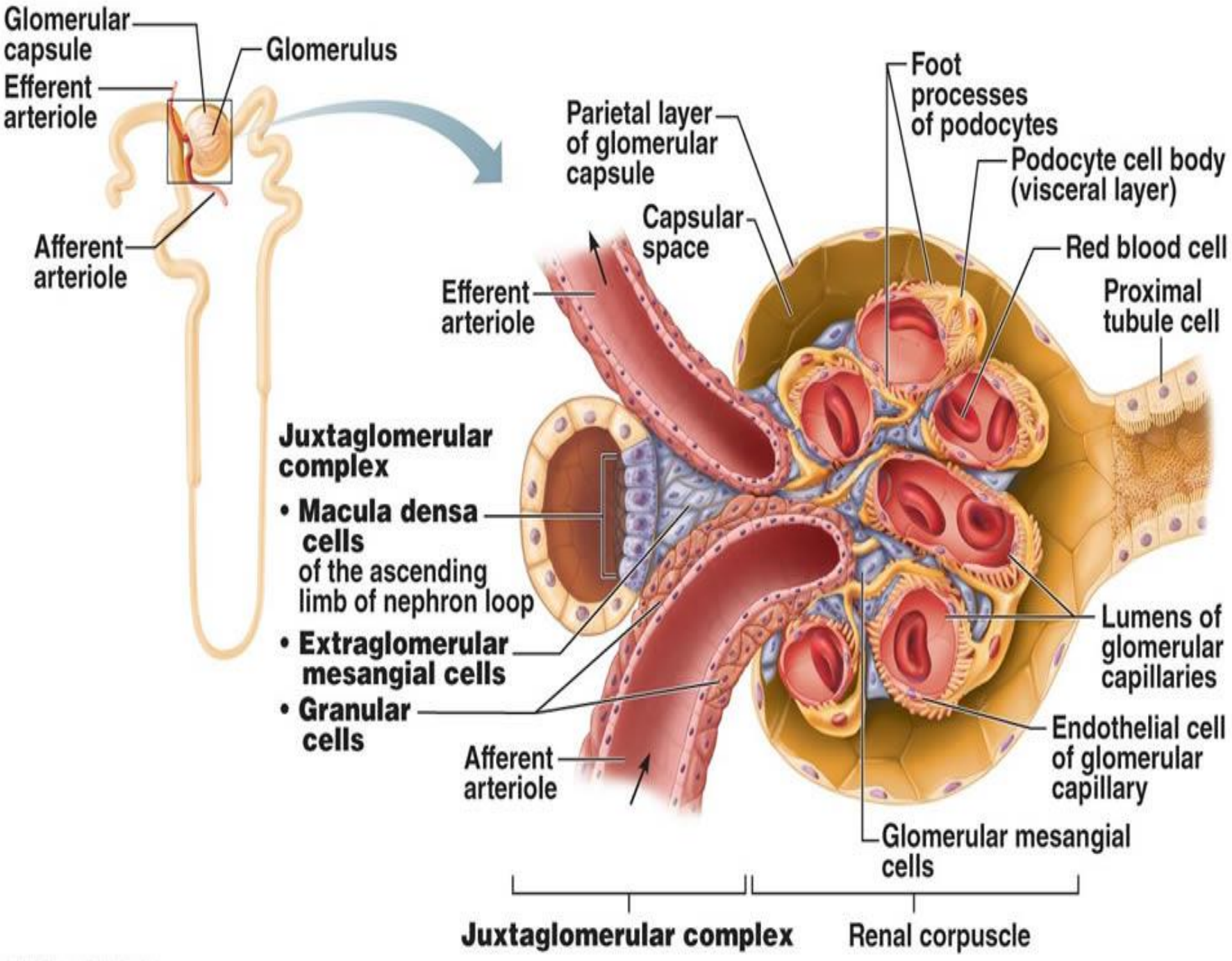
Blood Supply of a Nephron

Peritubular capillary

- Efferent arteriole braches into a second capillary bed
- Blood under low pressure
  - Capillaries adapted for reabsorption instead of filtration.
- Attached to a venule and eventually lead to the interlobular veins to drain blood from the glomerulus
- Cling close to the renal tubule where they receive solutes and water from the renal tubule cells as these substances from the filtrate are reabsorbed into the blood.

Juxtaglomerular apparatus

- At origin of the DCT it contacts afferent and efferent arterioles
- Epithelial cells of DCT narrow and densely packed, called macula densa
- Together with smooth muscle cells, comprise the juxtaglomerular apparatus
  - Control renin secretion & indirectly, aldosterone secretion


Glomerular capsule
Glomerulus
Efferent arteriole
Afferent arteriole
Parietal layer of glomerular capsule
Foot processes of podocytes
Podocyte cell body (visceral layer)
Capsular space
Red blood cell
Efferent arteriole
Proximal tubule cell
Juxtaglomerular complex
• Macula densa cells of the ascending limb of nephron loop
• Extraglomerular mesangial cells
• Granular cells
Lumens of glomerular capillaries
Endothelial cell of glomerular capillary
Afferent arteriole
Glomerular mesangial cells
Juxtaglomerular complex
Renal corpuscle