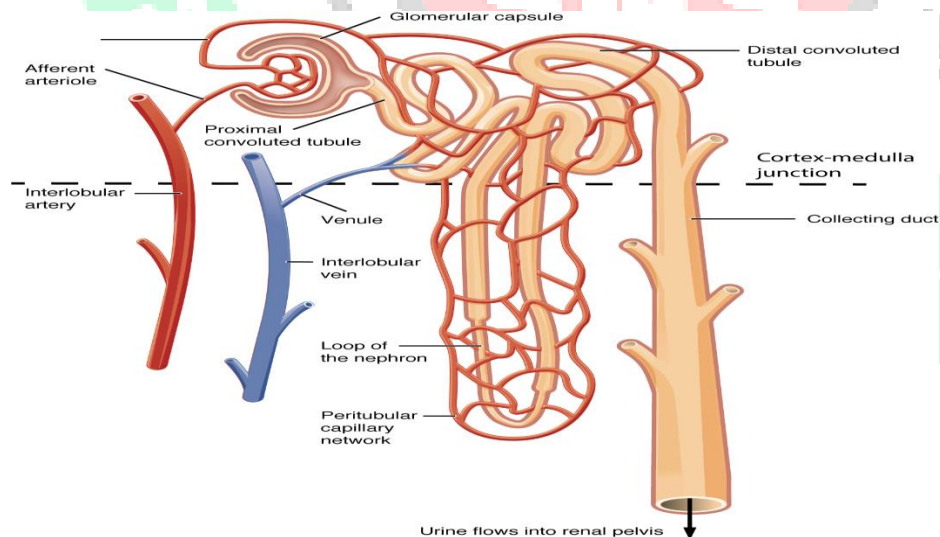


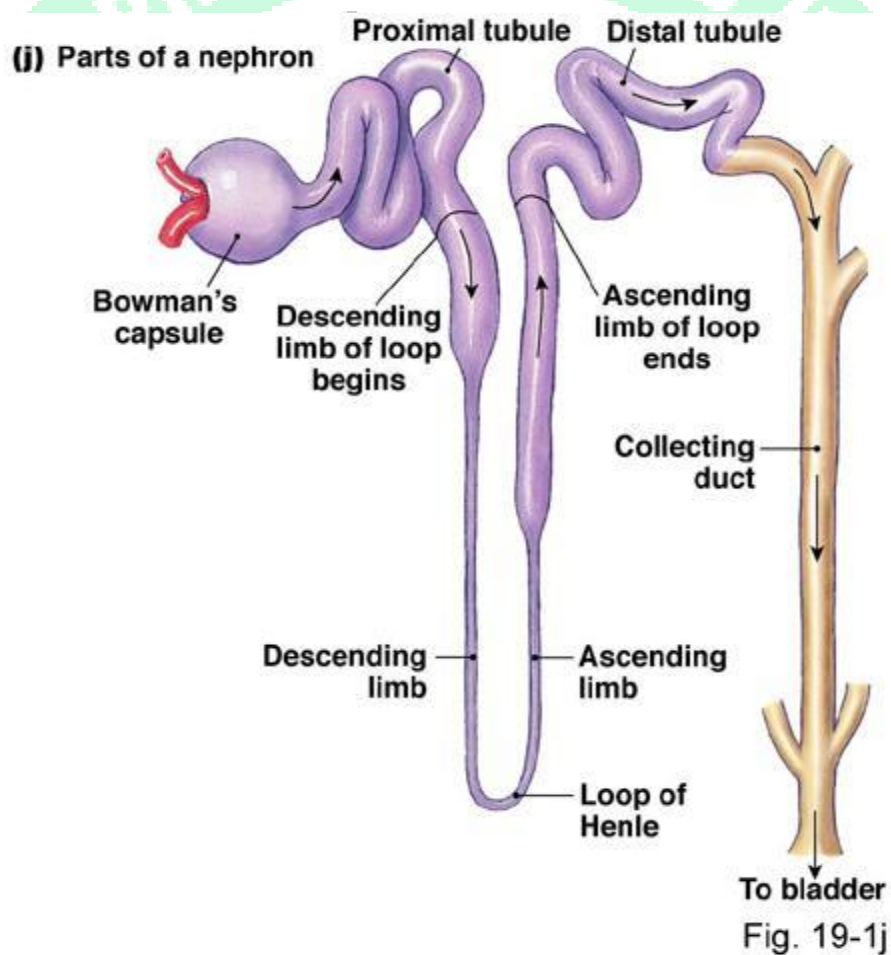
UNIT-3 NEPHRON

- Nephron is defined as the structural and functional unit of kidney.
- Each kidney consists of 1 to 1.3 millions of nephrons.
- Each nephron consists of two parts: a **renal corpuscle** where blood plasma is filtered, and a **renal tubule** into which the filtered fluid passes.
- The two components of a renal corpuscle are the **glomerulus** (capillary network) and the **glomerular (Bowman's) capsule**.
- Capsule is a double-walled cup with a cavity between the two layers that receives filtrate from the capillaries.
- In the order that fluid (filtrate) passes through them, the renal tubule consists of a
 - (1) **Proximal convoluted tubule (PCT)**
 - (2) **Nephron loop** (*loop of Henle*), and
 - (3) **Distal convoluted tubule (DCT)**.



- The distal convoluted tubules of several nephrons empty into a single **collecting duct**.

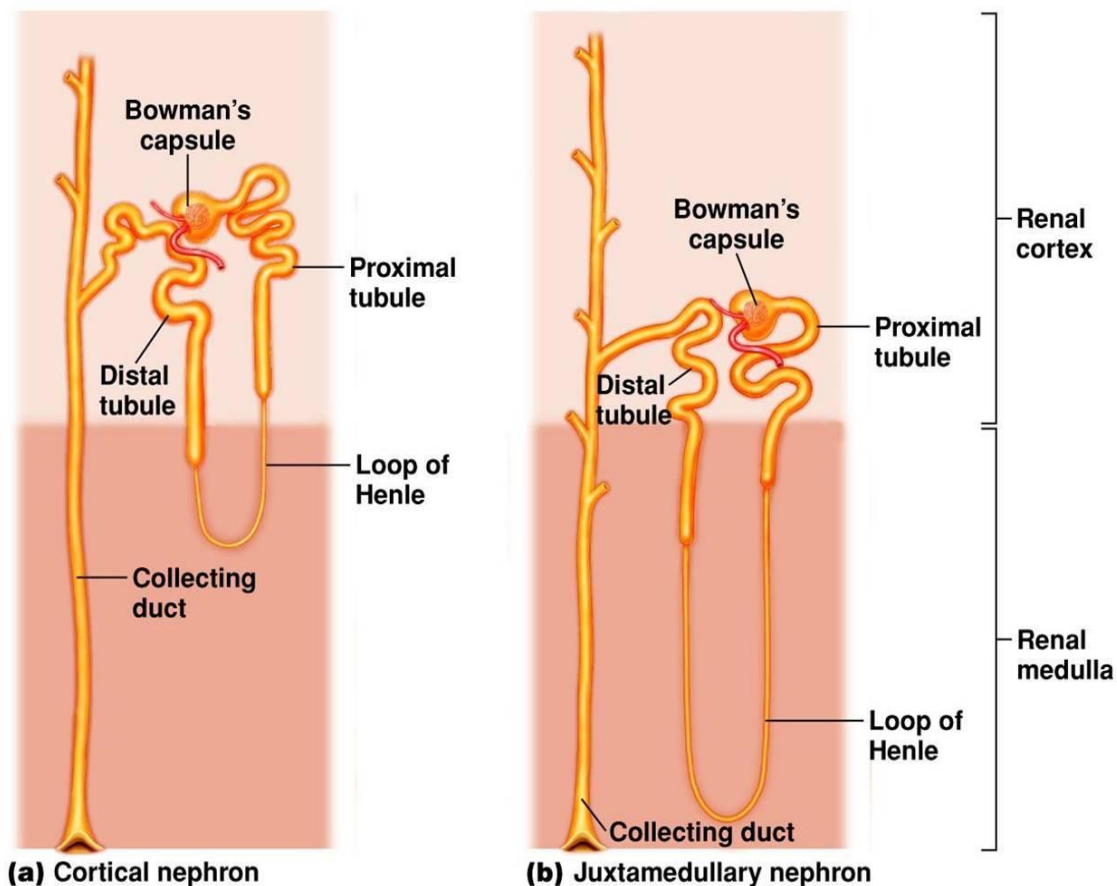
- Collecting ducts then unite and converge until eventually there are only several hundred large **papillary ducts**, which drain into the minor calyces.
- In a nephron, the nephron loop connects the proximal and distal convoluted tubules.
- The first part of the **nephron loop** dips into the renal medulla, where it is called the **descending limb of the nephron loop**.
- It then makes that hairpin turn and returns to the renal cortex as the **ascending limb of the nephron loop**.



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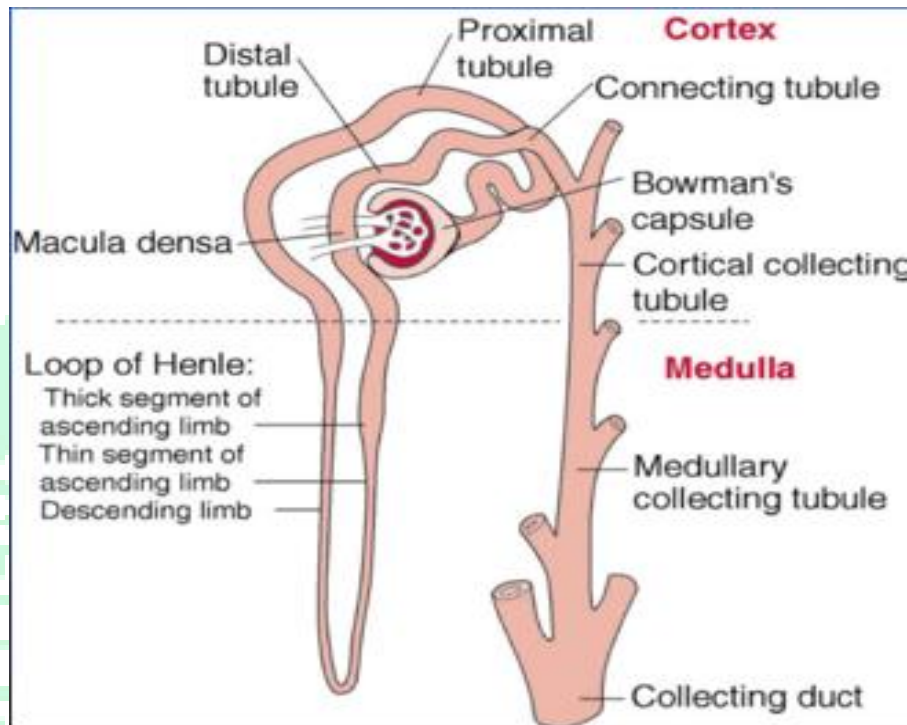
- About 80–85 percent of the nephrons are **cortical nephrons**.

- Their renal corpuscles lie in the outer portion of the renal cortex, and they have short nephron loops that lie mainly in the cortex and penetrate only into the outer region of the renal medulla.
- The short nephron loops receive their blood supply from peritubular capillaries that arise from efferent arterioles.
- The other 15–20 percent of the nephrons are **juxtamedullary nephrons**.



- Long loops of Henle receive their blood supply from peritubular capillaries and from the vasa recta that arise from efferent arterioles.
- In addition, in juxtamedullary nephrons the ascending limb of the nephron loop consists of two portions: a **thin ascending limb** followed by a **thick ascending limb**.

- The lumen diameter of the thin ascending limb is the same as in other areas of the renal tubule; it is only the epithelium that is thinner.
- Nephrons with long nephron loops enable the kidneys to excrete very concentrated urine.



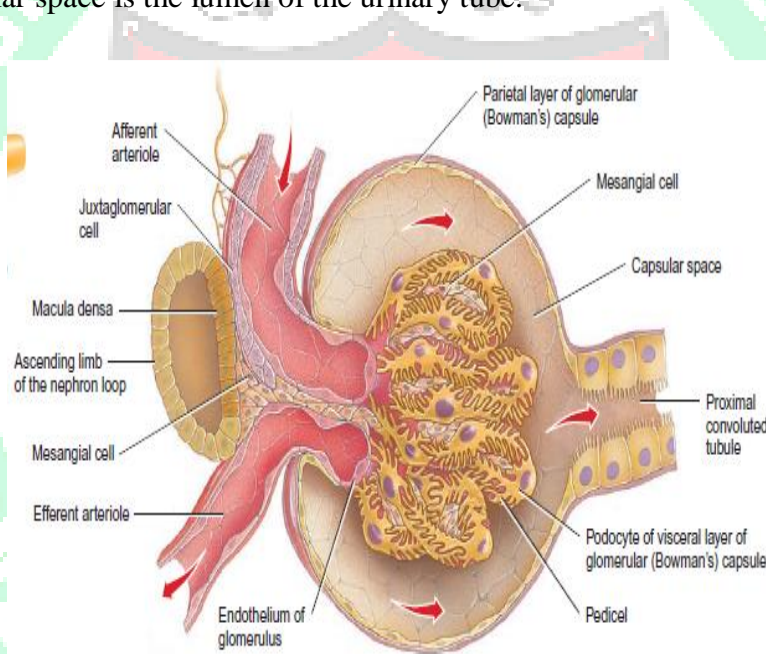
HISTOLOGY OF NEPHRON

- A single layer of epithelial cells forms the entire wall of the glomerular capsule, renal tubule, and ducts.
- Each part, however, has distinctive histological features that reflect its particular functions.
- In the order that fluid flows through them, the parts are **the glomerular capsule, the renal tubule, and the collecting duct.**

GLOMERULAR CAPSULE

- The **glomerular capsule** or Bowman's capsule consists of visceral and parietal layers.

- The visceral layer consists of modified simple squamous epithelial cells called **podocytes**.
- The many foot like projections of these cells (pedicels) wrap around the single endothelial cell layer of the glomerular capillaries and form the inner wall of the capsule.
- The parietal layer of the glomerular capsule consists of simple squamous epithelium and forms the outer wall of the capsule.
- Fluid filtered from the glomerular capillaries enters the space between the two layers of the glomerular capsule called the **capsular space** or Bowman's Space.
- The capsular space is the lumen of the urinary tube.



RENAL TUBULE AND COLLECTING DUCT

- In the proximal convoluted tubule, the cells are simple cuboidal epithelial cells with a prominent brush border of microvilli on their apical surface (surface facing the lumen).
- These microvilli increase the surface area for reabsorption and secretion.
- The descending limb of the nephron loop and the first part of the ascending limb of the nephron loop (the thin ascending limb) are composed of simple squamous epithelium.

- The thick ascending limb of the nephron loop is composed of simple cuboidal to low columnar epithelium.
- In each nephron, the final part of the ascending limb of the nephron loop makes contact with the afferent arteriole serving that renal corpuscle.
- Because the columnar tubule cells in this region are crowded together, they are known as the **macula densa**.
- Alongside the macula densa, the wall of the afferent arteriole (and sometimes the efferent arteriole) contains modified smooth muscle fibers called **juxtaglomerular (JG) cells**.
- Together with the macula densa, they constitute the **juxtaglomerular apparatus (JGA)**.
- The distal convoluted tubule (DCT) begins a short distance past the macula densa.
- In the last part of the DCT and continuing into the collecting ducts, two different types of cells are present.
- Most are **principal cells**, which have receptors for both antidiuretic hormone (ADH) and aldosterone, two hormones that regulate their functions.
- A smaller number are **intercalated cells**, which play a role in the homeostasis of blood pH.
- The collecting ducts drain into large papillary ducts, which are lined by simple columnar epithelium.
- Signs of kidney dysfunction usually do not become apparent until function declines to less than 25 percent of normal because the remaining functional nephrons adapt to handle a larger-than-normal load.