

Urinary System - Structure and Function

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What we'll talk about...

- Structure and function of nephrons
- Filtration barrier in renal corpuscles
- Segments of nephron that reabsorb solutes and water
- Feedback to regulate the filtration rate in individual nephrons

Components of the urinary system.

- Kidney
- Ureter
- Urinary bladder
- Urethra

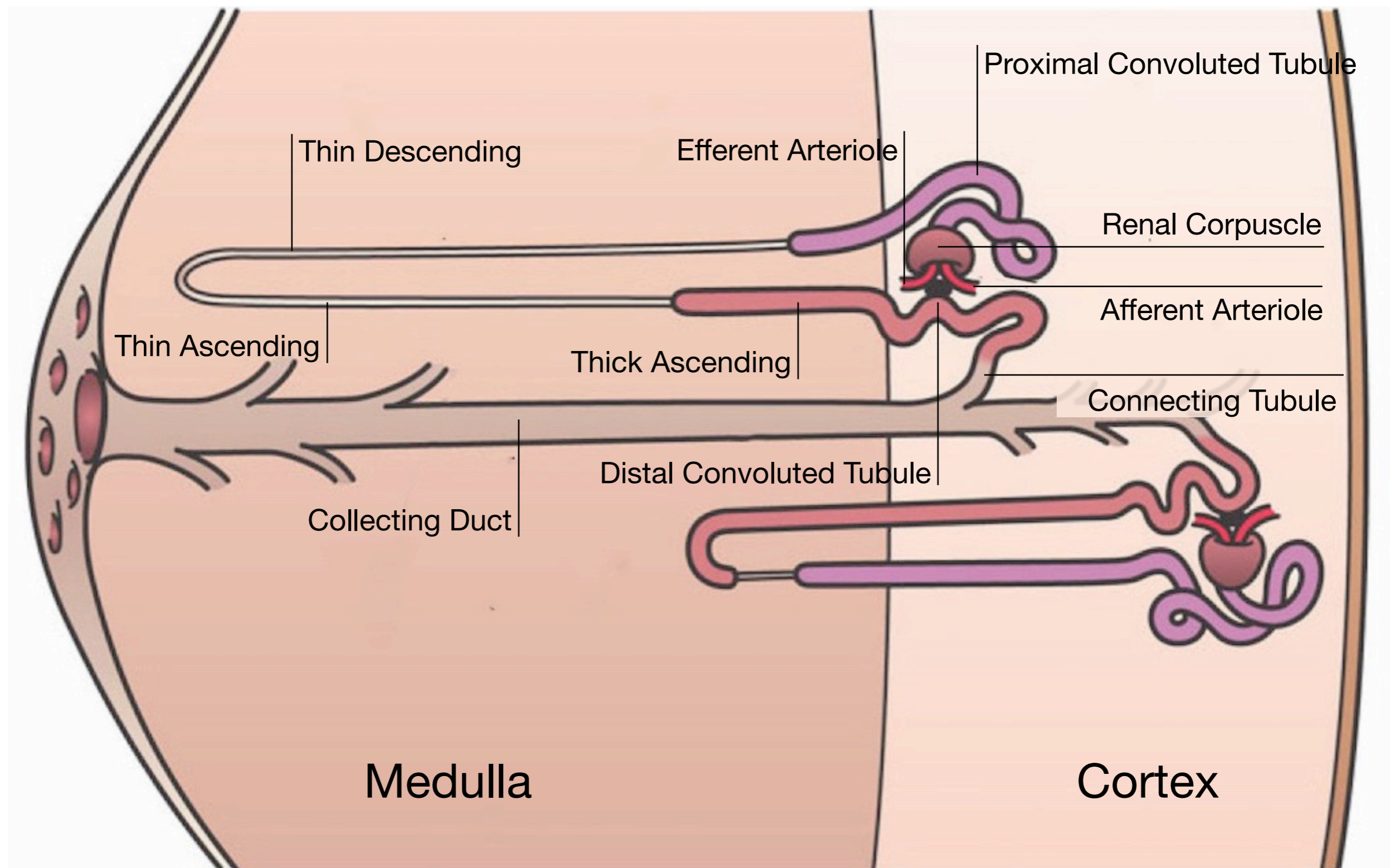
The kidney performs several critical functions.

- Excretion of metabolic waste products
- Water and electrolyte homeostasis
- pH homeostasis
- Renin production
- Vitamin D

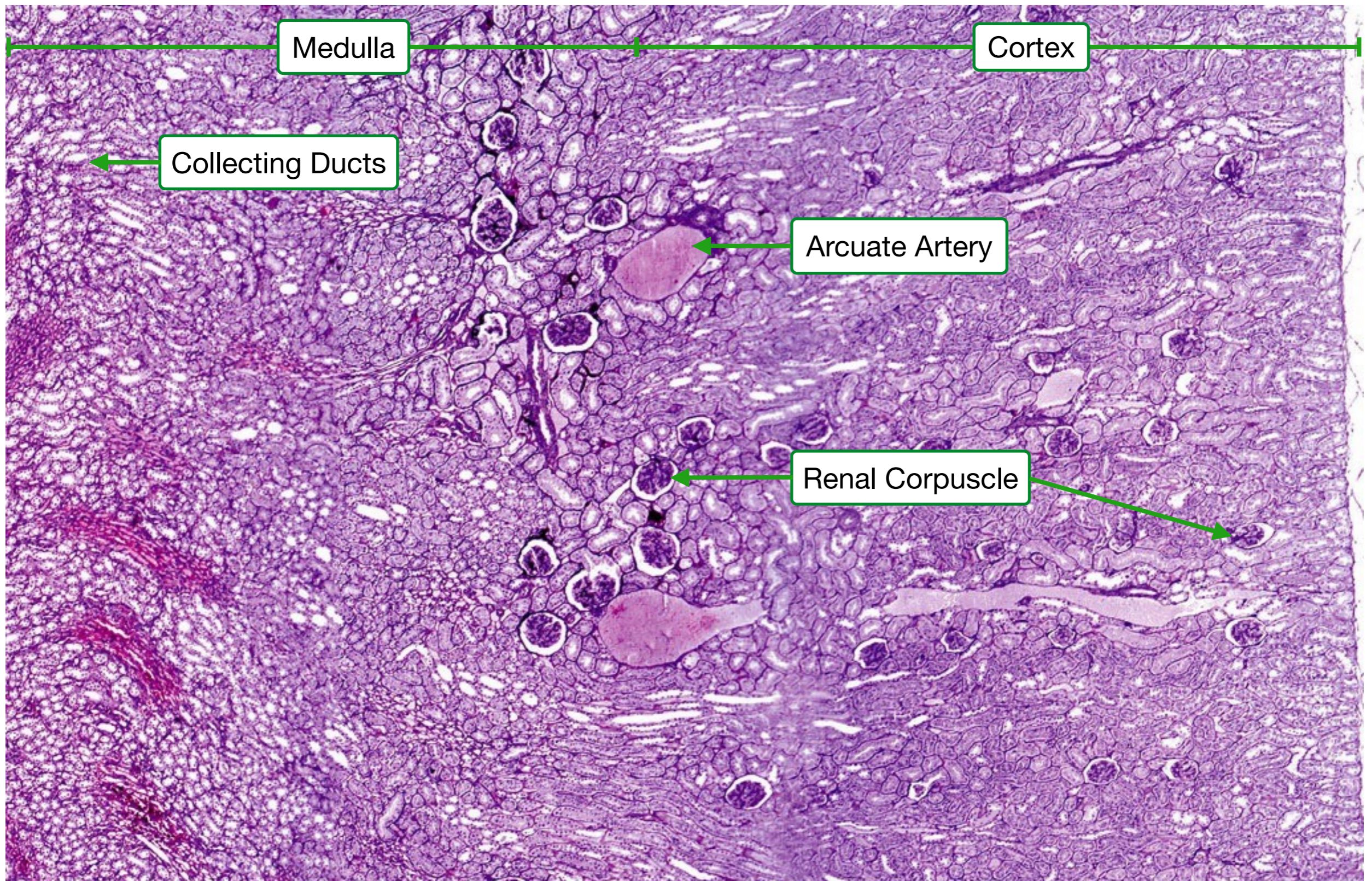
Nephrons filter blood and reabsorb solutes and water.

- Filtration Unit - Renal Corpuscle
 - Capillaries
 - Basement Membrane
 - Epithelium
- Reabsorption - Long Tubule

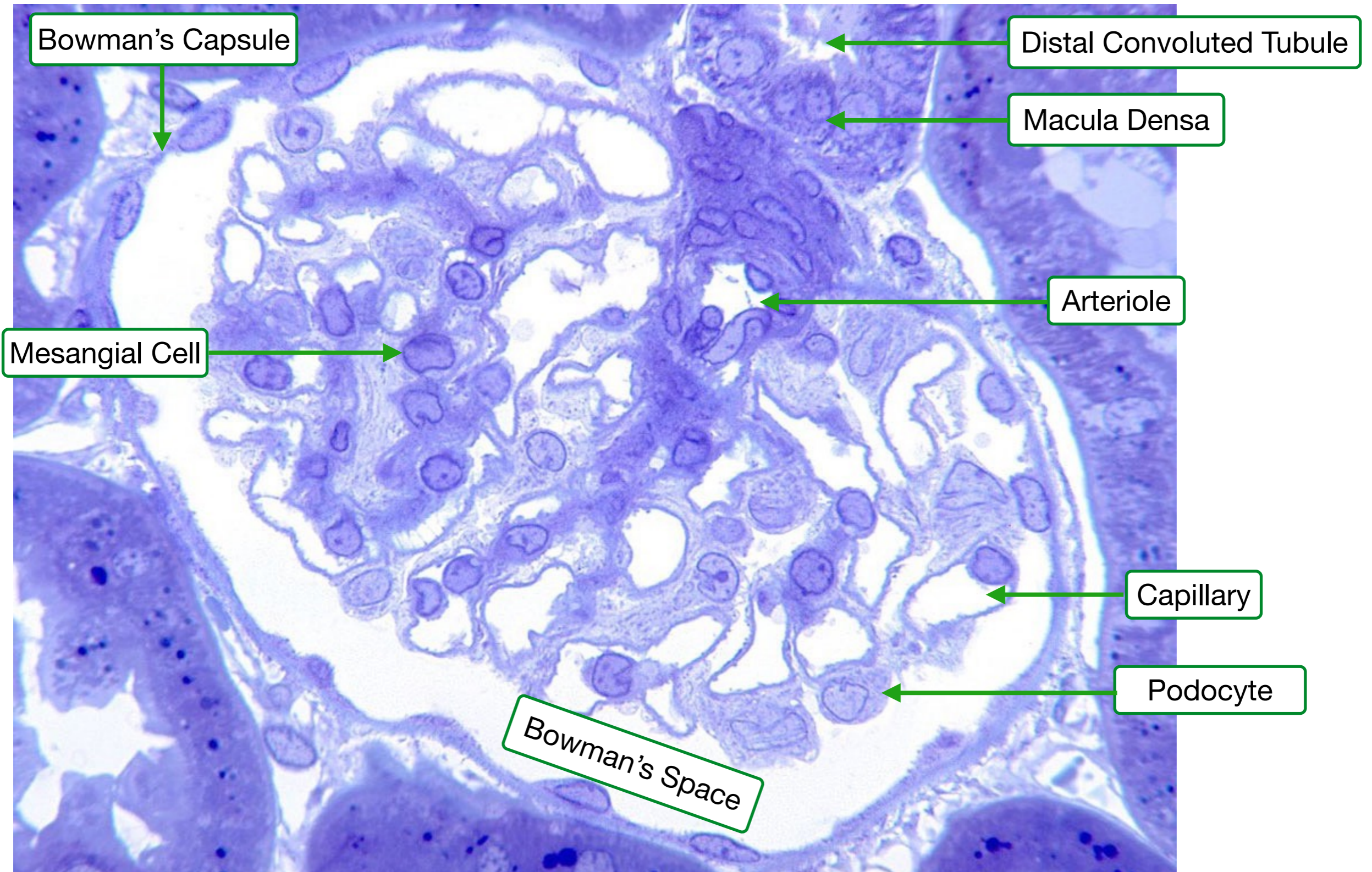
The kidney contains two types of nephrons to filter blood and regulate electrolyte concentration and pH.



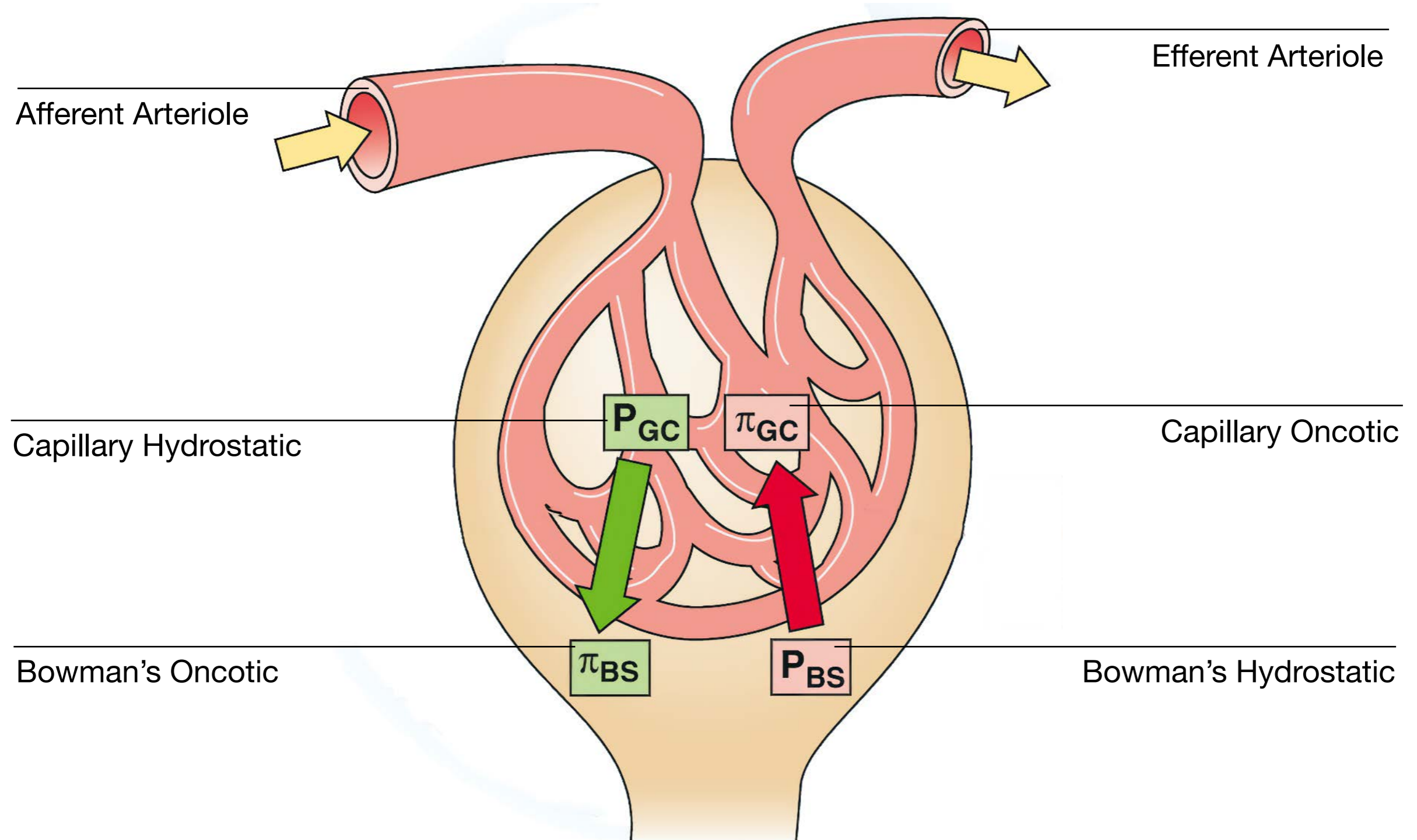
Arcuate arteries define the border between cortex and medulla in the kidney.



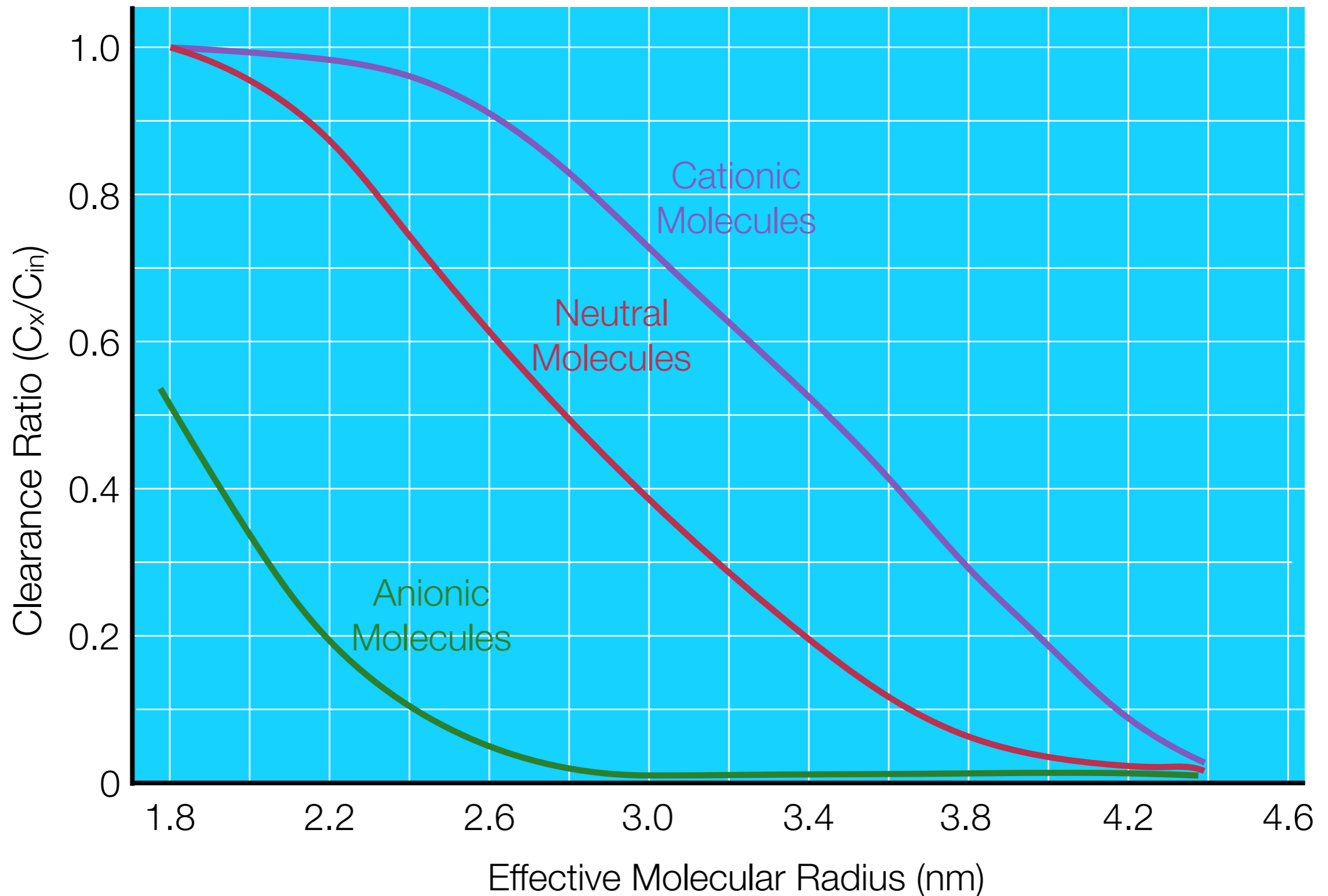
Renal corpuscles filter blood from a tuft of capillaries into Bowman's space.



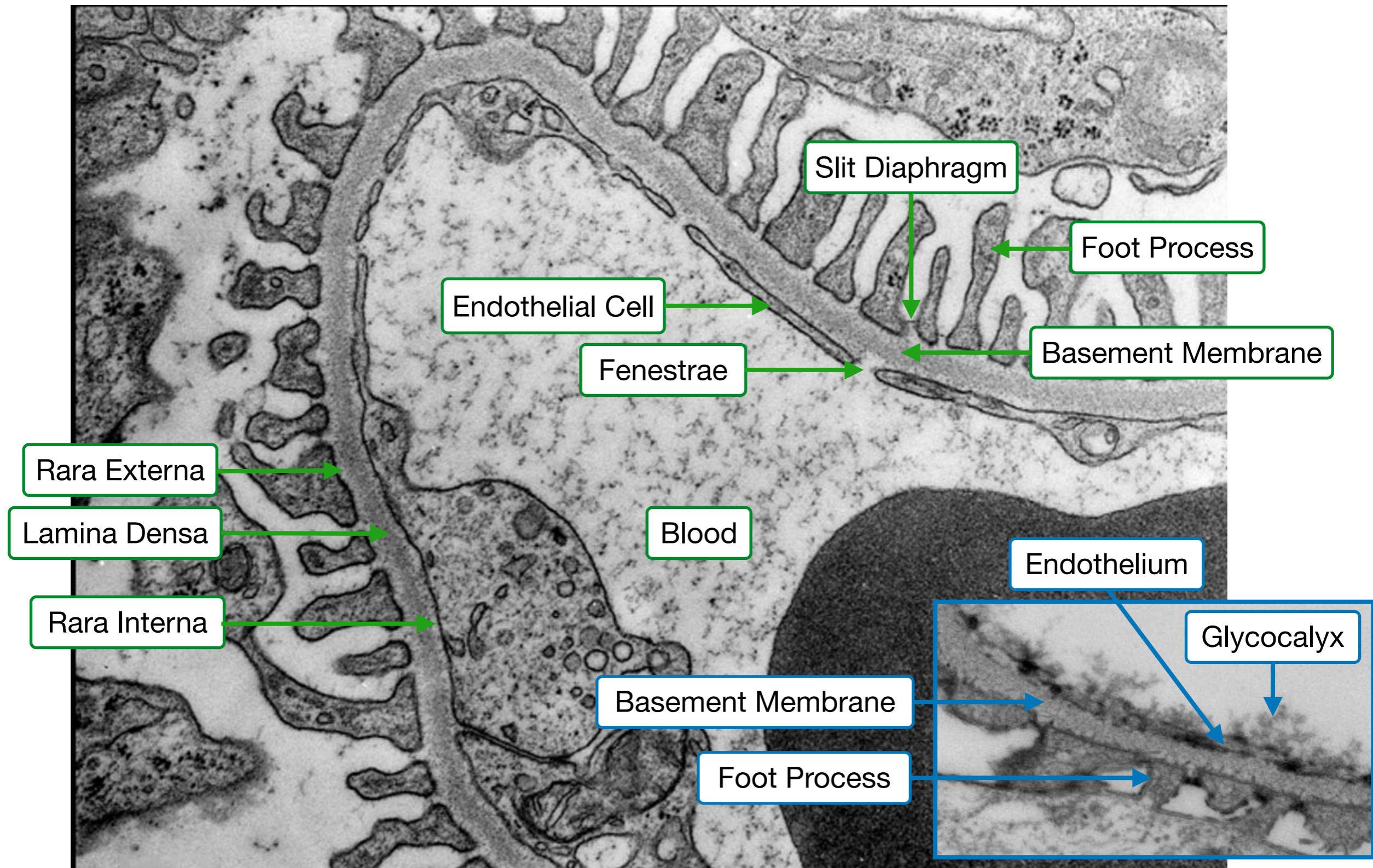
Starling forces determine the direction of fluid flow in the glomerular capillaries.



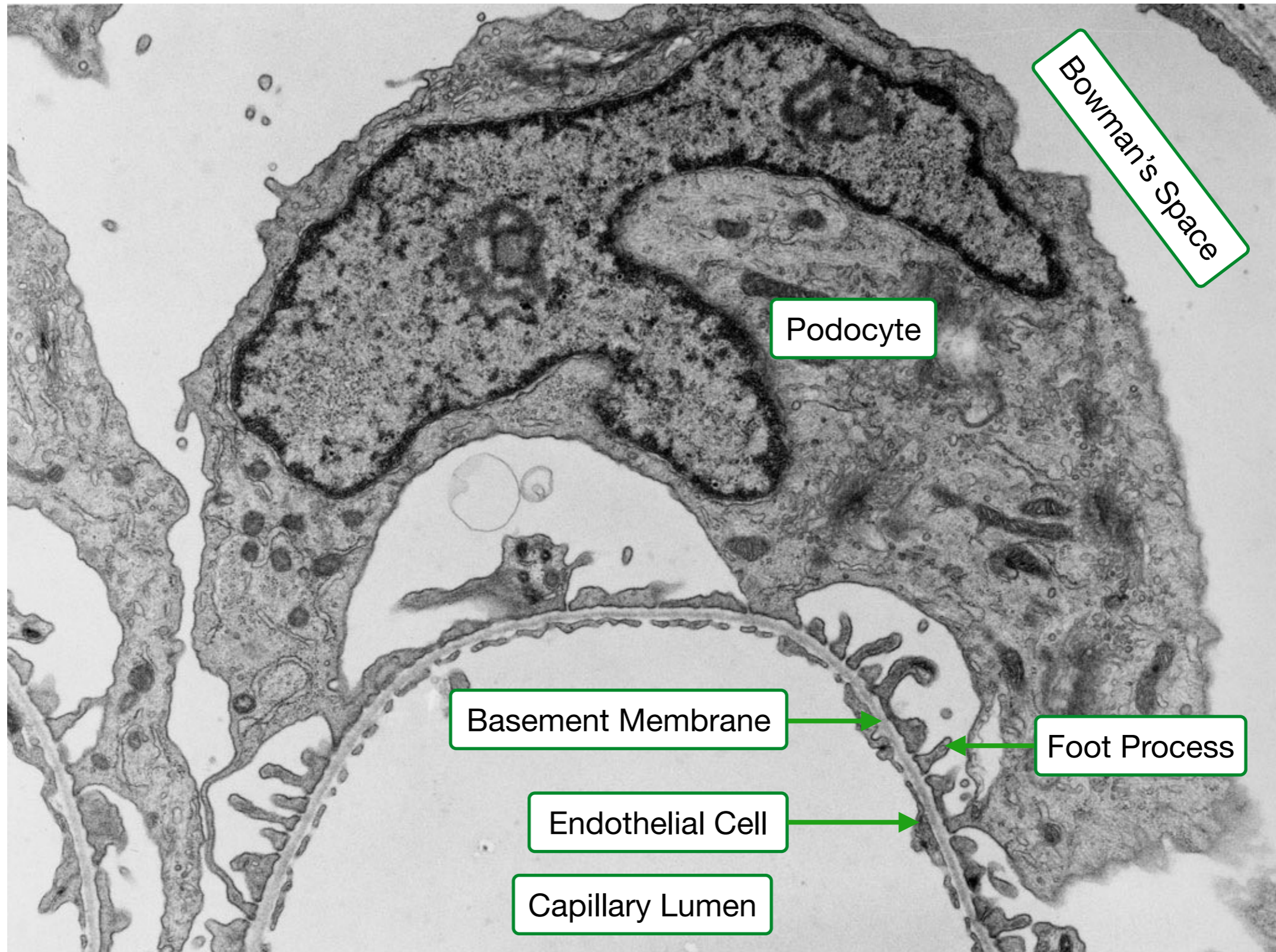
Renal corpuscles filter solutes based on size and charge.



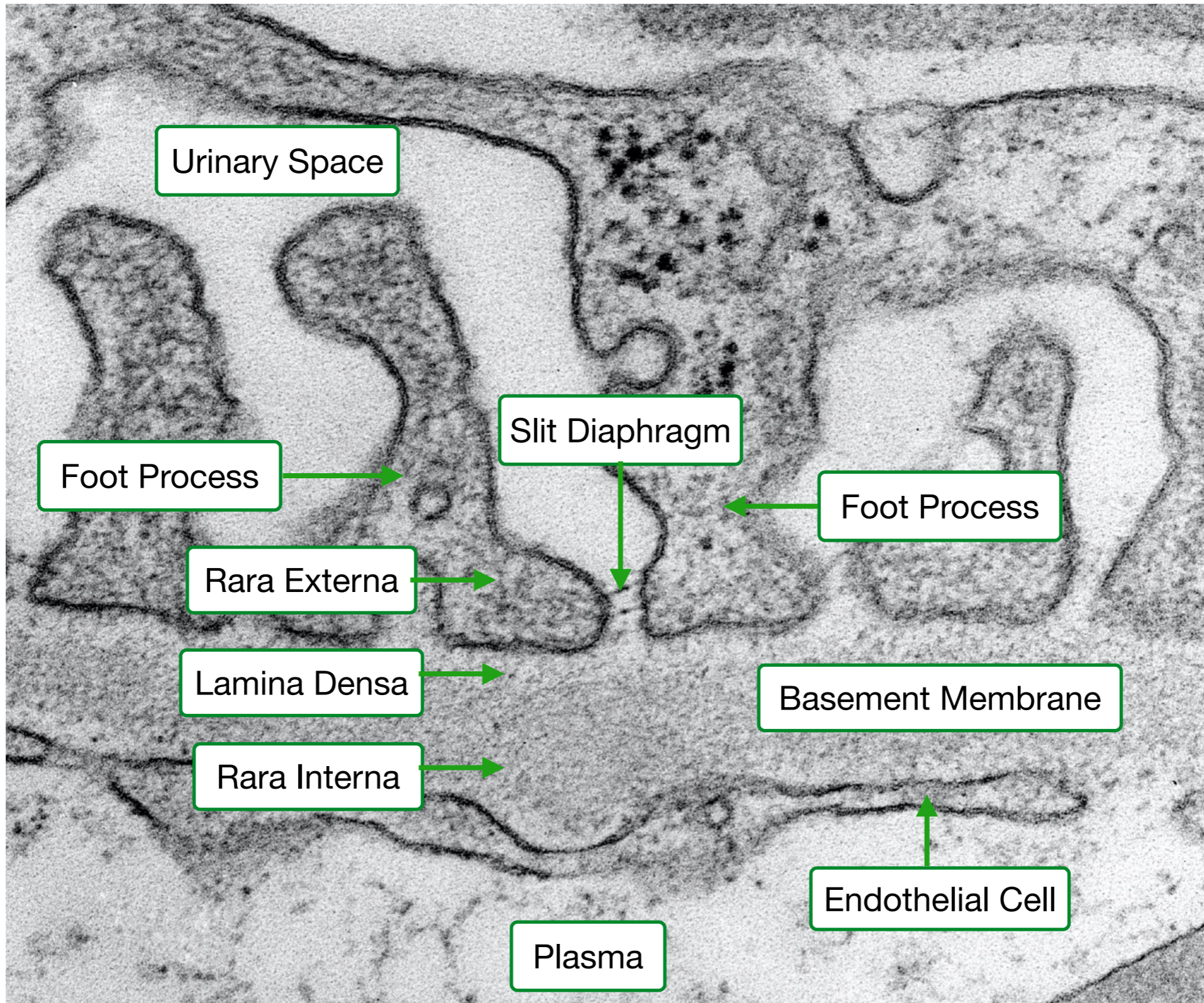
The filtration barrier consists of fenestrated endothelium, basement membrane and podocytes.



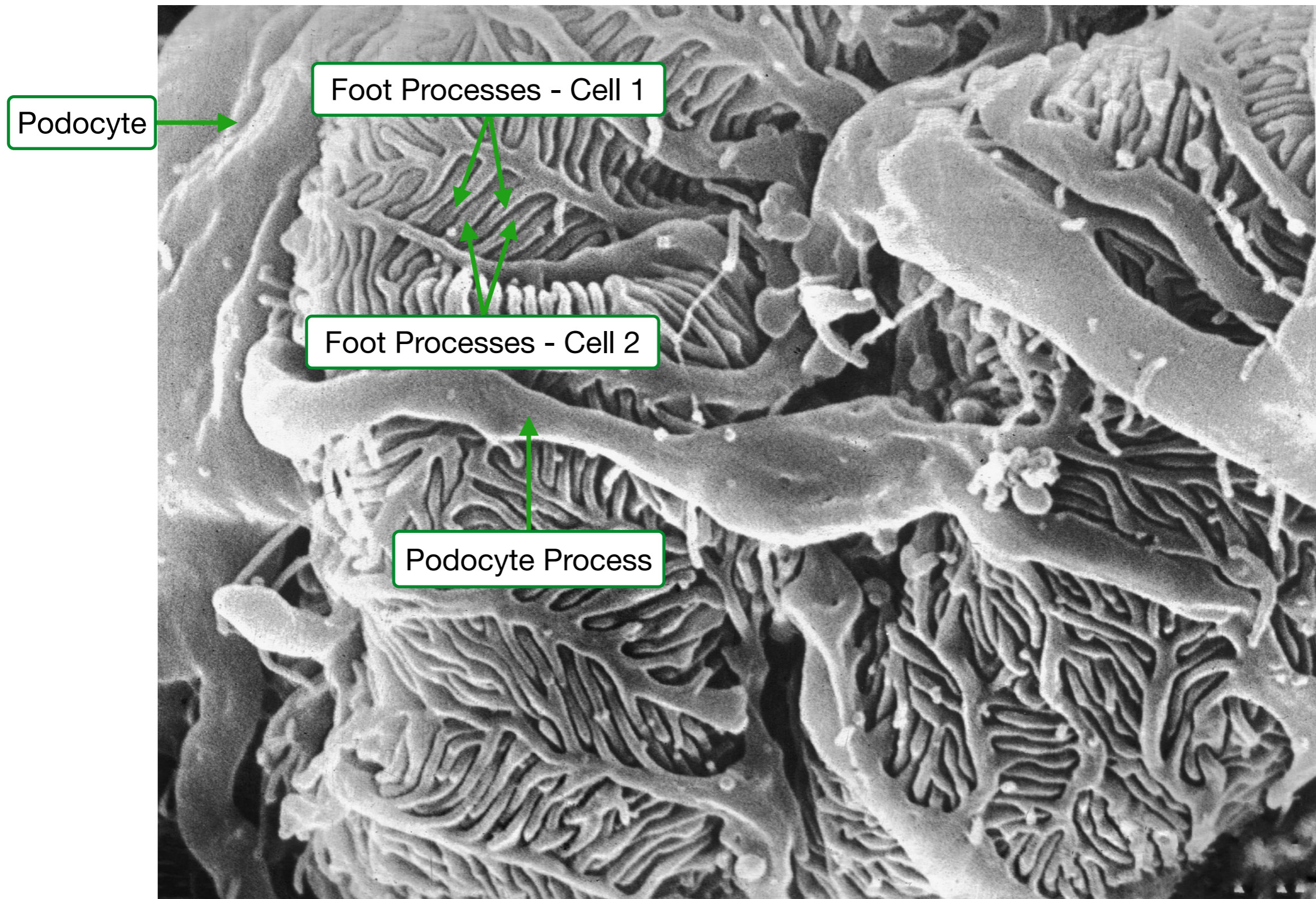
Podocytes form foot processes that attach to the basement membrane.



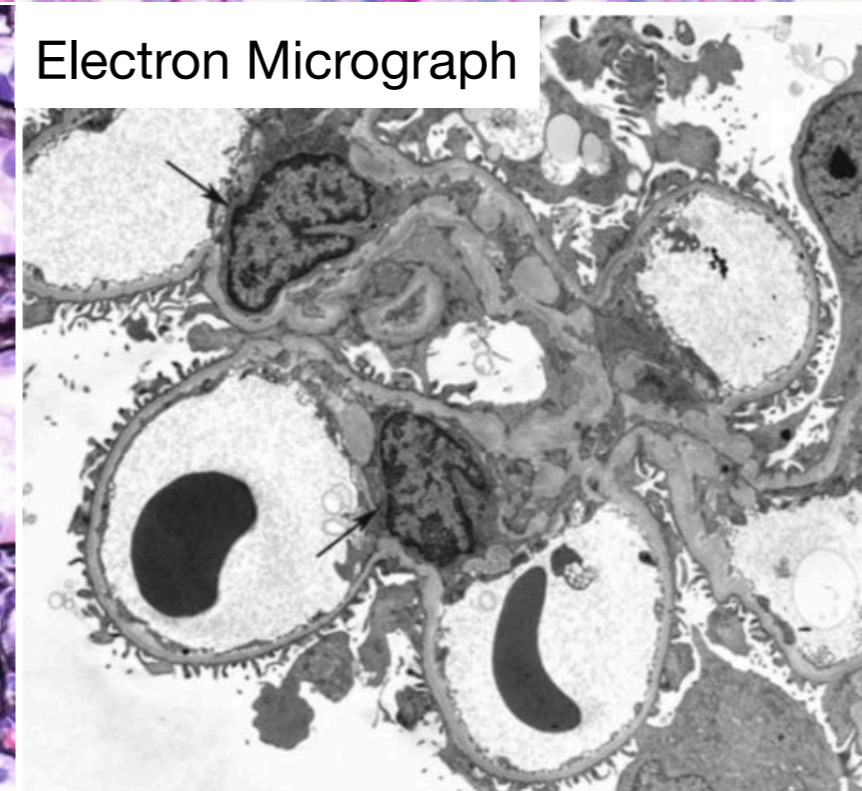
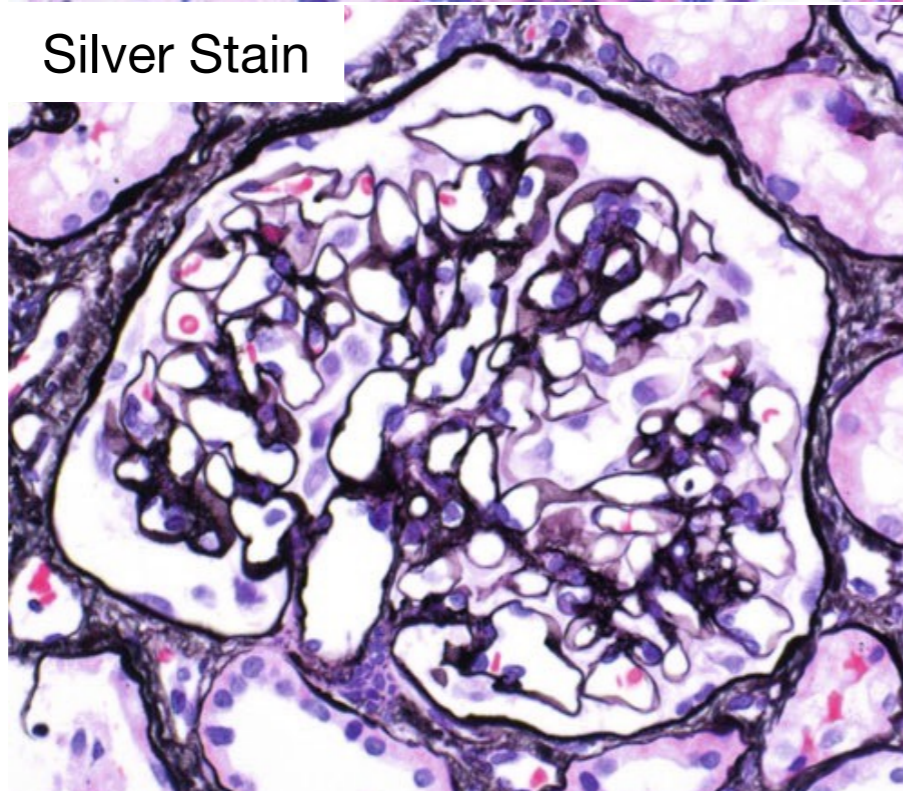
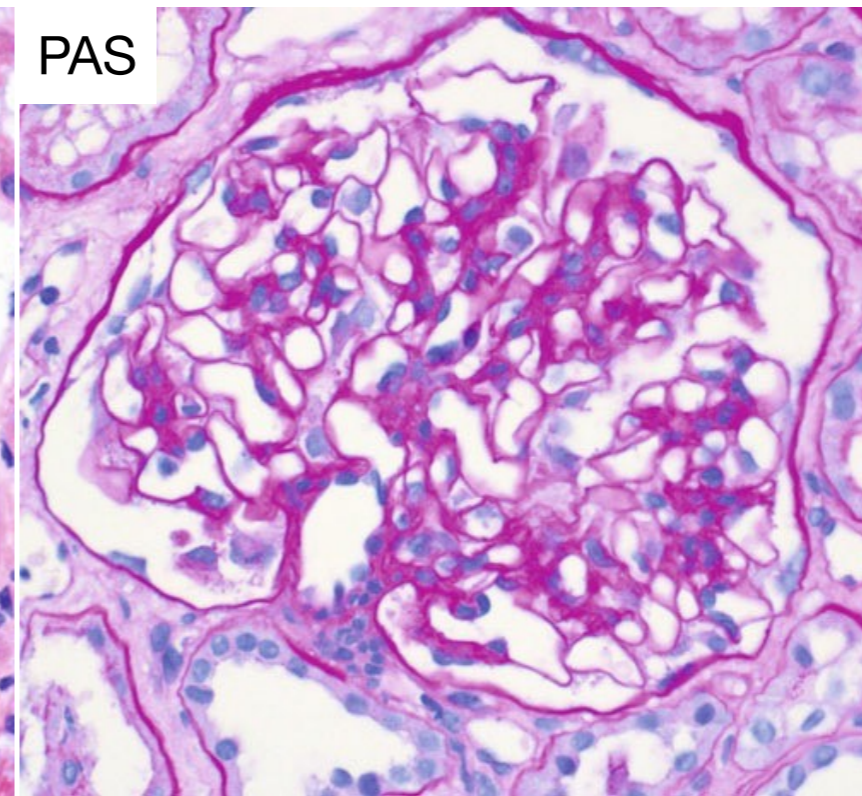
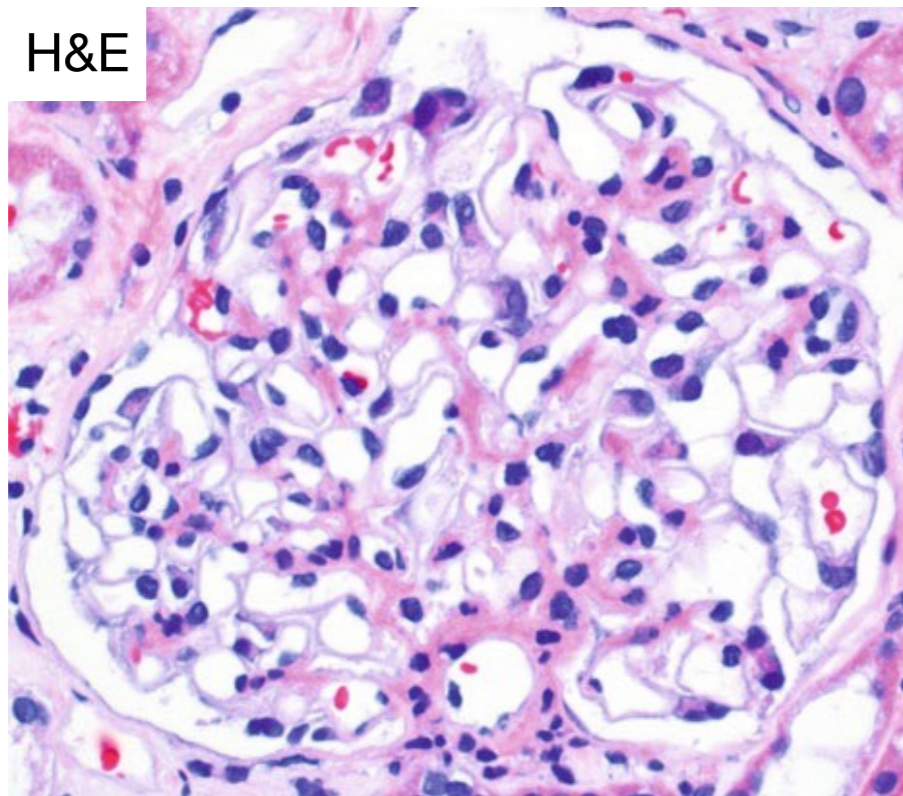
Slit diaphragms span the distance between foot processes and contribute to the filtration barrier.



Foot processes from adjacent podocytes interdigitate and surround capillaries.

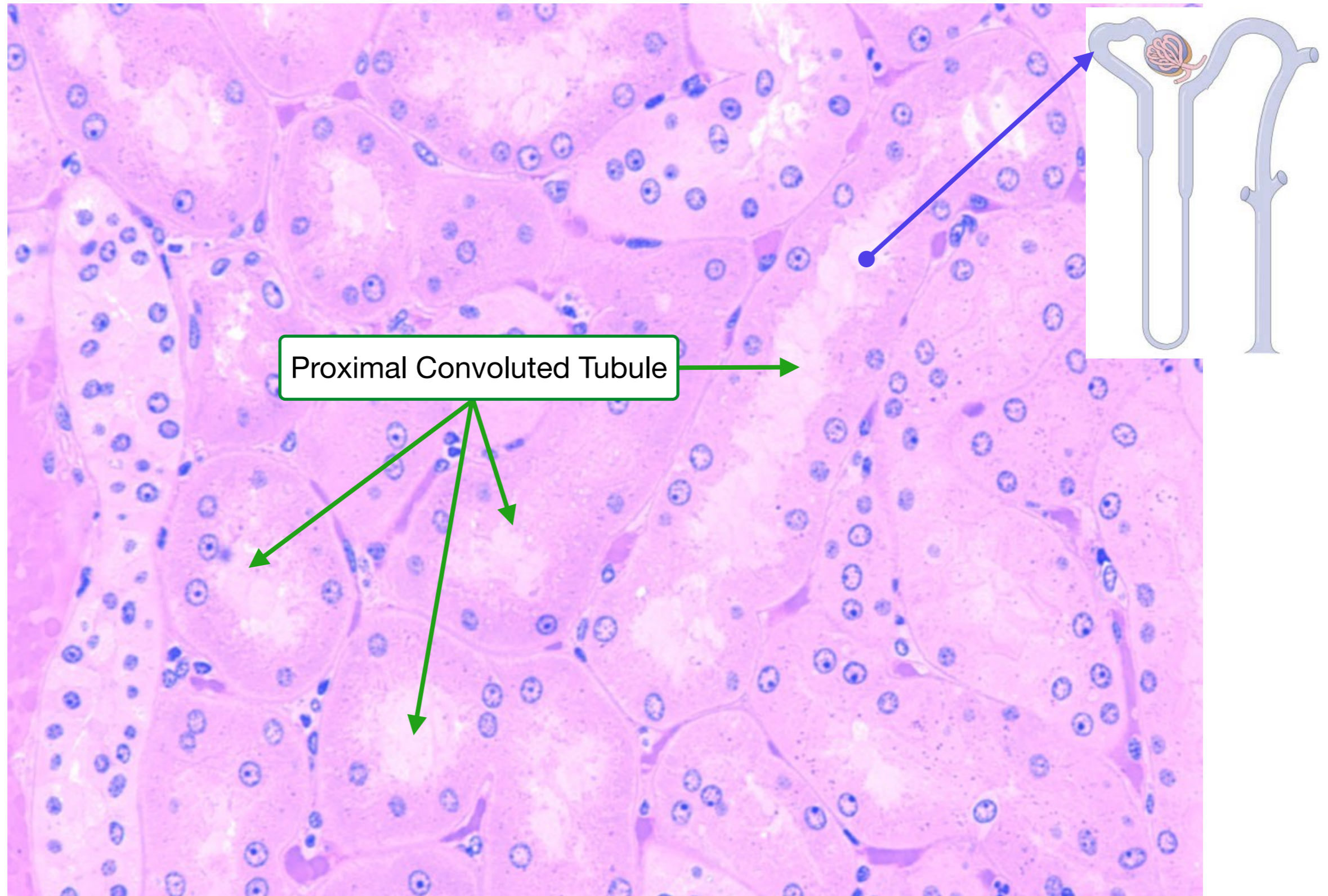


Different stains and microscopy methods are used to visualize features of renal corpuscles.

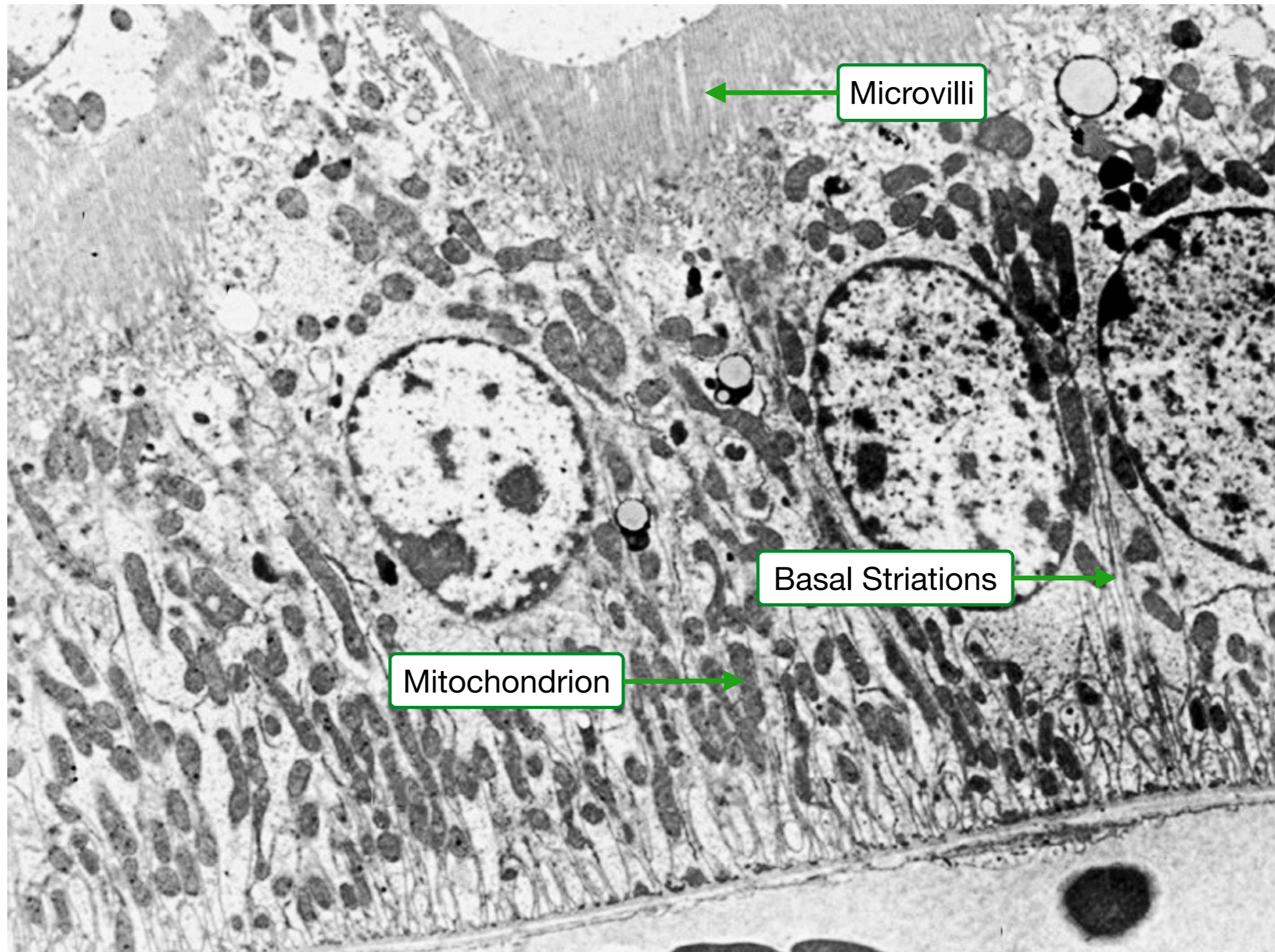


Nephron Tubule

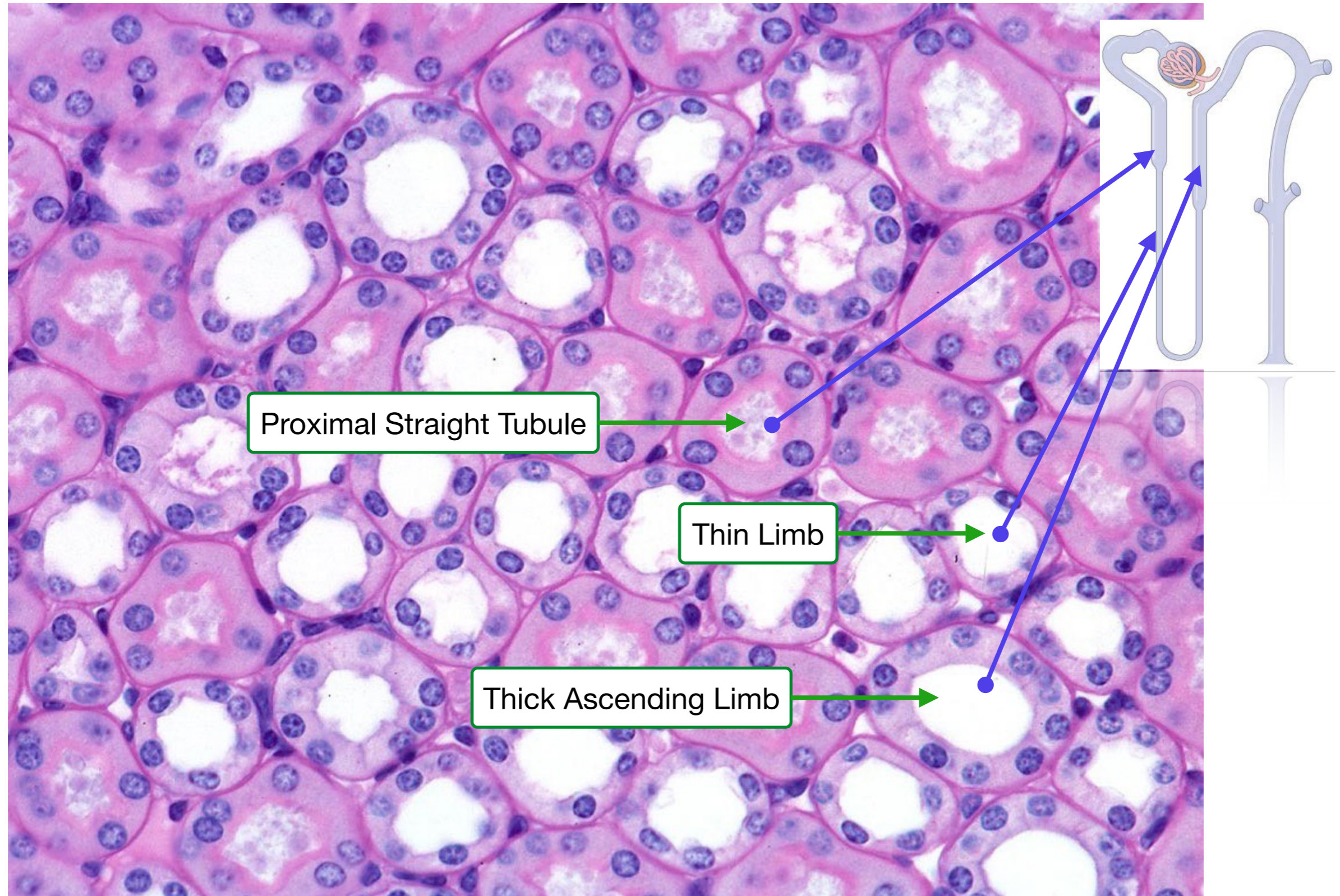
The proximal convoluted tubule absorbs most of the water and important biological solutes.



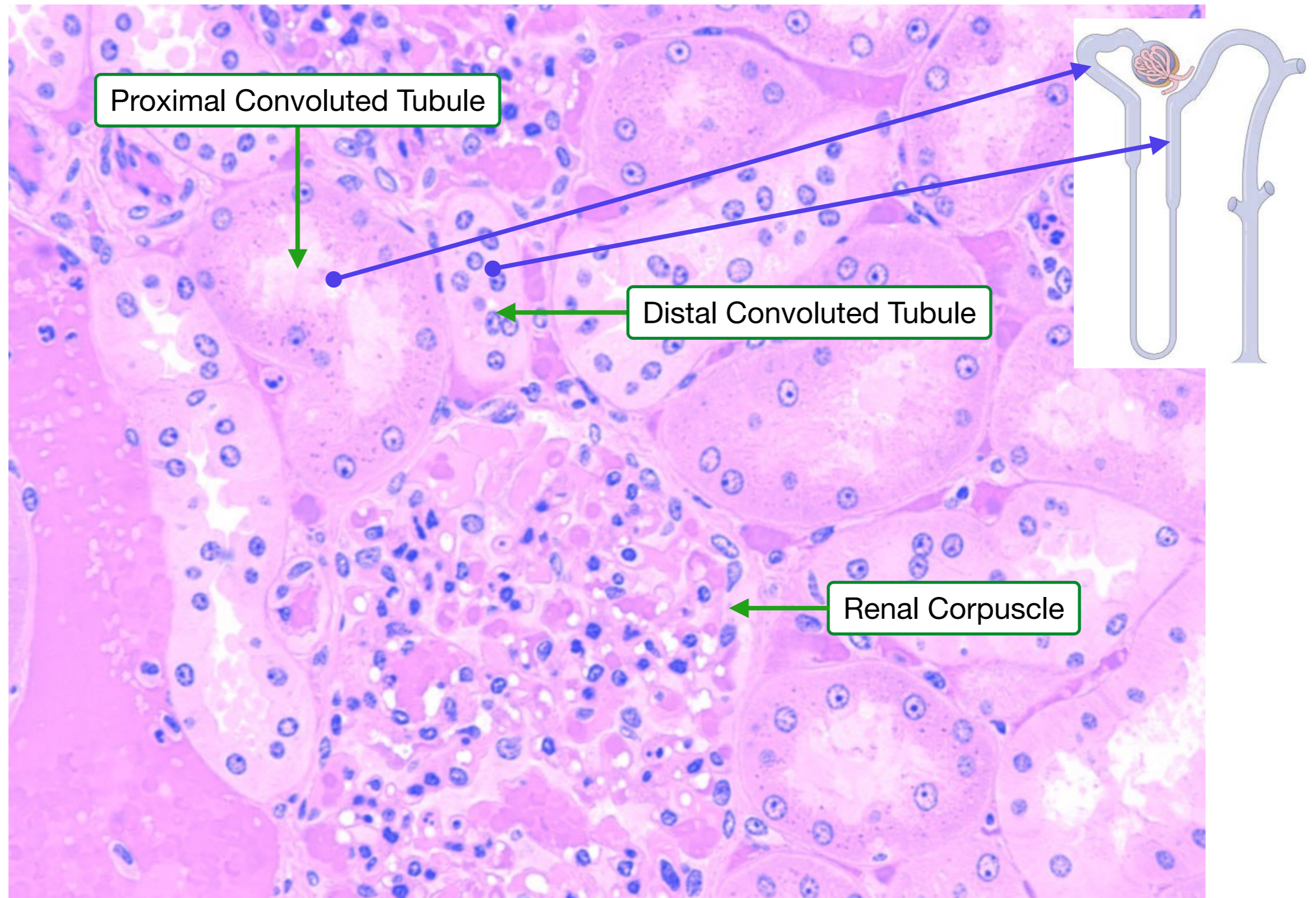
Microvilli on the apical surface and basal striations increase the surface area of epithelial cells.



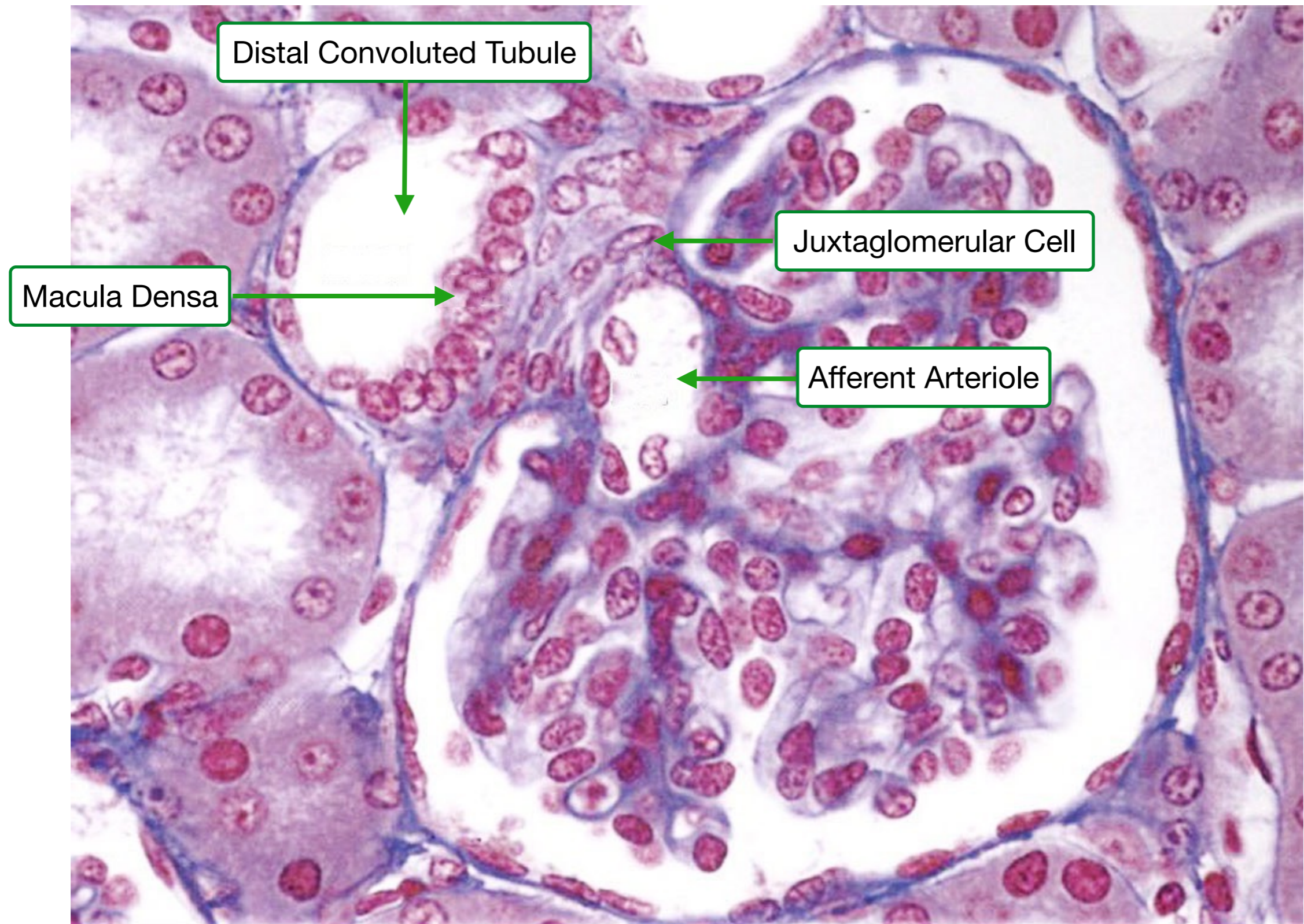
The loop of Henle in juxtamedullary nephrons increases the osmolality of the interstitium.



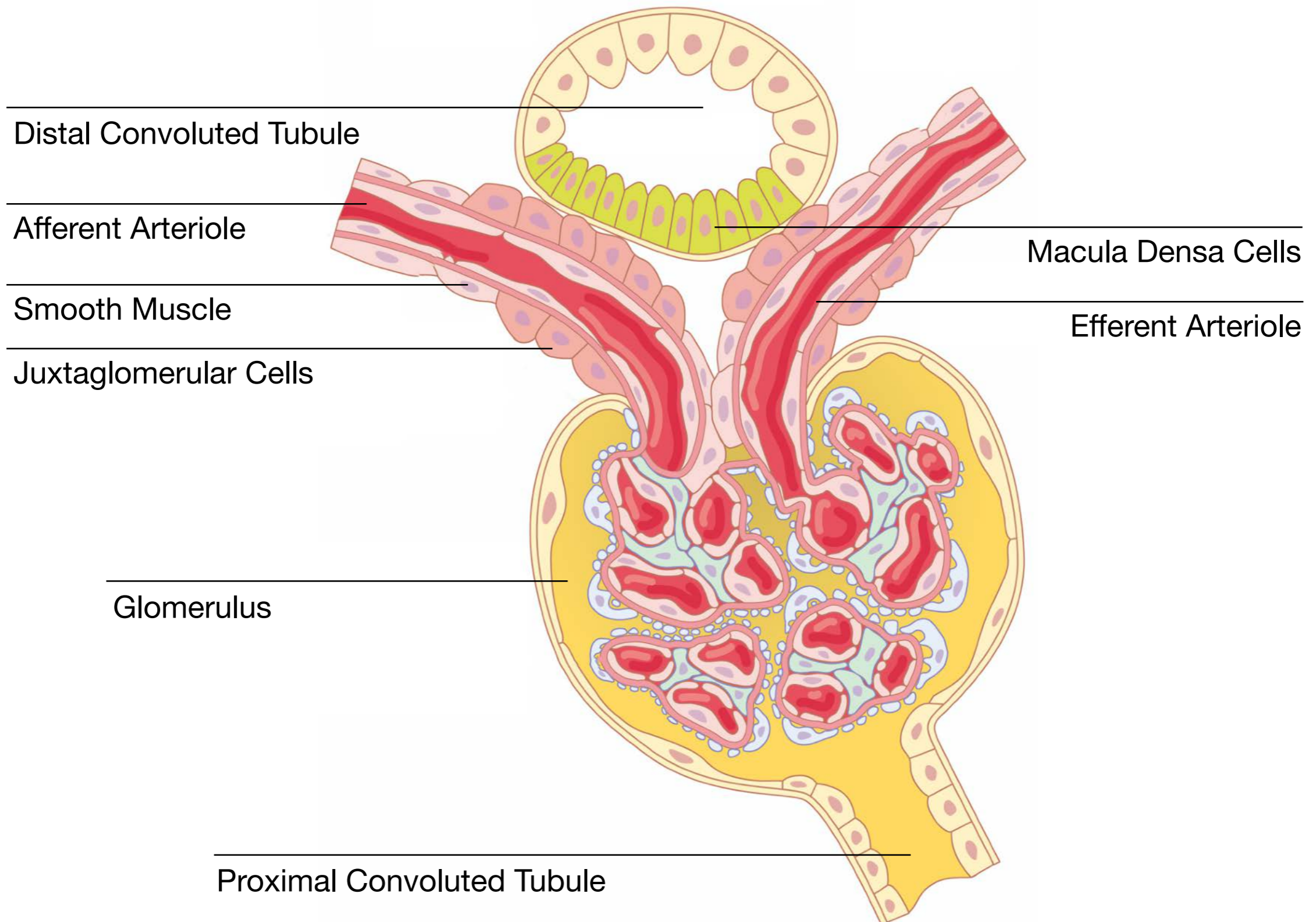
The distal convoluted tubule reabsorbs sodium and resides near the renal corpuscle.



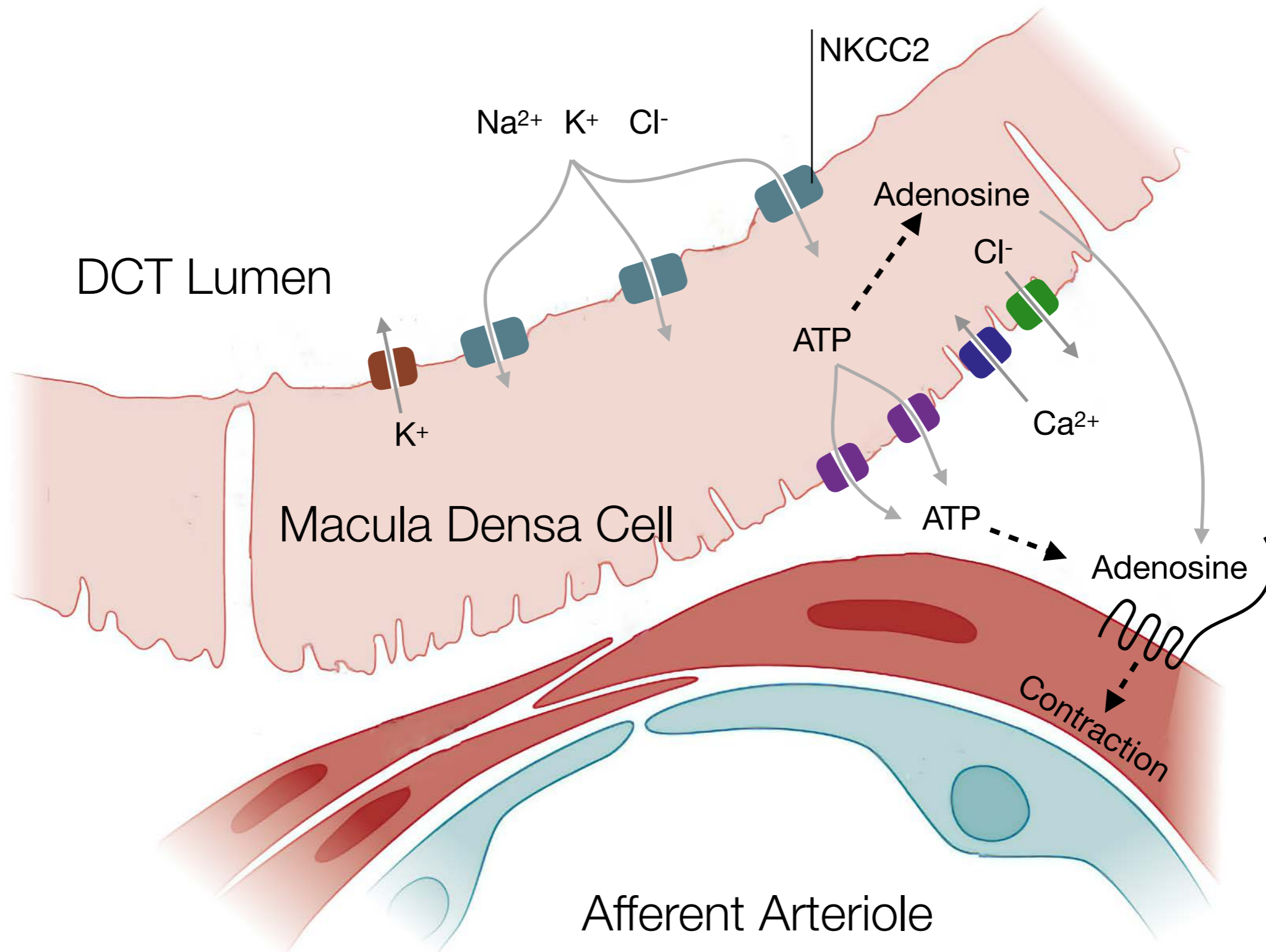
Cells of the distal convoluted tubule and afferent arteriole form the juxtamedullary complex.



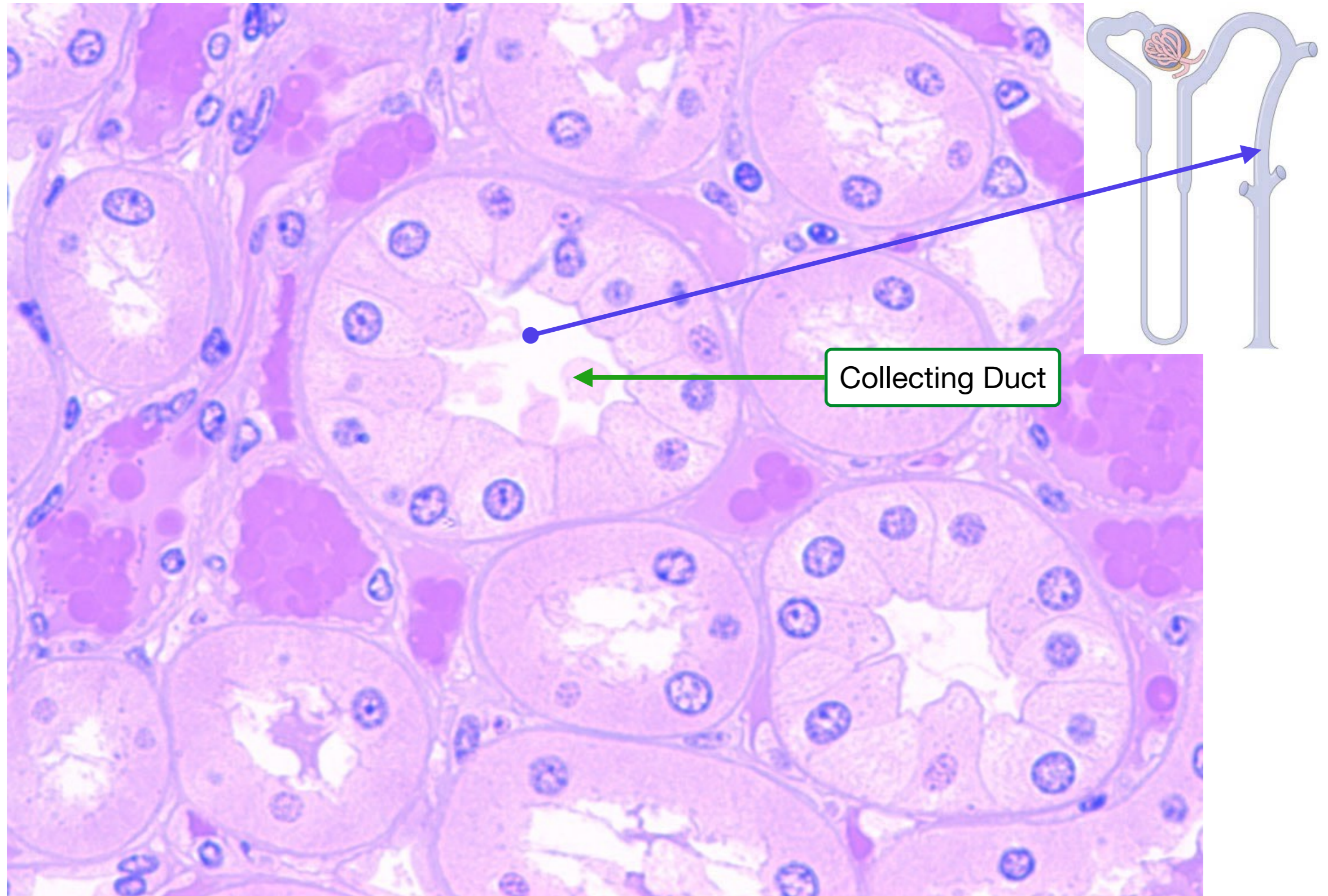
Macula densa cells sense sodium to regulate the glomerular filtration rate.



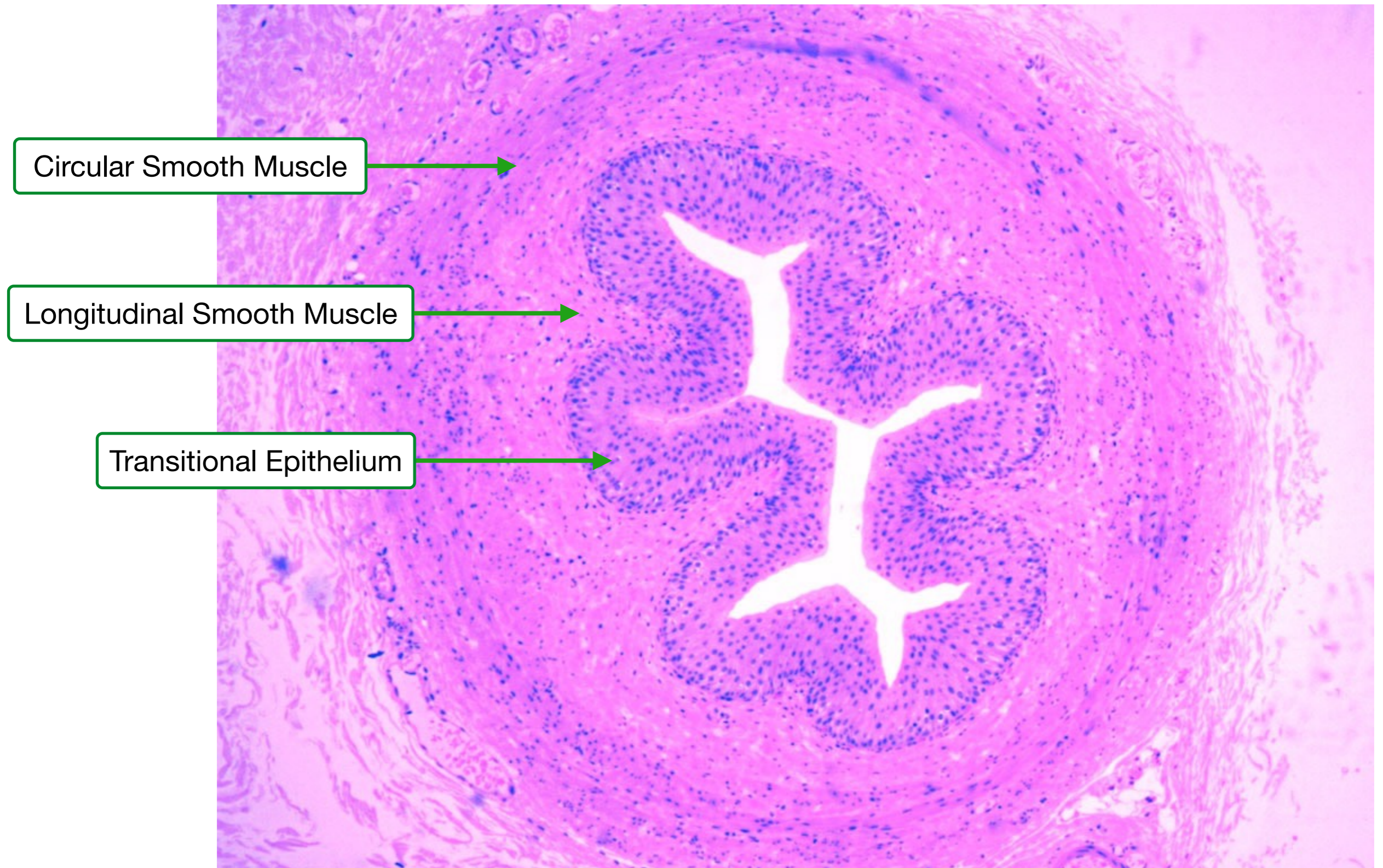
Sodium chloride uptake triggers release of ATP and adenosine which constricts the afferent arteriole.



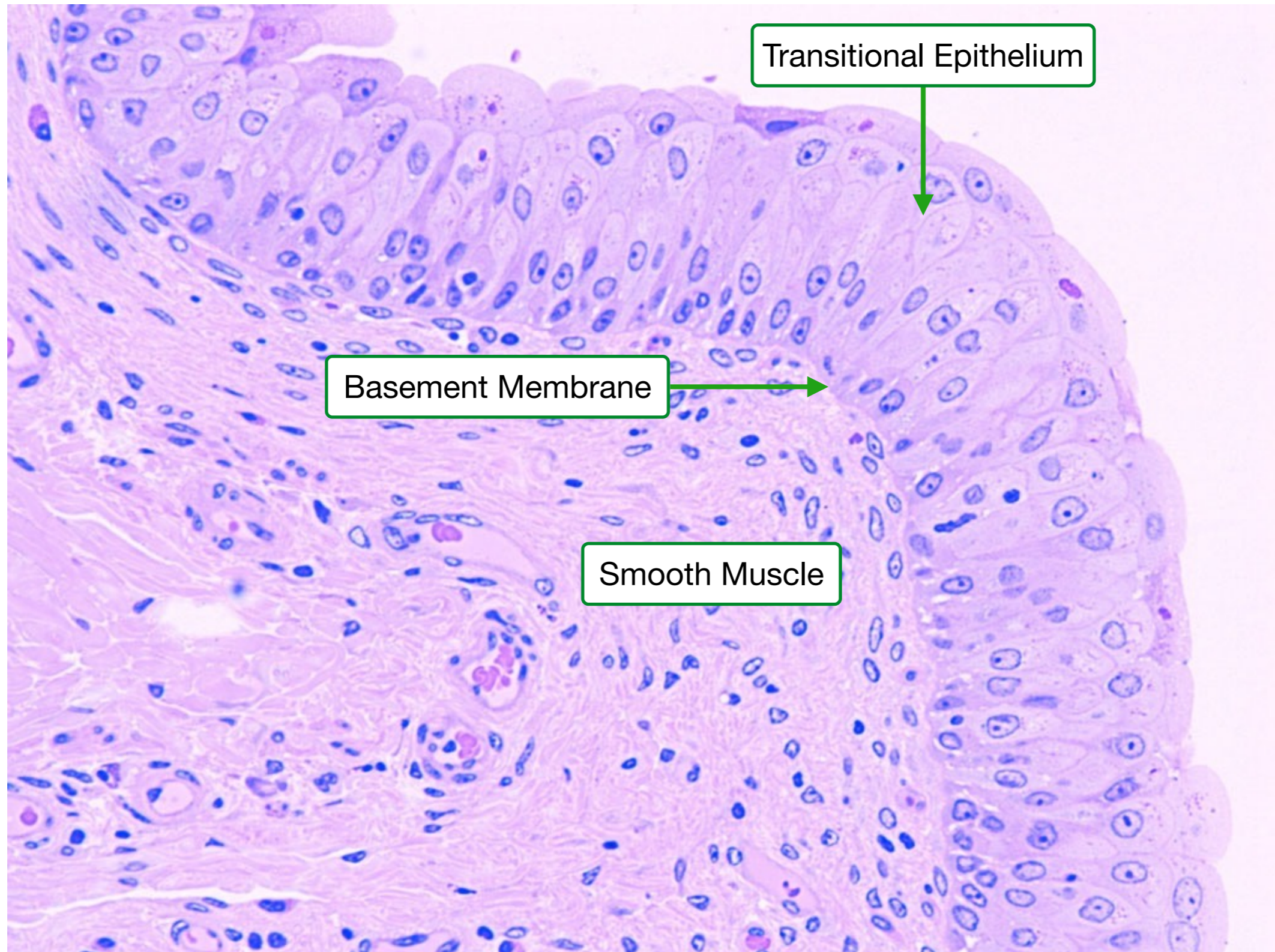
Collecting ducts contain intercalated cells and principle cells to regulate pH and water absorption.



The ureter is a muscular tube that connects the kidney to the urinary bladder.



The urinary bladder is lined by a transitional epithelium that stretches as urine fills the bladder.



Take home messages...

- Nephrons filter blood and reabsorb biologically important molecules.
- A filtration barrier of endothelium, basement membrane and podocyte determines what passes from blood into urine.
- Segments of the nephron tube have different properties to absorb biological molecules, ions and water.
- The juxtaglomerular complex generates feedback to regulate the glomerular filtration rate.