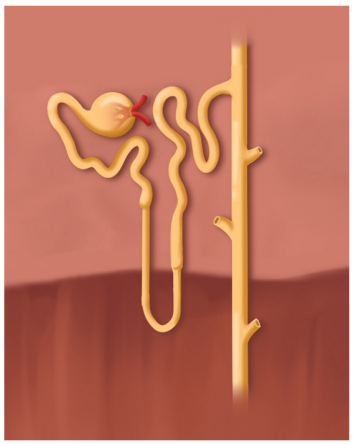
TOPIC: THE NEPHRON

Introduction to the Nephron

- **Nephron:** Microscopic structures that are the _____ units of the kidney.
  - Each kidney contains about 1-2 million nephrons.
- Filter _____ and produce _____.
- Located in renal cortex and renal medulla.
- Nephrons have ___ main components:
  1. **Renal Corpuscle**
  2. **Renal Tubule**

Renal _____

Renal _____



EXAMPLE

Which of the following statements is FALSE?

a) Nephrons are the functional units of the kidney.

b) Nephrons are located in the renal pelvis.

c) Nephrons filter blood and produce urine.

d) Between both kidneys, we have approximately 3-4 million nephrons.

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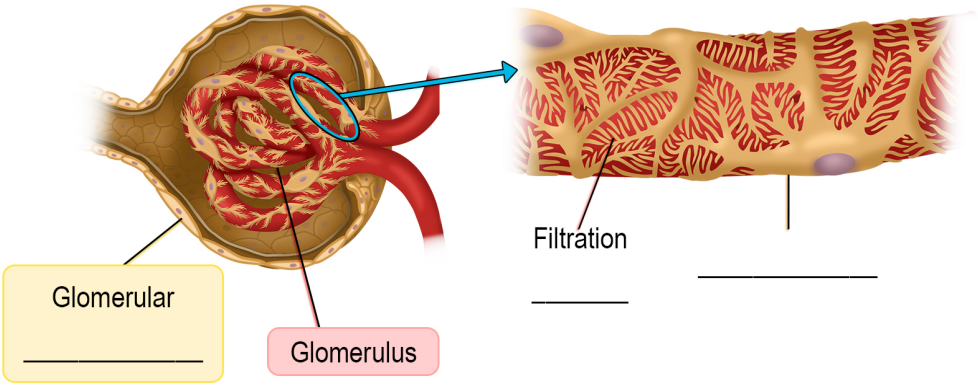
The Renal Corpuscle

- The renal corpuscle _____ blood.
- Each renal corpuscle has ____ parts:

1) **Glomerulus**: A group of fenestrated capillaries; also called *glomerular capillaries*.
   - Fenestrations make capillaries highly _____.
2) **Glomerular Capsule**: Sheath of _____ surrounding the glomerulus. Consists of:
   - Outer _____ layer: Forms the outer portion of the capsule.
   - Inner _____ layer: Composed of **podocytes**; surrounds glomerulus.
     - Each podocyte has "foot processes" that weave together to form **filtration** _____.



- Fluid that passes through fenestrated capillaries and podocytes is called _____.
  - A plasma-derived fluid - contains water, electrolytes, nutrients, and other small molecules.
  - Filtrate collects in the *capsular space* – a _____ region between the parietal and visceral layers.

EXAMPLE

True or False (if false, choose the answer that corrects the statement): The fluid that passes through the fenestrated capillaries is urine.

a) True

b) False: The fluid that passes through the fenestrated capillaries is filtrate.

c) False: The fluid that passes through the fenestrated capillaries is pre-urine.

d) False: The fluid that passes through the fenestrated capillaries is blood.

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PRACTICE

Which component of the renal corpuscle forms filtration slits?

a) Glomerulus.

b) Glomerular capsule.

c) Glomerular capillaries.

d) Podocytes.

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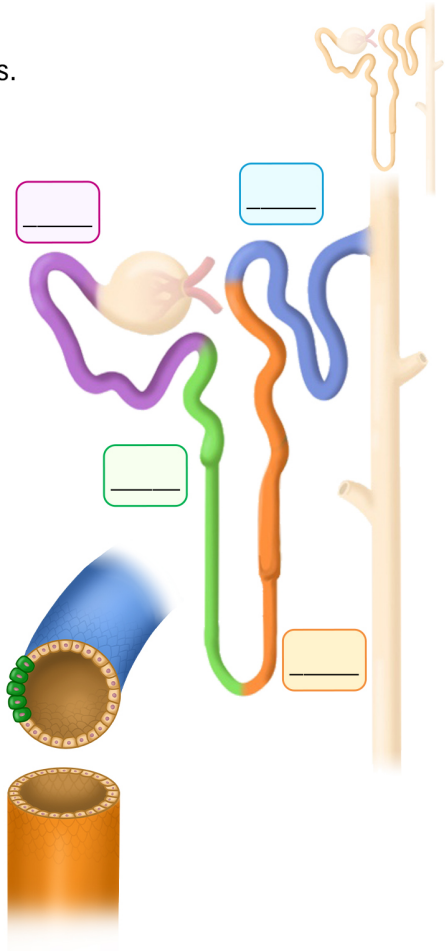
The Renal Tubule

- A winding tube that _____ filtrate by conserving or eliminating substances.
- Has _____ regions:

1) **Proximal Tubule**: Initial segment; located in renal _____.
   - Contains _____ - increased surface area allows high volume of filtrate to be modified faster.
2) **Nephron Loop**: Located in renal cortex, dips into renal _____.
   Has 2 limbs:
   a) **Descending Limb**: Travels toward the renal medulla.
   b) **Ascending Limb**: Travels toward the renal cortex.
3) **Distal Tubule**: _____ segment; located in renal cortex.

- **Macula Densa**: A group of _____ packed cells at transition point between ascending limb and distal tube.
  - Monitors _____content of filtrate.
  - Plays role in regulating filtration rate and blood pressure.



EXAMPLE

Nephrons modify a high volume of filtrate very quickly. Which portion of the renal tubule contains prominent microvilli to aid in this process?

a) The proximal tubule.
b) The descending limb of the nephron loop.
c) The ascending limb of the nephron loop.
d) The distal tubule.

PRACTICE

Macula densa cells monitor the _____ concentration of the filtrate.

a) H_2O
b) Na^+
c) NaCl
d) Ca^{2+}

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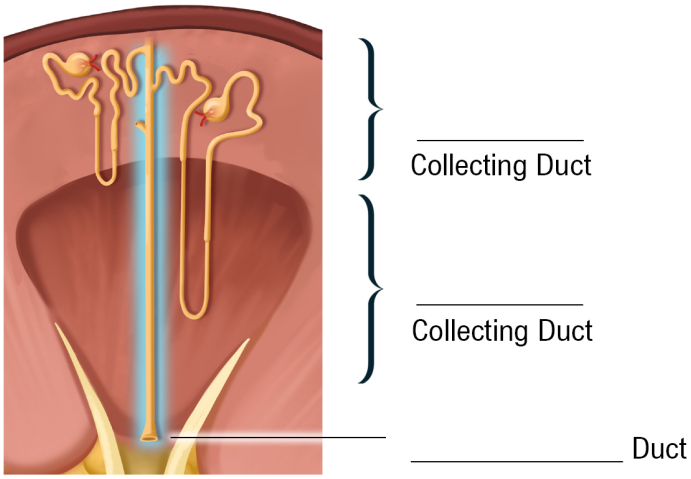
The Collecting Duct

- **Collecting Duct:** A tubule that further modifies the filtrate.
  - _____ segment of the nephron.
- Each collecting duct collects filtrate from _____ nephrons.
- Consists of 2 structures:
  - **Cortical Collecting Duct:** Portion of duct located in renal _____.
  - **Medullary Collecting Duct:** Portion of duct located in renal _____.



- As collecting ducts approach renal pelvis, they _____ into a **papillary duct.**
- When filtrate reaches end of papillary duct, it is _____.

EXAMPLE

At which *location* would filtrate officially be considered urine?

a) The end of the proximal tubule.

b) The ascending limb of the nephron loop.

c) The beginning of the collecting duct.

d) When it reaches the papillary duct.

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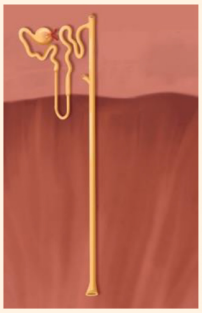
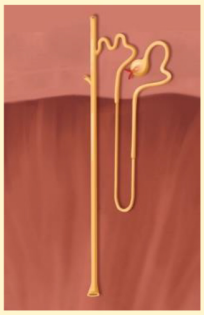
Types of Nephrons

◆ Kidneys contain _____ types of nephrons:

	Cortical Nephrons	Juxtamedullary Nephrons
Location	Renal _____ . Nephron loop *may* dip into renal medulla.	Boundary of renal cortex and medulla. Nephron loop goes _____ into renal medulla.
Features	_____ nephron loop. 	_____ nephron loop. 
Prevalence	Approx. _____% of nephrons.	Approx. _____% of nephrons.
Function	Filtration of blood, modification of filtrate, regulating _____ pressure.	Filtration of blood, modification of filtrate, creating concentrated _____.
Blood Supply	Peritubular capillaries.	Peritubular capillaries and vasa recta.

EXAMPLE

Which of the following statements is correct?

a) Cortical nephrons have longer nephron loops and juxtamedullary nephrons have short nephron loops.

b) Juxtamedullary nephrons are more abundant than cortical nephrons.

c) Cortical nephrons have longer nephron loops and are located mainly in the renal cortex, and juxtamedullary nephrons have shorter nephron loops and extend deeper into the renal medulla.

d) Cortical nephrons have shorter nephron loops and are located mainly in the renal cortex, and juxtamedullary nephrons have longer nephron loops and extend deeper into the renal medulla.

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Which of the following statements best describes the role of the juxtamedullary nephrons?

a) Juxtamedullary nephrons filter large volumes of blood to increase urine volume.

b) Juxtamedullary nephrons play a role in forming concentrated urine.

c) Juxtamedullary nephrons play a key role in regulating blood pressure.

d) Juxtamedullary nephrons control K^+ and Ca^{2+} levels.