

The Urinary System

A urinary system lab activity using Visible Body's Anatomy & Physiology

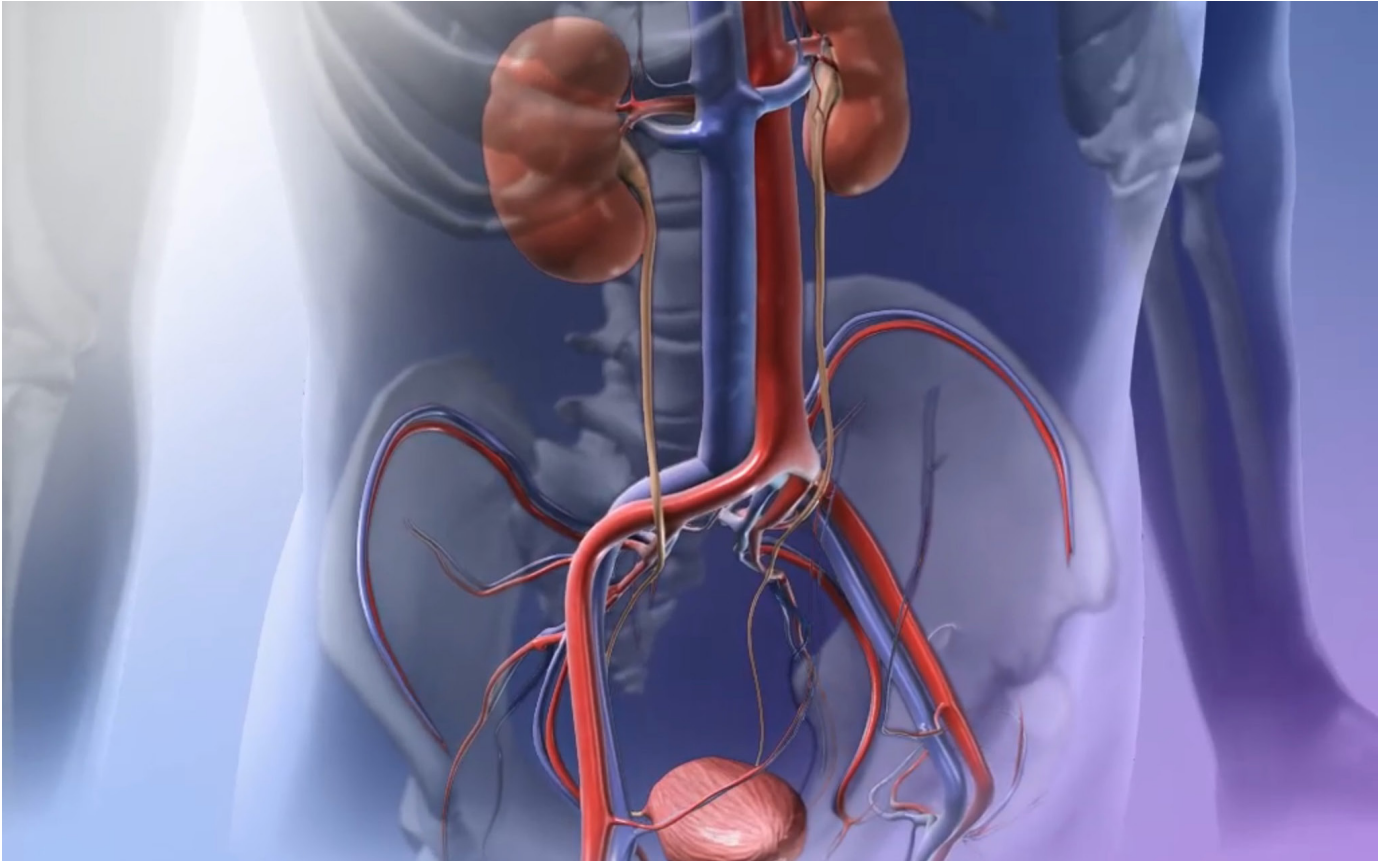
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PRE-LAB EXERCISES

Open the A&P app, and from the left-side menu, select the **Urinary System**.

You are responsible for the identification of **all bold terms** and all answers to the questions.

A. Watch the video in Module 43.1 Urinary System Overview and answer the following questions.



1. What is the main role of the **urinary system**?
2. How does blood enter the **kidneys**?
3. How does blood exit the kidneys?

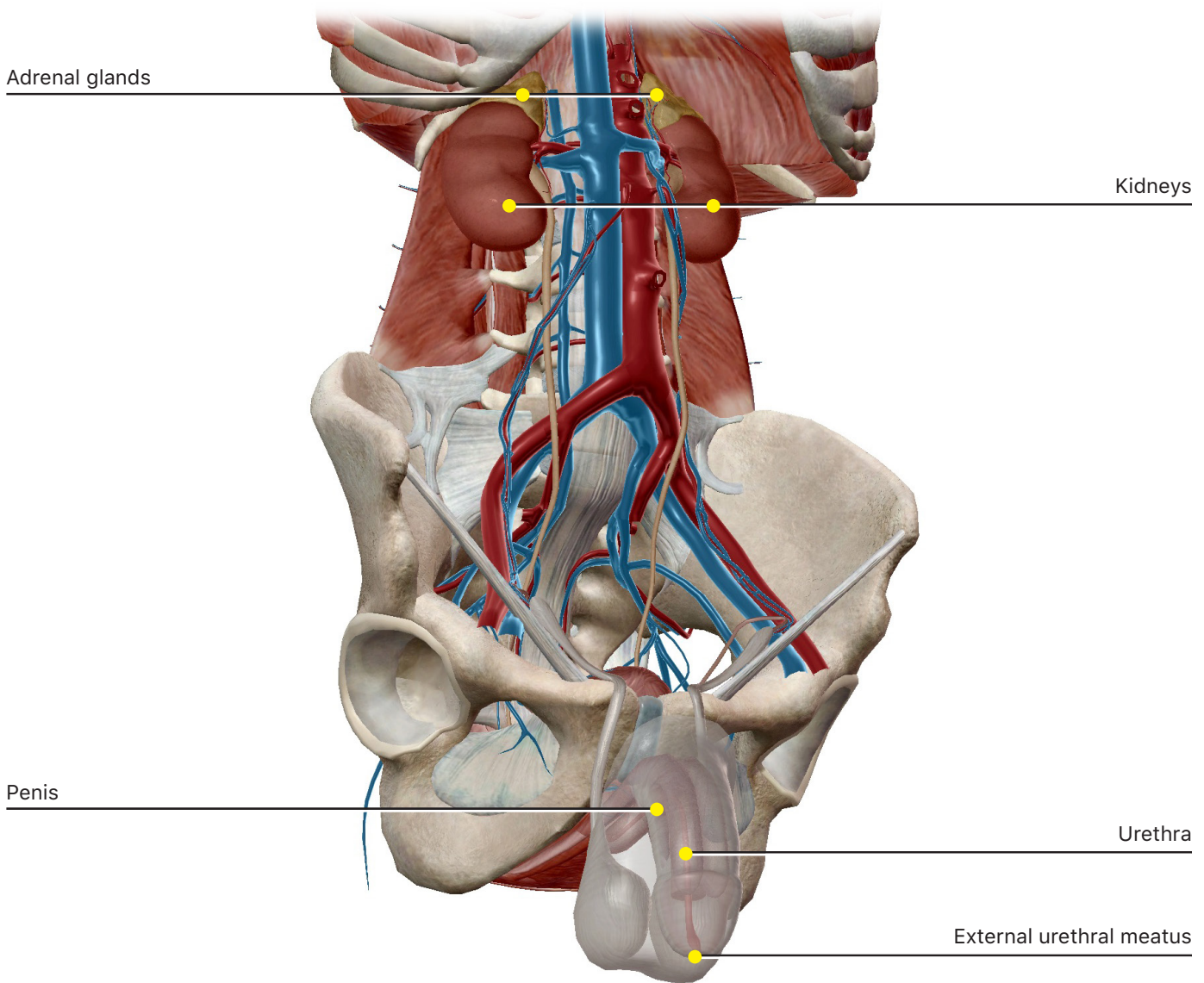
4. What are the blood-filtering organs of the body?

5. List the three steps of **urine** formation that occur in the kidneys.

6. How does urine travel from the kidneys to the **bladder**?

7. What structure conveys urine from the bladder?

B. Explore the 3D anatomical view in Module 43.2 Male Urinary Anatomy and answer the following questions.

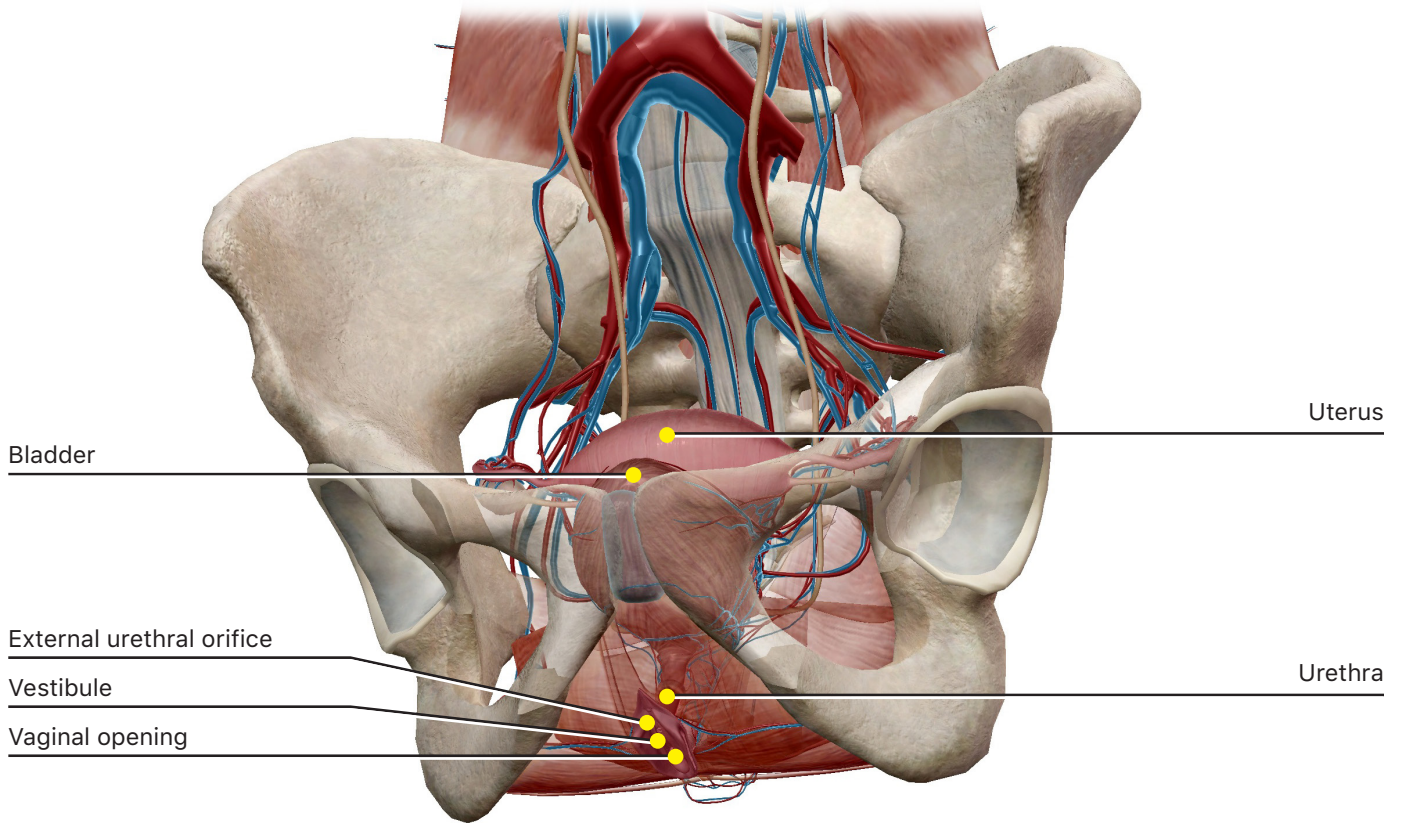


1. Select the **urethra** from the left-side menu and use the book icon to read the definition. The male urethra is much longer than the female urethra and the **external urethral orifice** is located in the tip of the _____.

2. How long is the male urethra?

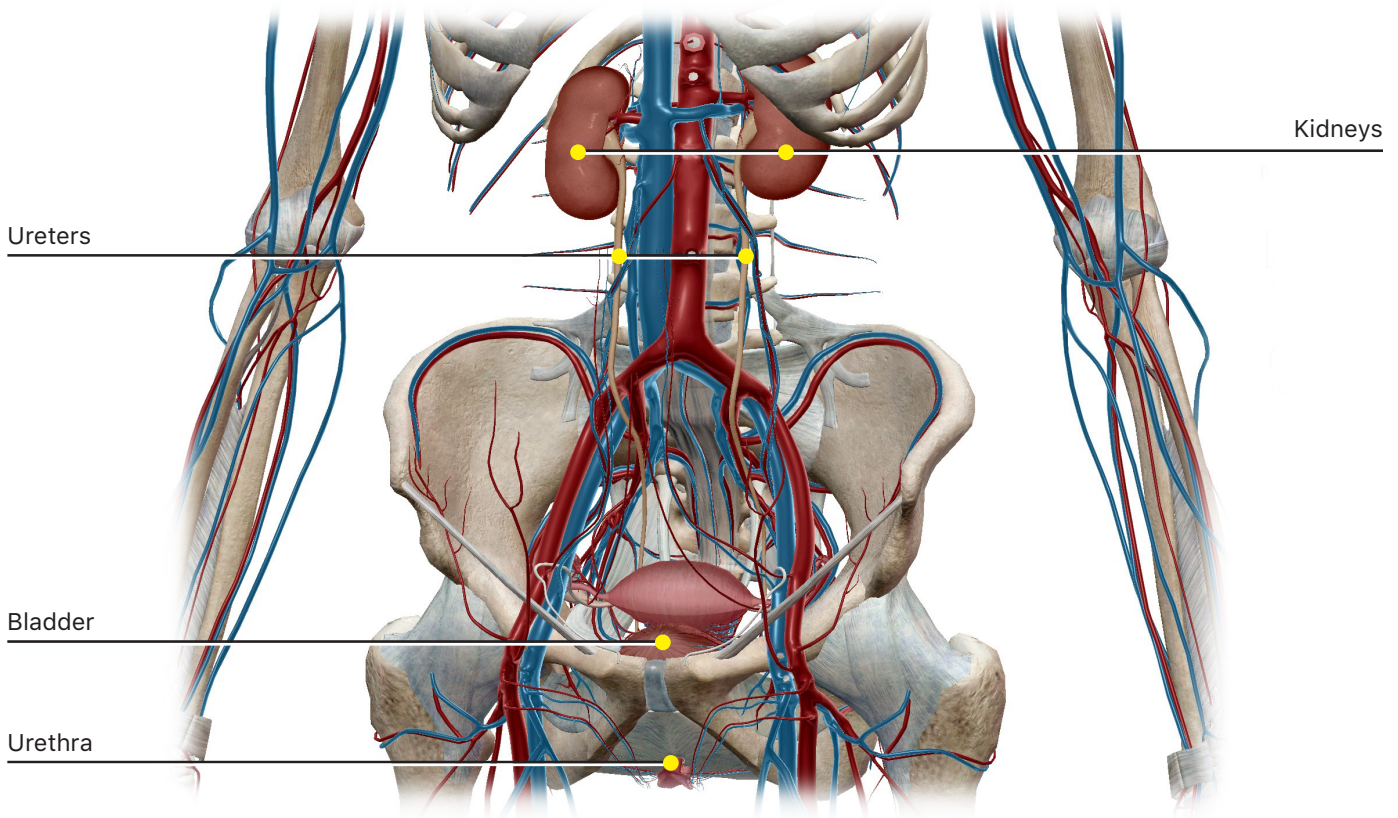
3. Refresh the view and select either of the pyramid shaped, yellowish glands on top of each kidney. These are the _____ glands, which produce hormones that affect kidney function.

C. Explore the 3D anatomical view in Module 43.3 Female Urinary Anatomy and answer the following questions.



1. Select the bladder from the left-side menu and use the book icon to read the definition. The female bladder lies underneath the _____.
2. Select the urethra from the left-side menu and use the book icon to read the definition. How long is the female urethra?
3. Select the urethral orifice from the left-side menu and use the book icon to read the definition. The female external urethral orifice is located in the **vestibule** directly in front of the _____.

D. Examine the 3D anatomical view in Module 43.4 Urinary Functions and answer the following questions.



1. Select the kidneys from the left-side menu and use the book icon to read the definition. How do the kidneys control the concentration of substances in the blood?
2. Select urination structures from the left-side menu to highlight the whole urinary system and use the book icon to read the definition. What are the organs of the urinary system?
3. What are the four main components of urine listed in the definition?
4. What is the source of the **nitrogenous compounds** in the urine?
5. The kidneys are influenced by _____ that can adjust the amount of water excreted by the kidneys. In this way, the kidneys play a role in the regulation of blood _____ and blood _____.
6. How much blood is filtered by the adult urinary system per day?

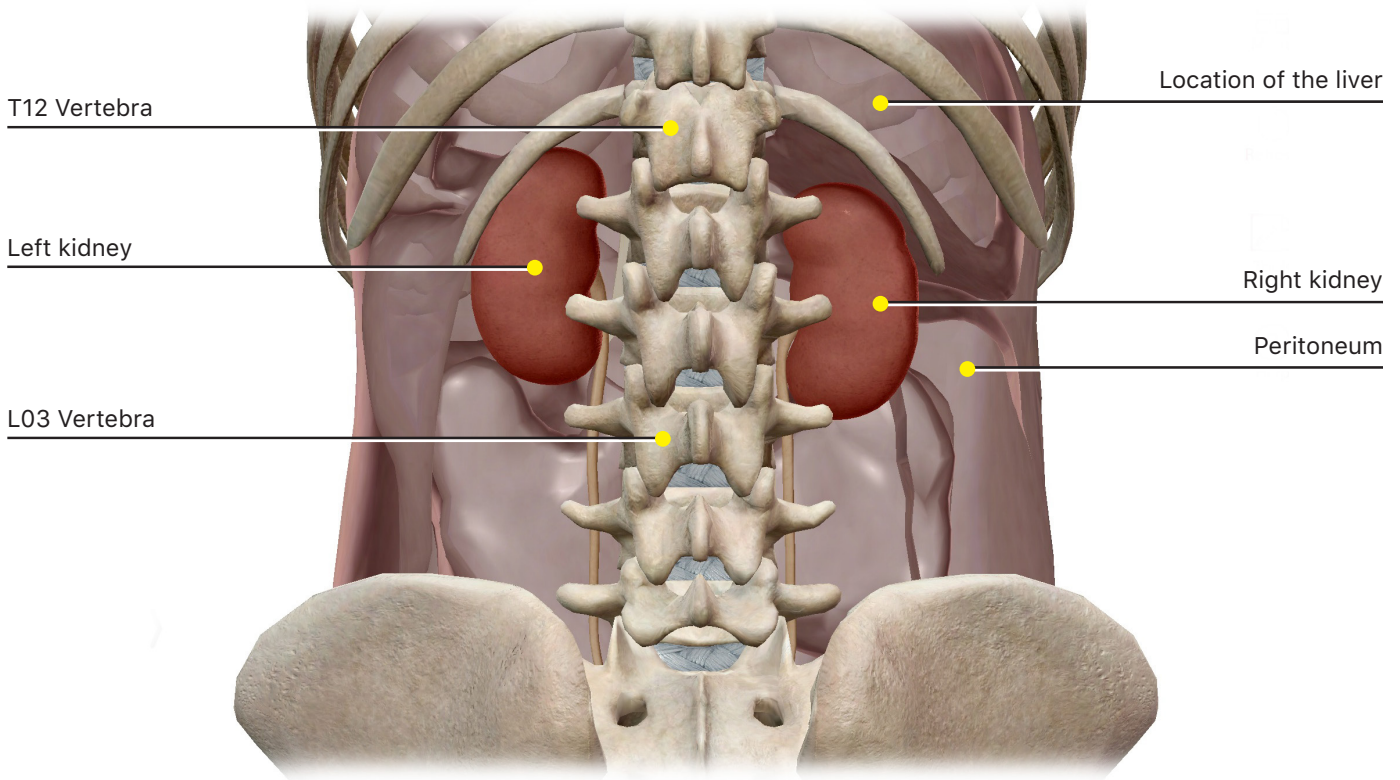
IN-LAB EXERCISES

Use the following modules in Visible Body's Anatomy & Physiology app to guide your exploration of the urinary system. You can manipulate the images to see different views and isolate each structure. Be sure to select the book icon under the structure name to read information specific to that structure.

You are responsible for the identification of **all bold terms** and all answers to the questions.

A. Go to the Urinary System unit and select Chapter 44. Kidney Anatomy and Physiology.

1. Explore the 3D anatomical view in Module 44.1 Position of the Kidneys and answer the following questions.

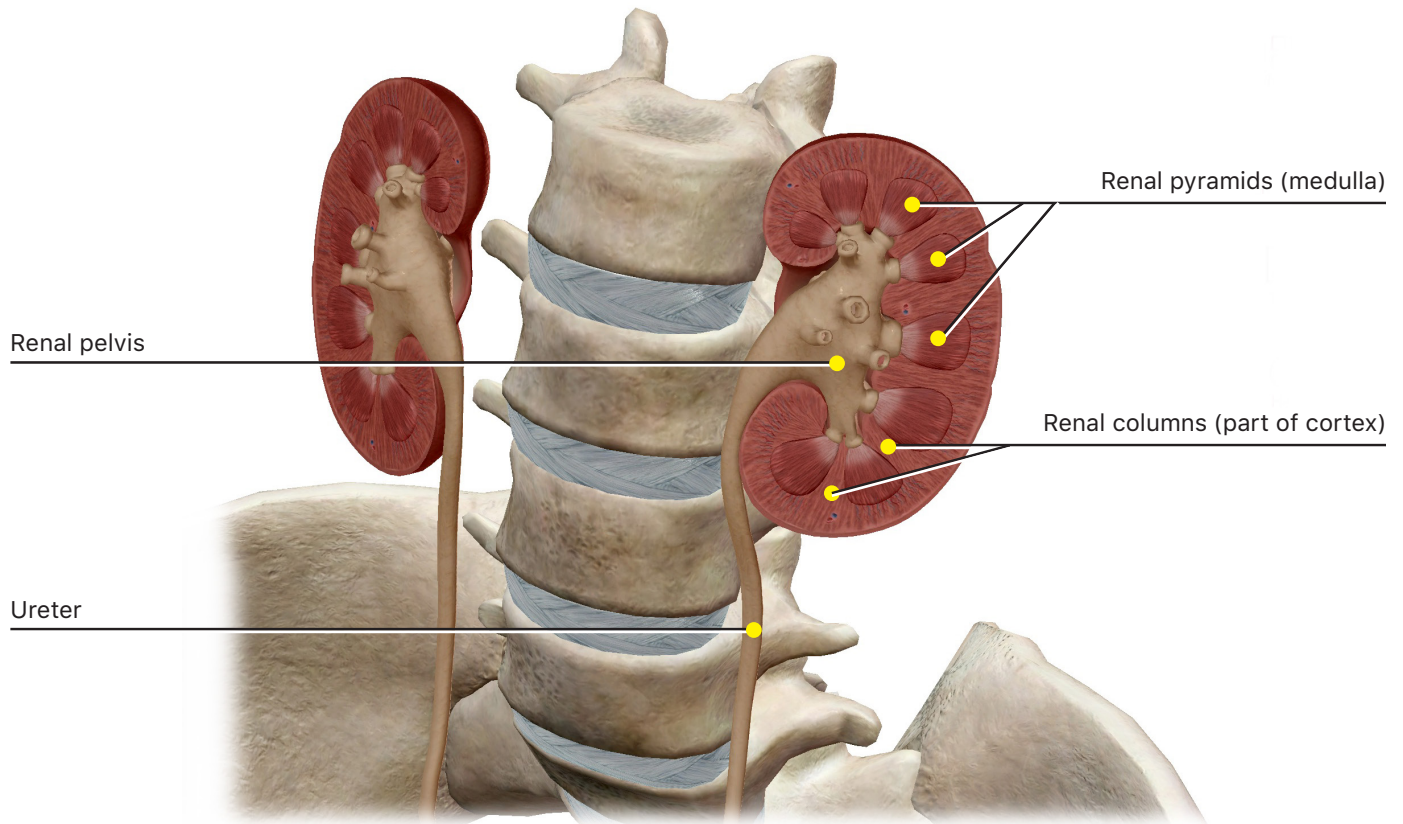


- Note the position of the kidneys in the abdomen. Which kidney is usually lower than the other one?
- According to the description, the kidney is lower to accommodate the_____.
- What is the term used to describe the position of an organ behind the **peritoneum**?

d. Select the peritoneum to view the position of the kidneys behind it.

e. The kidneys are located between the _____ and _____ vertebrae. Select each of these vertebrae to view their locations relative to the kidneys.

2. Explore the 3D anatomical view in Module 44.2 Kidney Anatomy and answer the following questions.



a. What are the three main regions of the kidney?

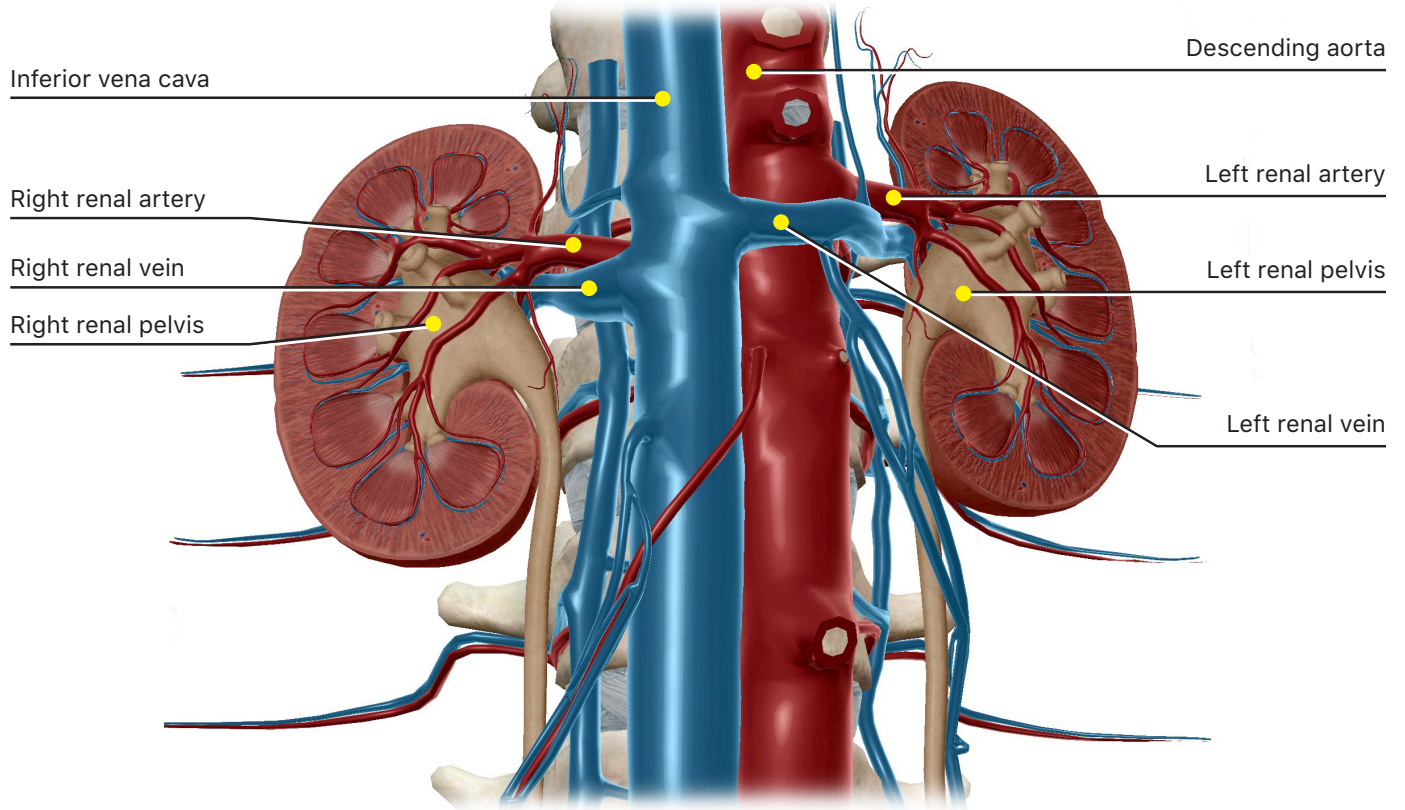
b. Select the **renal cortex** from the left-side menu and use the book icon to read the definition. Note that the cortex includes the outermost layer and columns that extend into the center of the kidney.

i. What is the **adipose capsule**?

ii. What are the basic functional units of the kidney?

- iii. Where are the **nephrons** found?
- iv. The **renal (Malpighian) corpuscle** is the site of **blood filtration**. It is made up of a spherical capillary network called the _____ and the surrounding _____ capsule.
- v. The **renal pyramids** are found in a region called the _____.
- c. Select the renal pyramids from the left-side menu and use the book icon to read the definition. Most of the mass of the renal pyramids is composed of _____.
- d. The regions of cortex between the pyramids are called _____.
- e. The tips of the pyramids converge toward the _____.
- f. Select the **renal pelvises** from the left-side menu and use the book icon to read the definition.
- i. Urine from the _____ drains into the renal pelvis.
- ii. The renal pelvis leaves the kidney and joins the _____, which carries urine to the _____.

3. Explore the 3D anatomical view in Module 44.4 Blood Supply to the Kidneys (formerly 44.3) and answer the following questions.



a. Select the **renal arteries** from the left-side menu and use the book icon to read the definition. Using kidney anatomy as a reference, describe the path of the arteries inside the kidney.

b. Which renal artery is higher than the other?

c. Which renal artery is longer than the other?

d. The renal arteries branch from the _____.

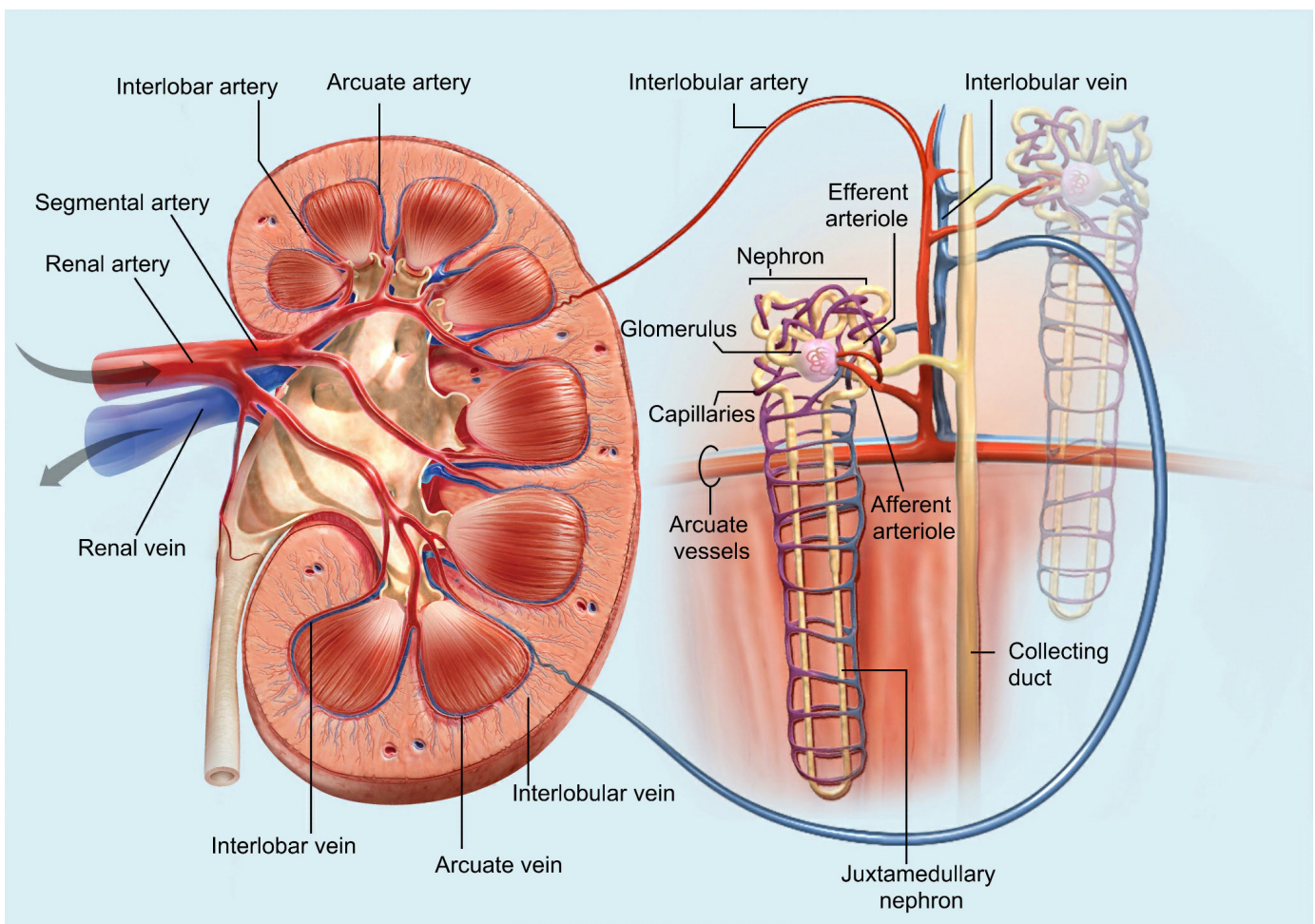
e. What other structures are supplied by the renal arteries?

f. Select the **renal veins** from the left-side menu and use the book icon to read the definition. Note that they follow the same path as the renal arteries. Which is longer than the other?

g. Which vein receives blood from the renal veins?

h. Which renal vein is slightly higher than the other?

4. Examine the illustration in Module 44.5 Blood Flow Through the Nephron (formerly 44.4) and answer the following questions.



a. Identify the arteries, arterioles, and capillary beds that bring blood to the nephron for filtering, and list them in the correct order, beginning with the renal artery.

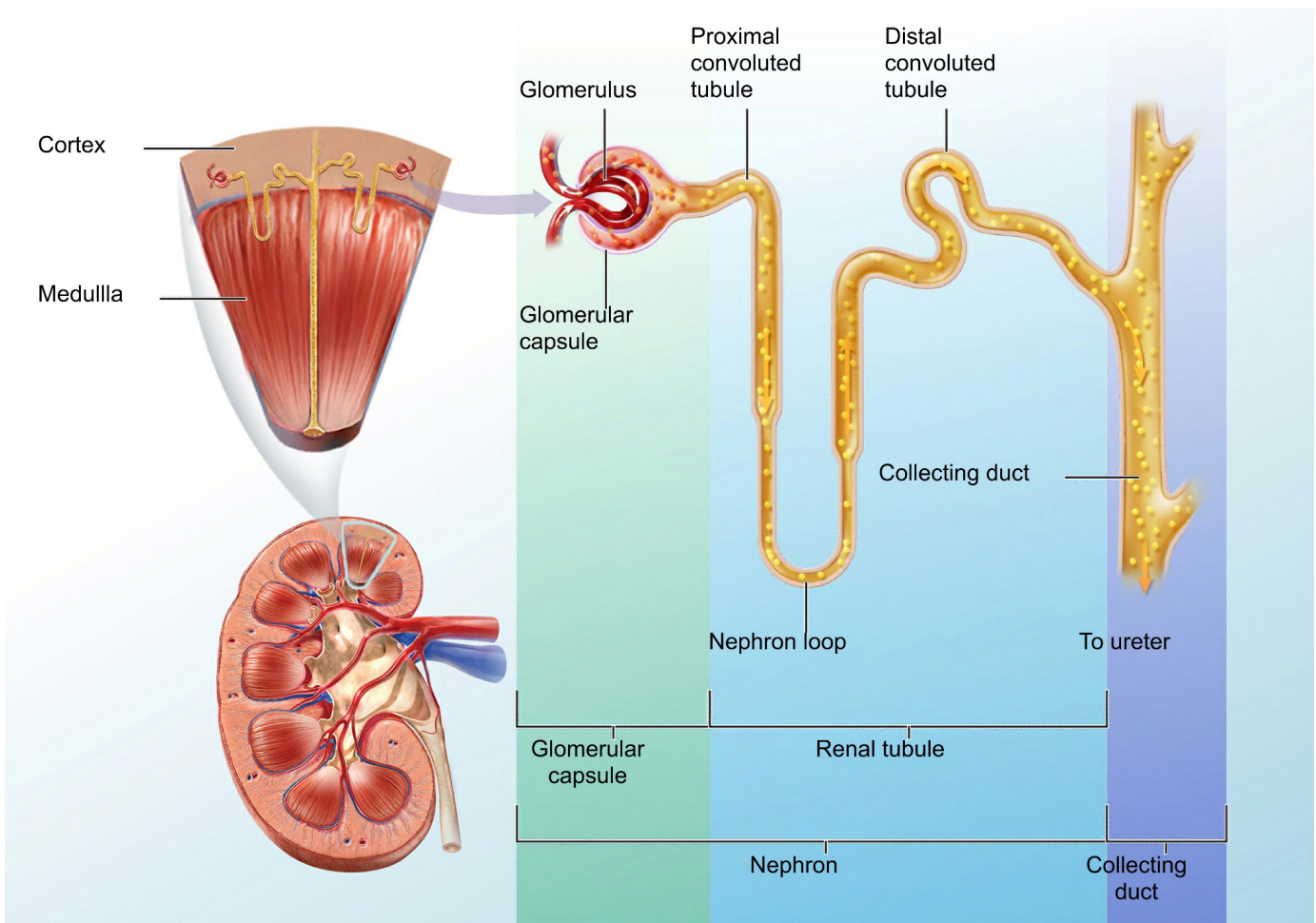
- i.
- ii.
- iii.
- iv.

- v.
- vi.
- vii.

b. What is the structure and function of the **glomerulus**?

c. Where does the blood go after it exits the glomerulus?

5. Examine the illustration in Module 44.6 Nephron Structure (formerly 44.5) and answer the following questions.



a. List the structures of the nephron in the correct order of the flow of filtrate, starting with the **glomerular capsule**.

- i.
- ii.

iii.

iv.

b. In which region are the glomerular capsules located?

c. What blood component is filtered from the glomerulus into the renal capsule?

d. To reach the ureter, the collecting ducts travel through the _____.

e. Together, the proximal convoluted tubule, the nephron loop, and the distal convoluted tubule make up the _____.

f. Urine is produced in these tubules through the processes of _____ and _____.

B. Go back to the Urinary System unit and select Chapter 45. Urine Production.

1. Watch the animation in Module 45.2 Filtration and answer the following questions.



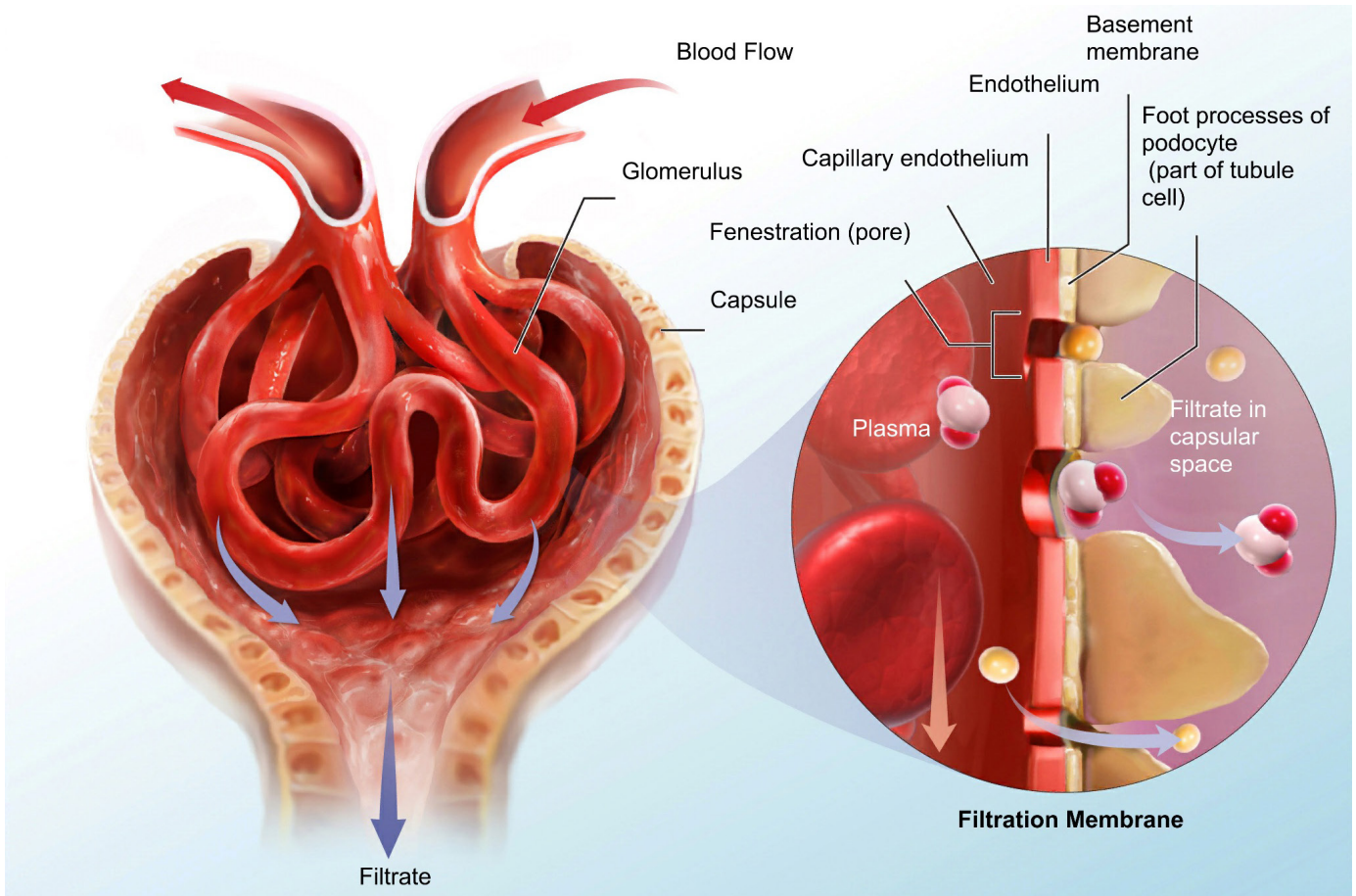
- a. How many nephrons are there in each kidney?

- b. Water and waste passes through the special cell layer surrounding the glomerular capillaries, but _____ and _____ cannot pass and are retained in the blood.

- c. The cup-like structure surrounding the glomerulus is the _____.

- d. This step, called **filtration**, is the first step in _____.

2. Examine the illustration in Module 45.3 Filtration Membrane and answer the following questions.



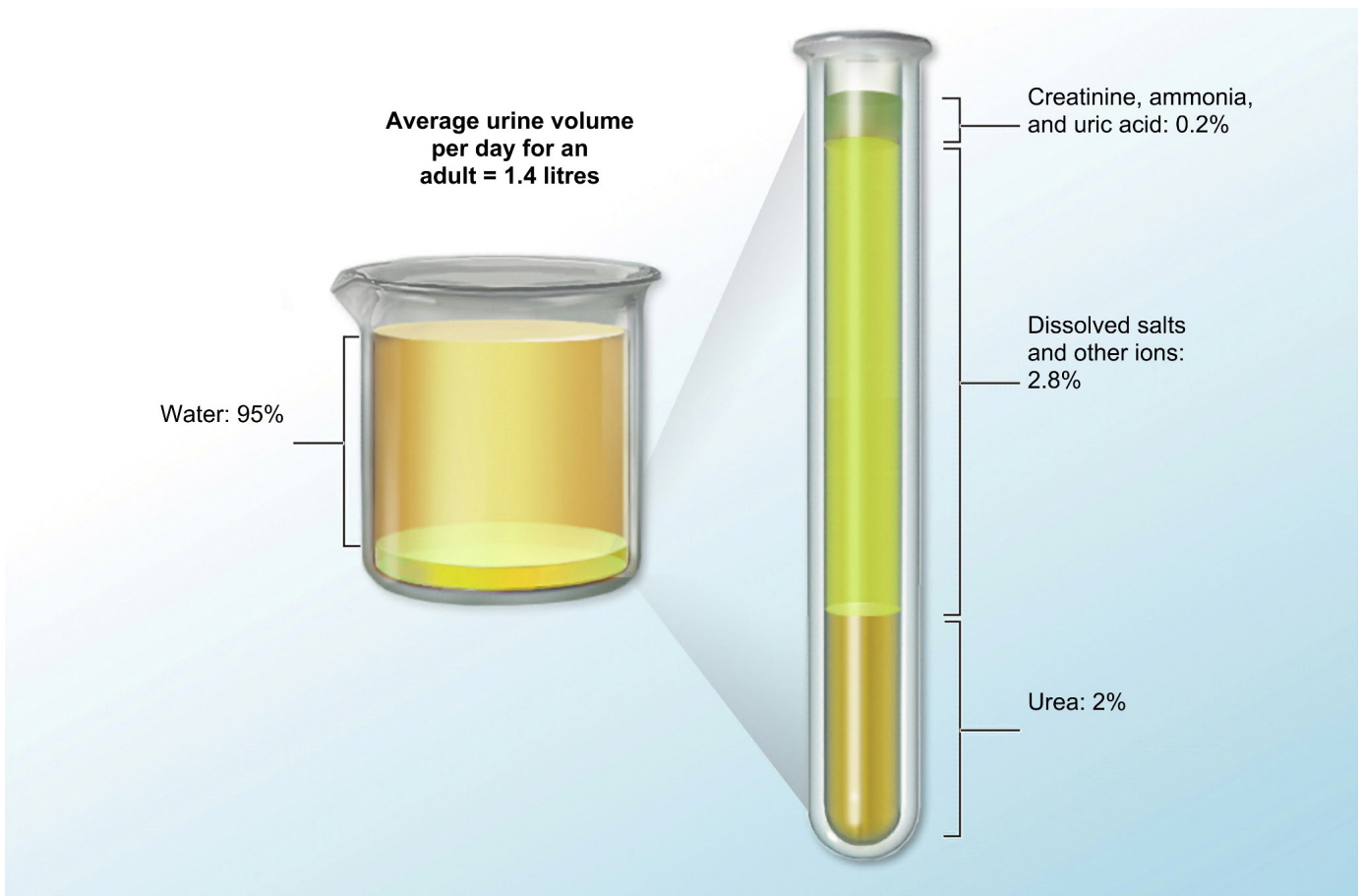
- Pressure inside the _____ is higher than in the _____, forcing **plasma** through the filtration membrane.
- How much **filtrate** is produced by the kidneys per minute?
- Surrounding the capillaries is a **basement membrane** and a layer of cells called _____. These cells have foot-like processes called _____.
- Together, the **tubule cells**, the basement membrane, and the capillary **endothelium** make up the _____.
- The **filtration membrane** contains pores called _____ that allow plasma to flow from the blood into the capsule.

3. Watch the animation in Module 45.4 Reabsorption and Secretion and answer the following questions.



- a. Water, nutrients, essential ions, and small proteins that have passed into the tubules are **reabsorbed** by the _____ cells of the tubule wall.
- b. Waste ions and excess H⁺ ions are passed from the blood into the tubule, as required to maintain **electrolyte balance**, via the process of _____.
- c. The processes of reabsorption and secretion in the tubules convert filtrate into _____.

4. Examine the illustration in Module 45.6 Urine Composition and answer the following questions.

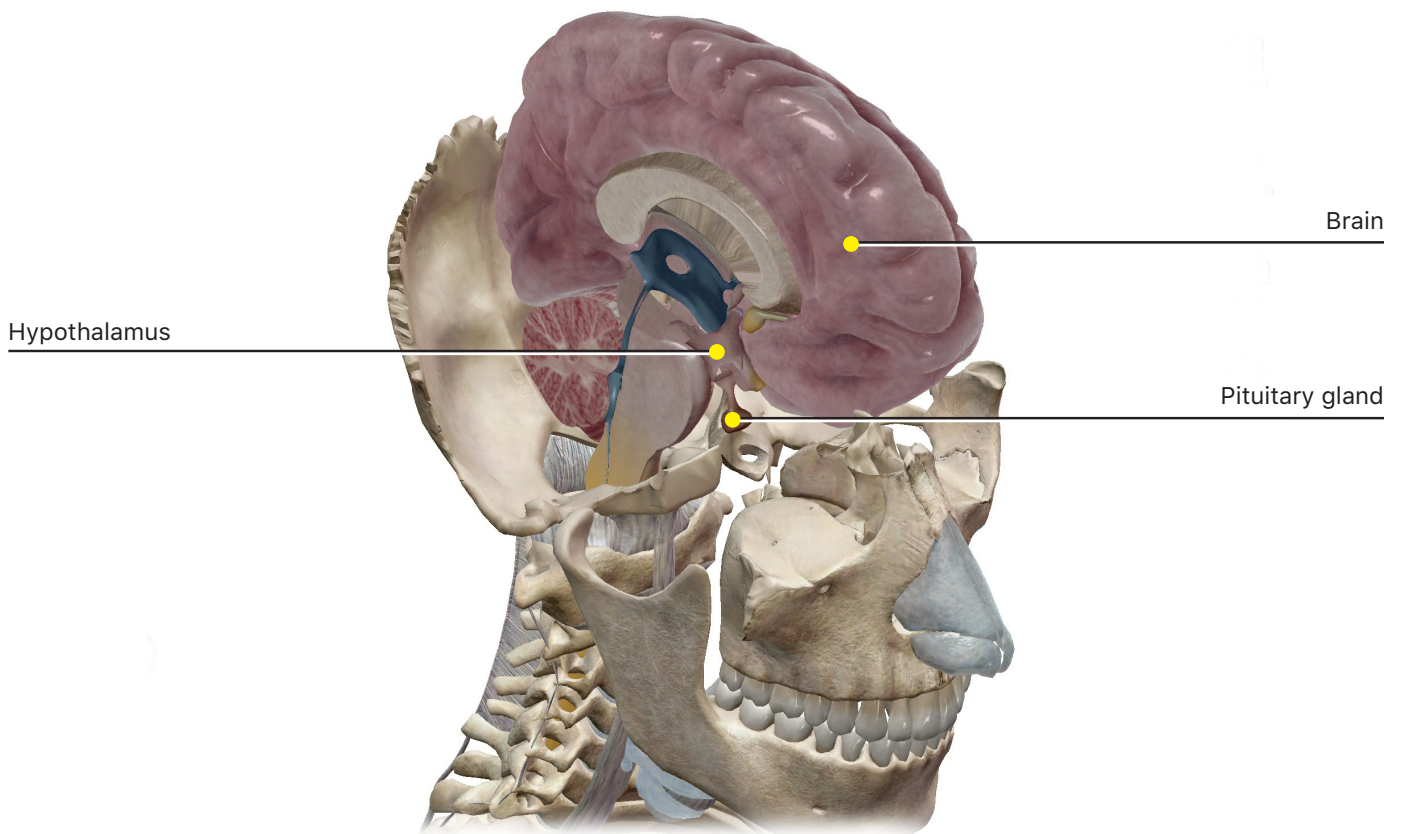


- a. What percentage of urine is (normally) water?
- b. What are the four main **nitrogenous waste** components of urine?

c. Adults usually produce about _____ liters of urine per day.

d. Salts and other waste ions make up about _____ % of urine.

5. Explore the 3D anatomical view in Module 45.7 Function of ADH and answer the following questions.



a. **ADH** stands for _____ a hormone that causes the kidneys to retain water.

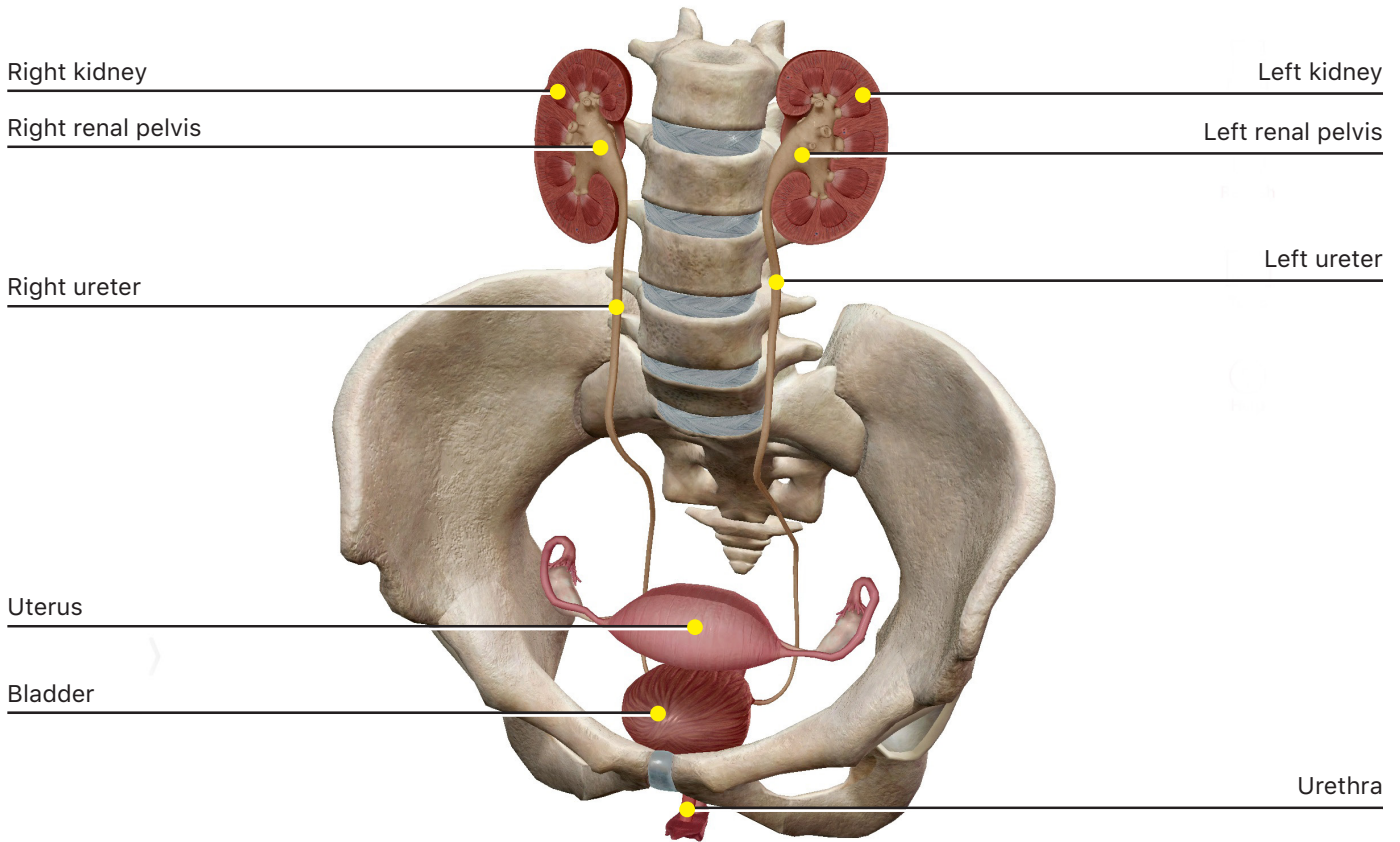
b. What does **diuretic** mean?

c. Which part of the brain detects blood water levels?

d. Which gland releases ADH?

C. Go back to the Urinary System unit and select Chapter 46. Urine storage and Elimination.

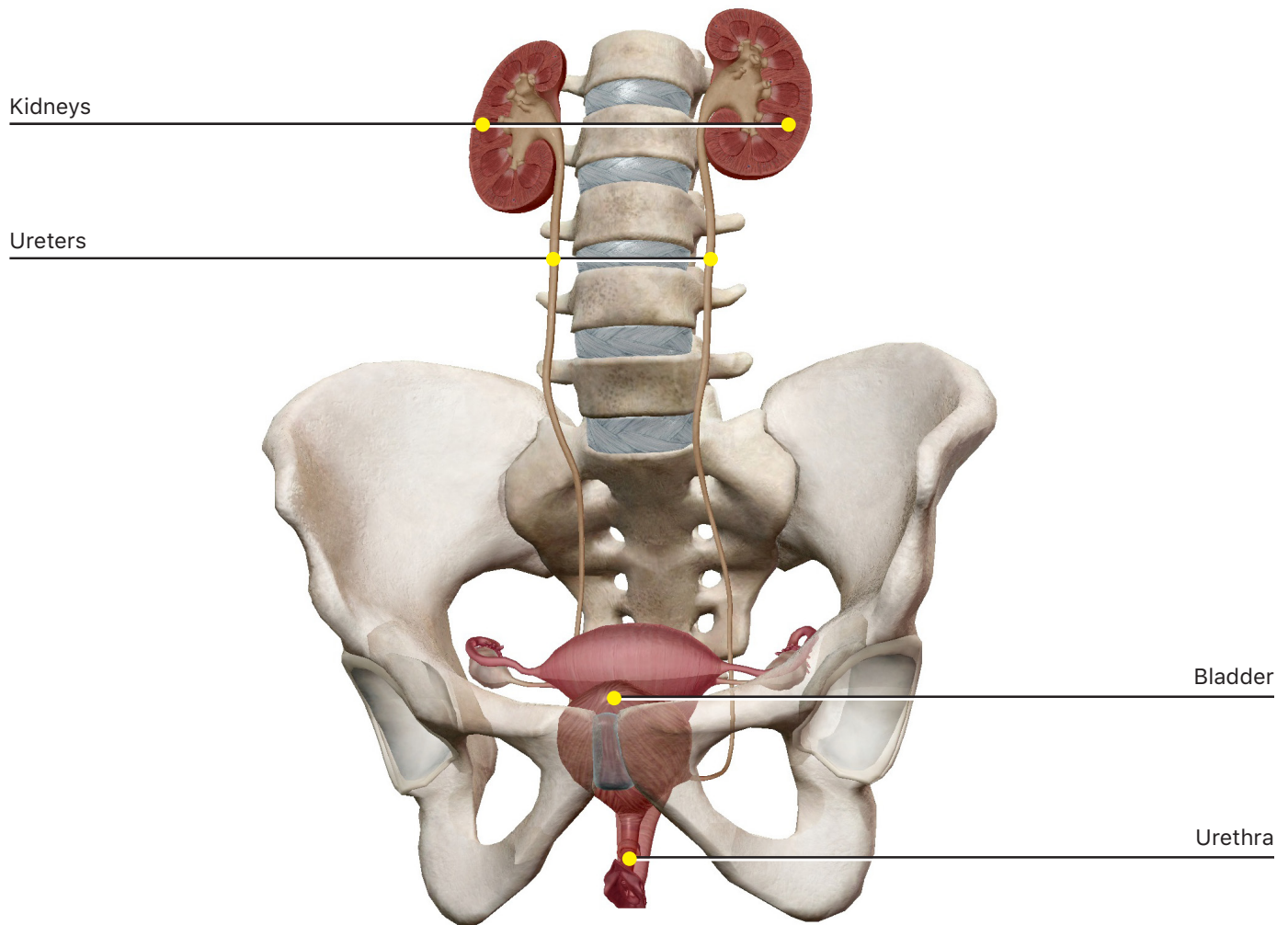
1. Explore the 3D anatomical view in Module 46.1 Pathway of Urine and answer the following questions.



a. In this overview, you can follow the path of urine as it leaves the kidneys and flows through the urinary system before exiting the body via the urethra. List the structures, in order, through which urine passes after it leaves the renal pyramids.

b. Is this a female or a male model?

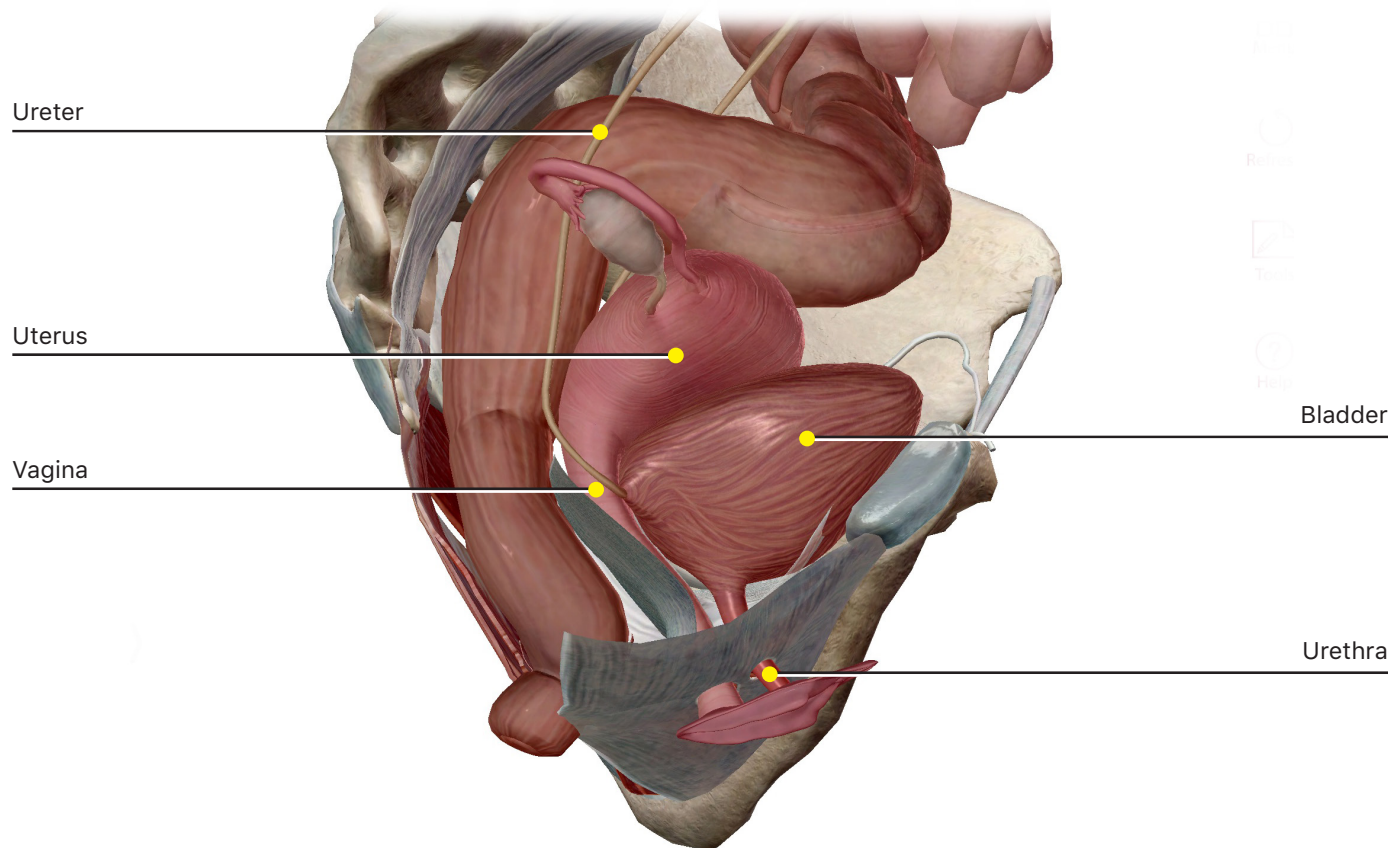
2. Explore the 3D anatomical view in Module 46.2 Ureters and answer the following questions.



a. Select ureters from the left-side menu and use the book icon to read the definition. What propels urine along the ureters?

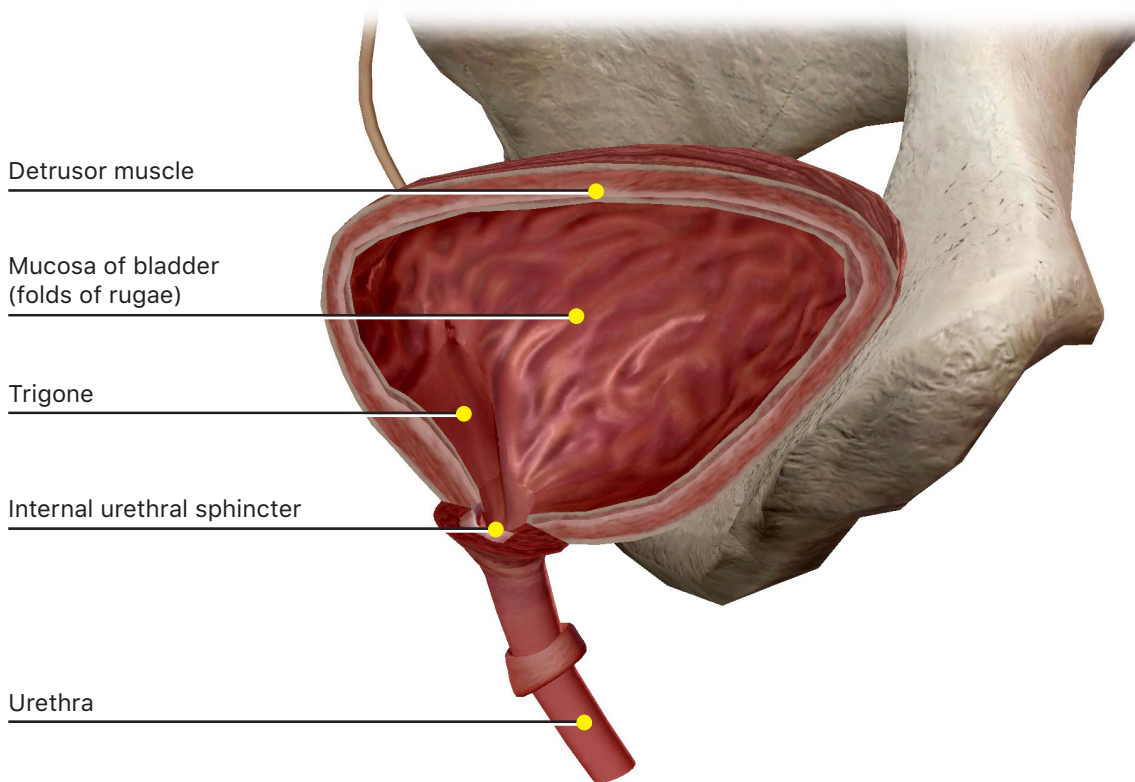
b. How long is each ureter?

3. Explore the 3D anatomical view in Module 46.4 Bladder in Female (formerly 46.3) and answer the following questions.



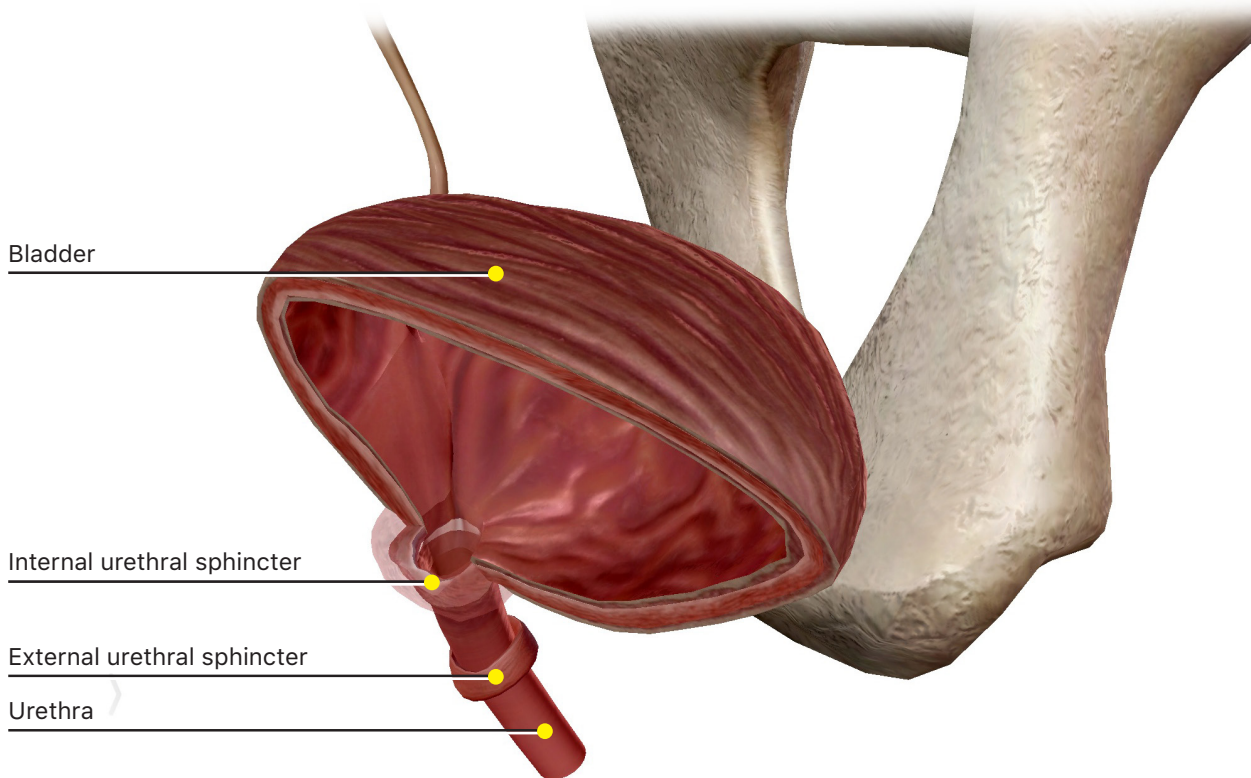
a. Note the relative positions of the bladder, the **vagina**, and the **uterus**. What do you think happens to the bladder when a woman is in the last month of pregnancy?

4. Explore the 3D anatomical view in Module 46.6 Bladder Anatomy (formerly 46.5) and answer the following questions.



- a. Select the **detrusor muscle** in the left-side menu to see a cross section view of the bladder. The **mucosa** of the bladder is made up of _____ epithelium, which is folded into _____. The underlying smooth muscle layer is called the _____ muscle. What is the function of these structures?
- b. The openings of the ureters and the **internal urethral sphincter** form a triangular, funnel-shaped region of the bladder called the _____.

5. Explore the 3D anatomical view in module 46.8 Micturition Reflex (formerly 46.6) and answer the following questions.



a. Select the internal urethral sphincter from the left-side menu and use the book icon to read the definition. In your own words, describe where this sphincter is located with respect to the bladder and the urethra.

b. Select the **external urethral sphincter** from the left-side menu and use the book icon to read the definition. In your own words, describe where this sphincter is located with respect to the bladder and the urethra.

c. Of these two sphincters, which is involuntary and which is voluntary?

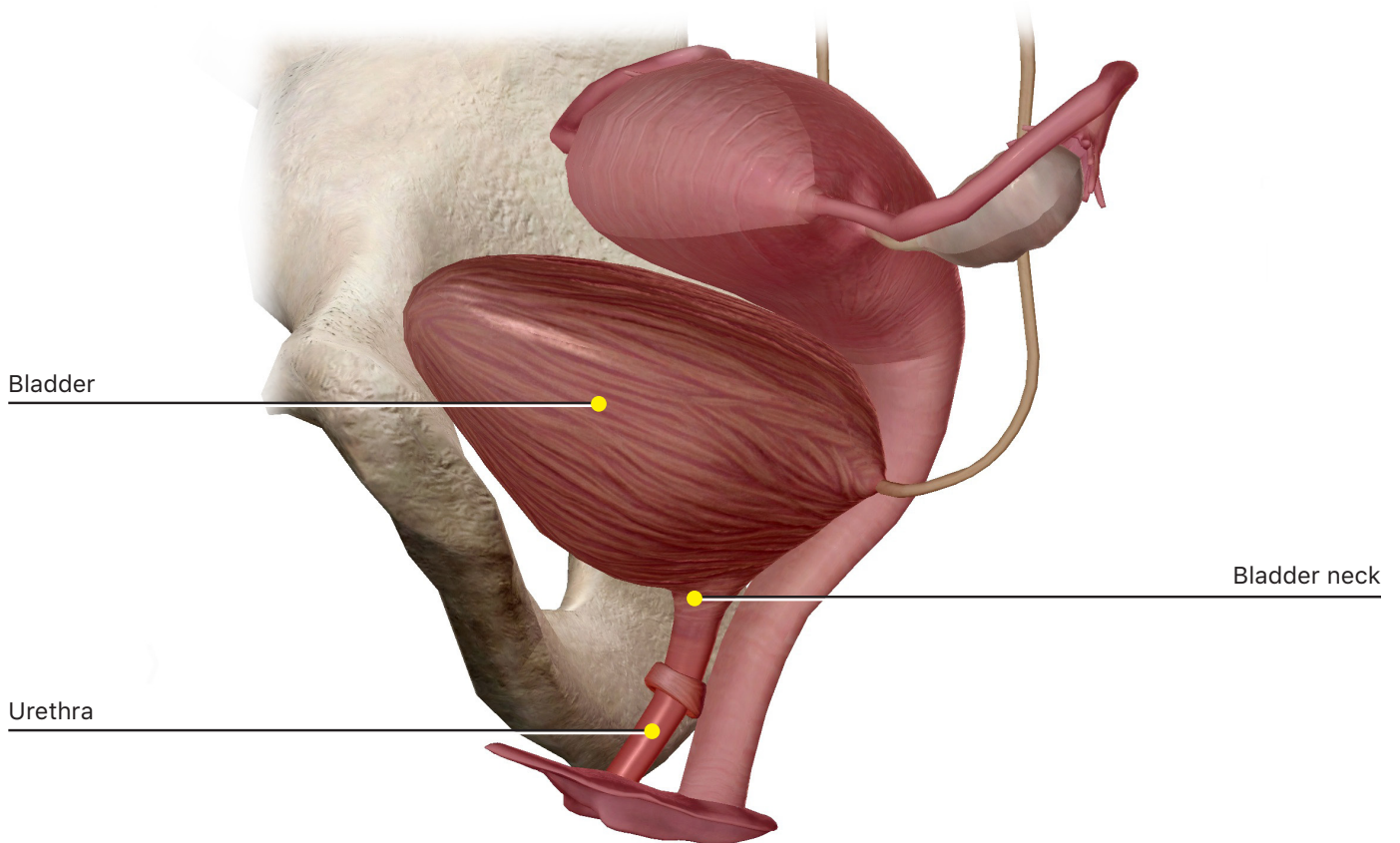
d. These two sphincters are found where the urethra passes through the _____.

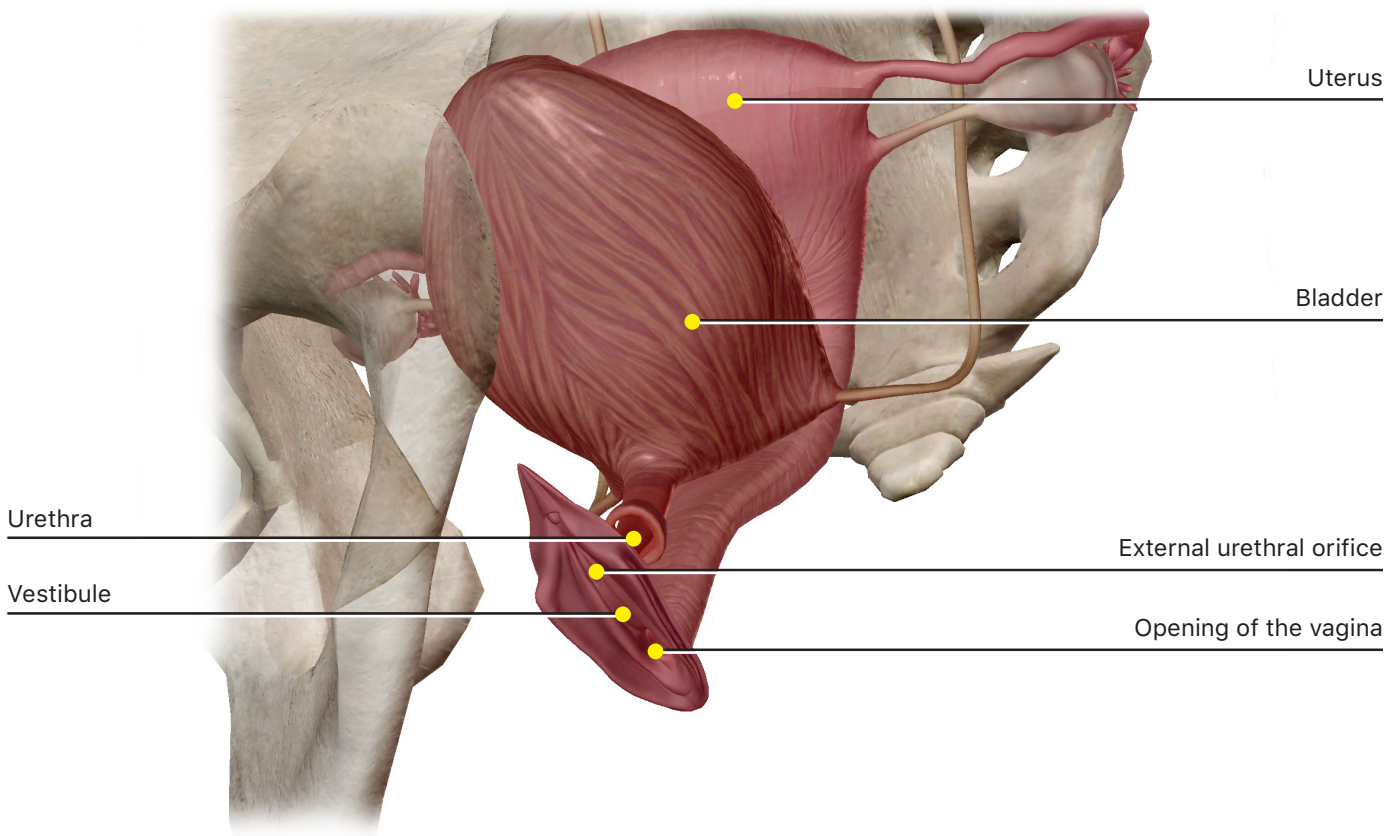
e. What triggers the **micturition reflex**?

f. What are the involuntary muscle actions of **micturition**?

g. Voluntary control over micturition is provided by the _____.

6. Explore the 3D anatomical view in Module 46.11 Female Urethra (formerly 46.9) and answer the following questions.





a. Select the urethra from the left-side menu and use the book icon to read the definition. How long is the female urethra?

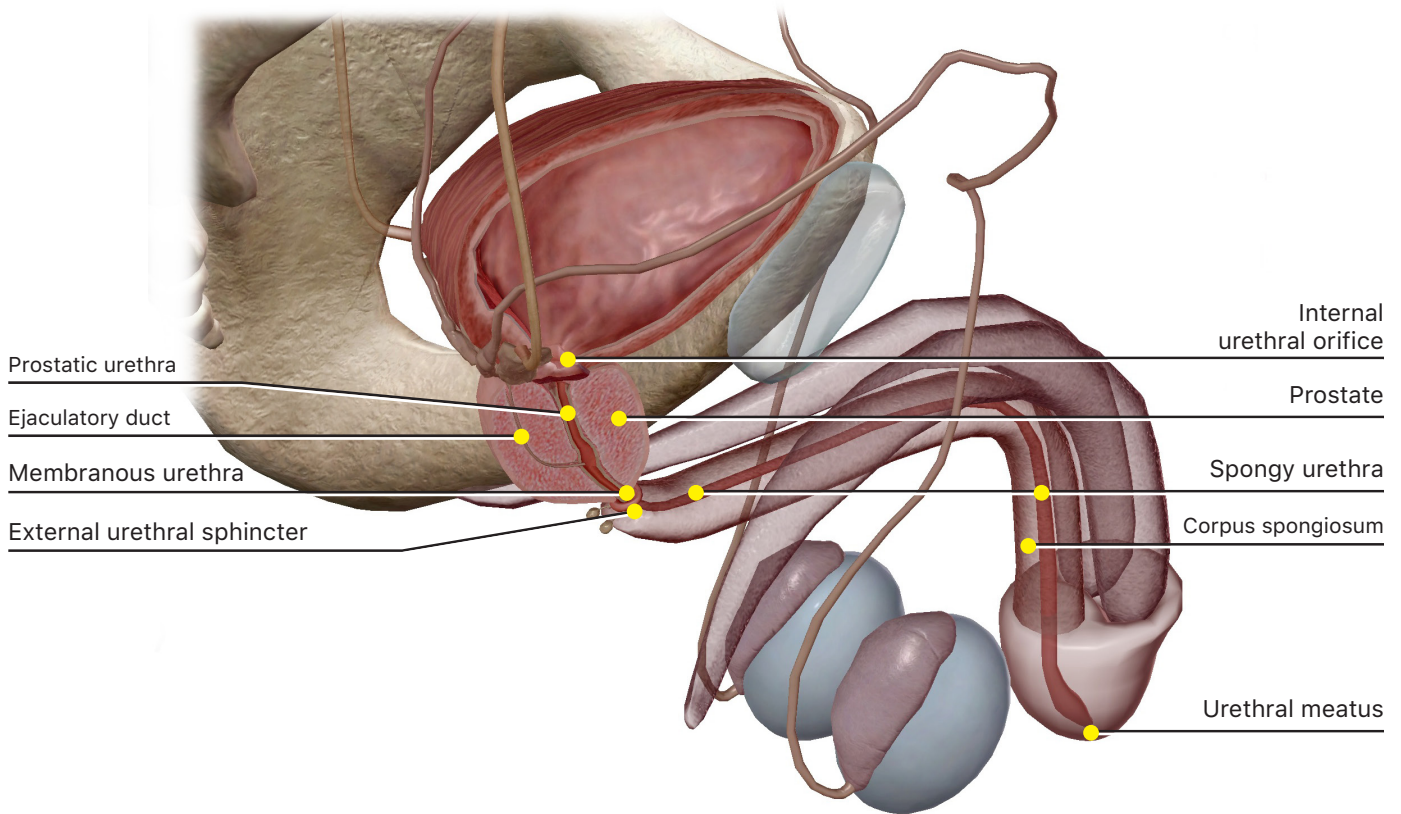
b. What is the function of the urethra?

c. The region of the urethra that attaches to the bladder is called the _____.

d. Select the **external urethral orifice** from the left-side menu to see the external opening of the urethra. It is surrounded by the _____. It is directly in front of the opening of the _____. Note that the female urethra is completely separate from the vagina and is used only for the passage of urine.

e. Select the **vestibule** from the left-side menu and note the locations of the urethra and the vaginal opening.

7. Explore the 3D anatomical view in Module 46.12 Male Urethra (formerly 46.10) and answer the following questions.



a. What are the three regions of the male urethra?

b. Select any part of the urethra from the left-side menu and use the book icon to read the definition. The male urethra extends from the _____ to the _____.

c. How long is the male urethra?

d. The **prostatic urethra** travels through the center of the _____ and is joined by the ejaculatory ducts. From here, both _____ and _____ can pass through the male urethra.

e. The **membranous urethra** is surrounded by the circular _____.

f. The _____ portion of the urethra passes through the _____.

PUTTING IT ALL TOGETHER

1. Draw a simple diagram of the female urinary system, labeling all the organs.

2. What would need to be different for a drawing of the male urinary system?

3. Open Module 44.5 Blood Flow Through the Nephron (formerly 44.4) and identify the:
 - a. Renal artery and vein
 - b. Segmental artery
 - c. Interlobar artery and vein
 - d. Arcuate artery and vein
 - e. Interlobular artery and vein

4. Open module 44.6 Nephron Structure (formerly 44.5) and answer the following questions.
 - a. Which structure contains fenestrations that allow plasma to pass through an epithelium?

 - b. Which structure collects filtrate?

 - c. Which part reabsorbs water and secretes ions?

 - d. Which structure delivers urine to the renal pelvis?

 - e. Which region contains all the afferent and efferent arterioles?

 - f. Collecting ducts travel mostly through the _____ (region).

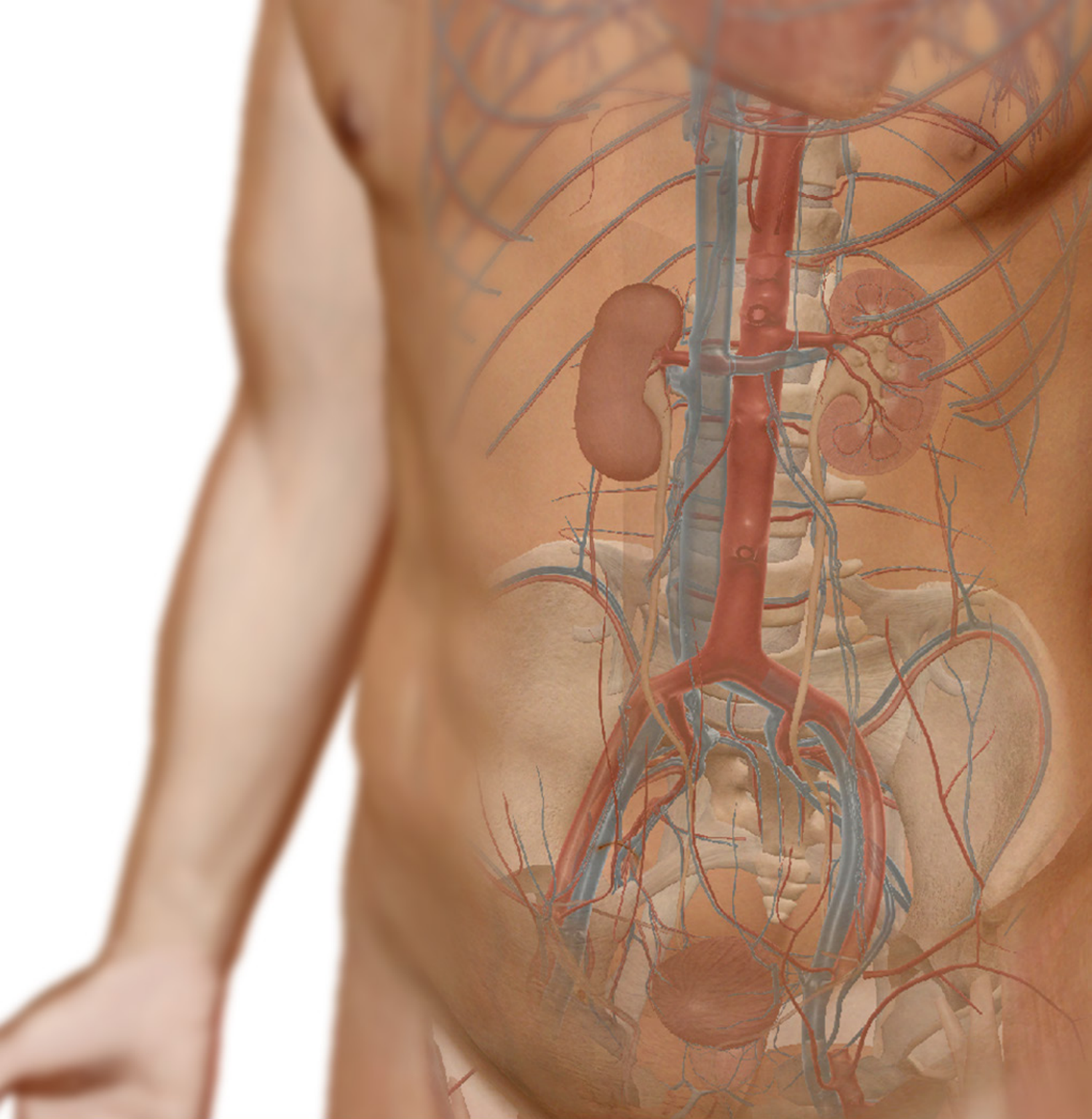
 - g. Which structure is said to contain urine (not filtrate)?

5. The kidneys are sometimes said to “clean” the blood. What does this mean?

TIME TO PRACTICE!

[GO TO THE QUIZZES MENU AND COMPLETE URINARY SYSTEM QUIZZES](#)

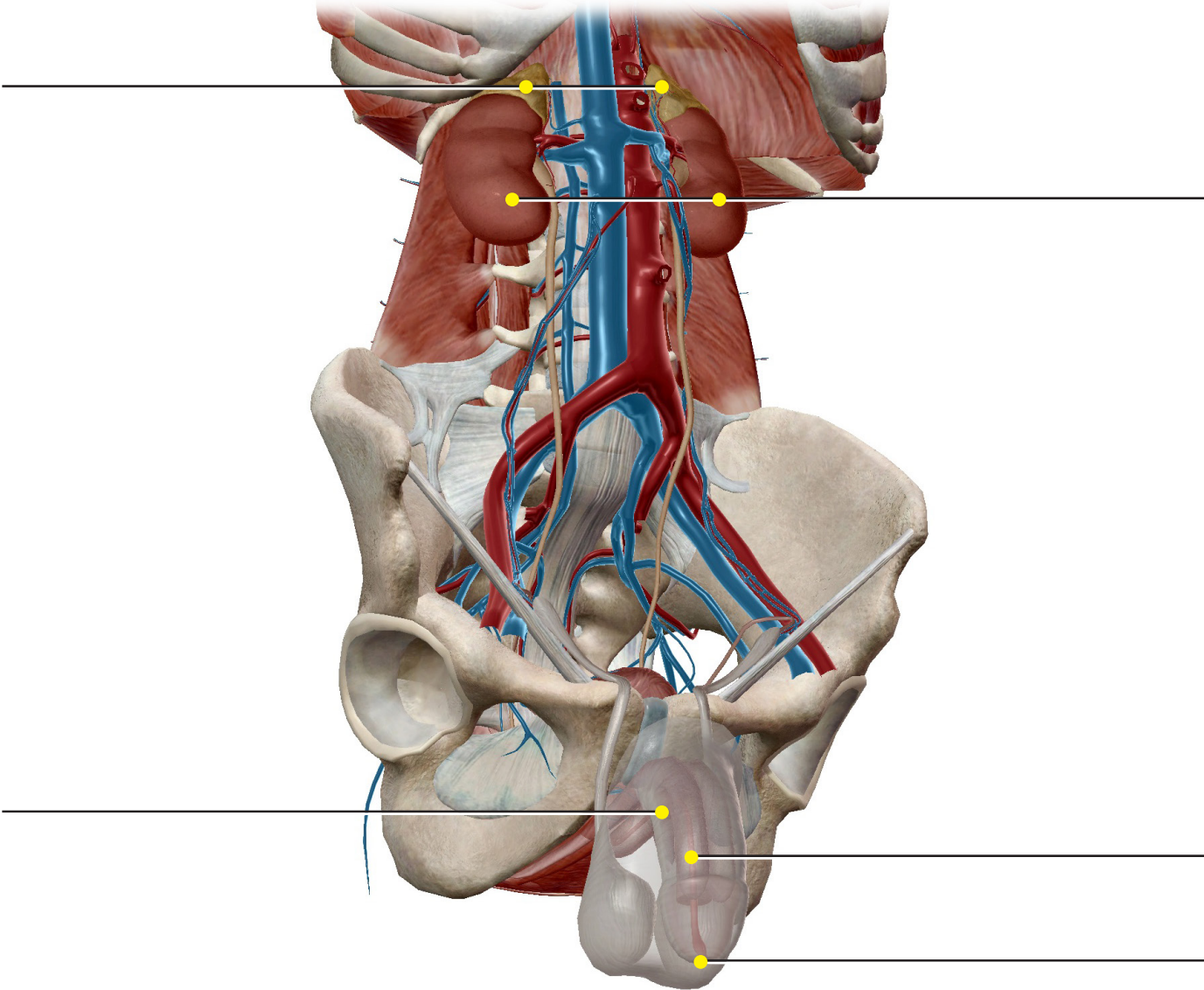
[44.A, 44.B, 45.A, 45.B, 46.A AND 46.B.](#)



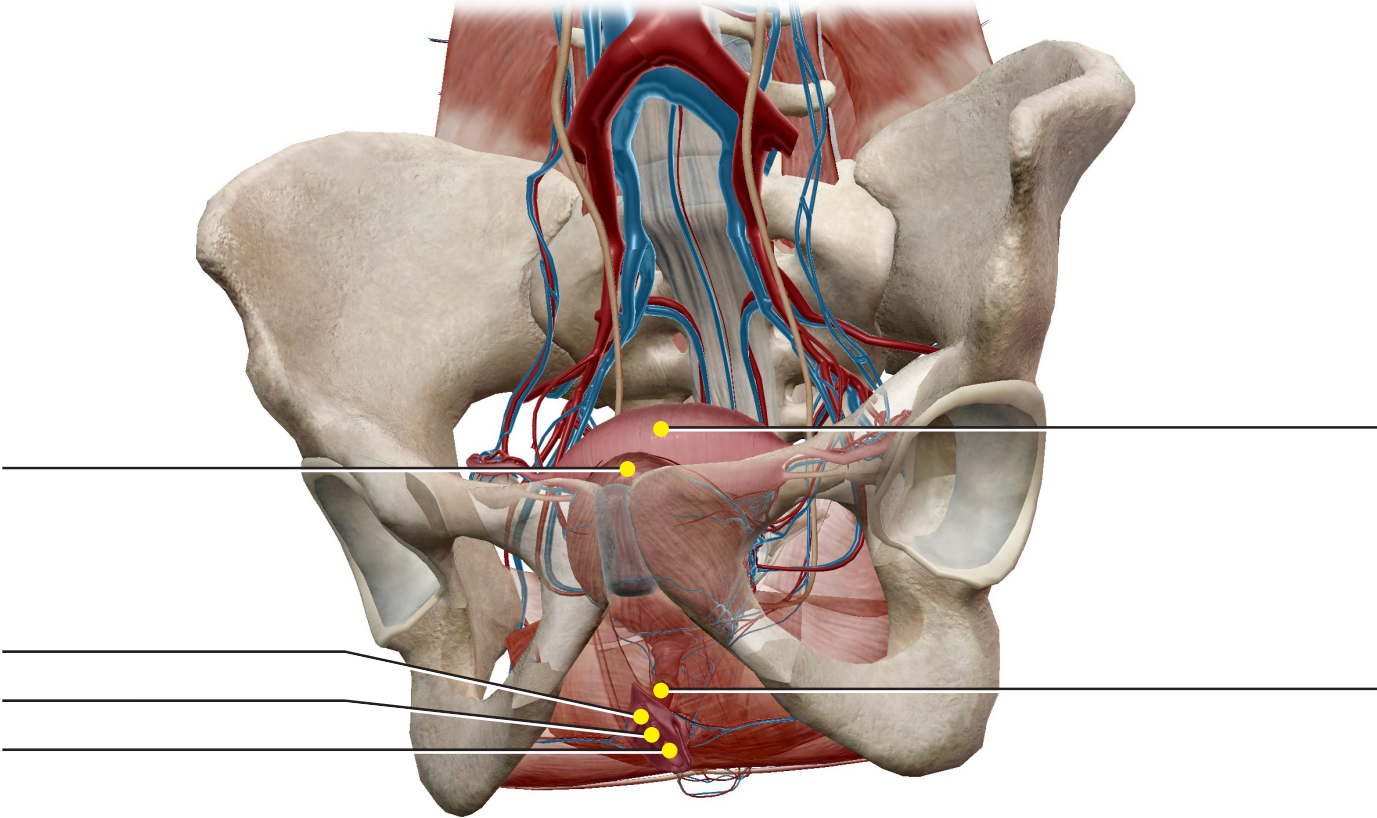
Student Practice

Label all the structures on the following images.

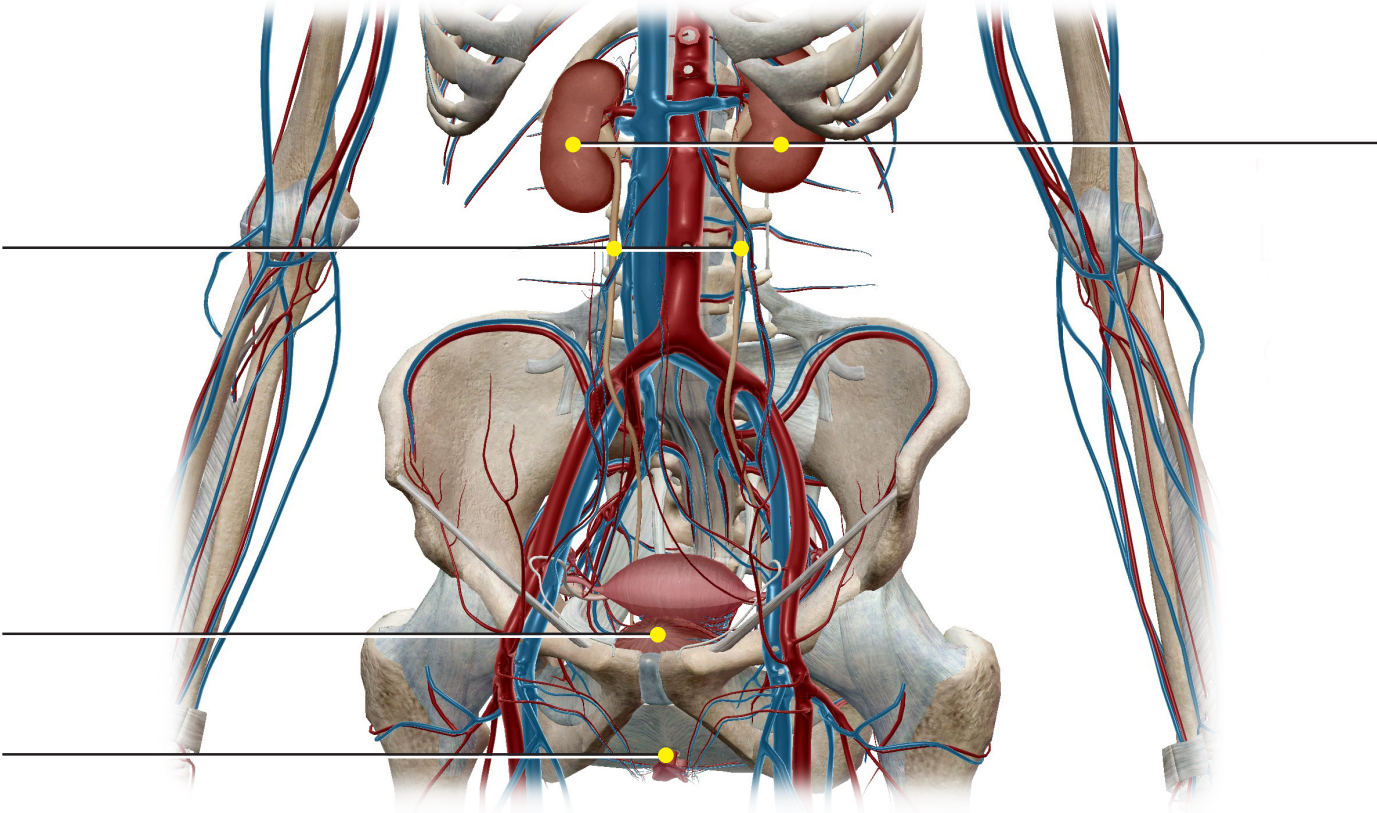
Module 43.2 Male Urinary Anatomy



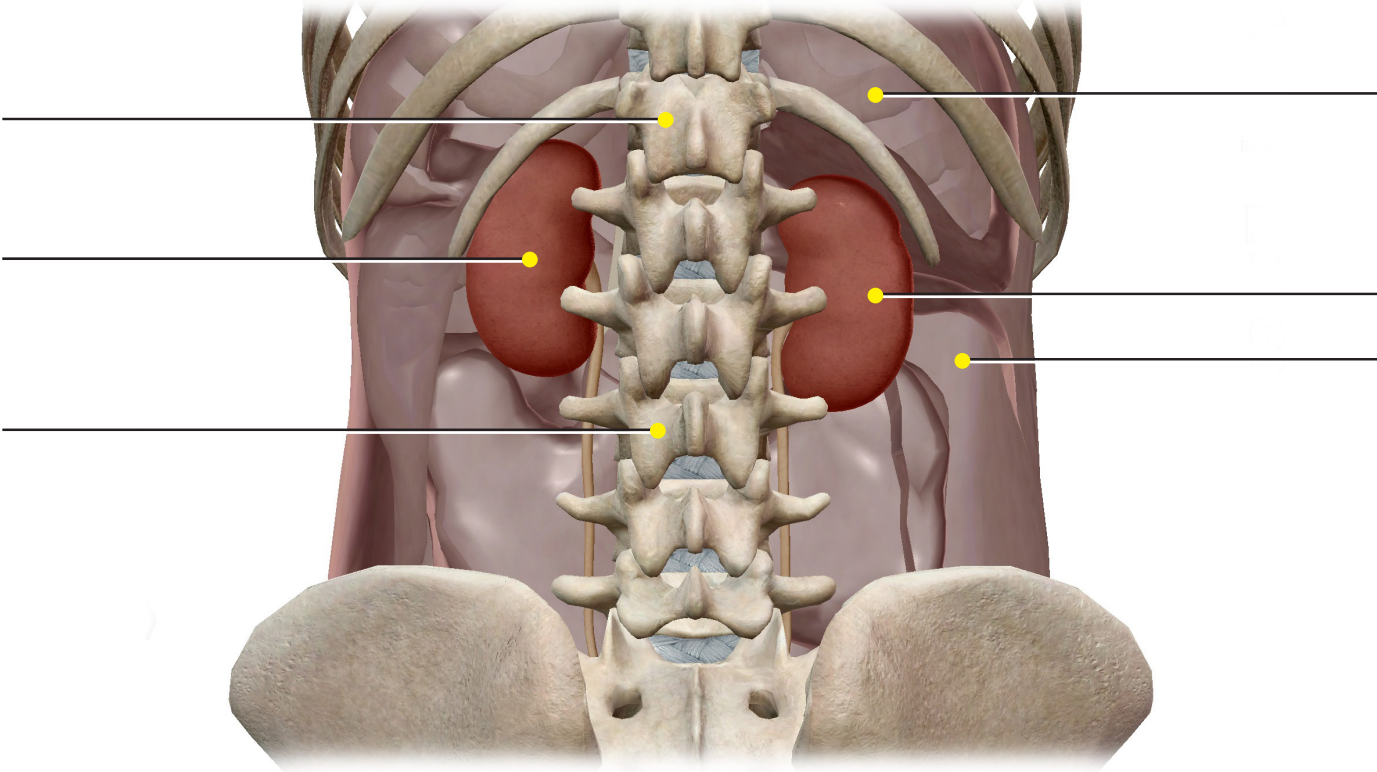
Module 43.3 Female Urinary Anatomy



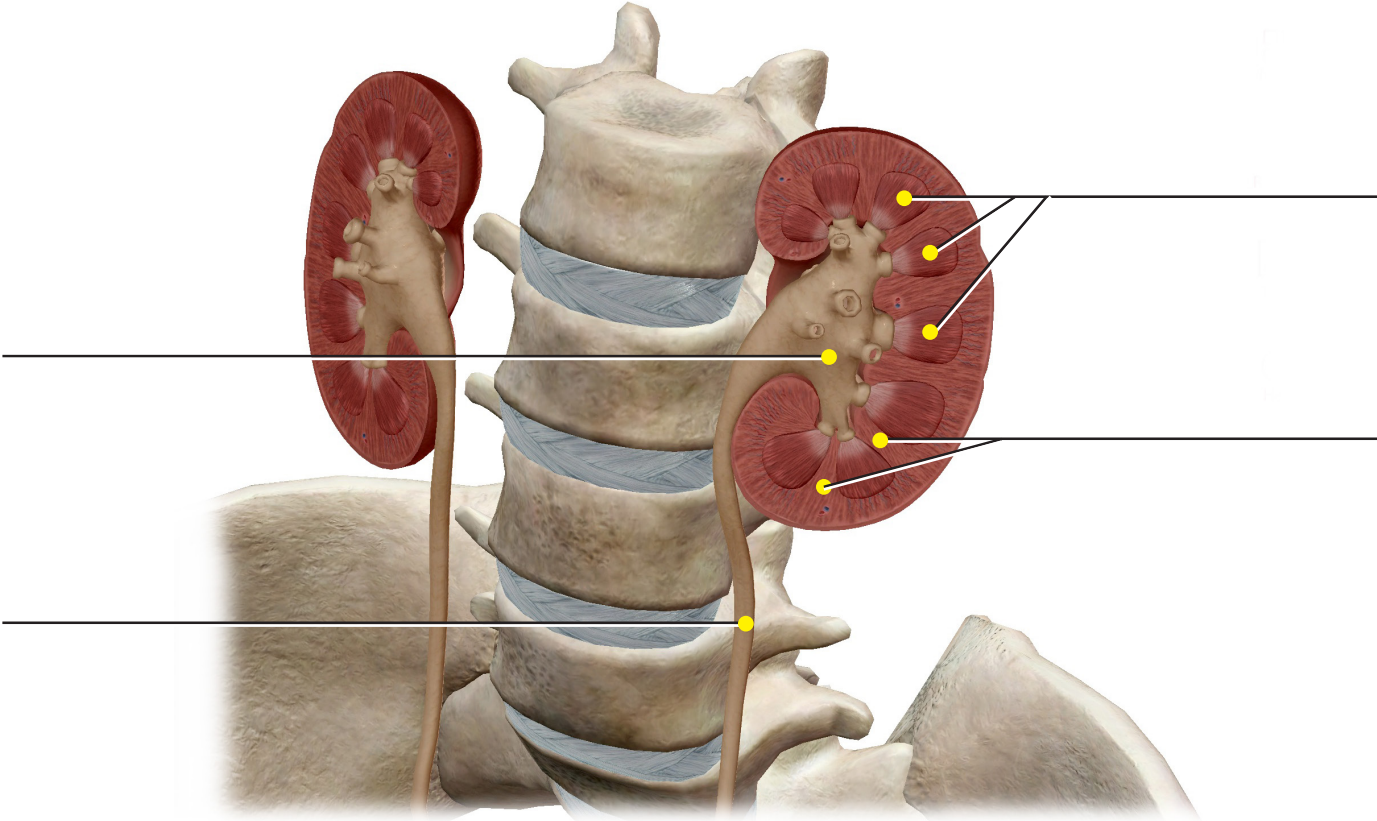
Module 43.4 Urinary Functions



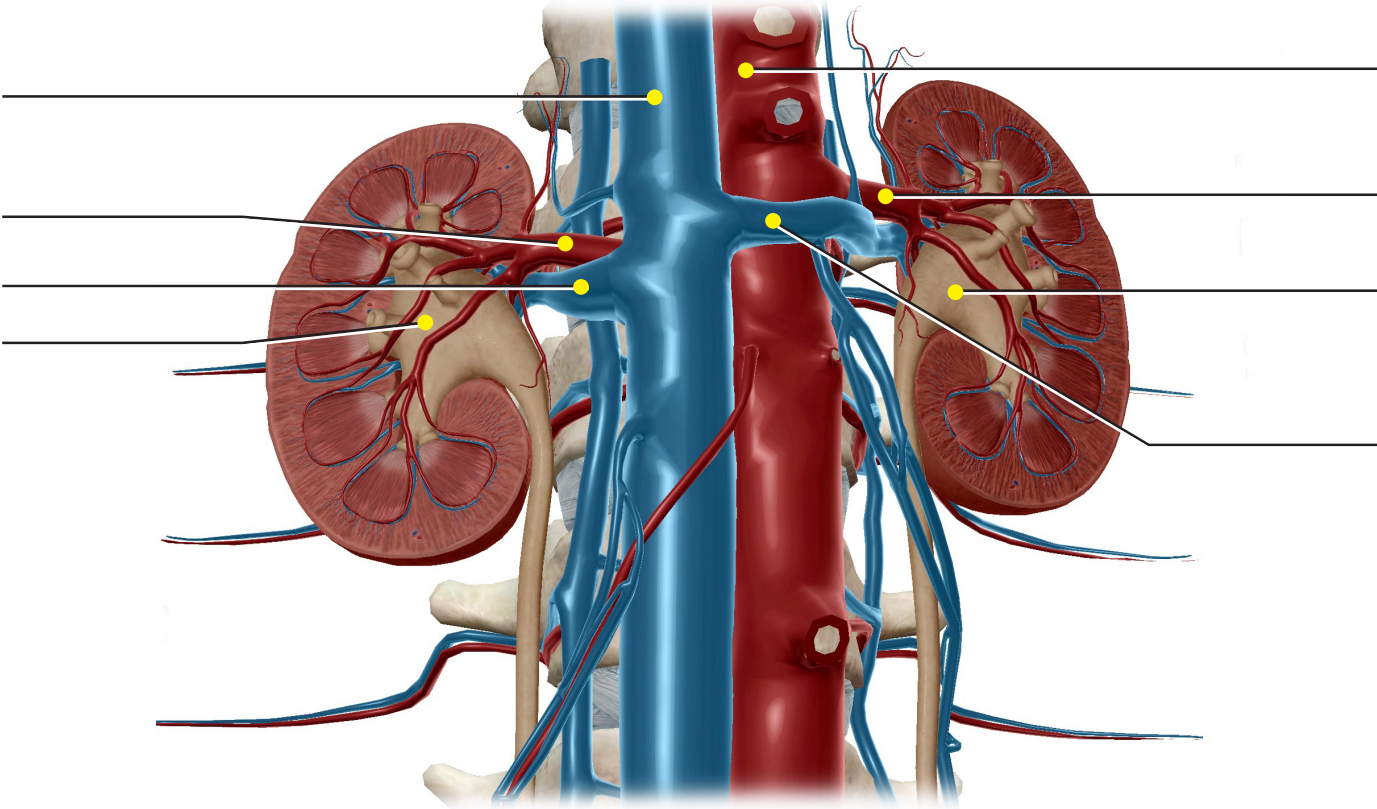
Module 44.1 Position of Kidneys



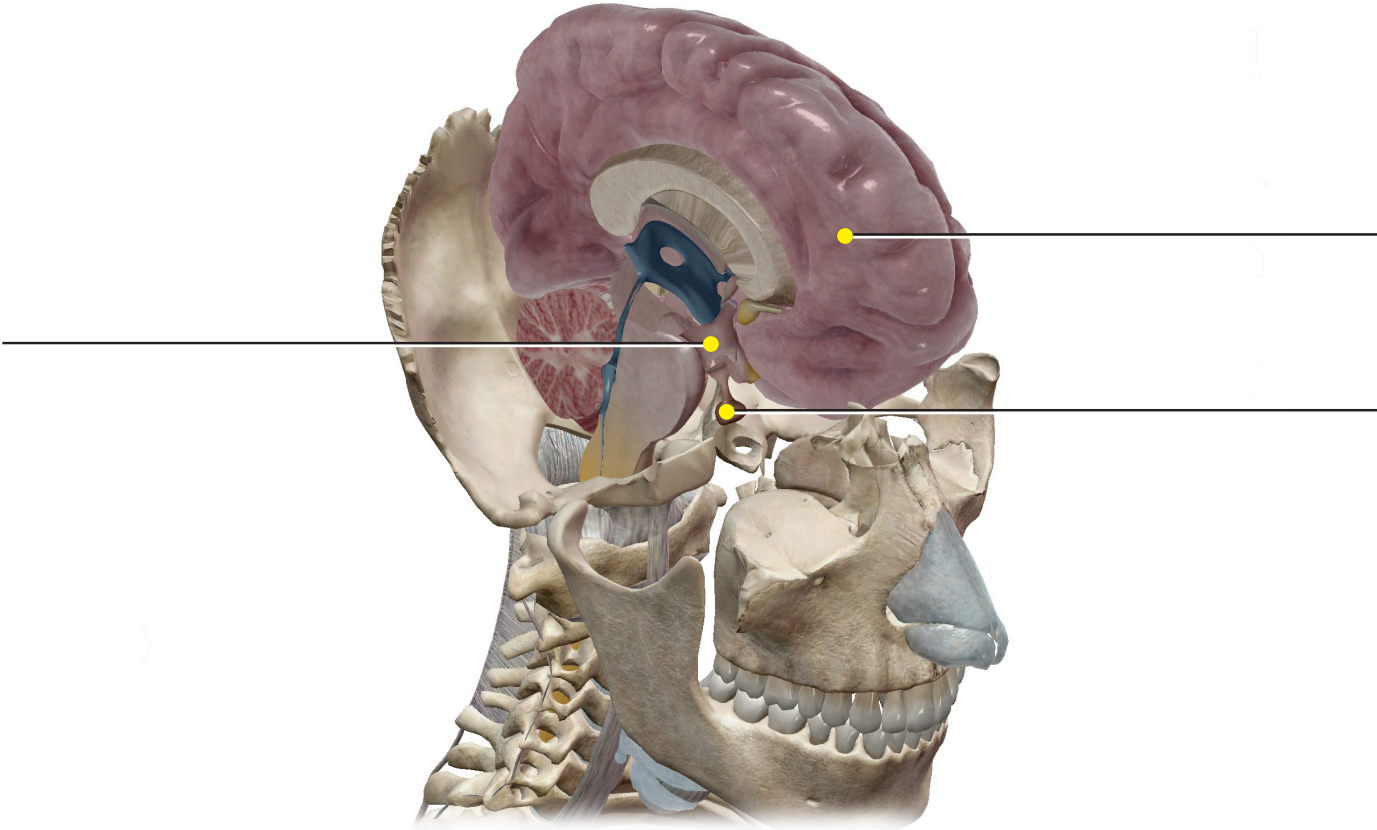
Module 44.2 Kidney Anatomy



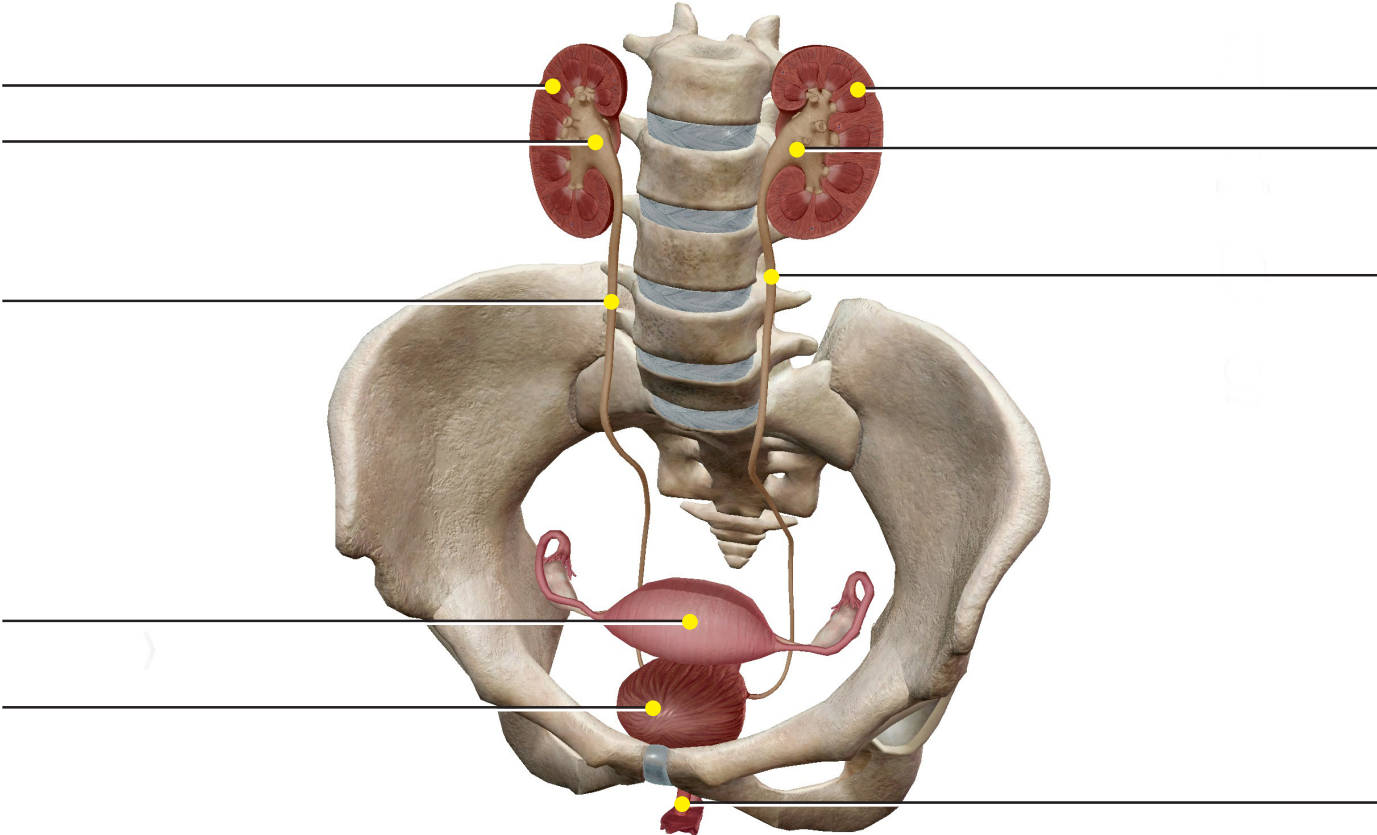
Module 44.4 Blood Supply to the Kidneys (formerly 44.3)



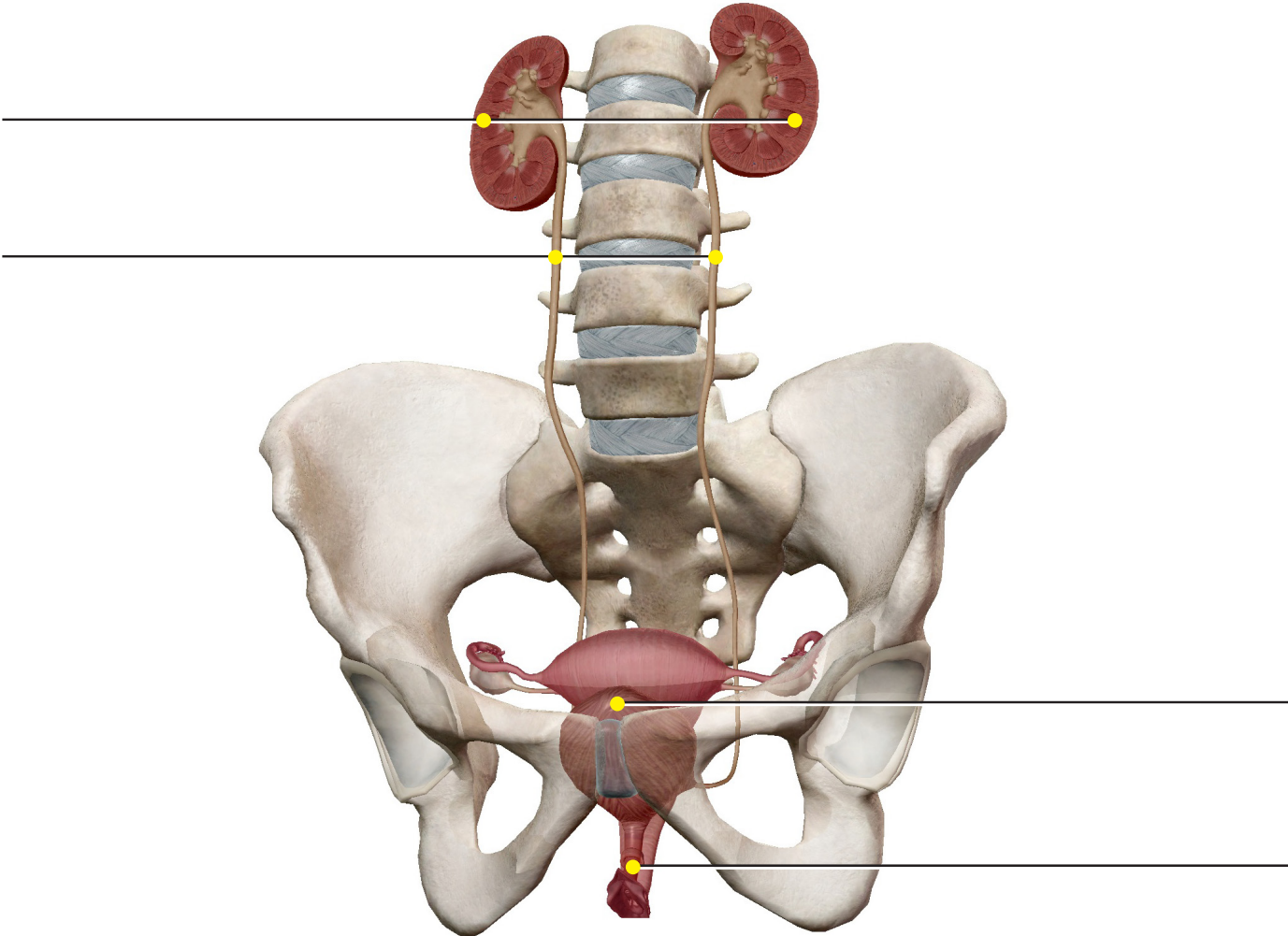
Module 45.7 Function of ADH



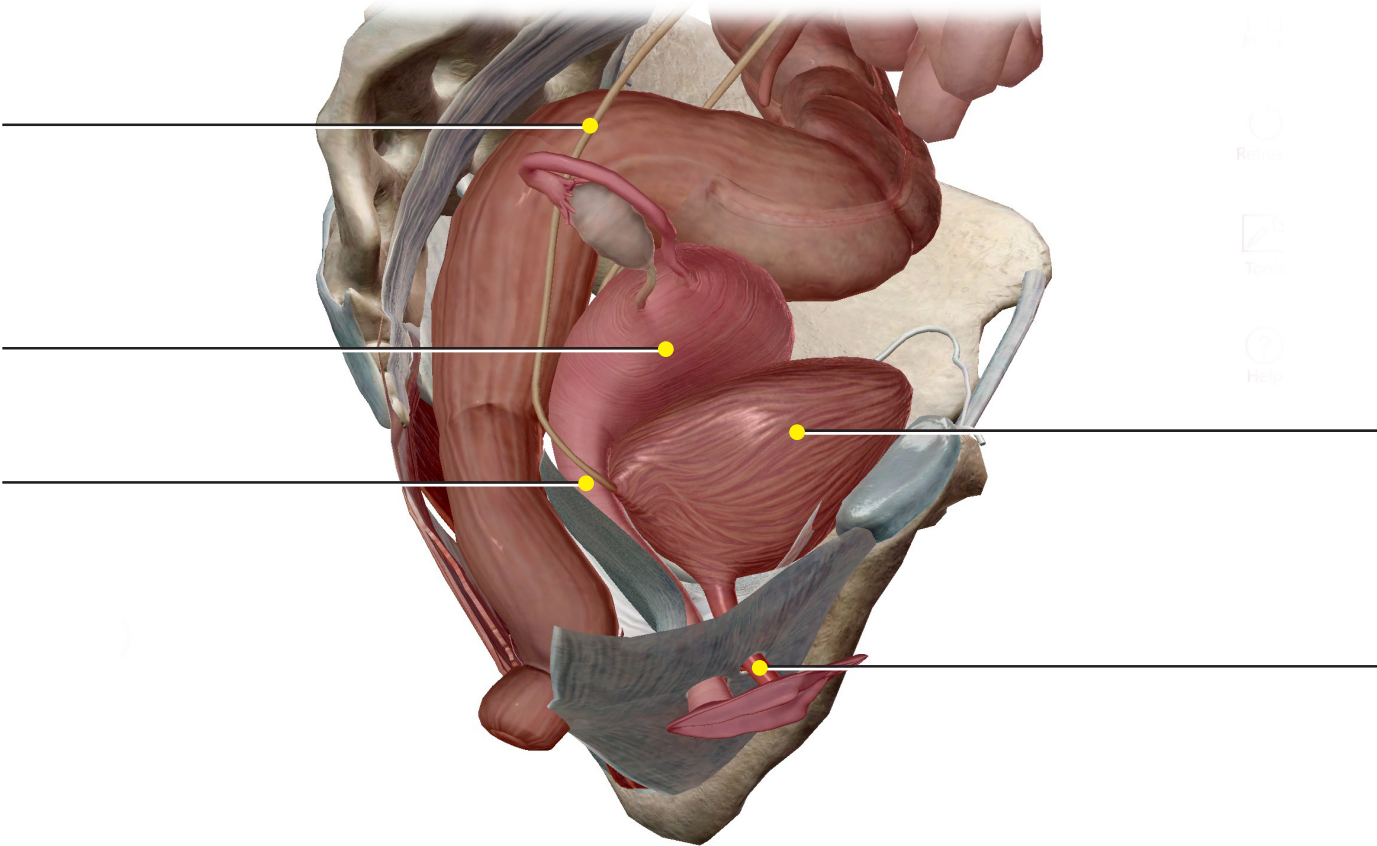
Module 46.1 Pathway of Urine



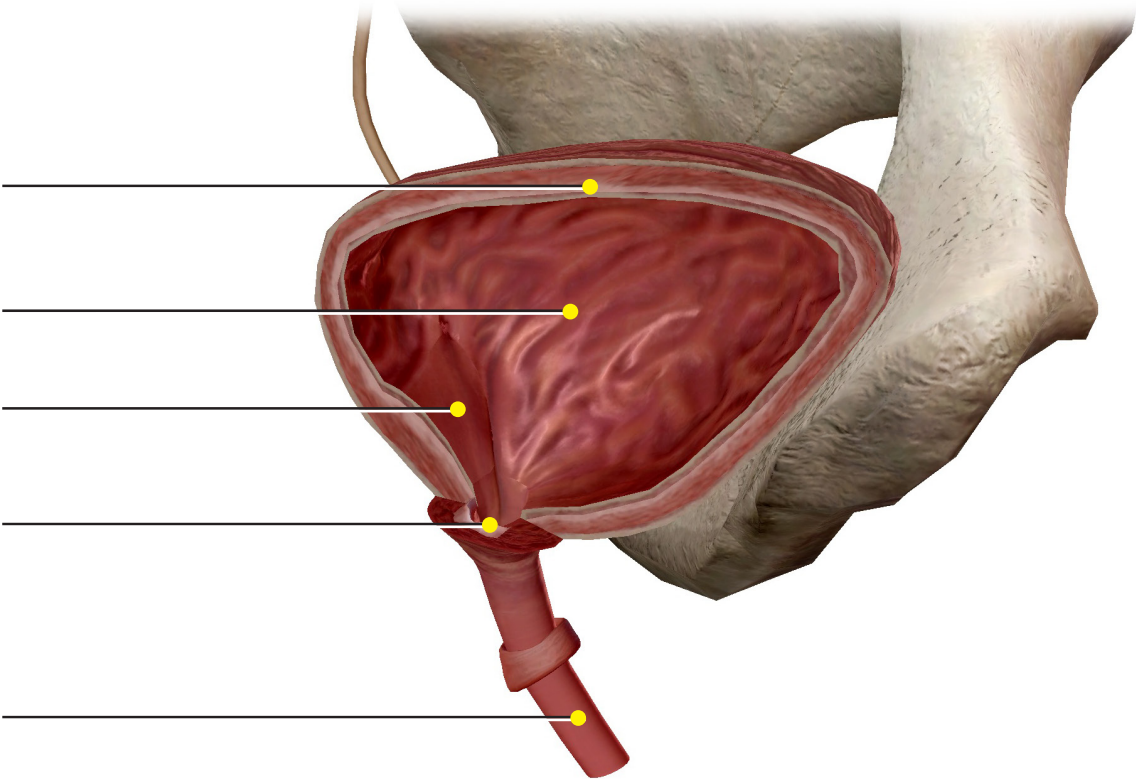
Module 46.2 Ureters



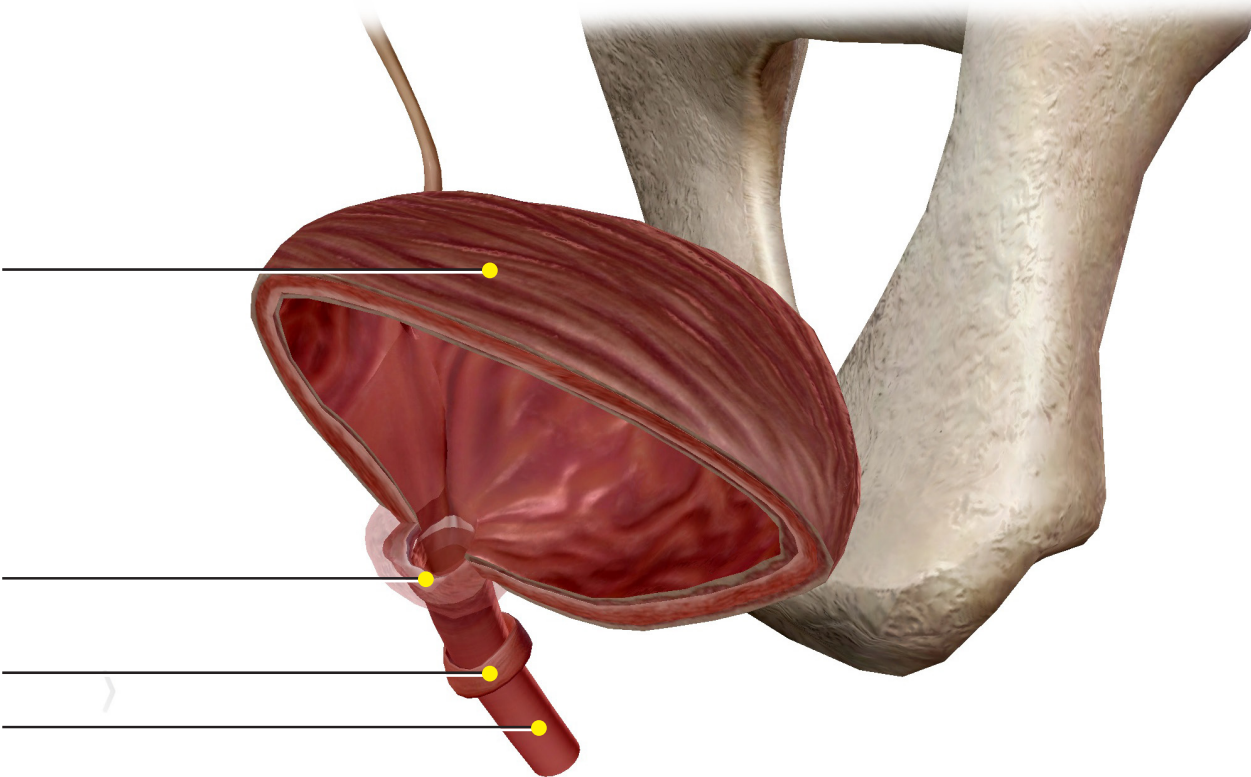
Module 46.4 Bladder in Female (formerly 46.3)



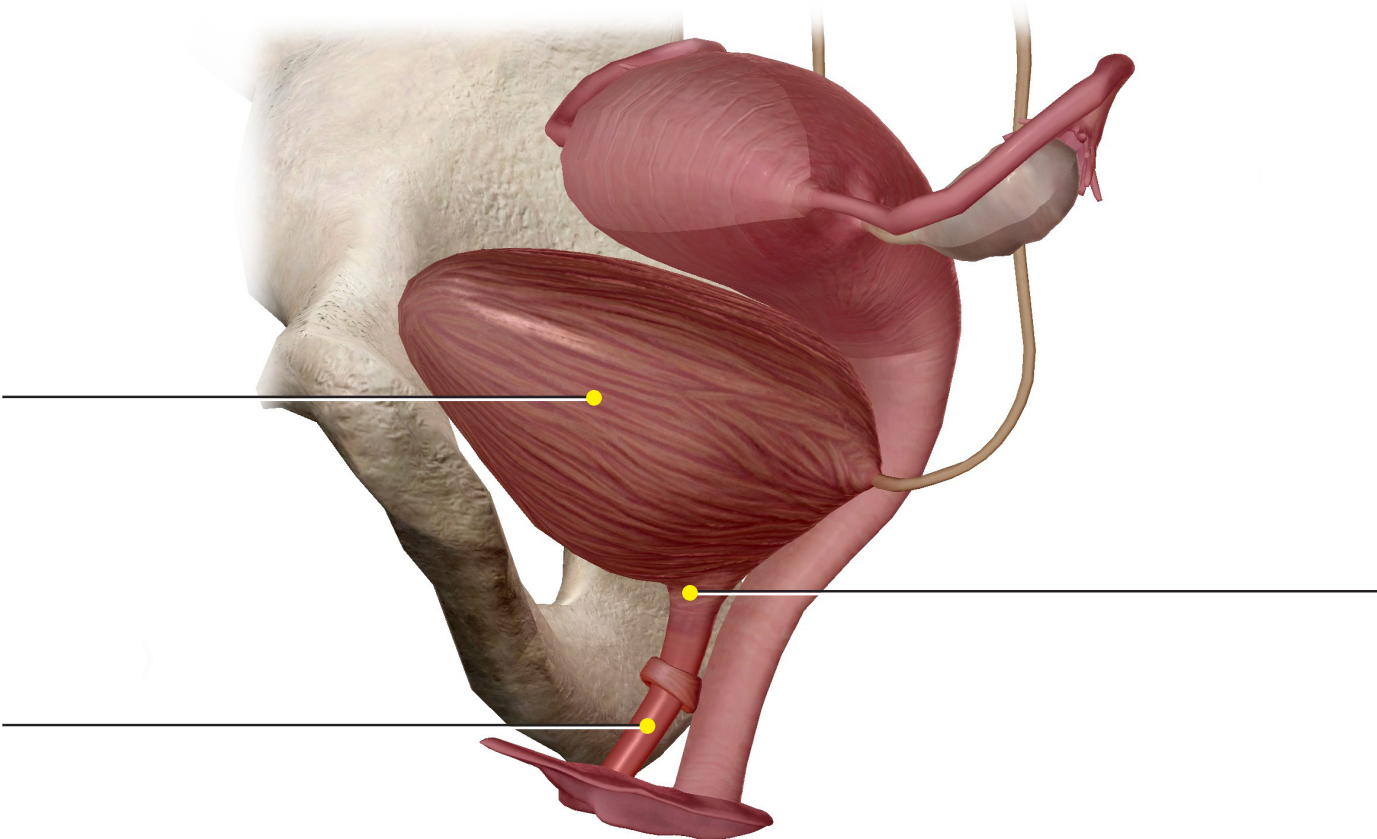
Module 46.6 Bladder Anatomy (formerly 46.5)



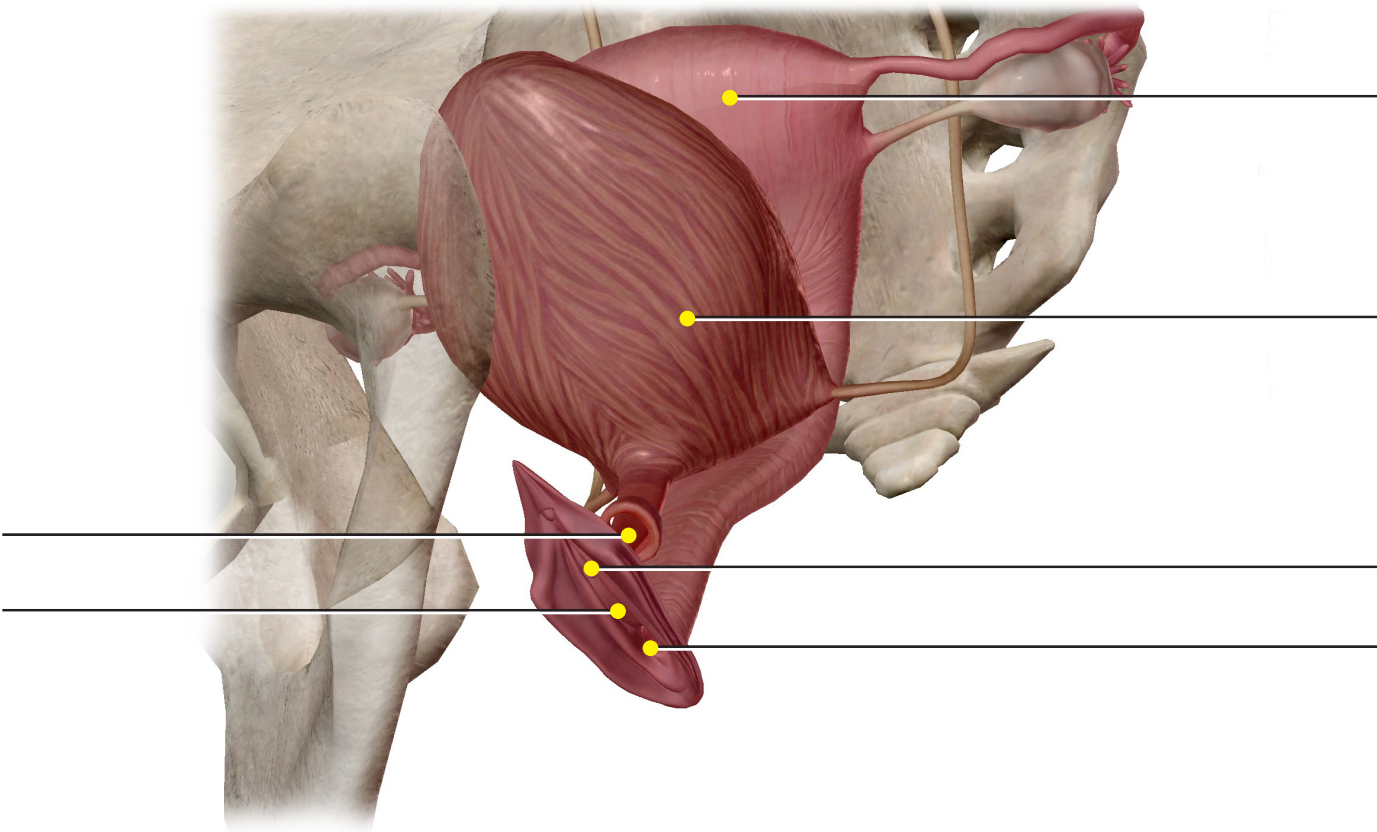
Module 46.8 Micturition Reflex (formerly 46.6)



Module 46.11 Female Urethra (Part 1) (formerly 46.9)



Module 46.11 Female Urethra (Part 2) (formerly 46.9)



Module 46.12 Male Urethra (formerly 46.10)

