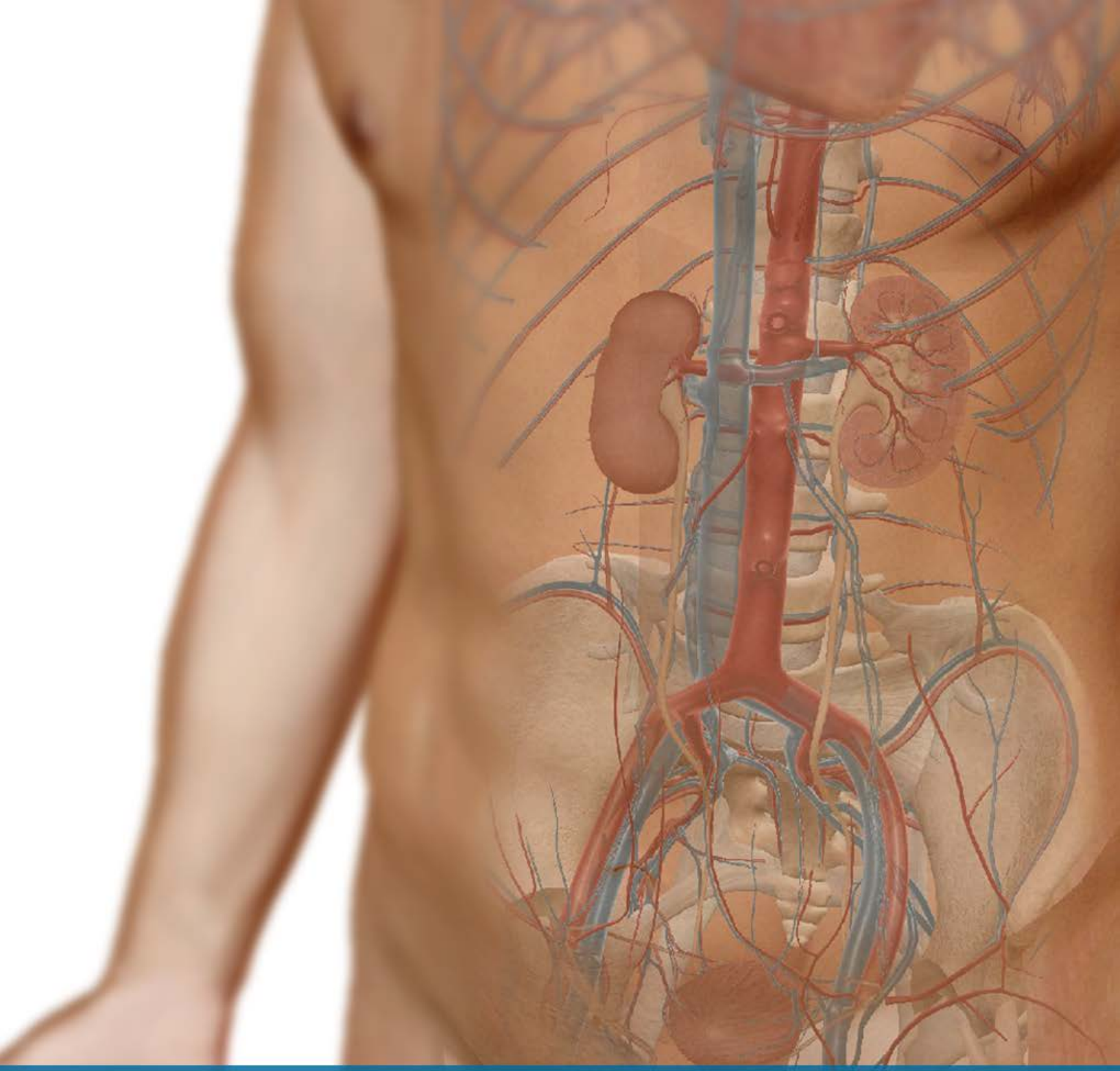

VISIBLE BODY®

The Urinary System

A urinary system lab activity using Visible Body Suite

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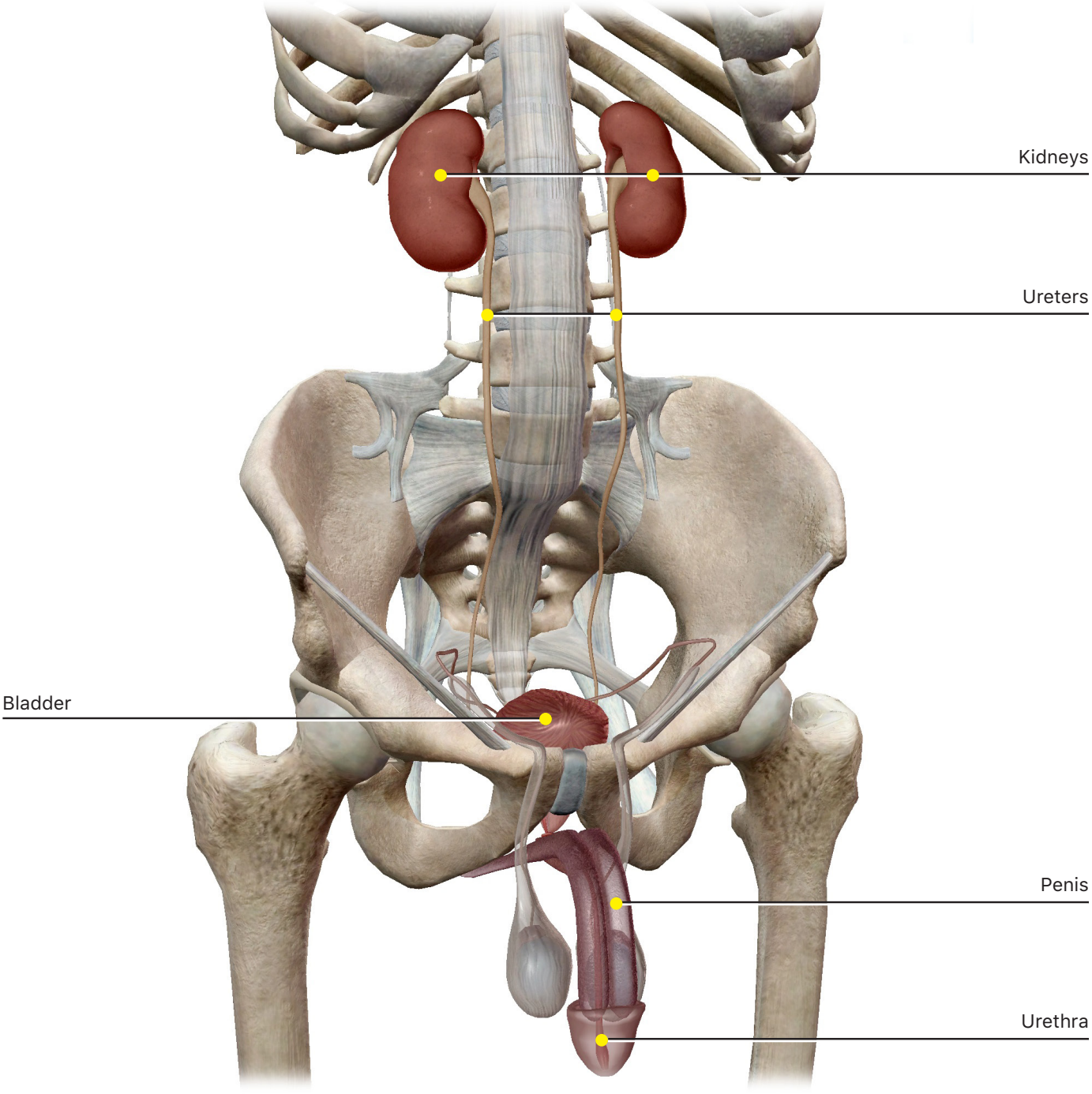
PRE-LAB EXERCISES

Open Visible Body Suite. Search for and select each of the Urinary System Views noted in the exercises below.

You are responsible for the identification of **all bold terms**.

A. Urinary System Overview

Open the Urinary System View "Urinary System (M)." Locate the paired, bean-shaped kidneys near the top of the view, select one of them to open the content box, and use the up-arrow to find and choose Urinary System from the list. Then, select the book icon, read the description of the urinary system, and use this information to answer the following questions.



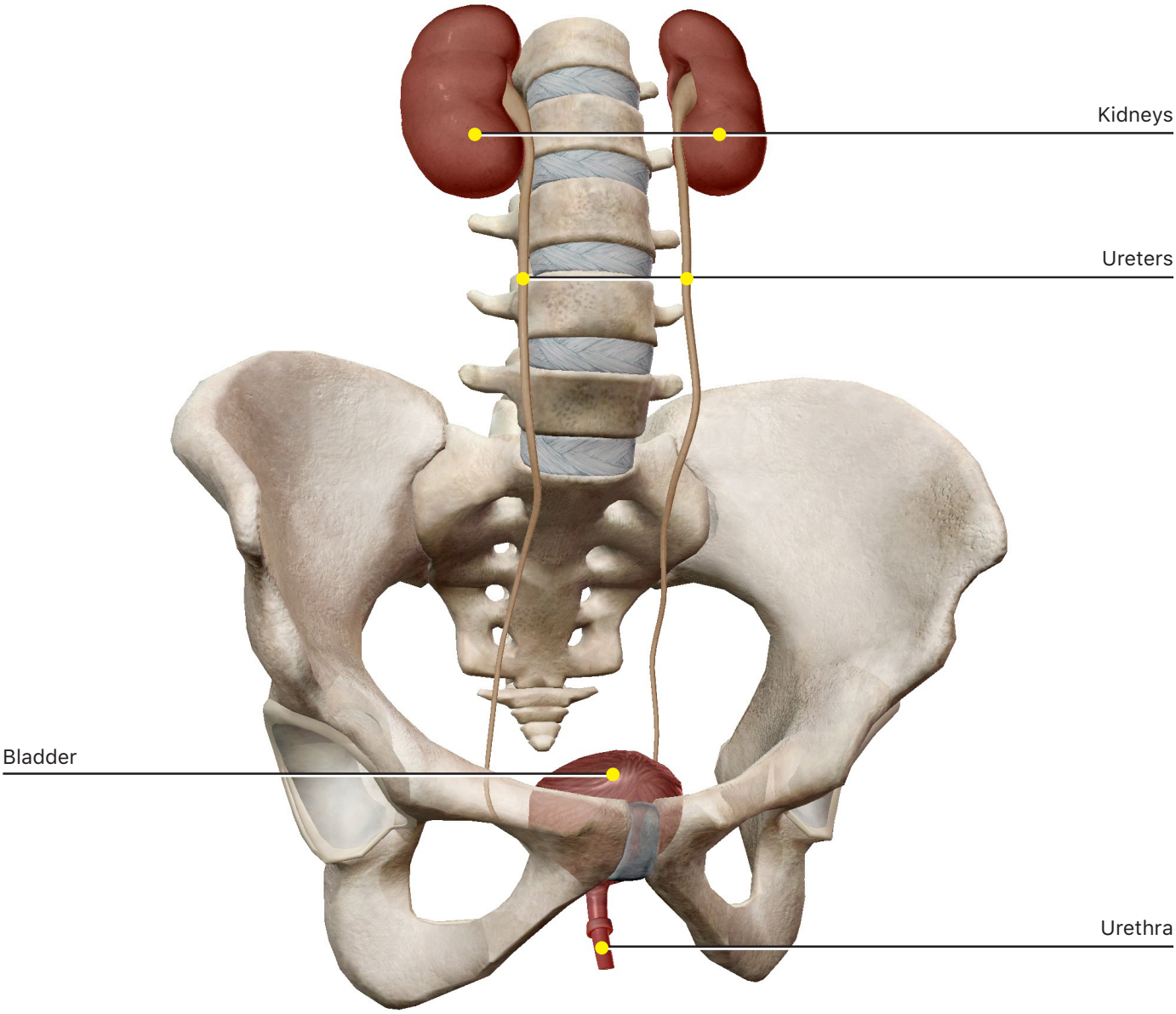
1. List the organs of the urinary system and locate them in the view. You may want to use the Select Others and Fade tools to get a clearer view of the highlighted structures.

2. Describe the main function of the urinary system.

3. What is the excretory product of the urinary system?

4. In men, the **urethra** passes through which two organs of the reproductive system?

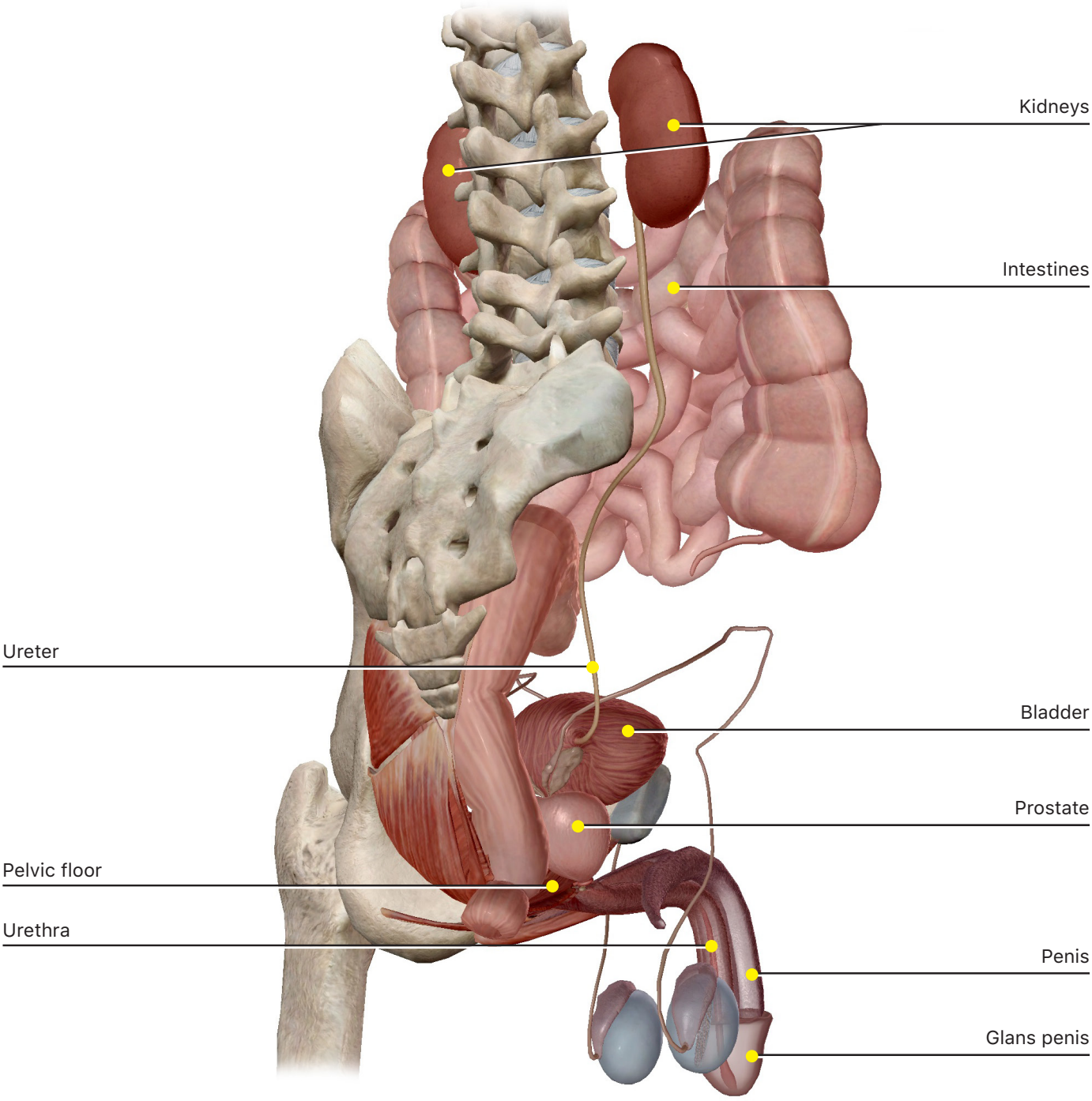
Open the Urinary System View "Urinary System (F)," and use this view to locate all the organs of the female urinary system. Complete the following statement so it accurately compares the male and female urinary systems.



5. In the _____ urinary system, the _____ is much longer.

B. Urinary System Overview

Open the Urinary System View "Pelvic Region (M)." Use this view to answer the following questions.

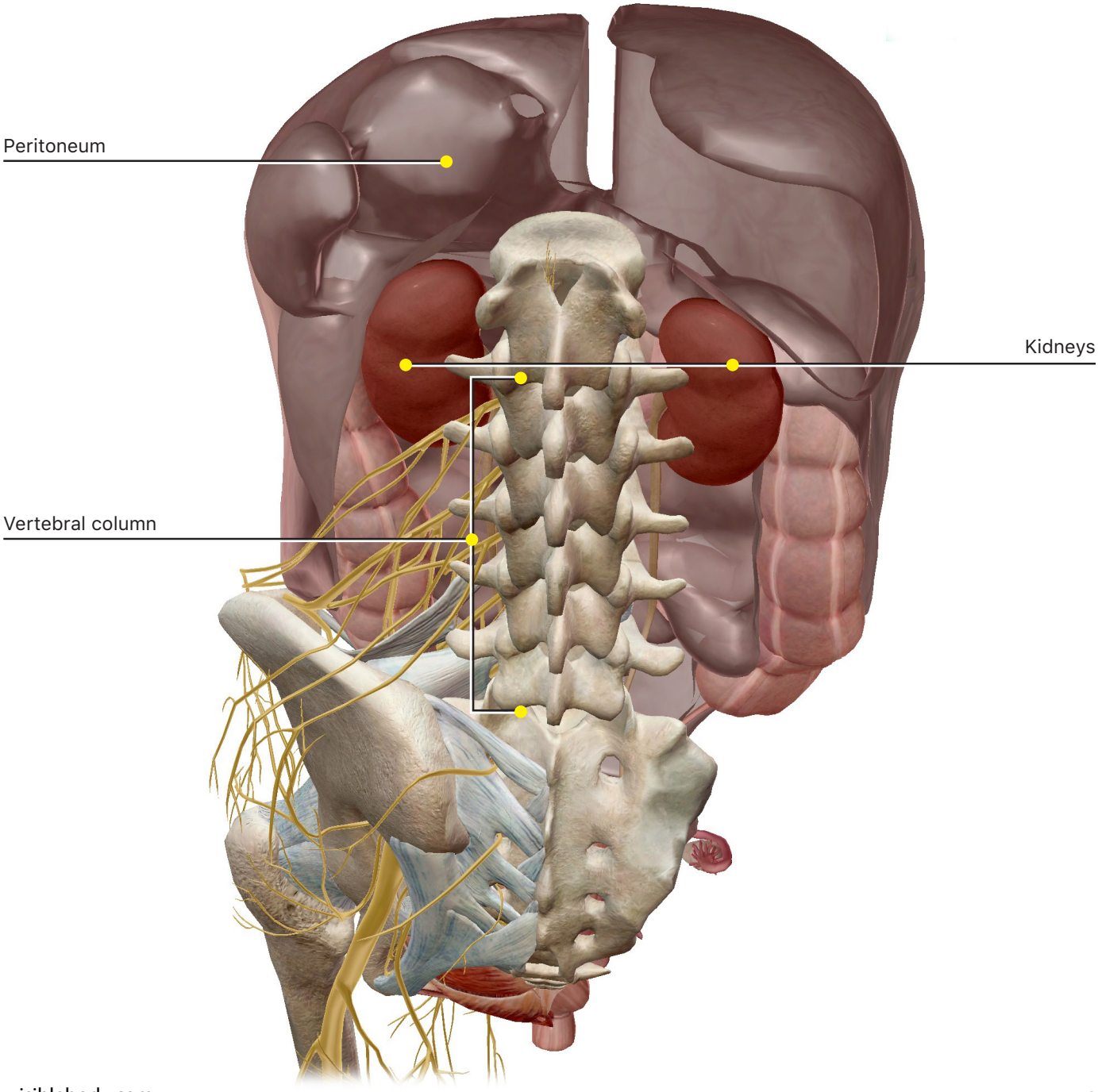


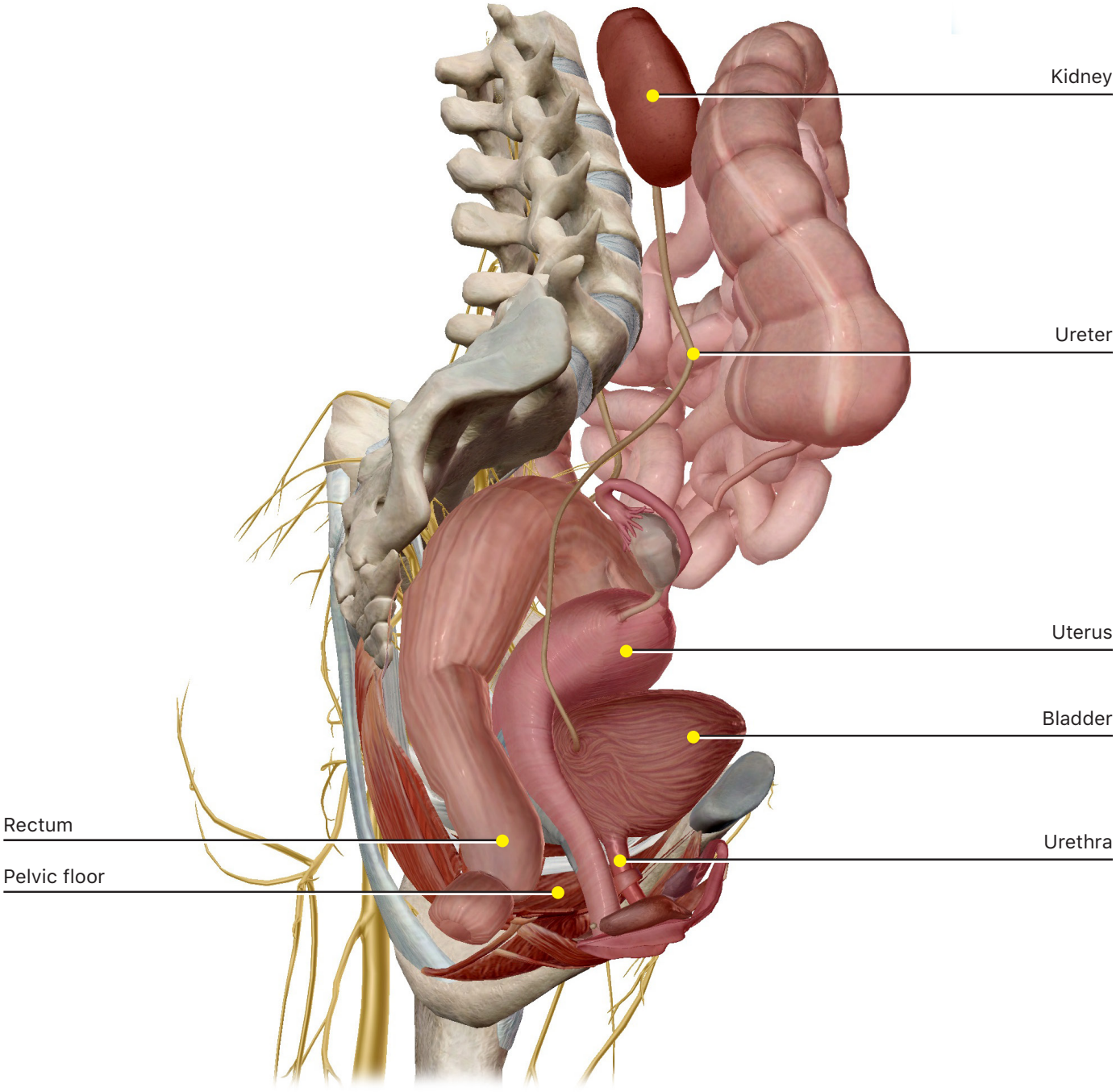
1. Adjust the view so you can see the paired **kidneys** near the top and rotate the view to see the dorsal portion of the kidneys. How would you describe their relationship to the intestines and the spine?

2. Locate the **bladder**. Note that it rests on the pelvic floor. Select the bladder and use the up-arrow in the content box to find and choose Urinary System from the list. Use the Select Others and Fade tools to get a clearer view of the highlighted structures. Locate the urethra as it leaves the bladder and follow its path. The first section of the male urethra passes through the _____.

3. The last section of the male urethra travels through the _____ portion of the penis and the _____ (the tip of the penis).

Open the Urinary System View "Pelvic Region (F)." Use this view to answer the following questions.





1. Adjust the view so you can see the anterior **peritoneum** covering the abdominal organs. Select the peritoneum and use the book icon to read the definition. The peritoneum is a _____ membrane. The inner layer forms the lining that covers the _____.

2. Rotate the view, select one of the kidneys, and use the book icon to read the definition. The kidneys are defined as **retroperitoneal** organs. What do you think "retroperitoneal" means?

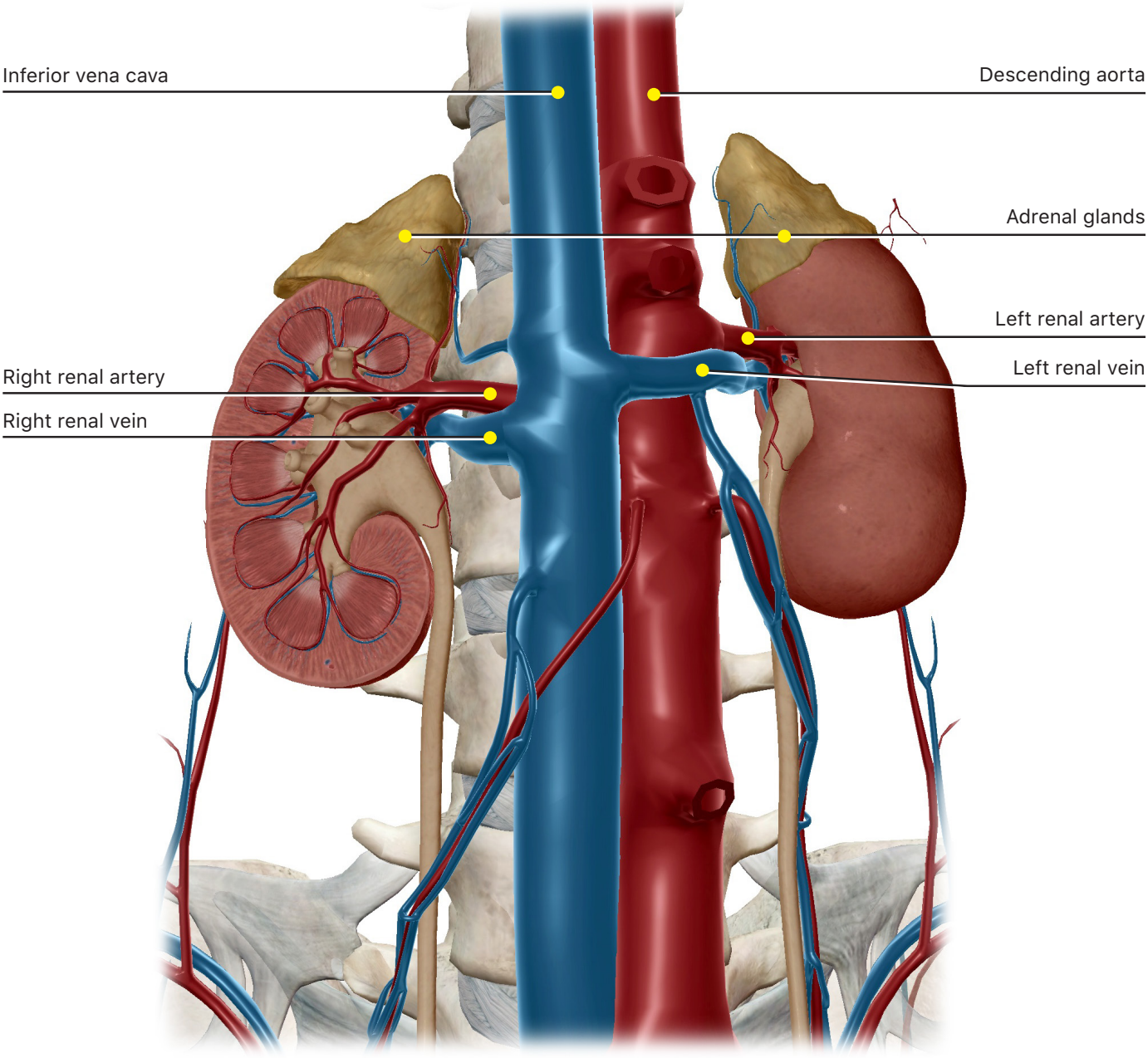
3. Hide the peritoneum and rotate the view to see the bladder from the side. The female bladder lies on the pelvic floor underneath the _____.

IN-LAB EXERCISES

Open Visible Body Suite. Search for and select each of the Urinary System Views noted in the exercises below.

A. The Kidneys: Vasculature

Open the Urinary System View "Renal Vasculature (M)." Use this view to answer the following questions.



1. In this view, you can see a cone-shaped endocrine gland on top of each **kidney**. These are the _____, which release hormones affecting the function of the kidneys.

2. Select either of the large arteries entering the kidneys to view the renal blood supply and use the book icon to read the definition.

a. These large arteries are branches of the _____.

b. The large arteries entering the kidneys are called the _____.

c. Which of these arteries is higher?

d. Which is longer?

3. Select either of the large veins leaving the kidneys to view the venous drainage of the kidneys and use the book icon to read the definition.

a. These large vessels drain into the _____.

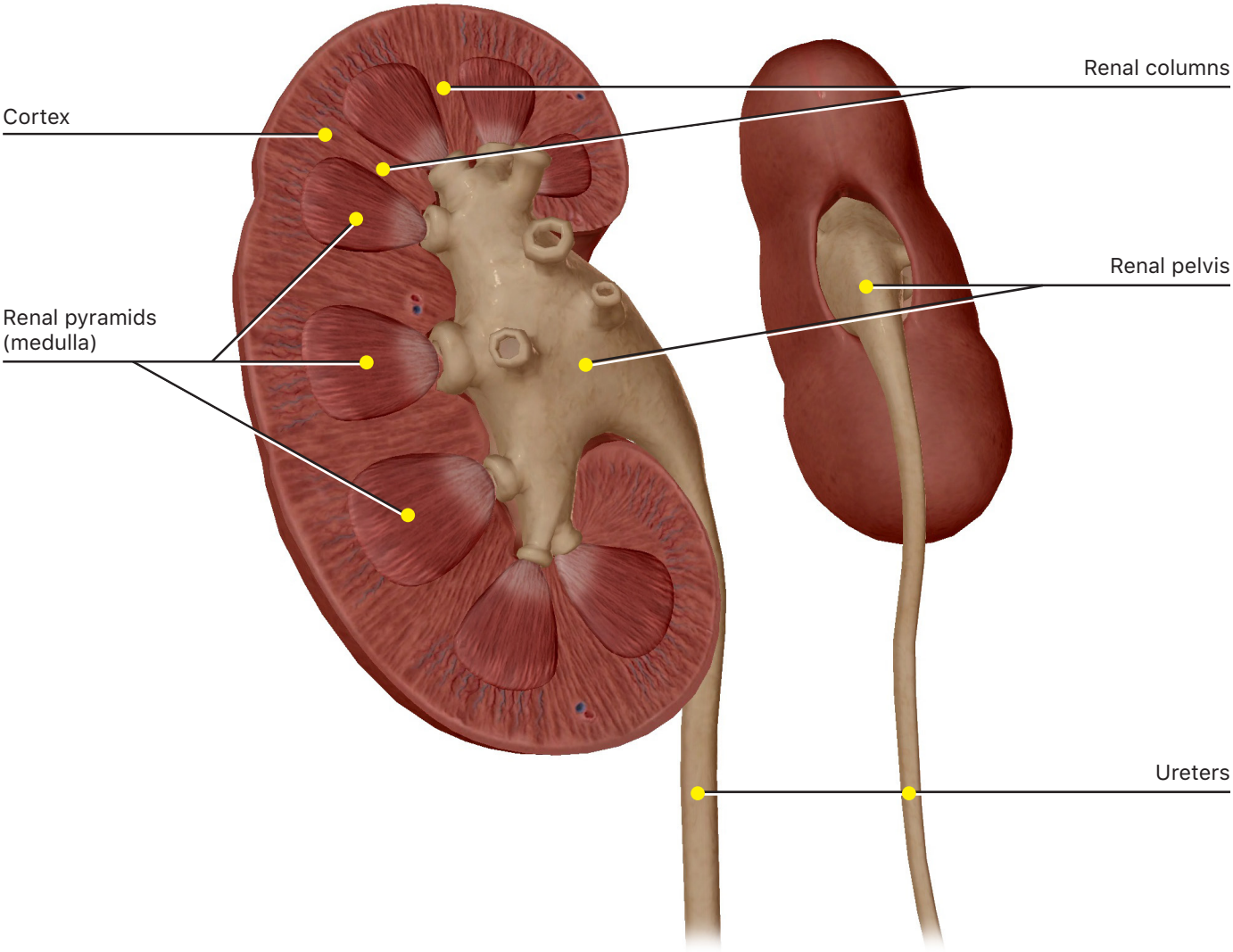
b. Which of these veins is higher?

c. Which is longer?

Note that as blood enters the kidneys, it brings oxygen to renal tissues and is filtered by the kidneys. Blood leaving the kidneys is depleted of oxygen and has been filtered.

B. The Kidneys: Internal Anatomy

Open the Urinary System View "Kidney Section (F)." Use this view to answer the following questions.



1. Select the outer part of the cross section of the right kidney and use the book icon to read the definition (Kidney back, R). Define the following terms:

   a. **Adipose capsule**

   b. **Cortex**

   c. **Medulla**

2. Select one of the several pyramid-shaped structures on the inside of the kidney. Which structures make up the bulk of the **renal pyramids**?

3. Where are the **renal columns** found?

4. **Urine** from the pyramids is channeled into the _____.

5. Locate the large **renal pelvis** in the center of the kidney. Urine from the renal pelvis is channeled into the _____.

6. **Nephrons** are the functional units of the kidneys that make up most of the cortex and the medulla.

   a. Nephrons are composed of a series of _____ and _____.

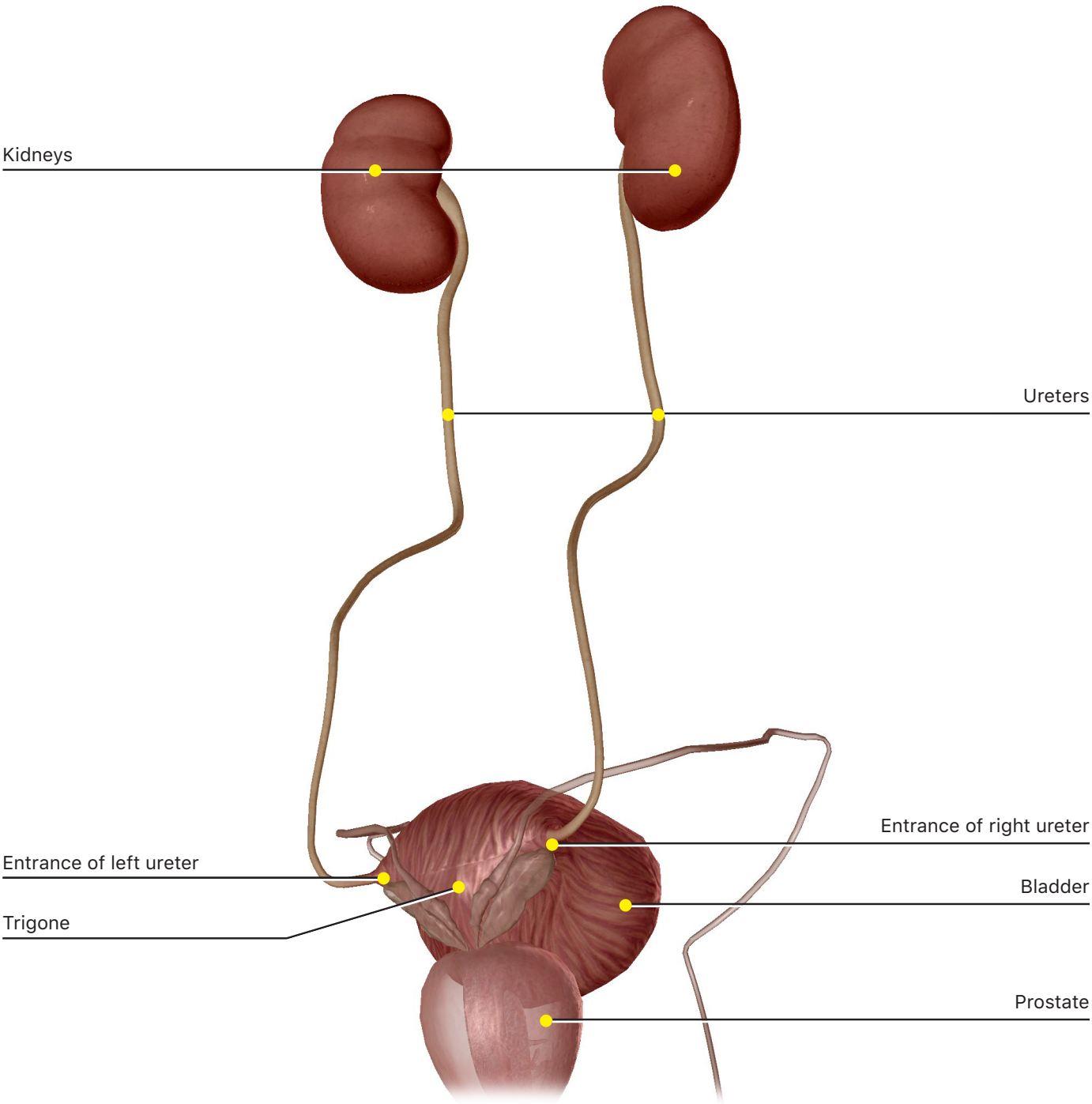
   b. The primary site of **filtration** is in a spherical capillary network called the _____.

   c. Inside the corpuscle, blood passes through a spherical capillary network called the _____.

   d. **Filtrate** from the blood enters a cavity called the _____. From there, the filtrate is passed through the **tubules** until it enters the renal pelvis as urine.

C. The Ureters and the Bladder

Open the Urinary System View "Ureters (M)." Use this view to answer the following questions.



1. Select either of the **ureters** and use the book icon to read the definition.

    a. What is the function of the ureters?

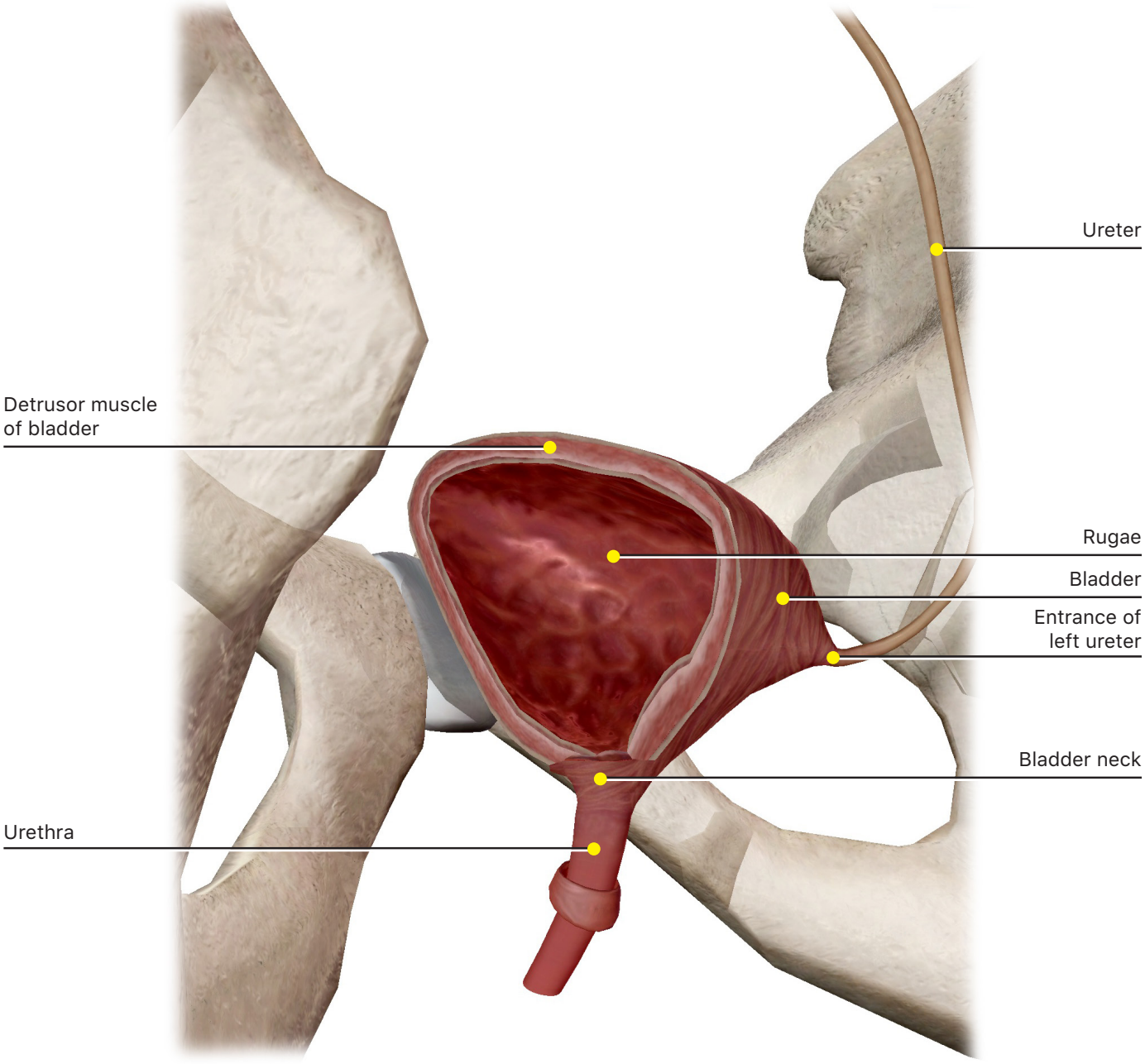
b. How is urine propelled through the ureters?

c. How long is each ureter?

2. In the system tray on the left side of the screen, deselect the skeleton system icon to hide the skeletal structures from the view. Rotate the view and observe where the ureters enter the **bladder**. The ureters enter the bladder through openings in the _____ **bladder floor**.

3. In the system tray on the left side of the screen, deselect the muscular system icon to hide the muscles from the view. Rotate the bladder for a posterior view, showing both ureters. The triangular region of the bladder, marked by the entrance of the two ureters and the **external urethral orifice**, is the _____ of the bladder.

Open the Urinary System View "Bladder (F)." Note that the bladder is located entirely inside the pelvis, protected by the pelvic bones. Select any part of the bladder, use the book icon to read the definition, and answer the following questions.

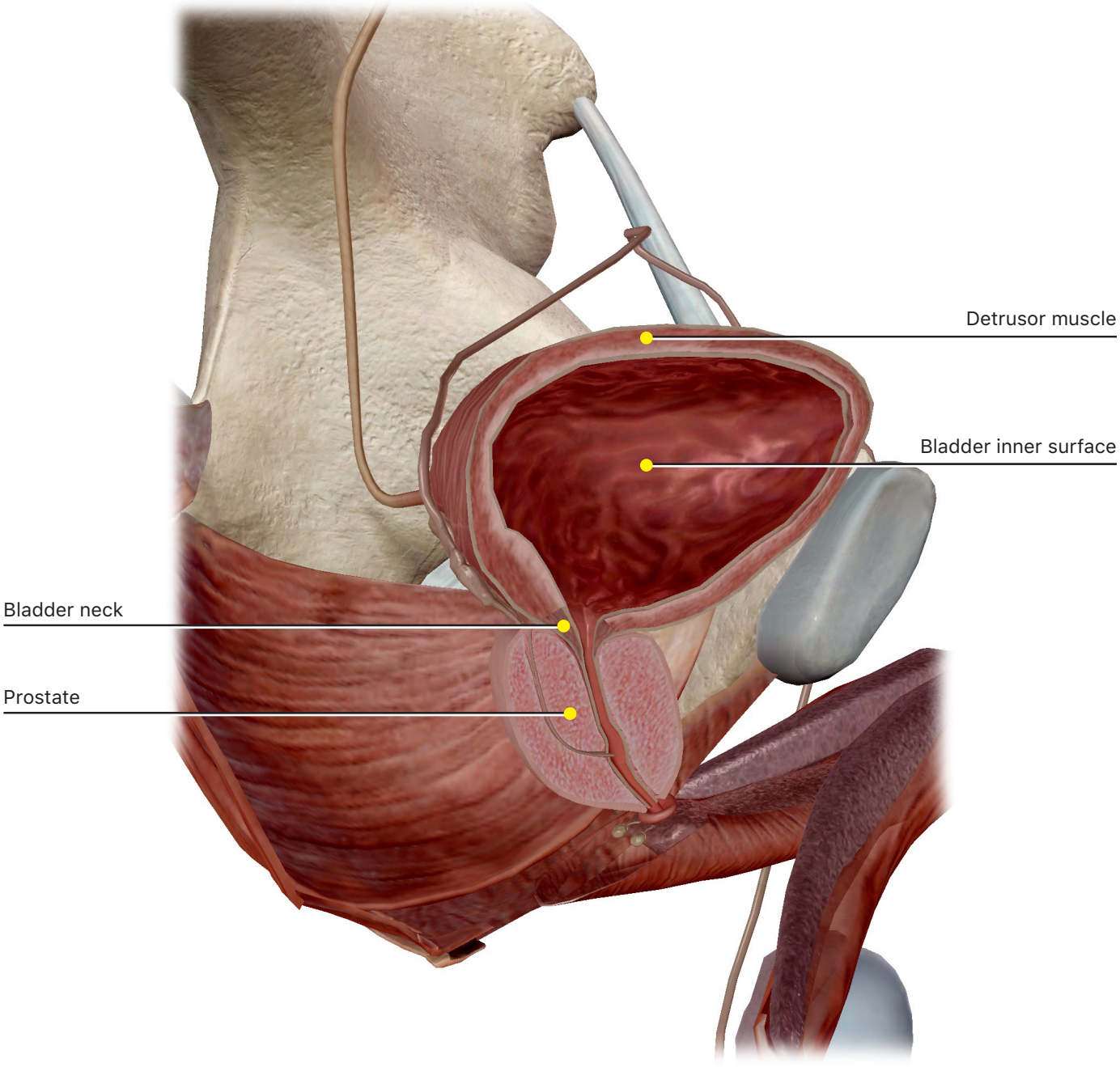


1. The **bladder mucosa** is covered by a _____ **epithelium** and is arranged in folds called _____.

2. A layer of smooth muscle, called the _____, gives the bladder wall its elasticity.

3. Approximately how much urine can the bladder hold before the urge to **micturate** is triggered?

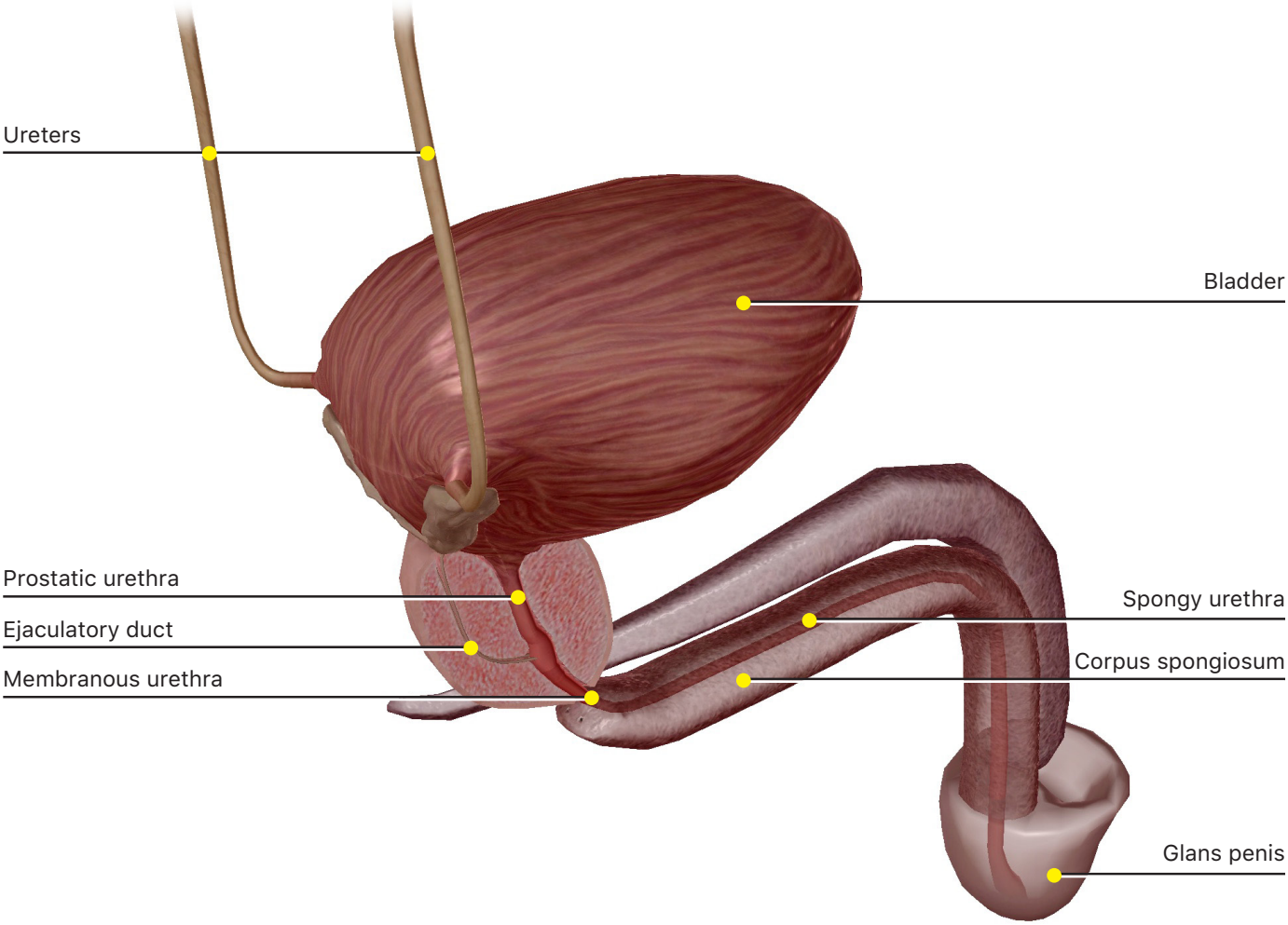
Open the Urinary System View "Bladder Section (M)." Locate the following structures in the cross-section view.



1. **Bladder inner surface**
2. **Detrusor muscle layer**
3. **Neck of the bladder** (the region joining the urethra)

D. The Male Urethra

Open the Urinary System View "Urethral Orifice (M)." Use this view to answer the following questions.



1. Select any part of the urethra and use the book icon to read the definition. Locate and name the three portions of the male urethra.

2. The **prostatic urethra** is completely within the _____.

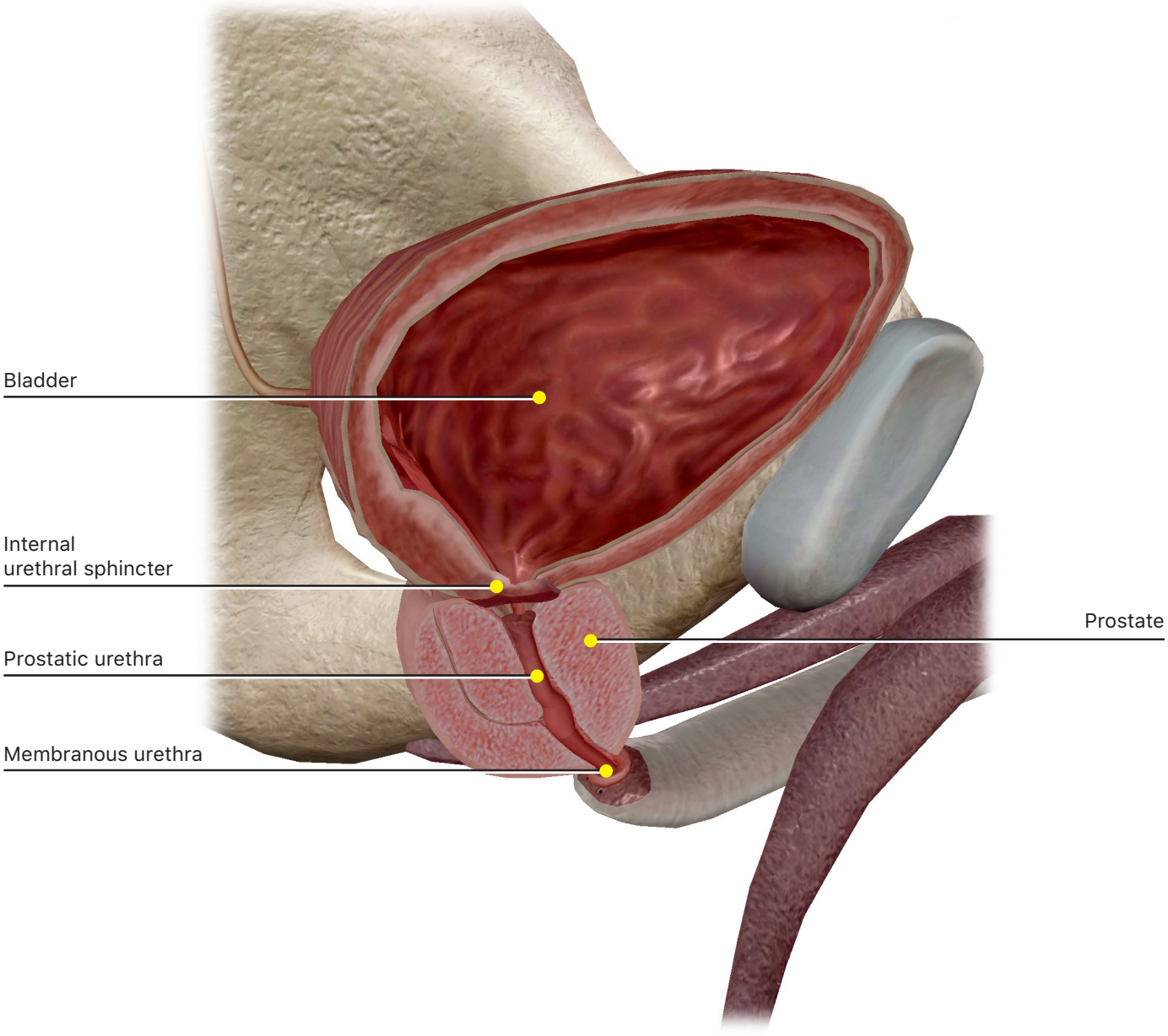
3. In the **prostate**, the urethra is joined by paired _____ **ducts**.

4. The **membranous urethra** passes through the _____ and receives ducts from the paired _____ glands.

5. Select the **corpus spongiosum** and use the Hide tool in the content box to hide it. Select the **spongy urethra** and rotate the view to observe where it exits the penis. Note that only half of the urethra will be highlighted. Next, select the **glans penis** and use the Hide tool in the content box to hide it, so you can view the end of the spongy urethra. Note how it expands slightly in the tip of the penis. The spongy portion of the urethra is divided into two sections: the _____ section and the _____ section.

6. The male urethra carries two products: _____ and _____.

Open the Urinary System View "Urethral Sphincter (M)." Use this view to answer the following questions.

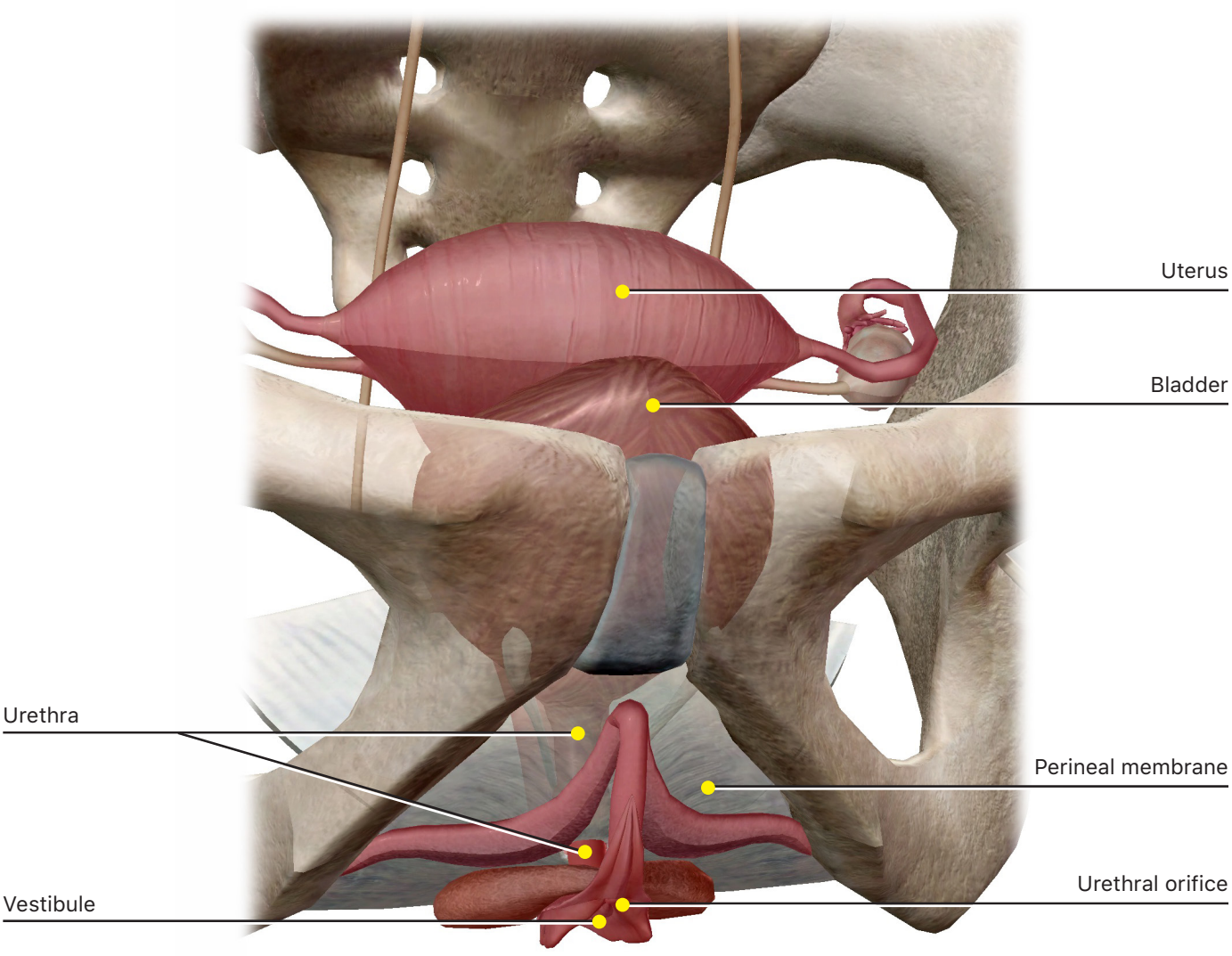


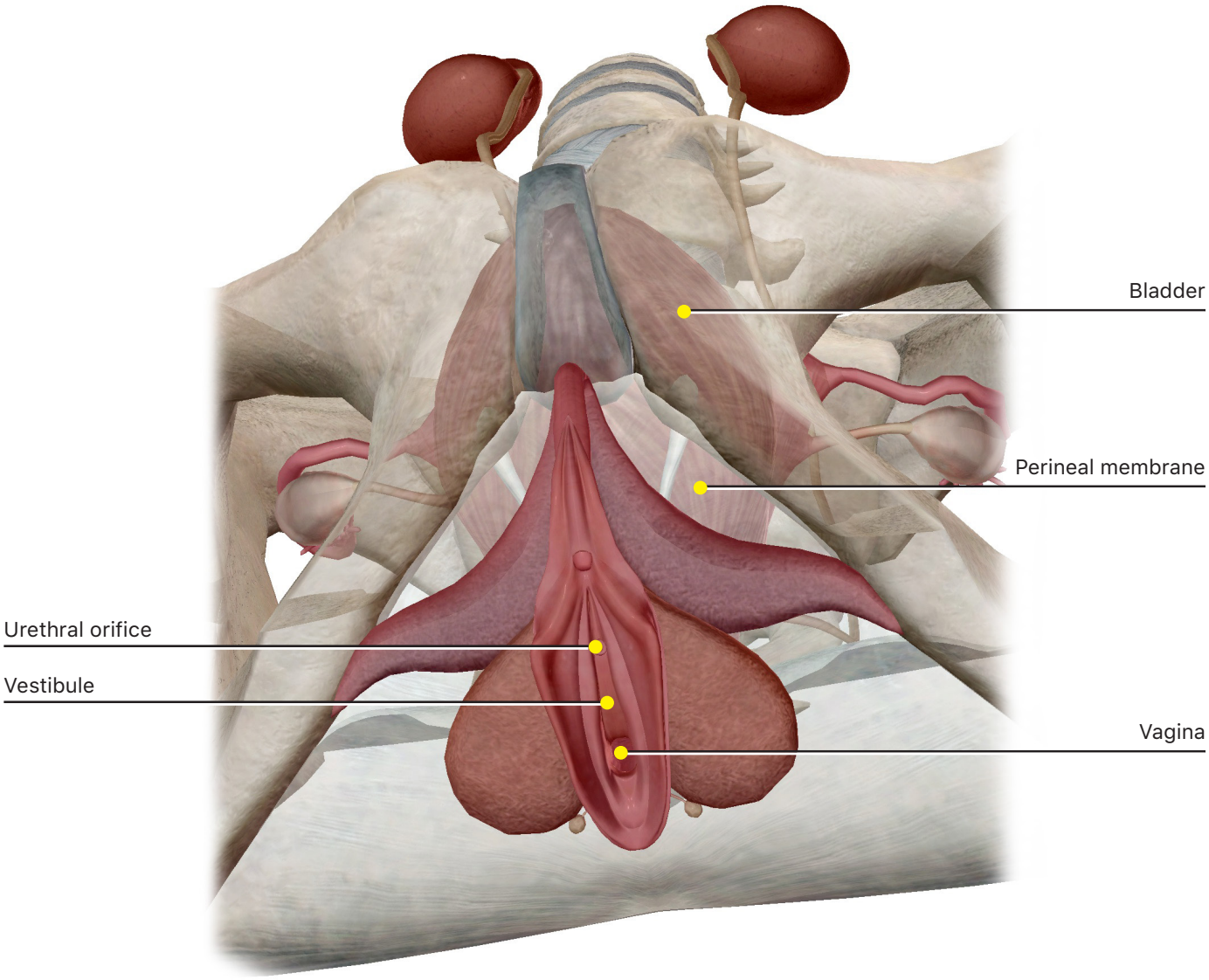
1. Locate and highlight the **internal urethral sphincter**. It controls the passage of urine from the bladder into the urethra. Control of this sphincter is involuntary, and it opens when the volume of urine in the bladder triggers the _____ reflex.

2. A second, **voluntary external urethral sphincter** encircles the _____ urethra. This muscle allows for voluntary control over micturition.

E. The Female Urethra

Open the Urinary System View "Bladder and Uterus (F)." Note that the bladder is located entirely within the pelvis under the uterus. Use this view to answer the following questions.

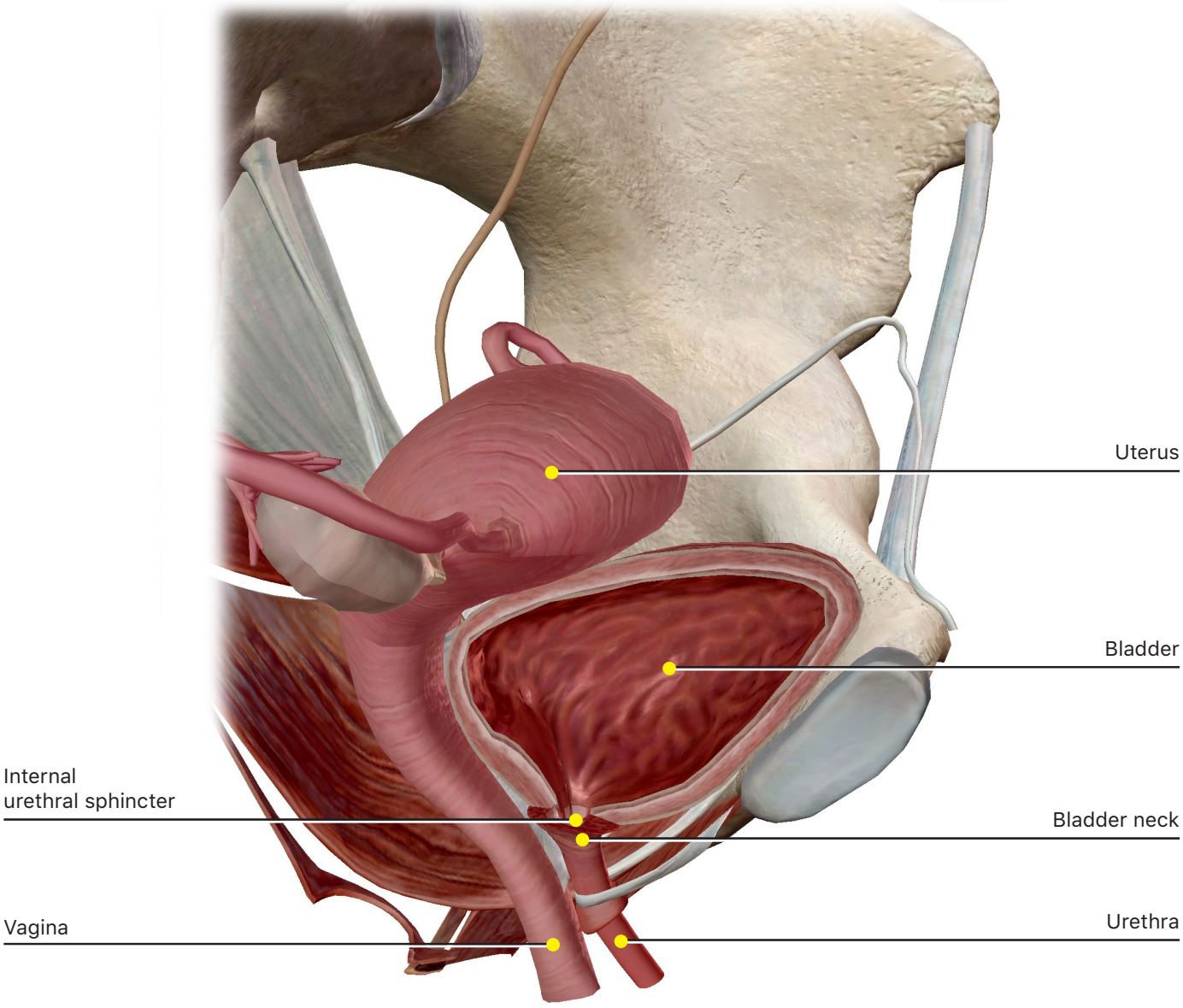




1. Locate and select the urethra. It passes through the _____ and exits through the _____. With the urethra highlighted, rotate the view to observe where it exits the vulva. It is very small, so you may need to zoom in.

2. Locate the **urethral orifice**, which surrounds the end of the urethra. Select it and use the book icon to read the definition. The urethral orifice is contained inside the _____, directly in front of the opening of the _____.

Open the Urinary System View "Urethral Sphincters (F)." Use this view to answer the following questions.

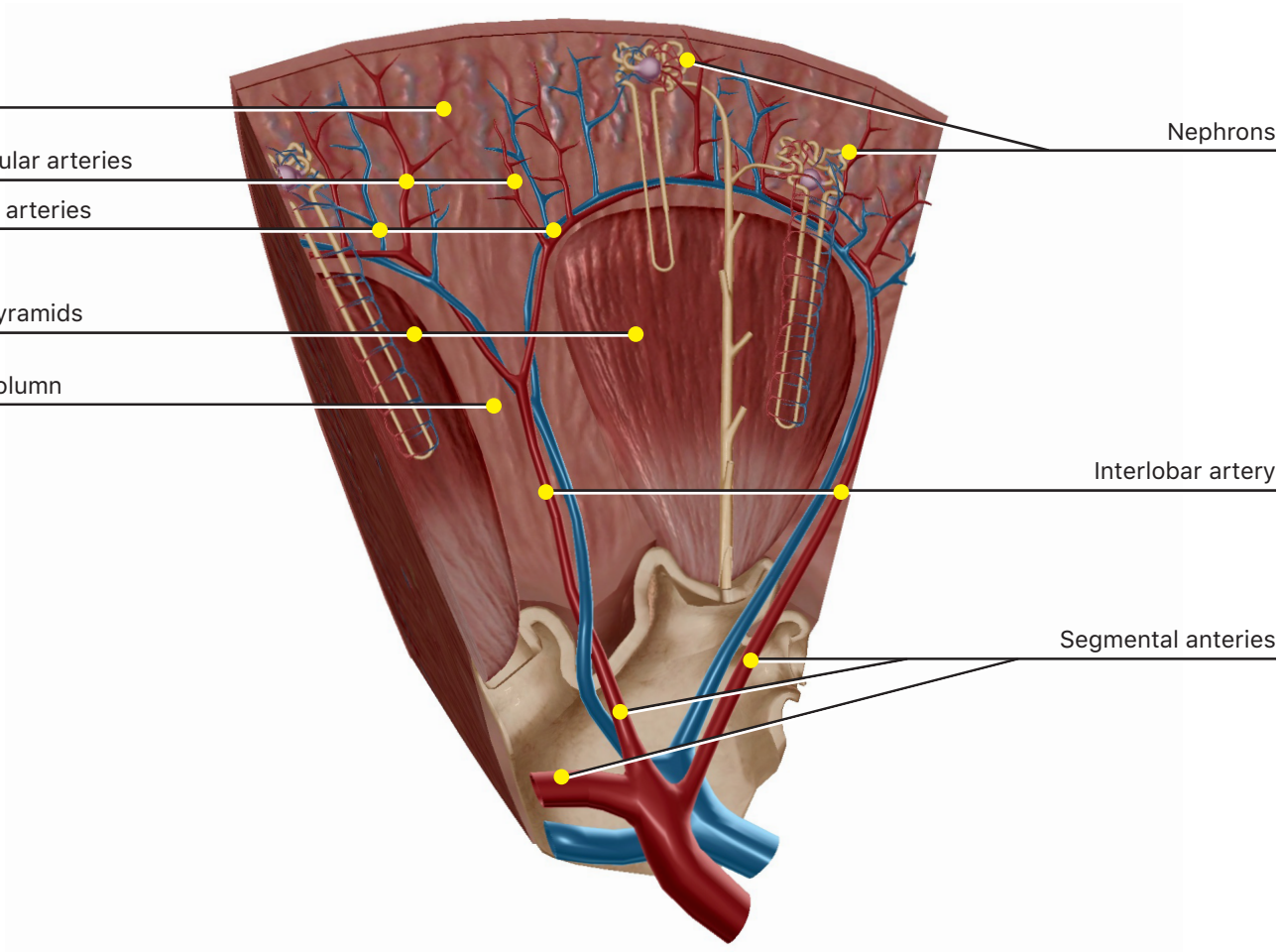


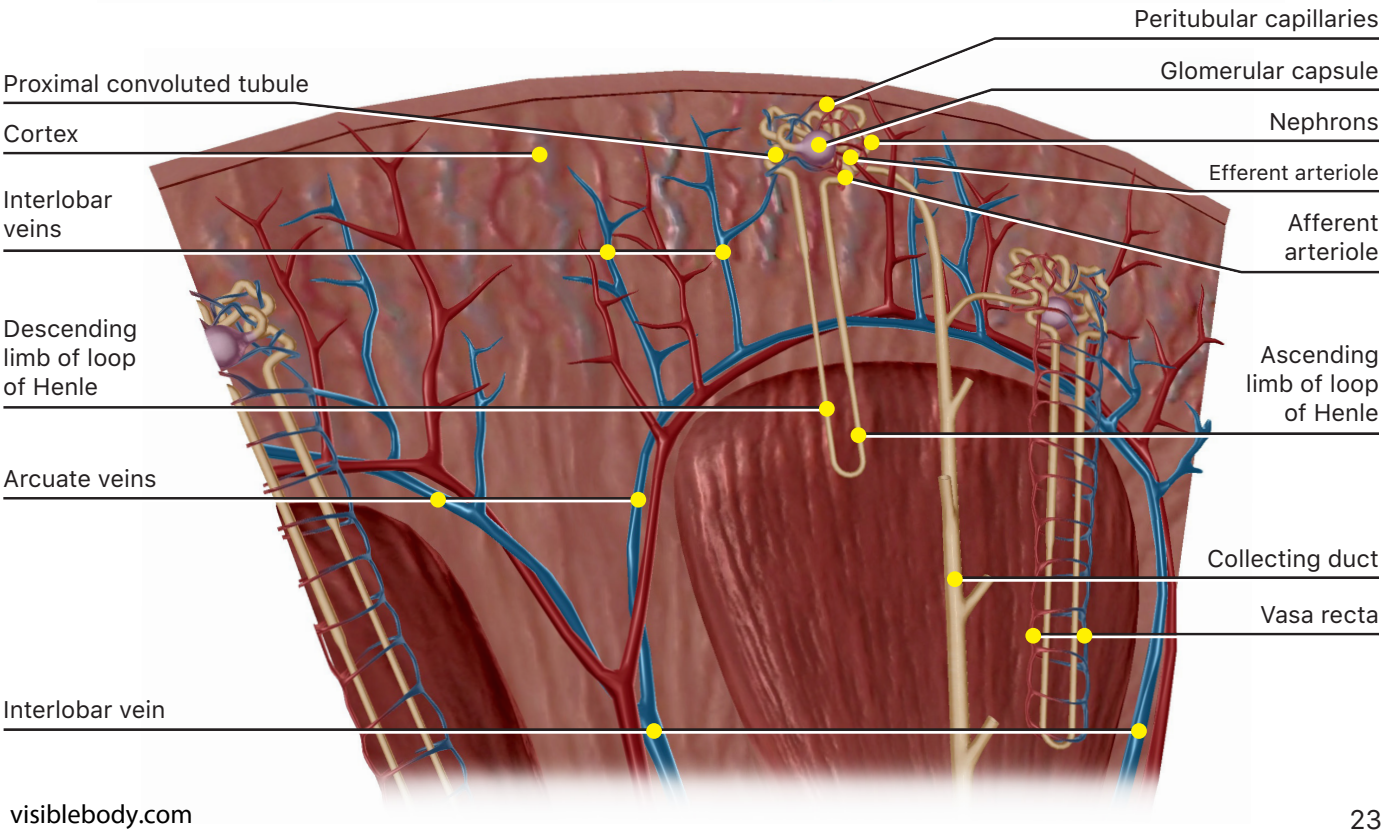
1. Select the neck of the bladder, where it joins the urethra. Now, hide the neck and locate the **internal urethral sphincter**. This involuntary sphincter opens during the _____ reflex.

2. Locate the **external urethral sphincter**. This muscle allows for _____ control over micturition.

G. Microanatomy: Nephrons

Open the Urinary System View "Nephrons."





1. Locate the **cortex**, the **renal pyramids**, and the **renal columns** of the **medulla**.

2. Locate the **renal artery** as it enters the kidney (it does not enter the renal pelvis as the diagram suggests). The first branches of this artery that are located inside the kidney are the _____ _____ and these extend into the renal columns as _____. The branches that arc over each pyramid are called _____, and smaller branches called _____ extend further into the cortex. These arteries supply the nephrons.

3. Locate and select the large, light-colored tubule passing through the renal pyramid. In the content box, select the arrow and choose **Nephrons** at the top. This will highlight all nephron structures. There are three nephrons in this view, but there are approximately one million of them in each kidney. Nephrons are complex structures that include a capsule, tubules, and associated blood vessels.

4. Locate the small, spherical **glomerular capsule** in the center nephron, at the top of the image. Select this capsule and use the book icon to read the definition. Inside the capsule, you'll see a spherical capillary network called a _____. High blood pressure in these specialized capillaries forces fluid out of the blood vessels and into the **capsular space**. This fluid, called **filtrate** because it has been filtered by the **glomerulus**, leaves the capsule and enters the _____. As the tubule travels down into the medullary pyramid, it is called the _____ and as it travels back up into the cortex, it is called the _____. As the filtrate passes through the **loop of Henle (also called a nephron loop)**, it is modified by the loop's epithelium. These epithelial cells are _____ in shape and have a "**brush border**," meaning they are covered with _____. As the tubule exits the medulla, it is called the _____. As the tubule straightens out again and exits via the renal pyramid, it is called a _____.

5. As filtrate travels through the nephron loop, the tubule cells secrete _____ and excess ions into the filtrate. As the loop travels down into the medulla and back, it passes through salt gradients that facilitate the reabsorption of _____ and other necessary molecules as required.

6. When these processes are complete, the filtrate is called _____. Fluid from the collecting duct flows into the _____.

7. Locate the arteriole entering the capsule to form the glomerulus. It is called the _____. The arteriole exiting the capsule, coming from the glomerulus, is the _____. This arteriole branches into a network of _____ that surround the proximal and distal convoluted tubules. These capillaries interact with the convoluted tubules to reabsorb water and adjust the concentrations of solutes in the filtrate. Blood leaving the **peritubular capillaries** enters the _____ veins, which join the _____ veins that arc over the pyramids. The arcuate veins join to become the _____ veins in the renal columns. These join the _____ veins, which take blood out of the kidneys to drain into the _____.

8. Look at the nephron on the right side of the view. It has a much longer loop of Henle, extending much further into the medulla, than the one in the center. The center nephron is called a **cortical nephron**. The one on the right is a **juxtamedullary nephron**, as its capsule is adjacent to the medulla. Approximately 20—30% of nephrons are juxtamedullary nephrons, which are responsible for creating most of the physiological gradients in the kidney. To help create these gradients, there are a series of capillaries, branching from the peritubular capillaries and associated with the loop of Henle, collectively called the _____. This network returns blood to the efferent end of the peritubular capillaries and to the interlobular veins.

PUTTING IT ALL TOGETHER

A. Draw an outline of the urinary system. Label each organ and use arrows to indicate the flow of urine.

B. Answer the following questions:

1. Open the Urinary System Views "Urethra and Orifice (M)" and "Urethra and Orifice (F)." What are the main differences between the male and female urinary systems?

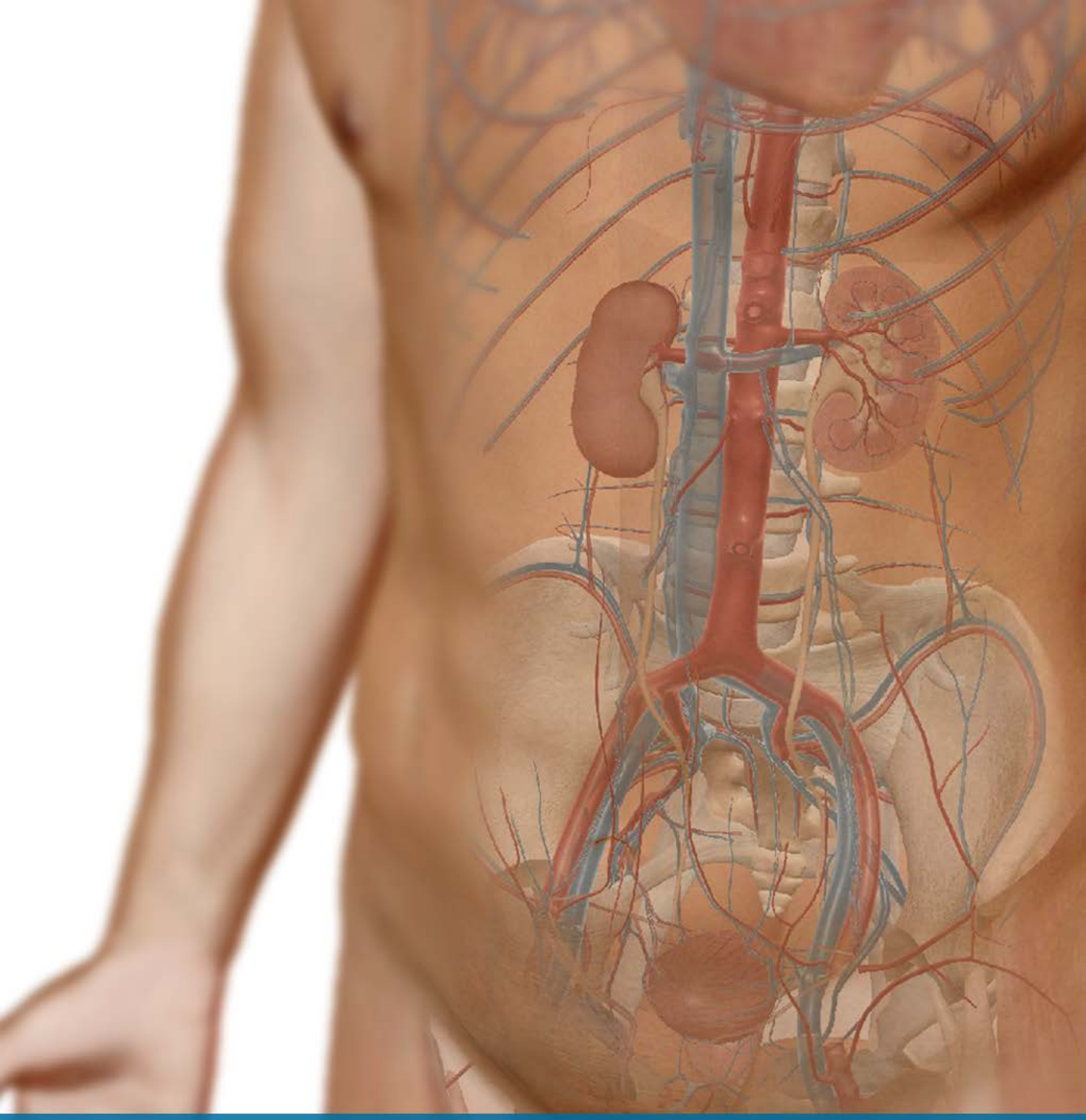
2. Open the Urinary System Views "Urethral Sphincter (M)" and "Urethral Sphincters (F)." Which structure gives us voluntary control over micturition?

3. Open the Urinary System View "Urinary System (M)." Then, select one of the kidneys, use the up-arrow in the content box to choose Urinary System from the list, and use the book icon to read the definition. Which of the following do you think is not a function of the kidney?

   a. Removal of waste product from the body
   b. Control of micturition
   c. Regulation of electrolyte balance (e.g. sodium, potassium, and calcium)
   d. Regulation of acid-base homeostasis
   e. Controlling blood volume and maintaining blood pressure

TIME TO PRACTICE!

SEARCH FOR AND TAKE THE FOLLOWING URINARY SYSTEM QUIZZES: OVERVIEW, URINARY (M); OVERVIEW, URINARY (F); KIDNEYS; URINARY & REPRO (M); AND URINARY & REPRO (F)

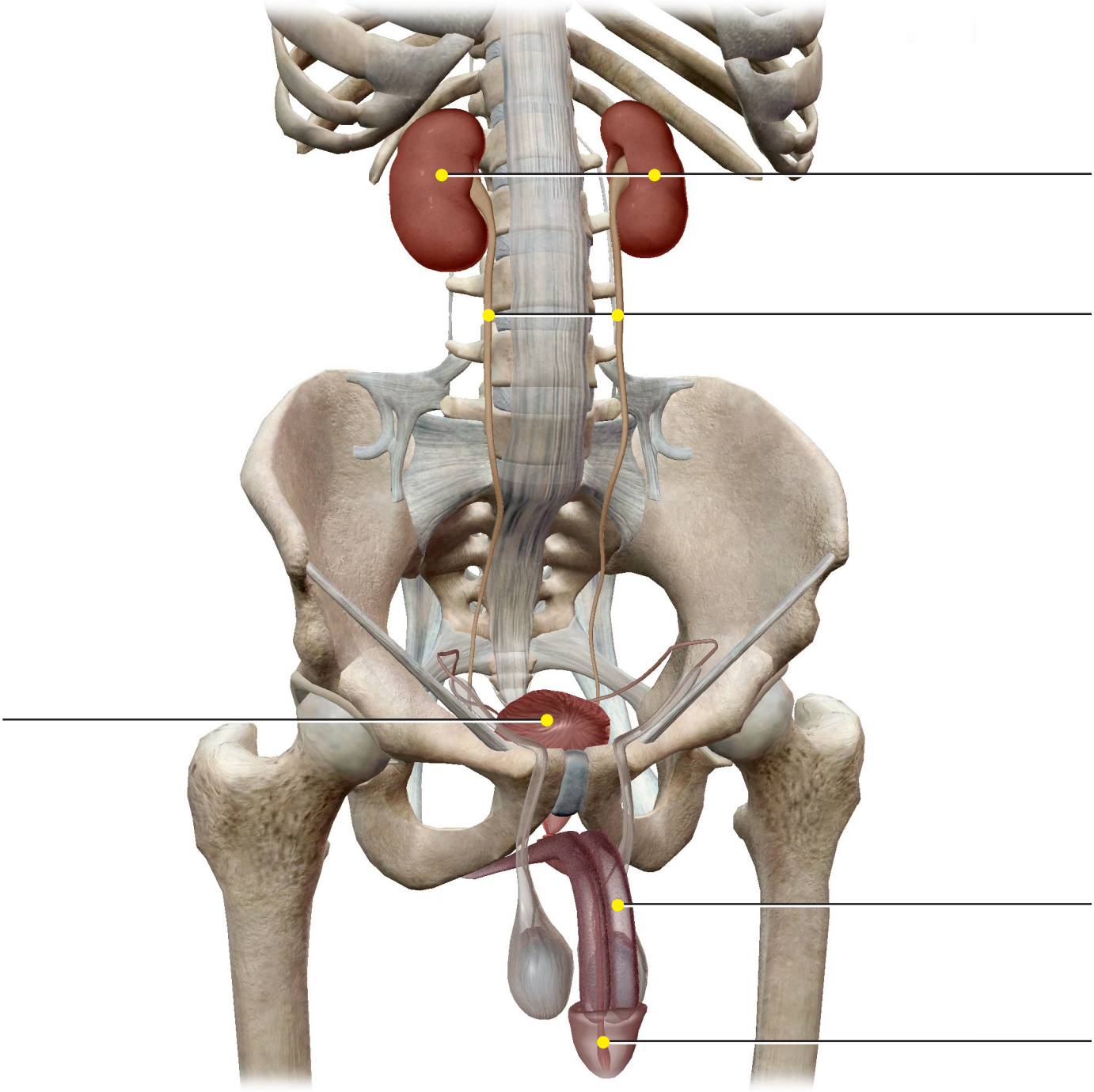


VISIBLE BODY®

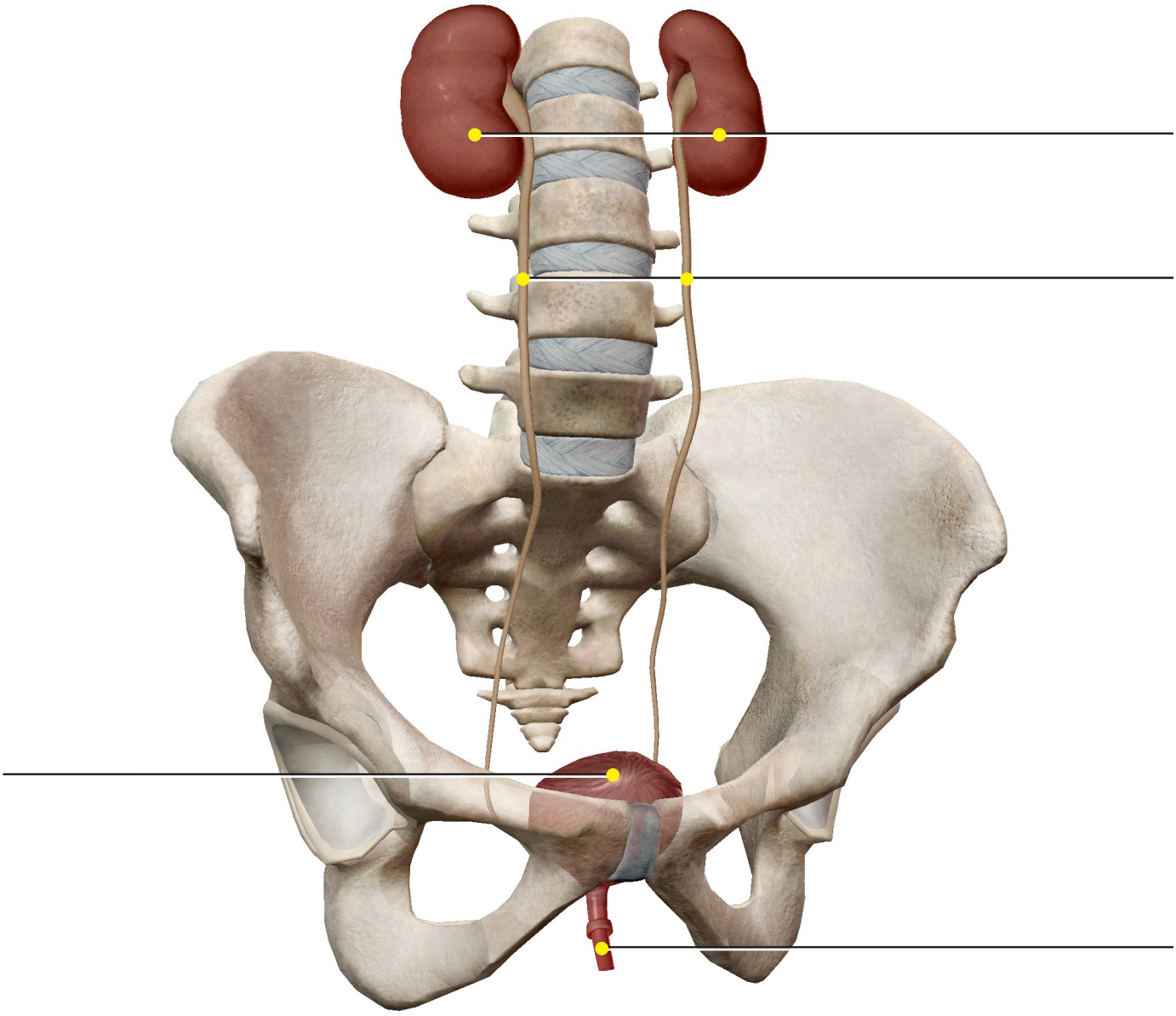
Student Practice

Label the structures in the following figures.

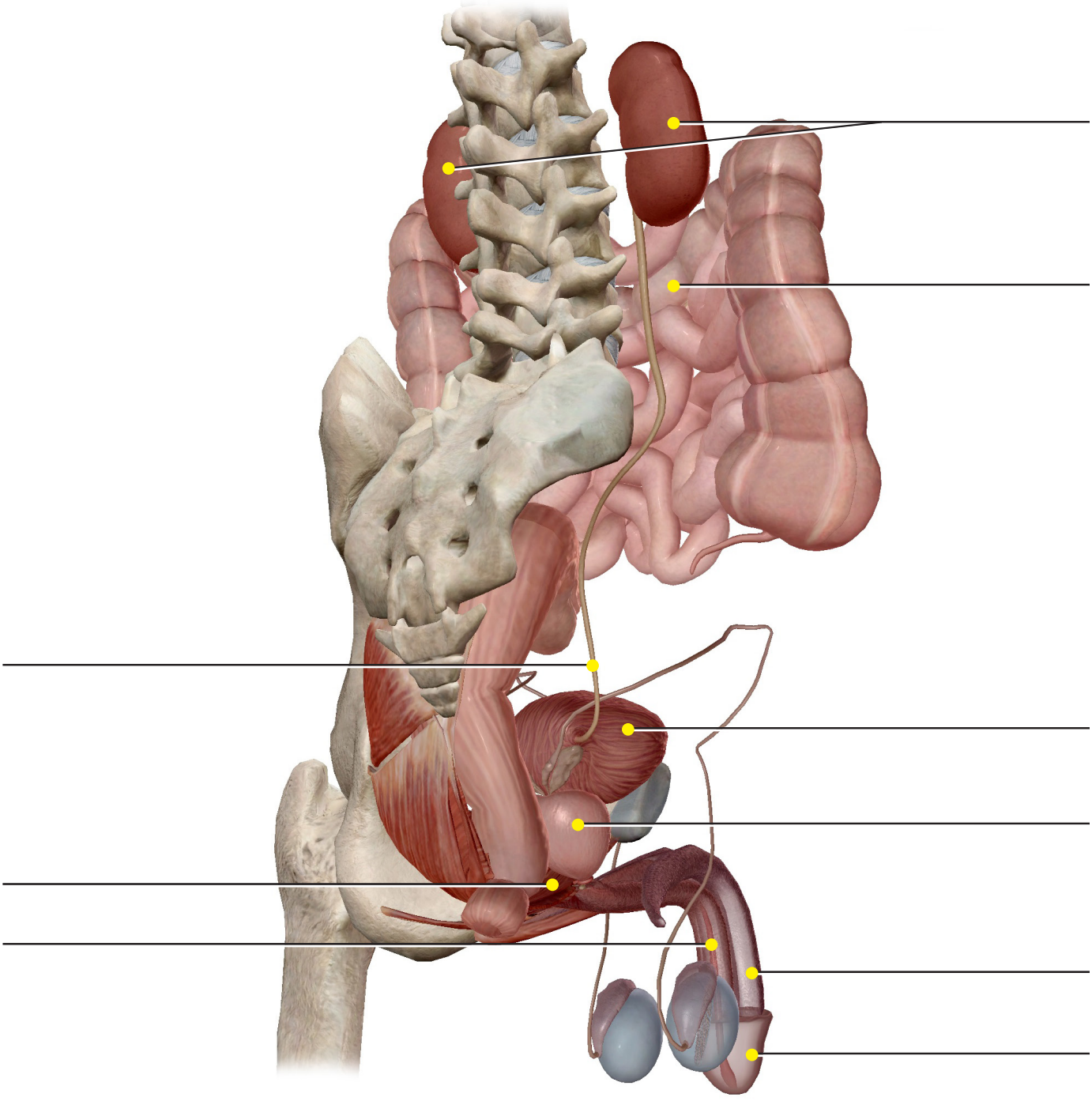
Source: Urinary System View "Urinary System (M)"



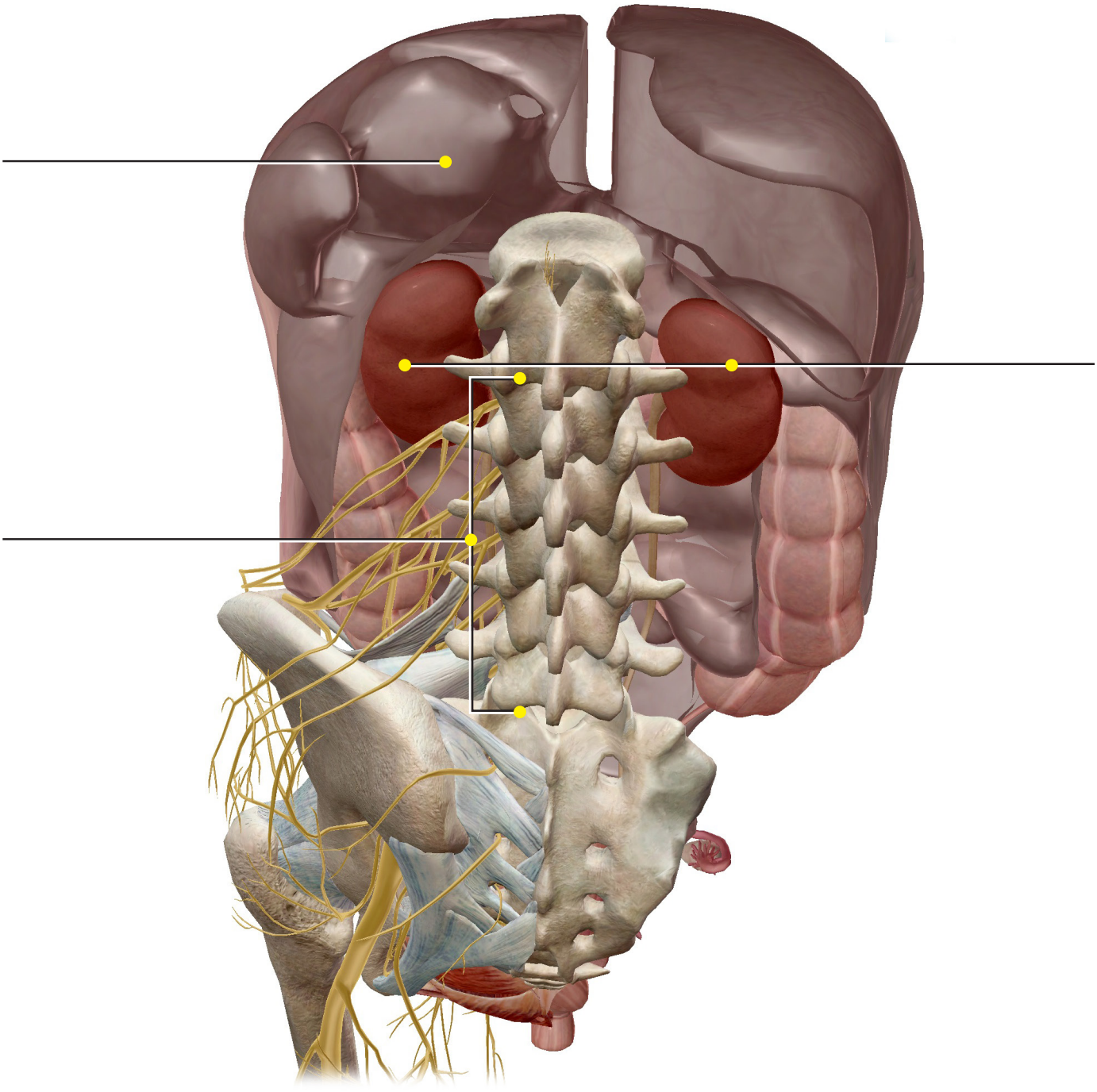
Source: Urinary System View "Urinary System (F)"



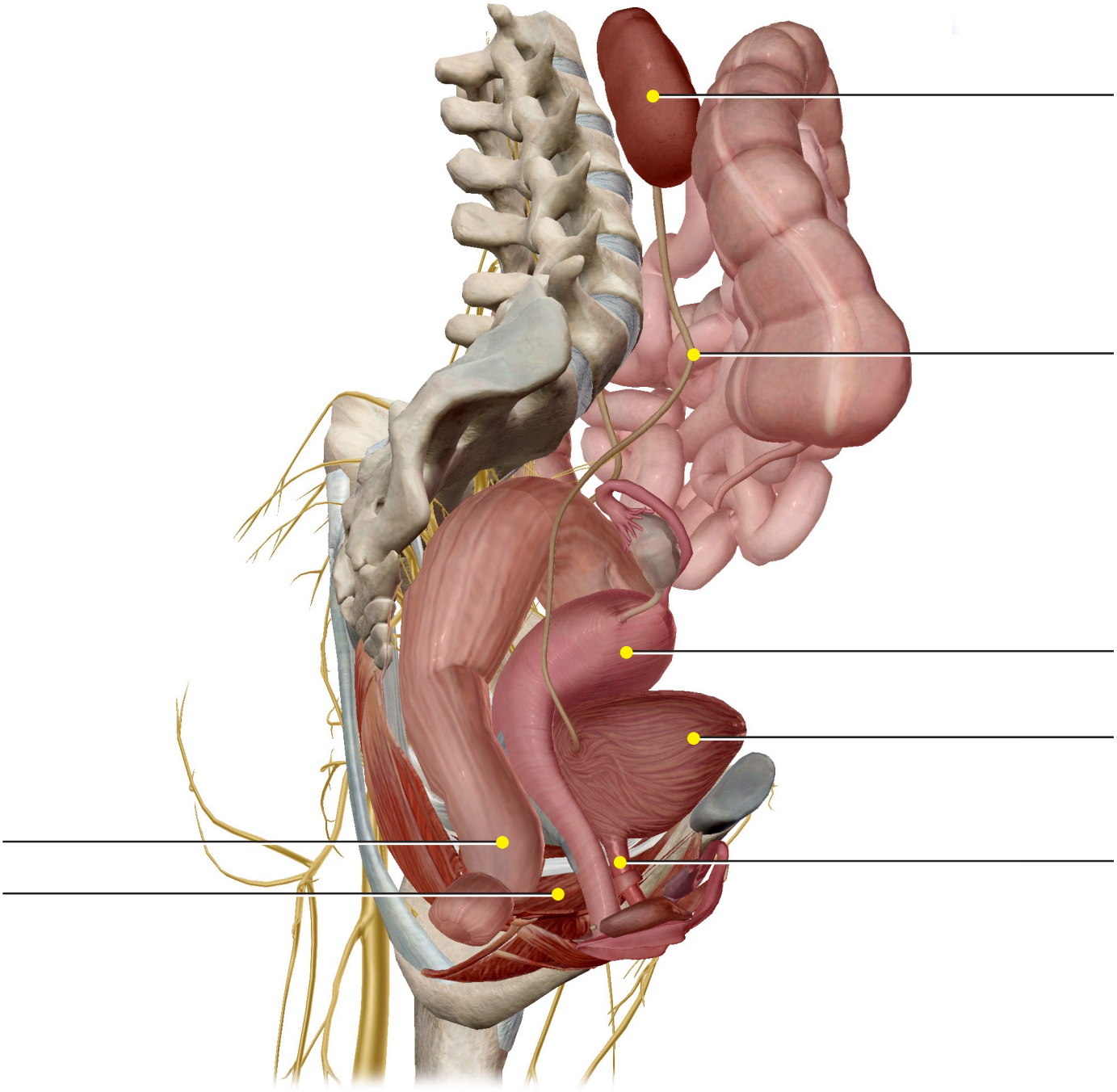
Source: Urinary System View "Pelvic Region (M)"



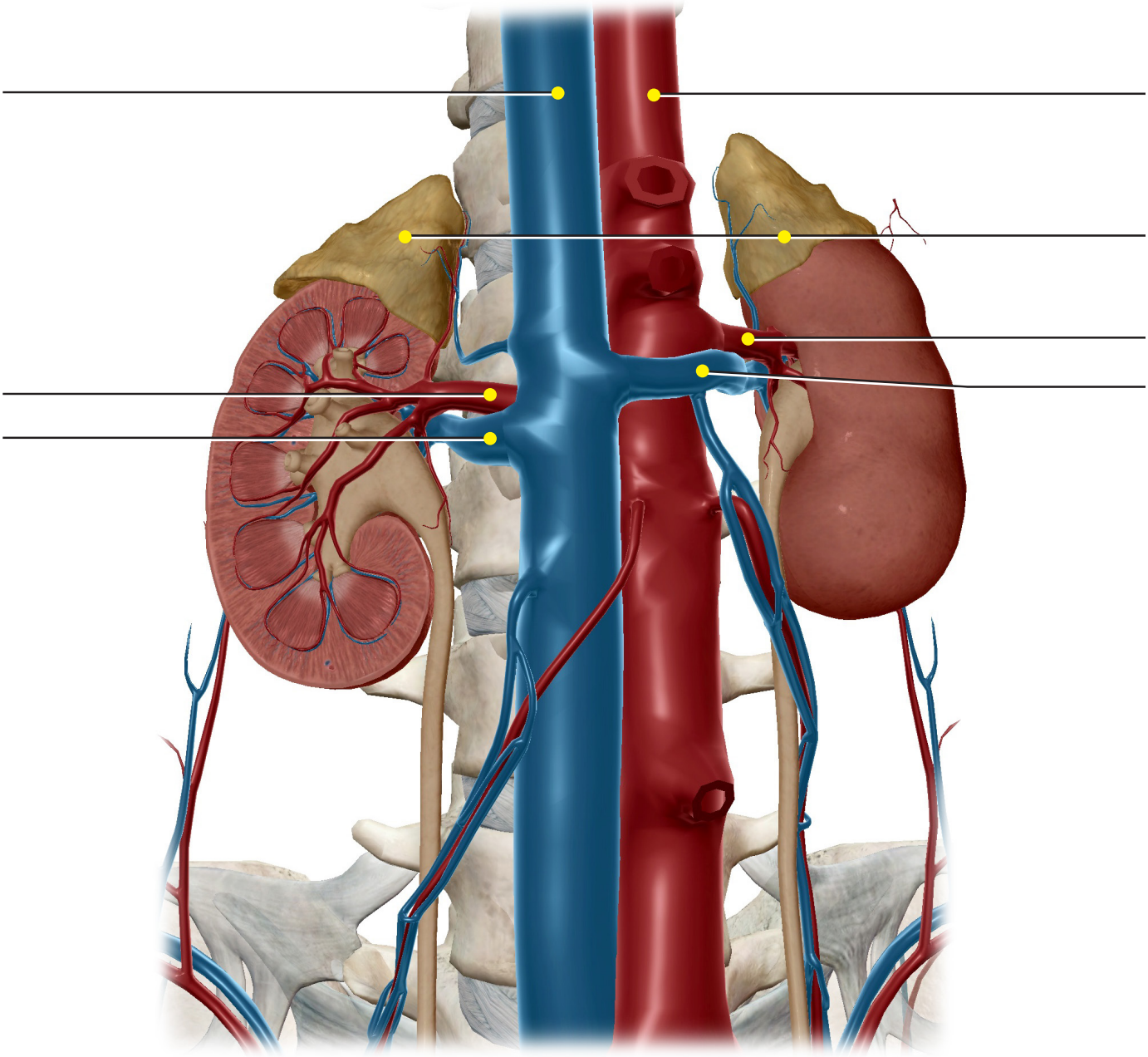
Source: Urinary System View "Pelvic Region (F)" (Part 1)



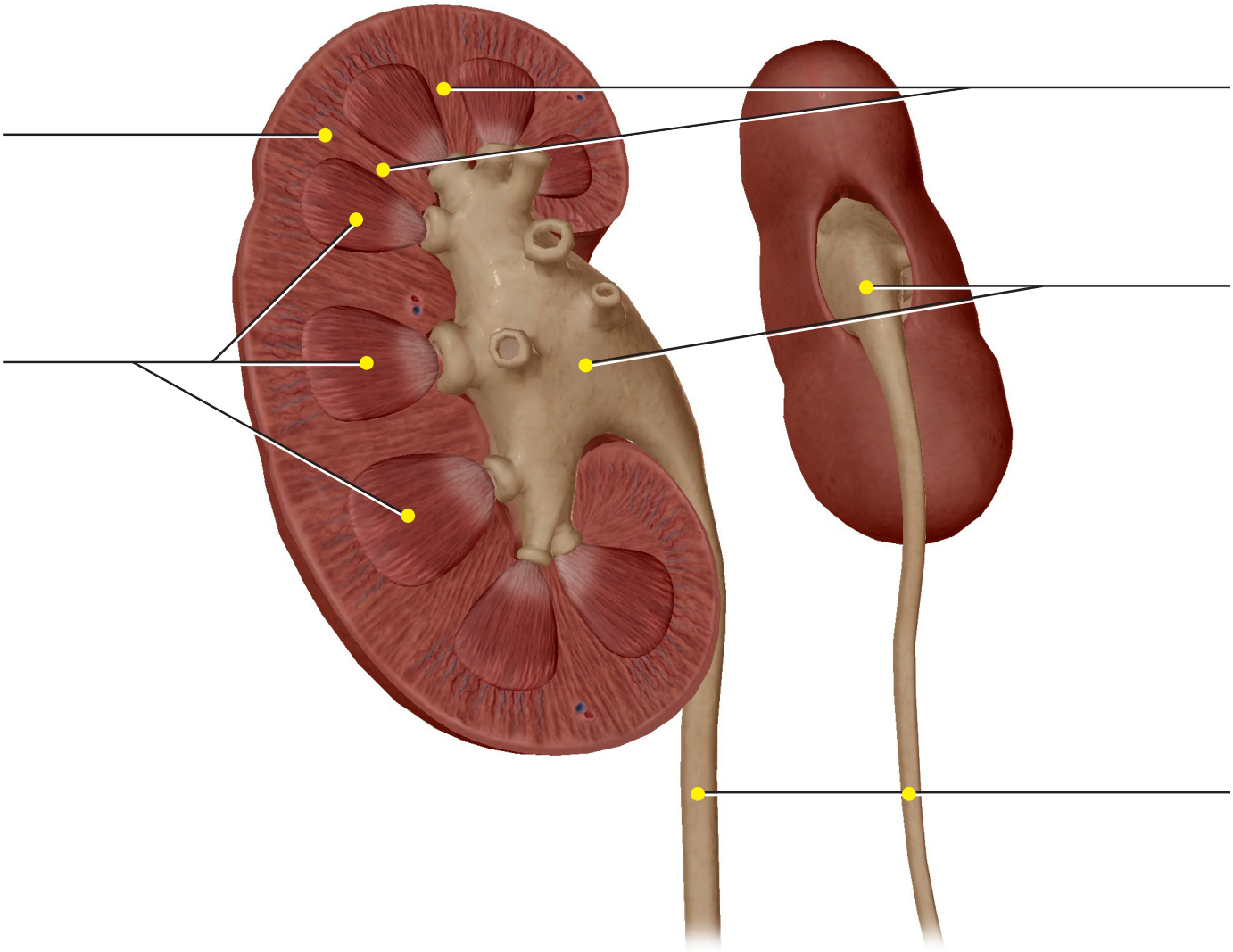
Source: Urinary System View "Pelvic Region (F)" (Part 2)



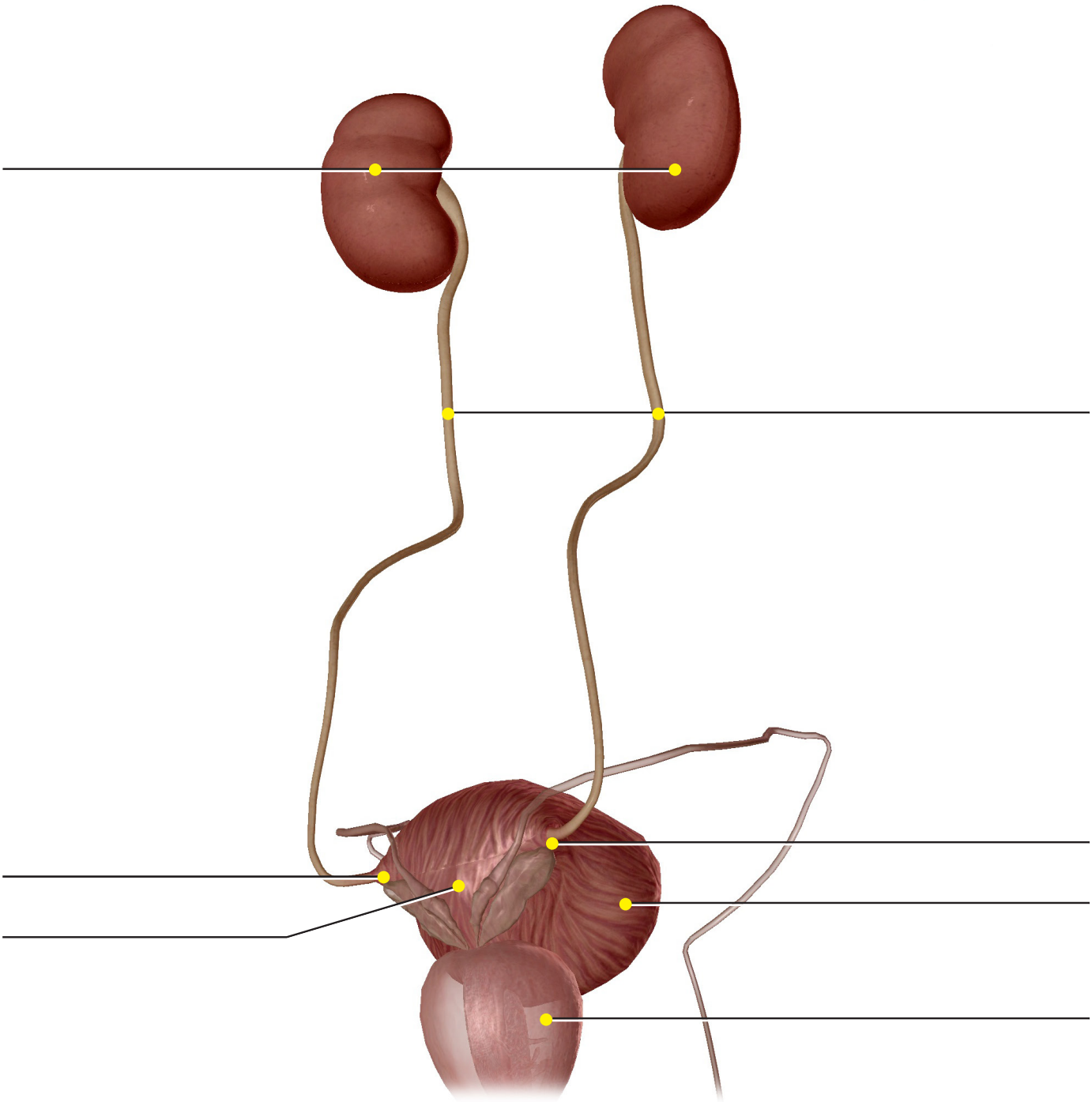
Source: Urinary System View "Renal Vasculature (M)"



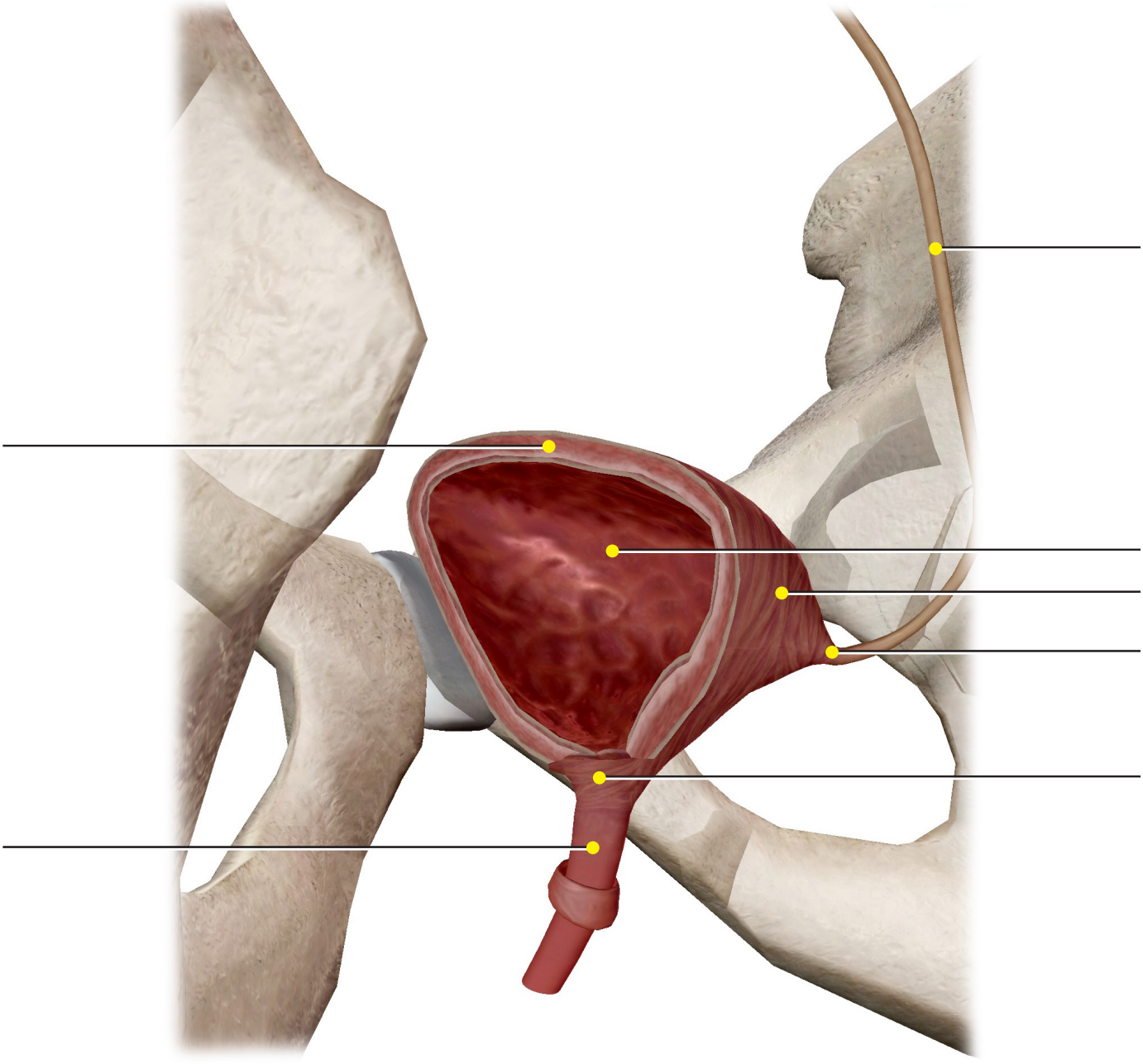
Source: Urinary System View "Kidney Section (F)"



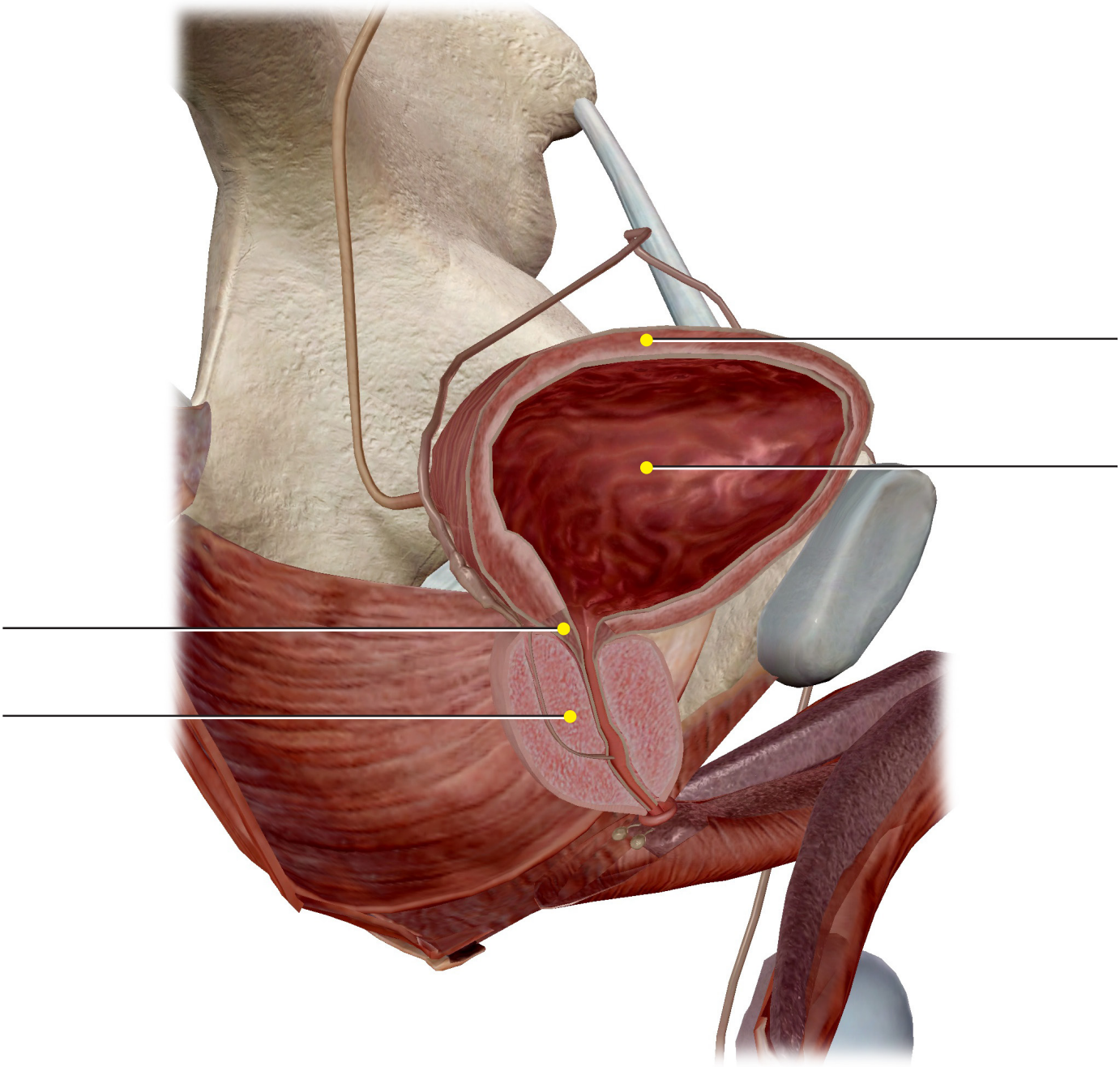
Source: Urinary System View "Ureters (M)"



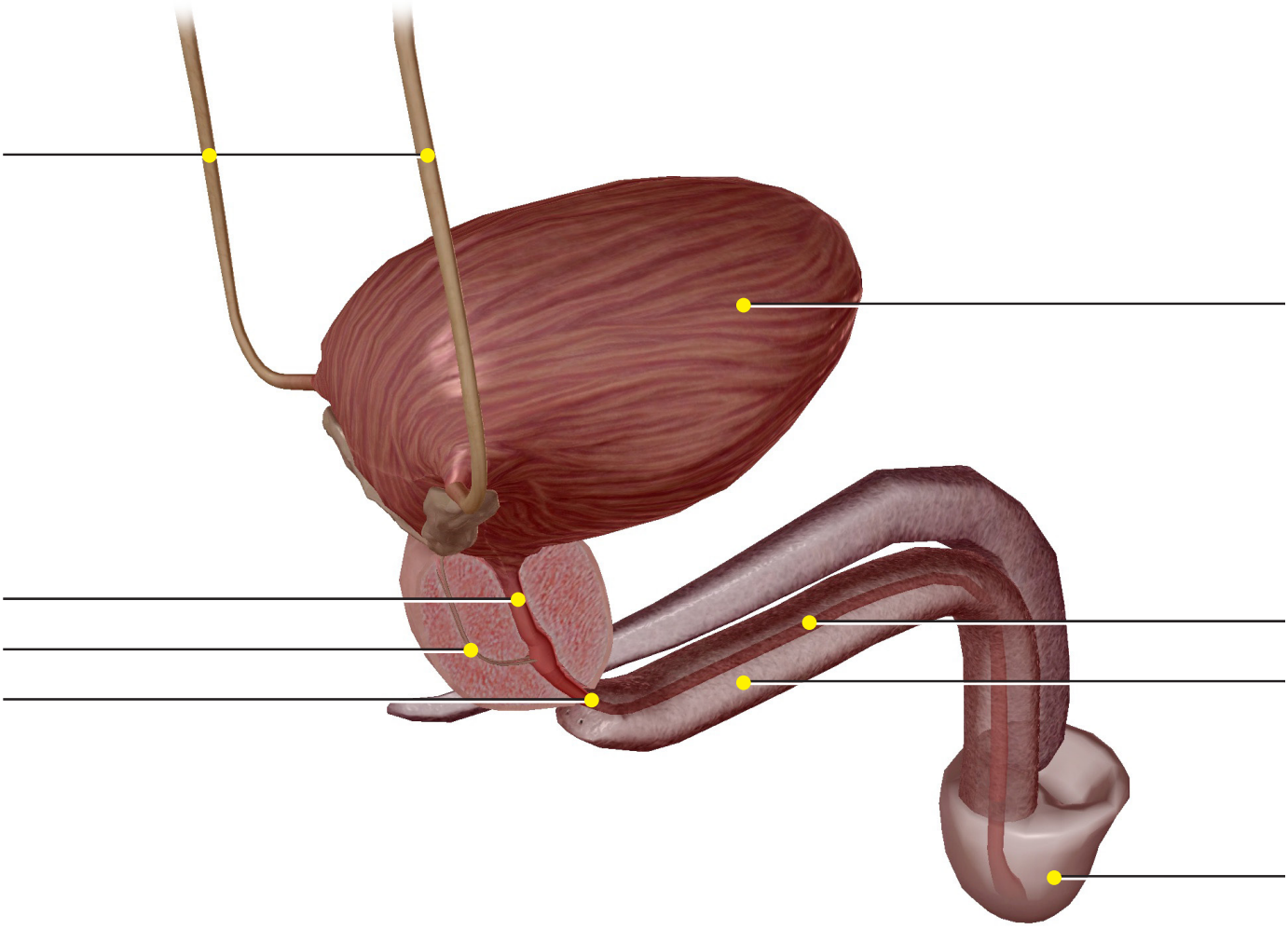
Source: Urinary System View "Bladder Section (F)"



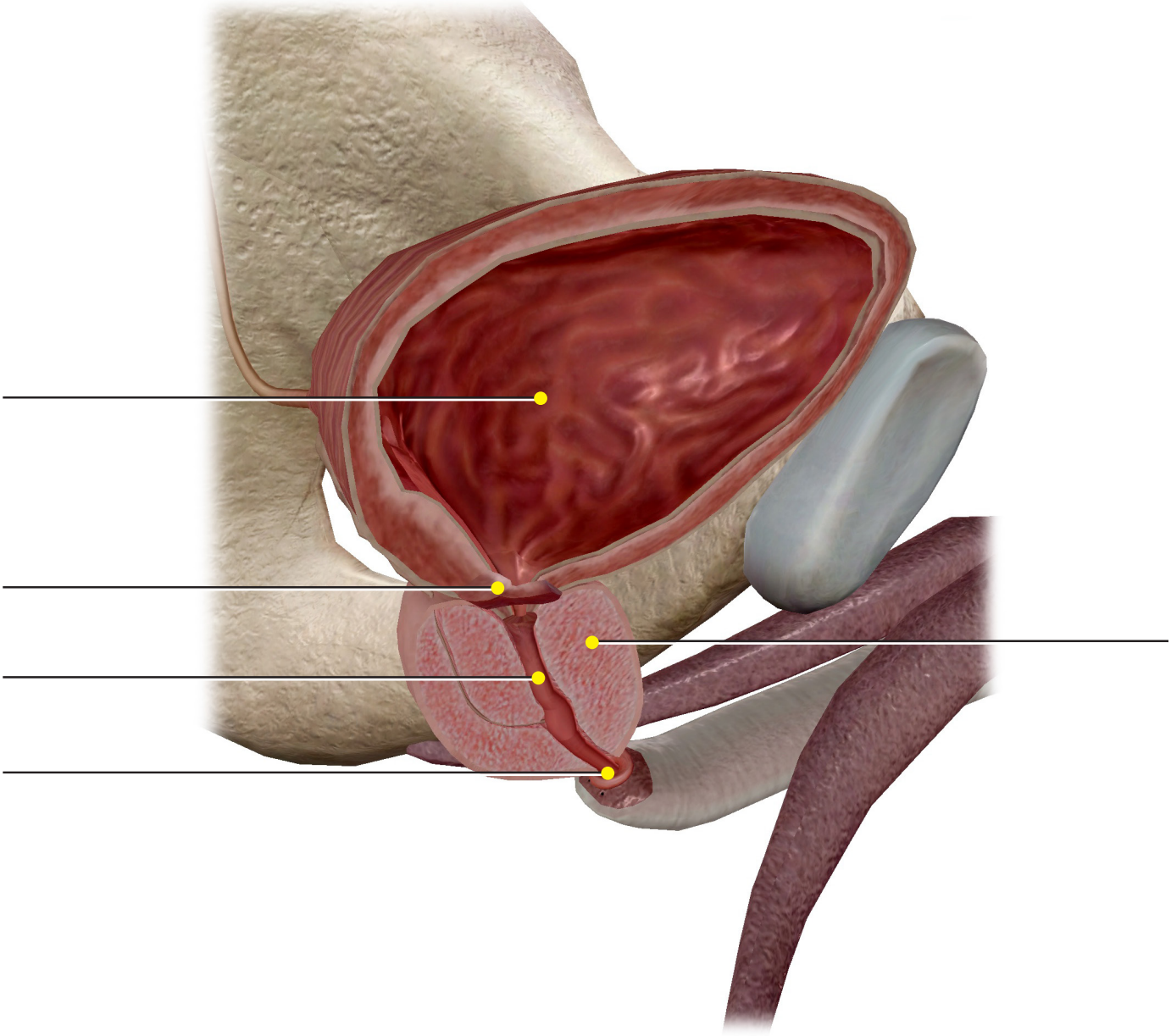
Source: Urinary System View "Bladder Section (M)"



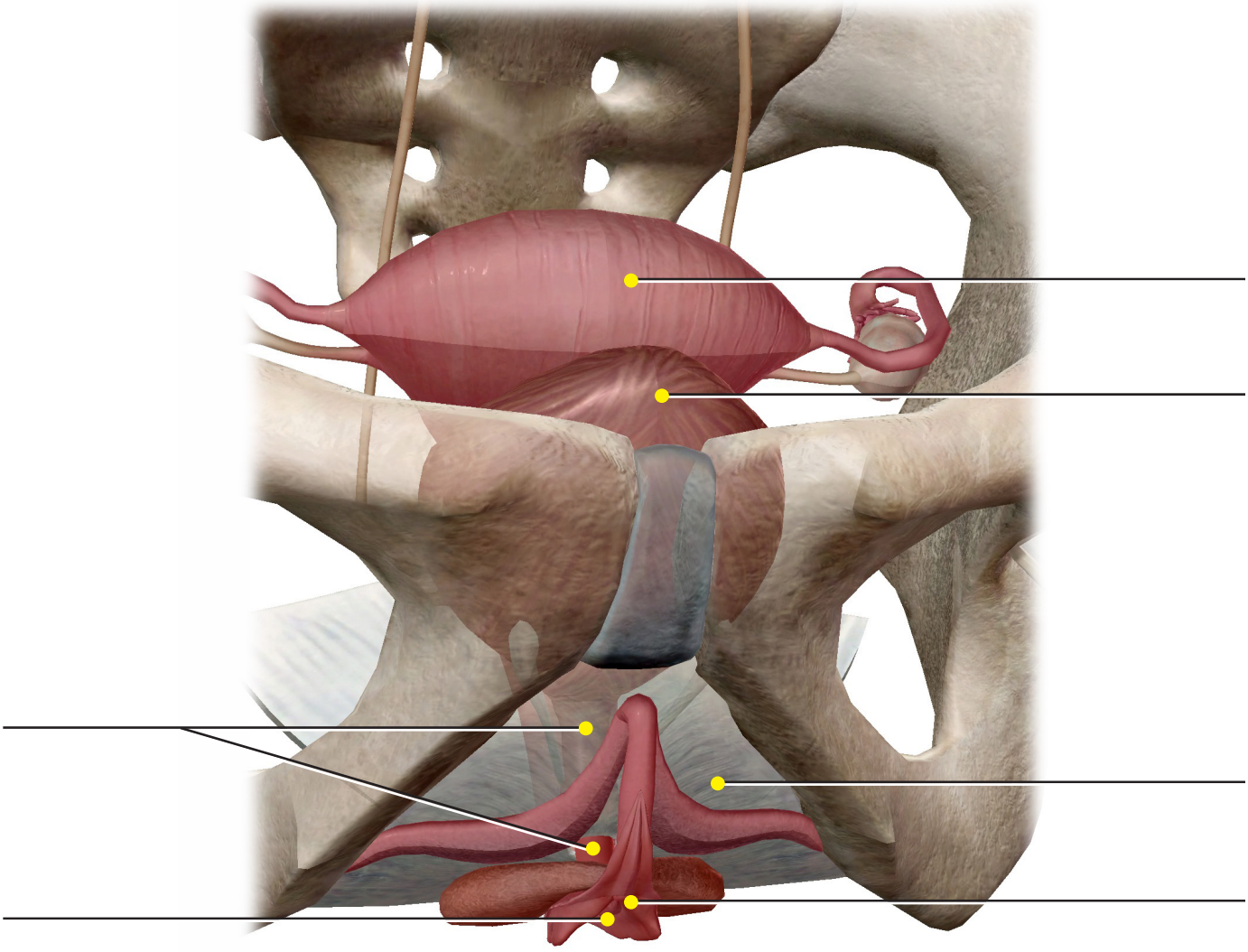
Source: Urinary System View "Urethral Orifice (M)"



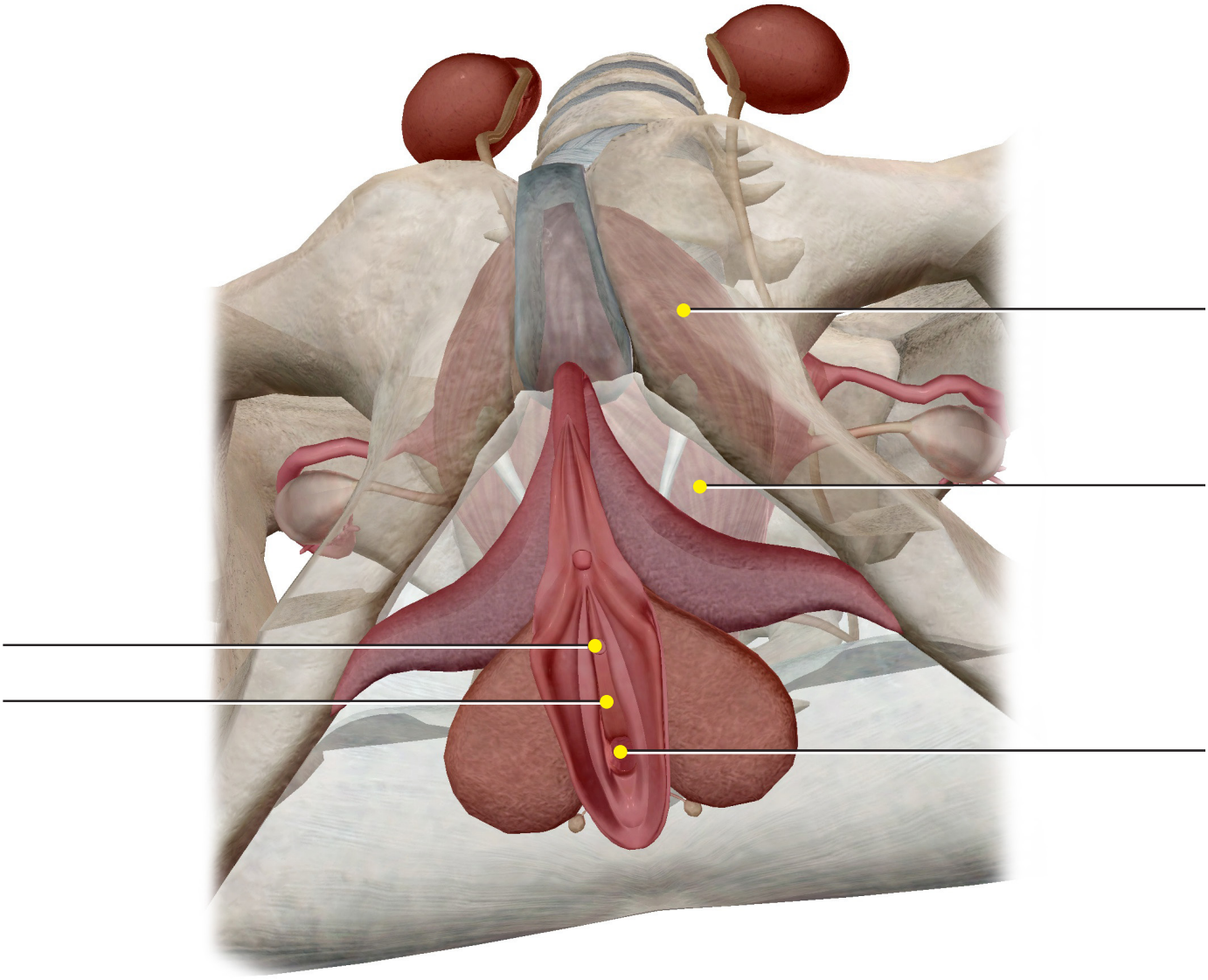
Source: Urinary System View "Urethral Sphincter (M)"



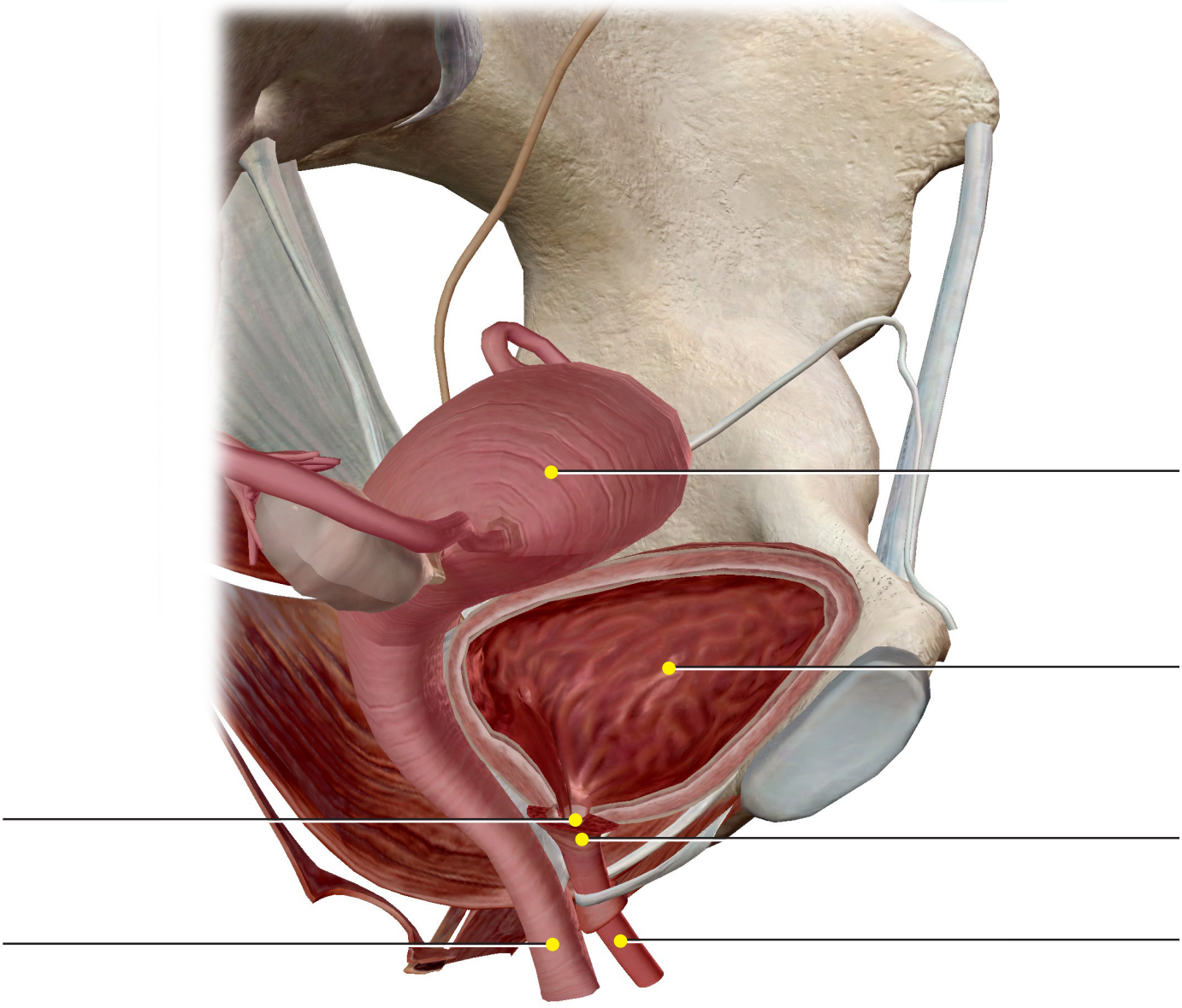
Source: Urinary System View "Bladder and Uterus (F)" (Part 1)



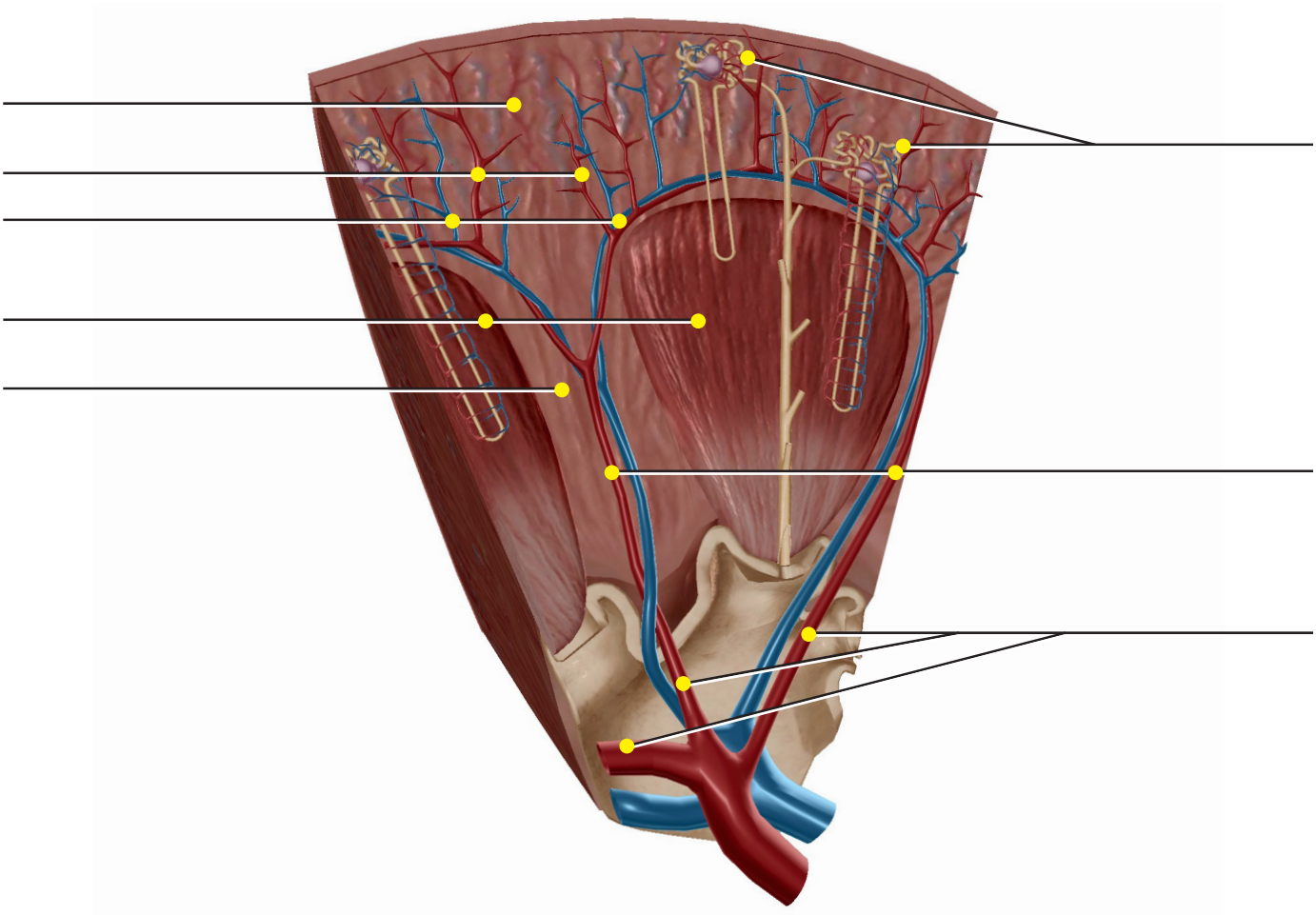
Source: Urinary System View "Bladder and Uterus (F)" (Part 2)



Source: Urinary System View "Urethral Sphincters (F)"



Source: Urinary System View "Nephrons" (Part 1)



Source: Urinary System View "Nephrons" (Part 2)