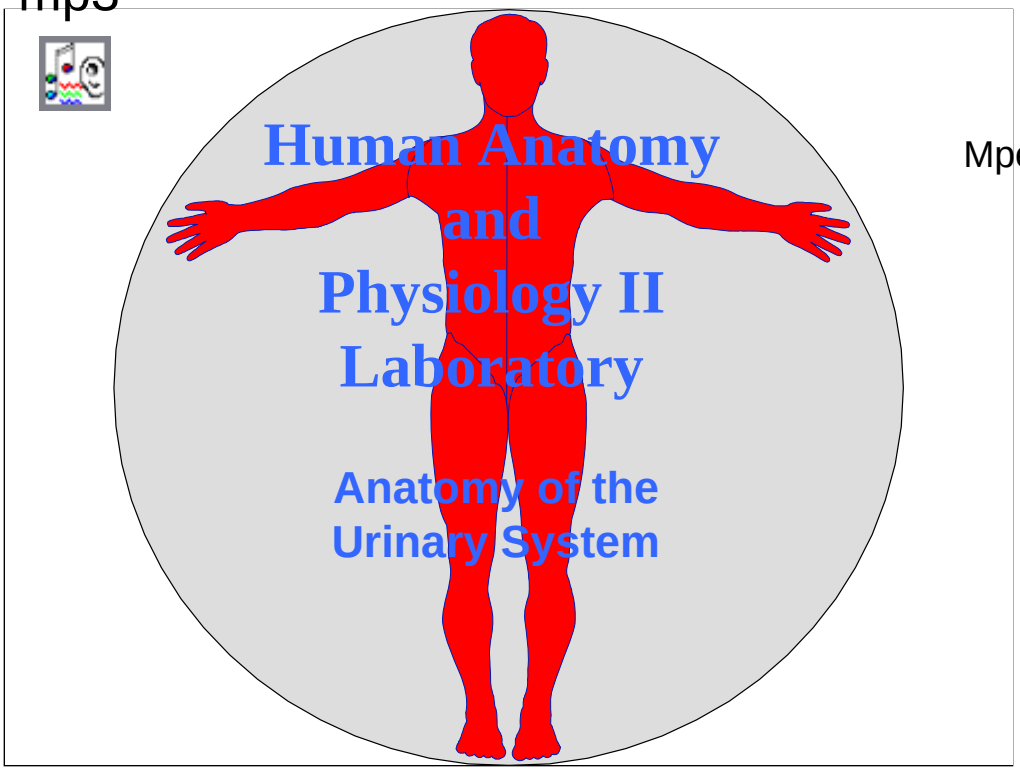
mp3



Mpeg 4 for iPod

This lab involves the exercise in the lab manual entitled "*Anatomy of the Urinary System*". In this lab you will look at urinary system histology, and anatomy.

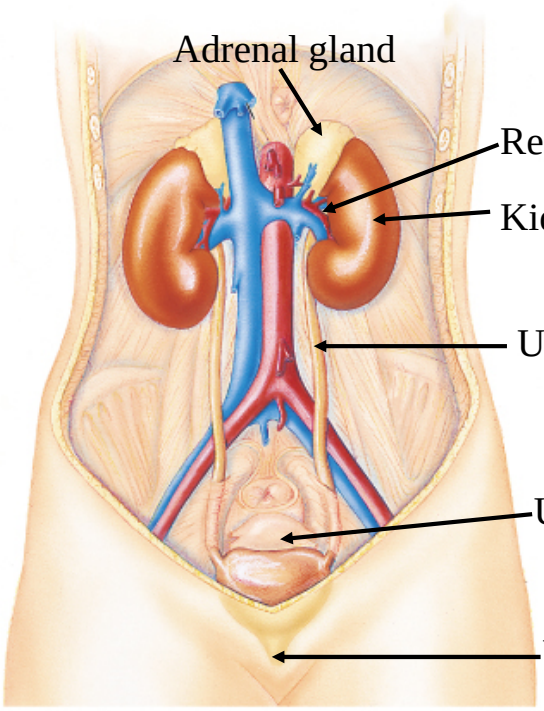
Complete the review sheet from the exercise and take the online urinary system quiz. As an alternate your instructor may have you submit a drawing of kidney tissue from the Virtual Microsocpe or other histology site.

There are also videos showing cadaver dissection of the urinary tract and sheep kidney.

Click on the sound icon for the audio file (mp3 format) for each slide.

There is also a link to a dowloadable mp4 video which can be played on an iPod.

Organs of The Urinary System



Adrenal gland

Renal artery and vein

Kidney

Maintains homeostasis of the blood.

Carries urine to the bladder

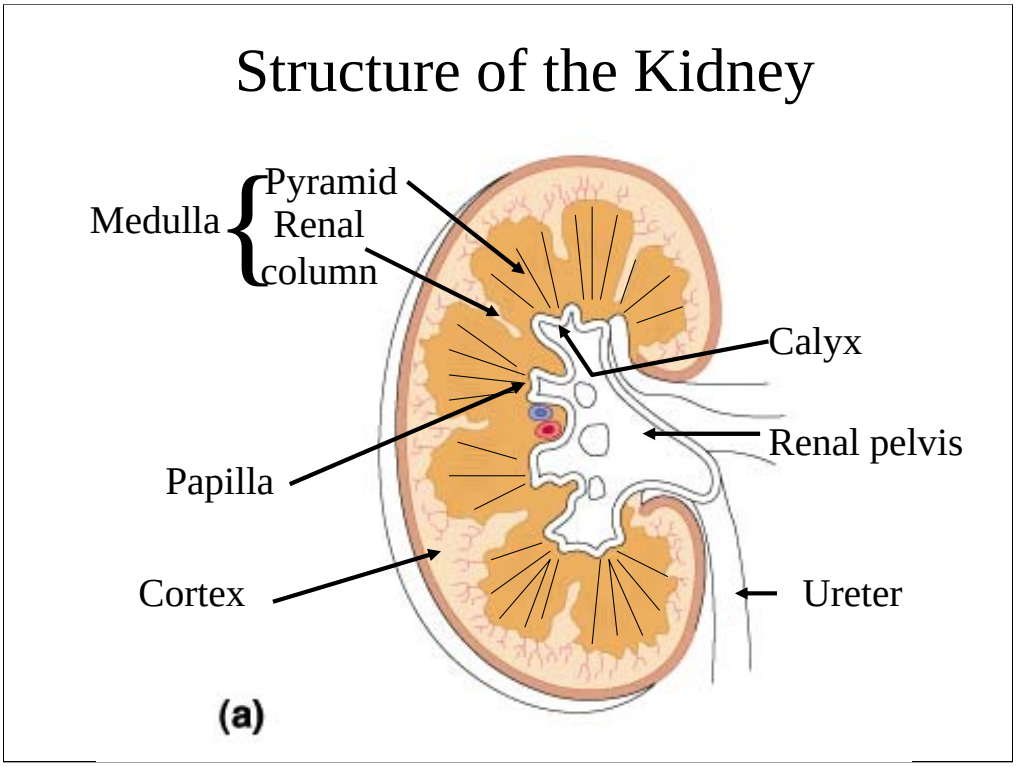
Ureter

Stores urine

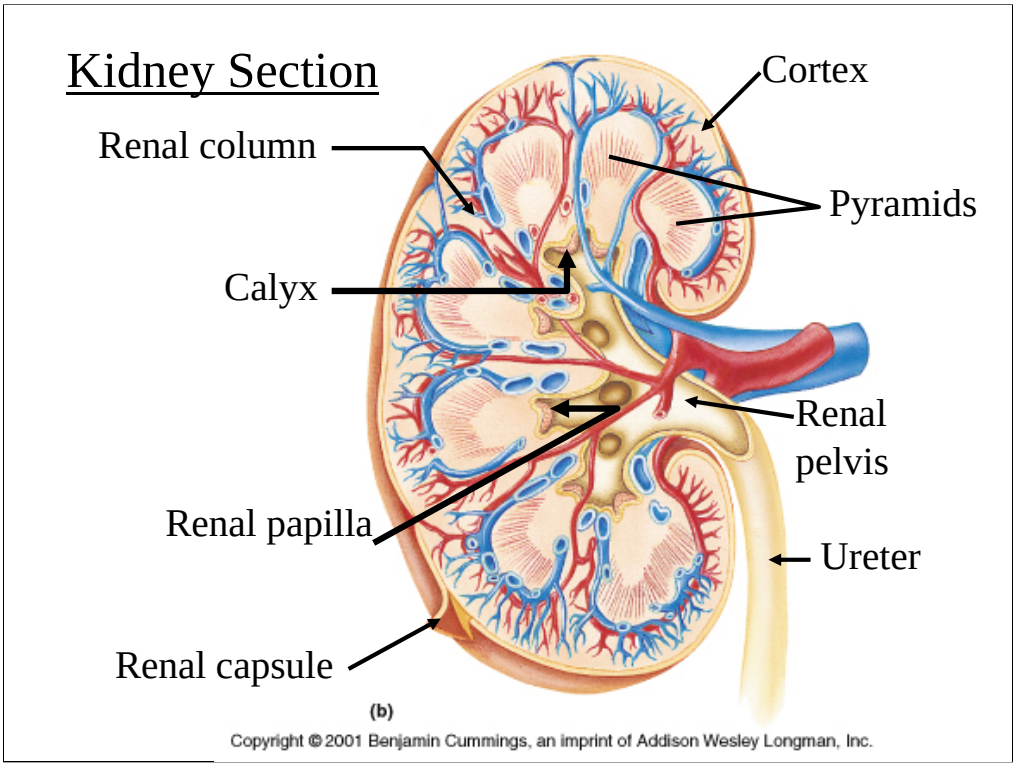
Urinary bladder

Expels urine from the bladder

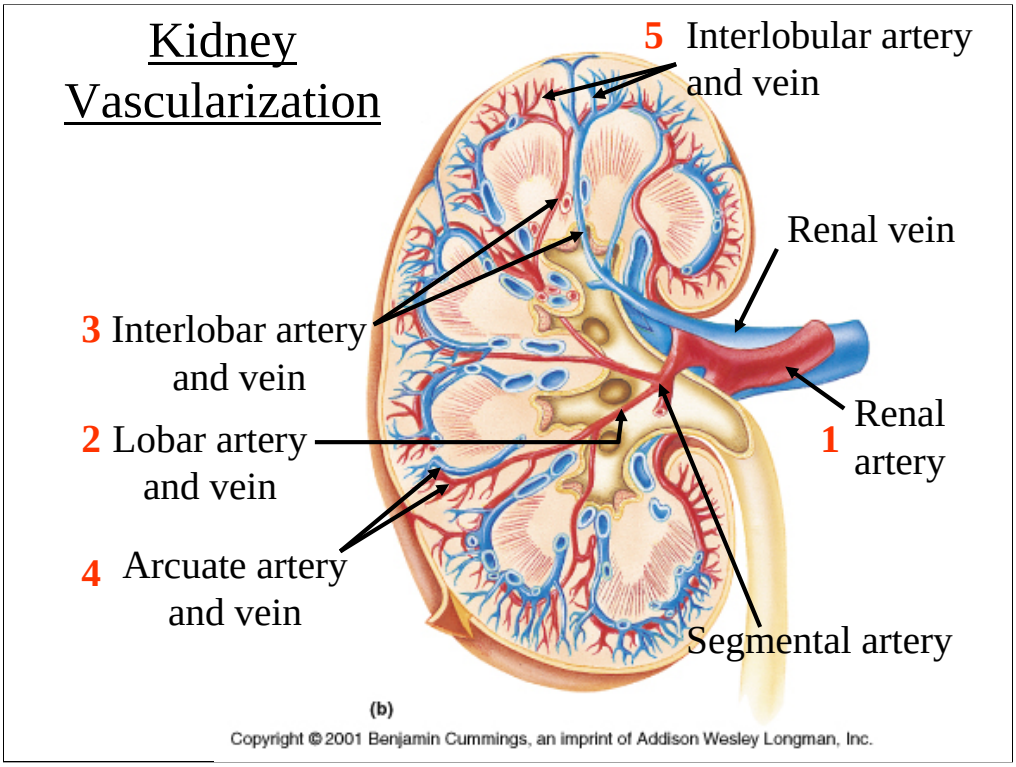
Urethra



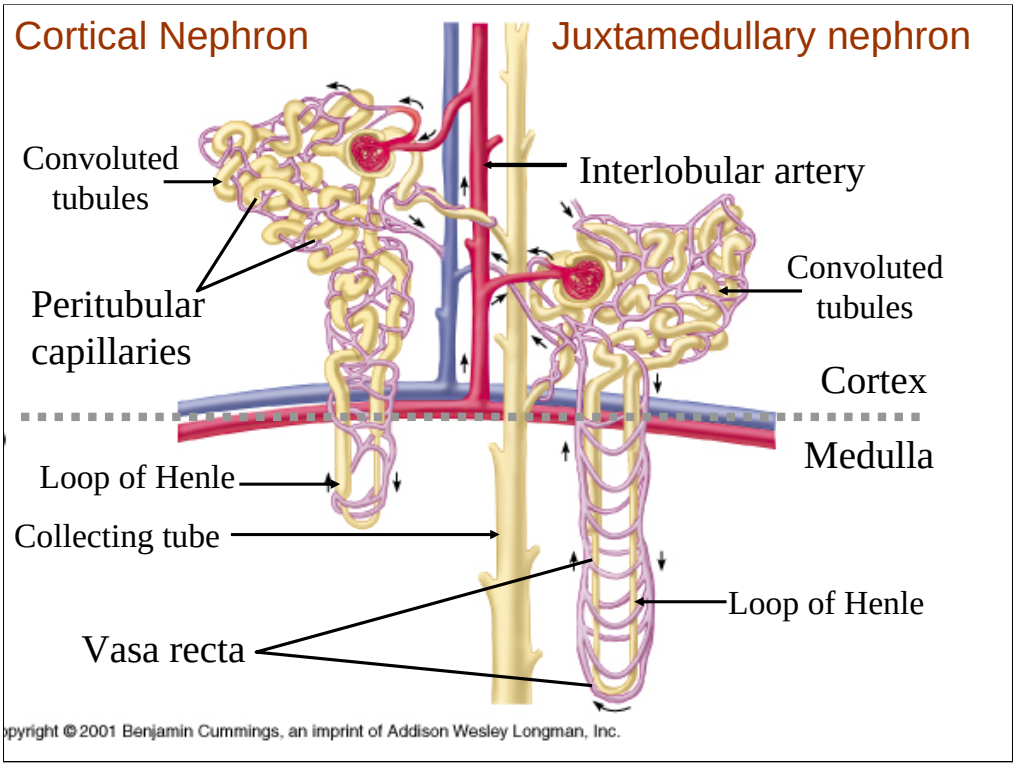
The kidney is composed of several layers and is covered with a **fibrous capsule**, the renal capsule. The outer layer of the kidney is the **cortex**. It contains the major (upper) portion of the **nephrons**. The middle layer of the kidney is the **medulla**. It is composed of the triangular shaped **pyramids** and the renal columns. The pyramids contain the **collecting tubules** and **loops of Henle**, the lower portion of the nephrons. These tubules run nearly parallel to one another and give the pyramids a grain which leads to their points or papillae. The renal columns are regions between the pyramids in which blood vessels run to and from the cortex. The papilla of each pyramid projects into a funnel-shaped area known as the calyx. The **calyces** (plural of calyx) collect the urine released from the papillae and allow itto drain into a large area known as the **renal pelvis** and then into the **ureter**.



This view of the kidney shows not only the regions mentioned previously but also the manner in which blood vessels supply these regions.

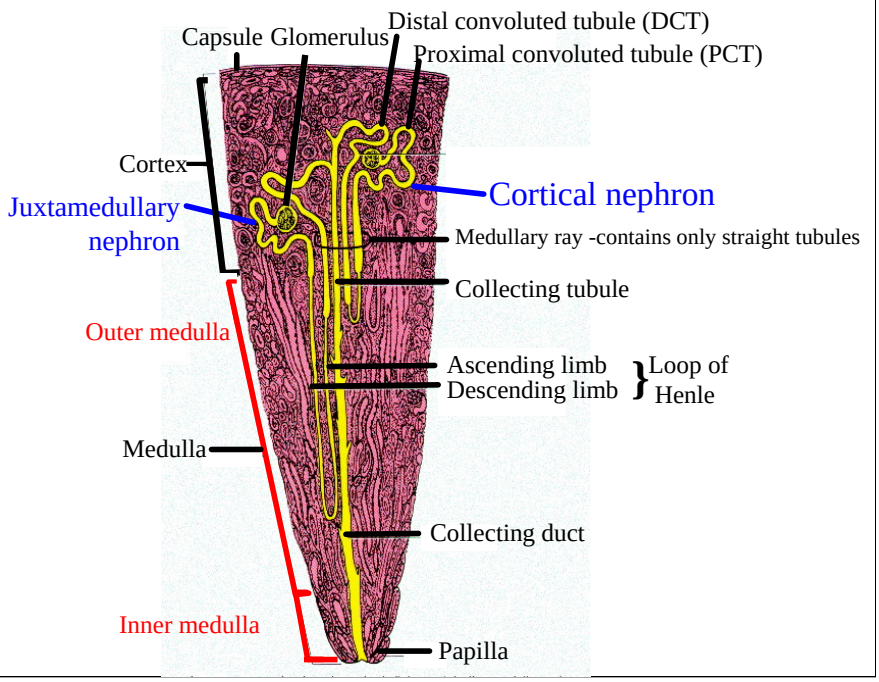


The blood supply of the kidney is paramount in its function. The two kidneys receive between 15 and 20% of the body's systemic blood flow at rest. The **renal artery** branches into **lobar** and then interlobar arteries. These pass through the renal columns toward the cortex. **Arcuate** arteries branch into the cortex and lead to interlobular arteries which distribute the blood evenly throughout the cortex to the **afferent arterioles** which serve the **nephrons**. Blood flow leaving the nephrons returns by veins of the corresponding names.



Cortical nephrons have short loops of Henle which barely enter the medulla. Longer loops which dip much further into the medulla belong to juxtamedullary nephrons. These nephrons are important for concentrating the urine by absorbing extra water.

Orientation of the Nephron Structures



Here you see the relationship of the nephron types to the parts of the kidney.

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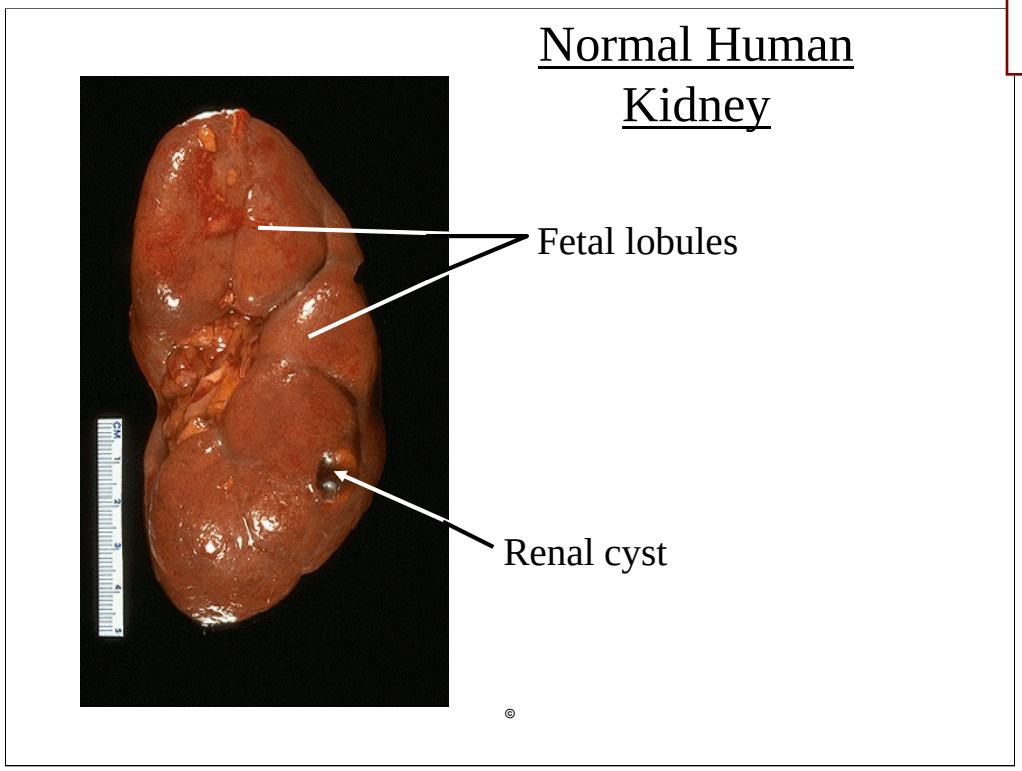

Here is a normal adult kidney. The capsule has been removed and a pattern of "**fetal lobules**" still persists, as it sometimes does. The **hilus** at the mid left contains some adipose tissue. At the lower right is a smooth-surfaced, small, clear fluid-filled simple renal cyst. Such cysts occur either singly or scattered around the renal parenchyma and are not uncommon in adults. Only when cysts are large and extensive do they have the potential to interfere with kidney structure and function.

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Kidney Section

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In a sectioned human kidney can easily be seen the regions shown in previous slides. Much of the hilus (notch) of the kidney is filled with the fat, the yellowish tissue.

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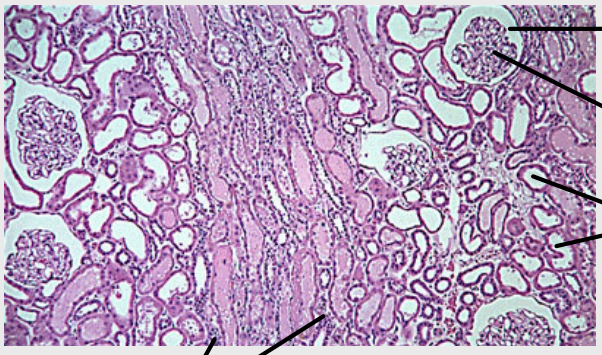
Structure of the Cortex



A medullary ray is a group of straight tubules of the loop of Henle and collecting tubules, along with blood vessels which project from the cortex into the medulla.

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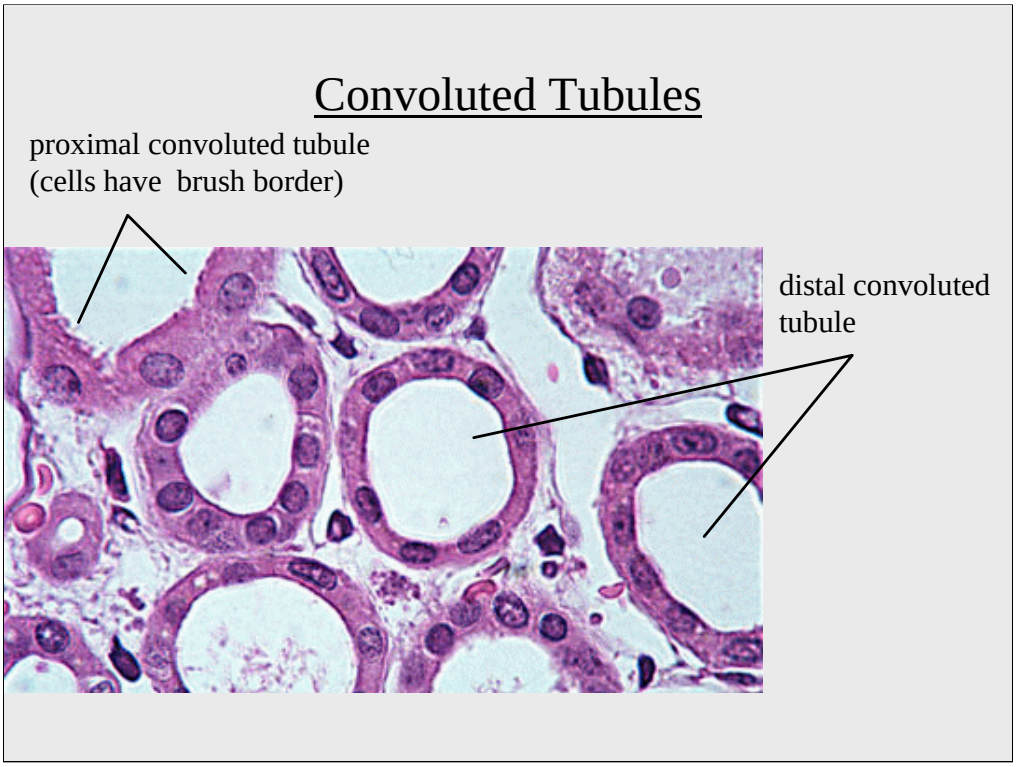

Note the structural difference between the cells of the **proximal and distal tubules**. Proximal tubule cells are much more active in reabsorption and secretion and are thicker and with brush border (microvilli) for increased surface area. Distal cells are less active and are therefore thinner.

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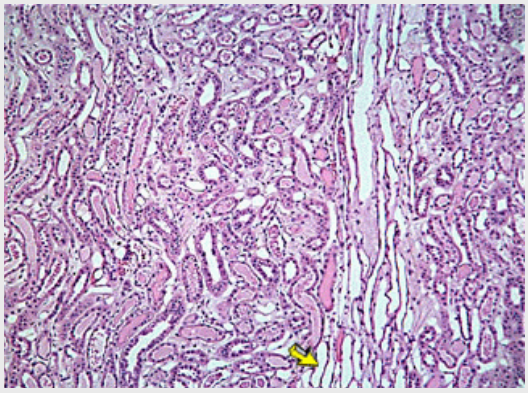
Renal Medulla



The collecting ducts have simple cuboidal epithelia as do some of the other tubule segments. A group of blood vessels called the vasa recta parallel these tubules running into the medulla. There are no arteries or arterioles supplying blood to the medullary structures, only the vasa recta.

In the medulla, the **collecting tubes** (ducts) and **loops of Henle** run parallel with one another as they travel through the **pyramids**. Therefore these tubules appear elongated when compared with those in the cortex. Also seen in the medulla are the blood vessels of the **vasa recta** which surround the long loops of Henle from the **juxtamedullary nephrons**.

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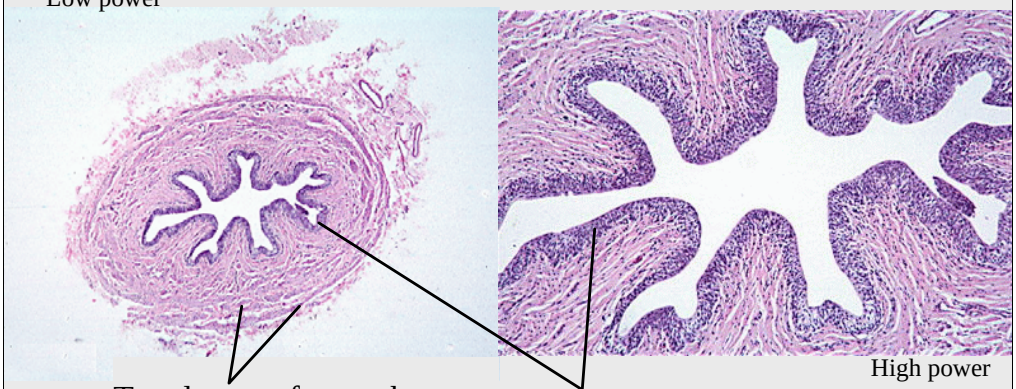
The Ureters

Low power



High power

Two layers of smooth muscle (three near the bladder) move urine by peristalsis.

Mucosa of transitional epithelium allows expansion and damping of pressure.

Transitional epithelial lining allows both the bladder and ureter to stretch

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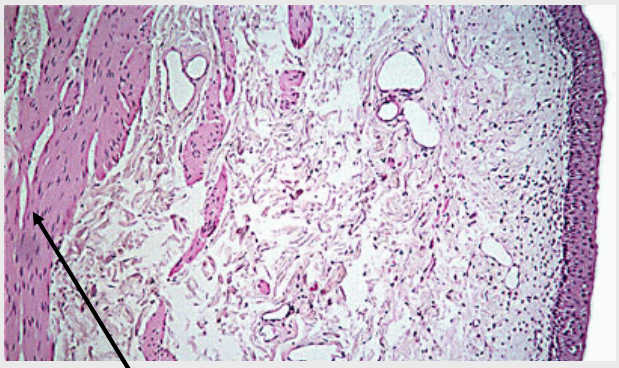
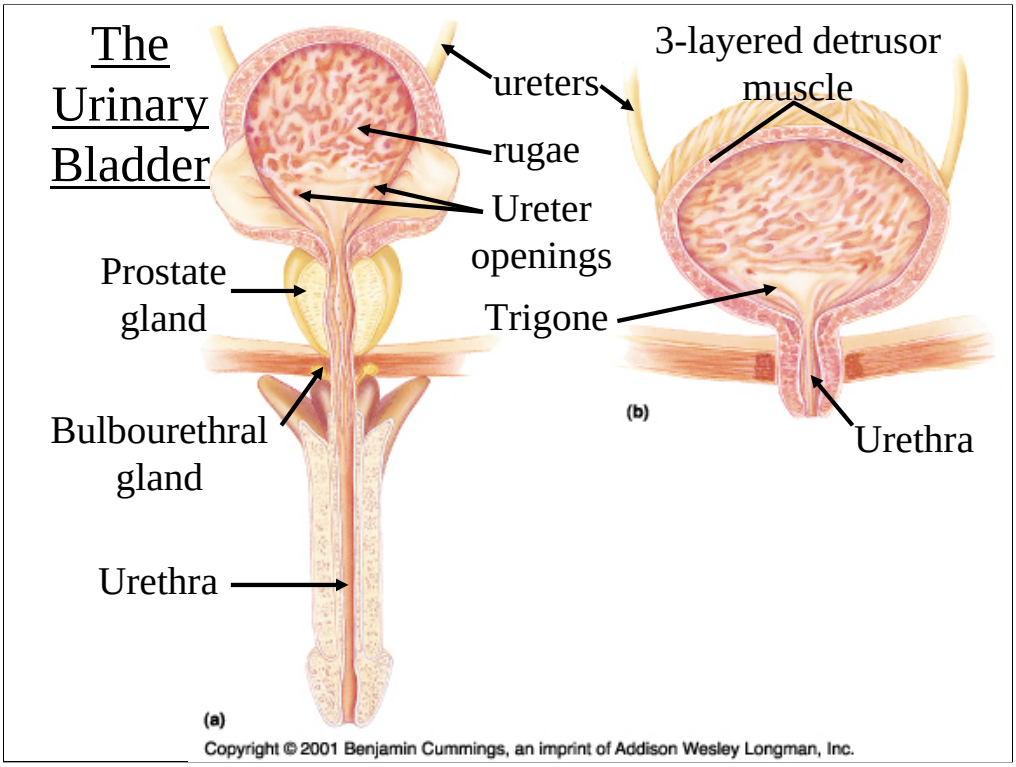
Urinary Bladder



Three layers of smooth muscle in the urinary bladder, called the detrusor muscle, cause a compression during micturition. The bladder wall has extensive rugae, flattened in this distended bladder. The transitional epithelial lining (on the right side) permits expansion as the bladder fills with urine.



Urine travels to the urinary bladder through the ureter by peristalsis. The ureter has two layers of smooth muscle which work like smooth muscle in the intestine, except they are in reversed position (longitudinal toward the inside, circular toward the outside). The ureter is lined with **transitional epithelium** to allow for stretch and reduce back pressure on the kidney.

The bladder is also lined with transitional epithelium and has many rugae for expansion. The bladder's **detrusor muscle** consists of three layers like the stomach's and also serves for compression. At the lower end of the bladder the ureteral openings form a triangle with the urethra which is called the trigone. The trigone has longitudinal folds which funnel the urine toward the urethra. These folds help squeeze the ureteral openings closed when micturition occurs.

The urethra varies from a short tubule in females to a longer tubule in males with several sections (see diagram). Near the bladder the urethra is lined with transitional epithelium and near the external os it is stratified squamous, while in the middle it is pseudostratified columnar epithelium.

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Lab Protocol

1) Complete the Review Sheet for this exercise .
2) Take the quiz on the urinary system.
3) Use ADAM to identify structures of the digestive system. (See next slide)
4) View the cadaver video on the urinary tract.

ADAM Interactive Anatomy

Dissectible Anatomy, Male, Anterior, Window centered on abdomen, Begin with Layer Indicator at 234, scroll to Layer Indicator 238 and 242 for the external and internal anatomy of the kidney, and the ureter.

Atlas Anatomy, Male, Anterior, System, Urinary, Renal Arteries

Atlas Anatomy, Male, Anterior, System, Urinary, Diagram of Nephron

Atlas Anatomy, Male, Anterior, System, Urinary, Diagram of Renal Glomerulus

There is no audio file for this slide.

ADAM Interactive Anatomy

Dissectible Anatomy, Male, Anterior, Window centered on abdomen, Begin with *Layer Indicator at 234,* scroll to *Layer Indicator 238 and 242* for the external and internal anatomy of the *kidney*, and the *ureter*.

Atlas Anatomy, Male, Anterior, System, Urinary, Renal Arteries

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