

**URINARY**

# Objectives

**Students should be able to:**

- 1. Describe the microscopic structure of the kidney cortex, medulla and renal pelvis; also the ureter and bladder.**
- 2. Identify the histological features of the kidney, ureter and bladder.**

# Kidney H & E stain

## General Histological Structure

Low power magnification.

Note the major features of a cross section through the kidney.

Identify : renal capsule, cortex (deep staining zone), medulla and renal corpuscles.



# Kidney

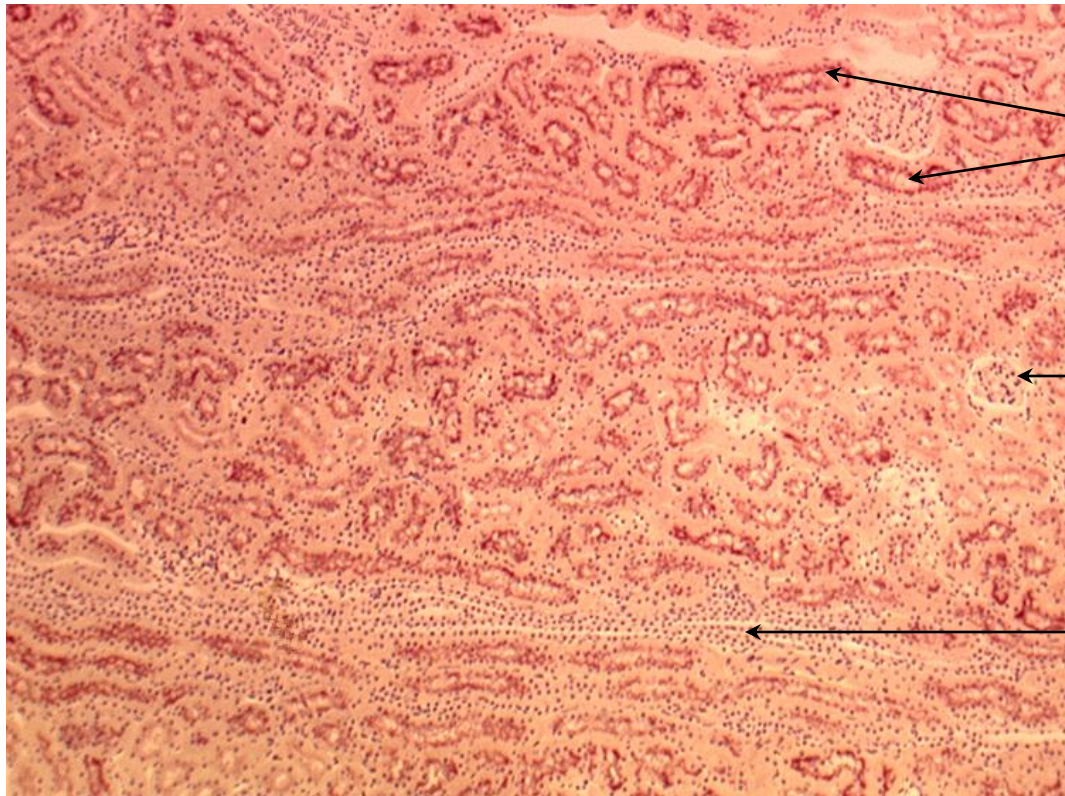
Alkaline phosphatase stain

## General Histological Structure

Identify : cortex , renal corpuscles,  
convoluted tubules and medullary rays.

What does the term medullary rays imply?

In the cortex- groups of radially arranged straight tubules form the cortical or medullary rays (pars radiata)



section from cortex

convoluted tubules

renal corpuscle

medullary ray

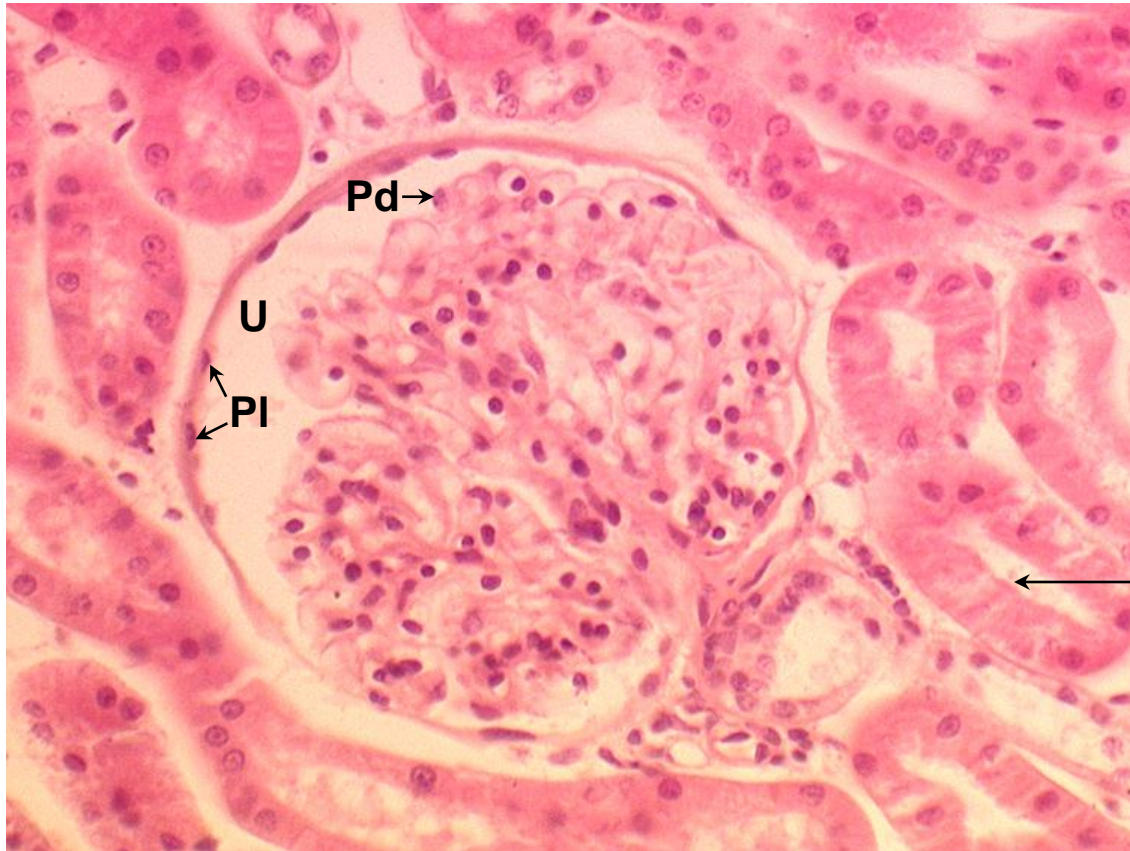
250  $\mu$ m

# Kidney

## Detailed Histology

Examine the structure of a renal corpuscle and appreciate how the filtration unit has been constructed. What constitutes the filter here?

1. Porous endothelium of capillaries.
2. Glomerular basement membrane.
3. Podocyte pedicels.



U : urinary space

Pd : podocyte

PI : parietal layer

proximal tubule

50  $\mu$ m

# Kidney

## Detailed Histology

Where does the filtrate collect?

**In the urinary space.**

What further changes take place in its composition before it is fully excreted?

**Extensive re-absorption (66-75%) of this glomerular filtrate in the proximal tubules.**



U : urinary space

50  $\mu$ m

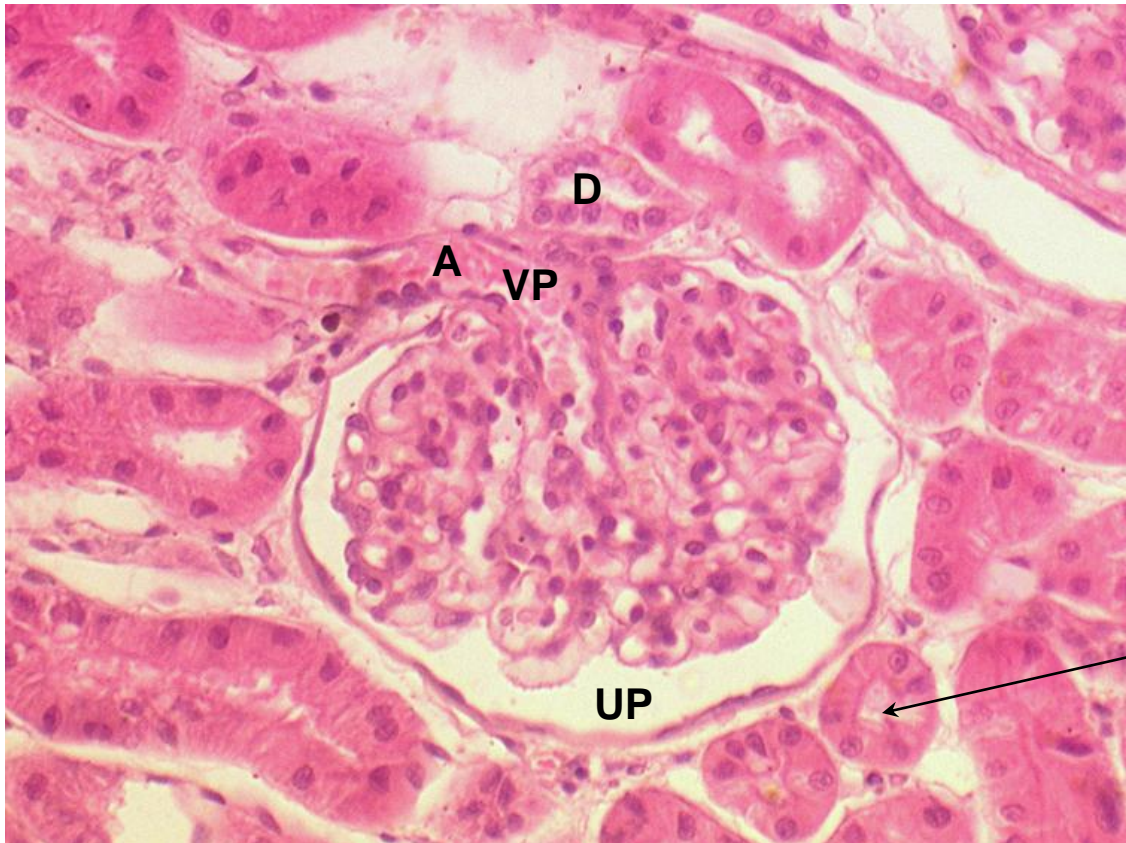
# Kidney

## Detailed Histology

What is the difference between vascular and urinary poles of the renal corpuscle?  
Why are they given these names?

**Vascular pole-** with afferent and efferent arteriole blood supply.

**Urinary pole-** with the start of the proximal convoluted tubule.



A : arteriole

D : distal tubule

UP : urinary pole

VP : vascular pole

proximal tubule

50 μm

# Kidney

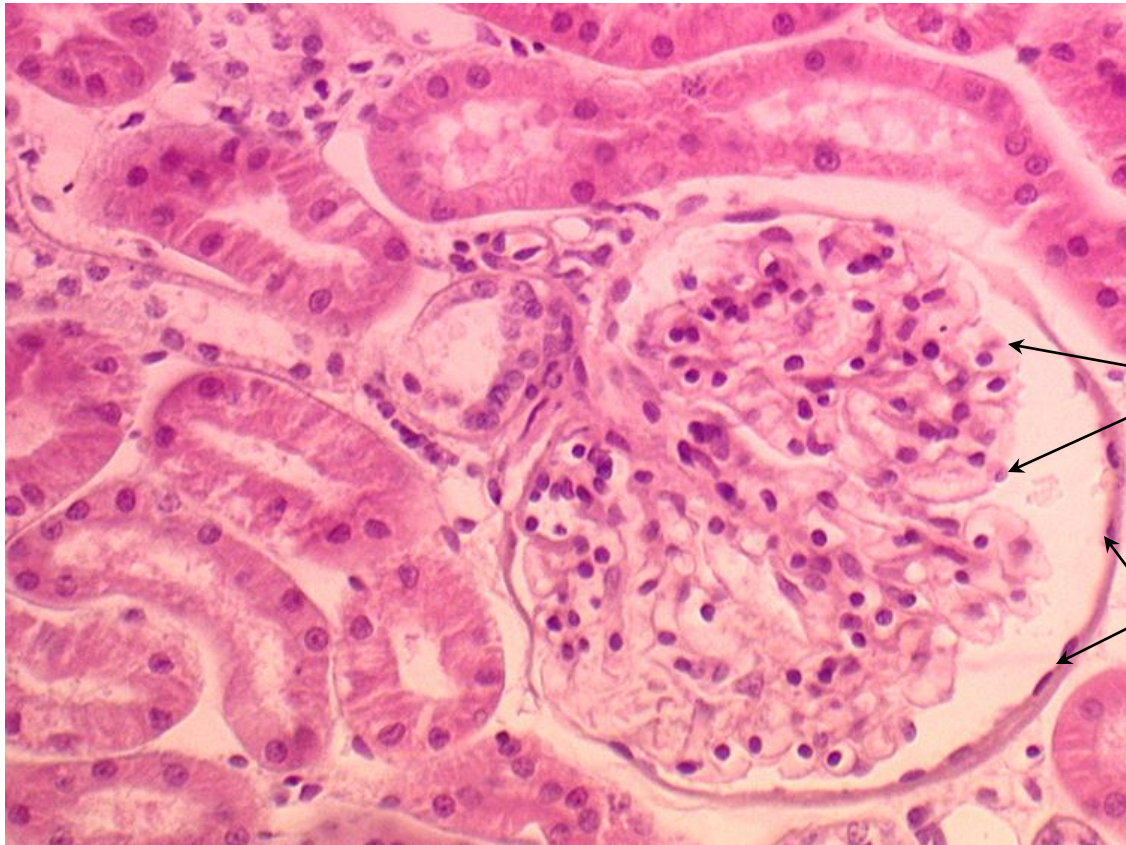
## Detailed Histology

What is the difference in parietal and visceral epithelia?

Together they form the glomerular capsule.

Visceral epithelium cells are called podocytes and they form the third component of the filtration barrier.

Parietal epithelium is a simple squamous layer.



visceral epithelium  
(podocytes)

parietal epithelium

50  $\mu$ m



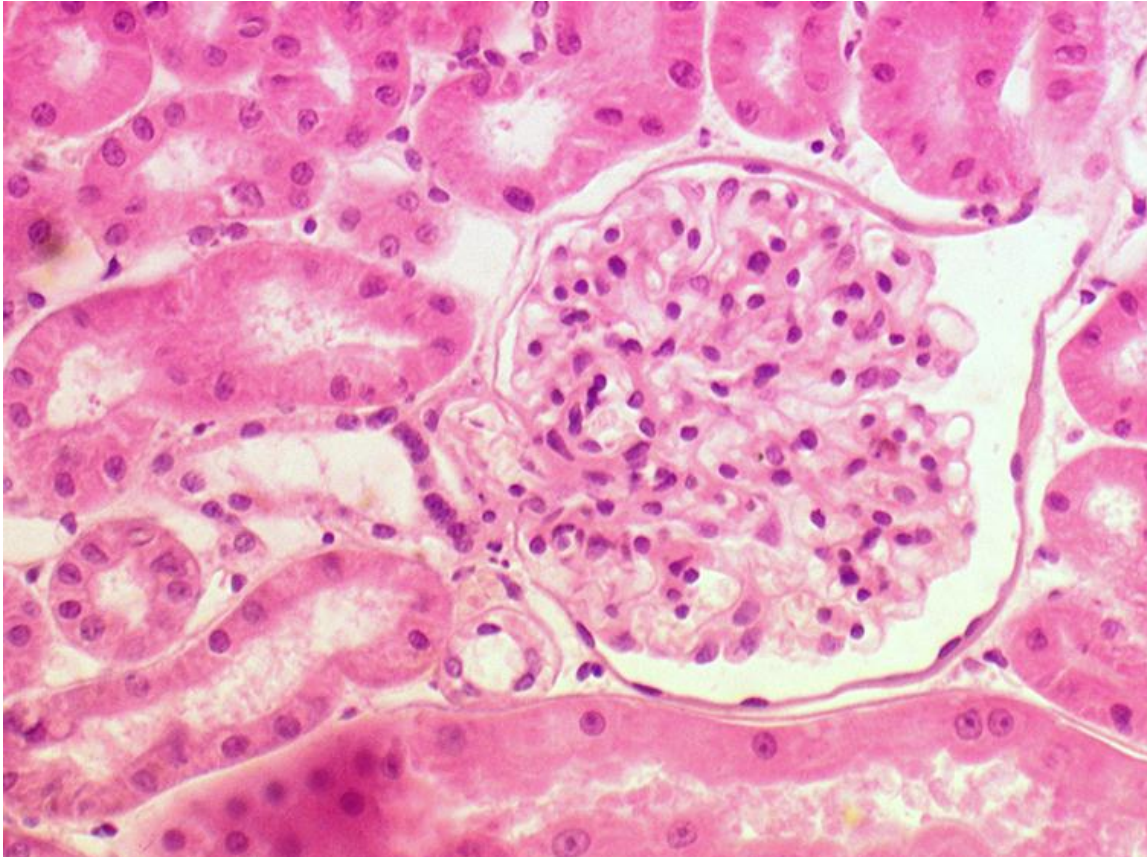
# Kidney

## Detailed Histology

What is the major function of the juxtaglomerular apparatus?

**Responds to various stimuli – decrease in blood pressure or a change in the Na and Cl ion concentrations in the distal tubule. Secretes renin.**

Look for elements of this in the illustration.



50  $\mu$ m

# Kidney

## Detailed Histology

Where would you expect to find juxtaglomerular cells?

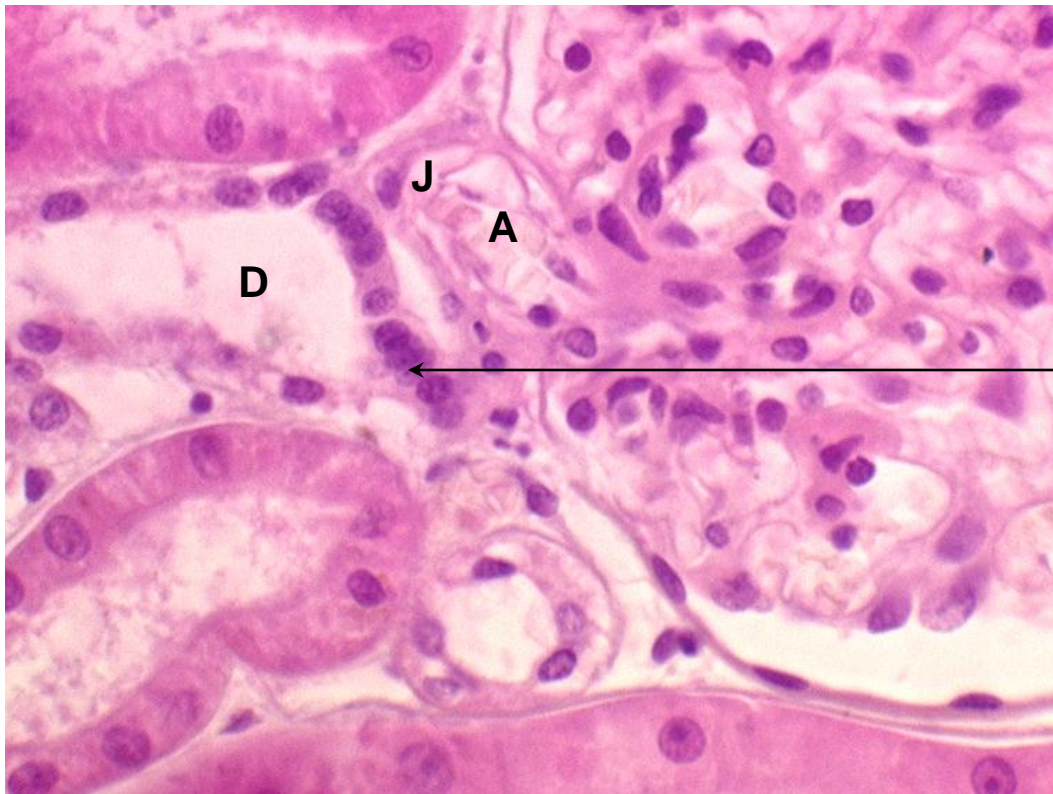
**They are modified smooth muscle cells in the wall of the afferent arteriole.**

Where would you find the macula densa?

**In the distal tubule.**

How would you histologically identify them?

**Taller epithelial cells, tightly packed prominent nuclei.**



A : afferent arteriole

D : distal tubule

J : juxtaglomerular cells

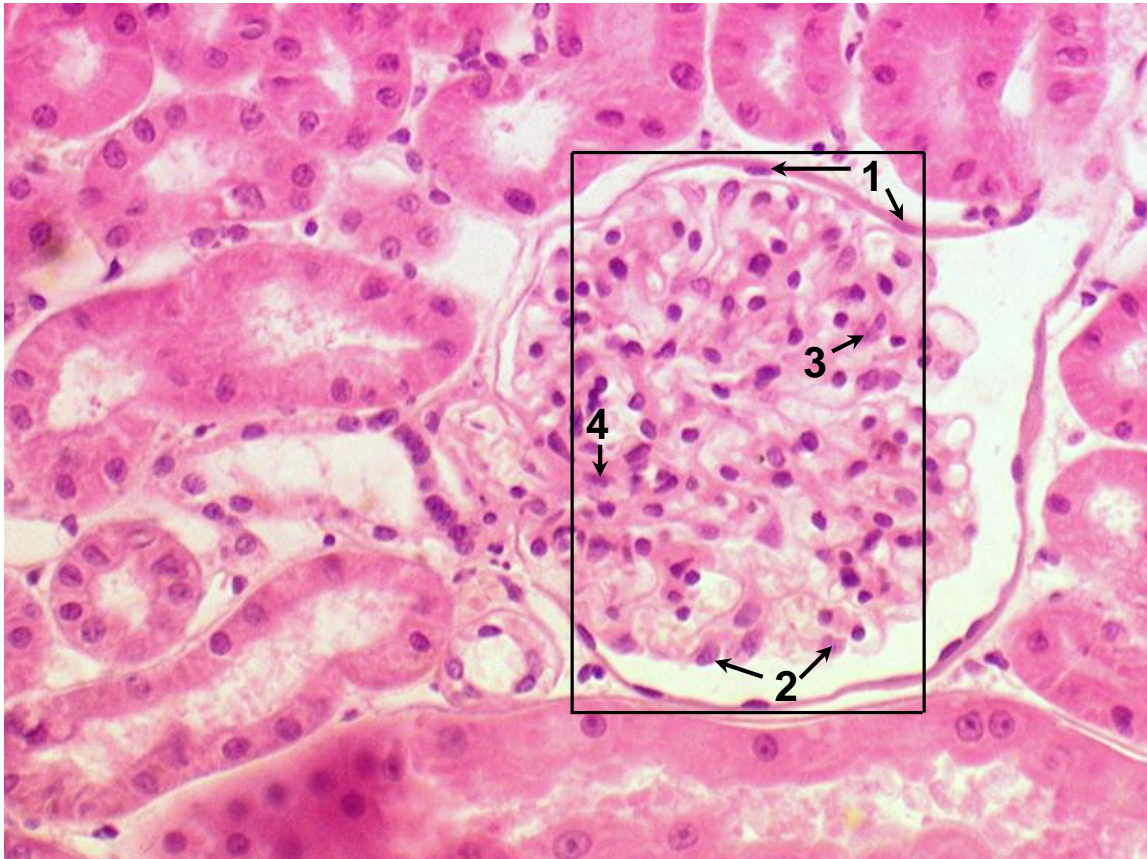
macula densa

25 μm

# Kidney

## Detailed Histology

What four cell types are represented by the nuclei in the glomerular area of the illustration?



- 1 : parietal cells
- 2 : podocytes
- 3 : endothelial cells
- 4 : mesangial cells

50  $\mu$ m

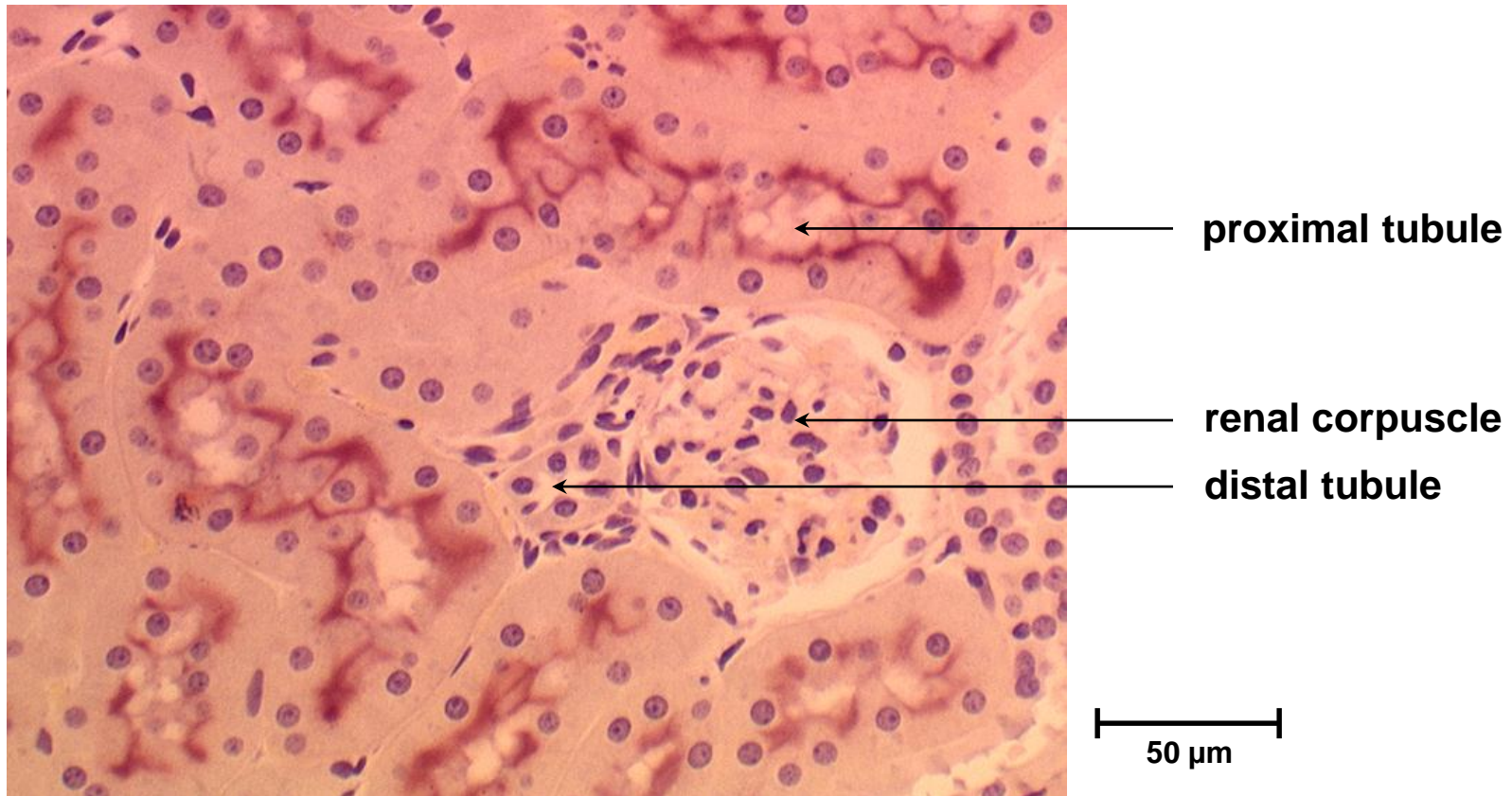
# Kidney

Alkaline phosphatase stain

## Convoluted Tubules

In slide 95 the presence of the alkaline phosphatase is indicated by a brown stain in both proximal and distal convoluted tubules.

The proximal tubules make up the bulk of the renal cortex.



# Kidney

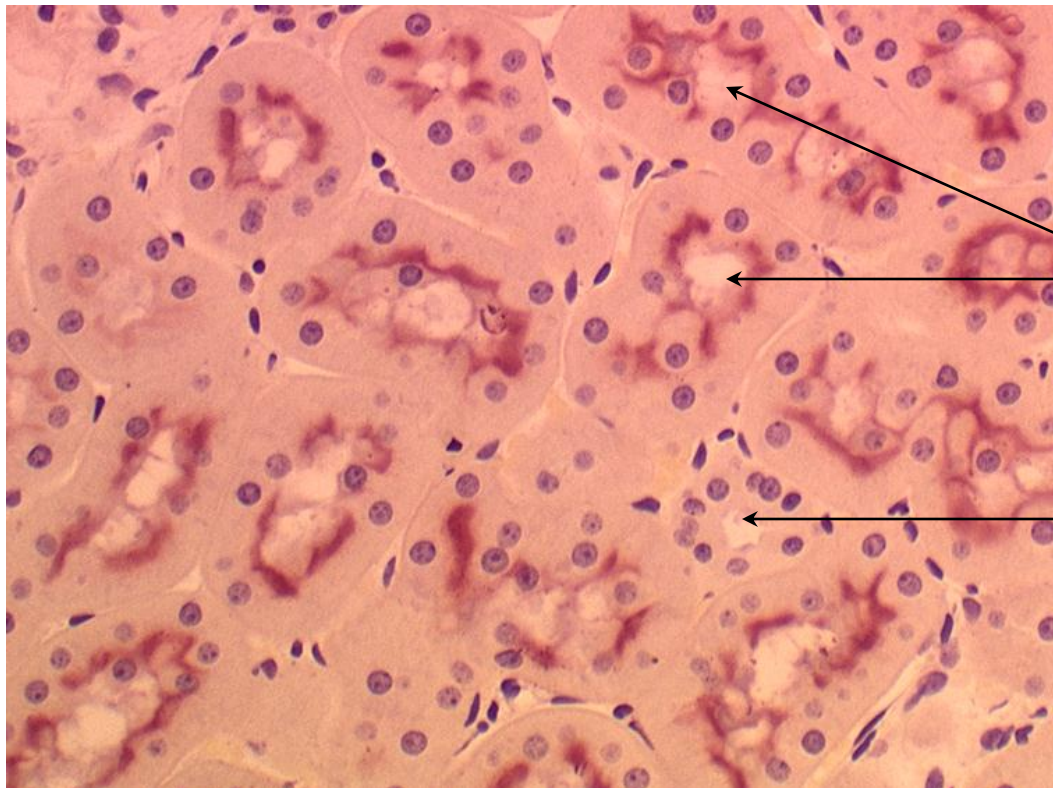
Alkaline phosphatase stain

## Convoluted Tubules

How would you distinguish between the cross sections of proximal and distal convoluted tubules?

**Proximal tubules : A deeper epithelium; brush border of microvilli staining with alkaline phosphatase.**

**Distal tubules : A lower epithelium, no brush border, stain not taken up.**



proximal tubules

distal tubule

50  $\mu$ m

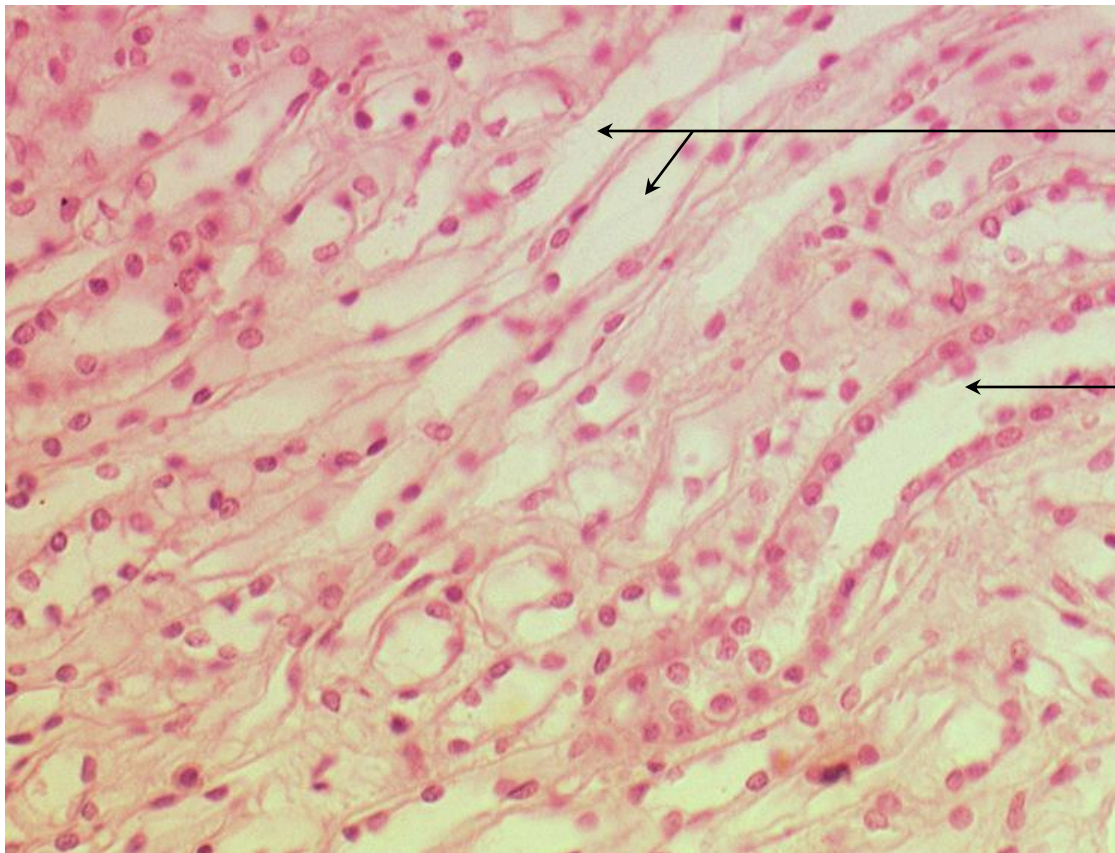
# Loop of Henle

Find these in medullary rays and in the superficial renal medulla.

Seen in longitudinal and transverse section.

How would you distinguish it from the collecting tubules and collecting ducts?

**The thin loop of Henle has flattened squamous-like cells with round bulging nuclei.**



← thin loops of Henle

← collecting duct

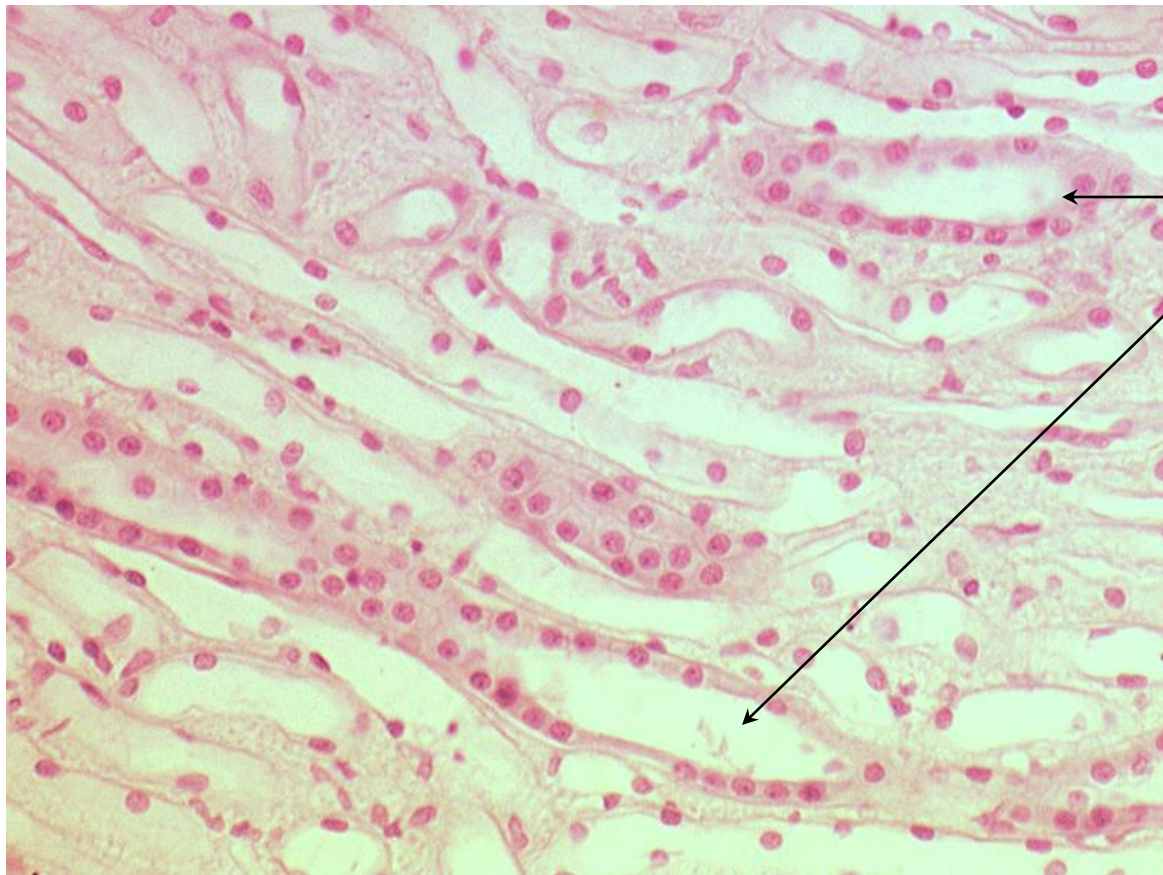
50 μm

# Collecting ducts

The deep medulla is made up mainly of collecting ducts.

Note their clearly defined cuboidal cells with pale staining cytoplasm.

Collecting ducts are larger in diameter than the convoluted tubules.



collecting ducts

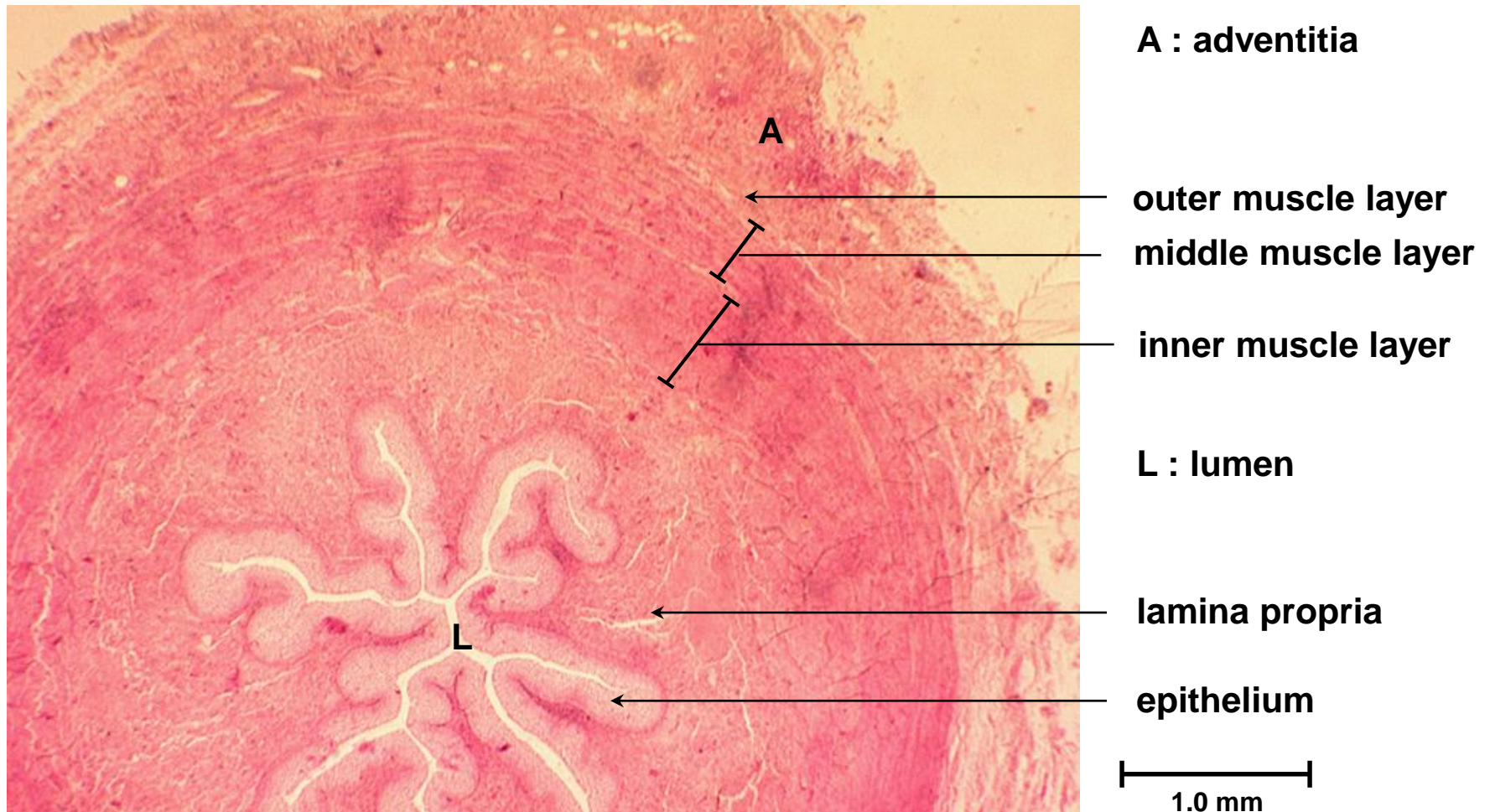
50  $\mu$ m

# **THE URINARY TRACT**



# Ureter

At low magnification observe and identify all the layers through the wall of the ureter.



# Ureter

What is the epithelium type?

**Transitional.**



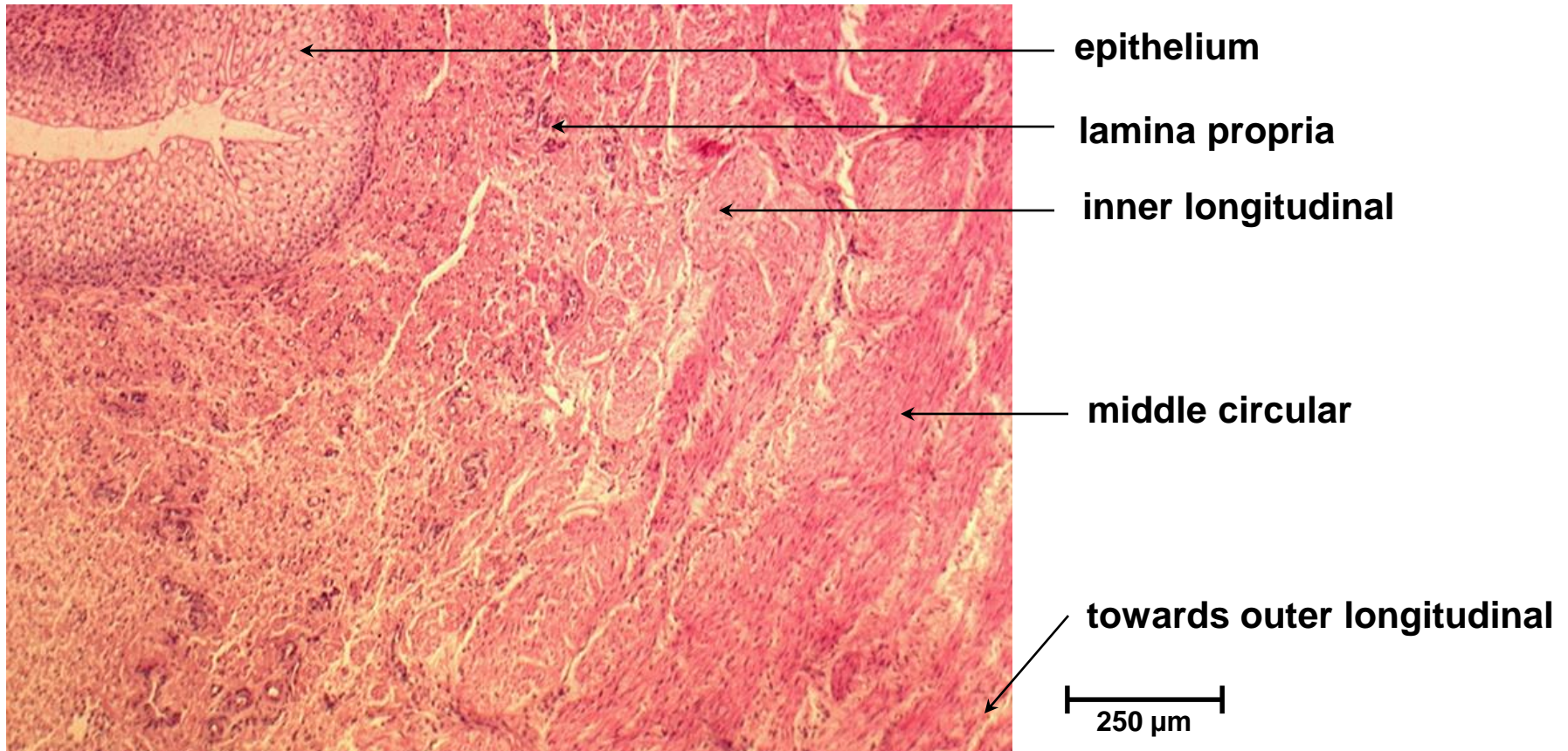
# Ureter

How many muscle layers do you see and what orientation do they have?

**Inner longitudinal, middle circular and outer longitudinal smooth muscle layers.**

Is the lamina muscularis present or absent?

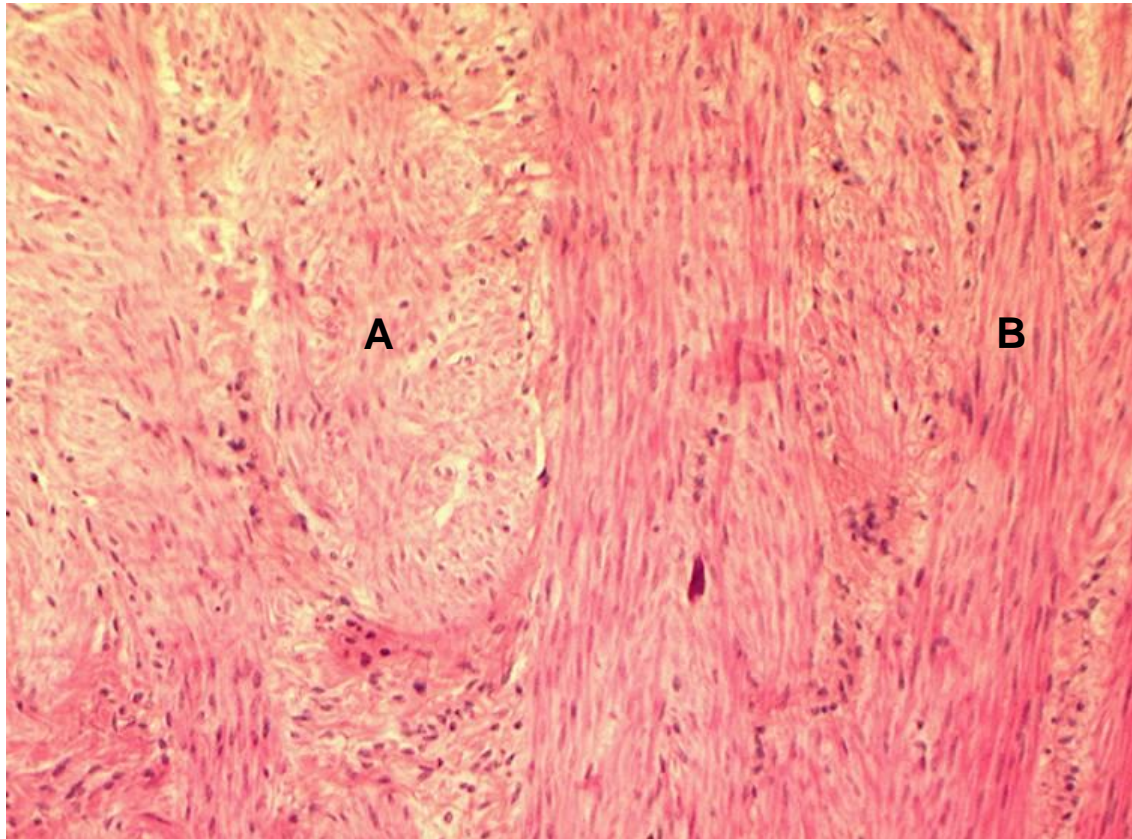
**Absent.**



# Ureter

How many muscle layers do you see and what orientation do they have?

**Inner longitudinal, middle circular and outer longitudinal smooth muscle layers.**



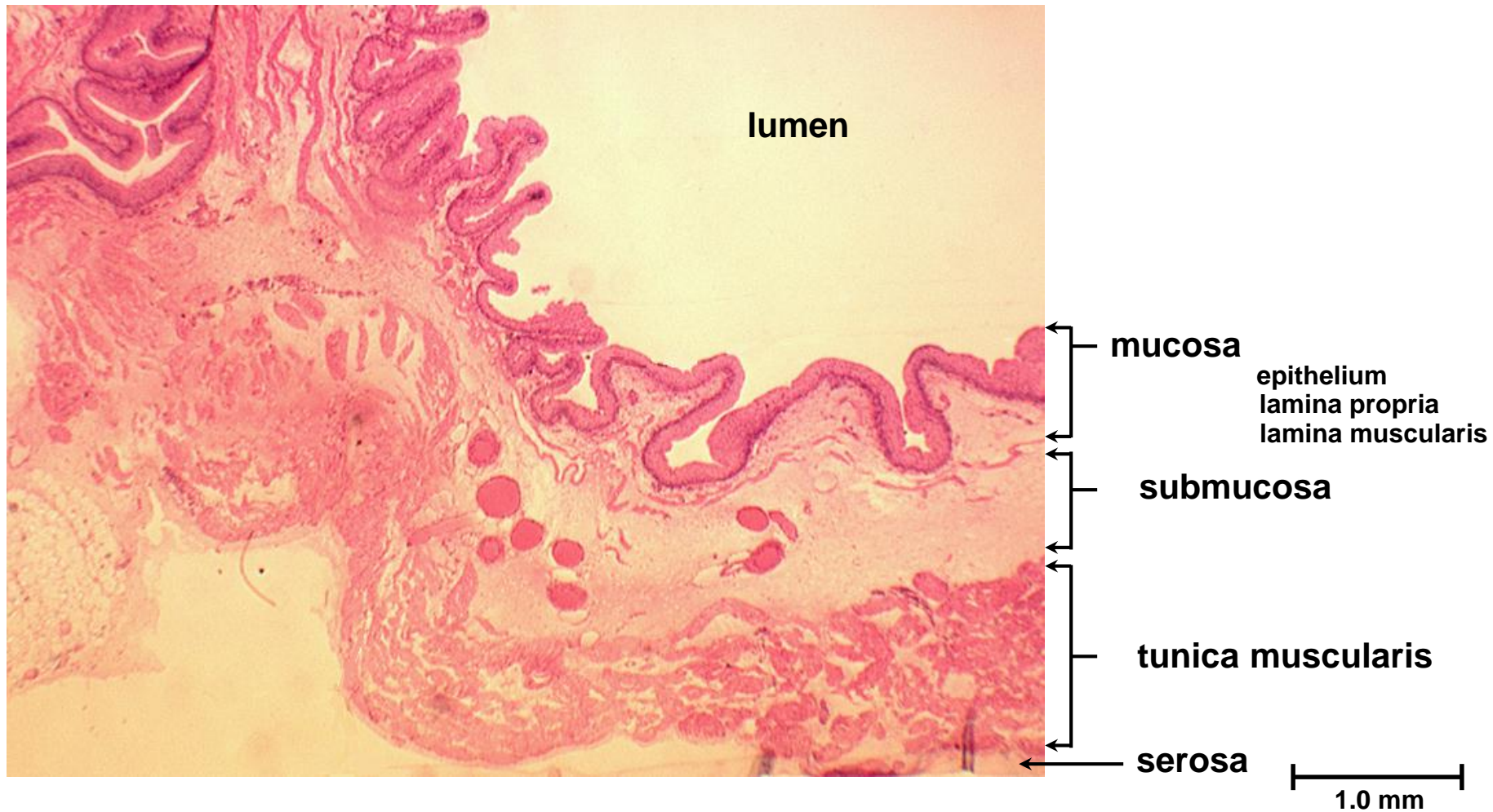
**A : inner longitudinal**

**B : middle circular**

100  $\mu$ m

# Bladder

Identify the main layers of the bladder wall



# Bladder

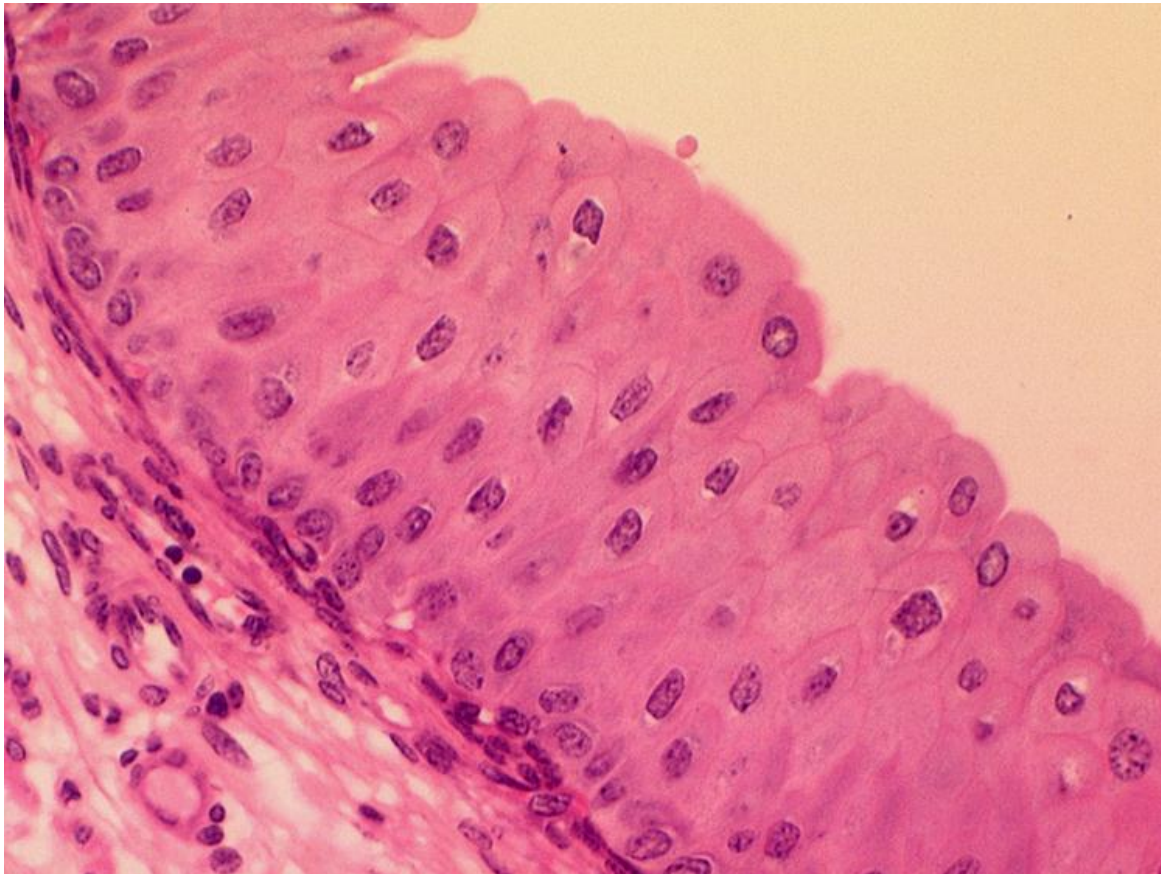
What is the epithelium type?

**Transitional.**

Why is this most appropriate for the bladder?

**Cells can change shape and position within the epithelium to allow for stretch.**

**This type of epithelium is impermeable to urine.**



50  $\mu$ m

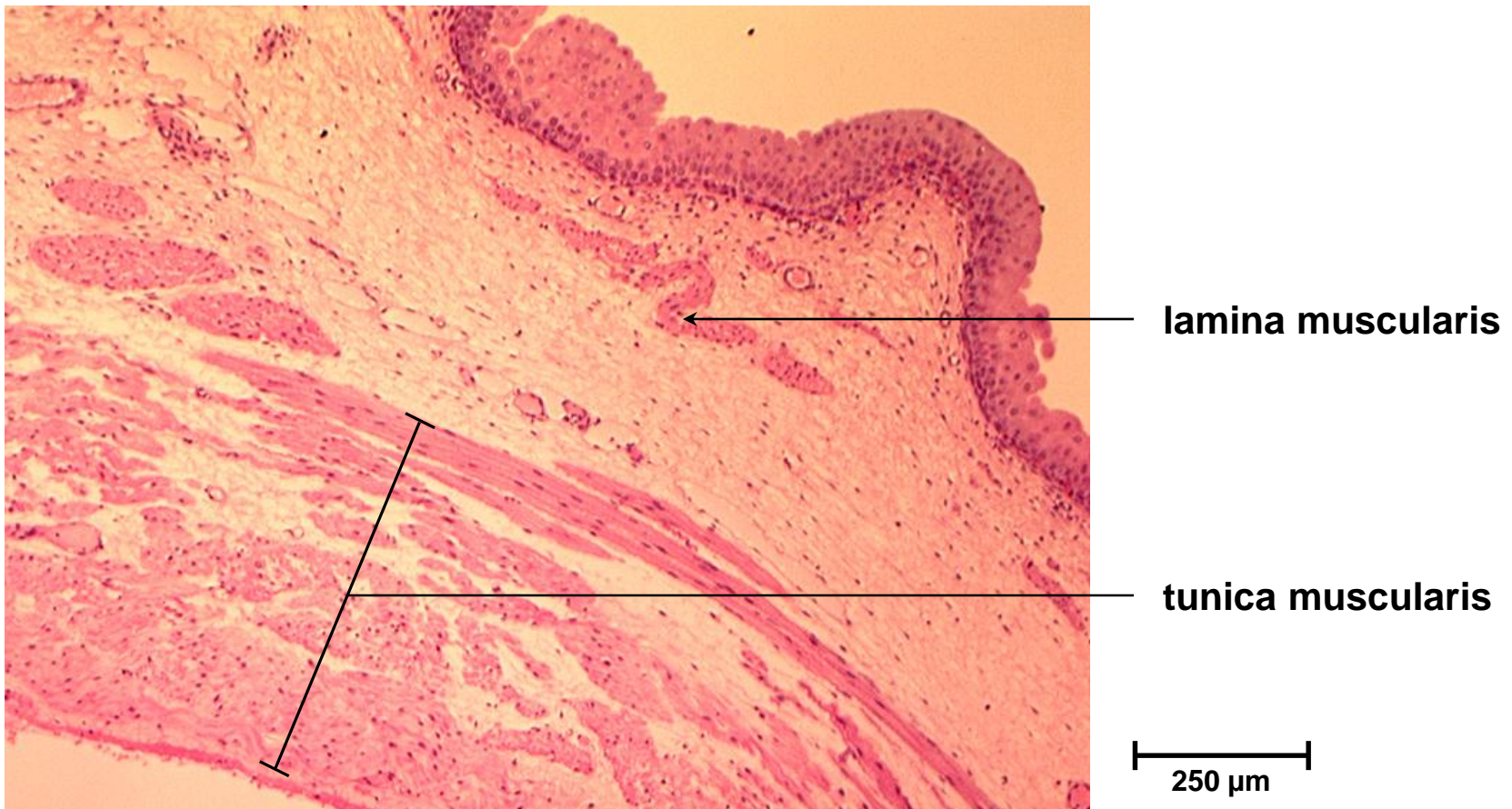
# Bladder

Identify the different muscle layers and their orientation.

Is the lamina muscularis present or absent?

**The tunica muscularis is formed of indistinct layers of smooth muscle.**

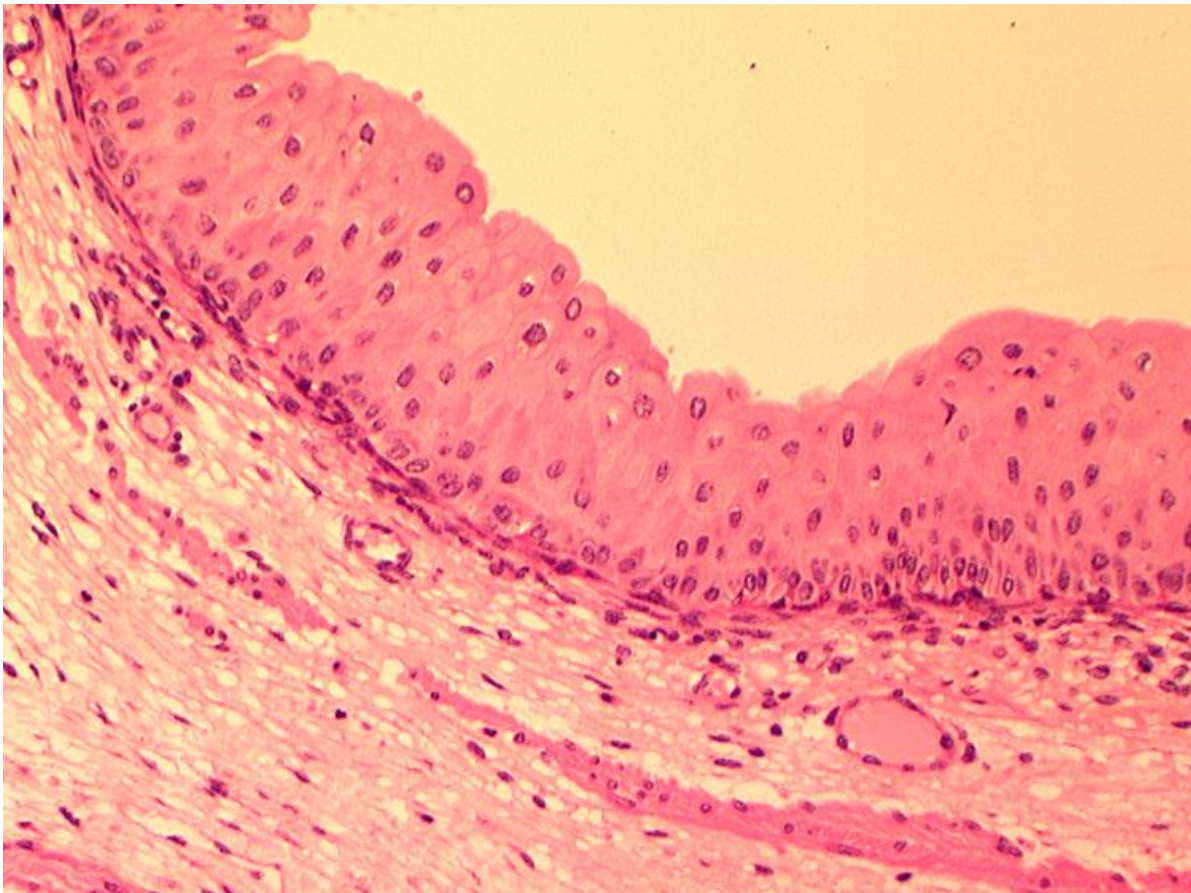
**A lamina muscularis is usually present, again with irregular bundles.**



# Bladder

What made you conclude that slides 92 and 93 represented the urinary system and not any part of the gastrointestinal tract?

**Transitional epithelium is the characteristic lining in the urinary system and is never found in the gastrointestinal tract.**



100  $\mu$ m