Renal System

(RRS-209)

(4th week/Lecture 40)

External collecting system

Prepared by

Dr. Marwa Hassan Bakr.

Department of Histology and Cell Biology

Faculty of Medicine

Assiut University

2021-2022

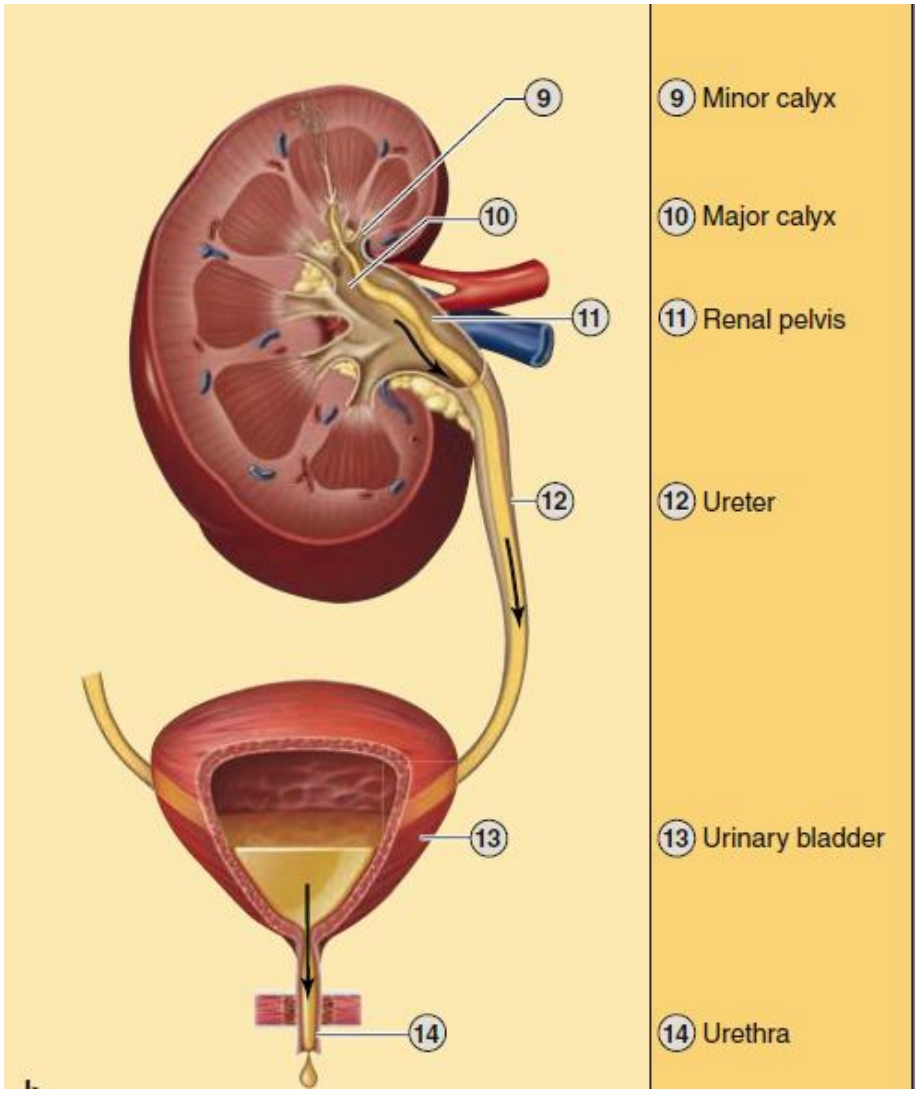
Learning objectives:

After this lecture, students should be able to:

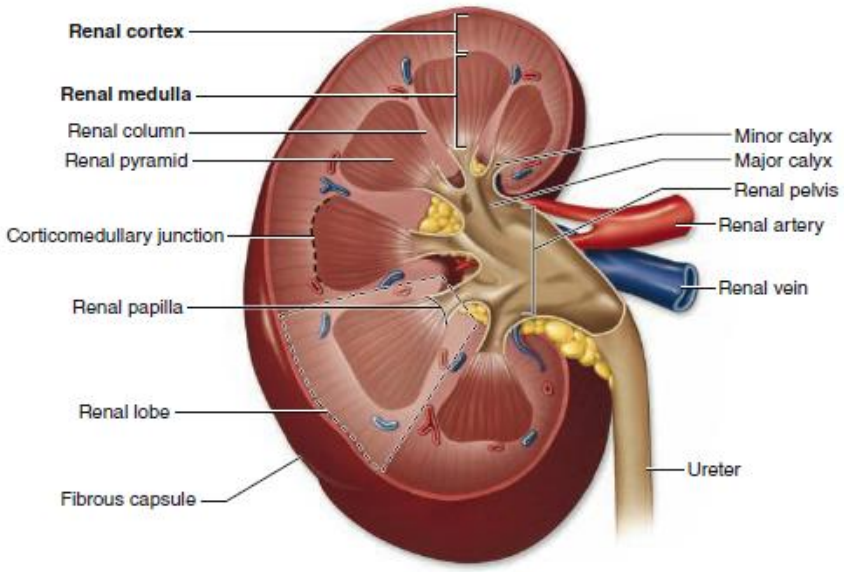
- Describe the histological structure of the minor calyces, the major calyces, the renal pelvis, the ureter, the bladder, and the urethra.
- Identify the transitional epithelium which is characteristic to all the urinary passages

❖ ***External collecting system:***

Urine is transported by the ureters from the renal pelvis to the urinary bladder, where it is stored until emptying by micturition via the urethra.



A. Renal calyces, renal pelvis, and ureter:



- Ureters are fibromuscular tubes that connect the kidneys to the urinary bladder in the pelvis
- The walls of the ureters are similar to that of the calyces and renal pelvis, with mucosal, muscular (muscularis externa), and adventitial layers.

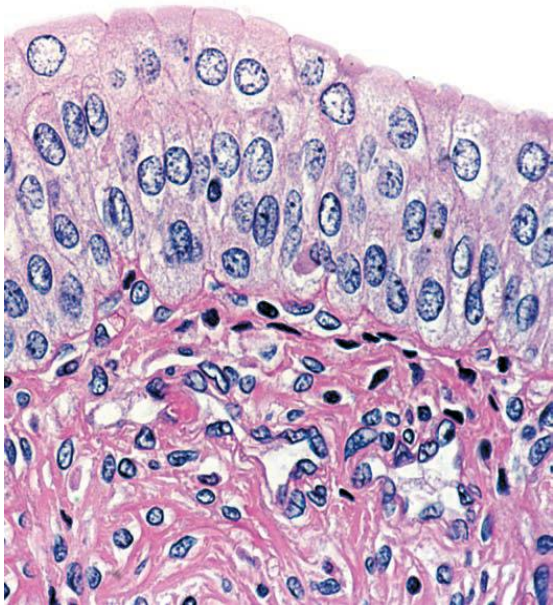
➢ ***Mucosa:***

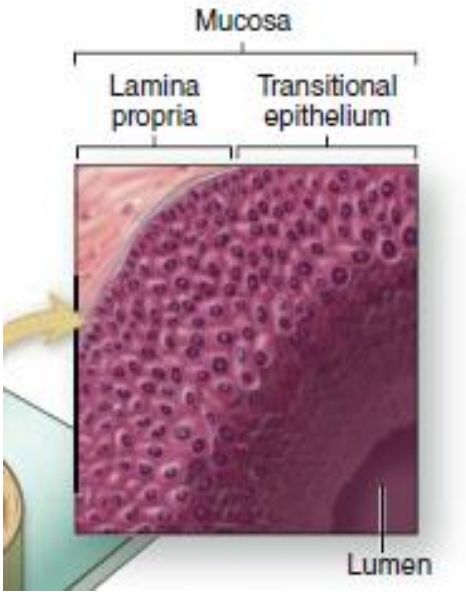
The mucosa of these organs is lined by **transitional epithelium (urothelium).**

Cells of this epithelium are organized into three layers:

- A single layer of small basal cells resting on a very thin basement membrane;
- An intermediate region containing from one to several layers of cuboidal cells; and

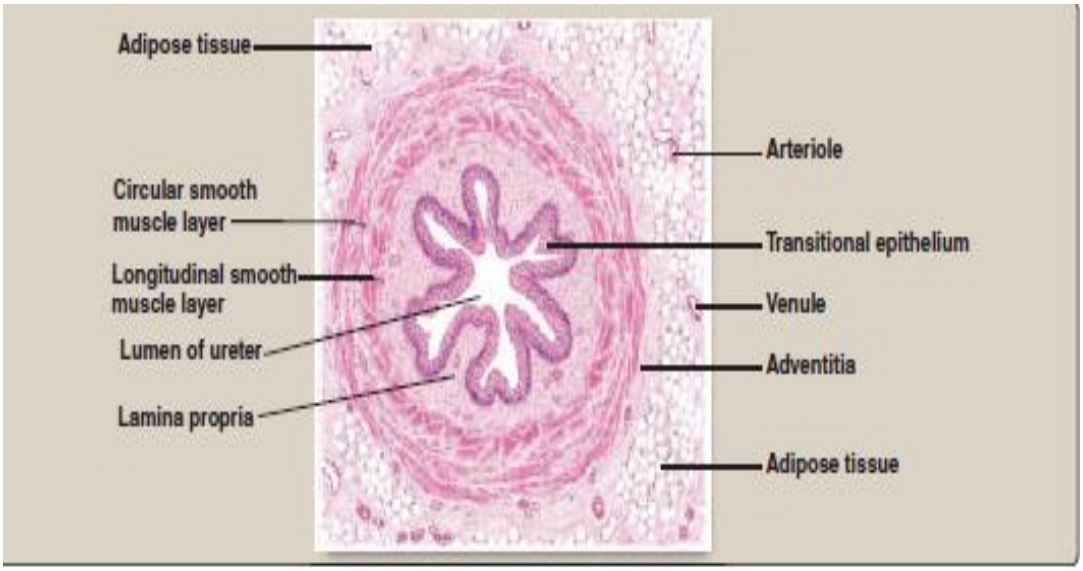
- A superficial layer of large bulbous or umbrella cells, sometimes binucleated, which are highly differentiated to protect the underlying cells against the potential cytotoxic effects of hypertonic urine.





- ***<u>Muscularis Externa:</u>***
  - The muscular layer of the calyces, pelvis, and ureters is composed of two layers of smooth muscle arranged mainly into an inner longitudinal and outer circular one.
  - A third longitudinal layer is present in the lower third of the ureter.
  - The thick muscularis of the ureters moves urine toward the bladder by peristaltic contractions.
- ***<u>Adventitia:</u>***

  Loose C.T commonly contains abundant adipocytes.



B. Urinary bladder

Similar cell layers are found in both the urinary bladder and the ureter.

The wall of the urinary bladder is composed of the following layers:

- ***Mucosa:***

The urinary bladder is lined by a **transitional epithelium** with a morphology that differs in the relaxed (empty) and distended states.

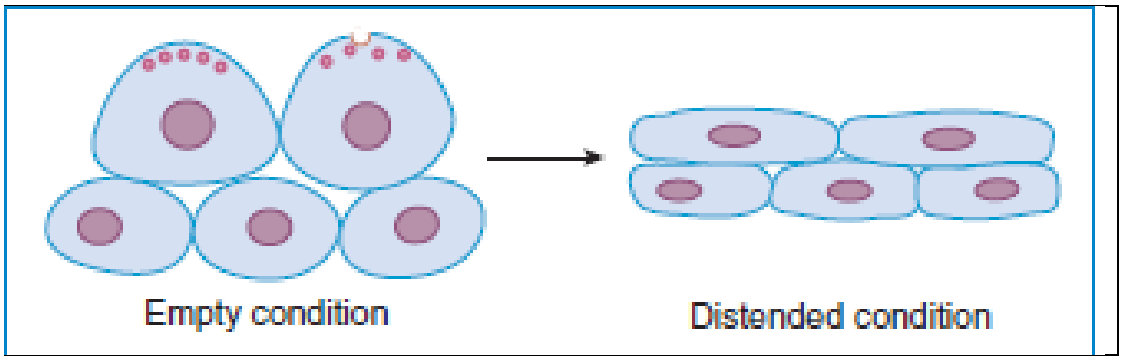
1. ***Epithelium of the relaxed bladder*** is five to six cell layers thick and has rounded superficial dome-shaped cells that bulge into the lumen. These cells contain unique **plaques** in their thick luminal plasma membrane and flattened elliptical vesicles in their cytoplasm.

2. Epithelium of the distended bladder

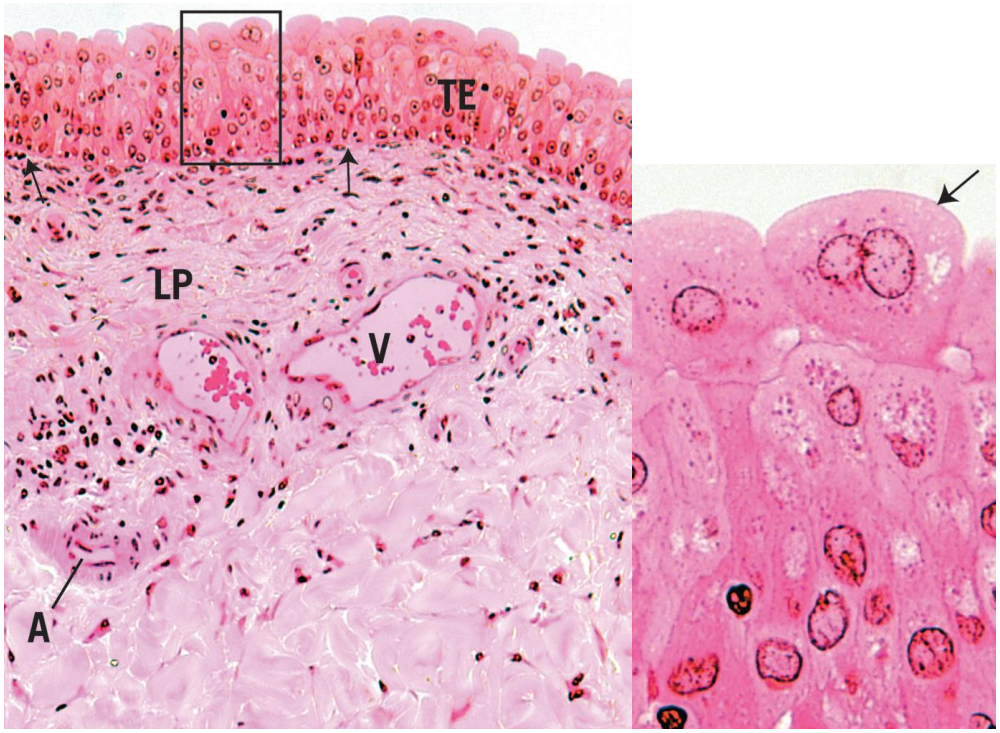
a. The epithelium of the distended bladder is only three to four cell layers thick.

b. It has superficial squamous cells.

c. It is much thinner and has a larger luminal surface than the relaxed bladder; this results from the insertion of the elliptical vesicles into the luminal plasma membrane of the surface cells.

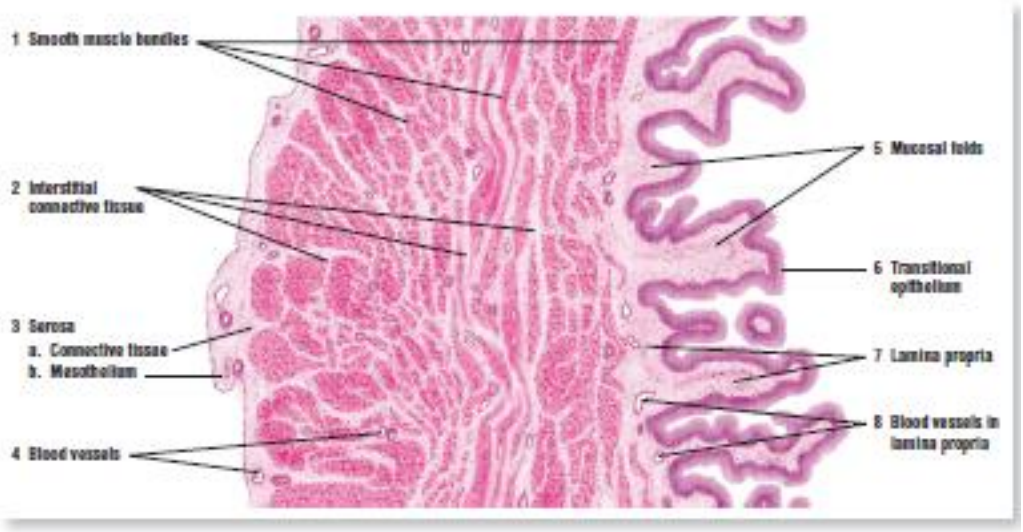


The lamina propria is formed of a dense layer of connective tissue containing capillaries.



- ***Muscularis Externa:***

  Three layers of smooth muscle are oriented in various directions and constitute the outer wall of the bladder, collectively called the **detrusor muscle,** which contracts to empty the bladder



- ***Adventitia:***

  All the urinary passages are covered externally by an adventitial layer, except for the upper part of the bladder that is covered by the serous peritoneum.

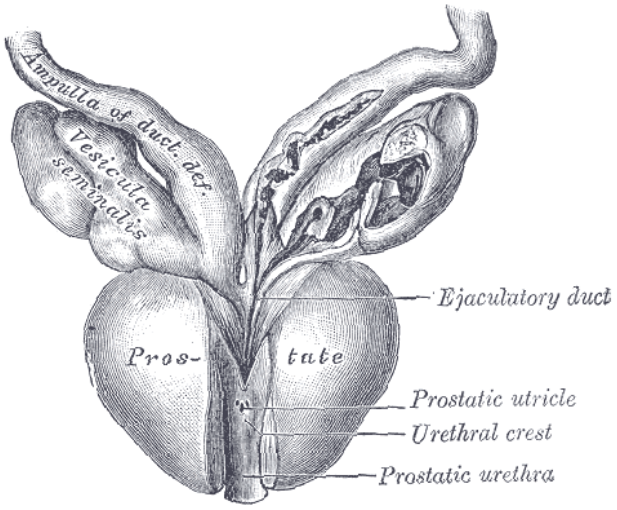
C. Urethra

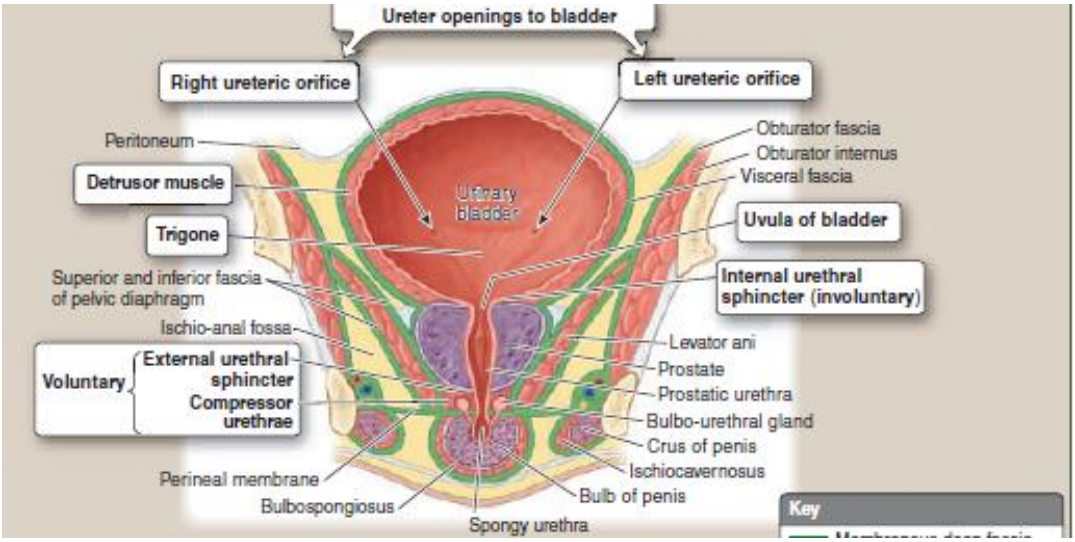
The urethra is a muscular tube that carries urine from the bladder to the exterior of the body. In males, it passes through the prostate gland and penis.

The **prostatic urethra** is lined by *transitional epithelium,* but the **penile urethra** acquires a *pseudostratified columnar epithelium*.

In **females**, the shorter urethra is mainly lined by *transitional epithelium.*

In both males and females., the **terminal** portions of the urethra acquire a *stratified squamous epithelium* similar to that of skin.





References:

- Lippincott Illustrated Reviews: Integrated Systems (2015).
- Elsevier's Integrated Histology (2007) 1st Edition.
- Kaplan medical .USMLE Step 1 Lecture Notes 2021;anatomy; Abdomen, Pelvis, and Perineum, chapter 3.page 137.

Self-assessment

Choose the correct answer:

1. Transitional epithelium is present in each of the following EXCEPT:

a) Collecting tubules

b) Minor calyces

c) Major calyces

d) The pelvis of the kidney

e) Urinary bladder

2. What type of epithelium lines the prostatic urethra?

a) Simple columnar

b) Pseudostratified columnar

c) Stratified squamous

d) Simple squamous

e) Transitional (urothelium)