



ST. CATHERINE  
UNIVERSITY

# Urinary System

# Kidney

- Functions
  - Excretion
  - Regulation of blood volume and pressure
  - Regulation of electrolyte and pH levels

# Kidney Structure

## □ Gross Anatomy

### ■ Fibrous Capsule

### ■ Renal Cortex

#### ■ Renal Columns

### ■ Renal Medulla

#### ■ Renal Pyramids

### ■ Renal Pelvis

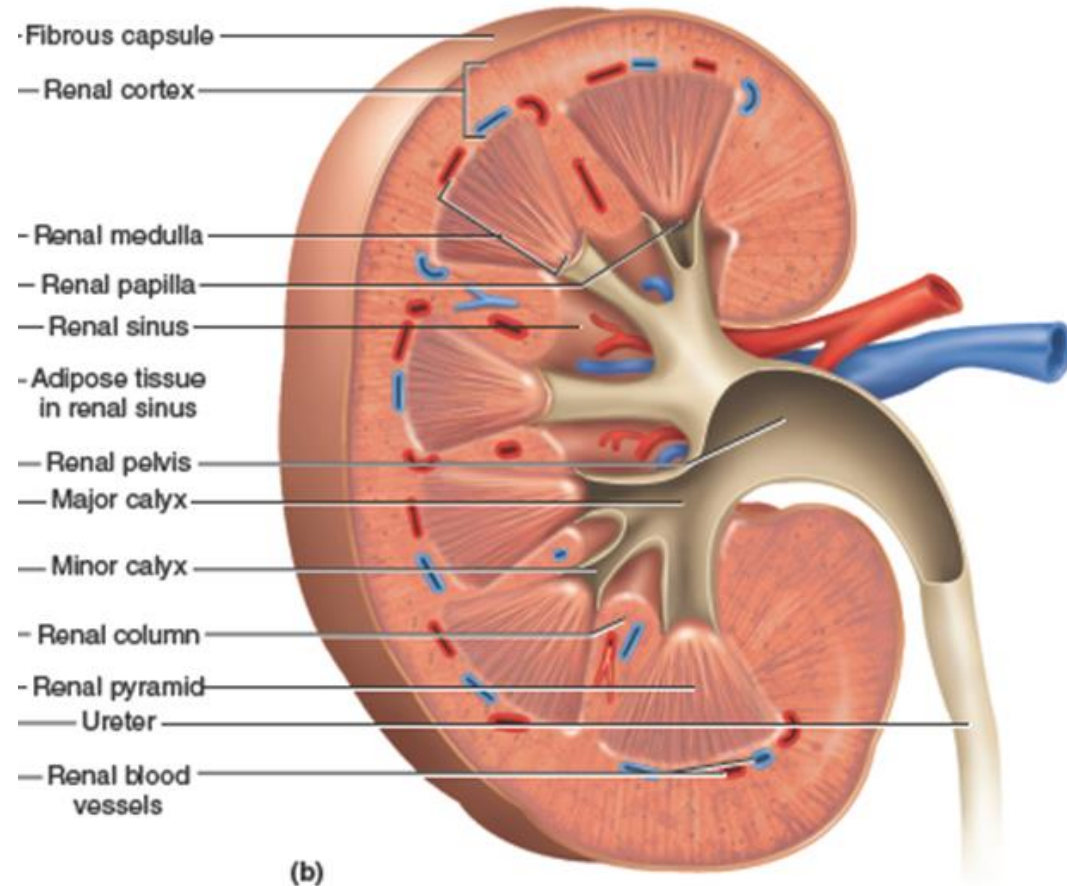
#### ■ Minor Calyx

#### ■ Major Calyx

### ■ Renal Hilum

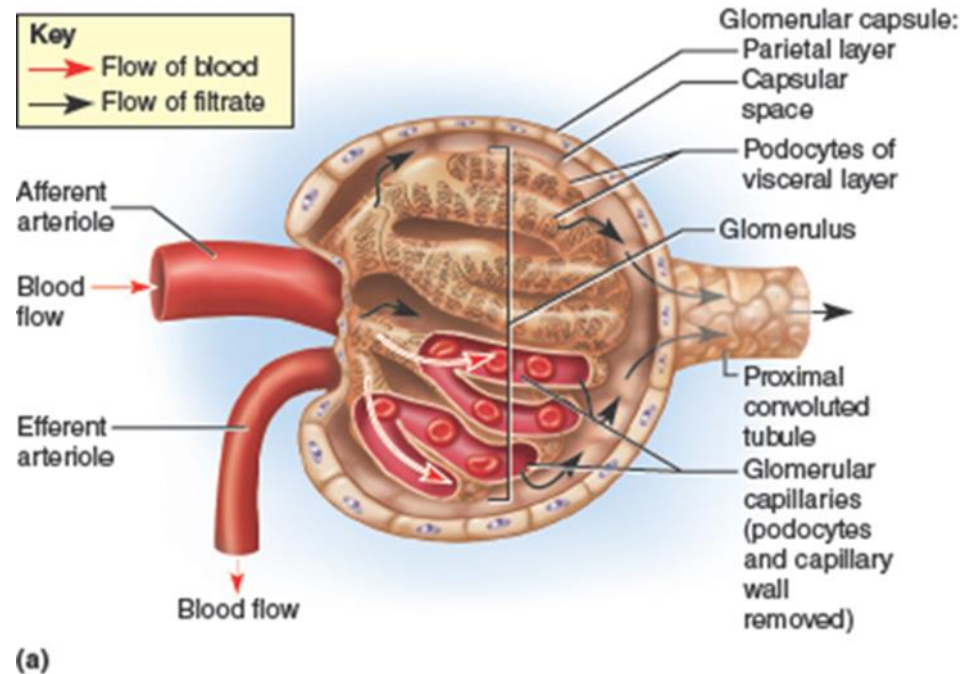
#### ■ Renal Artery and Vein

#### ■ Ureter



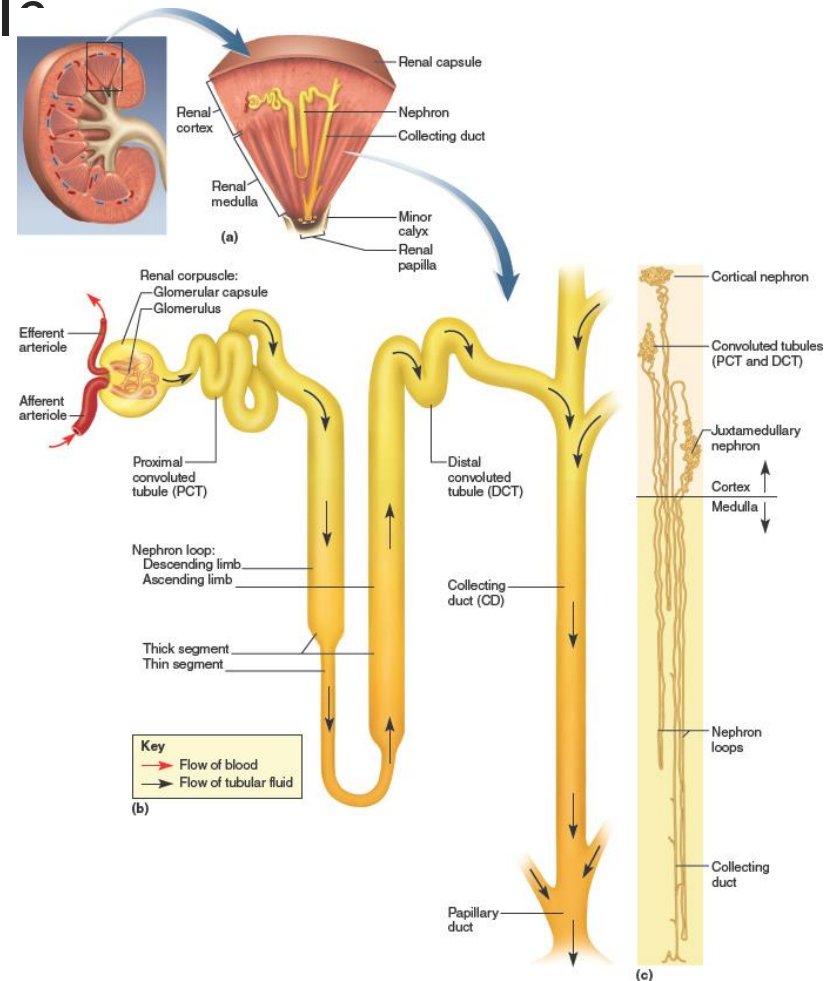
# Structure Cont'd – Microscopic

- Nephron
- Renal Corpuscle
  - Glomerulus
  - Afferent arterioles
  - Efferent arterioles
  - Glomerular Capsule
- Found in Cortex
- Produce Glomerular Filtrate



# Structure Cont'd – Tubules

- Proximal Convoluted Tubule
- Nephron Loop
  - Descending
  - Ascending
- Distal Convoluted Tubule
- Peritubular Capillaries
- Collecting Duct



# Formation of Urine

- Filtration
  - Glomerular filtrate
  - Filtration Membrane
    - Fenestrated endothelium of capillary
    - Filtration slits in capsule
    - Basement membrane
  - What gets filtered out?
    - Water, electrolytes, glucose, fatty acids, amino acids, nitrogenous wastes, and vitamins
  - Glomerular Filtration Rate

# Structure of Glomerulus

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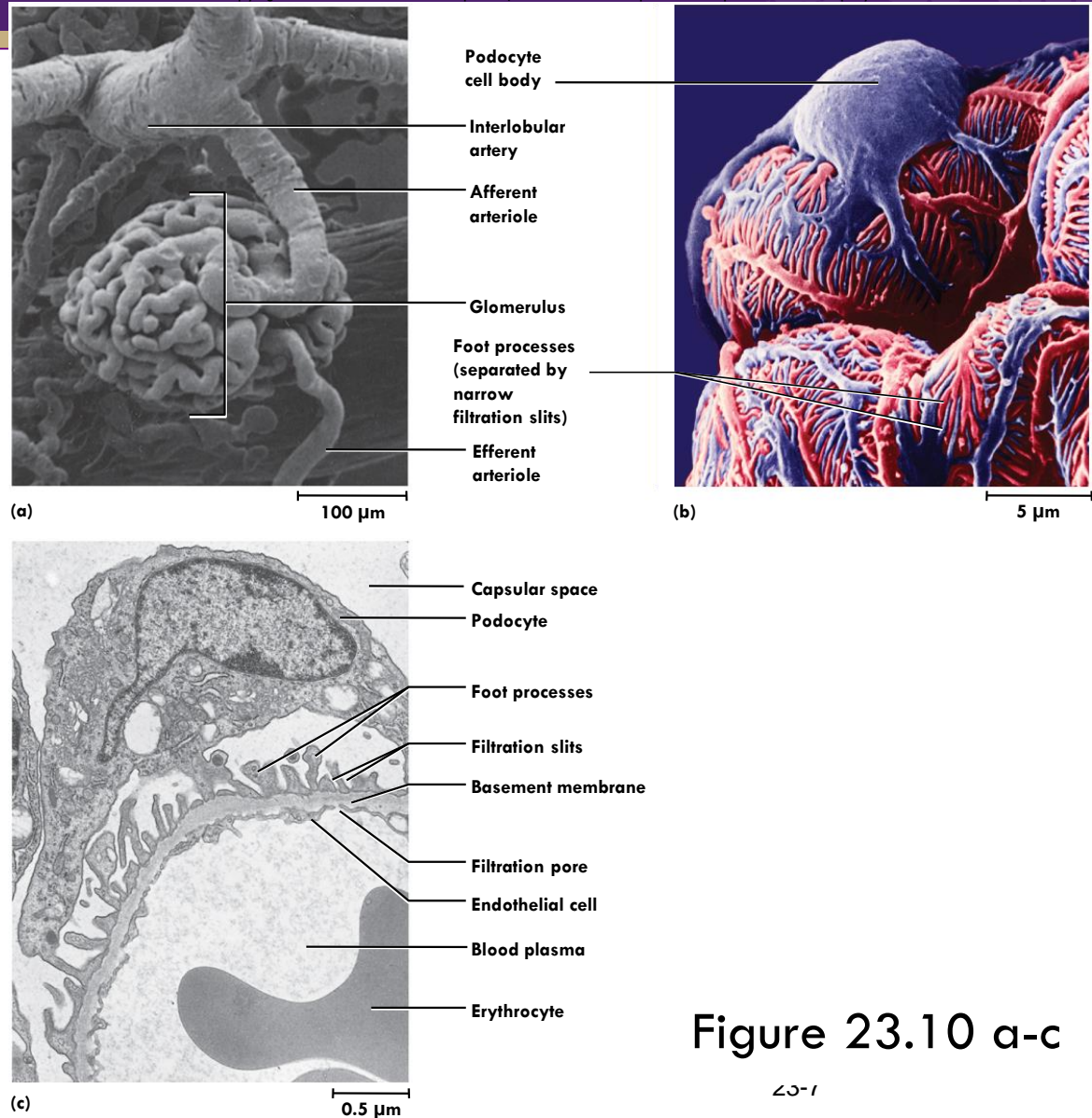


Figure 23.10 a-c

L33-1

# Filtration Pores and Slits

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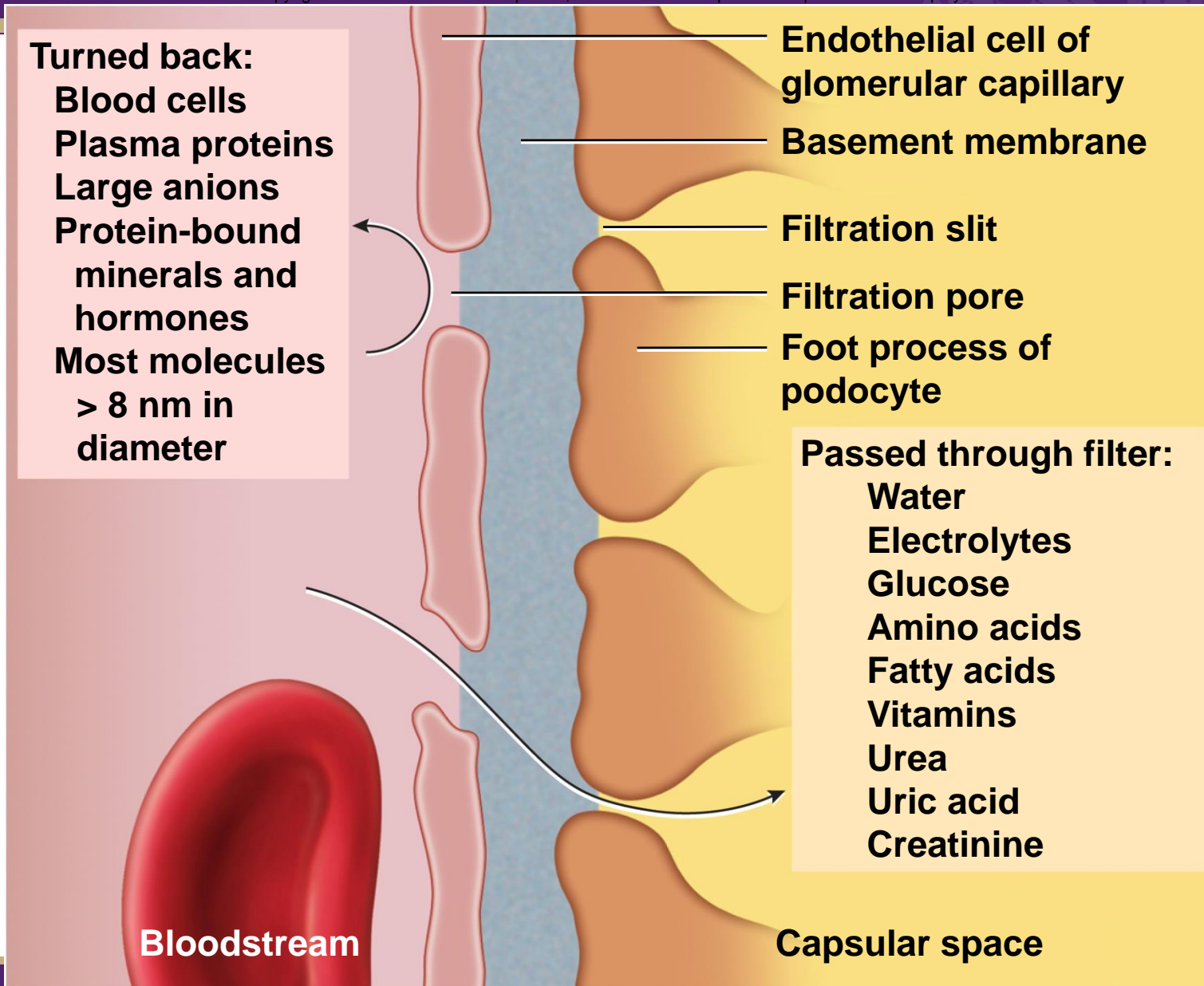


Figure 23.11



# Formation of Urine Cont'd

- Tubular Reabsorption
  - STILL FILTRATE NOT YET URINE!!!!!!!!!!!!
  - PCT reabsorbs the majority of the glomerular filtrate
  - The nephron loop and DCT work to absorb more water
- Tubular Secretion
  - Extracts chemicals from blood and secretes them into filtrate
- Water Conservation



# ADDITIONAL STRUCTURES

# Ureters

- Anatomy
  - Mucosa
  - Muscle Layer
  - Adventitia
- Function
  - Transportation of Urine

# Urinary Bladder

- Anatomy
  - Mucosa
    - Transitional Epithelium
    - Rugae
  - Muscle Layer
    - Detrusor Muscle
  - Adventitia and Parietal Peritonium
  - Trigone
  - Function
    - Holds Urine
    - Micturition reflex

# Neural Control of Micturition

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## Involuntary micturition reflex

- 1 Stretch receptors detect filling of bladder, transmit afferent signals to spinal cord.
- 2 Signals return to bladder from spinal cord segments S2 and S3 via parasympathetic fibers in pelvic nerve.
- 3 Efferent signals excite detrusor muscle.
- 4 Efferent signals relax internal urethral sphincter. Urine is involuntarily voided if not inhibited by brain.

## Voluntary control

- 5 For voluntary control, micturition center in pons receives signals from stretch receptors.
- 6 If it is timely to urinate, pons returns signals to spinal interneurons that excite detrusor and relax internal urethral sphincter. Urine is voided.
- 7 If it is untimely to urinate, signals from pons excite spinal interneurons that keep external urethral sphincter contracted. Urine is retained in bladder.
- 8 If it is timely to urinate, signals from pons cease and external urethral sphincter relaxes. Urine is voided.

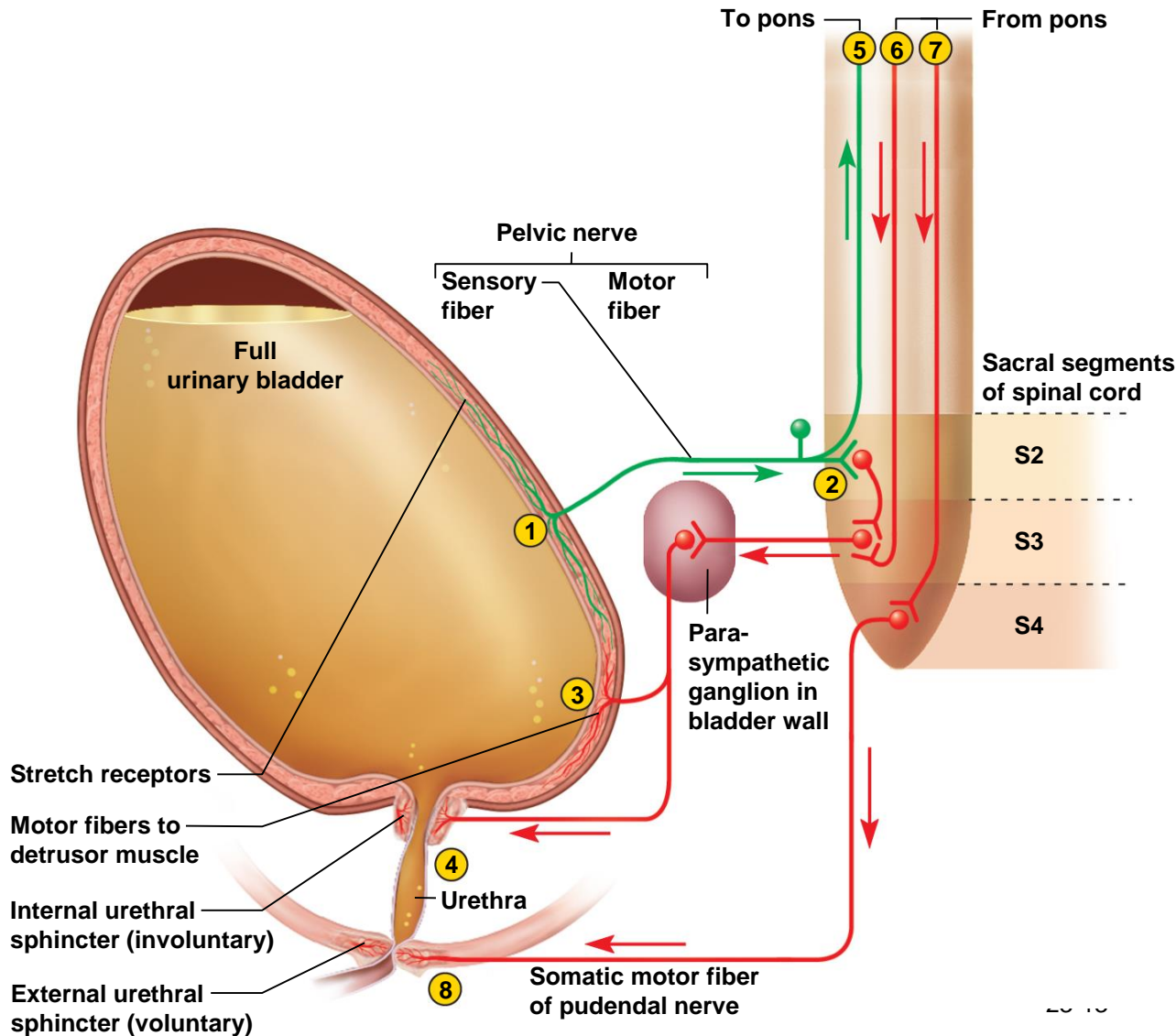


Figure 23.24

# Urethra

- Conveys urine out of the body
- External Urethral Orifice
- Internal and external urethral sphincters