

15 PART A

The Urinary System

PowerPoint® Lecture Slide Presentation by Jerry L. Cook, Sam Houston University



**ESSENTIALS
OF HUMAN
ANATOMY
& PHYSIOLOGY**
EIGHTH EDITION

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Functions of the Urinary System

- Elimination of waste products
 - Nitrogenous wastes
 - Toxins
 - Drugs

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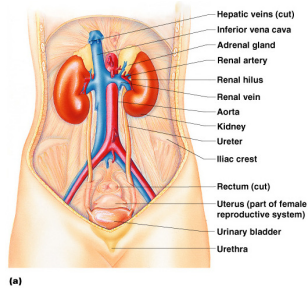
Functions of the Urinary System

- Regulate aspects of homeostasis
 - Water balance
 - Electrolytes
 - Acid-base balance in the blood
 - Blood pressure
 - Red blood cell production
 - Activation of vitamin D

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Organs of the Urinary system

- Kidneys
- Ureters
- Urinary bladder
- Urethra



(a)

Figure 15.1a

Location of the Kidneys

- Against the dorsal body wall
- At the level of T₁₂ to L₃
- The right kidney is slightly lower than the left
- Attached to ureters, renal blood vessels, and nerves at renal hilus
- Atop each kidney is an adrenal gland

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Coverings of the Kidneys

- Renal capsule
 - Surrounds each kidney
- Adipose capsule
 - Surrounds the kidney
 - Provides protection to the kidney
 - Helps keep the kidney in its correct location

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Regions of the Kidney

- Renal cortex – outer region
- Renal medulla – inside the cortex
- Renal pelvis – inner collecting tube

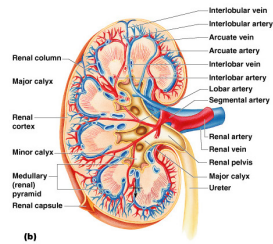


Figure 15.2b

Kidney Structures

- Medullary pyramids – triangular regions of tissue in the medulla
- Renal columns – extensions of cortex-like material inward
- Calyces – cup-shaped structures that funnel urine towards the renal pelvis

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Blood Flow in the Kidneys

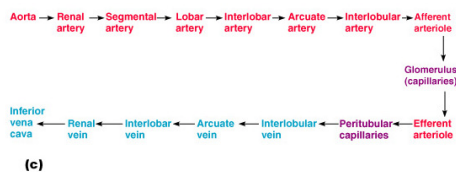


Figure 15.2c

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Nephrons

- The structural and functional units of the kidneys
- Responsible for forming urine
- Main structures of the nephrons
 - Glomerulus
 - Renal tubule

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Glomerulus

- A specialized capillary bed
- Attached to arterioles on both sides (maintains high pressure)
 - Large afferent arteriole
 - Narrow efferent arteriole

(c)

Figure 15.3c

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Glomerulus

- Capillaries are covered with podocytes from the renal tubule
- The glomerulus sits within a glomerular capsule (the first part of the renal tubule)

(c)

Figure 15.3c

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Renal Tubule

- Glomerular (Bowman's) capsule
- Proximal convoluted tubule
- Loop of Henle
- Distal convoluted tubule

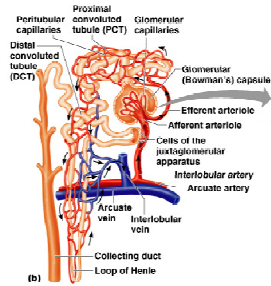


Figure 15.3b

Types of Nephrons

- Cortical nephrons
 - Located entirely in the cortex
 - Includes most nephrons

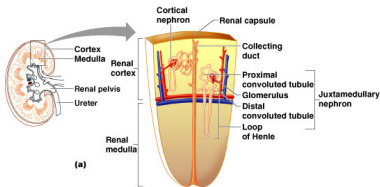


Figure 15.3a

Types of Nephrons

- Juxtamedullary nephrons
 - Found at the boundary of the cortex and medulla

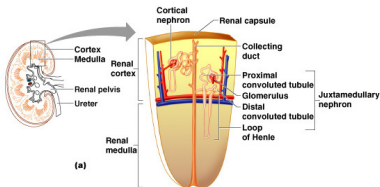


Figure 15.3a

Peritubular Capillaries

- Arise from efferent arteriole of the glomerulus
- Normal, low pressure capillaries
- Attached to a venule
- Cling close to the renal tubule
- Reabsorb (reclaim) some substances from collecting tubes

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Urine Formation Processes

- Filtration
- Reabsorption
- Secretion

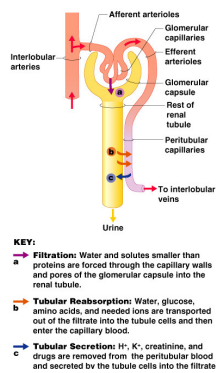


Figure 15.4

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Filtration

- Nonselective passive process
- Water and solutes smaller than proteins are forced through capillary walls
- Blood cells cannot pass out to the capillaries
- Filtrate is collected in the glomerular capsule and leaves via the renal tubule

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Reabsorption

- The peritubular capillaries reabsorb several materials
 - Some water
 - Glucose
 - Amino acids
 - Ions
- Some reabsorption is passive, most is active
- Most reabsorption occurs in the proximal convoluted tubule

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Materials Not Reabsorbed

- Nitrogenous waste products
 - Urea
 - Uric acid
 - Creatinine
- Excess water

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Secretion – Reabsorption in Reverse

- Some materials move from the peritubular capillaries into the renal tubules
 - Hydrogen and potassium ions
 - Creatinine
- Materials left in the renal tubule move toward the ureter

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