

## CHAPTER TWENTY-SEVEN

### Answers to WHAT DID YOU LEARN?

1. The organs of the urinary system are the kidneys, ureters, urinary bladder, and urethra.
2. The urinary system filters blood plasma, stores urine until the body is ready to expel it, excretes the urine from the kidneys to outside the body, helps maintain blood volume, and is responsible for regulating erythrocyte production.
3. The kidney's outer renal cortex is located immediately internal to its lateral border, and its inner renal medulla is located immediately internal to its medial border.
4. The right kidney is positioned about 2 centimeters inferior to the left kidney because of the large size of the right lobe of the liver.
5. The renal corpuscles of juxtamedullary nephrons lie adjacent to the corticomedullary border, and their relatively long nephron loops extend deep into the medulla. The renal corpuscles of cortical nephrons are near the peripheral edge of the cortex, and their relatively short nephron loops barely penetrate the medulla.
6. Filtration is the process by which water and some dissolved solutes in the blood plasma passively move out of capillaries due to pressure differences across the filtration membrane into the capsular space of the renal corpuscle.
7. As blood passes through the glomerulus, water and waste products are pushed from the glomerulus into the capsular space of the glomerular capsule by the process of filtration. This fluid is called filtrate.
8. The components of a nephron are the renal corpuscle, composed of a glomerulus and a glomerular capsule; the proximal convoluted tubule; the nephron loop; and the distal convoluted tubule. As blood passes through the glomerulus, water and waste products are pushed from the glomerulus into the space of the glomerular capsule, crudely filtering the blood. The filtrate leaves the glomerular capsule and enters the proximal convoluted tubule, where it is called tubular fluid. Its cells actively reabsorb almost all nutrients, electrolytes, and any plasma proteins from the tubular fluid. Water is reabsorbed by osmosis. The solutes and water are returned to the vascular system via the peritubular capillaries surrounding the convoluted tubules. From the proximal convoluted tubule, the tubular fluid next enters the nephron loop (loop of Henle), where additional water and solutes are reabsorbed. From there, it goes to the distal convoluted tubule, where ions are secreted into the tubular fluid from the blood. Reabsorption of water can occur here as well.
9. The posterior pituitary secretes antidiuretic hormone (ADH) as a consequence of dehydration. ADH secretion results in decreased water loss in urine, and thus the urine becomes more concentrated.

10. The juxtaglomerular apparatus consists of juxtaglomerular cells and the macula densa. The juxtaglomerular cells are modified smooth muscle cells in the wall of the afferent arteriole. The macula densa cells are modified epithelial cells that line the distal convoluted tubule at the point of contact between the afferent arteriole and the distal convoluted tubule. The juxtaglomerular apparatus continuously monitors the fluid electrolyte concentration in the distal convoluted tubule (by macula densa cells). Under conditions that reduce blood volume or solute concentration, the macula densa cells stimulate the juxtaglomerular cells to release renin. Ultimately aldosterone is produced, which increases blood electrolyte concentrations and blood volume.
11. Ureters enter the posterolateral wall at the base of the urinary bladder.
12. The middle tunic of the ureter is called the muscularis. It consists of an inner longitudinal and an outer circular layer of smooth muscle fibers. Additionally, the smooth muscle in the inferior one-third of the ureter consists of another outer longitudinal layer of smooth muscle. These muscle layers produce peristaltic waves that proceed along the length of the ureter from the kidney toward the urinary bladder.
13. The trigone is a posteroinferior triangular area of the urinary bladder wall. It is formed by imaginary lines connecting the two posterior ureteral openings and the anterior urethral opening. Because the trigone remains immovable during shape changes as the urinary bladder fills and evacuates, it funnels urine into the urethra as the bladder wall contracts to evacuate the stored urine.
14. Distension of the bladder due to filling activates stretch receptors in the bladder, which signal the micturition center and stimulate the micturition reflex.
15. The three parts of the male urethra, from its origin to its point of exit from the body, are the prostatic urethra, the membranous urethra, and the spongy urethra.
16. Structural changes in the kidneys affect urine production. With age, a gradual reduction in kidney size accompanies both a reduction in blood flow to the kidneys and a decrease in the number of functional nephrons in the kidney. These changes lead to reduced functional capability. Reduced blood flow also contributes to a decreased glomerular filtration rate; consequently, both reabsorption and secretion are reduced. The loss of nephrons results in diminished ability to filter and cleanse the blood.
17. The structures formed by the cloaca are the urinary bladder, urethra, rectum, and anal canal.