

Study Guide

Chapter 23: The Urinary System

1. What organs make-up the urinary system?
2. What are the kidney's two primary functions? What are the kidney's secondary functions?
3. What is a metabolic waste? Nitrogen waste products are some of the most toxic waste products produced by the body. List the three major nitrogen waste products and explain how each waste product is produced in the body?
4. What is azotemia?
5. What four organ systems play a role in excretion?

Study the Anatomy Illustrated in Figures 23.3, 23.4, 23.5, 23.6

6. What is the position of the kidneys in the peritoneum? What other related structures share the relative position of the kidneys?
7. What is the kidney's function unit and how many are in each kidney?
8. How do "three layers" of connective tissue protect the kidneys? What happens to the kidneys when you standup from a supine position?
9. How is the renal parenchyma organized? (Fig 23.4)
10. What is the kidney's renal fraction and how does this compare to the kidney's relative size to the human body? Be able to trace the flow of blood between the aorta and inferior vena cava:
11. To understand renal physiology you need to understand the unique blood flow of the kidney. Study Figure 23.5 to learn the pattern of blood flow through the arteries and veins of the kidney.
 - a. How many capillary beds can you identify in the renal circulation?
 - b. What term describes two capillary beds between an artery and a vein?
 - c. Where within the kidney do you find these capillaries?
12. Describe the general anatomy of a nephron?
13. How are the nephrons arranged in the kidney?
14. Urine is formed by the nephron. What are the three functions performed by the kidneys that forms the urine? Where do these events occur?

15. Filtration occurs within the renal corpuscle. How does the parietal layer differ from the visceral layer and what are the opposite sides of the corpuscle called?
16. What are the three areas of the renal tubule?
17. Trace the fluid from where the glomerular filtrate is formed to the point where it leaves the body:

Urine Formation: Glomerular Filtration

18. What is the difference between glomerular filtrate, tubular fluid and urine? Where are these fluids found?
19. What are the three barriers associated with the glomerular filtration membrane?
19. What type of molecules pass freely through filtration membrane?
20. What are the three forces that determine the glomerular net filtration pressure (NFP) and what is the NFP?
21. What is the glomerular filtration rate? How much would this create in a day? How much is “reabsorbed” and how much urine on average is excreted by an adult?
22. Renal autoregulation is the ability of the nephron to adjust their own blood flow and GFR without external (nervous or hormonal) control.
 - a. What are the names of the two mechanisms of autoregulation?
 - b. What is the anatomy associated with each mechanism?
 - c. What are two important “points” about renal autoregulation?
23. What type of nerve fibers innervate the kidneys? When are these fibers activated and how is blood flow altered?
23. The rennin-angiotensin mechanism has profound effects throughout the body. When blood pressure drops the sympathetic fibers to the JG cells also release an enzyme called rennin.
 - a. Why is rennin called an enzyme and not a hormone?
 - b. What is the function of angiotensin converting enzyme and where is it located?
 - c. Is angiotensin II an enzyme or hormone? Why?
 - d. How is cell metabolism altered by angiotensin II?

Urine Formation: Tubular Reabsorption and Secretion

24. What are the basic steps in the formation of urine? (See Figure 23.9)

25. In anatomy and physiology, we know structure “suggests” function. Explain why this is true with the proximal convoluted tubules:
26. What two mechanisms are used in tubular reabsorption?
27. What is the “key” cation that makes PCT reabsorption work?
28. What is a symport and how is this related to sodium reabsorption in the PCT?
29. What is a secondary active transport? Explain this process by using the sodium-glucose transport protein model.
30. How much water is absorbed by the PCT? Why does water move from the tubular lumen across the tubular cell and into the interstitial space surrounding the peritubular capillaries? What is the water channel called?
31. What three factors allow the peritubular capillaries to reabsorb water and solute?
32. What is glycosuria? Explain this condition in terms of tubular reabsorption and the glucose transport maximum index
33. What is tubular secretion? In the proximal convoluted tubules, what type of substances are secreted?
34. What is the main function of the nephron?
35. The distal convoluted cells and collecting ducts need to absorb about 34 Liters of water every day from the glomerular filtrate. What are the two different type of cells found in these structures? What is the function of each cell type?
36. Where do these hormones originate from and what is their action?
 - a. Aldosterone
 - b. Atrial natriuretic peptide
 - c. Antidiuretic hormone
 - d. Parathyroid hormone
37. How is the function of the PCT and DCT different?

Urine Formation: Water Conservation

38. Where are the collecting ducts located?

39. The collecting ducts make it possible to create an hypertonic urine. What two factors make this possible?
40. What is water diuresis?
41. What happens when you are dehydrated?
42. What is a countercurrent multiplier and where is it located? What is the range of osmolarity created by this system?
43. What is the countercurrent exchange system and what structures perform this function?
44. Urinalysis:
- a. Appearance
 - b. Odor
 - c. Specific gravity
 - d. Osmolarity
 - e. pH
 - f. chemical composition
45. Urine Volumes
- a. Normal daily volume
 - b. Polyuria
 - c. Oliguria
 - d. Anuria
46. Explain osmotic diuresis in relationship to diabetes mellitus? How is the diuresis caused by diabetes insipidus different than diabetes mellitus?
- 47 Diuretics: caffeine vs alcohol:
47. What is the anatomy of the ureters and how is urine moved into the bladder?
48. What is the anatomy of the urinary bladder?
49. What is the micturition reflex?