

The Heart and Heart Disease

The heart is actually two pumps—one moves blood to the lungs, the other pushes it out into the body. These two functions seem rather elementary in comparison to the complex and numerous functions performed by most of the other body organs, and yet if this pump stops, within a few short minutes all life ceases.

The heart is divided into two upper compartments called *atria*, or receiving chambers, and two lower compartments, or discharging chambers, called *ventricles*. By age 45, approximately 300,000 tons of blood will have passed through these chambers to be circulated to the blood vessels. This closed system of circulation provides distribution of blood to the entire body (systemic circulation) and to specific regions, such as the pulmonary circulation or coronary circulation.

The beating of the heart must be coordinated in a rhythmic manner if the heart is to pump effectively. This is achieved by electrical impulses that are stimulated by specialized structures embedded in the walls of the heart. The sinoatrial node, atrioventricular node, bundle of His, and Purkinje fibers combine efforts to conduct the tiny electrical currents necessary to contract the heart. Any interruption or failure of this system may result in serious pathology or death.

A healthy heart is necessary to pump sufficient blood throughout the body to nourish and oxygenate cells continuously. Your review of this chapter will provide you with an understanding of this vital organ that is necessary for survival.

TOPICS FOR REVIEW

Before progressing to Chapter 14, you should have an understanding of the structure and function of the heart. Your review should include a study of the coronary circulation and the conduction system of the heart. Your study should conclude with an understanding of the major coronary diseases and disorders.

LOCATION, SIZE, AND POSITION OF THE HEART

ANATOMY OF THE HEART

Fill in the blanks.

1. The system that supplies our cells' transportation needs is the circulatory system.
2. The Apex or blunt point at the lower edge of the heart lies on the diaphragm, pointing to the left.

3. The interatrial septum divides the heart into right and left sides between the atria.
4. The Atria are the two upper chambers of the heart.
5. The ventricles are the two lower chambers of the heart.
6. The cardiac muscle tissue is referred to as the myocardium.
7. Inflammation of the heart lining is endocarditis.
8. The two AV valves are bicuspid/mitral and tricuspid.
9. The inner layer of the pericardium is called the viseral pericardium or epicardium.
10. The outer layer of pericardium is called parietal pericardium.
11. If the pericardium becomes inflamed, a condition called pericarditis results.
12. The semilunar valves are located between the two ventricular chambers and the large arteries that carry blood away from the heart when contraction occurs.
13. A mitral valve prolapse is a condition caused when the flaps of this valve extend back into the left atrium, causing the valve to leak.
14. Rheumatic heart disease is cardiac damage resulting from a delayed inflammatory response to a streptococcal infection that occurs most often in children.

▶ If you had difficulty with this section, review pages 373-379.

CARDIAC CYCLE CONDUCTION SYSTEM OF THE HEART

Circle the correct answer.

25. The heart beats at an average rate of _____ beats per minute.
 A. 50
 B. 72
 C. 100
 D. 120
26. Each complete beat of the heart is called:
 A. Cardiac output
 B. Stroke volume
 C. A cardiac cycle
 D. A contraction
27. The pacemaker of the heart is also known as the:
 A. SA node
 B. AV node
 C. AV bundle
 D. Purkinje fibers
28. A rapid heart rhythm, over 100 beats per minutes, is referred to as:
 A. Bradycardia
 B. Sinus arrhythmia
 C. Tachycardia
 D. Premature contractions
29. The term _____ describes the electrical activity that triggers contraction of the heart muscle.
 A. Depolarization
 B. Repolarization
 C. AV node block
 D. Cardiac arrhythmia
30. A diagnostic tool that uses ultrasound to detect valve and heart disorders is known as a/an:
 A. Electrocardiogram
 B. Pacemaker
 C. TPA
 D. Echocardiogram
31. Frequent premature contractions can lead to:
 A. Extra systoles
 B. Bradycardia
 C. Fibrillation
 D. Heart failure
32. A drug that slows and increases the strength of cardiac contractions is:
 A. Digitalis
 B. Nitroglycerin
 C. Calcium-channel blocker
 D. Anticoagulant
33. Congestive heart failure inevitably causes:
 A. Extra systole
 B. Pulmonary edema
 C. Fibrillation
 D. Bradycardia
34. Failure of the right side of the heart due to blockage of pulmonary blood flow is called:
 A. Cardiomyopathy
 B. Ventricular fibrillation
 C. Cor pulmonale
 D. TPA
35. A nonmedical rescuer can defibrillate a victim in ventricular fibrillation with the use of a/an:
 A. AED
 B. Beta-blocker
 C. Demand pacemaker
 D. ECG
36. Coumadin and dicumarol are examples of commonly used oral:
 A. Beta-blockers
 B. Nitroglycerines
 C. Calcium-channel blockers
 D. Anticoagulants

▶ If you had difficulty with this section review pages 379-389.

HEART AND HEART DISEASE

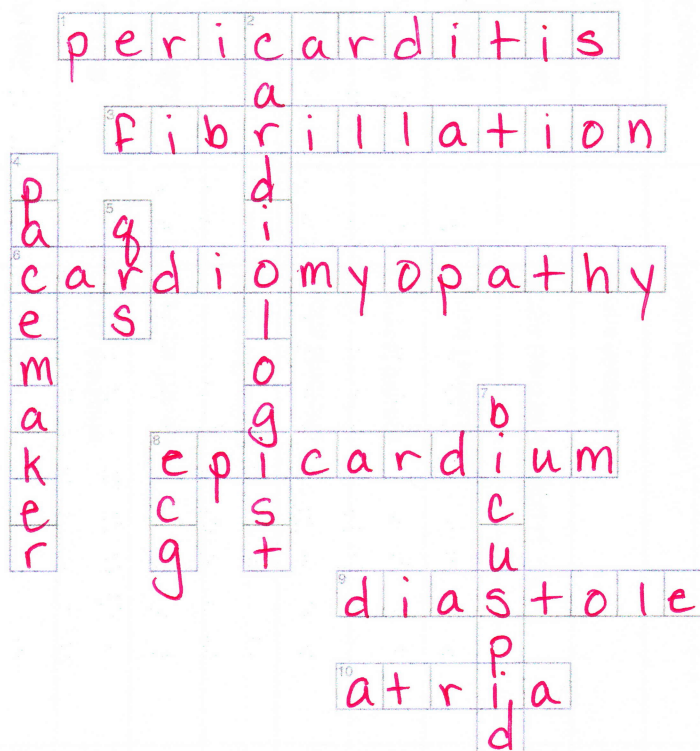
Fill in the crossword puzzle.

ACROSS

- Inflammation of the pericardium
- A condition in which muscle fibers contract out of step with each other
- Disease of the myocardial tissue
- Also known as the *visceral pericardium*
- Relaxation of the heart
- Upper chambers of the heart

DOWN

- Heart specialist
- Also known as the *sinoatrial node*
- Complex that occurs as a result of depolarization of the ventricles
- Also known as the *mitral valve*
- Graphic record of the heart's electrical activity



CHECK YOUR KNOWLEDGE

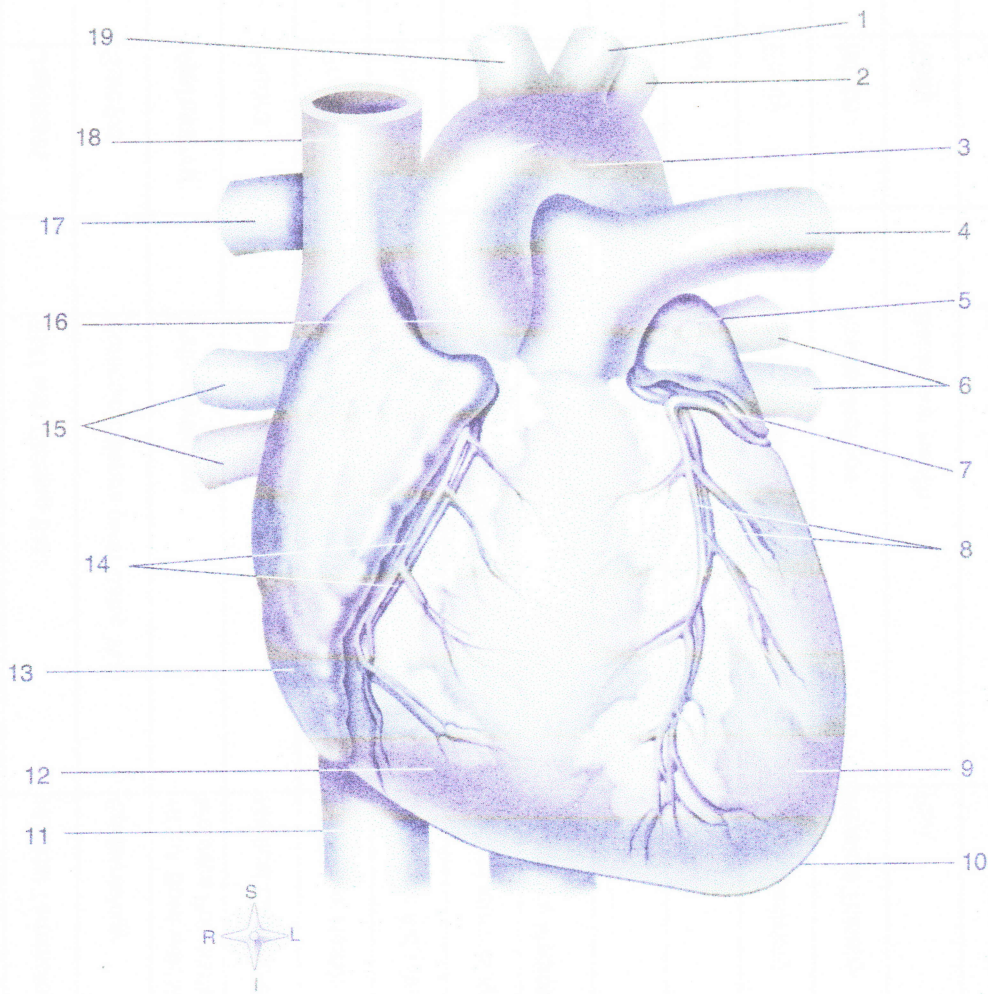
Multiple Choice

Circle the correct answer.

- The superior vena cava carries blood to the:
 - Left ventricle
 - Coronary arteries
 - Right atrium
 - Pulmonary veins
- Which of the following events, if any, does *not* precede ventricular contraction?
 - P wave
 - Atrial depolarization
 - Ventricular depolarization
 - All of these events precede contraction.
- Which of the following pairs is mismatched?
 - Angina pectoris—chest pain
 - Congestive heart failure—left-sided heart failure
 - Tachycardia—slow heart rhythm
 - Dysrhythmia—heart block
- Which of the following statements is *not* true regarding pericarditis?
 - It may be caused by infection or trauma.
 - It often causes severe chest pain.
 - It may result in impairment of the pumping action of the heart.
 - All of the above statements are true.

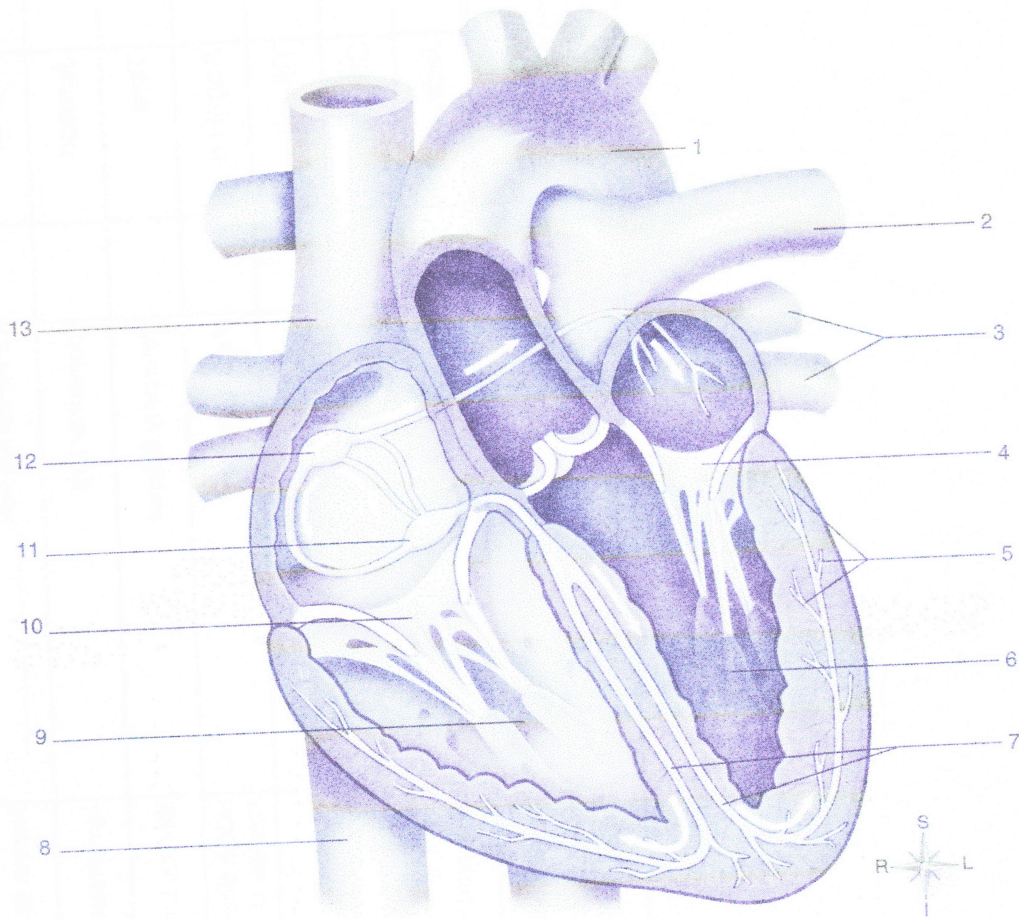
5. The outside covering that surrounds and protects the heart is called the:
- A. Endocardium
 - B. Myocardium
 - C. Pericardium
 - D. Ectocardium
6. Thin-walled upper heart cavities that receive blood from veins are called:
- A. Chordae tendineae
 - B. Atria
 - C. Pericardia
 - D. Ventricles
7. A valve that permits blood to flow from the right ventricle into the pulmonary artery is called:
- A. Tricuspid
 - B. Mitral
 - C. Aortic semilunar
 - D. Pulmonary semilunar
8. Ventricular contraction of the heart occurs *immediately after* depolarization of the:
- A. Purkinje fibers
 - B. Atrioventricular node
 - C. Sinoatrial node
 - D. Bundle of His
9. A variation in heart rate during the breathing cycle is called:
- A. Mitral valve prolapse
 - B. Fibrillation
 - C. Sinus dysrhythmia
 - D. None of the above
10. Heart implants:
- A. Allow patients to move around freely without external pumps.
 - B. Are artificial hearts that are made of biologically inert synthetic materials.
 - C. Weigh approximately 2 pounds.
 - D. All of the above are true.

THE HEART



- | | |
|---|--------------------------------------|
| 1. Left common carotid art. | 11. Inferior vena cava |
| 2. Left subclavian artery | 12. (R) ventricle |
| 3. Arch of aorta | 13. (R) Atrium |
| 4. Left pulmonary artery | 14. (R) Coronary art. + cardiac vein |
| 5. Left atrium | 15. (R) pulmonary veins |
| 6. Left pulmonary veins | 16. ascending aorta |
| 7. Great cardiac vein | 17. (R) pulmonary artery |
| 8. Branches of (L) coronary art. + cardiac vein | 18. Superior vena cava |
| 9. (L) ventricle | 19. Brachiocephalic trunk |
| 10. Apex | |

CONDUCTION SYSTEM OF THE HEART



- | | |
|---|--------------------------------|
| 1. Aorta | 8. Inferior vena cava |
| 2. Pulmonary artery | 9. Right ventricle |
| 3. Pulmonary veins | 10. Tricuspid valve |
| 4. Mitral (bicuspid) valve | 11. Atrioventricular (AV) node |
| 5. Purkinje fibers | 12. Sinoatrial (SA) node |
| 6. Left ventricle | 13. Superior vena cava |
| 7. Right and left branches of AV bundle (bundle of His) | |

The Circulation of the Blood

One hundred thousand miles of blood vessels make up the elaborate transportation system that circulates materials needed for energy, growth and repair, and also eliminates wastes from your body. These vessels, called *arteries*, *veins*, and *capillaries*, serve different functions. Arteries carry blood from the heart, veins carry blood to the heart, and capillaries are exchange vessels, or connecting links, between the arteries and veins. The pumping action of the heart keeps blood moving, or circulating, through this closed system of vessels. This system provides distribution of blood to the entire body (systemic circulation) and to specific regions such as the pulmonary circulation or hepatic portal circulation.

Blood pressure is the force of blood in the vessels. This force is highest in the arteries and lowest in the veins. Normal blood pressure varies among individuals and depends on the volume of blood in the arteries. The larger the volume of blood in the arteries, the more pressure is exerted on the walls of the arteries, and the higher the arterial pressure. Conversely, the less blood in the arteries, the lower the blood pressure.

A functional cardiovascular system is vital for survival because without circulation, tissues would lack a supply of oxygen and nutrients. Waste products would begin to accumulate and could become toxic. Your review of this system will provide you with an understanding of the complex transportation mechanism of the body necessary for survival.

TOPICS FOR REVIEW

Before progressing to Chapter 15, you should have an understanding of the structure and function of the blood vessels. Your review should include a study of systemic, pulmonary, hepatic portal, and fetal circulation and should conclude with a thorough understanding of blood pressure, pulse, and circulatory shock.

BLOOD VESSELS

Match each term on the left with its corresponding description on the right.

- | | |
|--------------------------------------|---|
| <u>d.</u> 1. Arteries | A. Smooth muscle cells that guard the entrance to capillaries |
| <u>b.</u> 2. Veins | B. Carry blood to the heart |
| <u>c.</u> 3. Capillaries | C. Carry blood into the venules |
| <u>g.</u> 4. Tunica externa | D. Carry blood away from the heart |
| <u>d.</u> 5. Precapillary sphincters | E. Largest vein |
| <u>e.</u> 6. Superior vena cava | F. Largest artery |
| <u>f.</u> 7. Aorta | G. Outermost layer of arteries and veins |

▶ If you had difficulty with this section, review pages 395-400.

CIRCULATION OF BLOOD

Circle the correct answer.

18. The aorta carries blood out of the:
- A. Right atrium
 - B. Left atrium
 - C. Right ventricle
 - D. Left ventricle
 - E. None of the above
19. The superior vena cava returns blood to the:
- A. Left atrium
 - B. Left ventricle
 - C. Right atrium
 - D. Right ventricle
 - E. None of the above
20. The _____ function as exchange vessels.
- A. Venules
 - B. Capillaries
 - C. Arteries
 - D. Arterioles
 - E. Veins
21. Blood returns from the lungs during pulmonary circulation via the:
- A. Pulmonary artery
 - B. Pulmonary veins
 - C. Aorta
 - D. Inferior vena cava
22. The hepatic portal circulation serves the body by:
- A. Removing excess glucose and storing it in the liver as glycogen
 - B. Detoxifying blood
 - C. Assisting the body to maintain proper blood glucose balance
 - D. All of the above
23. The structure used to bypass the liver in the fetal circulation is the:
- A. Foramen ovale
 - B. Ductus venosus
 - C. Ductus arteriosus
 - D. Umbilical vein
24. The foramen ovale serves the fetal circulation by:
- A. Connecting the aorta and the pulmonary artery
 - B. Shunting blood from the right atrium directly into the left atrium
 - C. Bypassing the liver
 - D. Bypassing the lungs
25. The structure used to connect the aorta and pulmonary artery in the fetal circulation is the:
- A. Ductus arteriosus
 - B. Ductus venosus
 - C. Aorta
 - D. Foramen ovale

26. Which of the following is *not* an artery?
 A. Femoral
 B. Popliteal
 C. Coronary
 D. Inferior vena cava

▶ If you had difficulty with this section, review pages 402-406.

BLOOD PRESSURE PULSE

If the statement is true, write "T" in the answer blank. If the statement is false, correct the statement by circling the incorrect term and writing the correct term in the answer blank.

- arteries/veins
 BP gradient
 stop
 high
 decreases
 True
 True
 True
 increase/decrease
 contract
 decreases
 True
 True
 right
 artery
 True
 True
 brachial artery
27. Blood pressure is highest in the veins and lowest in the arteries.
28. The difference between two blood pressures is referred to as blood pressure deficit.
29. If the blood pressure in the arteries were to decrease so that it became equal to the average pressure in the arterioles, circulation would increase.
30. A stroke is often the result of low blood pressure.
31. Massive hemorrhage increases blood pressure.
32. Blood pressure is the volume of blood in the vessels.
33. Both the strength and the rate of heartbeat affect cardiac output and blood pressure.
34. The diameter of the arterioles helps determine how much blood drains out of arteries into arterioles.
- A stronger heartbeat tends to decrease blood pressure and a weaker heartbeat tends to increase it.
36. The systolic pressure is the pressure being exerted against the vessels while the ventricles relax.
37. If blood becomes less viscous than normal, blood pressure increases.
38. A device called a *sphygmomanometer* is used to measure blood pressures in clinical situations.
39. Loud, tapping Korotkoff sounds suddenly begin when the cuff pressure measured by the mercury column equals the systolic pressure.
40. The venous blood pressure within the left atrium is called the *central venous pressure*.
41. The pulse is a vein expanding and then recoiling.
42. The radial artery is located at the wrist.
43. The common carotid artery is located in the neck along the front edge of the sternocleidomastoid muscle.
44. The artery located at the bend of the elbow that is used for locating the pulse is the dorsalis pedis.

▶ If you had difficulty with this section, review pages 406-413.