

12 The Circulatory System

Chapter Summary

The circulatory system consists of the heart and the blood vessels. The heart is a muscular, double pump with four chambers. There are right and left atria, and right and left ventricles. The right atrium receives oxygen poor blood from the body and pumps it to the right ventricle, which pumps it to the lungs. The left atrium receives oxygen rich blood from the lungs and pumps it to the left ventricle, which pumps the blood to the body tissues. Four different heart valves prevent backflow of blood in the heart and the conduction system of the heart, consisting of fibers with both muscular and nervous characteristics, conducts impulses through the myocardium thus producing muscular contractions. These muscular contractions comprise the cardiac cycle. During the cardiac cycle, both atria contract simultaneously, then both ventricles contract simultaneously. Systole refers to the period when a chamber is contracting. Diastole refers to the period when a chamber is relaxing. The production of heart sounds during the cardiac cycle is the result of the closing of the heart valves, and the characteristic electrocardiogram tracing is due to depolarization and repolarization of the heart chambers. The heartbeat is intrinsic and regulated by a part of the conduction system of the heart called the SA node, but the rate of the heartbeat is also controlled by the nervous system. Blood vessels comprise the vascular system. These vessels are the arteries, which carry blood away from the heart; the smaller arterioles, which branch to form the capillaries; the venules, which carry blood away from capillary beds; and the veins, which carry blood back to the heart. Arteries are the most muscular blood vessels and have the thickest walls, capillaries have walls that are only one cell thick, and veins contain valves that prevent the backflow of blood. The exchange of gases, nutrients, and wastes between the blood and the body cells occurs across the walls of the capillaries. A pulse results when the blood entering the arteries causes the arterial walls to swell, and blood pressure is the force of the blood against a blood vessel wall. Blood pressure depends on cardiac output and peripheral resistance and is regulated by the central nervous system and various hormones. Blood pressure is responsible for the flow of blood in the arteries, but skeletal muscle contraction causes the flow of blood in the veins. There are two major paths of circulation, the pulmonary circuit, which circulates blood through the lungs; and the systemic circuit, which serves the needs of the body tissues. The major vessels of these circuits are discussed in the text, as are the vessels involved in supplying blood to the brain, heart, and liver. Fetal circulation is discussed and the features of fetal circulation that are not present in adults are described.

Chapter Outline

- I. Anatomy of the Heart
 - A. The Wall and Coverings of the Heart
 - B. Chambers of the Heart
 1. Right Atrium
 2. Right Ventricle
 3. Left Atrium
 4. Left Ventricle
 - C. Operation of Heart Valves
 - D. Coronary Circuit
 1. Coronary Circuit Disorders

- II. Physiology of the Heart
 - A. Conduction System of the Heart
 - 1. Nodal Tissue
 - 2. Electrocardiogram
 - B. Cardiac Cycle and Heart Sounds
 - 1. Heart Sounds
 - C. Cardiac Output
 - 1. Stroke Volume
 - 2. Heart Rate
- III. Anatomy of Blood Vessels
 - A. Arteries and Arterioles
 - 1. Arteriosclerosis
 - B. Capillaries
 - C. Veins and Venules
 - 1. Varicose Veins and Phlebitis
- IV. Physiology of Circulation
 - A. Velocity of Blood Flow
 - B. Blood Pressure
 - 1. Cardiac Output Again
 - 2. Peripheral Resistance
 - C. Evaluating Circulation
 - 1. Pulse
 - 2. Blood Pressure
 - D. Congestive Heart Failure
- V. Circulatory Routes
 - A. The Major Systemic Arteries
 - B. The Major Systemic Veins
 - C. Special Systemic Circulation
 - 1. Hepatic Portal System
 - 2. Hypothalamus-Hypophyseal Portal System
 - 3. Blood Supply to the Brain
 - 4. Fetal Circulation
- VI. Effects of Aging
- VII. Homeostasis

Suggested Student Activities

1. Discuss the effects of a diet high in saturated fat on the circulatory system.
2. Discuss factors that affect blood pressure and pulse rate, including cigarette smoke, caffeine, and alcohol.
3. Locate, on a model or on charts, the main arteries and veins.
4. Trace circulation from the body cells to the heart, and back to the body cells.
5. Discuss fetal circulation and compare it with circulation after birth.

Answers to Objective Questions

1. aorta
2. lungs
3. sinoatrial (SA)
4. away from
5. coronary
6. subclavian, iliac

7. cerebral arterial circle
8. stomach and intestines, liver
9. blood pressure
10. blood pressure, skeletal muscle contraction
11. systolic, diastolic
12. cardiac output, peripheral resistance
13. foramen ovale, ductus arteriosus
14. bicuspid

Answers to Medical Terminology Reinforcement Exercise

1. cryo/cardio/plegia - paralysis of the heart by cooling
2. echo/cardio/graphy - making a record of the heart with the use of ultrasonic waves
3. per/cutaneous trans/luminal coronary angio/plasty - revision of the coronary vessel (artery) with the use of a balloon catheter passed through the skin and across the lumen (opening of a tubular structure)
4. vaso/con/stric/tion - process of lessening the diameter of a vessel
5. valvulo/plasty - plastic repair of a valve
6. anti/hyper/tensive - against high pressure—an agent used to lower high blood pressure
7. ar/rhythm/ia - without rhythm—variation from normal of heartbeat
8. thrombo/end/arter/ectomy - excision of a thrombus (clot) and atherosclerotic (hard) plaque from inner lining of an artery
9. cardio/valvul/itis - inflammation of a heart valve
10. vaso/spasm - contraction of a blood vessel
11. peri/cardio/contesis - drainage of the cavity surrounding the heart (pericardial cavity)
12. ventriculo/tomy - incision into a ventricle
13. phleb/ectasia - dilation of a vein
14. myo/cardio/rrhaphy - suturing of the heart wall

Audiovisual Materials

1. Model - Heart (13001)(Concept Media)
2. Model - Circulatory System (2071)(Concept Media)
3. Filmstrip - The Cardiovascular System (Unit 7)(Career Aids)
4. Film 16mm - Hemo the Magnificent (59 min)(Encyclopedia Britannica Educational Corp.)