

CHAPTER

6

The Cardiovascular System

► CARDIOLOGY

After studying this chapter, you will be able to:

- 6.1 Name the parts of the cardiovascular system and discuss the function of each part
- 6.2 Define combining forms used in building words that relate to the cardiovascular system
- 6.3 Identify the meaning of related abbreviations
- 6.4 Name the common diagnoses, clinical procedures, and laboratory tests used in treating disorders of the cardiovascular system
- 6.5 List and define the major pathological conditions of the cardiovascular system
- 6.6 Explain the meaning of surgical terms related to the cardiovascular system
- 6.7 Recognize common pharmacological agents used in treating disorders of the cardiovascular system

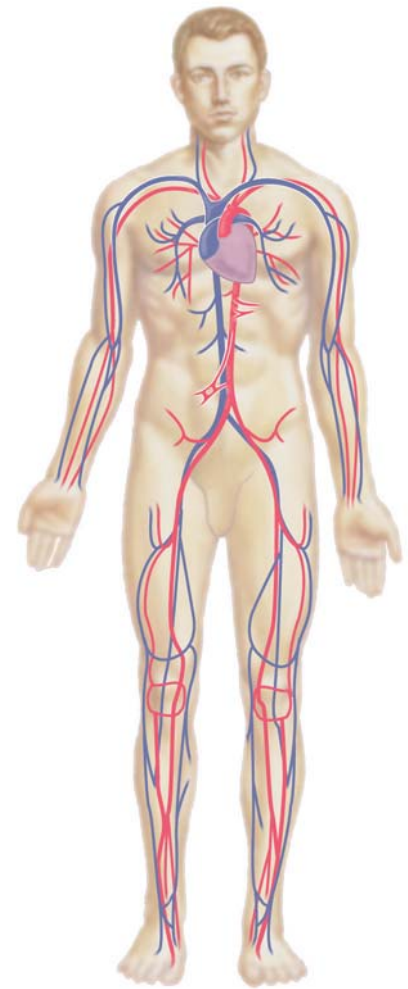
Structure and Function

The **cardiovascular** system is the body's delivery service. Figure 6-1 on the next page shows the routes of blood circulation throughout the cardiovascular system. The **heart** pumps **blood** through the **blood vessels** to all the cells of the body. The average adult heart is about 5 inches long and 3.5 inches wide and weighs anywhere from 7 ounces to almost 14 ounces, depending on an individual's size and gender.

The heart wall consists of a double-layered protective sac and two additional layers:

1. The protective sac is the **pericardium**. The pericardium covers the *pericardial cavity* which is filled with *pericardial fluid*, a lubricant for the membranes of the heart. The pericardium itself consists of the *visceral pericardium* (the inner layer) which is also called the **epicardium** and is attached to the heart wall and the *parietal pericardium* (the outer portion of the pericardium).
2. The second layer is the **myocardium**, a thick layer of muscular tissue.
3. The inner layer, the **endocardium**, forms a membranous lining for the chambers and valves of the heart.

The heart is divided into right and left sides. Each side of the heart pumps blood to a specific area of the body. The right side of the heart pumps oxygen-poor blood from the body to the lungs. The left side of the heart pumps oxygen-rich blood from the lungs to all other areas of the body, where



Remember epi- means upon or on and endo- means within. It is easy to remember that the epicardium is on the heart wall and the endocardium is the lining within the heart.

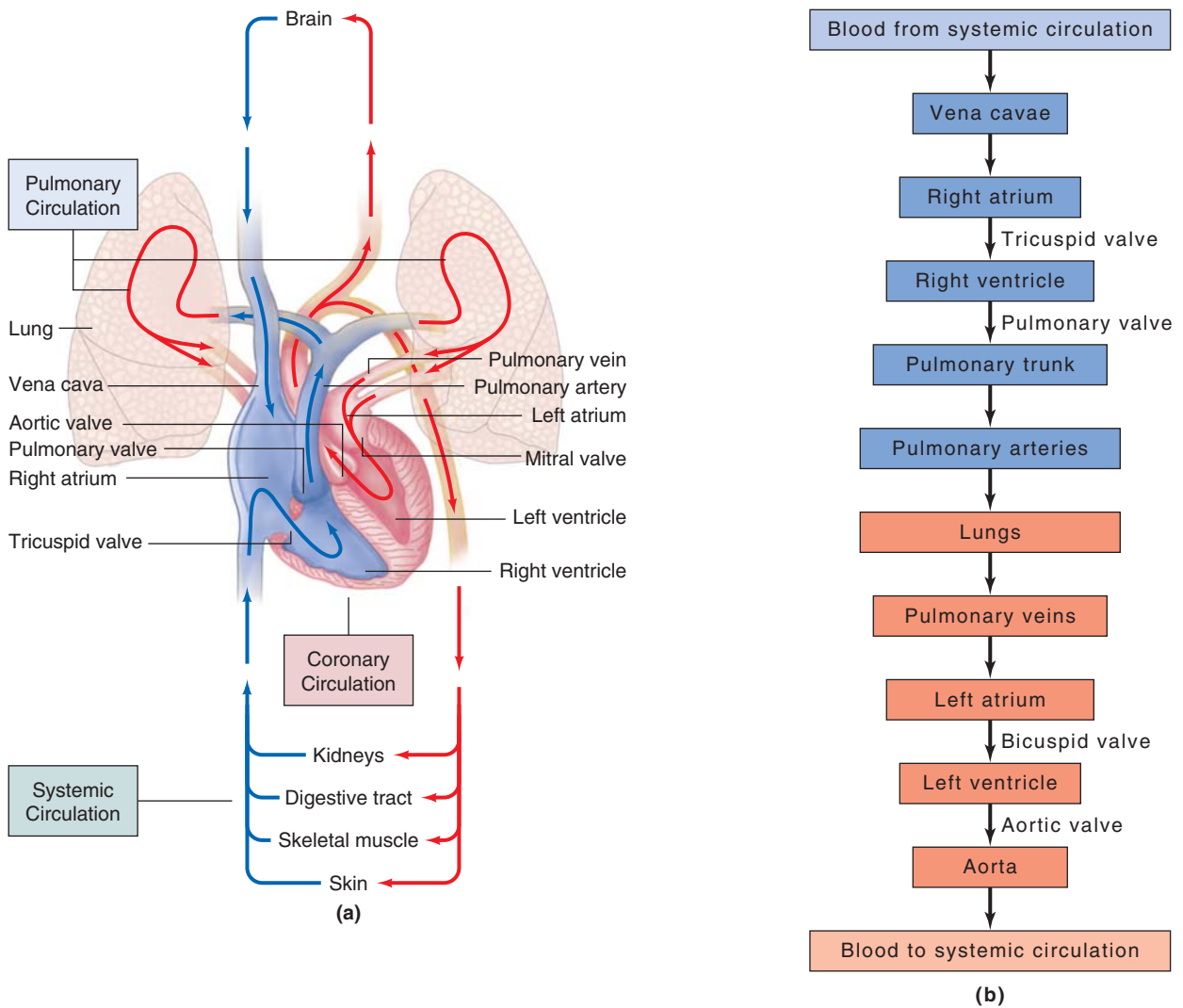


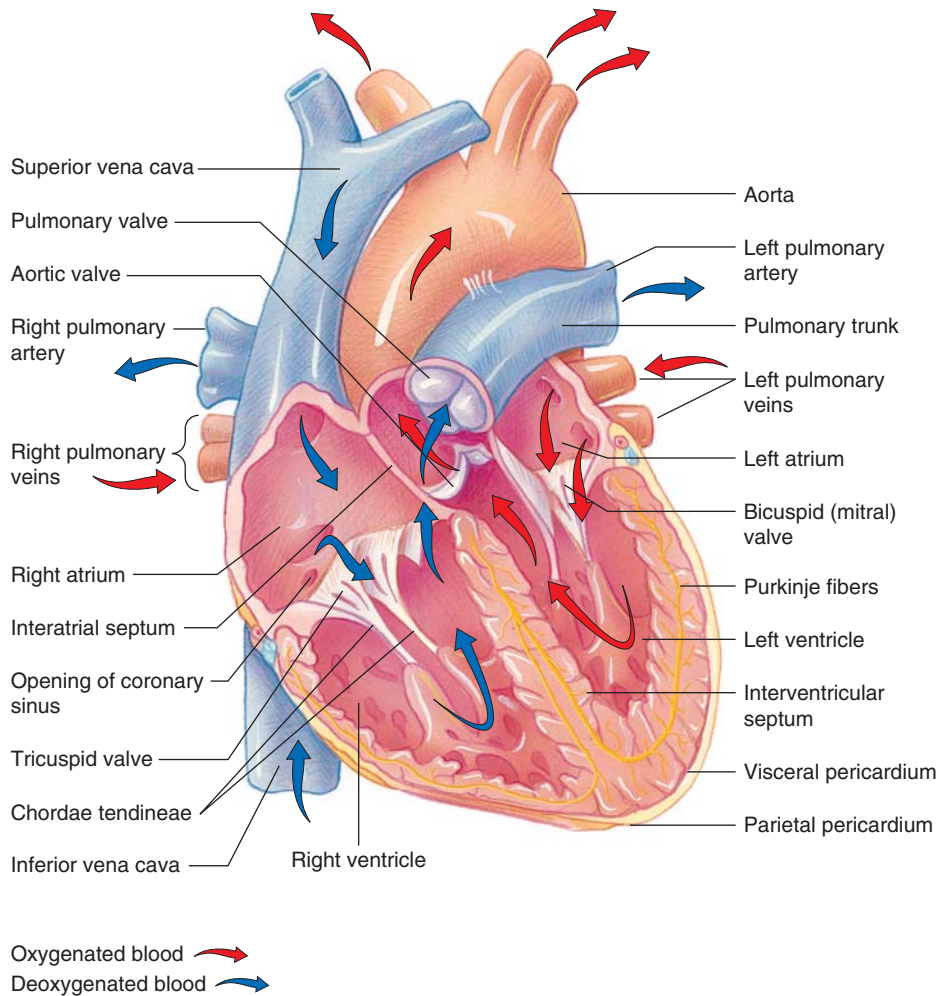
FIGURE 6-1 The heart pumps blood throughout the cardiovascular system via the blood vessels, arteries, and veins. (a). The flow chart (b) shows the path of deoxygenated blood in blue and oxygenated blood in red.

it will deliver nutrients and oxygen. Each side of the heart has two chambers. The **right atrium** and **right ventricle** on the right side are separated from the **left atrium** and **left ventricle** on the left side by a muscular partition called a **septum** (plural, **septa**). The part of the septum between the two **atria** (plural of **atrium**) is called the *interatrial septum*; the part between the two **ventricles** is called the *interventricular septum*.

Blood flows through the chambers of the heart in only one direction, with the flow regulated by one-way **valves**. The blood is pumped throughout the body through the system of **arteries** and **veins**. Arteries carry blood away from the heart. Veins carry blood toward the heart. The arteries carry oxygenated blood, except in pulmonary circulation. The veins carry deoxygenated blood, except in pulmonary circulation. Arteries have a lining called the **endothelium**, which secretes enzymes and other substances into the blood. The space within the arteries through which blood flows is called the **lumen**.

The valves of the heart also control the blood flow through the heart. The two **atrioventricular valves** (located between the atria and the ventricles)—the **tricuspid valve** and the **bicuspid valve** (also called the **mitral**

FIGURE 6-2 Blood flow through the heart and the structures leading to and from it.



valve)—control the flow of blood within the heart. The two **semilunar valves**—the **pulmonary valve** and the **aortic valve**—prevent the backflow of blood into the heart. The tricuspid valve has three cusps (flaps) that open and close to allow blood to flow from the right atrium into the right ventricle. The two cusps of the bicuspid valve are said to resemble a bishop’s miter (hat), so this valve is commonly known as the mitral valve. The bicuspid valve controls blood flow on the left side of the heart, from the atrium to the ventricle. Figure 6-2 shows the heart and the structures leading to and from it.

The Vessels of the Cardiovascular System

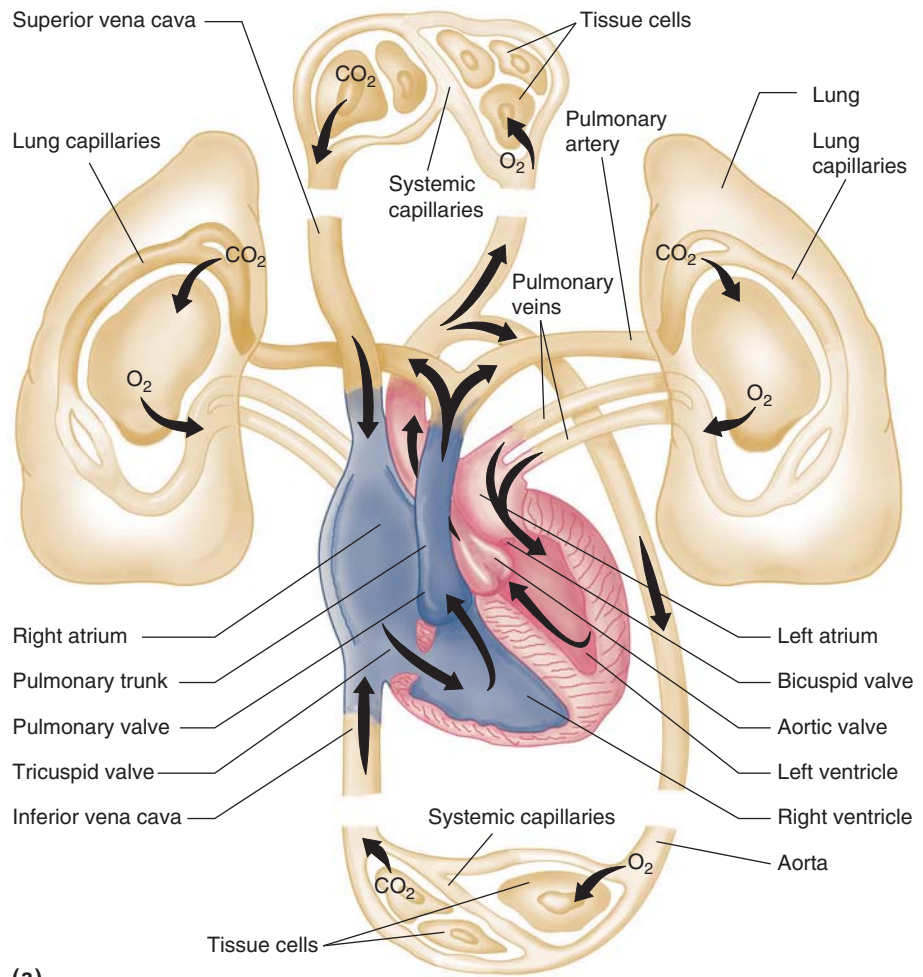
Arteries and veins are the vessels that carry blood to and from the heart and lungs and to and from the heart and the rest of the body. This circulation of blood is the essential function of the cardiovascular system, which includes *coronary circulation*, the circulation of blood within the heart; *pulmonary circulation*, the flow of blood between the heart and lungs; and *systemic circulation*, the flow of blood between the heart and the cells of the body.

Coronary Circulation

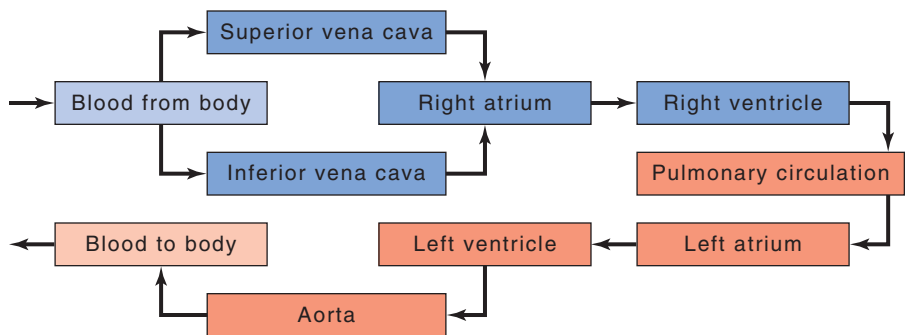
The **coronary arteries**, which branch off the **aorta** (the body’s largest artery and the artery through which blood exits the heart), supply blood to the heart muscle. The aortic semilunar valves control this flow of blood. The heart needs more oxygen than any other organ except the brain. The amount

The Web site www.heartinfo.org has heart animations that illustrate different parts of the heart and how they are affected by disease and surgery.

FIGURE 6-3 Coronary circulation is the circulation of blood within the heart (a). The flowchart (b) gives an overview of this type of circulation.



(a)



(b)

The average adult has about 5-6 liters of blood in the body.

of blood pumped to the heart through the coronary arteries is about 100 gallons per day. The atrioventricular valves control the circulation of blood within the heart, between the atria and the ventricles. Figure 6-3 diagrams coronary circulation.

Pulmonary Circulation

The **pulmonary arteries** carry blood that is low in oxygen (*deoxygenated blood*) from the right ventricle of the heart to the lungs to get oxygen. Blood that is rich in oxygen (*oxygenated blood*) flows from the lungs to the left atrium of the heart through the **pulmonary veins**. Figure 6-4 on p. 160 traces the circulation of blood from the heart to the lungs and back.

MORE ABOUT . . .

The Heart

The heart is the body's main pump, sending blood, oxygen, and nutrients to sustain all parts of the body. The heart is surprisingly small for such a large body function—only the size of an average adult fist. Although the heart has two sides, its shape is not symmetrical.



Systemic Circulation

The heart pumps blood through the arteries to the cells of the body. The blood moves in a surge caused by the muscular contraction of the heart. This surge is called the **pulse**. The blood that goes from the heart to the cells of the body (except the lungs) is oxygenated.

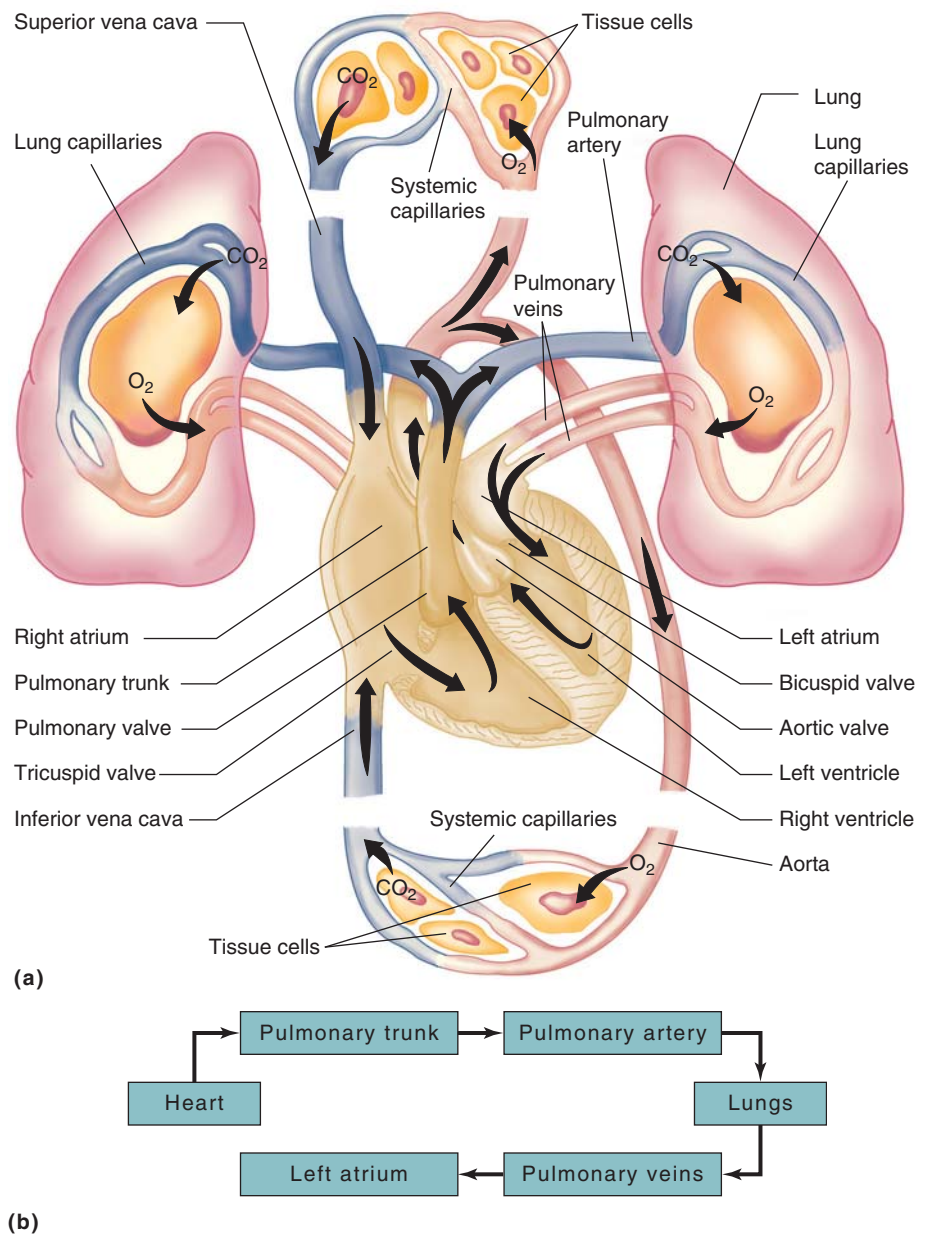
Specialized arteries (branching off the aorta) carry the oxygen-rich blood to different areas of the body. For example, the **carotid artery** supplies the head and neck; the **femoral artery** supplies the thigh; and the **popliteal artery** supplies the back of the knee. The arteries divide into smaller vessels called **arterioles**, which then divide into even smaller vessels called **capillaries**. The capillaries are the transfer station of the delivery system. The thin-walled capillaries allow the essential nutrients to leave the capillary through its single-celled walls via *osmosis*, the movement from a greater concentration to a lesser concentration through a membrane. The capillaries provide the cells they serve with essential nutrients and, in turn, remove waste products (including **carbon dioxide**, CO_2) from the cells, sending it to the **venules**, which are small branches of veins that then dump into the veins.

The veins take the deoxygenated blood back to the heart. An example of specialized veins are the **saphenous veins**, which remove oxygen-poor blood from the legs. Veins move the blood by gravity, skeletal muscle contractions, and respiratory activity. The veins contain small one-way valves that prevent the blood from flowing backward. The blood from the upper part of the body (above the diaphragm) is collected and carried to the heart through a large vein called the **superior vena cava**. The blood from the lower part of the body (below the diaphragm) goes to the other large vein called the **inferior vena cava** and then to the heart. Both of these large veins, the **venae cavae** (plural of **vena cava**), bring the blood to the right atrium of the heart. Figure 6-5 shows the major pathways in the systemic circulation.

Blood pressure Blood pressure measures the force of the blood surging against the walls of the arteries. Each heartbeat consists of two parts. The first is the contraction, called **systole**, and the second is the relaxation, the

Although interpretation of pulse rates is controversial, most health practitioners agree that normal pulse rates for adults at rest range from 60 to 100 beats per minute. Children's pulse rates vary depending on age, size, level of activity, and so on. If a heart beats 70 times a minute, pumping 70 ml of blood into the aorta each time; $70 \text{ ml} \times 70$ equals 4900 ml or almost 5 liters of blood every 60 seconds. This volume of blood is called the *cardiac output*. The volume of blood ejected from the ventricles during each heartbeat is called the *stroke volume*.

FIGURE 6-4 Pulmonary circulation is the circulation of blood between the hearts and lungs (a). The flowchart (b) is a diagram of the blood flow in this type of circulation.



If a stethoscope is placed on the anterior chest wall, two distinct sounds can be heard that are often described as *lub dup*. The first or *lub* sound is caused when the atrioventricular valves slam tightly shut as the ventricles contract pushing blood out of the heart to the lungs and cells of the body. The second or *dup* sound is caused by the shutting of the semilunar valves as the ventricles relax and rest from the contraction in anticipation of the next contraction. Each complete heartbeat is referred to as the *cardiac cycle* and includes the contraction (systole) and relaxation (diastole) of atria and ventricles. If the heart was beating at a rate of 72 beats per minute (bpm), each cycle would take about 0.8 seconds to complete.

diastole. **Blood pressure** is the measurement of the systolic pressure followed by the diastolic pressure. Normal blood pressure for an adult is 120/80. The number 120 represents the pressure within the walls of an artery during systole; the number 80 represents the pressure within the arterial wall during diastole. Pulse pressure represents the difference between the diastolic and systolic readings. In blood pressure of 120/80, the pulse pressure is 40, which represents the strength of the left ventricle pumping blood to the body.

Conduction System The heart has the unique ability to control its own rhythm. This electrical ability is called the **conduction system**, which is contained in special heart tissue called *conductive tissue* in the right atrium. This region is called the **sinoatrial (SA) node** and is known as the heart's **pacemaker** because its electrical impulse causes the regular contractions that result in a regular heartbeat or pulse. The contractions take place in the myocardium, which cycles through **polarization** (resting state) to **depolarization** (contracting state) to **repolarization** (recharging from contracting to resting) in the heartbeat. The electrical current from the SA node

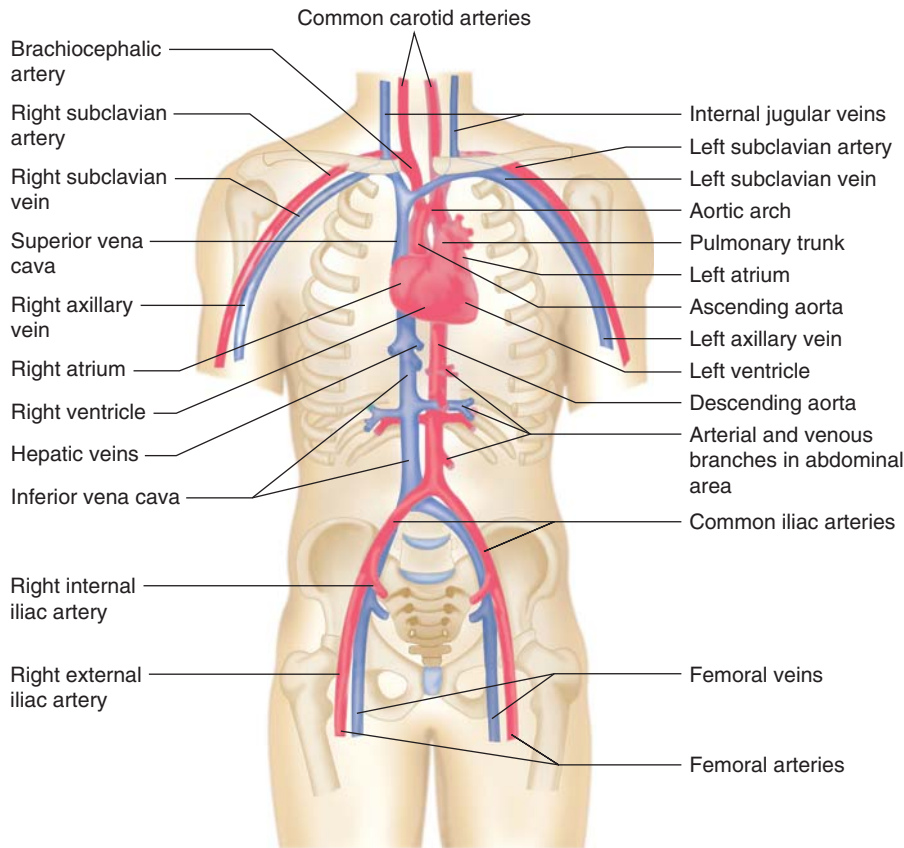


FIGURE 6-5 Systemic circulation is the flow of blood between the heart and the cells of the entire body. In addition to arteries and veins, smaller blood vessels branch off to connect with cellular material. Specific arteries and veins are named for the area of the body that they serve. The brachiocephalic artery serves the arms and head, the subclavian arteries and veins serve the area beneath the shoulder or collar bone, the iliac arteries and veins serve the small intestines, the hepatic vessels serve the liver, and the jugular veins serve the throat and neck.

causes fibers in the atria to contract. This current then passes to a portion of the interatrial septum called the **atrioventricular (AV) node**, which sends the charge to a group of specialized muscle fibers called the **atrioventricular bundle**, also called the **bundle of His**. The bundle of His divides into left and right bundle branches and causes the ventricles to contract, forcing blood away from the heart during systole. At the end of these branches are the *Purkinje fibers*, specialized fibers that conduct the charge.

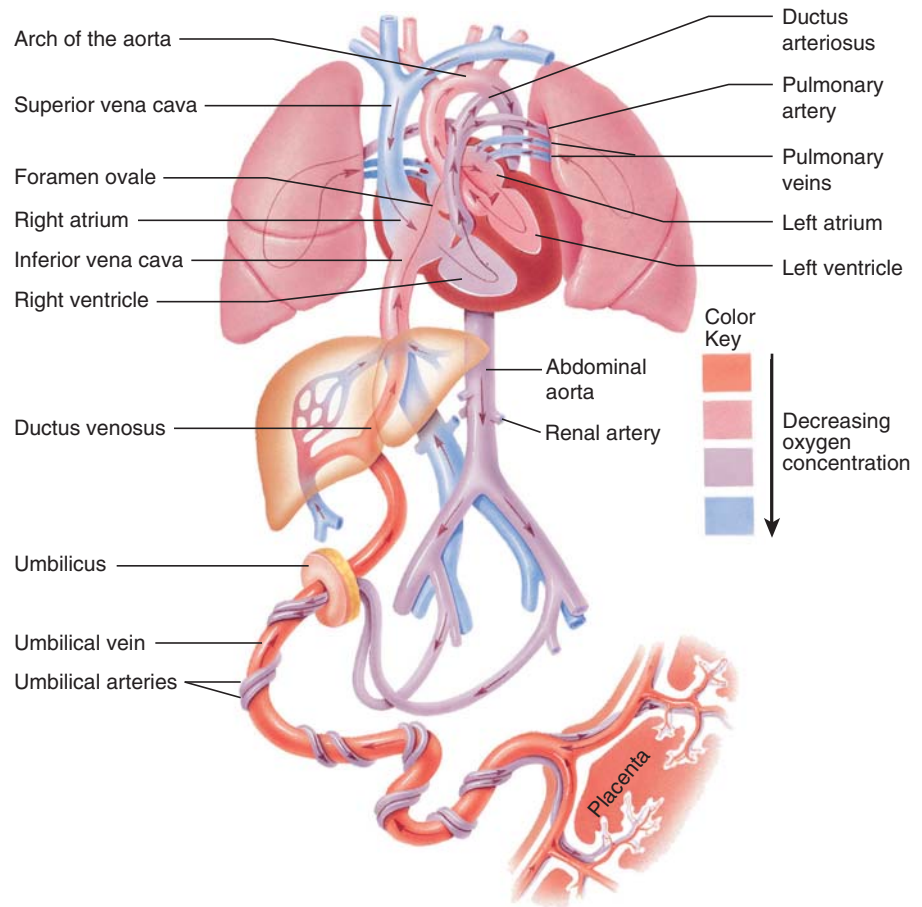
Heart rate can vary depending on a person's health, physical activity, or emotions at any one time. The repeated beating of the heart takes place in the **cardiac cycle**, during which the heart contracts and relaxes as it circulates blood. Normal heart rhythm is called **sinus rhythm**.

Fetal Circulation

The circulatory system of the fetus bypasses pulmonary circulation, because a fetus's lungs do not function until after birth and because the fetus gets oxygen and nutrients through the umbilical cord, which contains arteries and a vein. Fetal blood is transported back and forth to the placenta, where deoxygenated blood is oxygenated and returned to the fetus. Three structures are important to fetal circulation (Figure 6-6). The **ductus venosus** is the connection from the umbilical vein to the fetus's inferior vena cava, through which oxygenated blood is delivered to the fetal heart, bypassing the fetal liver. Deoxygenated blood flows from the fetal heart through the **ductus arteriosus** and back through the umbilical cord to the placenta. The septum between the atria of the fetal heart has a small opening called the **foramen ovale**, which allows blood to flow from the right atrium into the left atrium. After birth, this opening closes. Chapter 17 discusses fetal development.

The National Heart, Lung, and Blood Institute's Web site (www.nhlbi.nih.gov) can be searched for good information about blood pressure.

FIGURE 6-6 Fetal blood moves back and forth between the placenta and the growing fetus. The diagram shows the flow of oxygenated and deoxygenated blood from the fetus's heart through its nonfunctioning lungs to the umbilicus to the placenta. Structures unique to the fetus that change after birth are the foramen ovale and the ductus venosus.



MORE ABOUT . . .

Controlling High Blood Pressure

High blood pressure is a dangerous condition with virtually no symptoms felt by the patient. At almost every doctor visit, blood pressure is measured, usually with a sphygmomanometer. Blood pressure measurements are characterized as normal, low, or high. Blood pressure may gradually increase with age or may decrease with consistent athletic training. The generally regarded normal arterial blood pressure for an adult is 120/80 or 120 mm Hg systolic pressure (as the ventricles contract) and 80 mm Hg diastolic pressure (as the ventricles relax). High blood pressure is sometimes the result of heredity or lifestyle factors. Overeating leading to overweight, smoking, lack of exercise, and stress are lifestyle factors that affect blood pressure. For consistently high systolic pressures, most doctors recommend lifestyle changes along with medication.

The American Heart Association (www.amheart.org) categorizes blood pressure as follows:

Blood Pressure Category	Systolic (mm Hg)		Diastolic (mm Hg)
Normal	less than 120	and	less than 80
Prehypertension (considered hypertension in some high-risk cases)	120–139	or	80–89
High			
Stage 1	140–159	or	90–99
Stage 2	160 or higher	or	100 or higher

*Your doctor should evaluate unusually low readings.

VOCABULARY REVIEW

In the previous section, you learned terms relating to the cardiovascular system. Before going on to the exercises, review the terms below and refer to the previous section if you have any questions. Pronunciations are provided for certain terms. Sometimes information about where the word came from is included after the term. The etymologies (word histories) are for your information only. You do not need to memorize them.

Term	Definition
aorta [ā-ŌR-tă] Greek <i>aorte</i>	Largest artery of the body; vessel through which oxygenated blood exits the heart.
aortic [ā-ŌR-tĭk] valve	Valve between the aorta and the left ventricle.
arteriole [ăr-TĒ-rē-ōl] arteri-, artery + -ole, small	A tiny artery connecting to a capillary.
artery [ĂR-tēr-ē] Latin and Greek <i>arteria</i>	A thick-walled blood vessel that, in systemic circulation, carries oxygenated blood away from the heart.
atrioventricular [Ā-trē-ō-vĕn-TRĪK-yū-lăr] bundle atrio-, atrium + ventricular	Bundle of fibers in the interventricular septum that transfers charges in the heart's conduction system; also called bundle of His.
atrioventricular (AV) node	Specialized part of the interatrial septum that sends a charge to the bundle of His.
atrioventricular valve	One of two valves that control blood flow between the atria and ventricles.
atrium (<i>pl.</i> , atria) [Ā-trē-ŭm (Ā-trē-ă)]	Either of the two upper chambers of the heart.
bicuspid [bĭ-KŪS-pĭd] valve bi-, two + cuspid, having one cusp	Atrioventricular valve on the left side of the heart.
blood [blŭd] Old English <i>blod</i>	Essential fluid made up of plasma and other elements that circulates throughout the body; delivers nutrients to and removes waste from the body's cells.
blood pressure	Measure of the force of blood surging against the walls of the arteries.
blood vessel	Any of the tubular passageways in the cardiovascular system through which blood travels.
bundle of His [hĭz, hĭs] After Wilhelm His (1863–1934), German Physician	See atrioventricular bundle.
capillary [KĂP-ĭ-lăr-ē]	The smallest blood vessel that forms the exchange point between the arterial and venous vessels.
carbon dioxide (CO₂)	Waste material transported in the venous blood.
cardiac cycle	Repeated contraction and relaxation of the heart as it circulates blood within itself and pumps it out to the rest of the body or the lungs.

Term	Definition
cardiovascular [KĂR-dē-ō-VĂS-kyū-lēr]	Relating to or affecting the heart and blood vessels.
carotid [kă-RŌT-id] artery	Artery that transports oxygenated blood to the head and neck.
conduction system	Part of the heart containing specialized tissue that sends electrical charges through heart fibers, causing the heart to contract and relax at regular intervals.
coronary [KŌR-ō-nār-ē] artery Latin <i>coronarius</i> from <i>corona</i> , crown	Blood vessel that supplies oxygen-rich blood to the heart.
depolarization [dē-pō-lă-rĭ-ZĀ-shŭn] de-, away from + polarization	Contracting state of the myocardial tissue in the heart's conduction system.
diastole [dĭ-ĂS-tō-lē] Greek, <i>dilation</i>	Relaxation phase of a heartbeat.
ductus arteriosus [DŮK-tŭs ār-tēr-ē-Ō-sŭs]	Structure in the fetal circulatory system through which blood flows to bypass the fetus's nonfunctioning lungs.
ductus venosus [vĕn-Ō-sŭs]	Structure in the fetal circulatory system through which blood flows to bypass the fetal liver.
endocardium [ĕn-dō-KĂR-dē-ŭm] endo-, within + Greek <i>kardia</i> , heart	Membranous lining of the chambers and valves of the heart; the innermost layer of heart tissue.
endothelium [ĕn-dō-THĒ-lē-ŭm] endo- + Greek <i>thele</i> , nipple	Lining of the arteries that secretes substances into the blood.
epicardium [ĕp-ĭ-KĂR-dē-ŭm] epi-, upon + Greek <i>kardia</i> , heart	Outermost layer of heart tissue.
femoral [FĔM-ŏ-răl, FĒ-mŏ-răl] artery	An artery that supplies blood to the thigh.
foramen ovale [fŏ-RĀ-mĕn ō-VĀ-lē]	Opening in the septum of the fetal heart that closes at birth.
heart [hărt] Old English <i>heorte</i>	Muscular organ that receives blood from the veins and sends it into the arteries.
inferior vena cava [VĒ-nă KĂ-vă, KĀ-vă]	Large vein that draws blood from the lower part of the body to the right atrium.
left atrium	Upper left heart chamber.
left ventricle	Lower left heart chamber.
lumen [LŪ-mĕn]	Channel inside an artery through which blood flows.
mitral [MĪ-trăl] valve	See bicuspid valve.
myocardium [mĭ-ō-KĂR-dē-ŭm] myo-, muscle + Greek <i>kardia</i> , heart	Muscular layer of heart tissue between the epicardium and the endocardium.

Term	Definition
pacemaker	Term for the sinoatrial (SA) node; also, an artificial device that regulates heart rhythm.
pericardium [pĕr-ĭ-KĀR-dē-ŭm] peri-, around + Greek <i>kardia</i> , heart	Protective covering of the heart.
polarization [pō-lār-ĭ-ZĀ-shŭn]	Resting state of the myocardial tissue in the conduction system of the heart.
popliteal [pŏp-LĪT-ē-ăl] artery	An artery that supplies blood to the cells of the area behind the knee.
pulmonary [PŪL-mō-nār-ē] artery	One of two arteries that carry blood that is low in oxygen from the heart to the lungs.
pulmonary valve	Valve that controls the blood flow between the right ventricle and the pulmonary arteries.
pulmonary vein	One of four veins that bring oxygenated blood from the lungs to the left atrium.
pulse [pŭls]	Rhythmic expansion and contraction of a blood vessel, usually an artery.
repolarization [rĕ-pō-lār-ĭ-ZĀ-shŭn] re, again + polarization	Recharging state; transition from contraction to resting that occurs in the conduction system of the heart.
right atrium	Upper right chamber of the heart.
right ventricle	Lower right chamber of the heart.
saphenous [să-FĒ-nŭs] vein	Any of a group of veins that transport deoxygenated blood from the legs.
semilunar [sĕm-ē-LŪ-nār] valve semi-, half + Latin <i>luna</i> , moon	One of the two valves that prevent the backflow of blood flowing out of the heart into the aorta and the pulmonary artery.
septum (<i>pl.</i> , <i>septa</i>) [SĔP-tŭm (SĔP-tă)]	Partition between the left and right chambers of the heart.
sinoatrial [sĭ-nō-Ā-trĕ-ăl] (SA) node	Region of the right atrium containing specialized tissue that sends electrical impulses to the heart muscle, causing it to contract.
sinus rhythm	Normal heart rhythm.
superior vena cava	Large vein that transports blood collected from the upper part of the body to the heart.
systole [SĪS-tō-lē]	Contraction phase of the heartbeat.
tricuspid [trĭ-KŪS-pĭd] valve tri-, three + <i>cuspid</i> , having one cusp	Atrioventricular valve on the right side of the heart.
valve [vălv]	Any of various structures that slow or prevent fluid from flowing backward or forward.

Term	Definition
vein [vān]	Any of various blood vessels carrying deoxygenated blood toward the heart, except the pulmonary vein.
vena cava (<i>pl., venae cavae</i>) [VĒ-nă KĀ-vă, KĀ-vă (VĒ-nē KĀ-vē, KĀ-vē)]	See superior vena cava and inferior vena cava.
ventricle [VĚN-trĭ-kl]	Either of the two lower chambers of the heart.
venule [VĚN-yūl, VĒ-nūl]	A tiny vein connecting to a capillary.

CASE STUDY

A Cardiovascular Emergency

On a hot summer afternoon, Joseph Davino entered the emergency room at Stone General Hospital with severe shortness of breath (SOB). Dr. Mary Woodard was the cardiologist on call that day. She immediately started examining Mr. Davino and made a preliminary diagnosis based upon the physical assessment and the patient's history. She learned that Mr. Davino is 44 years old, is a smoker, is overweight, and has a sedentary lifestyle.

Mr. Davino's past medical history shows that he has a high cholesterol level, has a history of angina,

and takes medication to control high blood pressure. The physical exam shows normal temperature and a blood pressure of 190/100. Dr. Woodard orders an ECG and a cardiac panel.

Critical Thinking

1. Shortness of breath may indicate cardiovascular disease. What lifestyle factors put Mr. Davino at risk?
2. Was Mr. Davino's blood pressure normal?

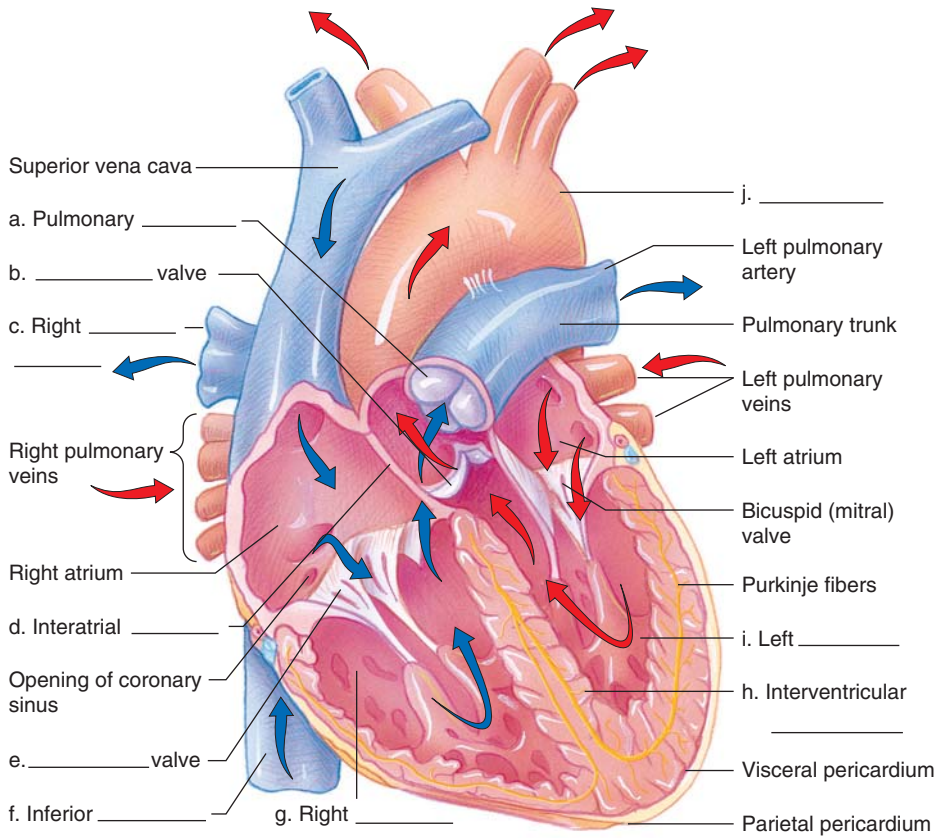
STRUCTURE AND FUNCTION EXERCISES

Finish the Picture

Complete the labeling of the parts of the heart on the diagram on page 167.

3. Describe the function of each lettered part from the diagram in the space below.

- a. _____
- b. _____
- c. _____
- d. _____
- e. _____
- f. _____
- g. _____
- h. _____
- i. _____
- j. _____



Spell It Correctly

For each of the following words, write C if the spelling is correct. If it is not, write the correct spelling.

- | | |
|----------------------------|-------------------------|
| 4. atriaventricular _____ | 9. arteryole _____ |
| 5. capillairy _____ | 10. bundle of His _____ |
| 6. ductus arteriosus _____ | 11. popliteal _____ |
| 7. Purkine fibers _____ | 12. sistole _____ |
| 8. myocardium _____ | |

Test Your Knowledge

Complete the sentences below by filling in the blanks.

13. A vessel that carries oxygenated blood is a(n) _____.
14. Deoxygenated blood flows through the _____.
15. The innermost layer of heart tissue is called the _____.
16. The two atrioventricular valves control the flow of blood between the _____ and the _____.
17. Carbon dioxide is carried back to the heart via the _____.

18. Three lifestyle factors that may result in high blood pressure are _____, _____, and _____.
19. The fetal circulatory system does not include _____ circulation.
20. The lining of the arteries that secretes substances into the blood is called the _____.
21. Pulmonary circulation is the flow of blood between the _____ and _____.
22. The head and neck receive oxygen-rich blood via the _____.
23. Fill in the missing part in the following sequence: pulmonary arteries → _____ → pulmonary veins.

Combining Forms and Abbreviations

The lists below include combining forms and abbreviations that relate specifically to the cardiovascular system. Pronunciations are provided for the examples.

COMBINING FORM	MEANING	EXAMPLE
angi(o)	blood vessel	<i>angiogram</i> [ĂN-jē-ō-grăm], image of a blood vessel
aort(o)	aorta	<i>aortitis</i> [ā-ōr-TĪ-tis], inflammation of the aorta
arteri(o), arter(o)	artery	<i>arteriosclerosis</i> [ăr-TĒR-ē-ō-sklēr-Ō-sis], hardening of the arteries
ather(o)	fatty matter	<i>atherosclerosis</i> [ĂTH-ēr-ō-sklēr-Ō-sis], hardening of the arteries with irregular plaque deposits
atri(o)	atrium	<i>atrioventricular</i> [Ā-trē-ō-vĕn-TRĪK-yū-lăr], relating to the atria and ventricles of the heart
cardi(o)	heart	<i>cardiomyopathy</i> [KĂR-dē-ō-mĭ-ŌP-ă-thĕ], disease of the heart muscle
hemangi(o)	blood vessel	<i>hemangioma</i> [hĕ-MĂN-jē-ō-mă], abnormal mass of blood vessels
pericardi(o)	pericardium	<i>pericarditis</i> [PĒR-ĭ-kăr-DĪ-tis], inflammation of the pericardium
phleb(o)	vein	<i>phlebitis</i> [flĕ-BĪ-tis], inflammation of a vein
sphygm(o)	pulse	<i>sphygmomanometer</i> [SFĪG-mō-mă-NŌM-ĕ-tĕr], instrument for measuring blood pressure
thromb(o)	blood clot	<i>thrombocytosis</i> [THRŌM-bō-sĭ-TŌ-sis], abnormal increase in blood platelets in the blood

COMBINING FORM	MEANING	EXAMPLE
vas(o)	blood vessel	<i>vasodepressor</i> [VĀ-sō-dē-PRĚS-ōr], agent that lowers blood pressure by relaxing blood vessels
ven(o)	vein	<i>venography</i> [vē-NŌG-ră-fē], radiographic imaging of a vein

ABBREVIATION	MEANING	ABBREVIATION	MEANING
AcG	accelerator globulin	ECHO	echocardiogram
AF	atrial fibrillation	ETT	exercise tolerance test
AMI	acute myocardial infarction	GOT	glutamic oxaloacetic transaminase
AS	aortic stenosis	HDL	high-density lipoprotein
ASCVD	arteriosclerotic cardiovascular disease	HR	heart rate
ASD	atrial septal defect	LDH	lactate dehydrogenase
ASHD	arteriosclerotic heart disease	LDL	low-density lipoprotein
AV	atrioventricular	LV	left ventricle
BP	blood pressure bpm beats per minute	LVH	left ventricular hypertrophy
CABG	coronary artery bypass graft	MI	mitral insufficiency; myocardial infarction
CAD	coronary artery disease	MR	mitral regurgitation
cath	catheter	MS	mitral stenosis
CCU	coronary care unit	MUGA	multiple-gated acquisition scan
CHD	coronary heart disease	MVP	mitral valve prolapse
CHF	congestive heart failure	PAC	premature atrial contraction
CO	cardiac output	PTCA	percutaneous transluminal coronary angioplasty
CPK	creatine phosphokinase	PVC	premature ventricular contraction
CPR	cardiopulmonary resuscitation	SA	sinoatrial
CVA	cerebrovascular accident	SV	stroke volume
CVD	cardiovascular disease	TC	total cholesterol
DIC	disseminated intravascular coagulation	tPA, TPA	tissue plasminogen activator
DSA	digital subtraction angiography	VLDL	very low-density lipoprotein
DVT	deep venous thrombosis	VSD	ventricular septal defect
ECG, EKG	electrocardiogram	VT	ventricular tachycardia

COMBINING FORMS AND ABBREVIATIONS EXERCISES

Build Your Medical Vocabulary

Build a word for each of the following definitions. Use the combining forms in this chapter as well as in Chapters 1, 2, and 3.

24. Disease of the heart muscle _____
25. Inflammation of the membrane surrounding the heart _____
26. X-ray of a vein _____
27. Inflammation of a vein _____
28. Operation for reconstruction of an artery _____
29. A disease involving both nerves and blood vessels _____
30. Tending to act on the blood vessels _____
31. Of cardiac origin _____
32. Enlargement of the heart _____
33. Inflammation of the artery with a thrombus _____

Use the following combining forms and the suffixes and prefixes you learned in Chapters 1, 2, and 3 to fill in the missing word parts: atrio-, arterio-, phlebo-, thrombo-, veno-

34. _____ itis, inflammation of a vein
35. _____ ectomy, surgical removal of a thrombus
36. _____ plasty, vein repair
37. _____ megaly, enlargement of the atrium
38. _____ graph, radiograph of veins

Give the term that fits each definition. Each term must contain at least one of the combining forms shown in the previous section. You may also refer to Chapters 1, 2, and 3.

- | | |
|--|---|
| 39. Enlargement of the heart _____ | 42. Inflammation of the endocardium _____ |
| 40. Relating to the heart and lungs _____ | 43. Repair of a vein _____ |
| 41. Establishing an opening into the pericardium _____ | 44. Paralysis of a blood vessel _____ |
| | 45. Suturing of a blood vessel _____ |

Check Your Knowledge

Complete the sentences below by filling in the blanks.

46. An inflammation of a vein is _____.
47. Atherosclerosis is hardening of the _____.
48. A venogram is an x-ray of a(n) _____.
49. An abbreviation for a term meaning heart attack is _____.
50. CABG is a surgical procedure that bypasses a blocked _____.

CASE STUDY

Reading the Record

The nurse on duty the night of Mr. Davino's admittance observed that his blood pressure dropped gradually from 190/100 to 160/90. The nurse, Joan Aquino, marked each change of blood pressure on his record. In addition to blood pressure, she also took Mr. Davino's temperature and pulse every two hours. All his measurements seemed to show improvement, except that Mr. Davino was running a slight fever. However, Joan did not like Mr. Davino's appearance. His skin had a gray pallor and he seemed very disoriented. Dr. Mirkhan, the cardiologist on call that night, spoke with Nurse Aquino and

looked over the results of the tests ordered earlier. The doctor also made the notes shown on the record.

Critical Thinking

51. Nurse Aquino made very specific comments to Dr. Mirkhan about her observations of Mr. Davino's appearance. What are the two items that Nurse Aquino noticed?
52. Referring to Mr. Davino's chart below, how long did Mr. Davino's temperature remain slightly elevated?

MEDICAL RECORD		PROGRESS NOTES
DATE 8/15/XX	3:30 pm Chest clear to auscultation bilaterally with mild crackles; Heart rate and rhythm regular; no audible murmur; no rubs; ECG, blood gases, and SED rate were ordered. Recommended transfer to CCU.—A. Mirkhan, M.D.	
8/15/XX	4 pm BP 190/100; temp 100.4°; no urine in catheter bag.—J. Aquino, R.N.	
8/15/XX	5 pm BP 182/95; temp 100.5°; still no urine in catheter bag; if no urine by 8 pm, notify Dr. Mirkhan.—J. Aquino, R.N.	
8/15/XX	6 pm BP 176/97; temp 100.6°; catheter bag empty.—J. Aquino, R.N.	
8/15/XX	7 pm Catheter bag empty.—J. Aquino, R.N.	
8/15/XX	8 pm BP 168/94; temp 100.7°; catheter bag empty; paged Dr. Mirkhan.—J. Aquino, R.N.	
8/15/XX	9 pm BP 162/96; temp 100.8°; start IV; ECG; blood gases.—A. Mirkhan, M.D.	
8/15/XX	10 pm Catheter bag contains 50 ml of urine; patient resting comfortably.—J. Aquino, R.N.	
8/15/XX	11 pm Catheter bag contains about 200 ml of urine; patient still sleeping.—J. Aquino, R.N.	
8/15/XX	12 pm Woke patient; BP 160/90; temp 100.2°; 300 ml of urine.—J. Aquino, R.N.	

PATIENT'S IDENTIFICATION (For typed or written entries give: Name—last, first, middle; grade; rank; hospital or medical facility)

REGISTER NO.

WARD NO.

4B

Matching

Match the following combining forms used in cardiovascular terms with the correct meanings. Some answers may be used more than once or not at all.

- | | |
|---------------------|-------------|
| 53. _____ angi(o) | a. aorta |
| 54. _____ arteri(o) | b. vein |
| 55. _____ ather(o) | c. blood |
| 56. _____ aden(o) | d. vessel |
| 57. _____ aort(o) | e. electric |

- | | |
|---------------------|----------------------------------|
| 58. _____ cardi(o) | f. artery |
| 59. _____ ech(o) | g. heart |
| 60. _____ electr(o) | h. thick, yellowish fatty plaque |
| 61. _____ hem(o) | i. gland |
| 62. _____ phleb(o) | j. sound |

Match the following combining forms used in cardiovascular terms with the correct meanings. Some answers may be used more than once or not at all.

- | | |
|------------------------|-------------------------|
| 63. _____ atri(o) | a. heat |
| 64. _____ hemangi(o) | b. vein |
| 65. _____ pericardi(o) | c. blood vessel |
| 66. _____ sphygm(o) | d. deficiency, blockage |
| 67. _____ thromb(o) | e. sound |
| 68. _____ vas(o) | f. pericardium |
| 69. _____ son(o) | g. blood clot |
| 70. _____ valv(o) | h. atrium |
| 71. _____ isch(o) | i. pulse |
| 72. _____ therm(o) | j. valve |

Define these abbreviations used on Mr. Davino's record.

- | | |
|---------------|----------------|
| 73. ECG _____ | 76. BP _____ |
| 74. CCU _____ | 77. ECHO _____ |
| 75. MI _____ | |

Diagnostic, Procedural, and Laboratory Terms

Treatment of cardiovascular disease requires a precise understanding of the structure and function of the heart and of the parts of the body that affect the heart's functioning. Doctors order many types of diagnostic tests based on their observations of a patient. They may order clinical procedures whose results will indicate certain specific conditions or they may order laboratory tests to find disease-causing factors or evidence of a specific disease. Sometimes, test results are used to rule out conditions, in which case, physicians look for other causes of disease.

Diagnostic Procedures and Tests

Doctors who specialize in the diagnosis and treatment of cardiovascular disease (*cardiology*) are called *cardiologists*. Cardiologists usually see patients who already have some type of cardiovascular problem or indication of disease. In addition, cardiac surgeons are specialists who perform heart surgery.

The cardiologist often starts an examination with **auscultation** (listening to sounds within the body through a stethoscope). Some abnormal sounds a physician may hear are a *murmur*, a *bruit*, or a *gallop*. Each sound is a clue to the patient's condition. A **sphygmomanometer** is then usually used to measure blood pressure.

One common diagnostic test is a **stress test** (Figure 6-7) or *exercise tolerance test (ETT)*. Patients are asked to exercise on a treadmill while technicians take certain measurements, such as heart rate and respiration. A stress test may be used to diagnose coronary artery disease or it may give a risk factor for heart attack.

Another common test is **electrocardiography**, which produces an *electrocardiogram (ECG, EKG)*, which measures the amount of electricity flowing through the heart by means of electrodes placed on the patient's skin at specific points surrounding the heart. Figure 6-8 illustrates the printout that results from an electrocardiogram. Figure 6-9 illustrates some of the abnormalities that may show up on ECGs. A **Holter monitor** is a portable type of electrocardiograph or instrument that performs an electrocardiogram over a 24-hour period.

Various diagnostic procedures can be performed by producing some type of image. Taking x-rays after a dye has been injected is called **angiocardiology** (x-ray of the heart and its large blood vessels), **angiography** (x-ray of the heart's large blood vessels), **arteriography** (x-ray of a specific artery), **aortography** (x-ray of the aorta), or **venography** or **phlebography** (x-ray of a specific vein). The tests are called an *angiocardigram*, *angiogram*, *arteriogram*, *aortogram*, or *venogram* or *phlebogram*. A **ventriculogram** is an x-ray showing the ventricles. Ventriculograms measure *stroke volume (SV)*,

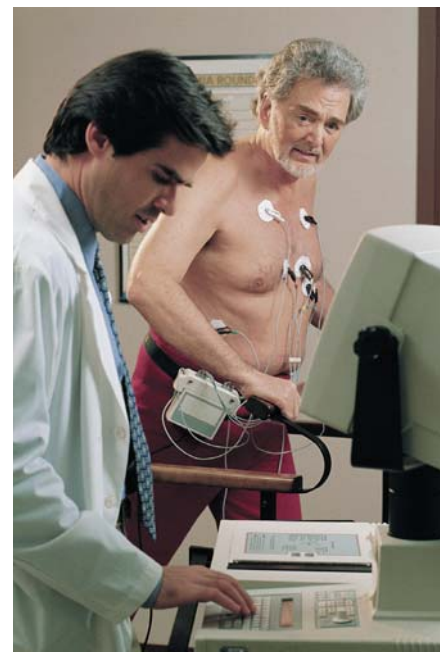


FIGURE 6-7 A stress test includes monitoring of heart function.

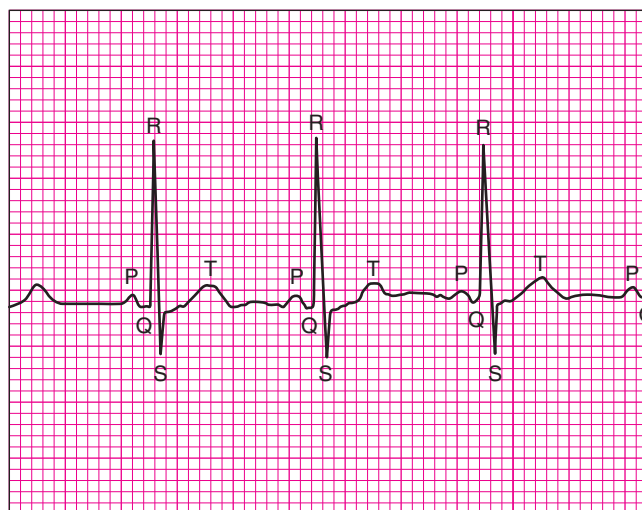


FIGURE 6-8 A normal ECG. The waves of electrical changes in the heart are mapped as P, QRS, and T waves. The P wave is the first electrical impulse through the atria, the QRS complex is the point at which the ventricles contract, and the T wave represents relaxation of the ventricles.

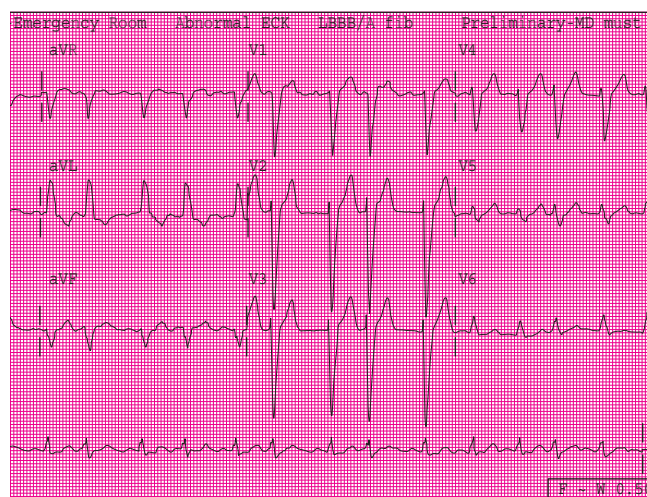


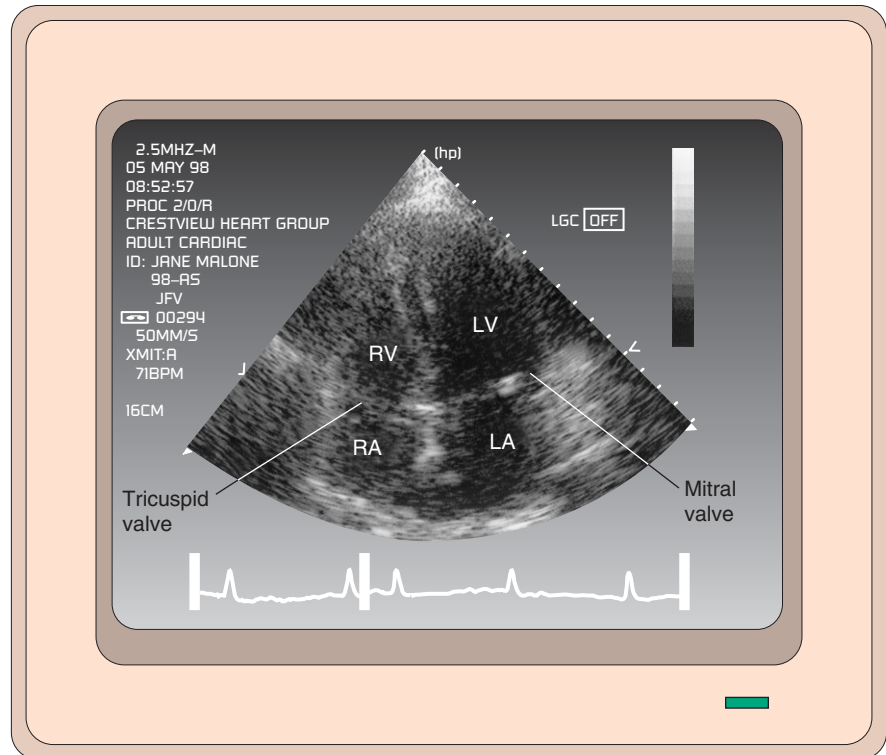
FIGURE 6-9 An abnormal ECG taken in the emergency room. Note the irregularities compared to Figure 6-8. These irregularities show atrial fibrillation and a blockage. In atrial fibrillation, the heart's rhythm is irregular, chaotic, and out of sync, with as many as 350 beats per minute. It results from the atria discharging blood simultaneously. If not treated with medication, it can result in heart failure. Heart blockage represents a delay in the heart's conduction system.

MORE ABOUT . . .

Electrocardiograms

The electrocardiograph can have twelve leads, which are placed at specific points on the patient's body to monitor electrical activity of the heart. Four of the leads go on the arms and legs and six of the leads go at specific points on the chest. The chest leads are marked with specific codes. For example, V_1 goes in the fourth intercostal space to the right of the sternum. Each lead traces the electrical activity from a different angle.

FIGURE 6-10 An echocardiogram is a test that shows the structure and movement of the heart.



the amount of blood going out of a ventricle in one contraction; *cardiac output* (CO), the amount of blood ejected from a ventricle every minute; and the **ejection fraction**, the percentage of volume of the contents of the left ventricle ejected with each contraction. Another x-ray test, **digital subtraction angiography** (DSA), requires two angiograms with different contrast material to compare the results of the two tests in a computer.

Ultrasound tests, or *ultrasonography* or **sonography**, produce images by measuring the echoes of sound waves against various structures. **Doppler ultrasound** measures blood flow in certain blood vessels. **Echocardiography** records sound waves to show the structure and movement of the heart. The test itself is called an *echocardiogram*. Figure 6-10 shows an echocardiogram.

Radioactive substances that are injected into the patient can provide information in a **cardiac scan**, a test that measures movement of areas of the heart, or in *nuclear medicine imaging*. **Positron emission tomography** (PET) scans are one form of nuclear imaging. A PET scan of the heart produces three-dimensional images of the heart's blood flow and other functional processes. Another form of nuclear imaging is **multiple-gated acquisition** (MUGA) **angiography**. A MUGA scan is a noninvasive method that provides a movielike image of the beating heart. It allows for evaluation of the function of ventricles.

Magnetic resonance imaging (MRI) uses magnetic waves to produce images. A **cardiac MRI** uses radio waves to provide images of the heart while beating and provides a detailed image of the heart and shows any lesions in the large blood vessels of the heart.

Cardiac catheterization is used to sample the blood in the chambers of the heart to determine the oxygen content and blood pressure in the chambers. Cardiac output can also be checked. This procedure involves passing a small plastic catheter into the heart through a vein or artery. A vein is used for

The Web site www.heartsite.com has a search item called tests. Click on echocardiogram or any other test listed to learn more details about these tests.

right-sided catheterization while an artery is used for a left-sided approach into the heart. The veins and arteries of the legs and arms are most commonly used.

Laboratory Tests

Laboratory tests are crucial for determining what may be happening to a patient or for evaluating risk factors for heart disease. Drug therapy, clinical procedures, and lifestyle changes may all be recommended largely on the basis of laboratory test results. All laboratory tests have a range of normal values (also called *reference ranges*—see the Appendix section on laboratory values). Some of these ranges change as new studies are done and views of what constitutes a healthy value (such as for cholesterol readings) is revised. Laboratory tests may fall outside of normal ranges due to a variety of reasons, age, gender, dietary habits, problems with collection, and so on. Results are viewed as one part of an entire exam in focusing on a diagnosis.

The flow of blood in the arteries is affected by the amount of **cholesterol** and **triglycerides** (fatty substances or *lipids*) contained in the blood. Lipids are carried through the blood by *lipoproteins*. *Low-density lipoproteins* (LDL) and *very low-density lipoproteins* (VLDL) cause cholesterol to form blockages in the arteries and are referred to as “bad” cholesterol. *High-density lipoproteins* (HDL, referred to as “good” cholesterol) actually remove lipids from the arteries and help protect people from the formation of blockages or fatty deposits, called *plaque*. One factor that increases LDL and VLDL is a diet high in *saturated fats* (animal fats and some vegetable fats that tend to be solid). The processing of some shortenings or margarines produces *trans-fats* (man-made fats), which are thought to cause particular risk for heart disease and cancer. *Polyunsaturated fats* (certain vegetable oils such as safflower or olive) do not raise LDL or VLDL. Laboratory tests performed on blood samples determine the levels of lipoproteins in the blood.

Adult cholesterol readings below 200 are considered to pose little risk for coronary artery disease (this number is controversial and varies as new studies are performed). The importance of cholesterol testing is evidenced by the fact that the chance of heart disease is reduced by 2 to 3 percent for each percentage point reduction in the cholesterol level. A **lipid profile** (a series of laboratory tests performed on a blood sample) gives the lipid, triglyceride, glucose, and other values that help in evaluating a patient’s risk factors. Figure 6-11 is an example of a patient’s lipid profile.

A laboratory test that can be used to diagnose a myocardial infarction earlier than most other laboratory tests measures the levels of *troponin T* and *troponin I*, proteins found in the heart. As levels of the two rise, it usually indicates the early states of an acute myocardial infarction. If only one level rises,

Laboratory Report Emhar Diagnostics Three Riverview Drive Wesley, OH 66666 (800) 999-0000			
PATIENT NAME <u>Mary Helfer</u>			
PATIENT ID <u>777-888-6666</u>			
DATE RECEIVED <u>06/14/XXXX</u>			
DATE REPORTED <u>06/15/XXXX</u>			
TEST	RESULTS		REFERENCE RANGE/UNITS
	OUT OF RANGE	WITHIN RANGE	
HDL	36 mg/dL		>40 mg/dL
LDL	192 mg/dL		<130mg/dL
Triglycerides	204 mg/dL		40–199 mg/dL
Cholesterol	208 mg/dL		120–199mg/dL

FIGURE 6-11 This lipid profile reveals the need to cut cholesterol in the patient’s diet.

MORE ABOUT . . .

Cholesterol

Cholesterol is just one of the risk factors for heart disease but it is one that can be changed by lifestyle and/or medication. That is why many researchers focus on cholesterol levels and ratios. It is generally thought that low LDL levels and high HDL levels are healthier.

To learn more about cardiac enzyme tests, visit the information site of the BBC (www.bbc.co.uk/health/talking/tests/blood_cardiac_enzymes.shtml).

it can indicate a number of conditions not related to the heart, such as kidney failure or muscle trauma. A fairly new test for the evaluation of heart disease is the IMA (ischemia modified albumin). It is used with troponin and ECG to rule out acute coronary syndrome (ACS) patients with chest pain. Tests for C-reactive protein indicate levels of inflammation which is considered an accurate predictor of cardiovascular disease. “Also” needs to be removed

Another important laboratory test of blood is the **cardiac enzyme test** or **study** (also called a **serum enzyme test**), which measures the levels of enzymes released into the blood by damaged heart muscle during a myocardial infarction. The three enzymes that help evaluate the condition of the patient are **GOT** (*glutamic oxaloacetic transaminase*), **CPK** (*creatine phosphokinase*), and **LDH** (*lactate dehydrogenase*). The enzymes may indicate the degree of injury to the heart or the seriousness of an attack. Research to find markers for heart disease is ongoing. For example, brain natriuretic peptide (a hormone found in the body) levels have been found to be higher in patients with congestive heart failure. Looking for such markers in laboratory tests may be a reliable predictor of future disease.

VOCABULARY REVIEW

In the previous section, you learned terms relating to diagnosis, clinical procedures, and laboratory tests. Before going on to the exercises, review the terms below and refer to the previous section if you have questions. Pronunciations are provided for certain terms. Sometimes information about where the word came from is included after the term. The etymologies (word histories) are for your information only. You do not need to memorize them.

Term	Definition
angiocardiology [än-jē-ō-kär-dē-ŎG-rä-fē] angio-, vessel + cardio-, heart + -graphy, a recording	Viewing of the heart and its major blood vessels by x-ray after injection of a contrast medium.
angiography [än-jē-ŎG-rä-fē] angio- + -graphy	Viewing of the heart’s major blood vessels by x-ray after injection of a contrast medium.
aortography [ā-ōr-TŎG-rä-fē] aorto-, aorta + -graphy	Viewing of the aorta by x-ray after injection of a contrast medium.
arteriography [är-tēr-ē-ŎG-rä-fē] arterio-, artery + -graphy	Viewing of a specific artery by x-ray after injection of a contrast medium.
auscultation [äws-kül-TĀ-shŭn]	Process of listening to body sounds via a stethoscope.
cardiac catheterization [käth-ě-tēr-ī-ZĀ-shŭn]	Process of passing a thin catheter through an artery or vein to the heart to take blood samples, inject a contrast medium, or measure various pressures.
cardiac enzyme tests/studies	Blood tests for determining levels of enzymes during a myocardial infarction; serum enzyme tests.
cardiac MRI	Viewing of the heart by magnetic resonance imaging.
cardiac scan	Process of viewing the heart muscle at work by scanning the heart of a patient into whom a radioactive substance has been injected.

Term	Definition
cholesterol [kō-LĚS-tĕr-ōl]	Fatty substance present in animal fats; cholesterol circulates in the bloodstream, sometimes causing arterial plaque to form.
digital subtraction angiography	Use of two angiograms done with different dyes to provide a comparison between the results.
Doppler [DŌP-lĕr] ultrasound After Christian Doppler (1803–1853), Austrian physicist	Ultrasound test of blood flow in certain blood vessels.
echocardiography [ĕk-ō-kār-dĕ-ŌG-ră-fĕ] echo-, sound + cardio- + -graphy	Use of sound waves to produce images showing the structure and motion of the heart.
ejection fraction	Percentage of the volume of the contents of the left ventricle ejected with each contraction.
electrocardiography [ĕ-lĕk-trō-kār-dĕ-ŌG-ră-fĕ] electro-, electrical + cardio- + -graphy	Use of the electrocardiograph in diagnosis.
Holter [HŌL-tĕr] monitor After Norman Holter (1914–1983), U.S. biophysicist	Portable device that provides a 24-hour electrocardiogram.
lipid profile [LĪP-ĭd] Greek <i>lipos</i> , fat	Laboratory test that provides the levels of lipids, triglycerides, and other substances in the blood.
multiple-gated acquisition (MUGA) angiography	Radioactive scan showing heart function.
phlebography [flĕ-BŌG-ră-fĕ] phlebo-, vein + -graphy	Viewing of a vein by x-ray after injection of a contrast medium.
positron emission tomography (PET) scan [tō-MŌG-ră-fĕ]	Type of nuclear image that measures movement of areas of the heart.
serum enzyme tests	Laboratory tests performed to detect enzymes present during or after a myocardial infarction; cardiac enzyme studies.
sonography [sō-NŌG-ră-fĕ] Latin <i>sonus</i> , sound + -graphy	Production of images based on the echoes of sound waves against structures.
sphygmomanometer [SFĪG-mō-mă-NŌM-ĕ-tĕr] sphygmo-, pulse + Greek <i>manos</i> , thin + -meter	Device for measuring blood pressure.
stress test	Test that measures heart rate, blood pressure, and other body functions while the patient is exercising on a treadmill.
triglyceride [tri-GLĪS-ĕr-ĭd] tri-, three + glyceride	Fatty substance; lipid.
venography [vē-NŌG-ră-fĕ] veno-, vein + -graphy	Viewing of a vein by x-ray after injection of a contrast medium.
ventriculogram [vēn-TRĪK-yū-lō-grām] ventricle + -gram, a recording	X-ray of a ventricle taken after injection of a contrast medium.

CASE STUDY

Diagnosing the Problem

Dr. Woodard, the admitting physician, had made notations on the patient's chart, but her shift ended before the results of the tests she had ordered were in. The doctor on call that night was Dr. Mirkhan, a cardiologist. He agreed with Nurse Aquino that the patient's pallor and disorientation warranted further tests. First, Dr. Mirkhan reviewed the ECG that Dr. Woodard had ordered. It showed a sinus rhythm with Q waves in 2 AVF and a mild ST elevation in V2 and V3. Dr. Mirkhan ordered some more laboratory tests to help in his diagnosis of

Mr. Davino's current condition. He made the additions to Mr. Davino's record. He also made some notes for Mr. Davino's personal physician.

Critical Thinking

78. From the notations added to the chart, is his **yes** cholesterol still high?
79. Which of his laboratory tests shows an abnormal level that can often be corrected by dietary changes? **cholesterol**

MEDICAL RECORD		PROGRESS NOTES
DATE 8/15/XX	3:30 pm Have reviewed nursing notes. Chest clear to auscultation bilaterally with mild crackles; Heart rate and rhythm regular; no audible murmur; no rubs; ECG, blood gases, and SED rate were ordered. Recommend transfer to CCU.—A. Mirkhan, M.D.	
8/15/XX	9 pm BP 162/96; temp 100.8°; start IV; ECG, blood gases.—A. Mirkhan, M.D.	
8/16/XX	2 am ECG—sinus rhythm with Qwaves in 2AVF; mild ST elevation in V2 and V3; cholesterol 296; SED rate 15 mm/1 hr.—A. Mirkhan, M.D.	

PATIENT'S IDENTIFICATION (For typed or written entries give: Name—last, first, middle; grade; rank; hospital or medical facility) <i>Davino, Joseph A.</i> 000-77-9999	REGISTER NO.	WARD NO. 4B
	PROGRESS NOTES STANDARD FORM 509	

DIAGNOSTIC, PROCEDURAL, AND LABORATORY TERMS EXERCISES

Apply What You Learn

Dr. Mirkhan also works in private practice. Patients' notes from his practice that follow give you an idea of the types of clinical problems he treats.

80. What is Marvin's diagnosis? _____
81. List five laboratory tests Dr. Mirkhan reviewed on 9/7/xx.

Patient name <u>Angela O'Toole</u> Age <u>57</u> Current Diagnosis <u>angina</u>	
DATE/TIME 9/7/XX 9:30	<i>Exercise thallium test with no post-exercise changes; continue current medication.</i>
Patient name <u>Marvin Hochstadter</u> Age <u>64</u> Current Diagnosis <u>arteriosclerosis</u>	
DATE/TIME 9/7/XX 10:15	<i>Two-year post angioplasty; SOB; cardiac pain; schedule cardiac catheterization.</i>
Patient name <u>Lou Lawisky</u> Age <u>49</u> Current Diagnosis <u>unstable angina</u>	
DATE/TIME 9/7/XX 1:20	<i>Negative stress radiolite scan to 1.2 MET; peak heart rate of 153/min with no ischemia or infarction; epigastric burning, no angina; recommend Tagamet to control reflux.</i>
Patient name <u>Marlena Castelli</u> Age <u>68</u> Current Diagnosis <u>R/O MI</u>	
DATE/TIME 9/7/XX 2:30	<i>Neck and jaw discomfort; two previous MIs (last 1/23/XX); PTCA 2/6/XX; BP 126/84, pulse 88, heart: Apical impulse discrete. S1 and S2 are regular in rate and intensity. There is an S4 gallop, no S3 gallop, no cardiac murmur. Laboratory: Sodium 142, potassium 3.7, CO₂ 29, chloride 103, creatinine 1.1, BUN 13, cholesterol 293, triglycerides 28; HDL 35; LDL 156; CPK 133.</i>

Pathological Terms

Cardiovascular disease (CVD) can have many causes and can take many forms. Some diseases are caused by heredity or a congenital anomaly, whereas others may be caused by other pathology or by lifestyle factors (**risk factors**), such as poor diet, smoking, and lack of exercise.

Almost one-third of all deaths in Western countries are attributed to heart disease.

Heart Rhythm

The rhythm of the heart maintains the blood flow through and in and out of the heart. Abnormal rhythms are called **arrhythmias** or dysrhythmias. Figure 6-12 shows a patient with an arrhythmia being treated with an automated external defibrillator (AED). Heart rates may be too slow (**bradycardia**), too fast (**tachycardia**), or irregular (also called **atrial fibrillation**, **fibrillation**, or **dysrhythmia**). Ventricular fibrillation is considered lethal and must be treated immediately. A **flutter** is a rapid but regular heartbeat. The heart rate may be regular, but the sound of the heartbeat may be abnormal (**bruit**, heard on auscultation of the carotid artery, or **murmur**, a soft humming sound), which may indicate valve leakage. A new murmur heard during a heart attack may indicate a rupture of the heart muscle, which is life-threatening and an urgent surgical emergency. Other sounds indicate

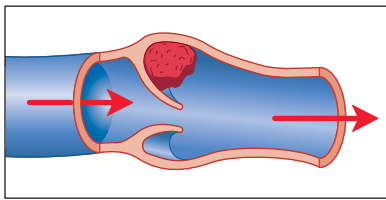


FIGURE 6-12 An automated external defibrillator (AED) is used for patients with a sudden arrhythmia.

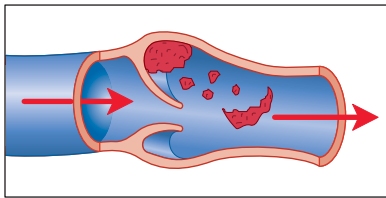
specific problems; for example, a **rub** (a frictional sound) usually indicates a pericardial murmur, and a **gallop** (a triple heart sound) usually indicates serious heart disease. Some pulsations of the heart (**palpitations**) can be felt by the patient as thumping in the chest. An **atrioventricular block** or **heart block** is caused by a blocking of impulses from the AV node. The electrical impulses of the heart control contractions. Irregularities in the heart's contractions, such as **premature atrial contractions (PACs)** or **premature ventricular contractions (PVCs)**, can cause palpitations.

Blood Pressure

Abnormalities in blood pressure (**hypertensive heart disease**) can damage the heart as well as other body systems. If the blood pressure is too high (**hypertension** or **high blood pressure**) or too low (**hypotension** or **low blood pressure**), the blood vessels do not have the proper pressure of blood flowing through them. **Essential hypertension** is high blood pressure that is *idiopathic* or without any known cause. **Secondary hypertension** has a known cause, such as a high-salt diet, renal disease, adrenal gland disease, and so on. Hypertension is the most common cardiovascular disease. Hypotension often results from another disease process or trauma (as in shock). Hypotension may lead to fainting or becoming unconscious. Extremely low hypotension may lead to death.



A thrombus.



An embolus.

FIGURE 6-13 A thrombus is a stationary blood clot, while an embolus is a traveling mass of material that blocks a blood vessel.

Diseases of the Blood Vessels

Blood vessels can become damaged, diseased, or even destroyed, as when **plaque**, buildup of fatty material, is deposited on the wall of an artery. An **atheroma** is plaque specifically on the wall of an artery, which can build up to cause **atherosclerosis**. An **embolus** is a mass traveling through the bloodstream causing a blockage in the vessel. A **thrombus** is a stationary blood clot, usually formed from elements of the blood. Figure 6-13 shows the difference between an embolus and a thrombus. **Thrombophlebitis** is an inflammation of a vein with a thrombus. **Thrombosis** is the presence of a thrombus in a blood vessel. **Deep vein thrombosis (DVT)** forms in a deep vein or in a vein within a structure rather than one on the surface of a structure. **Thrombotic occlusion** is the occlusion or closing of a vessel caused by a thrombus. Any blockage in a blood vessel can lead to *ischemia*, or insufficient blood flow.

Blood vessels can have a **constriction**, or narrowing, due to contraction. An **occlusion** is the closing off of a blood vessel due to a blockage. A weakness in an artery wall can cause a ballooning or **aneurysm**, which can fatally rupture. Loss of elasticity or hardening of the arteries (**arteriosclerosis**) can lessen blood flow. Inadequate blood supply, particularly to the blood vessels in the legs, causes **claudication**, limping. **Intermittent claudication**, irregular attacks of claudication, is helped by resting.

Peripheral vascular disease is a general term for vascular disease in the lower extremities. A sudden drop in the supply of blood to a vessel (an **infarction**) can cause an area of dead tissue, or **necrosis** (an **infarct**). The general term for lack of flow through a blood vessel is **perfusion deficit**. An area of blood insufficiency in the body is called **ischemia**. Insufficiently oxygenated areas of the body may develop **cyanosis**, a bluish or purplish discoloration of the skin caused by deficient oxygenation of the blood.

Veins sometimes become twisted or enlarged (**varicose veins**). **Hemorrhoids** are varicose veins in the anal region. An inflammation of a vein is called **phlebitis** (which most often occurs in the lower legs). An inflammation of an artery is called **arteritis**. Minute hemorrhages in the blood vessels in the skin are called **petechiae**.

Numbness or pain in the fingers caused by arterial spasms is called **Raynaud's phenomenon**. Raynaud's phenomenon may be an indicator of some serious connective tissue or autoimmune diseases. Most often, it is a reaction to cold or to emotional stress. Once a "trigger" starts the phenomenon, three color changes usually take place. First, the finger(s) turn absolutely white when the blood flow is blocked by the spasm; second, the finger becomes cyanotic from the slow return of blood to the site; and third, as blood fills the finger, a darker red color appears. Treatment of Raynaud's not linked to another disease is usually as simple as wearing gloves when removing items from the freezer and when going out in cold weather. *Buerger's Disease* is an inflammation of the peripheral arteries and veins in the arms and legs with clot formations. Symptoms of Buerger's include intense pain in the affected area that is exacerbated or aggravated by exercise and relieved by rest. The primary cause of Buerger's is long-term smoking of tobacco that results in clot formation in the vessels until the entire vessel is destroyed and circulation to that area is seriously compromised.

There are three basic forms of aneurysms; **saccular** which is a bulge in one arterial wall that involves all three of the vessel layers; **fusiform** which has both walls in the same area ballooning outward; and **dissecting** where the arterial wall splits allowing blood to enter into the vessel and blood within the artery to flow in both directions.

Coronary Artery Disease

Coronary artery disease (CAD) refers to any condition that reduces the nourishment the heart receives from the blood flowing through the arteries of the heart. Such diseases include **aortic stenosis** or narrowing of the aorta. **Coarctation of the aorta** is also an abnormal narrowing of the aorta. **Stenosis** is any narrowing of a blood vessel. **Pulmonary artery stenosis** slows the flow of blood to the lungs. **Angina** or **angina pectoris** (sometimes referred to as cardiac pain) can result from lack of oxygen to the heart muscle. Angina is usually categorized in degrees from class I to class IV. A person with class I angina (able to withstand prolonged exertion) will have no limits to normal activity. Severe angina (class IV) requires strict limitations on any activity except rest.

General Heart and Lung Diseases

When the heart suffers an attack that causes insufficient blood flow to the heart or ischemia, one is said to have a *coronary* or *heart attack*. These are informal terms for a **myocardial infarction (MI)** or *acute myocardial infarction (AMI)*, a disruption in the heart's activity usually caused by blockage (a clot or plaque) of blood flow to a coronary artery. Myocardial infarctions are often classified by the location of the area to which blood flow is restricted; for example, an anterior myocardial infarction is one in which the anterior wall of the heart is affected, and a posterior one involves the heart's posterior wall.

Cardiac arrest or **asystole** is a sudden stopping of the heart. Such an attack can be fatal or, with treatment, can be a warning to make medical and lifestyle changes to ward off a further attack. Approximately 1.5 million people suffer heart attacks annually. One-third of these people do not survive. Before age 50, men are much more likely to suffer heart attacks than are

The survival rate of patients who have suffered cardiac arrest depends on many factors, the more important ones being (1) the size of the infarct, (2) the patient's age, (3) the development of complications and presence of other diseases, and (4) how rapidly emergency care was received. Mortality rates vary from about 6 percent in patients who have had small MI's to more than 50 percent in patients with large MI's and who do not receive immediate emergency care.

women, who are thought to be protected by their production of estrogen before menopause. After menopause, the risk for women is approximately the same as for men. In March 2008, in a major announcement, the American Heart Association (AHA) issued an advisory statement regarding revisions in how CPR was to be performed on a patient suffering cardiac arrest. Called "Hands-Only CPR," the directive included the recommendation that lay persons or bystanders should perform CPR using hands-only chest compressions without attempting to give the patient mouth-to-mouth breaths or rescue breaths. Hands-only CPR calls for immediate activation of 911 and then uninterrupted chest presses at a rate of approximately 100 per minute until paramedics take over or an automated external defibrillator (AED) is available to restore a normal or sustainable heart rhythm. Although not recommended for children or infants, experts hope bystanders will now be more willing to help if they see someone suddenly collapse. Hands-only CPR is simpler and easier to remember and removes a big barrier for people skittish about the mouth-to-mouth breathing.

Some diseases of the heart are specific inflammations, such as **endocarditis**, **myocarditis**, **pericarditis**, or **bacterial endocarditis**. Other conditions of the heart have to do with fluid accumulation. **Congestive heart failure** occurs when the heart is unable to pump the necessary amount of blood. People suffering from congestive heart failure usually experience shortness of breath, edema, enlarged organs and veins, and irregular breathing patterns. **Pulmonary edema** or accumulation of fluid in the lungs can result from this failure. Fluid accumulation in the pericardial sac causes **cardiac tamponade**.

An **intracardiac tumor** is a tumor in a heart chamber. **Cardiomyopathy** is disease of the heart muscle.

Valve Conditions

The heart valves control the flow of blood into, through, and out of the heart. Valve irregularities affecting the flow of blood can be serious. **Aortic regurgitation** or **reflux** is a backward flow of blood through the aortic valve. An abnormal narrowing of the opening of the mitral valve (**mitral stenosis**) affects the opening and closing of the valve. **Mitral insufficiency** or **reflux** is a backward flow of blood through the mitral valve. Similarly, **mitral valve prolapse** is a backward flow of blood, but it is due to the abnormal protrusion of one or both of the mitral cusps into the left atrium. **Tricuspid stenosis** is an abnormal narrowing of the opening of the tricuspid valve.

MORE ABOUT . . .

Familiar Terms for Heart Disease

Cardiovascular disease is a common ailment all Americans today. Many familiar terms are used by lay people to describe common cardiovascular diseases and procedures. A myocardial infarction may be called a *coronary* or a *heart attack*. Arteriosclerosis is often referred to as *hardening of the arteries*. Congestive heart failure may be called *heart failure*. *Vein stripping* is a common term for removal of veins for transplanting elsewhere or for treating varicosities.

Sometimes, infections or inflammation may cause valve damage. **Valvulitis** is the general term for a heart valve inflammation. **Rheumatic heart disease** is damage to the heart, usually to the valves, caused by an untreated streptococcal infection. Some infections can cause a clot on a heart valve or opening (**vegetation**).

Congenital Heart Conditions

Congenital heart disease results from a condition present at birth. Some common conditions are **patent ductus arteriosus**, a disease in which a small duct remains open at birth; **septal defect**, an abnormal opening in the septum between the atria or ventricles; and **tetralogy of Fallot**, actually a combination of four congenital heart abnormalities (ventricular septal defect, pulmonary stenosis, incorrect position of the aorta, and right ventricular hypertrophy) that appear together.

VOCABULARY REVIEW

In the previous section, you learned terms relating to pathology. Before going on to the exercises, review the terms below and refer to the previous section if you have questions. Pronunciations are provided for certain terms. Sometimes information about where the word came from is included after the term. The etymologies (word histories) are for your information only. You do not need to memorize them.

Term	Definition
aneurysm [ĂN-yū-rĭzm] Greek <i>aneurysma</i> , dilation	Ballooning of the artery wall caused by weakness in the wall.
angina [ĂN-jĭ-nă, ăn-JĪ-nă] Latin, sore throat	Angina pectoris.
angina pectoris [PĚK-tōr-ĭs, pĕk-TŌR-ĭs] Latin, sore throat of the chest	Chest pain, usually caused by a lowered oxygen or blood supply to the heart.
aortic regurgitation [rĕ-GŪR-jĭ-TĀ-shŭn] or reflux [RĔ-flŭks]	Backward flow or leakage of blood through a faulty aortic valve.
aortic stenosis [stĕ-NŌ-sĭs]	Narrowing of the aorta.
arrhythmia [ă-RĪTH-mĕ-ă] a-, without + Greek <i>rhythmos</i> , rhythm	Irregularity in the rhythm of the heartbeat.
arteriosclerosis [ăr-TĔR-ĕ-ō-sklĕr-Ō-sĭs] arterio-, artery + sclerosis	Hardening of the arteries.
arteritis [ăr-tĕr-Ī-tĭs] arter-, artery + -itis, inflammation	Inflammation of an artery or arteries.
asystole [ă-SĪS-tō-lĕ] a- + Greek <i>systole</i> , a contracting	Cardiac arrest.
atheroma [ăth-ĕr-Ō-mă] ather-, fatty matter + oma, tumor	A fatty deposit (plaque) in the wall of an artery.

Term	Definition
atherosclerosis [ĂTH-ēr-ō-sklēr-ō-sĭs] athero-, fatty matter + sclerosis	Hardening of the arteries caused by the buildup of atheromas.
atrial fibrillation [fĭ-brĭ-LĀ-shŭn]	An irregular, usually rapid, heartbeat caused by overstimulation of the AV node.
atrioventricular block atrio-, atrium + ventricle	Heart block; partial or complete blockage of the electrical impulses from the atrioventricular node to the ventricles.
bacterial endocarditis	Bacterial inflammation of the inner lining of the heart.
bradycardia [brād-ē-KĀR-dē-ă] brady-, slow + Greek <i>kardia</i> , heart	Heart rate of fewer than 60 beats per minute.
bruit [brū-Ē] French, noise	Sound or murmur, especially an abnormal heart sound heard on auscultation, especially of the carotid artery.
cardiac arrest	Sudden stopping of the heart; also called asystole.
cardiac tamponade [tām-pō-NĀD]	Compression of the heart caused by fluid accumulation in the pericardial sac.
cardiomyopathy [KĀR-dē-ō-mĭ-ŎP-ă-thē] cardio-, heart + myo-, muscle + -pathy, disease	Disease of the heart muscle.
claudication [klăw-dĭ-KĀ-shŭn] Latin <i>claudicatio</i> , limping	Limping caused by inadequate blood supply during activity; usually subsides during rest.
coarctation [kō-ărk-TĀ-shŭn] of the aorta Latin <i>coarcto</i> , to press together	Abnormal narrowing of the aorta.
congenital [kŏn-JĔN-Ĭ-tăł] heart disease	Heart disease (usually a type of malformation) that exists at birth.
congestive [kŏn-JĔS-tĭv] heart failure	Inability of the heart to pump enough blood out during the cardiac cycle; collection of fluid in the lungs results.
constriction [kŏn-STRĪK-shŭn]	Compression or narrowing caused by contraction, as of a vessel.
coronary artery disease	Condition that reduces the flow of blood and nutrients through the arteries of the heart.
cyanosis [sĭ-ă-NŎ-sĭs] Greek, dark blue color	Bluish or purplish coloration, as of the skin, caused by inadequate oxygenation of the blood.
deep vein thrombosis [thrŏm-BŎ-sĭs]	Formation of a thrombus (clot) in a deep vein, such as a femoral vein.
dysrhythmia [dĭs-RĪTH-mē-ă] dys-, difficult + Greek <i>rhythmos</i> , rhythm	Abnormal heart rhythm.
embolus [ĔM-bŏ-lŭs] Greek <i>embolos</i> , plug	Mass of foreign material blocking a vessel.

Term	Definition
endocarditis [ĔN-dō-kār-DĪ-tĭs] endo-, within + card-, heart + -itis, inflammation	Inflammation of the endocardium, especially an inflammation caused by a bacterial (for example, staphylococci) or fungal agent.
essential hypertension	High blood pressure without any known cause.
fibrillation [fĭ-brĭ-LĀ-shŭn] Latin <i>fibrilla</i> , little fiber	Random, chaotic, irregular heart rhythm.
flutter	Regular but very rapid heartbeat.
gallop	Triple sound of a heartbeat, usually indicative of serious heart disease.
heart block	See atrioventricular block.
hemorrhoids [HĔM-ō-rŏydz] Greek <i>haima</i> , blood + <i>rhoia</i> , flow	Varicose condition of veins in the anal region.
high blood pressure	See hypertension.
hypertension [HĪ-pĕr-TĔN-shŭn] hyper-, excessive + tension	Chronic condition with blood pressure greater than 140/90.
hypertensive heart disease	Heart disease caused, or worsened, by high blood pressure.
hypotension [HĪ-pō-TĔN-shŭn] hypo-, below normal + tension	Chronic condition with blood pressure below normal.
infarct [ĪN-fārkt] Latin <i>infarcto</i> , to stuff into	Area of necrosis caused by a sudden drop in the supply of arterial or venous blood.
infarction [Īn-FĀRK-shŭn]	Sudden drop in the supply of arterial or venous blood, often due to an embolus or thrombus.
intermittent claudication	Attacks of limping, particularly in the legs, due to ischemia of the muscles.
intracardiac [ĭn-tră-KĀR-dĕ-ăk] tumor intra-, within + cardiac	A tumor within one of the heart chambers.
ischemia [ĭs-KĔ-mĕ-ă] From Greek <i>ischo</i> , to keep back + <i>haima</i> , blood	Localized blood insufficiency caused by an obstruction.
low blood pressure	See hypotension.
mitral [MĪ-tră] insufficiency or reflux	Backward flow of blood due to a damaged mitral valve.
mitral stenosis	Abnormal narrowing at the opening of the mitral valve.
mitral valve prolapse	Backward flow of blood into the left atrium due to protrusion of one or both mitral cusps into the left atrium during contractions.
murmur	Soft heart humming sound heard between normal beats.

Term	Definition
myocardial infarction myocardi(um) + -al, pertaining to	Sudden drop in the supply of blood to an area of the heart muscle, usually due to a blockage in a coronary artery.
myocarditis [MĪ-ō-kār-DĪ-tis] myocard(ium) + -itis	Inflammation of the myocardium.
necrosis [nĕ-KRŌ-sis] Greek <i>nekrosis</i> , death	Death of tissue or an organ or part due to irreversible damage; usually a result of oxygen deprivation.
occlusion [ō-KLŪ-zhŭn] From Latin <i>ob-</i> , against + <i>claudo</i> , to close	The closing of a blood vessel.
palpitations [pāl-pĭ-TĀ-shŭnz] Latin <i>palpito</i> , to throb	Uncomfortable pulsations of the heart felt as a thumping in the chest.
patent ductus arteriosus [PĀ-tĕnt DŪK-tŭs ār-tĕr-ĕ-Ō-sis]	A condition at birth in which the ductus arteriosus, a small duct between the aorta and the pulmonary artery, remains abnormally open.
perfusion deficit	Lack of flow through a blood vessel, usually caused by an occlusion.
pericarditis [PĔR-ĭ-kār-DĪ-tis] pericard(ium) + -itis	Inflammation of the pericardium.
peripheral vascular disease	Vascular disease in the lower extremities, usually due to blockages in the arteries of the groin or legs.
petechiae (<i>sing.</i> , petechia) [pĕ-TĔ-kĕ-ĕ, pĕ-TĔK-ĕ-ĕ, (pĕ-TĔ-kĕ-ă, pĕ-TĔK-ĕ-ă)] Italian <i>petecchie</i>	Minute hemorrhages in the skin.
phlebitis [flĕ-BĪ-tis] phleb-, vein + -itis	Inflammation of a vein.
plaque [plāk] French, plate	Buildup of solid material, such as a fatty deposit, on the lining of an artery.
premature atrial contractions (PACs)	Atrial contractions that occur before the normal impulse; can be the cause of palpitations.
premature ventricular contractions (PVCs)	Ventricular contractions that occur before the normal impulse; can be the cause of palpitations.
pulmonary artery stenosis	Narrowing of the pulmonary artery, preventing the lungs from receiving enough blood from the heart to oxygenate.
pulmonary edema	Abnormal accumulation of fluid in the lungs.
Raynaud's phenomenon [rā-NŌZ] After Maurice Raynaud (1834–1881), French physician	Spasm in the arteries of the fingers causing numbness or pain.

Term	Definition
rheumatic heart disease Greek <i>rheumatikos</i> , subject to flux, the discharge of fluids	Heart valve and/or muscle damage caused by an untreated streptococcal infection.
risk factor	Any of various factors considered to increase the probability that a disease will occur; for example, high blood pressure and smoking are considered risk factors for heart disease.
rub	Frictional sound heard between heartbeats, usually indicating a pericardial murmur.
secondary hypertension	Hypertension having a known cause, such as kidney disease.
septal defect	Congenital abnormality consisting of an opening in the septum between the atria or ventricles.
stenosis [stĕ-NŌ-sĭs]	Narrowing, particularly of blood vessels or of the cardiac valves.
tachycardia [TĀK-ĭ-KĀR-dĕ-ă] tachy-, fast + Greek <i>kardia</i> , heart	Heart rate greater than 100 beats per minute.
tetralogy of Fallot [fă-LŌ] After Étienne-Louis A. Fallot (1850–1911), French physician	Set of four congenital heart abnormalities appearing together that cause deoxygenated blood to enter the systemic circulation: ventricular septal defect, pulmonary stenosis, incorrect position of the aorta, and right ventricular hypertrophy.
thrombophlebitis [THRŌM-bō-flĕ-BĪ-tĭs] thrombo-, thrombus + phleb- + -itis	Inflammation of a vein with a thrombus.
thrombosis [thrŏm-BŌ-sĭs] Greek, a clotting	Presence of a thrombus in a blood vessel.
thrombotic [thrŏm-BŌT-ĭk] occlusion	Narrowing caused by a thrombus.
thrombus [THRŌM-bŭs] Latin, clot	Stationary blood clot in the cardiovascular system, usually formed from matter found in the blood.
tricuspid stenosis	Abnormal narrowing of the opening of the tricuspid valve.
valvulitis [văl-vyū-LĪ-tĭs] New Latin <i>valvula</i> , valve + -itis	Inflammation of a heart valve.
varicose [VĀR-ĭ-kōs] vein Latin <i>varix</i> , dilated vein	Dilated, enlarged, or twisted vein, usually on the leg.
vegetation [vēj-ĕ-TĀ-shŭn]	Clot on a heart valve or opening, usually caused by infection.

CASE STUDY

Applying Medical Technology to Reimbursement

Mr. Davino had a follow-up visit in Dr. Mirkhan's office. The doctor's billing clerk received the records and notes for Mr. Davino. Mr. Davino's insurance company will pay the claim once the doctor's office submits it for payment. A section of the claim is shown below

Critical Thinking

82. On the claim, what is the procedure code for the service provided to Mr. Davino?
83. On the claim, what is the code for Mr. Davino's diagnosis?

24.	A DATE(S) OF SERVICE						B Place of Service	C Type of Service	D PROCEDURES, SERVICES, OR SUPPLIES		E DIAGNOSIS CODE	F \$ CHARGES		G DAYS OR UNITS	H EPSDT Family Plan	I EMG	J COB	K RESERVED FOR LOCAL USE
	From MM	DD	YY	To MM	DD	YY			CPT/HCPCS	MODIFIER								
1	08	15	XXXX					82803		I	74	00	1					
2																		
3																		
4																		
5																		
6	25. FEDERAL TAX I.D. NUMBER		SSN		EIN		26. PATIENT'S ACCOUNT NO.		27. ACCEPT ASSIGNMENT? (For govt. claims, see back)		28. TOTAL CHARGE		29. AMOUNT PAID		30. BALANCE DUE			
	12-34-56789		<input checked="" type="checkbox"/>		<input type="checkbox"/>		000-77-9999		<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		\$ 74 00		\$		\$ 74 00			

PHYSICIAN OR SUPPLIER INFORMATION

PATHOLOGICAL TERMS EXERCISES

Make an Educated Guess

For each of the following four situations, insert the likely age of the patient from the following age ranges. Use each range only once.

- A. 0–2
- B. 11–18
- C. 40–55
- D. 67–90

84. A patient going into surgery for a septal defect _____
85. Arteriosclerosis with pulmonary edema _____
86. Cardiac arrest of an athlete during a stressful game _____
87. Hypertension due to stress _____

Check Your Knowledge

Complete the sentences below by filling in the blanks.

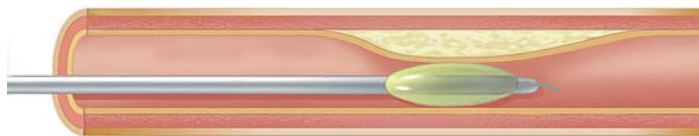
88. Heart rhythms may be dangerously fast (called _____) or dangerously slow (called _____).
89. Atrial fibrillation is another name for _____ or _____, irregular rhythm.
90. An embolus travels in the blood while a(n) _____ is stationary.

91. An abnormal sound heard on auscultation is called a(n) _____.
92. An abnormal heartbeat with a soft humming sound is called a(n) _____.
93. The most common cardiovascular disease is _____.
94. Smoking, poor diet, and lack of exercise are _____ _____ for heart disease.
95. A heart attack is also called a(n) _____ _____.

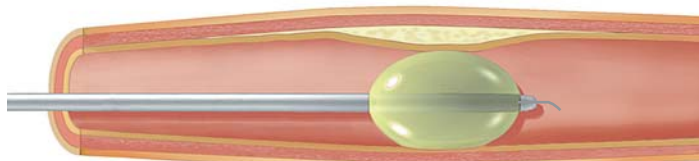
Surgical Terms

Cardiovascular surgery usually involves opening up or repairing blood vessels or valves; removal, repair, or replacement of diseased portions of blood vessels; or bypass of blocked areas. The goal of most cardiovascular surgery is to improve blood flow, thereby allowing proper oxygenation and nourishment of all the cells of the body. Many types of heart surgery are now *minimally invasive procedures*. Most heart operations require opening up the chest to access the heart. However, devices such as lasers, robotic devices, and miniature surgical instruments now allow surgeons to perform certain procedures through a “keyhole,” a small opening in the chest.

A balloon catheter is used in **balloon catheter dilation** (also called **percutaneous transluminal coronary angioplasty** or **PTCA**) to open the passageway inside a blood vessel so that blood can flow freely (see Figure 6-14).



Narrowed artery with balloon catheter positioned.



Inflated balloon presses against arterial wall.

FIGURE 6-14 Balloon catheter dilation.

MORE ABOUT . . .

Surgical Devices

New surgical devices are being developed all the time. The Da Vinci System is a robotic device that uses a tiny camera with multiple lenses inserted into the patient’s chest, providing a three-dimensional image of the heart. The surgeon, at a nearby computer workstation, watches through a viewer to see inside the chest as a pair of joysticks control two robotic arms. The arms hold specially designed surgical instruments that mimic the actual movement of the surgeon’s hands on the joysticks. This allows for minimal incision into the patient.

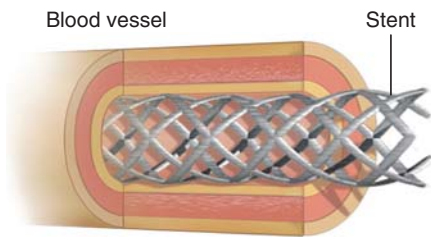


FIGURE 6-15 Drug-eluting stent.

A **balloon valvuloplasty** involves the use of a balloon catheter to open narrowed cardiac valve openings. Similarly, **angioplasty** or **coronary angioplasty** is the opening of a blood vessel using a balloon catheter. *Cardiac catheterization* uses a catheter threaded through an artery or vein into the heart to observe blood flow. It is the most common type of operation performed in the United States; over 1 million operations are performed annually. **Angioscopy** uses a fiberoptic catheter to view the interior of a blood vessel. Surgery that involves the use of cardiac catheterization is called **endovascular surgery**. During surgery, a **stent** or an **intravascular stent** may be inserted to hold a blood vessel passageway open. Many stents are now *drug-eluting* stents (Figure 6-15), meaning that they include slowly released medication that helps to maintain the open passageways. Such procedures also help to break up blockages.

Sometimes it becomes necessary to create a detour or a **bypass** around blockages. **Coronary bypass surgery** or **CABG** (coronary artery bypass graft) is performed to attach the vessel to be used for the bypass. A **graft**, particularly of a blood vessel from another part of the body, can be used to bypass an arterial blockage. Saphenous (leg) veins or mammary (chest) arteries are two types of vessels used for this procedure. The number of arteries that are bypassed determines whether a CABG is a triple (three arteries bypassed) bypass, a quadruple (four) bypass, and so on. **Fontan's operation** creates a bypass from the right atrium to the main pulmonary artery. Sometimes it is necessary to divert blood flow from the heart during surgery. This procedure, **cardiopulmonary bypass** (also called *extracorporeal circulation*), circulates the blood through a heart-lung machine and back into systemic circulation.



FIGURE 6-16 Phlebotomists must follow standard precautions when drawing blood.

Surgical removal and replacement of the entire heart is called a **heart transplant**. **Valve replacement** is the removal and replacement of a heart valve. Surgical removal of a thrombus is a **thrombectomy**; of an embolus, an **embolectomy**; of an atheroma, an **atherectomy**; and of hemorrhoids, a **hemorrhoidectomy**. An **endarterectomy** removes the diseased lining of an artery, while an **arteriotomy** is an incision into an artery, as to remove a clot. A **valvotomy** is the incision into a cardiac valve to remove an obstruction. **Venipuncture** is a small puncture for the purpose of drawing blood (**phlebotomy**). Figure 6-16 shows a phlebotomist preparing to draw blood from a patient.

Some surgeries are for the purpose of reconstruction or repair—a **valvuloplasty** is done to reconstruct a cardiac valve. Other surgical procedures, such as **anastomosis**, are performed to connect blood vessels and to implant devices, such as *pacemakers*, that help regulate body functions. Pacemakers are small computers that provide electrical stimulation to regulate the heart rate. They can be attached temporarily (usually with a small box worn outside the body and a sensor attached to the outside of the chest) or permanently (the lead is surgically inserted into a blood vessel leading to the heart).

VOCABULARY REVIEW

In the previous section, you learned terms relating to surgery. Before going on to the exercises, review the terms below and refer to the previous section if you have questions. Pronunciations are provided for certain terms. Sometimes information about where the word came from is included after the term. The etymologies (word histories) are for your information only. You do not need to memorize them.

Term	Definition
anastomosis [ă-năs-tō-MŌ-sīs] Greek, to furnish with a mouth	Surgical connection of two blood vessels to allow blood flow between them.
angioplasty [ĂN-jē-ō-plās-tē] angio-, vessel + -plasty, repair	Opening of a blocked blood vessel, as by balloon dilation.
angiосcopy [ăn-jē-ŌS-kō-pē] angio- + -scopy, viewing	Viewing of the interior of a blood vessel using a fiberoptic catheter inserted or threaded into the vessel.
arteriotomy [ăr-tēr-ē-ŌT-ō-mē] arterio-, artery + -tomy, cutting	Surgical incision into an artery, especially to remove a clot.
atherectomy [ăth-ě-RĚK-tō-mē] ather-, fatty matter + -ectomy, removal	Surgical removal of an atheroma.
balloon catheter dilation	Insertion of a balloon catheter into a blood vessel to open the passage so blood can flow freely.
balloon valvuloplasty [VĂL-vyū-lō-PLĂS-tē]	Procedure that uses a balloon catheter to open narrowed orifices in cardiac valves.
bypass	A structure (usually a vein graft) that creates a new passage for blood to flow from one artery to another artery or part of an artery; used to create a detour around blockages in arteries.
cardiopulmonary [KĂR-dē-ō-PŪL-mō-nēr-ē] bypass	Procedure used during surgery to divert blood flow to and from the heart through a heart-lung machine and back into circulation.
coronary angioplasty	See angioplasty.
coronary bypass surgery	See bypass.
embolectomy [ēm-bō-LĚK-tō-mē] embol(us) + -ectomy	Surgical removal of an embolus.
endarterectomy [ënd-ăr-tēr-ĚK-tō-mē] end-, within + arter-, artery + -ectomy	Surgical removal of the diseased portion of the lining of an artery.
endovascular [ën-dō-VĂS-kyū-lăr] surgery endo-, within + vascular	Any of various procedures performed during cardiac catheterization, such as angiосcopy and atherectomy.
Fontan's [FŌN-tănz] operation After François Fontan (1929–), French surgeon	Surgical procedure that creates a bypass from the right atrium to the main pulmonary artery; Fontan's procedure.
graft	Any tissue or organ implanted to replace or mend damaged areas.
heart transplant	Implantation of the heart of a person who has just died into a person whose diseased heart cannot sustain life.
hemorrhoidectomy [HĚM-ō-rōy-DĚK-tō-mē] hemorrhoid + -ectomy;	Surgical removal of hemorrhoids.

Term	Definition
intravascular stent intra-, within + vascular	Stent placed within a blood vessel to allow blood to flow freely.
percutaneous transluminal [pĕr-kyū-TĀ-nē-ŭs trĀns-LŪ-mĭn-Āl] coronary angioplasty	See balloon catheter dilation.
phlebotomy [flĕ-BŎT-ō-mĕ] phlebo-, vein + -tomy	Drawing blood from a vein via a small incision.
stent [stĕnt]	Surgically implanted device used to hold something (as a blood vessel) open.
thrombectomy [thrŏm-BĔK-tō-mĕ] thromb-, thrombus + -ectomy	Surgical removal of a thrombus.
valve replacement	Surgical replacement of a coronary valve.
valvotomy [vāl-VŎT-ō-mĕ] valve + -tomy	Incision into a cardiac valve to remove an obstruction.
valvuloplasty [VĀL-vyū-lō-PLĀS-tĕ] New Latin <i>valvula</i> , valve + -plasty	Surgical reconstruction of a cardiac valve.
venipuncture [VĔN-ĭ-pŭnk-chŭr, VĔ-nĭ-PŪNK-chŭr] veni-, vein + puncture	Small puncture into a vein, usually to draw blood or inject a solution.

CASE STUDY

Surgery Helps

Mr. Davino's progress is poor after three days in the hospital. After determining that his heart has extensive blockages, the doctors decide to perform a CABG on him. Mr. Davino has a smooth postoperative recovery. He is told that he must make some lifestyle changes and will have to attend a cardiac rehabilitation center as an outpatient.

Critical Thinking

96. What are some of the lifestyle changes the staff at the cardiac rehabilitation center will probably recommend?
97. Evaluate your own general cardiovascular health based on your lifestyle. What changes should you make to prevent heart disease?

SURGICAL TERMS EXERCISES

Check Your Knowledge

Define the following terms.

98. Anastomosis is _____
99. Valvuloplasty is _____
100. Valvotomy is _____
101. Embolectomy is _____
102. Angioplasty is _____

Spell It Correctly

Check the spelling of the following terms. If the term is spelled correctly, put “C” in the blank. If not, put the correct spelling.

103. thromboctomy _____

104. atherectomy _____

105. arteritomy _____

106. angiascopy _____

107. hemorrhoidectomy _____

108. valvotomy _____

109. veinipuncture _____

110. valvuloplasty _____

111. coronery _____

Pharmacological Terms

Drug therapy for the cardiovascular system generally treats the following conditions: angina, heart attack, high blood pressure, high cholesterol, congestive heart failure, rhythm disorders, and vascular problems. Many of the pharmacological agents treat several problems at once. Table 6-1 lists some of the medications commonly used to treat the cardiovascular system. These are just a sample of the many cardiovascular medications available. To find about more details about heart medications, go to www.americanheart.org and search medications.

TABLE 6-1 Medications for the Cardiovascular System

Drug Class	Purpose	Generic Name	Trade Name
coronary vasodilators	dilate veins, arteries, and coronary arteries; used to treat angina, myocardial infarction, congestive heart failure	nitroglycerin	Nitrocot, Nitrong, Deponit, Nitro-Dur, Nitro-Bid, Transderm-Nitro, and many others
beta blockers	reduce contraction strength of heart muscle; lower blood pressure; slow heartbeat	propranolol metoprolol atenolol bisoprolol	Inderal Lopressor Tenormin Zabeta
calcium channel blockers	inhibit ability of calcium ions to enter heart muscle and blood vessel muscle cells; reduce heart rate; lower squeezing strength of heart contraction; lower blood pressure; dilate coronary arteries to enhance blood flow; normalize some fast or irregular heartbeats	verapamil nifedipine diltiazem nicardipine amlodipine bepridil felodipine	Calan, Isoptin, Verelan Procardia, Adalat Cardizem, Dilacor XR Cardene Noravsc, Istin Vascor Plendil, Hydac
thrombolytics	dissolve blood clots	urokinase tissue-type plasminogen activator (tPA, TPA)	Abbokinase Activase

(continued)

TABLE 6-1 (continued)

Drug Class	Purpose	Generic Name	Trade Name
bile acid sequestrants	lipid-lowering medications that bind to bile acids and require more body cholesterol to create other bile acids; more cholesterol used up and hence lowered	cholestyramine colestipol colesevalam	Prevalite, Questran, Cholybar Colestid Welchol
lipid-lowering medications	reduce triglycerides and cholesterol (but mechanisms not totally understood)	atorvastatin lovastatin pravastatin simvastatin	Lipitor Mevacor Pravachol Zocor
centrally acting hypertensive agents, antihypertensive	decrease blood pressure by affecting brain control centers	methyldopa guanfacine guanabenz	Aldomet Tenex Wytensin
direct-acting vasodilators	lower blood pressure by relaxing walls of blood vessels	hydralazine minoxidil	Apresoline Loniten
peripherally acting hypertensive agents	lower blood pressure by affecting nerves involved in blood pressure regulation	guanadrel guanethidine mecamylamine prazosin rauwolfia alkaloids	Hylorel Ismelin Inversine Minipres Harmonyl, Raudixin,
ACE inhibitors	ease heart pumping and lower blood pressure by dilating arteries	lisinopril enalapril quinapril	Zestril, Prinivil Vasotec, Renitec Accupril
angiotensin II receptor blockers	block the action of angiotensin II, a chemical that causes blood vessels to narrow. The blood vessels then dilate and blood pressure is lowered.	lasartan valsartan irbesartan	Cozaar Diovin Avapro
diuretics	promote removal of water by kidneys to lower blood pressure and relieve edema	furosemide hydrochlorothiazide spironolactone bumetanide	Lasix Esidrix, Hydrodiuril Aldactone Bumex
combination diuretics		hydrochlorothiazide plus triamterene	Maxzide
inotropic agents	increase amount of blood the heart is able to pump by increasing squeezing strength of heart muscle	digitalis milrinone digoxin digitoxin dopamine	Primacor Lanoxin, Lanoxicap Crystodigin Intropin
antiarrhythmics	alter the electrical flow through the heart's conduction system thereby regulating fast or irregular heartbeats	quinidine procainamide disopyramide mexiletine	Cardioquin, Quinagulte, Quinidex, Quinora Procan SR, Pronestyl Norpace, Norpace CR Mexitil

TABLE 6-1 (continued)

Drug Class	Purpose	Generic Name	Trade Name
anticoagulants, ant clotting	reduce proteins involved in blood clotting so clots cannot form as readily	warfarin enoxaparin dicumarol heparin	Coumadin Lovenox
antiplatelet medications	reduce ability of blood platelets to clot	aspirin dipyridamole clopidogrel	(numerous) Persantine Plavix
hemorrhheologic agents	decrease viscosity of blood; used to treat claudication	pentoxifylline cukistazik	Trental Pletal

Antianginals relieve the pain and prevent attacks of angina. Three categories of drugs—**nitrates**, **beta blockers**, and **calcium channel blockers**—are used as antianginals. Figure 6-17 illustrates how antianginals can be administered. **Thrombolytics** are used to dissolve blood clots in heart-attack victims. **Tissue-type plasminogen activator (tPA or TPA)** is an agent used to prevent the formation of a thrombus. Nitrates and beta blockers are used to treat myocardial infarctions.

High blood pressure may require treatment with one drug or a combination of drugs. Such drugs are called **antihypertensives**. Beta blockers and calcium channel blockers are used along with a number of agents that affect the control centers in the brain that regulate blood pressure. **Vasodilators** relax the walls of the blood vessels. Other treatments for high blood pressure include **diuretics**, to relieve edema (swelling) and increase kidney function; **angiotensin converting enzyme (ACE) inhibitors**, which dilate arteries thus making it easier for blood to flow out of the heart; and agents that affect the nerves of the body. Congestive heart failure is treated with ACE inhibitors, diuretics, and **cardiotonics**, which increase myocardial contractions. In certain situations, **vasoconstrictors** may be needed to narrow blood vessels.

Rhythm disorders are treated with a number of medications (some are called **antiarrhythmics**) that normalize heart rate by affecting the nervous system that controls the heart rate. Beta blockers and calcium channel blockers may also be used for rhythm disorders.

Cholesterol is a substance the body needs in certain quantities. Excesses of certain kinds of cholesterol such as LDL can cause fatty deposits or plaque to form on blood vessels. **Lipid-lowering** drugs work in various ways (some of which are not understood) to help the body excrete unwanted cholesterol. Blood clotting in vessels can cause dangerous blockages. The most common type of lipid-lowering drugs are **statins**. The widespread use of statins is thought to be helping reduce the incidence of coronary artery disease. **Anticoagulants**, ant clotting and *antiplatelet* medications (such as **heparin**) inhibit the ability of the blood to clot. Other medications used for vascular problems may include drugs that decrease the thickness of the blood, or drugs that increase the amount of blood the heart is able to pump.

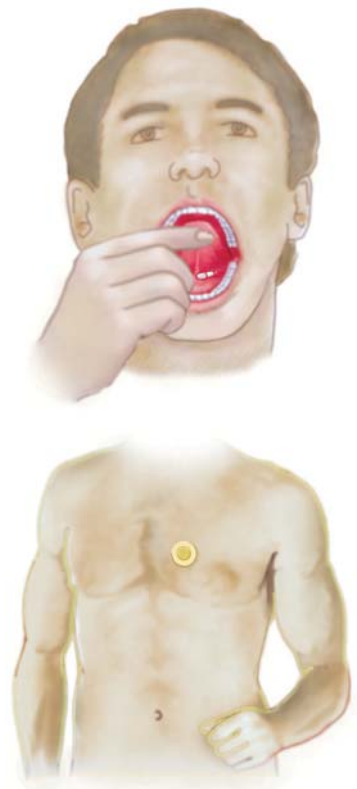


FIGURE 6-17 The most common antianginal is nitroglycerin, which is administered sublingually under the tongue or via a patch on the skin.

VOCABULARY REVIEW

In the previous section, you learned terms relating to pharmacology. Before going on to the exercises, review the terms below and refer to the previous section if you have questions. Pronunciations are provided for certain terms. Sometimes information about where the word came from is included after the term. The etymologies (word histories) are for your information only. You do not need to memorize them.

Agent	Purpose
angiotensin converting enzyme (ACE) inhibitor [ǎn-jē-ō-TĔN-sĭn] angio-, vessel + (hyper)tension	Medication used for heart failure and other cardiovascular problems; acts by dilating arteries to lower blood pressure and makes heart pump easier.
antianginal [ǎn-tē-ǺN-jĭ-nǎl] anti-, against + angina	Agent used to relieve or prevent attacks of angina.
antiarrhythmic [ǎn-tē-ā-RĪTH-mĭ] anti- + arrhythmic	Agent used to help normalize cardiac rhythm.
anticlotting anti- + clotting	See anticoagulant.
anticoagulant anti- + coagulant	Agent that prevents the formation of dangerous clots
antihypertensive anti- + hypertensive	Agent that helps control high blood pressure.
beta [BĀ-tǎ] blocker	Agent that lowers blood pressure by reducing contraction strength of the heart muscle; slows heartbeat.
calcium channel blocker	Medication that lessens the ability of calcium ions to enter heart and blood vessel muscle cells; used to lower blood pressure and normalize some arrhythmias.
cardiotonic [KĀR-dē-ō-TŌN-ĭk] cardio-, heart + Greek <i>tonos</i> , tension	Medication for congestive heart failure; increases the force of contractions of the myocardium.
diuretic [dĭ-yū-RĔT-ĭk] di-, throughout + Greek <i>uresis</i> , urine	Medication that promotes the excretion of urine.
heparin [HĔP-ǎ-rĭn] From Greek <i>hepar</i> , liver	Anticoagulant present in the body; also, synthetic version administered to prevent clotting.
lipid-lowering	Helpful in lowering cholesterol levels.
nitrate [NĪ-trāt]	Any of several medications that dilate the veins, arteries, or coronary arteries; used to control angina.
statins [STĀ-tĭnz]	A class of lipid-lowering agents that are the most frequently used today.
thrombolytic [thrŏm-bŏ-LĪT-ĭk] thrombo-, thrombus + -lytic, destroying	Agent that dissolves a thrombus.
tissue-type plasminogen [plǎz-MĪN-ŏ-jĕn] activator (tPA, TPA)	Agent that prevents a thrombus from forming.
vasoconstrictor [VĀ-sŏ-kŏn-STRĪK-tŏr] vaso-, vessel + constrictor	Agent that narrows the blood vessels.
vasodilator [VĀ-sŏ-dĭ-LĀ-tŏr] vaso- + dilator	Agent that dilates or widens the blood vessels.

CASE STUDY

The Long-Term Treatment

As part of Mr. Davino's long-term rehabilitation, medication has been prescribed, as shown on the prescription forms given to him upon his release.

Critical Thinking

112. For what condition is Mr. Davino's medication in prescription form (a) most likely being prescribed?

a

Dr. Andar Mirkhan 16 Courtyard Lane • Andover, Ohio 66666	
PATIENT'S NAME <i>Joseph Davino</i>	AGE <i>44</i>
ADDRESS _____	
CITY <i>Wesley</i>	DATE <i>9/1/XX</i>
℞	
<i>Questran 4g ac TID</i> #90	
DEA NO. 54321x LICENSE NO. 12345y	<i>Andar Mirkhan, M.D.</i> SIGNATURE

113. Prescription form (b) prescribes a medication for what other condition?

b

Dr. Andar Mirkhan 16 Courtyard Lane • Andover, Ohio 66666	
PATIENT'S NAME <i>Joseph Davino</i>	AGE <i>44</i>
ADDRESS _____	
CITY <i>Wesley</i>	DATE <i>9/1/XX</i>
℞	
<i>Lasix 80 mg q12h</i> #60	
DEA NO. 54321x LICENSE NO. 12345y	<i>Andar Mirkhan, M.D.</i> SIGNATURE

PHARMACOLOGICAL TERMS EXERCISES

Reverse Diagnosis

Using Table 6-1, describe the condition for which each combination of medications is probably being prescribed.

114. metoprolol, Vasotec, and Bumex _____
115. Coumadin, aspirin, and pentoxifylline _____
116. nitroglycerin, Avapro, and furosemide _____

Check Your Knowledge

From Table 6-1, name at least one medication used to treat each of the following conditions.

117. hypertension _____
118. water retention _____
119. arrhythmia _____
120. high cholesterol _____
121. clotting _____
122. arterial plaque _____
123. angina _____
124. congestive heart failure _____

Matching

Match the following cardiovascular pharmacological classifications with their correct definitions.

125. _____ diuretics
126. _____ ACE inhibitors
127. _____ calcium channel blockers
- a. reduce ability of blood platelets to clot
- b. decrease viscosity of blood
- c. dissolve blood clots

- | | |
|------------------------------------|--|
| 128. _____ vasodilators | d. ease heart pumping, lower blood pressure |
| 129. _____ beta blockers | e. alter electrical flow through the heart |
| 130. _____ antiplatelet medication | f. increase urine production, relieve edema |
| 131. _____ anticoagulants | g. reduce contraction of heart, slow heartbeat |
| 132. _____ hemorrhheologic agents | h. dilate veins and arteries, used to treat angina |
| 133. _____ antiarrhythmics | i. reduce blood clotting |
| 134. _____ thrombolytics | j. reduce heart rate, lower squeezing strength of heart contraction, lower blood pressure by inhibiting calcium from entering heart muscle |

Match the following medications with their correct pharmacological classification. Some answers may be used more than once and some not at all.

- | | |
|--------------------------|------------------------------|
| 135. _____ Coumadin | a. anticoagulant |
| 136. _____ aspirin | b. inotropic agent |
| 137. _____ procainamide | c. antiarrhythmic |
| 138. _____ nitroglycerin | d. lipid-lowering medication |
| 139. _____ verapamil | e. diuretic |
| 140. _____ Lipitor | f. beta blocker |
| 141. _____ Accupril | g. antiplatelet medication |
| 142. _____ Lasix | h. coronary vasodilator |
| 143. _____ Inderal | i. calcium channel blocker |
| 144. _____ digitalis | j. ACE inhibitor |

CHALLENGE SECTION

The cardiologists on the hospital staff have a weekly meeting to review cases. Dr. Woodard and Dr. Mirkhan have discussed the admission of Mr. Davino to the CCU and have reported on his progress. Another interesting case is a 50-year-old woman who presented with no symptoms except chest pain when she was admitted for possible coronary disease. After she was stabilized in the emergency room, the cardiologist on call examined her closely. The patient was found to have very few risk factors (nonsmoker, normal weight, normal BP). However, upon discussions with her, they found she has a high-stress job and a moderate-to-poor diet. The notes on the woman's record are shown here.

Referring physician: Margaret Lao, M.D.

Examination: Resting pulse was 78 beats per minute. The blood pressure was 126/80 mm/Hg. Lungs clear. Soft systolic ejection murmur along left sternal border.

ECG: Patient's resting, modified 12-lead ECG had no resting abnormalities.

Patient was given a stress electrocardiogram one month ago. Her doctor noted no exercise-associated arrhythmias and found mild-to-moderate hypokinesia of inferior and posterior segments. Her improved contractility with exercise suggested adequate myocardial perfusion.

Critical Thinking

From the cardiologist's notes, describe the patient's condition.

TERMINOLOGY IN ACTION

Shown below is a medical chart entry in SOAP format for a 61-year-old male. What is his diagnosis and what are some ways it could be treated in addition to the prescribed medication?

Patient Name: Donald Arelio

March 29, 2XXX

S: Mr. Arelio is a 61-year-old male who has a problem with nosebleeds. No history of nose trauma. Hemorrhage occurs spontaneously approximately once a week for a couple of months often followed by a period of no nosebleeds for several weeks. The bleeding often starts at rest and sometimes upon exertion. He has been able to stop them with pressure up until the last week. He has no other bleeding problems and is not currently taking any medication.

O: BP 180/71; pulse 80; height 69"; weight 235 lb. No active bleeding at this time, but there is a small clot over the anterior midseptum.

A: 1. Hypertension

2. Recurrent epistaxis

P: Patient was given Procardia sublingually with blood pressure dropping to 140/70. Patient was instructed in treatment of nosebleeds. Schedule for a recheck of blood pressure in 5 days. IF nosebleeds continue, he may need a referral.

USING THE INTERNET

If you search the World Wide Web for the American Heart Association (<http://www.amhrt.org>), you will find many discussions of all aspects of heart disease.

Use the Internet to find and list at least three inherited (genetic) risk factors and at least three acquired risk factors for heart disease.

List at least three things you can do personally to prevent heart disease.

What are three heart attack warning signs listed on the American Heart Association's Web site?

CHAPTER REVIEW

The material that follows is to help you review all the material in this chapter.

Building Cardiovascular Terms

Using word parts you have learned in this chapter and earlier chapters, build the correct medical term for each of the following definitions.

145. Hardening of fatty plaque on the arterial wall: _____
146. Inflammation of the inner layer of the heart: _____
147. Abnormally slow heart rate: _____
148. Narrowed blood vessels: _____
149. Disease of the heart muscle: _____
150. A blood clot: _____
151. Narrowing of the aorta: _____
152. Mass of blood in the tissues: _____
153. Abnormally enlarged heart: _____
154. Viewing the aorta by x-ray with contrast: _____
155. Using sound waves to produce images of the heart (structure and motion): _____
156. An electrical tracing of the heart conduction system: _____
157. Deficiency of blood flow: _____
158. Unusually rapid, fast heart rate: _____
159. Hardening of the arteries: _____
160. Study of the heart: _____
161. Abnormally low body temperature: _____
162. Study of blood: _____
163. Dissolving of a blood clot: _____
164. Study of veins: _____
165. Originating in the heart: _____
166. Formation of blood cells: _____
167. Pertaining to the heart: _____
168. Instrument used to record the electrical activity of the heart: _____
169. Radiographic imaging of a blood vessel: _____
170. Process of recording the electrical activity of the heart: _____
171. Incision into a vein: _____
172. Excision of fatty plaque: _____
173. Inflammation of the sac surrounding the heart: _____

Know the Meaning

For each of the following definitions, write the correct term in the space provided.

174. Connect arterioles with venules: _____
175. Carry oxygen-rich blood away from the heart: _____
176. The body's smallest veins: _____
177. Vessels that carries blood back to the heart: _____
178. Outermost layer of the heart muscle: _____
179. The body's largest, most pressurized vessel: _____
180. Vessel that delivers oxygen-poor blood to the heart from the upper portion of the body: _____
181. Tube-like vessels that supply blood to the entire body: _____
182. Controls blood flow between left atrium and left ventricle: _____
183. Vessels that return oxygen-rich blood from the lungs to the heart: _____
184. Inner opening of a vessel that the blood flows through: _____
185. Structure in the fetal circulatory system that allows the blood to bypass the undeveloped lungs: _____
186. Organ of muscle that receives blood from the veins and returns it to the body through the arteries: _____
187. Innermost layer of the heart muscle: _____
188. Opening in the septum of the fetal heart that closes soon after birth: _____
189. Upper right chamber of the heart: _____
190. Separates the right and left halves of the heart: _____
191. Vessel that supplies the heart with oxygen-rich blood: _____

True or False

Circle T for true or F for false.

192. The term *atrioventricular* relates to the atria and the ventricles of the heart. T F
193. *Thrombocytosis* is an abnormal decrease in the number of platelets in the blood. T F
194. An image of a blood vessel is called an *angiography*. T F
195. A patient with an abnormally large heart is diagnosed with *cardiopathy*. T F
196. *Arteriography* is the x-ray of an artery after the injection of a contrast medium. T F
197. A normal heart rhythm is called *normal sinus rhythm*. T F
198. The amount of blood pushed out of the ventricles with each contraction is measured as the *ejection fraction*. T F
199. Laboratory blood tests performed to determine whether a patient has experienced a myocardial infarction are called *serum enzyme tests*. T F
200. A test that measures the blood pressure, heart rate, and other functions while the patient is exercising on a treadmill is called an *echocardiogram*. T F
201. A portable device that is used to perform a 24-hour electrocardiogram is a *Holter monitor*. T F

Matching

Match the following heart rhythms with their correct descriptions.

- | | |
|---|--------------------------|
| 202. _____ unusually fast heart beat above 100 bpm | a. normal sinus |
| 203. _____ a regular but very rapid heartbeat more than 250 bpm | b. bradycardia |
| 204. _____ a normal, regular heart beat | c. fibrillation |
| 205. _____ slow but regular heartbeat below 60 bpm | d. flutter |
| 206. _____ chaotic, irregular, life-threatening rhythm | e. tachycardia |
| 207. _____ rapid, triple beat of the heart | f. asystole |
| 208. _____ the heart has completely stopped beating | g. myocardial infarction |
| 209. _____ sudden drop in blood supply to the heart, usually due to a blockage in a coronary artery | h. gallop |

Match the following cardiac terms with their correct definitions. Some answers may be used twice and some not at all.

- | | |
|------------------------------|----------------------|
| 210. _____ ductus arteriosus | a. contraction |
| 211. _____ aorta | b. muscular tissue |
| 212. _____ myocardium | c. semilunar valve |
| 213. _____ aortic valve | d. thrombocytes |
| 214. _____ septum | e. fetal circulation |
| 215. _____ systole | f. partition |
| 216. _____ pulmonary valve | g. largest artery |

Remembering Suffixes

Write the suffix (used in cardiovascular terms) belonging to the following definitions.

217. pertaining to _____
218. hardening _____
219. removal _____
220. abnormal decrease _____
221. pain _____
222. disease _____
223. cell _____
224. destroying _____
225. condition, state of _____
226. sound _____
227. condition of cells _____
228. relating to blood _____
229. inflammation _____
230. enlargement _____
231. surgical repair _____

Remembering Prefixes

Write the prefix (used in cardiovascular terms) belonging to the following definitions.

232. blood clot _____
233. half _____
234. reflected sound _____
235. slow _____
236. surround _____
237. rapid, fast _____
238. inner _____
239. below normal _____
240. muscle _____
241. small _____
242. before _____
243. against _____
244. two _____
245. above normal _____
246. many _____
247. after _____
248. large _____
249. within _____
250. three _____
251. more than one _____

DEFINITIONS

Define the following terms and combining forms. Review the chapter before starting. Make sure you know how to pronounce each term as you define it. The blue words in curly brackets are references to the Spanish glossary available online at www.mhhe.com/medterm3e.

TERM

- | | | |
|---|--|---|
| 252. anastomosis [ă-năs-tō-MŌ-sīs]
{ anastomosis } | 258. angiography [ăn-jē-ŎG-ră-fē] | 264. anticlotting |
| 253. aneurysm [ĂN-yū-rizm]
{ aneurisma } | 259. angioplasty [ĂN-jē-ō-plăs-tē]
{ angioplastia } | 265. anticoagulant |
| 254. angina [ĂN-jī-nă, ăn-JĪ-nă]
{ angina } | 260. angioscopy [ăn-jē-ŎS-kō-pē]
{ angioscopia } | 266. antihypertensive |
| 255. angina pectoris [PĚK-tōr-īs,
pĚk-TŎR-īs] { angina de pecho } | 261. angiotensin [ăn-jē-ō-TĚN-sin]
converting enzyme (ACE)
inhibitor | 267. aorta [ă-ŎR-tă] { aorta } |
| 256. angi(o) | 262. antianginal [ăn-tē-ĂN-jī-nă] | 268. aort(o) |
| 257. angiocardiology
[ăn-jē-ō-kăr-dē-ŎG-ră-fē] | 263. antiarrhythmic
[ăn-tē-ă-RĪTH-mĭk] | 269. aortic regurgitation [ă-ŎR-tĭk
rē-GŪR-jĭ-TĂ-shŭn] or reflux
[RĚ-flŭks] |
| | | 270. aortic stenosis [stĕ-NŎ-sīs] |
| | | 271. aortic valve |

TERM

272. aortography [ā-ōr-TÖG-rā-fē]
 273. arrhythmia [ā-RĪTH-mē-ā] {arritmia}
 274. arteri(o), arter(o)
 275. arteriography [ār-tēr-ē-ÖG-rā-fē]
 276. arteriole [ār-TĒ-rē-ōl] {arteriola}
 277. arteriosclerosis [ār-TĒR-ē-ō-sklēr-Ö-sīs] {arteriosclerosis}
 278. arteriotomy [ār-tēr-ē-ÖT-ō-mē]
 279. arteritis [ār-tēr-Ī-tīs] {arteritis}
 280. artery [ĀR-tēr-ē] {arteria}
 281. asystole [ā-SĪS-tō-lē] {asistolia}
 282. ather(o)
 283. atherectomy [āth-ē-REK-tō-mē]
 284. atheroma [āth-ēr-Ö-mā] {ateroma}
 285. atherosclerosis [ĀTH-ēr-ō-sklēr-ō-sīs] {arteriosclerosis}
 286. atri(o)
 287. atrial fibrillation [Ā-trē-āl fī-brī-LĀ-shŭn]
 288. atrioventricular [Ā-trē-ō-vĕn-TRĪK-yū-lār] block
 289. atrioventricular bundle
 290. atrioventricular node (AV node)
 291. atrioventricular valve
 293. atrium (pl., atria) [Ā-trē-ŭm (Ā-trē-ā)] {atrium}
 294. auscultation [āws-kŭl-TĀ-shŭn] {auscultación}
 295. bacterial endocarditis
 296. balloon catheter dilation
 297. balloon valvuloplasty [VĀL-vyū-lō-PLĀS-tē]
 298. beta [BĀ-tā] blocker
 299. bicuspid [bī-KŪS-pīd] valve
 300. blood [blŭd] {sangre}
 301. blood pressure
 302. blood vessel
 303. bradycardia [brād-ē-KĀR-dē-ā] {bradicardia}
 304. bruit [brū-Ē] {ruido}
 305. bundle of His [hĭz, hīs]
 306. bypass
 307. calcium channel blocker
 308. capillary [KĀP-ī-lār-ē] {capilar}
 309. carbon dioxide {dióxido de carbono}
 310. cardi(o)
 311. cardiac arrest
 312. cardiac catheterization [kāth-ē-tēr-ī-ZĀ-shŭn]
 313. cardiac cycle
 314. cardiac enzyme studies
 315. cardiac MRI
 316. cardiac scan
 317. cardiac tamponade [tām-pō-NĀD]
 318. cardiomyopathy [KĀR-dē-ō-mī-ÖP-ā-thē] {cardiomiopatía}
 319. cardiopulmonary [KĀR-dē-ō-PŪL-mō-nār-ē] bypass
 320. cardiogenic [KĀR-dē-ō-TÖN-ik]
 321. cardiovascular [KĀR-dē-ō-VĀS-kyū-lār]
 322. carotid [kā-RÖT-īd] artery
 323. cholesterol [kō-LĒS-tēr-ōl] {colesterol}
 324. claudication [klāw-dī-KĀ-shŭn] {claudicación}
 325. coarctation [kō-ārk-TĀ-shŭn] of the aorta
 326. conduction system
 327. congenital heart disease
 328. congestive heart failure
 329. constriction [kōn-STRĪK-shŭn] {constricción}
 330. coronary angioplasty
 331. coronary [KÖR-ō-nār-ē] artery
 332. coronary artery disease
 333. coronary bypass surgery
 334. cyanosis [sī-ā-NÖ-sīs] {cianosis}
 335. deep vein thrombosis [thrōm-BÖ-sīs]
 336. depolarization [dē-pō-lā-rĭ-ZĀ-shŭn] {despolarización}
 337. diastole [dī-ĀS-tō-lē] {diástole}
 338. digital subtraction angiography
 339. diuretic [dī-yū-RĒT-ĭk]
 340. Doppler [DÖP-lēr] ultrasound
 341. ductus arteriosus [DŪK-tŭs ār-tēr-ē-Ö-sŭs]
 342. ductus venosus [vĕn-Ö-sīs]
 343. dysrhythmia [dĭs-RĪTH-mē-ā] {disritmia}
 344. echocardiography [ĕk-ō-kār-dē-ÖG-rā-fē] {ecocardiografía}
 345. ejection fraction
 346. electrocardiography [ē-lĕk-trō-kār-dē-ÖG-rā-fē]
 347. embolectomy [ēm-bō-LĒK-tō-mē]
 348. embolus [ĒM-bō-lŭs] {émbolo}
 349. endarterectomy [ĕnd-ār-tēr-ĒK-tō-mē]
 350. endocarditis [ĒN-dō-kār-DĪ-tīs] {endocarditis}
 351. endocardium [ĕn-dō-KĀR-dē-ŭm] {endocardio}
 352. endothelium [ĕn-dō-THĒ-lē-ŭm] {endotelio}
 353. endovascular surgery
 354. epicardium [ĕp-ī-KĀR-dē-ŭm] {epicardio}
 355. essential hypertension
 356. femoral [FĒM-ō-rāl, FĒ-mō-rāl] artery
 357. fibrillation [fī-brī-LĀ-shŭn] {fibrilación}
 358. flutter {aleteo}
 359. Fontan's [FÖN-tānz] operation

TERM

360. foramen ovale [fō-RĀ-mĕn
ō-VĀ-lĕ]
361. gallop {galope}
362. graft
363. heart [hărt] {corazón}
364. heart block
365. heart transplant
366. hemangi(o)
367. hemorrhoidectomy
[HĚM-ō-rōy-DĚK-tō-mĕ]
{hemorroidectomía}
368. hemorrhoids [HĚM-ō-rōydz]
{hemorroides}
369. heparin [HĚP-ă-rĭn] {heparina}
370. high blood pressure {presión
arterial alta}
371. Holter [HŌL-tĕr] monitor
372. hypertension [HĪ-pĕr-TĚN-
shŭn] {hipertensión}
373. hypertensive heart disease
374. hypotension [HĪ-pō-TĚN-
shŭn] {hipotensión}
375. infarct [ĪN-fărk] {infarto}
376. infarction [ĭn-FĀRK-shŭn]
{infarto}
377. inferior vena cava [VĚ-nă
KĀ-vă, KĀ-vă]
378. intermittent claudication
379. intracardiac
[ĭn-tră-KĀR-dĕ-ăk] tumor
380. intravascular stent
381. ischemia [ĭs-KĚ-mĕ-ă] {isquemia}
382. left atrium
384. left ventricle
385. lipid-lowering
386. lipid [LĪP-ĭd] profile
387. low blood pressure {presión
arterial baja}
388. lumen [LŪ-mĕn] {lumen}
389. mitral [MĪ-trăł] insufficiency
or reflux
390. mitral stenosis
391. mitral [MĪ-trăł] valve
392. mitral valve prolapse
393. multiple-gated acquisition
(MUGA) angiography
394. murmur {soplo}
395. myocardial infarction
396. myocarditis [MĪ-ō-kăr-DĪ-tĭs]
{miocarditis}
397. myocardium [mĭ-ō-KĀR-
dĕ-ŭm] {miocardio}
398. necrosis [nĕ-KRŌ-sĭs]
{necrosis}
399. nitrate [NĪ-trăt]
400. occlusion [ŏ-KLŪ-zhŭn]
{oclusión}
401. pacemaker {marcapaso}
402. palpitations [păł-pĭ-TĀ-shŭnz]
{palpitaciones}
403. patent ductus arteriosus
[PĀ-tĕnt DŪK-tŭs
ăr-tĕr-ĕ-Ō-sĭs]
404. percutaneous transluminal
[pĕr-kyŭ-TĀ-nĕ-ŭs trăns-LŪ-
mĭn-ăł] coronary angioplasty
405. perfusion deficit
406. pericardi(o)
407. pericarditis [PĚR-ĭ-kăr-DĪ-tĭs]
{pericarditis}
408. pericardium [pĕr-ĭ-KĀR-dĕ-
ŭm] {pericardio}
409. peripheral vascular disease
410. petechiae (*sing.*, petechia)
[pĕ-TĚ-kĕ-ĕ, pĕ-TĚK-ĕ-ĕ
(pĕ-TĚ-kĕ-ă, pĕ-TĚK-ĕ-ă)]
{petequia}
411. phleb(o)
412. phlebitis [flĕ-BĪ-tĭs] {flebitis}
413. phlebography [flĕ-BŌG-ră-fĕ]
{flebografía}
414. phlebotomy [flĕ-BŌT-ō-mĕ]
{flebotomía}
415. plaque [plăk] {placa}
416. polarization [pō-lăr-ĭ-ZĀ-
shŭn] {polarización}
417. popliteal [pŏp-LĪT-ĕ-ăł] artery
418. positron emission tomography
[tō-MŌG-ră-fĕ] (PET) scan
419. premature atrial contractions
(PACs)
420. premature ventricular
contractions (PVCs)
421. pulmonary [PŪL-mō-năr-ĕ]
artery {arteria pulmonar}
422. pulmonary artery stenosis
423. pulmonary edema
424. pulmonary valve
425. pulmonary vein
426. pulse [pŭls] {pulso}
427. Raynaud's [ră-NŌZ]
phenomenon
428. repolarization [rĕ-pō-lăr-ĭ-ZĀ-
shŭn] {repolarización}
429. rheumatic heart disease
430. right atrium
431. right ventricle
432. risk factor
433. rub {roce}
434. saphenous [să-FĚ-nŭs] vein
435. secondary hypertension
436. semilunar [sĕm-ĕ-LŪ-năr] valve
437. septal defect
438. septum (*pl.*, septa) [SĚP-tŭm
(SĚP-tă)] {tabique}
439. serum enzyme tests
440. sinoatrial [sĭ-nō-Ā-trĕ-ăł]
node (SA node)
441. sinus rhythm
442. sonography [sō-NŌG-ră-fĕ]
{sonografía}
443. sphygm(o)
444. sphygmomanometer
[SFĪG-mō-mă-NŌM-ĕ-tĕr]
{esfigmomanómetro}
445. statins [STĀ-tĭ-nz]
446. stenosis [stĕ-NŌ-sĭs]
{estenosis}
447. stent [stĕnt]
448. stress test

TERM

449. superior vena cava
450. systole [SĪS-tō-lē] {sístole}
451. tachycardia [TĀK-ĭ-KĀR-dē-ă] {taquicardia}
452. tetralogy of Fallot [fā-LŌ]
453. thromb(o)
454. thrombectomy [thrŏm-BĚK-tō-mē] {trombectomia}
455. thrombolytic [thrŏm-bŏ-LĪT-ĭk]
456. thrombophlebitis [THRŌM-bŏ-flĕ-BĪ-tĭs] {tromboflebitis}
457. thrombosis [thrŏm-BŌ-sĭs] {trombosis}
458. thrombotic [thrŏm-BŎT-ĭk] occlusion
459. thrombus [THRŌM-bŭs] {trombo}
460. tissue-type plasminogen [plāz-MĪN-ŏ-jĕn] activator (tPA, TPA)
461. tricuspid [trĭ-KŪS-pĭd] stenosis
462. tricuspid valve
463. triglyceride [trĭ-GLĪS-ĕr-ĭd] {triglicérido}
464. valve [vālv] {válvula}
465. valve replacement
466. valvotomy [vāl-VŎT-ŏ-mē]
467. valvulitis [vāl-vyū-LĪ-tĭs] {valvulitis}
468. valvuloplasty [VĀL-vyū-lŏ-PLĀS-tē] {valvuloplastia}
469. varicose [VĀR-ĭ-kŏs] vein
470. vas(o)
471. vasoconstrictor [VĀ-sŏ-kŏn-STRĪK-tŏr]
472. vasodilator [VĀ-sŏ-dĭ-LĀ-tŏr]
473. vegetation [vēj-ĕ-TĀ-shŭn] {vegetación}
474. vein [vān] {vena}
475. vena cava (*pl.*, *venae cavae*) [VĚ-nā KĀ-vā, KĀ-vā (VĚ-nē KĀ-vĕ, KĀ-vĕ)]
476. ven(o)
477. venipuncture [VĚN-ĭ-pŭnk-chŭr, VĚ-nĭ-PŪNK-chŭr] {venipuntura}
478. venography [vē-NŎG-ră-fē] {venografía}
479. ventricle [VĚN-trĭ-kl] {ventrículo}
480. ventriculogram [vēn-TRĪK-yū-lŏ-grām]
481. venule [VĚN-yūl, VĚ-nŭl] {vénula}

Abbreviations

Write out the full meaning of each abbreviation.

ABBREVIATION

482. AcG
483. AF
484. AS
485. ASCVD
486. ASD
487. ASHD
488. AV
489. BP
490. CABG
491. CAD
492. zcath
493. CCU
494. CHD
495. CHF
496. CO
497. CPK
498. CPR
499. CVA
500. CVD
501. DSA
502. DVT
503. ECG, EKG
504. ECHO
505. ETT
506. GOT
507. HDL
508. LDH
509. LDL
510. LV
511. LVH
512. MI
513. MR
514. MS
515. MUGA
516. MVP
517. PAC
518. PTCA
519. PVC
520. SA
521. SV
522. tPA, TPA
523. VLDL
524. VSD
525. VT

Name _____ Date _____

Chapter 6: Word-Building (20 questions - 1 pts. each)

Using the following combining forms, complete the word that best fits the definition of each word relating to the cardiovascular system listed below. Combining forms may be used more than once.

angi(o)	cardi(o)	thromb(o)
aort(o)	hemangi(o)	vas(o)
arteri(o)	pericardi(o)	ven(o)
ather(o)	phleb(o)	
atri(o)	sphygm(o)	

1. Dissolving of a blood clot: _____ lysis
2. Inflammation of the pericardium: _____ itis
3. Blood clot in the heart: _____ thrombus
4. Formation of atheromas: _____ genesis
5. Heart paralysis: _____ plegia
6. Hardening of the arteries: _____ sclerosis
7. Hardening of the veins: _____ sclerosis
8. Imaging of the aorta: _____ graphy
9. Feeling the pulse: _____ palpation
10. Suture of the pericardium: _____ rrhaphy
11. Study of blood vessels: _____ logy
12. Disease of the arteries: _____ pathy
13. Resembling blood vessels: _____ oid
14. Rupture in the heart: _____ rrhexis
15. Agent that narrows blood vessels: _____ constrictor
16. Presence of a blood clot: _____ osis
17. Incision into the heart: _____ tomy
18. Throbbing of an artery: _____ palmus
19. Abnormally enlarged atrium: _____ megaly
20. Aortal narrowing: _____ stenosis