The Cardiovascular System

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
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
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

---

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

The Web site www.hearinfo.org has heart animations that illustrate different parts of the heart and how they are affected by disease and surgery.
The average adult has about 5-6 liters of blood in the body.

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.

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.
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, $\text{CO}_2$) 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...
Chapter 6  The Cardiovascular System

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...
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 change.

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 intro the left atrium. After birth, this opening closes. Chapter 17 discusses fetal development.
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:

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

Your doctor should evaluate unusually low readings.
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.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>aorta [ä-ÖR-tä] Greek aorte</td>
<td>Largest artery of the body; vessel through which oxygenated blood exits the heart.</td>
</tr>
<tr>
<td>aortic [ä-ÖR-tïk] valve</td>
<td>Valve between the aorta and the left ventricle.</td>
</tr>
<tr>
<td>arteriole [är-TÊ-re-o-lë]</td>
<td>A tiny artery connecting to a capillary.</td>
</tr>
<tr>
<td>artery [ÄR-të-rë] Latin and Greek arteria</td>
<td>A thick-walled blood vessel that, in systemic circulation, carries oxygenated blood away from the heart.</td>
</tr>
<tr>
<td>atrioventricular [Ä-trë-ö-vën-TRIK-yu-lär] bundle</td>
<td>Bundle of fibers in the interventricular septum that transfers charges in the heart’s conduction system; also called bundle of His.</td>
</tr>
<tr>
<td>atrioventricular (AV) node</td>
<td>Specialized part of the interatrial septum that sends a charge to the bundle of His.</td>
</tr>
<tr>
<td>atrioventricular valve</td>
<td>One of two valves that control blood flow between the atria and ventricles.</td>
</tr>
<tr>
<td>atrium (pl., atria) [Ä-trë-üm (Ä-trë-ä)]</td>
<td>Either of the two upper chambers of the heart.</td>
</tr>
<tr>
<td>bicuspid [bi-KUS-pid] valve</td>
<td>Atrioventricular valve on the left side of the heart.</td>
</tr>
<tr>
<td>blood [blüd] Old English blod</td>
<td>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.</td>
</tr>
<tr>
<td>blood pressure</td>
<td>Measure of the force of blood surging against the walls of the arteries.</td>
</tr>
<tr>
<td>blood vessel</td>
<td>Any of the tubular passageways in the cardiovascular system through which blood travels.</td>
</tr>
<tr>
<td>bundle of His [hïz, his]</td>
<td>See atrioventricular bundle.</td>
</tr>
<tr>
<td>capillary [KAP-i-lär-ë]</td>
<td>The smallest blood vessel that forms the exchange point between the arterial and venous vessels.</td>
</tr>
<tr>
<td>carbon dioxide (CO₂)</td>
<td>Waste material transported in the venous blood.</td>
</tr>
<tr>
<td>cardiac cycle</td>
<td>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.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>------</td>
<td>------------</td>
</tr>
<tr>
<td>cardiovascular [KÄR-de-Ö-VÄS-kyu-lér]</td>
<td>Relating to or affecting the heart and blood vessels.</td>
</tr>
<tr>
<td>carotid [kÄ-ROT-id] artery</td>
<td>Artery that transports oxygenated blood to the head and neck.</td>
</tr>
<tr>
<td>conduction system</td>
<td>Part of the heart containing specialized tissue that sends electrical charges through heart fibers, causing the heart to contract and relax at regular intervals.</td>
</tr>
<tr>
<td>coronary [KÖR-o-när-e] artery</td>
<td>Blood vessel that supplies oxygen-rich blood to the heart.</td>
</tr>
<tr>
<td>depolarization [de-pō-lā-ri-ZÄ-shún]</td>
<td>Contracting state of the myocardial tissue in the heart’s conduction system.</td>
</tr>
<tr>
<td>diastole [di-ÄS-tō-le]</td>
<td>Relaxation phase of a heartbeat.</td>
</tr>
<tr>
<td>ductus arteriosus [DÜK-tūs är-tēr-ē-Ö-sūs]</td>
<td>Structure in the fetal circulatory system through which blood flows to bypass the fetus’s nonfunctioning lungs.</td>
</tr>
<tr>
<td>ductus venosus [vēn-Ö-sūs]</td>
<td>Structure in the fetal circulatory system through which blood flows to bypass the fetal liver.</td>
</tr>
<tr>
<td>endocardium [ěn-dō-KÄR-de-ūm]</td>
<td>Membranous lining of the chambers and valves of the heart; the innermost layer of heart tissue.</td>
</tr>
<tr>
<td>endothelium [ěn-dō-THÉ-le-ūm]</td>
<td>Lining of the arteries that secretes substances into the blood.</td>
</tr>
<tr>
<td>epicardium [ēp-ī-KÄR-de-ūm]</td>
<td>Outermost layer of heart tissue.</td>
</tr>
<tr>
<td>femoral [FĒM-ō-rāl, FĒ-mō-rāl] artery</td>
<td>An artery that supplies blood to the thigh.</td>
</tr>
<tr>
<td>foramen ovale [fō-RĀ-mēn ō-VÄ-lē]</td>
<td>Opening in the septum of the fetal heart that closes at birth.</td>
</tr>
<tr>
<td>heart [hārt]</td>
<td>Muscular organ that receives blood from the veins and sends it into the arteries.</td>
</tr>
<tr>
<td>inferior vena cava [VĒ-nā KÄ-vā, KÄ-vā]</td>
<td>Large vein that draws blood from the lower part of the body to the right atrium.</td>
</tr>
<tr>
<td>left atrium</td>
<td>Upper left heart chamber.</td>
</tr>
<tr>
<td>left ventricle</td>
<td>Lower left heart chamber.</td>
</tr>
<tr>
<td>lumen [LŪ-mēn]</td>
<td>Channel inside an artery through which blood flows.</td>
</tr>
<tr>
<td>myocardium [mī-ō-KÄR-de-ūm]</td>
<td>Muscular layer of heart tissue between the epicardium and the endocardium.</td>
</tr>
<tr>
<td>myo-, muscle + Greek kardia, heart</td>
<td></td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>----------------------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>pacemaker</td>
<td>Term for the sinoatrial (SA) node; also, an artificial device that regulates heart rhythm.</td>
</tr>
<tr>
<td>pericardium [për-ī-KĀR-de-ūm]</td>
<td>peri-, around + Greek kardia, heart</td>
</tr>
<tr>
<td></td>
<td>Protective covering of the heart.</td>
</tr>
<tr>
<td>polarization [pō-lär-ī-ZĀ-shūn]</td>
<td>Resting state of the myocardial tissue in the conduction system of the heart.</td>
</tr>
<tr>
<td>popliteal [pəp-LĪT-e-āl]artery</td>
<td>An artery that supplies blood to the cells of the area behind the knee.</td>
</tr>
<tr>
<td>pulmonary [PÜL-mō-nār-ē] artery</td>
<td>One of two arteries that carry blood that is low in oxygen from the heart to the lungs.</td>
</tr>
<tr>
<td>pulmonary valve</td>
<td>Valve that controls the blood flow between the right ventricle and the pulmonary arteries.</td>
</tr>
<tr>
<td>pulmonary vein</td>
<td>One of four veins that bring oxygenated blood from the lungs to the left atrium.</td>
</tr>
<tr>
<td>pulse [pǔls]</td>
<td>Rhythmic expansion and contraction of a blood vessel, usually an artery.</td>
</tr>
<tr>
<td>repolarization [rē-pō-lār-ī-ZĀ-shūn]</td>
<td>Recharging state; transition from contraction to resting that occurs in the conduction system of the heart.</td>
</tr>
<tr>
<td>right atrium</td>
<td>Upper right chamber of the heart.</td>
</tr>
<tr>
<td>right ventricle</td>
<td>Lower right chamber of the heart.</td>
</tr>
<tr>
<td>saphenous [sā-FĒ-nūs] vein</td>
<td>Any of a group of veins that transport deoxygenated blood from the legs.</td>
</tr>
<tr>
<td>semilunar [sēm-ē-LŪ-nār] valve</td>
<td>semi-, half + Latin luna, moon</td>
</tr>
<tr>
<td></td>
<td>One of the two valves that prevent the backflow of blood flowing out of the heart into the aorta and the pulmonary artery.</td>
</tr>
<tr>
<td>septum (pl., septa) [SĒP-tūm (SĒP-tā)]</td>
<td>Partition between the left and right chambers of the heart.</td>
</tr>
<tr>
<td>sinoatrial [sī-nō-Ã-trē-āl] (SA) node</td>
<td>Region of the right atrium containing specialized tissue that sends electrical impulses to the heart muscle, causing it to contract.</td>
</tr>
<tr>
<td>sinus rhythm</td>
<td>Normal heart rhythm.</td>
</tr>
<tr>
<td>superior vena cava</td>
<td>Large vein that transports blood collected from the upper part of the body to the heart.</td>
</tr>
<tr>
<td>systole [SĪS-tō-lē]</td>
<td>Contraction phase of the heartbeat.</td>
</tr>
<tr>
<td>tricuspid [trī-KUS-pīd] valve</td>
<td>tri-, three + cuspid, having one cusp</td>
</tr>
<tr>
<td></td>
<td>Atrioventricular valve on the right side of the heart.</td>
</tr>
<tr>
<td>valve [vālv]</td>
<td>Any of various structures that slow or prevent fluid from flowing backward or forward.</td>
</tr>
</tbody>
</table>
Term | Definition
--- | ---
vein [vän] | Any of various blood vessels carrying deoxygenated blood toward the heart, except the pulmonary vein.
vena cava (pl., venae cavae) [VĒ-nä KĀ-vä, KĀ-vä (VĒ-nē KĀ-vē, KĀ-vē)] | See superior vena cava and inferior vena cava.
ventricle [VĒN-trî-kl] | Either of the two lower chambers of the heart.
venule [VĒN-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. atrioventricular ________
5. capillary ________
6. ductus arteriosus ________
7. Purkinje fibers ________
8. myocardium ________

9. arteryole ________
10. bundle of His ________
11. popliteal ________
12. sistole ________

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.

<table>
<thead>
<tr>
<th>Combining Form</th>
<th>Meaning</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>angi(o)</td>
<td>blood vessel</td>
<td>angiogram [ÁN-jē-ō-grām], image of a blood vessel</td>
</tr>
<tr>
<td>aort(o)</td>
<td>aorta</td>
<td>aortitis [ā-ōr-TĪ-tís], inflammation of the aorta</td>
</tr>
<tr>
<td>arteri(o), arter(o)</td>
<td>artery</td>
<td>arteriosclerosis [ār-TĒR-ē-ō-skī-lēr-Ō-sĭs], hardening of the arteries</td>
</tr>
<tr>
<td>ather(o)</td>
<td>fatty matter</td>
<td>atherosclerosis [ĀTH-ēr-ē-ō-skī-lēr-Ō-sĭs], hardening of the arteries with irregular plaque deposits</td>
</tr>
<tr>
<td>atri(o)</td>
<td>atrium</td>
<td>atrioventricular [Ā-trē-ō-vĕn-TRĪ-kū-lār], relating to the atria and ventricles of the heart</td>
</tr>
<tr>
<td>cardi(o)</td>
<td>heart</td>
<td>cardiomyopathy [KĀR-dē-ō-mī-ŌP-ă-thē], disease of the heart muscle</td>
</tr>
<tr>
<td>hemangi(o)</td>
<td>blood vessel</td>
<td>hemangioma [hē-MĀN-jē-ō-mā], abnormal mass of blood vessels</td>
</tr>
<tr>
<td>pericardi(o)</td>
<td>pericardium</td>
<td>pericarditis [PĒR-ī-kār-ĐĪ-tís], inflammation of the pericardium</td>
</tr>
<tr>
<td>phleb(o)</td>
<td>vein</td>
<td>phlebitis [flē-ĐĪ-tís], inflammation of a vein</td>
</tr>
<tr>
<td>sphygm(o)</td>
<td>pulse</td>
<td>sphygmomanometer [SFĪG-mō-mā-NŌM-ē-tēr], instrument for measuring blood pressure</td>
</tr>
<tr>
<td>thromb(o)</td>
<td>blood clot</td>
<td>thrombocytosis [THRŌM-bō-sĭ-TŌ-sĭs], abnormal increase in blood platelets in the blood</td>
</tr>
</tbody>
</table>
### Combining Form | Meaning | Example
--- | --- | ---
vas(o) | blood vessel | vasodepressor [VÅ-sō-dé-PRÉS-ör], agent that lowers blood pressure by relaxing blood vessels
ven(o) | vein | venography [ve-NOG-rā-fēl], 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 ____________
40. Relating to the heart and lungs ____________
41. Establishing an opening into the pericardium ____________
42. Inflammation of the endocardium ____________
43. Repair of a vein ____________
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 ____________.
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

<table>
<thead>
<tr>
<th>DATE</th>
<th>TIME</th>
<th>PROGRESS NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>8/15/XX</td>
<td>3:30 pm</td>
<td>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.</td>
</tr>
<tr>
<td>8/15/XX</td>
<td>4 pm</td>
<td>BP 190/100; temp 100.4°; no urine in catheter bag.— J. Aquino, R.N.</td>
</tr>
<tr>
<td>8/15/XX</td>
<td>5 pm</td>
<td>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.</td>
</tr>
<tr>
<td>8/15/XX</td>
<td>6 pm</td>
<td>BP 176/97; temp 100.6°; catheter bag empty.— J. Aquino, R.N.</td>
</tr>
<tr>
<td>8/15/XX</td>
<td>7 pm</td>
<td>Catheter bag empty.— J. Aquino, R.N.</td>
</tr>
<tr>
<td>8/15/XX</td>
<td>8 pm</td>
<td>BP 168/94; temp 100.7°; catheter bag empty; paged Dr. Mirkhan.— J. Aquino, R.N.</td>
</tr>
<tr>
<td>8/15/XX</td>
<td>9 pm</td>
<td>BP 162/96; temp 100.8°; start IV; ECG; blood gases.— A. Mirkhan, M.D.</td>
</tr>
<tr>
<td>8/15/XX</td>
<td>10 pm</td>
<td>Catheter bag contains 50 ml of urine; patient resting comfortably.— J. Aquino, R.N.</td>
</tr>
<tr>
<td>8/15/XX</td>
<td>11 pm</td>
<td>Catheter bag contains about 200 ml of urine; patient still sleeping.— J. Aquino, R.N.</td>
</tr>
<tr>
<td>8/15/XX</td>
<td>12 pm</td>
<td>Woke patient; BP 160/90; temp 100.2°; 300 ml of urine.— J. Aquino, R.N.</td>
</tr>
</tbody>
</table>

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
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 _____________  
74. CCU _____________  
75. MI _____________
76. BP _____________
77. ECHO _____________

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 angiocardiography (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 angiocardiogram, angiogram, arteriogram, aortogram, or venogram or phlebogram. A ventriculogram is an x-ray showing the ventricles. Ventriculograms measure stroke volume (SV),

![FIGURE 6-7](image_url) A stress test includes monitoring of heart function.

![FIGURE 6-8](image_url) 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](image_url) 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.
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
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,

![FIGURE 6-11](image_url)  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.
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.

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.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>angiography [än-jē-ōG-rā-fē]</td>
<td>Viewing of the heart’s major blood vessels by x-ray after injection of a contrast medium.</td>
</tr>
<tr>
<td>auscultation [äs-kūl-TĀ-shūn]</td>
<td>Process of listening to body sounds via a stethoscope.</td>
</tr>
<tr>
<td>cardiac catheterization [kāth-ē-tērē-iZĀ-shūn]</td>
<td>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.</td>
</tr>
<tr>
<td>cardiac enzyme tests/studies</td>
<td>Blood tests for determining levels of enzymes during a myocardial infarction; serum enzyme tests.</td>
</tr>
<tr>
<td>cardiac MRI</td>
<td>Viewing of the heart by magnetic resonance imaging.</td>
</tr>
<tr>
<td>cardiac scan</td>
<td>Process of viewing the heart muscle at work by scanning the heart of a patient into whom a radioactive substance has been injected.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>cholesterol [kō-LĒS-tēr-ōl]</td>
<td>Fatty substance present in animal fats; cholesterol circulates in the bloodstream, sometimes causing arterial plaque to form.</td>
</tr>
<tr>
<td>digital subtraction angiography</td>
<td>Use of two angiograms done with different dyes to provide a comparison between the results.</td>
</tr>
<tr>
<td>ejection fraction</td>
<td>Percentage of the volume of the contents of the left ventricle ejected with each contraction.</td>
</tr>
<tr>
<td>echocardiography [ěk-o-kăr-dē-ÔG-r̝-f̝e]</td>
<td>Use of sound waves to produce images showing the structure and motion of the heart.</td>
</tr>
<tr>
<td>Holter [HÔL-tēr] monitor</td>
<td>Portable device that provides a 24-hour electrocardiogram.</td>
</tr>
<tr>
<td>lipid profile [LĪP-id]</td>
<td>Laboratory test that provides the levels of lipids, triglycerides, and other substances in the blood.</td>
</tr>
<tr>
<td>multiple-gated acquisition (MUGA) angiography</td>
<td>Radioactive scan showing heart function.</td>
</tr>
<tr>
<td>positron emission tomography (PET) scan</td>
<td>Type of nuclear image that measures movement of areas of the heart.</td>
</tr>
<tr>
<td>serum enzyme tests</td>
<td>Laboratory tests performed to detect enzymes present during or after a myocardial infarction; cardiac enzyme studies.</td>
</tr>
<tr>
<td>sonography [sō-NŌG-r̝-f̝e]</td>
<td>Production of images based on the echoes of sound waves against structures.</td>
</tr>
<tr>
<td>stress test</td>
<td>Test that measures heart rate, blood pressure, and other body functions while the patient is exercising on a treadmill.</td>
</tr>
<tr>
<td>triglyceride [trī-GLĪS-ēr-īd]</td>
<td>Fatty substance; lipid.</td>
</tr>
<tr>
<td>ventriculogram [vēn-TRĪK-yū-lō-gr̝m]</td>
<td>X-ray of a ventricle taken after injection of a contrast medium.</td>
</tr>
</tbody>
</table>
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 cholesterol still high?
79. Which of his laboratory tests shows an abnormal level that can often be corrected by dietary changes?

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

PATIENT’S IDENTIFICATION

Davino, Joseph A.
000-77-9999

DIAGNOSTIC, PROCURINAL, 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.

________________________________________________________________________________________
________________________________________________________________________________________
________________________________________________________________________________________
________________________________________________________________________________________
________________________________________________________________________________________
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.

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 dysrythmias. 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

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

**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.

**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 women.
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.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>aneurysm [ĀN-ŷ-u-rīzm]</td>
<td>Greek <em>aneurysma</em>, dilation Ballooning of the artery wall caused by weakness in the wall.</td>
</tr>
<tr>
<td>angina pectoris [PĒ-k-tōr-īs, pēk-TŌR-īs]</td>
<td>Latin, sore throat of the chest Chest pain, usually caused by a lowered oxygen or blood supply to the heart.</td>
</tr>
<tr>
<td>aortic regurgitation [rē-GŪR-jī-TĀ-shūn] or reflux [RĒ-flūks]</td>
<td>Backward flow or leakage of blood through a faulty aortic valve.</td>
</tr>
<tr>
<td>aortic stenosis [stē-NO-sīs]</td>
<td>Narrowing of the aorta.</td>
</tr>
<tr>
<td>arrhythmia [ā-RĪTH-mē-ā]</td>
<td>a-, without + Greek <em>rhythmos</em>, rhythm Irregularity in the rhythm of the heartbeat.</td>
</tr>
<tr>
<td>arteritis [ār-tēr-Ī-tīs]</td>
<td>arter-, artery + -itis, inflammation Inflammation of an artery or arteries.</td>
</tr>
<tr>
<td>asystole [ā-SĪS-tō-le]</td>
<td>a- + Greek <em>systole</em>, a contracting Cardiac arrest.</td>
</tr>
<tr>
<td>atheroma [āth-e-r-O-mā]</td>
<td>ather-, fatty matter + oma, tumor A fatty deposit (plaque) in the wall of an artery.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>atherosclerosis</strong> [ATH-ér-ō-sklěr-ō-sis]</td>
<td>Hardening of the arteries caused by the buildup of atheromas.</td>
</tr>
<tr>
<td>athero-, fatty matter + sclerosis</td>
<td></td>
</tr>
<tr>
<td><strong>atrial fibrillation</strong> [ă-trî-LĂ-shŭn]</td>
<td>An irregular, usually rapid, heartbeat caused by overstimulation of the AV node.</td>
</tr>
<tr>
<td>atrio-, atrium + ventricle</td>
<td></td>
</tr>
<tr>
<td><strong>bacterial endocarditis</strong></td>
<td>Bacterial inflammation of the inner lining of the heart.</td>
</tr>
<tr>
<td><strong>bradycardia</strong> [brăd-ē-KĀR-de-ă]</td>
<td>Heart rate of fewer than 60 beats per minute.</td>
</tr>
<tr>
<td>brady-, slow + Greek kardia, heart</td>
<td></td>
</tr>
<tr>
<td><strong>bruit</strong> [brū-Ê]</td>
<td>Sound or murmur, especially an abnormal heart sound heard on auscultation, especially of the carotid artery.</td>
</tr>
<tr>
<td>French, noise</td>
<td></td>
</tr>
<tr>
<td><strong>cardiac arrest</strong></td>
<td>Sudden stopping of the heart; also called asystole.</td>
</tr>
<tr>
<td><strong>cardiac tamponade</strong> [tām-pō-NĀD]</td>
<td>Compression of the heart caused by fluid accumulation in the pericardial sac.</td>
</tr>
<tr>
<td><strong>cardiomyopathy</strong> [KĀR-de-ŏ-mī-ÔP-ă-thē]</td>
<td>Disease of the heart muscle.</td>
</tr>
<tr>
<td>cardio-, heart + myo-, muscle + -pathy, disease</td>
<td></td>
</tr>
<tr>
<td><strong>claudication</strong> [klāw-ŭ-KĀ-shŭn]</td>
<td>Limping caused by inadequate blood supply during activity; usually subsides during rest.</td>
</tr>
<tr>
<td>Latin claudicatio, limping</td>
<td></td>
</tr>
<tr>
<td><strong>coarctation</strong> [kō-ărk-TA-shŭn] of the aorta</td>
<td>Abnormal narrowing of the aorta.</td>
</tr>
<tr>
<td>Latin coarcto, to press together</td>
<td></td>
</tr>
<tr>
<td><strong>congenital</strong> [kŏn-JĔN-Ĭ-tăl] heart disease</td>
<td>Heart disease (usually a type of malformation) that exists at birth.</td>
</tr>
<tr>
<td><strong>congestive</strong> [kŏn-JĔS-tĭv] heart failure</td>
<td>Inability of the heart to pump enough blood out during the cardiac cycle; collection of fluid in the lungs results.</td>
</tr>
<tr>
<td><strong>constriction</strong> [kŏn-STRĬK-shŭn]</td>
<td>Compression or narrowing caused by contraction, as of a vessel.</td>
</tr>
<tr>
<td><strong>coronary artery disease</strong></td>
<td>Condition that reduces the flow of blood and nutrients through the arteries of the heart.</td>
</tr>
<tr>
<td><strong>cyanosis</strong> [sĭ-ă-NŌ-sĭs]</td>
<td>Bluish or purplish coloration, as of the skin, caused by inadequate oxygenation of the blood.</td>
</tr>
<tr>
<td>Greek, dark blue color</td>
<td></td>
</tr>
<tr>
<td><strong>deep vein thrombosis</strong> [thrŏm-BŎ-sĭs]</td>
<td>Formation of a thrombus (clot) in a deep vein, such as a femoral vein.</td>
</tr>
<tr>
<td><strong>dysrhythmia</strong> [dīs-RĪTH-mē-ă]</td>
<td>Abnormal heart rhythm.</td>
</tr>
<tr>
<td>dysr-, difficult + Greek rhythmos, rhythm</td>
<td></td>
</tr>
<tr>
<td><strong>embolus</strong> [ĒM-bŏ-lŭs]</td>
<td>Mass of foreign material blocking a vessel.</td>
</tr>
<tr>
<td>Greek embolos, plug</td>
<td></td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>------------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>endocarditis [ÉN-dō-kār-DĬ-tĭs] endo-, within + card-, heart + -itis, inflammation</td>
<td>Inflammation of the endocardium, especially an inflammation caused by a bacterial (for example, staphylococci) or fungal agent.</td>
</tr>
<tr>
<td>essential hypertension</td>
<td>High blood pressure without any known cause.</td>
</tr>
<tr>
<td>flutter</td>
<td>Regular but very rapid heartbeat.</td>
</tr>
<tr>
<td>gallop</td>
<td>Triple sound of a heartbeat, usually indicative of serious heart disease.</td>
</tr>
<tr>
<td>heart block</td>
<td>See atrioventricular block.</td>
</tr>
<tr>
<td>high blood pressure</td>
<td>See hypertension.</td>
</tr>
<tr>
<td>hypertension [HI-pĕr-TĔN-shŭn] hyper-, excessive + tension</td>
<td>Chronic condition with blood pressure greater than 140/90.</td>
</tr>
<tr>
<td>hypertensive heart disease</td>
<td>Heart disease caused, or worsened, by high blood pressure.</td>
</tr>
<tr>
<td>hypotension [HI-pŏ-TĔN-shŭn] hypo-, below normal + tension</td>
<td>Chronic condition with blood pressure below normal.</td>
</tr>
<tr>
<td>infarct [ĬN-färkt] Latin infarcto, to stuff into</td>
<td>Area of necrosis caused by a sudden drop in the supply of arterial or venous blood.</td>
</tr>
<tr>
<td>infarction [ihn-FĀRK-shŭn]</td>
<td>Sudden drop in the supply of arterial or venous blood, often due to an embolus or thrombus.</td>
</tr>
<tr>
<td>intermittent claudication</td>
<td>Attacks of limping, particularly in the legs, due to ischemia of the muscles.</td>
</tr>
<tr>
<td>intracardiac [ihn-tră-KĀR-dē-ăk] tumor intra-, within + cardiac</td>
<td>A tumor within one of the heart chambers.</td>
</tr>
<tr>
<td>ischemia [ĭs-KĔ-mē-ă] From Greek ischo, to keep back + haima, blood</td>
<td>Localized blood insufficiency caused by an obstruction.</td>
</tr>
<tr>
<td>low blood pressure</td>
<td>See hypotension.</td>
</tr>
<tr>
<td>mitral [MĬ-trăl] insufficiency or reflux</td>
<td>Backward flow of blood due to a damaged mitral valve.</td>
</tr>
<tr>
<td>mitral stenosis</td>
<td>Abnormal narrowing at the opening of the mitral valve.</td>
</tr>
<tr>
<td>mitral valve prolapse</td>
<td>Backward flow of blood into the left atrium due to protrusion of one or both mitral cusps into the left atrium during contractions.</td>
</tr>
<tr>
<td>murmur</td>
<td>Soft heart humming sound heard between normal beats.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>------</td>
<td>------------</td>
</tr>
<tr>
<td>myocardial infarction</td>
<td>Sudden drop in the supply of blood to an area of the heart muscle, usually due to a blockage in a coronary artery.</td>
</tr>
<tr>
<td>myocarditis</td>
<td>Inflammation of the myocardium.</td>
</tr>
<tr>
<td>necrosis</td>
<td>Death of tissue or an organ or part due to irreversible damage; usually a result of oxygen deprivation.</td>
</tr>
<tr>
<td>occlusion</td>
<td>The closing of a blood vessel.</td>
</tr>
<tr>
<td>palpitations</td>
<td>Uncomfortable pulsations of the heart felt as a thumping in the chest.</td>
</tr>
<tr>
<td>patent ductus arteriosus</td>
<td>A condition at birth in which the ductus arteriosus, a small duct between the aorta and the pulmonary artery, remains abnormally open.</td>
</tr>
<tr>
<td>perfusion deficit</td>
<td>Lack of flow through a blood vessel, usually caused by an occlusion.</td>
</tr>
<tr>
<td>pericarditis</td>
<td>Inflammation of the pericardium.</td>
</tr>
<tr>
<td>peripheral vascular disease</td>
<td>Vascular disease in the lower extremities, usually due to blockages in the arteries of the groin or legs.</td>
</tr>
<tr>
<td>petechiae</td>
<td>Minute hemorrhages in the skin.</td>
</tr>
<tr>
<td>phlebitis</td>
<td>Inflammation of a vein.</td>
</tr>
<tr>
<td>plaque</td>
<td>Buildup of solid material, such as a fatty deposit, on the lining of an artery.</td>
</tr>
<tr>
<td>premature atrial contractions (PACs)</td>
<td>Atrial contractions that occur before the normal impulse; can be the cause of palpitations.</td>
</tr>
<tr>
<td>premature ventricular contractions (PVCs)</td>
<td>Ventricular contractions that occur before the normal impulse; can be the cause of palpitations.</td>
</tr>
<tr>
<td>pulmonary artery stenosis</td>
<td>Narrowing of the pulmonary artery, preventing the lungs from receiving enough blood from the heart to oxygenate.</td>
</tr>
<tr>
<td>pulmonary edema</td>
<td>Abnormal accumulation of fluid in the lungs.</td>
</tr>
<tr>
<td>Raynaud's phenomenon</td>
<td>Spasm in the arteries of the fingers causing numbness or pain.</td>
</tr>
</tbody>
</table>

**Chapter 6 The Cardiovascular System**
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>rheumatic heart disease</td>
<td>Heart valve and/or muscle damage caused by an untreated streptococcal infection.</td>
</tr>
<tr>
<td>Greek rheumatikos, subject to flux, the discharge of fluids</td>
<td></td>
</tr>
<tr>
<td>risk factor</td>
<td>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.</td>
</tr>
<tr>
<td>rub</td>
<td>Frictional sound heard between heartbeats, usually indicating a pericardial murmur.</td>
</tr>
<tr>
<td>secondary hypertension</td>
<td>Hypertension having a known cause, such as kidney disease.</td>
</tr>
<tr>
<td>septal defect</td>
<td>Congenital abnormality consisting of an opening in the septum between the atria or ventricles.</td>
</tr>
<tr>
<td>stenosis [stē-NÕ-sís]</td>
<td>Narrowing, particularly of blood vessels or of the cardiac valves.</td>
</tr>
<tr>
<td>tachycardia [TÅK-ĭ-KÄR-de-ă] tachy-, fast + Greek kardia, heart</td>
<td>Heart rate greater than 100 beats per minute.</td>
</tr>
<tr>
<td>tetralogy of Fallot [fā-LÔ] After Étienne-Louis A. Fallot (1850–1911), French physician</td>
<td>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.</td>
</tr>
<tr>
<td>thrombosis [thrōm-BÔ-sís] Greek, a clotting</td>
<td>Presence of a thrombus in a blood vessel.</td>
</tr>
<tr>
<td>thrombus [THRÔM-būs] Latin, clot</td>
<td>Stationary blood clot in the cardiovascular system, usually formed from matter found in the blood.</td>
</tr>
<tr>
<td>tricuspid stenosis</td>
<td>Abnormal narrowing of the opening of the tricuspid valve.</td>
</tr>
<tr>
<td>varicose [VĀR-ĭ-kōs] vein Latin varīx, dilated vein</td>
<td>Dilated, enlarged, or twisted vein, usually on the leg.</td>
</tr>
<tr>
<td>vegetation [vĕj-ĕ-TĀ-shūn]</td>
<td>Clot on a heart valve or opening, usually caused by infection.</td>
</tr>
</tbody>
</table>
**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?

<table>
<thead>
<tr>
<th>24. A</th>
<th>Date(s) of Service From</th>
<th></th>
<th>25. FEDERAL TAX I.D. NUMBER</th>
<th></th>
<th>26. PATIENT’S ACCOUNT NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td>MM</td>
<td>DD</td>
<td>YY</td>
<td>MM</td>
<td>DD</td>
<td>YY</td>
</tr>
<tr>
<td>08</td>
<td>15</td>
<td>2023</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>27. ACCEPT ASSIGNMENT?</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>28. TOTAL CHARGE</th>
<th>29. AMOUNT PAID</th>
<th>30. BALANCE DUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>74 00</td>
<td>74 00</td>
<td>74 00</td>
</tr>
</tbody>
</table>

**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.
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).

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) __________ __________.

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.
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.

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.
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>anastomosis [än-nås-tō-MÔ-sës] Greek, to furnish with a mouth</td>
<td>Surgical connection of two blood vessels to allow blood flow between them.</td>
</tr>
<tr>
<td>angioplasty [än-jë-ÔS-kō-pë] angio-, vessel + -plasty, repair</td>
<td>Opening of a blocked blood vessel, as by balloon dilation.</td>
</tr>
<tr>
<td>angioscopy [än-jë-ÖS-kō-pë] angio- + -scopy, viewing</td>
<td>Viewing of the interior of a blood vessel using a fiberoptic catheter inserted or threaded into the vessel.</td>
</tr>
<tr>
<td>arteriotomy [år-tër-ë-ÖT-ô-më] arterio-, artery + -tomy, cutting</td>
<td>Surgical incision into an artery, especially to remove a clot.</td>
</tr>
<tr>
<td>balloon catheter dilation</td>
<td>Insertion of a balloon catheter into a blood vessel to open the passage so blood can flow freely.</td>
</tr>
<tr>
<td>balloon valvuloplasty [VÄL-vyū-lō-PLÄS-të]</td>
<td>Procedure that uses a balloon catheter to open narrowed orifices in cardiac valves.</td>
</tr>
<tr>
<td>bypass</td>
<td>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.</td>
</tr>
<tr>
<td>cardiopulmonary [KÂR-dë-ô-PÜL-mô-nër-ë] bypass</td>
<td>Procedure used during surgery to divert blood flow to and from the heart through a heart-lung machine and back into circulation.</td>
</tr>
<tr>
<td>coronary angioplasty</td>
<td>See angioplasty.</td>
</tr>
<tr>
<td>coronary bypass surgery</td>
<td>See bypass.</td>
</tr>
<tr>
<td>endovascular [ën-dō-VÂS-kyû-lâr] surgery endo-, within + vascular</td>
<td>Any of various procedures performed during cardiac catheterization, such as angioscopy and atherectomy.</td>
</tr>
<tr>
<td>Fontan’s [FÔN-tänz] operation After François Fontan (1929–), French surgeon</td>
<td>Surgical procedure that creates a bypass from the right atrium to the main pulmonary artery; Fontan’s procedure.</td>
</tr>
<tr>
<td>graft</td>
<td>Any tissue or organ implanted to replace or mend damaged areas.</td>
</tr>
<tr>
<td>heart transplant</td>
<td>Implantation of the heart of a person who has just died into a person whose diseased heart cannot sustain life.</td>
</tr>
</tbody>
</table>
**Term** | **Definition**
--- | ---
intravascular stent | Stent placed within a blood vessel to allow blood to flow freely.
intra-, within + vascular


phlebotomy [flē-BÔT-ə-mē] phlebo-, vein + -tomy | Drawing blood from a vein via a small incision.

stent [stěnt] | Surgically implanted device used to hold something (as a blood vessel) open.


valve replacement | Surgical replacement of a coronary valve.

valvotomy [vāl-VOŤ-ə-mē] valve + -tomy | Incision into a cardiac valve to remove an obstruction.


venipuncture [VĔN-ĭ-pûnk-chūr, VĔ-nĭ-PŬNK-chūr] 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 ________________________________

---

192 Chapter 6 The Cardiovascular System
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 ____________ 108. valvitomy ____________
104. atherectomy ____________ 109. veinipuncture ____________
105. arteritomy ____________ 110. valvuloplasty ____________
106. angiascopy ____________ 111. coronery ____________
107. hemorrhoidectomy ____________

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

<table>
<thead>
<tr>
<th>Drug Class</th>
<th>Purpose</th>
<th>Generic Name</th>
<th>Trade Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>coronary vasodilators</td>
<td>dilate veins, arteries, and coronary arteries; used to treat angina, myocardial infarction, congestive heart failure</td>
<td>nitroglycerin</td>
<td>Nitrocut, Nitrong, Deponit, Nitro-Dur, Nitro-Bid, Transderm-Nitro, and many others</td>
</tr>
<tr>
<td>beta blockers</td>
<td>reduce contraction strength of heart muscle; lower blood pressure; slow heartbeat</td>
<td>propanolol, metoprolol, atenolol bisoprolol</td>
<td>Inderal, Lopressor, Tenormin, Zabeta</td>
</tr>
<tr>
<td>calcium channel blockers</td>
<td>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</td>
<td>verapamil, nifedipine, diltiazem, nicardipine, amlodipine, bepridil, felodipine</td>
<td>Calan, Isoptin, Verelan, Procardia, Adalat, Cardizem, Dilacor XR, Cardene, Noravsc, Istin, Vascor, Plendil, Hydac</td>
</tr>
<tr>
<td>thrombolytics</td>
<td>dissolve blood clots</td>
<td>urokinase tissue-type plasminogen activator (tPA, TPA)</td>
<td>Abbokinase, Activase</td>
</tr>
<tr>
<td>Drug Class</td>
<td>Purpose</td>
<td>Generic Name</td>
<td>Trade Name</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>------------------------------------------------------------------------</td>
<td>-----------------------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>bile acid sequestrants</td>
<td>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</td>
<td>cholestyramine</td>
<td>Prevalite, Questran, Cholybar, Colestid, Welchol</td>
</tr>
<tr>
<td></td>
<td></td>
<td>colestipol</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>colesevelam</td>
<td></td>
</tr>
<tr>
<td>lipid-lowering medications</td>
<td>reduce triglycerides and cholesterol (but mechanisms not totally understood)</td>
<td>atorvastatin</td>
<td>Lipitor, Mevacor, Pravachol, Zocor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>lovastatin</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>pravastatin</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>simvastatin</td>
<td></td>
</tr>
<tr>
<td>centrally acting hypertensive agents, antihypertensive</td>
<td>decrease blood pressure by affecting brain control centers</td>
<td>methyldopa</td>
<td>Aldomet, Tenex, Wytensin</td>
</tr>
<tr>
<td></td>
<td></td>
<td>guanfacine</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>guanabenz</td>
<td></td>
</tr>
<tr>
<td>direct-acting vasodilators</td>
<td>lower blood pressure by relaxing walls of blood vessels</td>
<td>hydralazine</td>
<td>Apressoline, Loniten</td>
</tr>
<tr>
<td>peripherally acting hypertensive agents</td>
<td>lower blood pressure by affecting nerves involved in blood pressure regulation</td>
<td>guanadrel</td>
<td>Hylorel, Ismelin, Inversine, Minipres, Harmonyl, Raudixin,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>guanethidine</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>mecamylamine</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>prazosin</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>rauwolfia alkaloids</td>
<td></td>
</tr>
<tr>
<td>ACE inhibitors</td>
<td>ease heart pumping and lower blood pressure by dilating arteries</td>
<td>lisinopril</td>
<td>Zestril, Prinivil, Vasotec, Renitec, Accupril</td>
</tr>
<tr>
<td></td>
<td></td>
<td>enalapril</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>quinapril</td>
<td></td>
</tr>
<tr>
<td>angiotensin II receptor blockers</td>
<td>block the action of angiotensin II, a chemical that causes blood vessels to narrow. The blood vessels then dilate and blood pressure is lowered.</td>
<td>losartan</td>
<td>Cozaar, Diovin, Avapro</td>
</tr>
<tr>
<td></td>
<td></td>
<td>valsartan</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>irbesartan</td>
<td></td>
</tr>
<tr>
<td>diuretics</td>
<td>promote removal of water by kidneys to lower blood pressure and relieve edema</td>
<td>furosemide</td>
<td>Lasix, Esidrix, Hydrodiuril, Aldactone, Bumex</td>
</tr>
<tr>
<td></td>
<td></td>
<td>hydrochlorothiazide</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>spironolactone</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>bumetanide</td>
<td></td>
</tr>
<tr>
<td>combination diuretics</td>
<td></td>
<td>hydrochlorothiazide plus triamterene</td>
<td>Maxside</td>
</tr>
<tr>
<td>inotropic agents</td>
<td>increase amount of blood the heart is able to pump by increasing squeezing strength of heart muscle</td>
<td>digitalis</td>
<td>Primacor, Lanoxin, Lanoxicap, Crystodiggin, Intropin</td>
</tr>
<tr>
<td></td>
<td></td>
<td>milrinone</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>digoxin</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>digitoxin</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>dopamine</td>
<td></td>
</tr>
<tr>
<td>antiarrhythmics</td>
<td>alter the electrical flow through the heart's conduction system thereby regulating fast or irregular heartbeats</td>
<td>quinidine</td>
<td>Cardioquin, Quinagulte, Quinidx, Quinora, Procan SR, Pronestyl, Norpace, Norpace CR, Mexitil</td>
</tr>
<tr>
<td></td>
<td></td>
<td>procainamide</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>disopyramide</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>mexiletine</td>
<td></td>
</tr>
</tbody>
</table>
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, anticlotting 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.

**TABLE 6-1 (continued)**

<table>
<thead>
<tr>
<th>Drug Class</th>
<th>Purpose</th>
<th>Generic Name</th>
<th>Trade Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>anticoagulants, anticlotting</td>
<td>reduce proteins involved in blood clotting so clots cannot form as readily</td>
<td>warfarin</td>
<td>Coumadin</td>
</tr>
<tr>
<td></td>
<td></td>
<td>enoxaparin</td>
<td>Lovenox</td>
</tr>
<tr>
<td></td>
<td></td>
<td>dicumarol</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>heparin</td>
<td></td>
</tr>
<tr>
<td>antiplatelet medications</td>
<td>reduce ability of blood platelets to clot</td>
<td>aspirin</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>dipyridamole</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>clopidogrel</td>
<td></td>
</tr>
<tr>
<td>hemorrhologic agents</td>
<td>decrease viscosity of blood; used to treat claudication</td>
<td>pentoxifylline</td>
<td>Trental</td>
</tr>
<tr>
<td></td>
<td></td>
<td>cuksistazik</td>
<td>Pletal</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Agent</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>angiotensin converting enzyme (ACE) inhibitor</td>
<td>Medication used for heart failure and other cardiovascular problems; acts by dilating arteries to lower blood pressure and makes heart pump easier.</td>
</tr>
<tr>
<td>antianginal</td>
<td>Agent used to relieve or prevent attacks of angina.</td>
</tr>
<tr>
<td>antiarrhythmic</td>
<td>Agent used to help normalize cardiac rhythm.</td>
</tr>
<tr>
<td>anticlotting</td>
<td>See anticoagulant.</td>
</tr>
<tr>
<td>anticoagulant</td>
<td>Agent that prevents the formation of dangerous clots</td>
</tr>
<tr>
<td>antihypertensive</td>
<td>Agent that helps control high blood pressure.</td>
</tr>
<tr>
<td>beta [BÀ-tá] blocker</td>
<td>Agent that lowers blood pressure by reducing contraction strength of the heart muscle; slows heartbeat.</td>
</tr>
<tr>
<td>calcium channel blocker</td>
<td>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.</td>
</tr>
<tr>
<td>cardiotonic [KĀR-dē-ō-TŌN-ık]</td>
<td>Medication for congestive heart failure; increases the force of contractions of the myocardium.</td>
</tr>
<tr>
<td>diuretic [dī-yū-RĒT-ık]</td>
<td>Medication that promotes the excretion of urine.</td>
</tr>
<tr>
<td>heparin [HĒP-ā-rīn]</td>
<td>Anticoagulant present in the body; also, synthetic version administered to prevent clotting.</td>
</tr>
<tr>
<td>lipid-lowering</td>
<td>Helpful in lowering cholesterol levels.</td>
</tr>
<tr>
<td>nitrate [NĪ-trät]</td>
<td>Any of several medications that dilate the veins, arteries, or coronary arteries; used to control angina.</td>
</tr>
<tr>
<td>statins [STĀ-tinz]</td>
<td>A class of lipid-lowering agents that are the most frequently used today.</td>
</tr>
<tr>
<td>tissue-type plasminogen [plāz-MĪN-ō-jēn] activator (tPA, TPA)</td>
<td>Agent that prevents a thrombus from forming.</td>
</tr>
<tr>
<td>vasoconstrictor [VĀ-sō-kôn-STRĪK-tōr]</td>
<td>Agent that narrows the blood vessels.</td>
</tr>
<tr>
<td>vasodilator [VĀ-sō-di-LĀ-tōr] vaso- + dilator</td>
<td>Agent that dilates or widens the blood vessels.</td>
</tr>
</tbody>
</table>
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?

PHARMACOLOGICAL TERMS EXERCISES

Reverse Diagnosis

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

114. metprolol, Vasotec, and Bumex ________________________________

115. Coumadin, aspirin, and pentoxifylline ________________________________

116. nitroglycerin, Avapro, and furosmide ________________________________

Check Your Knowledge

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

117. hypertension __________________ 121. clotting __________

118. water retention __________________ 122. arterial plaque __________

119. arrhythmia ______________ 123. angina ______________

120. high cholesterol ______________ 124. congestive heart failure __________

Matching

Match the following cardiovascular pharmacological classifications with their correct definitions.

125. __________ diuretics  a. reduce ability of blood platelets to clot

126. __________ ACE inhibitors  b. decrease viscosity of blood

127. __________ calcium channel blockers  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. _________ antiarrhythmic  
   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 hypokinesis 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

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  
203. __________ a regular but very rapid heartbeat  
  more than 250 bpm  
204. __________ a normal, regular heart beat  
205. __________ slow but regular heartbeat below 60 bpm  
206. __________ chaotic, irregular, life-threatening rhythm  
207. __________ rapid, triple beat of the heart  
208. __________ the heart has completely stopped beating  
209. __________ sudden drop in blood supply to the heart,  
  usually due to a blockage in a coronary artery

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

210. __________ ductus arteriosus  
211. __________ aorta  
212. __________ myocardium  
213. __________ aortic valve  
214. __________ septum  
215. __________ systole  
216. __________ pulmonary valve

217. __________ a. contraction  
218. __________ b. muscular tissue  
219. __________ c. semilunar valve  
220. __________ d. thrombocytes  
221. __________ e. fetal circulation  
222. __________ f. partition  
223. __________ 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 [ä-näs-tō-MÕ-sīs] [anastomosis]
253. aneurysm [ÅN-yūr-īzm] [aneurisma]
254. angina [ÅN-jī-nā, än-Jī-nā] [angina]
255. angina pectoris [åŋ-kgōr-ēs, åŋ-TÔr-ēs] [angina de pecho]
256. angi(o)
257. angiocardiology [åŋ-jē-ō-kâr-dē-OG-rā-fē]
258. angiography [åŋ-jō-ÖG-rā-fē]
259. angioplasty [ÅN-jē-ō-plās-tē] [angioplastia]
260. angioscopy [åŋ-jē-ÖS-kō-pē] [angioscopia]
261. angiotensin [åŋ-jō-ÖTÉNS-sīn] converting enzyme (ACE) inhibitor
262. antianginal [åŋ-tē-ÅN-jī-nāl]
263. antiarrhythmic [åŋ-tē-ä-āRITH-mīk]
264. anticlotting
265. anticoagulant
266. antihypertensive
267. aorta [ä-ÖR-tā] [aorta]
268. aort(o)
269. aortic regurgitation [ä-ÖR-tīk rē-GÜR-jī-TĀ-shūn] or reflux [RĒ-flūks]
270. aortic stenosis [stē-NO-sīs]
271. aortic valve
359. foramen ovale (fô-rÄ-mën ő-VÄ-lé)
360. gallop (galope)
361. graft
362. heart [hårt] (corazón)
363. heart block
364. heart transplant
365. hemangi(o)
366. hemorrhoidectomy [HÉM-ô-röy-DËK-tô-më] (hemorroidectomía)
367. hemorrhoids [HÉM-ô-röydë] (hemorroides)
368. heparin [HÊP-ä-rûn] (heparina)
369. high blood pressure [presión arterial alta]
370. Holter [HÔL-têr] monitor
371. hypertension [HÎ-për-TÉN-shûn] (hipertensión)
372. hypertensive heart disease
373. hypotension [HÎ-pô-TÉN-shûn] (hipotensión)
374. infarct [ÎN-fârk] (infarto)
375. infarction [în-FÄRK-shûn] (infarto)
376. inferior vena cava [VÈ-nä KÄ-vä, KÄ-vä]
377. intermittent claudication
378. intracardiac [în-trä-KÄR-dë-äk] tumor
379. intravascular stent
380. ischemia [îs-KÉ-më-ä] (isquemia)
381. left atrium
382. left ventricle
383. lipid-lowering
384. lipid [LÎP-îd] profile
385. low blood pressure [presión arterial baja]
386. lumen [LÛ-mên] (lumen)
387. mitral [MÎ-trä] insufficiency or reflux
388. mitral stenosis
389. mitral [MÎ-trä] valve
390. mitral valve prolapse
391. multiple-gated acquisition (MUGA) angiography
392. murmur [so-plô]
393. myocardial infarction
394. myocarditis [MÎ-ô-käŕ-DÎ-tës] (miocarditis)
395. myocardium [mî-ô-KÄR-dë-ûm] (miocardio)
396. necrosis [në-KRÖ-sës] (necrosis)
397. nitrate [NÎ-trât]
398. occlusion [ô-KLÜ-zhûn] (oclusión)
399. pacemaker (marcapaso)
400. palpitations [päl-pî-TÄ-shûn] (palpitaciones)
401. patent ductus arteriosus [PÄ-tënt DÜK-tës är-tèr-e-Ö-sës]
402. percutaneous transluminal [për-kyû-TÄ-në-ûs trâns-LÜ-min-ä] coronary angioplasty
403. perfusion deficit
404. pericardi(o)
405. pericarditis [PÉR-ë-käŕ-DÎ-tës] (pericarditis)
406. pericardium [për-ë-KÄR-de-ûm] (pericardio)
407. peripheral vascular disease
408. petechiae (sing., petechia) [pë-TÉ-ke-ë, pë-TÉK-e-ë (pë-TÉ-ke-ë, pë-TÉK-e-ë)] (petequia)
409. phleb(o)
410. phlebitis [flë-BÎ-tës] (flebitis)
411. phlebography [flë-BÔG-rä-fë] (flebografía)
412. phlebotomy [flë-BÔT-ô-më] (flebotomía)
413. plaque [plâk] (placa)
414. polarization [pô-lär-ë-ŻÄ-shûn] (polarización)
415. popliteal [pôplî-teal] artery
416. positron emission tomography [rô-MÔG-rä-fë] (PET) scan
417. premature atrial contractions (PACs)
418. premature ventricular contractions (PVCs)
419. pulmonary [PÜL-mô-när-ë] artery (arteria pulmonar)
420. pulmonary artery stenosis
421. pulmonary edema
422. pulmonary valve
423. pulmonary vein
424. pulse [pûls] (pulso)
425. Raynaud's [râ-NÖZ] phenomenon
426. repolarization [rê-pû-lär-ë-ŻÄ-shûn] (repolarización)
427. rheumatic heart disease
428. right atrium
429. right ventricle
430. risk factor
431. rub [roce]
432. saphenous [sâ-FÊ-nûs] vein
433. secondary hypertension
434. semilunar [sëm-ë-LÜ-när] valve
435. septal defect
436. septum (pl., septa) [SÈP-tûm (SÈP-të) (tablique)
437. serum enzyme tests
438. sinoatrial [si-nô-Ä-trë-ë] node (SA node)
439. sinus rhythm
440. sonography [sô-ÑÖG-rä-fë] (sonografía)
441. sphygm(o)
442. sphygmonanometer [SFIG-mô-mä-ÑÖM-ë-tër] (esfigmanómetro)
443. statins [STÄ-tî-ë]
444. stenosis [stë-ÑÖ-sës] (estenosis)
445. stent [stënt]
446. stress test
TERM

447. superior vena cava
448. systole [SĬS-tŏ-le] {sístole}
449. tachycardia [TĀK-ĭ-KĀR-dē-ă] {taquicardia}
450. tetralogy of Fallot [fā-LŎ]
451. throm(o)
452. thrombectomy [thrŏm-BĒK-tŏ-mē] {trombectomia}
453. thrombolytic [thrŏm-bō-LĬ-tĭk]
454. thrombophlebitis [THRŎM-bō-flē-BĬ-tĭs] {tromboflebitis}
455. thrombosis [thrŏm-BŎ-sĭs] {trombosis}
456. thrombotic [thrŏm-BŎT-ĭk] occlusion
457. thrombus [THRŎM-bŭs] {trombo}
458. tissue-type plasminogen activator (tPA, TPA)
459. tricuspid [trĭ-KŬS-pĭd] stenosis
460. tricuspid valve
461. triglyceride [trĭ-GLĬS-ĕr-id] {triglicérido}
462. valve [vālv] {válvula}
463. valve replacement
464. valvotomy [vāl-VŎT-ŏ-mē] {valvulitis}
465. valvulitis [vāl-vyŭ-LĬ-tĭs] {valvulitis}
466. valvuloplasty [VĀL-vyŭ-lō-PLĀS-tē] {valvuloplastia}
467. varicose [VĀR-ĭ-kŏs] vein
468. vas(o)
469. vasoconstrictor [VĀ-sŏ-kŏn-STRĬK-tŏr]
470. vasodilator [VĀ-sŏ-dĭ-LĀ-tŏr]
471. vegetation [vēj-ĕ-TĀ-shŭn] {vegetación}
472. vein [vēn] {vena}
473. vena cava (pl., venae cavae) [VE-nā KĀ-va, KĀ-va (VE-nē KĀ-ve, KĀ-ve)]
474. ven(o)
475. venipuncture [VĔN-ĭ-pŭnk-chŭr, VĔ-nĭ-PŬNK-chŭr] {venipuntura}
476. venography [vē-NŎG-rĭ-fĕ] {venografía}
477. ventricle [VĔN-trĭ-kl] {ventrículo}
478. ventriculogram [vēn-TRĬK-yŭ-lō-grām]
479. venule [VĔN-yŭl, VĔ-nūl] {vēnula}

Abbreviations

Write out the full meaning of each abbreviation.

ABBREVIATION

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>480. AcG</td>
<td>495. CPK</td>
</tr>
<tr>
<td>481. AF</td>
<td>496. CPR</td>
</tr>
<tr>
<td>482. AS</td>
<td>497. CVA</td>
</tr>
<tr>
<td>483. ASCVD</td>
<td>498. CVD</td>
</tr>
<tr>
<td>484. ASD</td>
<td>499. DSA</td>
</tr>
<tr>
<td>485. ASHD</td>
<td>500. DVT</td>
</tr>
<tr>
<td>486. AV</td>
<td>501. ECG, EKG</td>
</tr>
<tr>
<td>487. BP</td>
<td>502. ECHO</td>
</tr>
<tr>
<td>488. CABG</td>
<td>503. ETT</td>
</tr>
<tr>
<td>489. CAD</td>
<td>504. GOT</td>
</tr>
<tr>
<td>490. zcath</td>
<td>505. HDL</td>
</tr>
<tr>
<td>491. CCU</td>
<td>506. LDH</td>
</tr>
<tr>
<td>492. CHD</td>
<td>507. LDL</td>
</tr>
<tr>
<td>493. CHF</td>
<td>508. LV</td>
</tr>
<tr>
<td>494. CO</td>
<td>509. LVH</td>
</tr>
<tr>
<td>495. CPK</td>
<td>510. MI</td>
</tr>
<tr>
<td>496. CPR</td>
<td>511. MR</td>
</tr>
<tr>
<td>497. CVA</td>
<td>512. MS</td>
</tr>
<tr>
<td>498. CVD</td>
<td>513. MUGA</td>
</tr>
<tr>
<td>499. DSA</td>
<td>514. MVP</td>
</tr>
<tr>
<td>500. DVT</td>
<td>515. PAC</td>
</tr>
<tr>
<td>501. ECG, EKG</td>
<td>516. PTCA</td>
</tr>
<tr>
<td>502. ECHO</td>
<td>517. PVC</td>
</tr>
<tr>
<td>503. ETT</td>
<td>518. SA</td>
</tr>
<tr>
<td>504. GOT</td>
<td>519. SV</td>
</tr>
<tr>
<td>505. HDL</td>
<td>520. tPA, TPA</td>
</tr>
<tr>
<td>506. LDH</td>
<td>521. VLDL</td>
</tr>
<tr>
<td>507. LDL</td>
<td>522. VSD</td>
</tr>
<tr>
<td>508. LV</td>
<td>523. VT</td>
</tr>
<tr>
<td>509. LVH</td>
<td>510. MI</td>
</tr>
</tbody>
</table>

Chapter 6  The Cardiovascular System
### Answers to Chapter Exercises

1. overweight, sedentary, smoker
2. no
3. a. pulmonary valve—controls blood flow between the right ventricle and the pulmonary arteries
   b. aortic valve—controls blood flow between the aorta and the left ventricle
   c. right pulmonary artery—one of two arteries that carry blood that is low in oxygen from the heart to the lungs
   d. interatrial septum—partition separating the two atria
   e. tricuspid valve—atrioventricular valve on the right side of the heart
   f. inferior vena cava—large vein that draws blood from the lower part of the body to the right atrium
   g. right ventricle—one of the heart’s four chambers
   h. interventricular septum—part of the septum between two ventricles
   i. left ventricle—one of the heart’s four chambers
   j. aorta—artery through which blood exits the heart
4. atrioventricular
5. capillary
6. C
7. Purkinje fibers
8. C
9. arteriole
10. C
11. C
12. systole
13. artery
14. veins
15. endocardium
16. atria and ventricles
17. blood
18. poor diet, smoking, and lack of exercise
19. pulmonary
20. endothelium
21. heart and lungs
22. carotid artery
23. lungs
24. cardiomyopathy
25. pericarditis
26. venogram
27. phlebitis
28. arterioplasty
29. vasoneuropathy
30. vasotropic
31. cardiogenic
32. cardiomegaly
33. thromboarteritis
34. phlebitis
35. thrombectomy
36. phleboplasty, venoplasty
37. atriomegaly
38. phlebograph, venograph
39. cardiomegaly
40. cardiopulmonary
41. pericardiotomy
42. endocarditis
43. phleboplasty, venoplasty
44. vasoparalysis
45. angiorrhaphy
46. phlebitis
47. arteries
48. vein
49. MI
50. artery
51. Skin color and disorientation
52. 8 hours
53. d
54. f
55. h
56. I
57. a
58. g
59. I
60. e
61. c
62. b
63. h
64. c
65. f
66. i
67. g
68. c
69. e
70. j
71. d
72. a
73. ECG—electrocardiogram
74. CCU—coronary care unit
75. MI—myocardial infarction
76. BP—blood pressure
77. ECHO—echocardiogram
78. yes
79. cholesterol
80. arteriosclerosis
81. exercise thallium test, sodium, potassium, CO2, chloride, creatinine, BUN, cholesterol, triglycerides, HDL, LDL, CPK
82. 82803
83. 414.0
84. A
85. D
86. B
87. C
88. tachycardia, bradycardia
89. arrhythmia, dysrhythmia
90. thrombus
91. bruit
92. murmur
93. hypertension
94. risk factors
95. myocardial infarction
96. dietary changes, quit smoking, exercise program, stress reduction
97. depends on individual, but maintaining a healthy lifestyle will help prevent heart disease
98. surgical connection of two blood vessels
99. repair of a cardiac valve
100. incision into a cardiac valve to remove an obstruction
101. surgical removal of an embolus
102. opening of a blocked blood vessel, as by balloon dilation
103. thrombectomy
104. C
105. arteriotomy
106. angioscopy
107. C
108. valvotomy
109. venipuncture
110. C
111. coronary
112. high cholesterol
113. high blood pressure
114. high blood pressure
115. clotting in blood vessels; anticoagulants
116. myocardial infarction
117. Inderal 164. phlebolathy
118. Lasix 165. cardiogenesis
119. Cardioquin 166. hematopoiesis
120. Lipitor 167. cardiac
121. Coumadin 168. electrocardiograph
122. Abbo kinase 169. angiography
123. nitroglycerin 170. electrocardiography
124. Dilatrate 171. phlebotomy
125. f 172. atherectomy
126. d 173. pericarditis
127. j 174. capillaries
128. h 175. arteries
129. g 176. veins
130. a 177. veins
131. i 178. pericardium
132. b 179. aorta
133. e 180. superior vena cava
134. c 181. blood vessels
135. a 182. mitral valve
136. g 183. pulmonary veins
137. c 184. lumen
138. h 185. ductus arteriosus
139. i 186. heart
140. d 187. endocardium
141. j 188. foramen ovale
142. e 189. right atrium
143. f 190. septum
144. b 191. coronary artery
145. arteriosclerosis 192. T
146. endocarditis 193. F
147. bradycardia 194. F
148. angiostenosis 195. F
149. cardiomyopathy 196. T
150. thrombus 197. T
151. aortic stenosis 198. T
152. hematoma 199. T
153. cardiomegaly 200. F
154. aortogram 201. T
155. echocardiogram 202. e
156. electrocardiogram 203. d
157. ischemia 204. a
158. thrombolyis 205. b
159. atherosclerosis 206. c
160. cardiology 207. h
161. hypothermia 208. f
162. hematology 209. g
163. thrombolysis 210. e
164. phlebolathy 211. g
165. cardiogenesis 212. b
166. hematopoiesis 213. c
167. cardiac 214. f
168. electrocardiograph 215. a
169. angiography 216. c
170. electrocardiography 217. -ac
171. phlebotomy 218. -sclerosis
172. atherectomy 219. -pheresis
173. pericarditis 220. -penia
174. capillaries 221. -odynia, -algia
175. arteries 222. -pathy
176. veins 223. -cyte
177. veins 224. -lysis
178. pericardium 225. -osis
179. aorta 226. -phonia
180. superior vena cava 227. -cytosis
181. blood vessels 228. -emic
182. mitral valve 229. -it is
183. pulmonary veins 230. -megaly
184. lumen 231. -plasty
185. ductus arteriosus 232. thrombo-
186. heart 233. semi-
187. endocardium 234. echo-
188. foramen ovale 235. brady-
189. right atrium 236. peri-
190. septum 237. tachy-
191. coronary artery 238. endo-
192. T 239. hypo-
193. F 240. myo-
194. F 241. micro-
195. F 242. pre-
196. T 243. anti-
197. T 244. bi-
198. T 245. hyper-
199. T 246. multi-
200. F 247. post-
201. T 248. macro-
202. e 249. intra-
203. d 250. tri-
204. a 251. poly-
205. b 252–253. Answers are available in
206. c the vocabulary reviews in
207. h this chapter.
208. f
209. g

208  Chapter 6  The Cardiovascular System