CHAPTER

11 The Cardiovascular System

The major structures of the cardiovascular system, the heart and blood vessels, play a vital role in human physiology. The major function of the cardiovascular system is transportation. Using blood as the transport vehicle, the system carries nutrients, gases, wastes, antibodies, electrolytes, and many other substances to and from body cells. Its propulsive force is the contracting heart.

The anatomy and location of the heart and blood vessels and the important understandings of cardiovascular physiology (for example, cardiac cycle, ECG, and regulation of blood pressure) are the major topics of this chapter.

CARDIOVASCULAR SYSTEM: THE HEART

1. Complete the following statements by inserting your answers in the answer blanks.

_____ 1.
_____ 2.
_____ 3.
_____ 4.
_____ 5.
_____ 6.
_____ 7.
_____ 8.
_____ 9.
_____ 10.
_____ 11.

The heart is a cone-shaped muscular organ located within the __(1)__. Its apex rests on the __(2)__, and its base is at the level of the __(3)__ rib. The coronary arteries that nourish the myocardium arise from the __(4)__. The coronary sinus empties into the __(5)__. Relative to the roles of the heart chambers, the __(6)__ are receiving chambers, whereas the __(7)__ are discharging chambers. The membrane that lines the heart and also forms the valve flaps is called the __(8)__. The outermost layer of the heart is called the __(9)__. The fluid that fills the pericardial sac acts to decrease __(10)__ during heart activity. The heart muscle, or myocardium, is composed of a specialized type of muscle tissue called __(11)__.

2. The heart is called a double pump because it serves two circulations. Trace the flow of blood through both the pulmonary and systemic circulations by writing the missing terms in the answer blanks. Then, color regions transporting O_2-poor blood blue and regions transporting O_2-rich blood red on Figure 11–1. Finally, identify the various regions of the circulation shown in Figure 11–1 by labeling them using the key choices.

_____ 1.

_____ 2.

_____ 3.

_____ 4.

_____ 5.

_____ 6.

_____ 7.

_____ 8.

_____ 9.

_____ 10.

_____ 11.

_____ 12.

_____ 13.

From the right atrium through the tricuspid valve to the __(1)__, through the __(2)__ valve to the pulmonary trunk to the right and left __(3)__, to the capillary beds of the __(4)__, to the __(5)__, to the __(6)__ of the heart through the __(7)__ valve, to the __(8)__ through the __(9)__ semilunar valve, to the __(10)__, to the systemic arteries, to the __(11)__ of the body tissues, to the systemic veins, to the __(12)__ and __(13)__, which enter the right atrium of the heart.

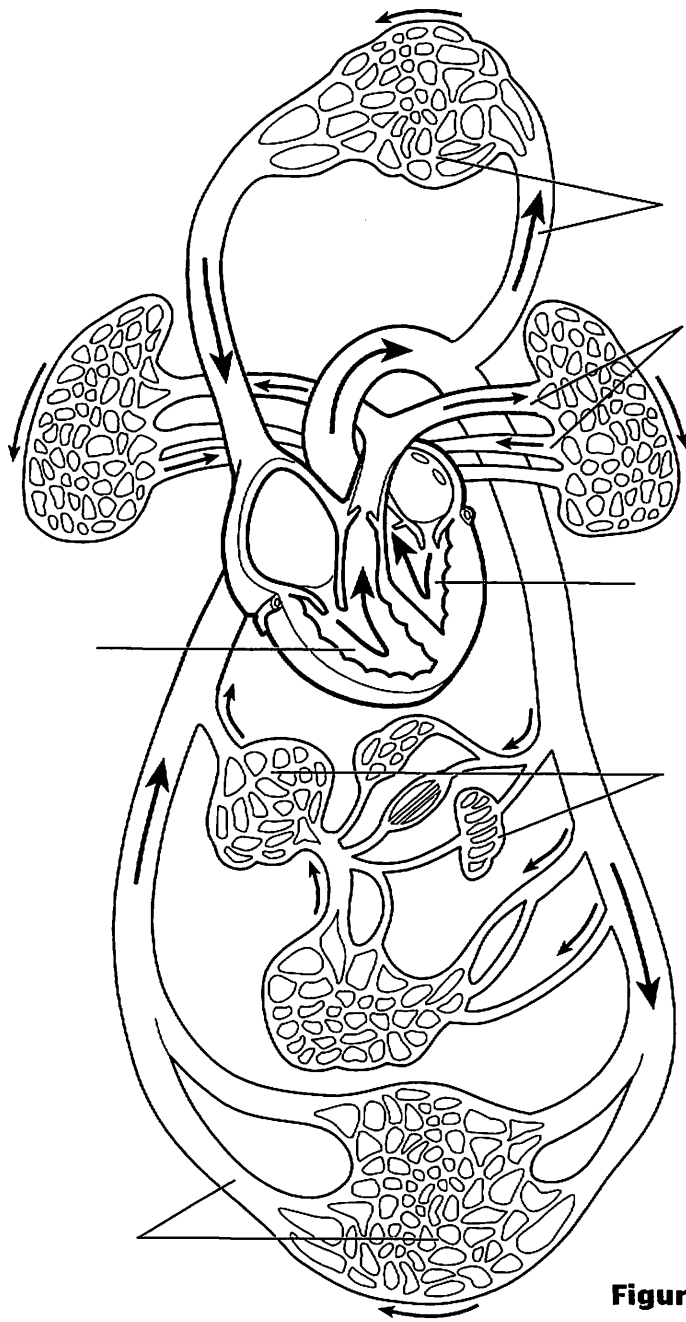


Figure 11–1

Key Choices

A. Vessels serving head and upper limbs

B. Vessels serving body trunk and lower limbs

C. Vessels serving the viscera

D. Pulmonary circulation

E. Pulmonary "pump"

F. Systemic "pump"

3. Figure 11–2 is an anterior view of the heart. Identify each numbered structure and write its name in the corresponding numbered space below the figure. Then, select different colors for each structure provided with a color-coding circle, and use them to color the coding circles and corresponding structures on the figure.

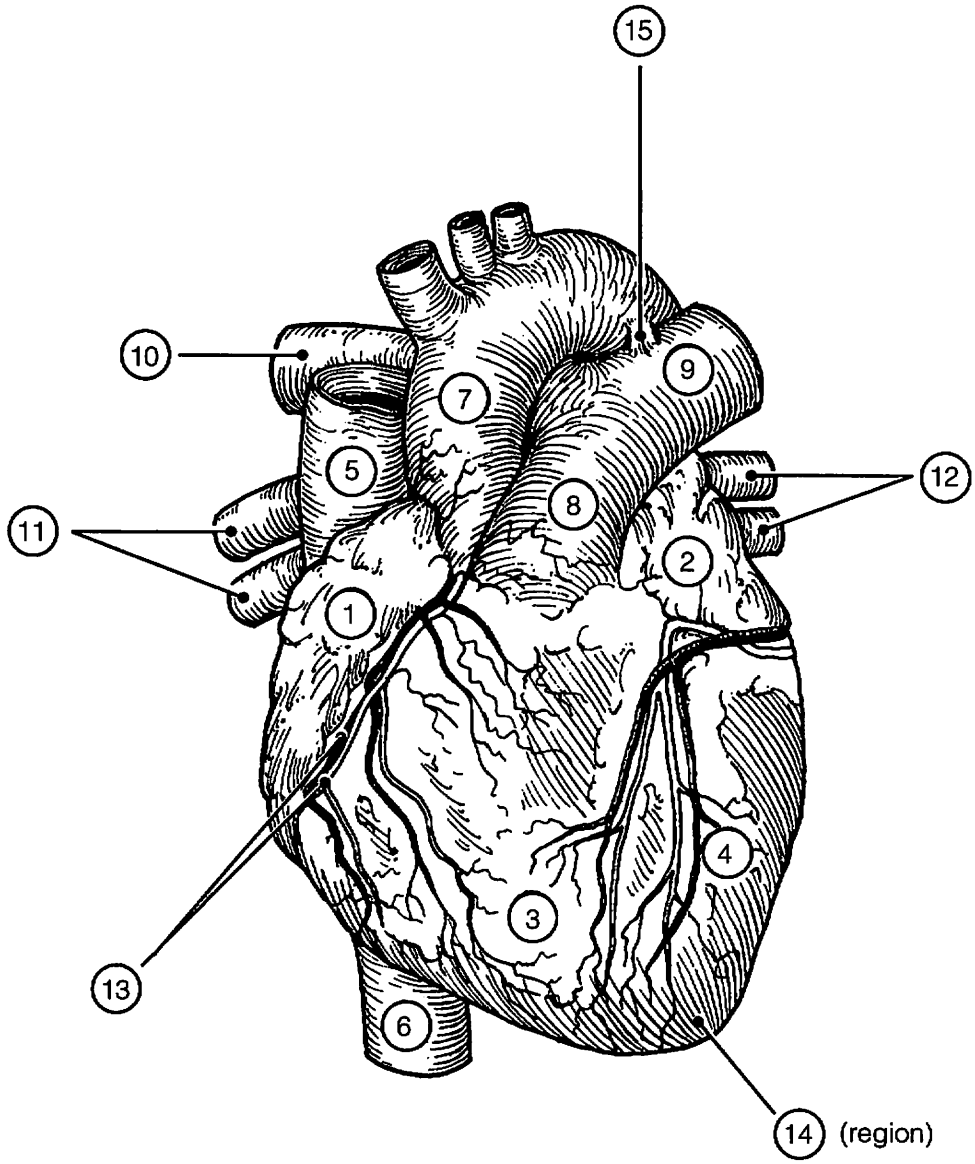


Figure 11–2

○ _____ 1.	○ _____ 6.	○ _____ 11.
○ _____ 2.	○ _____ 7.	_____ 12.
○ _____ 3.	○ _____ 8.	_____ 13.
○ _____ 4.	_____ 9.	_____ 14.
_____ 5.	_____ 10.	○ _____ 15.

4. Figure 11–3 is a schematic drawing of the microscopic structure of cardiac muscle. Using different colors, color the coding circles of the structures listed below and the corresponding structures on the figure.

◯ Nuclei (with nucleoli) ◯ Muscle fibers

◯ Intercalated discs ◯ Striations

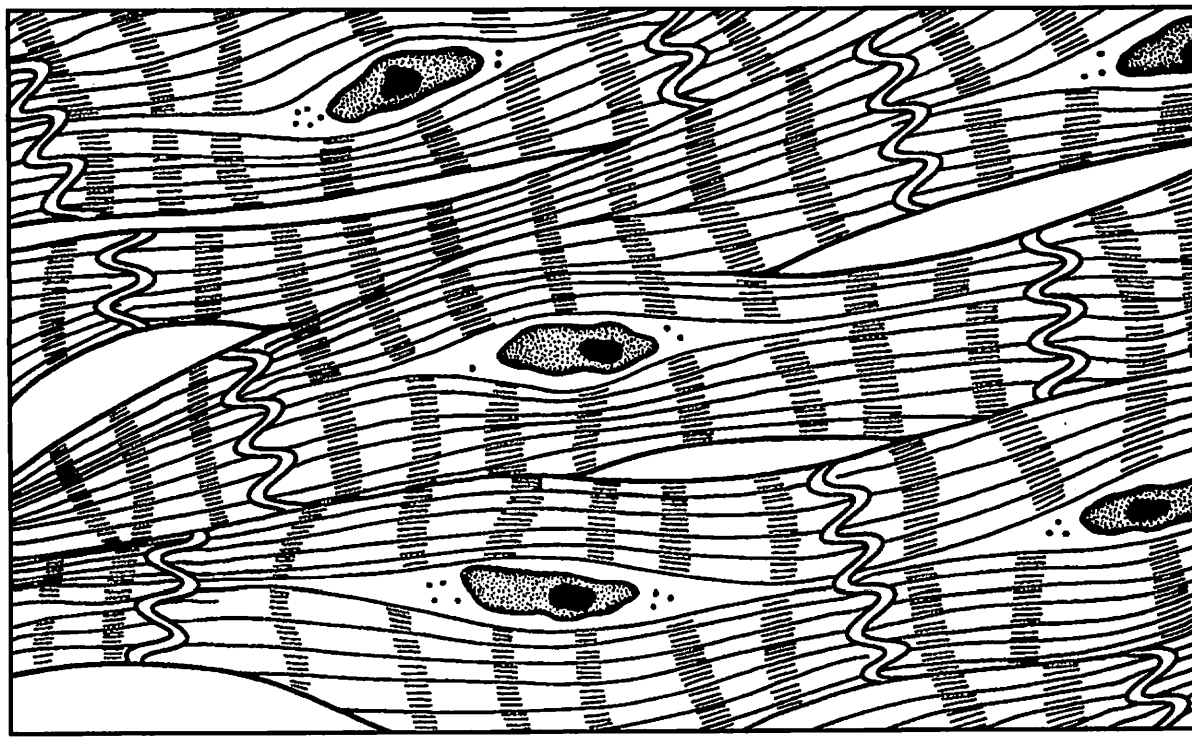


Figure 11–3

5. The events of one complete heartbeat are referred to as the cardiac cycle. Complete the following statements that describe these events. Insert your answers in the answer blanks.

_____ 1. The contraction of the ventricles is referred to as __(1)__, and the period of ventricular relaxation is called __(2)__. The

_____ 2. monosyllables describing heart sounds during the cardiac cycle are __(3)__. The first heart sound is a result of closure of

_____ 3. the __(4)__ valves; closure of the __(5)__ valves causes the second heart sound. The heart chambers that have just been

_____ 4. filled when you hear the first heart sound are the __(6)__, and the chambers that have just emptied are the __(7)__. Immedi-

_____ 5. ately after the second heart sound, the __(8)__ are filling with blood, and the __(9)__ are empty. Abnormal heart sounds, or

_____ 6. __(10)__, usually indicate valve problems.

_____ 7. _____ 9.

_____ 8. _____ 10.

6. Figure 11–4 is a diagram of the frontal section of the heart. Follow the instructions below to complete this exercise.

First, draw arrows to indicate the direction of blood flow through the heart. Draw the pathway of the oxygen-rich blood with red arrows, and trace the pathway of oxygen-poor blood with blue arrows.

Second, identify each of the elements of the intrinsic conduction system (numbers 1–5 on the figure) by inserting the appropriate terms in the blanks left of the figure. Then, indicate with green arrows the pathway that impulses take through this system.

Third, correctly identify each of the heart valves (numbers 6–9 on the figure) by inserting the appropriate terms in the blanks left of the figure, and draw in and identify by name the cordlike structures that anchor the flaps of the atrioventricular (AV) valves.

Fourth, use the numbers from the figure to identify the structures described below. Place the numbers in the lettered answer blanks.

_____ A. _____ B. Prevent backflow into the ventricles when the heart is relaxed

_____ C. _____ D. Prevent backflow into the atria when the ventricles are contracting

_____ E. AV valve with three flaps

_____ F. AV valve with two flaps

_____ G. The pacemaker of the intrinsic conduction system

_____ H. The point in the intrinsic conduction system where the impulse is temporarily delayed

_____ 1.

_____ 2.

_____ 3.

_____ 4.

_____ 5.

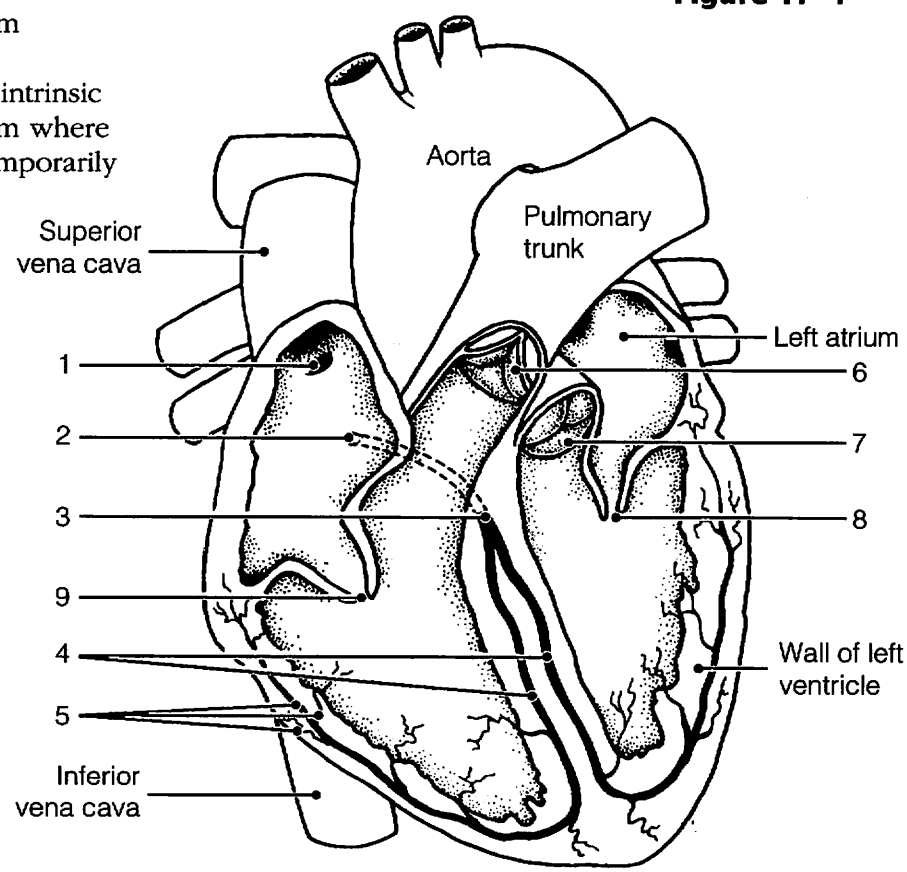
_____ 6.

_____ 7.

_____ 8.

_____ 9.

Figure 11–4



7. Match the terms provided in Column B with the statements given in Column A. Place the correct term or letter response in the answer blanks.

Column A	Column B
_____ 1. A recording of the electrical activity of the heart	A. Angina pectoris
_____ 2. The period during which the atria are depolarizing	B. Bradycardia
_____ 3. The period during which the ventricles are repolarizing	C. Electrocardiogram
_____ 4. The period during which the ventricles are depolarizing, which precedes their contraction	D. Fibrillation
_____ 5. An abnormally slow heartbeat, that is, below 60 beats per minute	E. Heart block
_____ 6. A condition in which the heart is uncoordinated and useless as a pump	F. P wave
_____ 7. An abnormally rapid heartbeat, that is, over 100 beats per minute	G. QRS wave
_____ 8. Damage to the AV node, totally or partially releasing the ventricles from the control of the sinoatrial (SA) node	H. T wave
_____ 9. Chest pain, resulting from ischemia of the myocardium	I. Tachycardia

8. A portion of an electrocardiogram is shown in Figure 11–5. On the figure identify the QRS complex, the P wave, and the T wave. Then, using a red pencil, bracket a portion of the recording equivalent to the length of one cardiac cycle. Using a blue pencil, bracket a portion of the recording in which the *ventricles* would be in diastole.

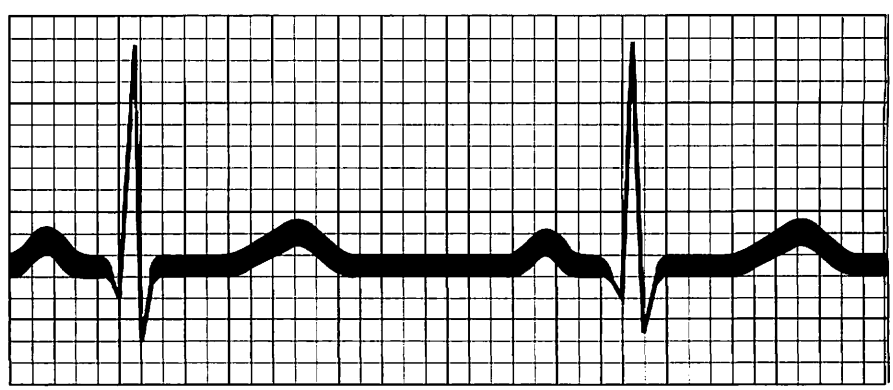


Figure 11–5

9. Complete the following statements relating to cardiac output by writing the missing terms in the answer blanks.

_____ 1.
_____ 2.
_____ 3.
_____ 4.
_____ 5.
_____ 6.
_____ 7.
_____ 8.

In the relationship CO = HR x SV, CO stands for __(1)__, HR stands for __(2)__, and SV stands for __(3)__. For the normal resting heart, the value of HR is __(4)__ and the value of SV is __(5)__. The normal average adult cardiac output, therefore, is __(6)__. The time for the entire blood supply to pass through the body is once each __(7)__.

According to Starling's law of the heart, the critical factor that determines force of heartbeat, or __(8)__, is the degree of __(9)__ of the cardiac muscle just before it contracts. Consequently, the force of heartbeat can be increased by increasing the amount of __(10)__ returned to the heart.

_____ 9. _____ 10.

10. Check (✓) all factors that lead to an *increase* in cardiac output by influencing either heart rate or stroke volume.

_____ 1. Epinephrine
_____ 2. Thyroxine
_____ 3. Hemorrhage
_____ 4. Fear
_____ 5. Exercise
_____ 6. Activation of the sympathetic nervous system
_____ 7. Activation of the vagus nerves
_____ 8. Low blood pressure
_____ 9. High blood pressure
_____ 10. Fever

11. For each of the following statements that is true, write *T* in the answer blank. For any false statements, correct the underlined term by writing the correct term in the answer blank.

_____ 1. The resting heart rate is fastest in adult life.

_____ 2. Because the heart of the highly trained athlete hypertrophies, its stroke volume decreases.

_____ 3. If the right side of the heart fails, pulmonary congestion occurs.

_____ 4. In peripheral congestion, the feet, ankles, and fingers become edematous.

_____ 5. The pumping action of the healthy heart ordinarily maintains a balance between cardiac output and venous return.

12. Circle the term that does not belong in each of the following groupings.

1. Pulmonary trunk Vena cava Right side of heart Left side of heart
2. QRS wave T wave P wave Electrical activity of the ventricles
3. AV valves closed AV valves opened Ventricular systole Semilunar valves open
4. Papillary muscles Aortic semilunar valve Tricuspid valve Chordae tendineae
5. Tricuspid valve Mitral valve Bicuspid valve Left AV valve
6. Ischemia Infarct Scar tissue repair Heart block

CARDIOVASCULAR SYSTEM: BLOOD VESSELS

13. Complete the following statements concerning blood vessels.

_____ 1.
_____ 2.
_____ 3.
_____ 4.
_____ 5.
_____ 6.
_____ 7.

The central cavity of a blood vessel is called the __(1)__. Reduction of the diameter of this cavity is called __(2)__, and enlargement of the vessel diameter is called __(3)__. Blood is carried to the heart by __(4)__ and away from the heart by __(5)__. Capillary beds are supplied by __(6)__ and drained by __(7)__.

14. Briefly explain in the space provided why valves are present in veins but not in arteries.

_____

_____

15. Name two events *occurring within the body* that aid in venous return. Place your responses in the blanks that follow.

_____ and _____

16. First, select different colors for each of the three blood vessel tunics listed in the key choices and illustrated in Figure 11–6 on p. 185. Color the color-coding circles and the corresponding structures in the three diagrams. In the blanks beneath the illustrations correctly identify each vessel type. In the additional spaces provided, list the structural details that allowed you to make the identifications. Then, using the key choices, identify the blood vessel tunics

described in each of the following descriptions. Insert the term or letter of the key choice in the answer blanks.

Key Choices

A. ◯ Tunica intima B. ◯ Tunica media C. ◯ Tunica externa

_____ 1. Single thin layer of endothelium

_____ 2. Bulky middle coat, containing smooth muscle and elastin

_____ 3. Provides a smooth surface to decrease resistance to blood flow

_____ 4. The only tunic of capillaries

_____ 5. Also called the adventitia

_____ 6. The only tunic that plays an active role in blood pressure regulation

_____ 7. Supporting, protective coat

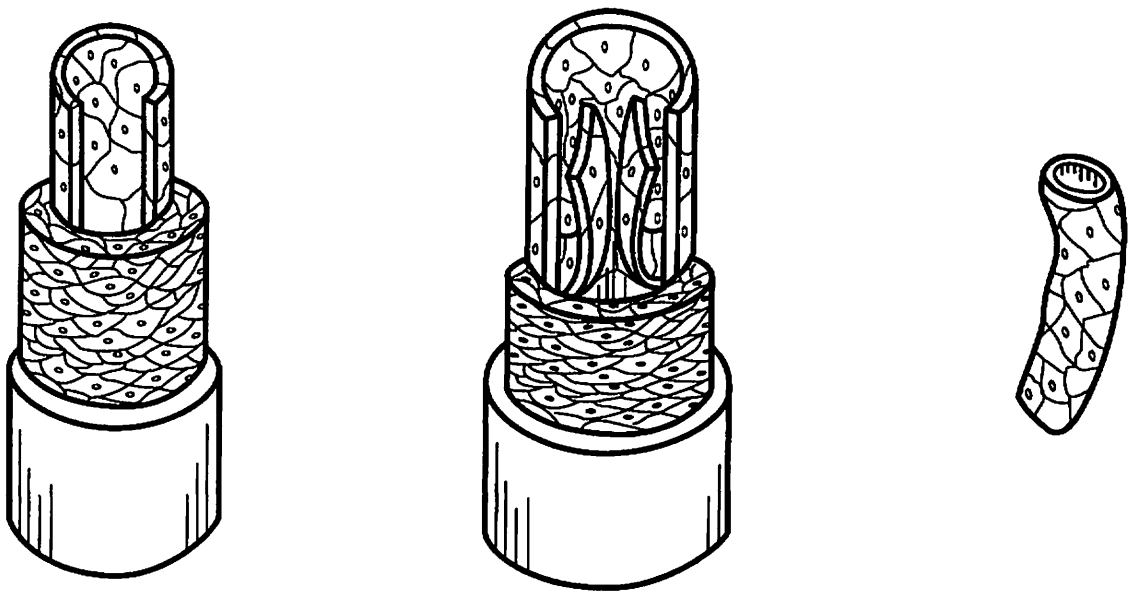


Figure 11–6

A _____ B _____ C _____

_____ _____ _____

_____ _____ _____

17. Figures 11–7 and 11–8 on pp. 186 and 187 illustrate the location of the most important arteries and veins of the body. The veins are shown in Figure 11–7. Color the veins blue and then identify each vein provided with a leader line on the figure. The arteries are shown in Figure 11–8. Color them red and then identify those indicated by leader lines on the figure. NOTE: If desired, the vessels identified may be colored differently to aid you in their later identification.

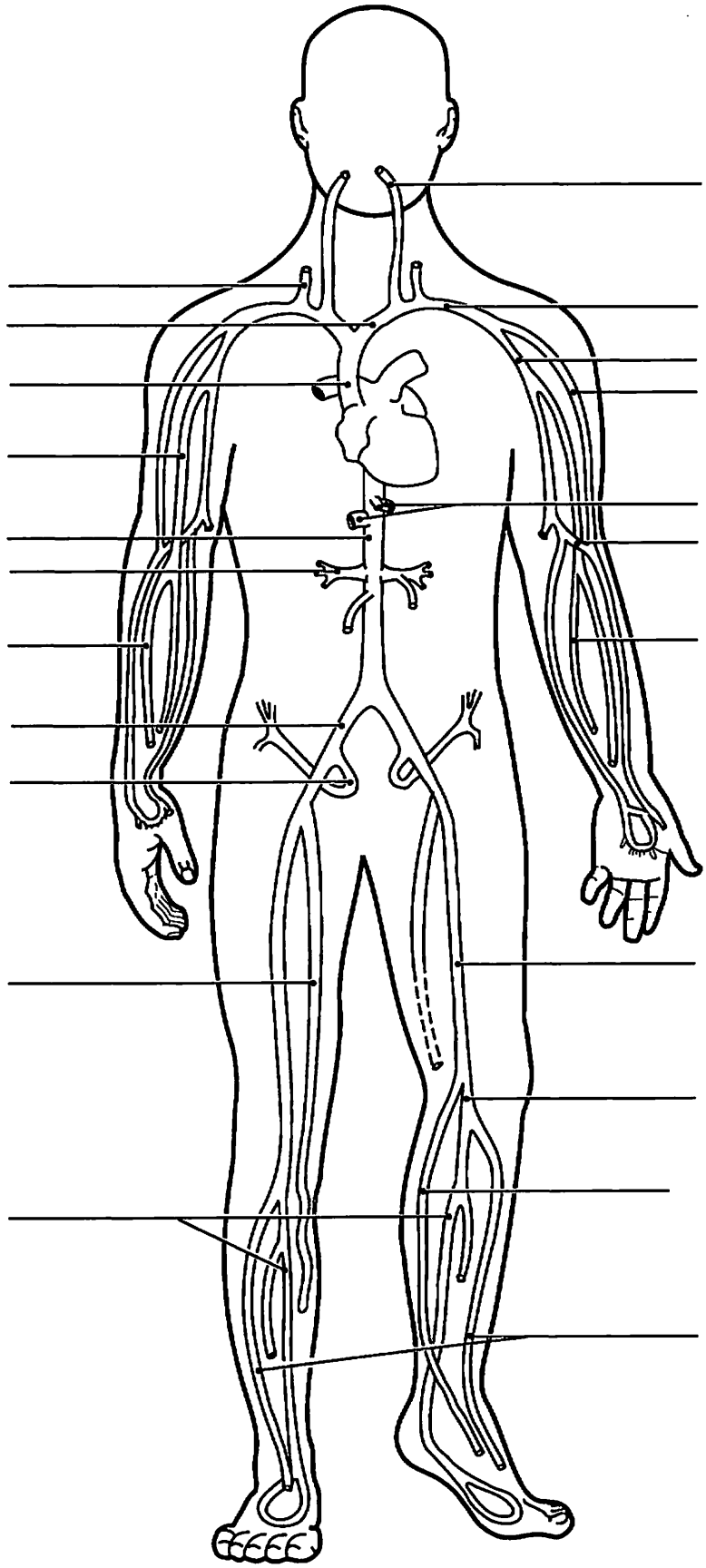


Figure 11–7 Veins

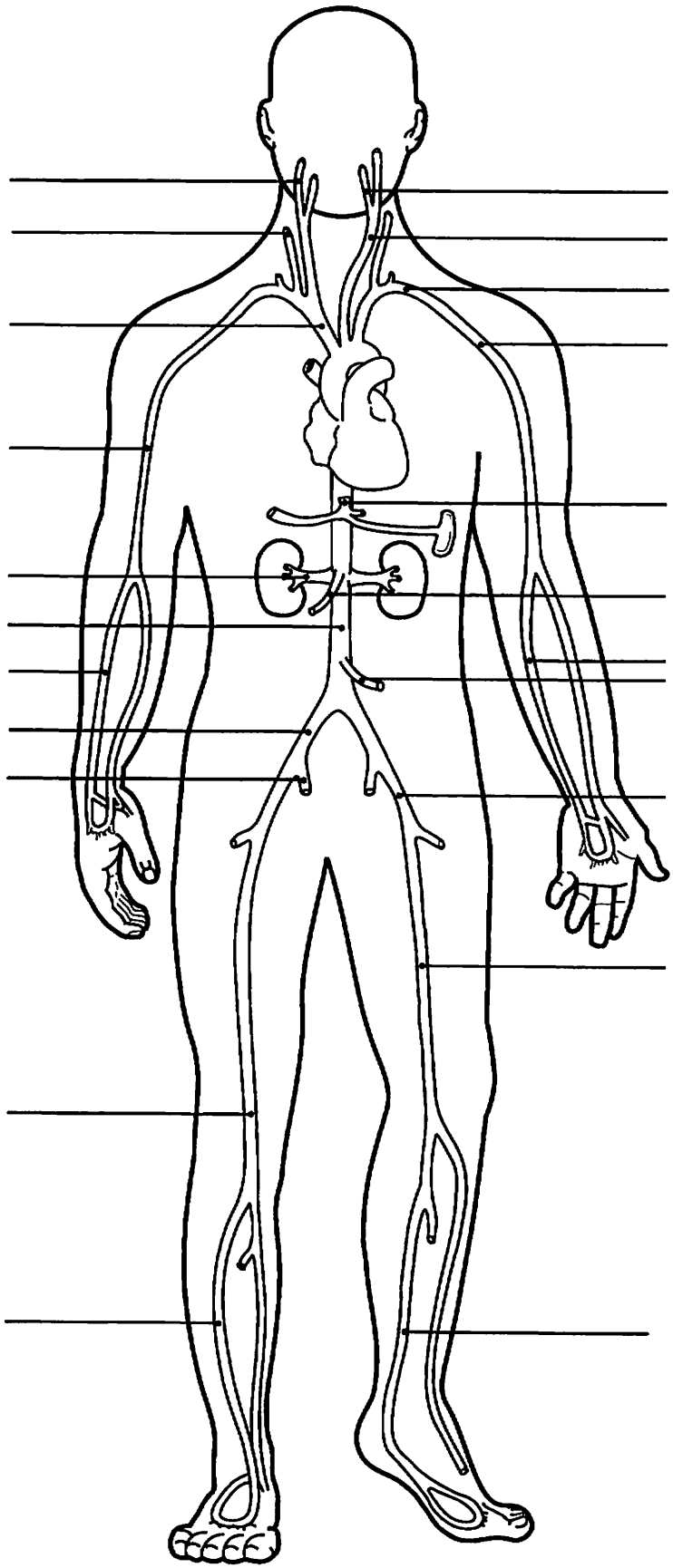


Figure 11–8 Arteries

18. Using key choices, identify the veins described as follows. Place the correct term or letter response in the answer blanks.

Key Choices

A. Anterior tibial	G. Common iliac	M. Hepatic portal	S. Radial
B. Azygos	H. Femoral	N. Inferior mesenteric	T. Renal
C. Basilic	I. Gastric	O. Inferior vena cava	U. Subclavian
D. Brachiocephalic	J. Gonadal	P. Internal iliac	V. Superior mesenteric
E. Cardiac	K. Great saphenous	Q. Internal jugular	W. Superior vena cava
F. Cephalic	L. Hepatic	R. Posterior tibial	X. Ulnar

_____ 1. _____ 2. Deep veins, draining the forearm

_____ 3. Vein that receives blood from the arm via the axillary vein

_____ 4. Veins that drain venous blood from the myocardium of the heart into the coronary sinus

_____ 5. Vein that drains the kidney

_____ 6. Vein that drains the dural sinuses of the brain

_____ 7. Two veins that join to become the superior vena cava

_____ 8. _____ 9. Veins that drain the leg and foot

_____ 10. Large vein that carries nutrient-rich blood from the digestive organs to the liver for processing

_____ 11. Superficial vein that drains the lateral aspect of the arm

_____ 12. Vein that drains the ovaries or testes

_____ 13. Vein that drains the thorax, empties into the superior vena cava

_____ 14. Largest vein below the thorax

_____ 15. Vein that drains the liver

_____ 16. _____ 17. _____ 18. Three veins that form/empty into the hepatic portal vein

_____ 19. Longest superficial vein of the body; found in the leg

_____ 20. Vein that is formed by the union of the external and internal iliac veins

_____ 21. Deep vein of the thigh

19. Figure 11–9 is a diagram of the hepatic portal circulation. Select different colors for the structures listed below and use them to color the color-coding circles and corresponding structures on the illustration.

- ◯ Inferior mesenteric vein
- ◯ Splenic vein
- ◯ Hepatic portal vein
- ◯ Superior mesenteric vein
- ◯ Gastric vein

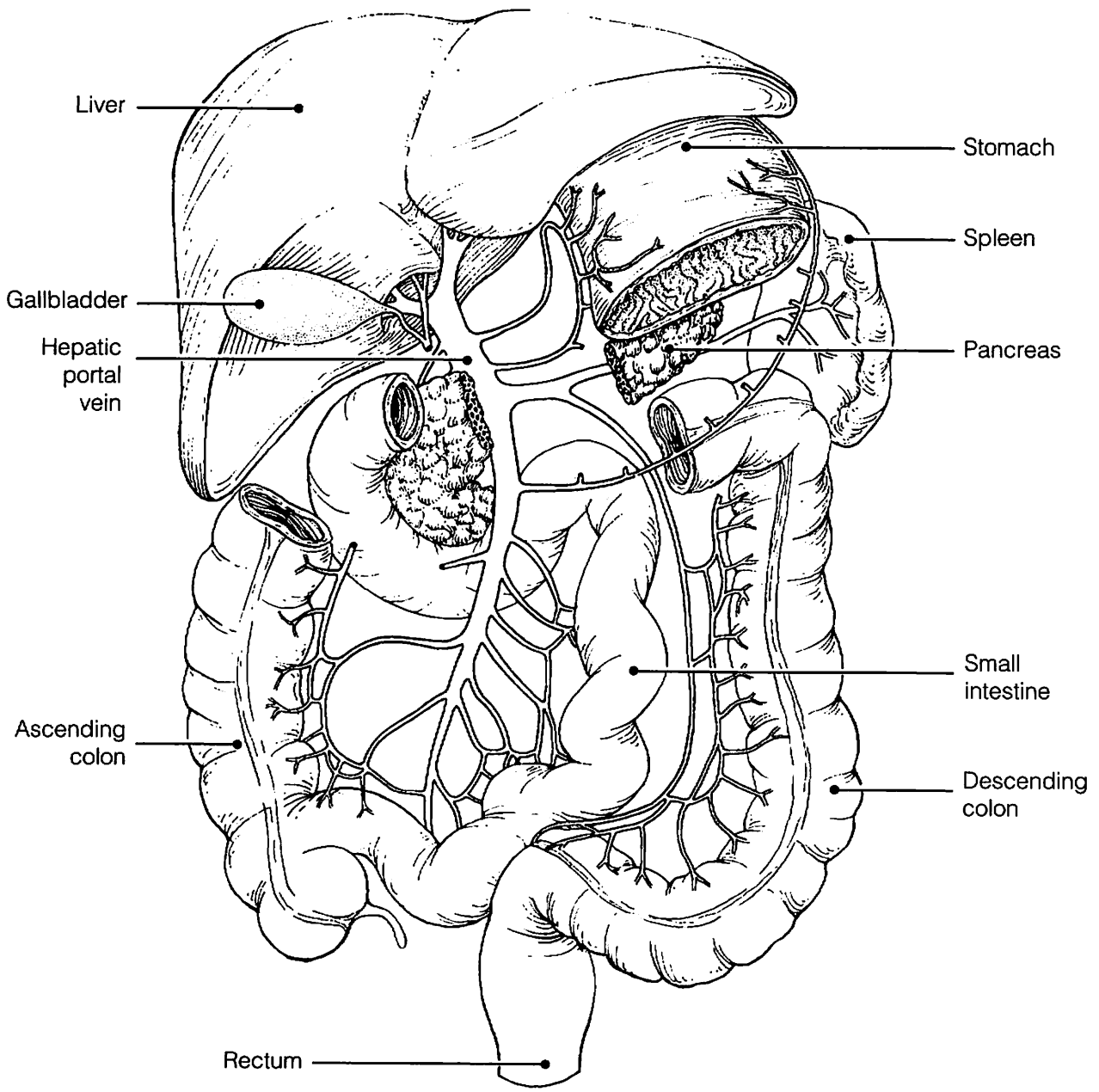


Figure 11–9

20. Using key choices, identify the *arteries* described as follows. Place the correct term or letter response in the spaces provided.

Key Choices

A. Anterior tibial	H. Coronary	O. Intercostals	V. Renal
B. Aorta	I. Deep femoral	P. Internal carotid	W. Subclavian
C. Brachial	J. Dorsalis pedis	Q. Internal iliac	X. Superior mesenteric
D. Brachiocephalic	K. External carotid	R. Peroneal	Y. Vertebral
E. Celiac trunk	L. Femoral	S. Phrenic	Z. Ulnar
F. Common carotid	M. Hepatic	T. Posterior tibial	
G. Common iliac	N. Inferior mesenteric	U. Radial	

_____ 1. _____ 2. Two arteries formed by the division of the brachiocephalic artery

_____ 3. First artery that branches off the ascending aorta; serves the heart

_____ 4. _____ 5. Two paired arteries, serving the brain

_____ 6. Largest artery of the body

_____ 7. Arterial network on the dorsum of the foot

_____ 8. Artery that serves the posterior thigh

_____ 9. Artery that supplies the diaphragm

_____ 10. Artery that splits to form the radial and ulnar arteries

_____ 11. Artery generally auscultated to determine blood pressure in the arm

_____ 12. Artery that supplies the last half of the large intestine

_____ 13. Artery that serves the pelvis

_____ 14. External iliac becomes this artery on entering the thigh

_____ 15. Major artery serving the arm

_____ 16. Artery that supplies most of the small intestine

_____ 17. The terminal branches of the dorsal, or descending, aorta

_____ 18. Arterial trunk that has three major branches, which serve the liver, spleen, and stomach

_____ 19. Major artery, serving the tissues external to the skull

_____ 20. _____ 21. _____ 22. Three arteries, serving the leg inferior to the knee

_____ 23. Artery generally used to feel the pulse at the wrist

21. Figure 11–10 illustrates the arterial circulation of the brain. Select different colors for the following structures and use them to color the coding circles and corresponding structures in the diagram.

- ◯ Basilar artery
- ◯ Anterior cerebral arteries
- ◯ Posterior cerebral arteries
- ◯ Communicating branches
- ◯ Middle cerebral arteries

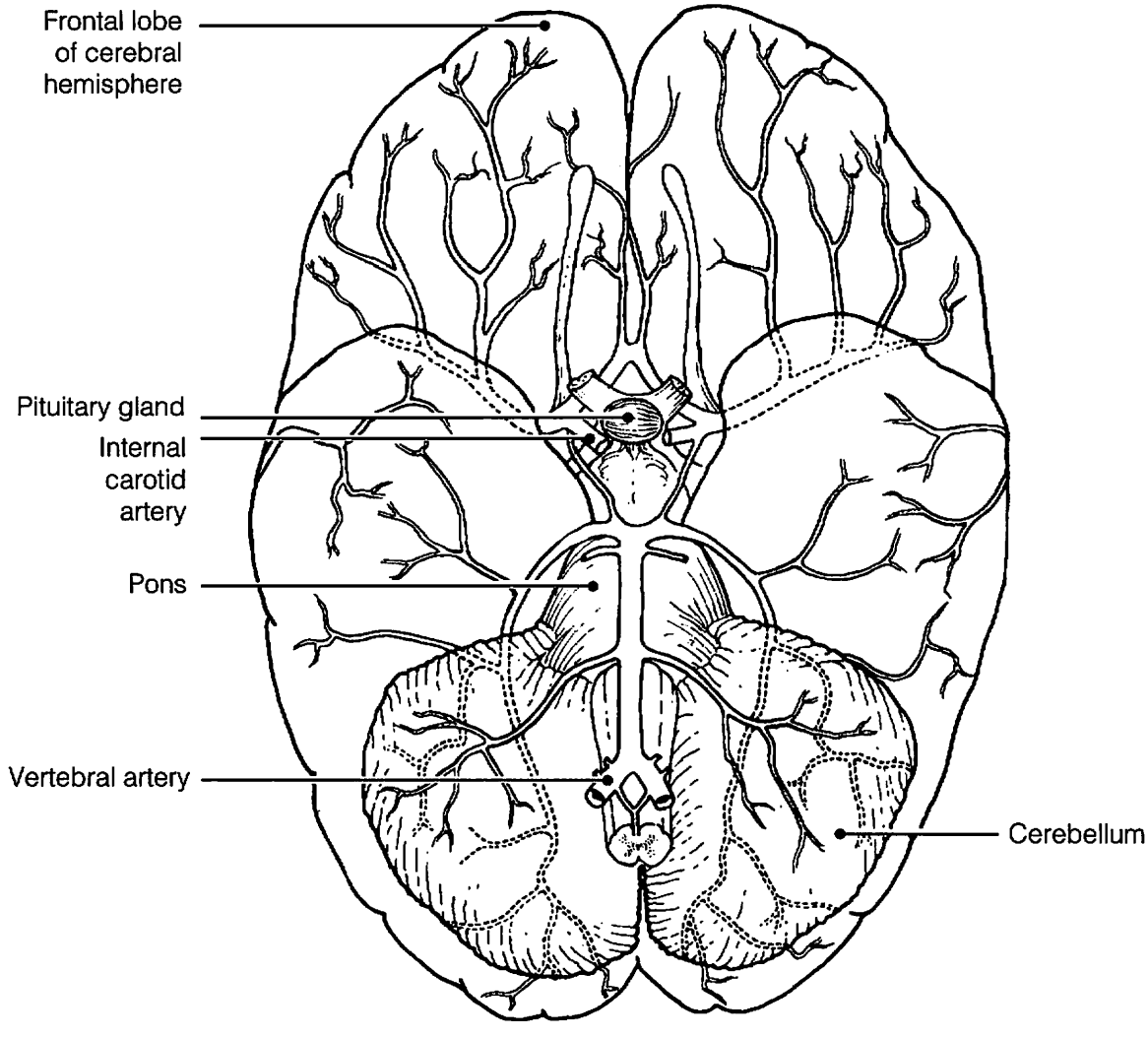


Figure 11–10

22. Figure 11-11 illustrates the special fetal structures listed below. Select different colors for each and use them to color coding circles and corresponding structures in the diagram.

- ◯ Foramen ovale
- ◯ Ductus arteriosus
- ◯ Ductus venosus
- ◯ Umbilical arteries
- ◯ Umbilical cord
- ◯ Umbilical vein

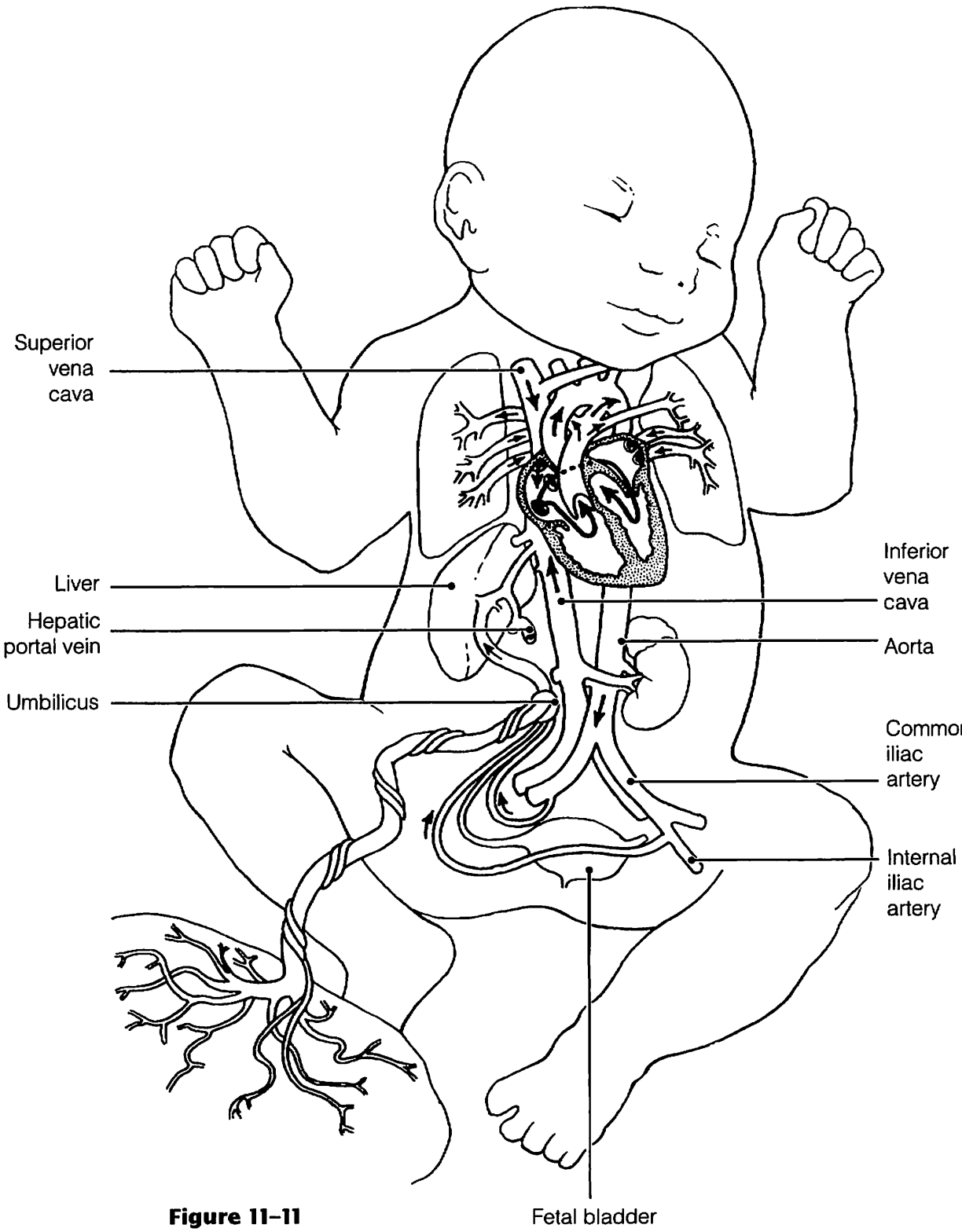


Figure 11–11

23. Eight structures unique to the special circulations of the body are described here. Identify each, using the key choices. Place the correct terms or letters in the answer blanks.

Key Choices

A. Anterior cerebral artery
B. Basilar artery
C. Circle of Willis
D. Ductus arteriosus
E. Ductus venosus
F. Foramen ovale
G. Middle cerebral artery
H. Posterior cerebral artery
I. Umbilical artery
J. Umbilical vein

_____ 1. An anastomosis that allows communication between the posterior and anterior blood supplies of the brain

_____ 2. The vessel carrying oxygen and nutrient-rich blood to the fetus from the placenta

_____ 3. The shunt that allows most fetal blood to bypass the liver

_____ 4. Two pairs of arteries, arising from the internal carotid artery

_____ 5. The posterior cerebral arteries, serving the brain, arise from here

_____ 6. Fetal shunt between the aorta and pulmonary trunk that allows the lungs to be bypassed by the blood

_____ 7. Opening in the interatrial septum that shunts fetal blood from the right to the left atrium, thus bypassing the fetal lungs

24. Briefly explain in the space provided why the lungs are largely bypassed by the circulating blood in the fetus.

_____

_____

25. Circle the term that does not belong in each of the following groupings.

1. High pressure — Vein — Artery — Spurting blood
2. Carotid artery — Cardiac vein — Coronary sinus — Coronary artery
3. Increased venous return — Respiratory pump — Vasodilation — Milking action of skeletal muscles
4. High blood pressure — Hemorrhage — Weak pulse — Low cardiac output
5. Resistance — Friction — Vasodilation — Vasoconstriction

26. The following section relates to understandings concerning blood pressure and pulse. Match the items given in Column B with the appropriate descriptions provided in Column A. Place the correct term or letter response in the answer blanks.

	Column A	**Column B**
_____	1. Expansion and recoil of an artery during heart activity	A. Over arteries
_____	2. Pressure exerted by the blood against the blood vessel walls	B. Blood pressure
_____	3. _____ 4. Factors related to blood pressure	C. Cardiac output
_____	5. Event primarily responsible for peripheral resistance	D. Constriction of arterioles
_____	6. Blood pressure during heart contraction	E. Diastolic blood pressure
_____	7. Blood pressure during heart relaxation	F. Peripheral resistance
_____	8. Site where blood pressure determinations are normally made	G. Pressure points
_____	9. Points at the body surface where the pulse may be felt	H. Pulse
_____	10. Sounds heard over a blood vessel when the vessel is partially compressed	I. Sounds of Korotkoff
		J. Systolic blood pressure
		K. Over veins

27. Complete the following statements about capillary functions by placing answers from the key in the answer blanks. Use terms or letters from the key.

Key Choices

A. Blood	E. Fat soluble	H. Osmotic pressure
B. Capillary clefts	F. Hydrostatic pressure	I. Vesicles
C. Diffusion	G. Interstitial fluid	J. Water soluble
D. Fenestrations		

_____ 1.
_____ 2.
_____ 3.

All exchanges to and from the blood and tissue cells occur through the __(1)__. Generally speaking, substances tend to move according to their concentration gradients by the process of __(2)__. Substances that are __(3)__ pass directly through the plasma membranes of the capillary endothelial cells; other

substances pass by means of or via (4), (5), or (6). The most permeable capillaries are those exhibiting (7). Capillaries that have (8) and (9) tend to be leaky and two forces acting at capillary beds cause fluid flows. The pressure that forces fluid out of the capillaries is (10) and the force that causes fluid to reenter the blood is (11). Hence fluid is forced into the (12) at the arteriole end of the bed and into the (13) at the venule end of the capillary bed.

_____ 4.
_____ 5.
_____ 6.
_____ 7.
_____ 8.
_____ 9.
_____ 10.
_____ 11.
_____ 12.
_____ 13.

28. Indicate what effect the following factors have on blood pressure. Indicate an increase in pressure by *I* and a decrease in pressure by *D*. Place the correct letter response in the answer blanks.

_____ 1. Increased diameter of the arterioles
_____ 2. Increased blood viscosity
_____ 3. Increased cardiac output
_____ 4. Increased pulse rate
_____ 5. Anxiety, fear
_____ 6. Increased urine output
_____ 7. Sudden change in position from reclining to standing
_____ 8. Physical exercise
_____ 9. Physical training
_____ 10. Alcohol
_____ 11. Hemorrhage
_____ 12. Nicotine
_____ 13. Arteriosclerosis

29. Respond to the following exercise by placing brief answers in the spaces provided. Assume someone has been injured in an automobile accident and is bleeding profusely. What pressure point could you compress to help stop the bleeding from the following areas?

_____ 1. Thigh
_____ 2. Forearm
_____ 3. Calf
_____ 4. Lower jaw
_____ 5. Thumb

30. For each of the following statements that is true, insert *T* in the answer blank. If any of the statements are false, correct the underlined term by inserting the correct word in the answer blank.

_____ 1. Renin, released by the kidneys, causes a decrease in blood pressure.

_____ 2. The decreasing efficiency of the sympathetic nervous system vasoconstrictor functioning, due to aging, leads to a type of hypotension called sympathetic hypotension.

_____ 3. Two body organs in which vasoconstriction rarely occurs are the heart and the kidneys.

_____ 4. A sphygmomanometer is used to take the apical pulse.

_____ 5. The pulmonary circulation is a high-pressure circulation.

_____ 6. The fetal equivalent of (functional) lungs and liver is the placenta.

_____ 7. Cold has a vasodilating effect.

_____ 8. Thrombophlebitis is called the silent killer.

DEVELOPMENTAL ASPECTS OF THE CARDIOVASCULAR SYSTEM

31. Complete the following statements by inserting your responses in the answer blanks.

_____ 1. The cardiovascular system forms early and the heart is acting as a functional pump by the __(1)__ week of development.

_____ 2. The ductus arteriosus and foramen ovale allow the blood to bypass the nonfunctioning fetal __(2)__. Another fetal structure,

_____ 3. the __(3)__, allows most of the blood to bypass the liver. The fetus is supplied with oxygen and nutrients via the __(4)__,

_____ 4. which carries blood from the __(5)__ to the __(6)__. Metabolic wastes and carbon dioxide are removed from the fetus in

_____ 5. blood carried by the __(7)__. These special bypass structures that exist to bypass the fetal lungs and liver become __(8)__

_____ 6. shortly after birth. Congenital heart defects (some resulting from the failure of the bypass structures to close) account for

_____ 7. half of all infant __(9)__ resulting from congenital defects.

_____ 8. __(10)__ is a degenerative process that begins in youth but may take its toll in later life by promoting a myocardial infarct or

_____ 9. stroke. Generally women have less atherosclerosis than men until after __(11)__, when estrogen production ends.

_____ 10.

_____ 11.

_____ 12.
_____ 13.
_____ 14.
_____ 15.
_____ 16.

Regular _(12)_ increases the efficiency of the cardiovascular system and helps to slow the progress of _(13)_. A vascular problem that affects many in "standing professions" is _(14)_. In this condition, the valves become incompetent, and the veins become twisted and enlarged, particularly in the _(15)_ and _(16)_.

INCREDIBLE JOURNEY

A Visualization Exercise for the Cardiovascular System

All about you are huge white cords, hanging limply from two flaps of endothelial tissue. . .

32. Where necessary, complete the statements by inserting the missing word(s) in the answer blanks.

_____ 1.
_____ 2.
_____ 3.
_____ 4.
_____ 5.

Your journey starts in the pulmonary vein and includes a trip to part of the systemic circulation and a special circulation. You ready your equipment and prepare to be miniaturized and injected into your host.

Almost immediately after injection, you find yourself swept into a good-sized chamber, the _(1)_. However, you do not stop in this chamber, but continue to plunge downward into a larger chamber below. You land with a large splash and examine your surroundings. All about you are huge white cords, hanging limply from two flaps of endothelial tissue far above you. You report that you are sitting in the _(2)_ chamber of the heart, seeing the flaps of the _(3)_ valve above you. The valve is open and its anchoring cords, the _(4)_, are lax. Since this valve is open, you conclude that the heart is in the _(5)_ phase of the cardiac cycle.

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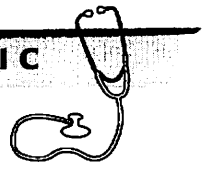
Gradually you notice that the chamber walls seem to be closing in. You hear a thundering boom, and the whole chamber vibrates as the valve slams shut above you. The cords, now rigid and strained, form a cage about you, and you feel extreme external pressure. Obviously, the heart is in a full-fledged __(6)__. Then, high above on the right, the "roof" opens, and you are forced through this __(7)__ valve. A fraction of a second later, you hear another tremendous boom that sends shock waves through the whole area. Out of the corner of your eye, you see that the valve below you is closed, and it looks rather like a pie cut into three wedges.

As you are swept along in this huge artery, the __(8)__, you pass several branch-off points, but continue to careen along, straight down at a dizzying speed until you approach the __(9)__ artery, feeding the small intestine. After entering this artery and passing through successively smaller and smaller subdivisions of it, you finally reach the capillary bed of the small intestine. You watch with fascination as nutrient molecules move into the blood through the single layer of __(10)__ cells forming the capillary wall. As you move to the opposite shore of the capillary bed, you enter a venule and begin to move superiorly once again. The venules draining the small intestine combine to form the __(11)__ vein, which in turn combines with the __(12)__ vein to form the hepatic portal vein that carries you into the liver. As you enter the liver, you are amazed at the activity there. Six-sided hepatic cells, responsible for storing glucose and making blood proteins, are literally grabbing __(13)__ out of the blood as it percolates slowly past them. Protective __(14)__ cells are removing bacteria from the slowly moving blood. Leaving the liver through the __(15)__ vein, you almost immediately enter the huge __(16)__, which returns blood from the lower part of the body to the __(17)__ of the heart. From here, you move consecutively through the right chambers of the heart into the __(18)__. Soon that vessel splits and you are carried into a __(19)__ artery, which carries you to the capillary beds of the __(20)__ and then back to the left side of the heart once again. After traveling through the left side of the heart again, you leave your host when you are aspirated out of the __(21)__ artery, which extends from the aorta to the axillary artery of the armpit.

AT THE CLINIC



33. A man, en route to the hospital emergency room by ambulance, is in fibrillation. What is his cardiac output likely to be? He arrives at the emergency entrance DOA (dead on arrival). His autopsy reveals a blockage of the posterior interventricular artery. What is the cause of death?

34. Excessive vagal stimulation can be caused by severe depression. How would this be reflected in a routine physical examination?

35. A patient has swollen ankles and signs of degenerating organ functions. What is a likely diagnosis?

36. A routine scan of an elderly man reveals partial occlusion of the right internal carotid artery, yet blood supply to his cerebrum is unimpaired. What are two possible causes of the occlusion? What anastamosis is maintaining blood supply to the brain and by what (probable) route(s)?

37. A patient with a bone marrow cancer is polycythemic. Will his blood pressure be high or low? Why?

38. After a bout with bacterial endocarditis, scar tissue often stiffens the edges of the heart valves. How would this be picked up in a routine examination?

39. Len, an elderly man, is bedridden after a hip fracture. He complains of pain in his legs and thrombophlebitis is diagnosed. What is thrombophlebitis and what life-threatening complication can develop?

40. Mr. Langley is telling his friend about his recent visit to his doctor for a checkup. During his story, he mentions that the ECG revealed that he had a defective mitral valve and a heart murmur. Mr. Langley apparently misunderstood some of what the doctor explained to him about the diagnostic process. What has he misunderstood?

41. A less-than-respectable news tabloid announced that "Doctors show that exercise shortens life. Life expectancy is programmed into a set number of heartbeats; the faster your heart beats, the sooner you die." Even if this "theory" were true, what is wrong with the conclusion concerning exercise?

42. Mrs. Tuney says that when she stands up after lying down in the afternoon that she gets very dizzy. Her husband grumbles that "Its because she keeps the danged house too warm." He's right (in this particular case). Explain how this might cause her dizziness.