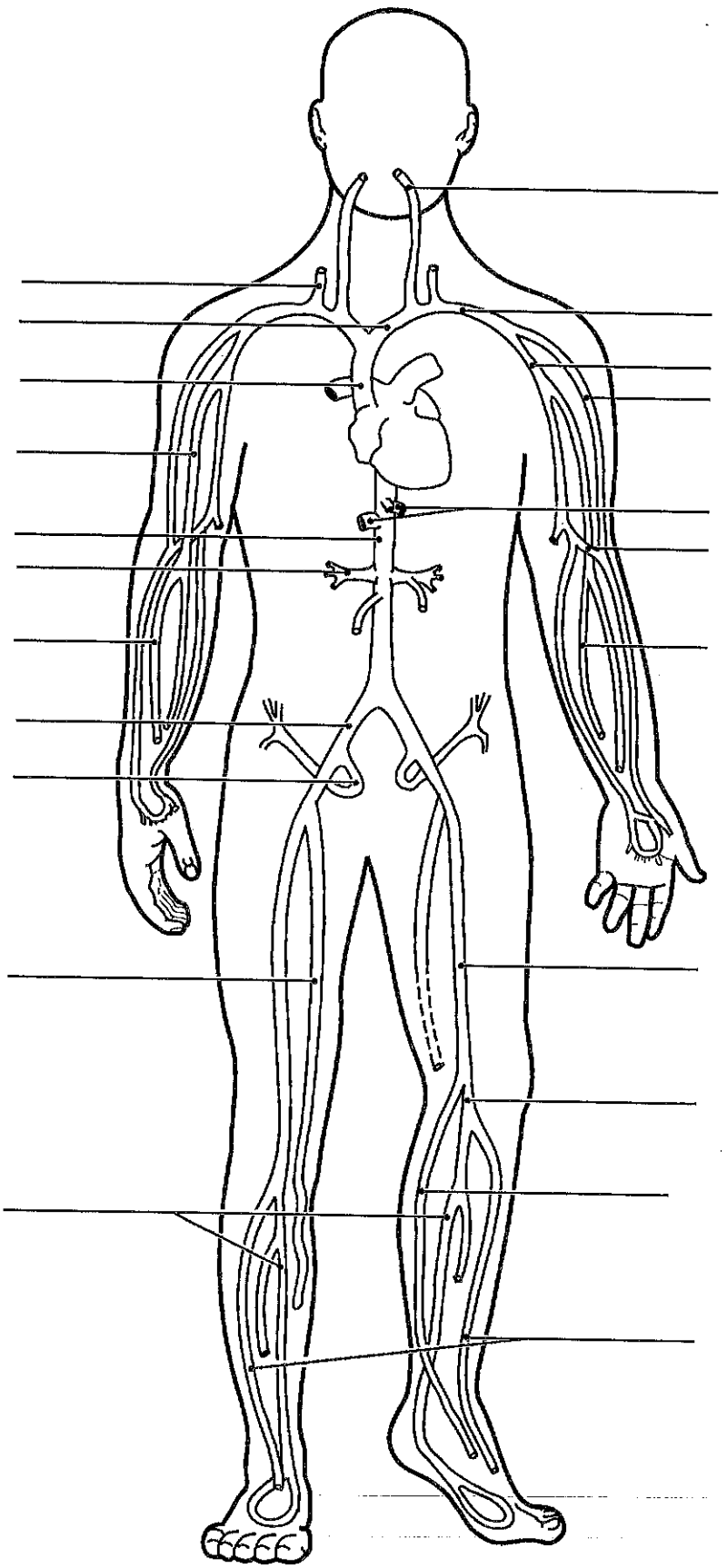


Figure 11–7 Veins

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

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.

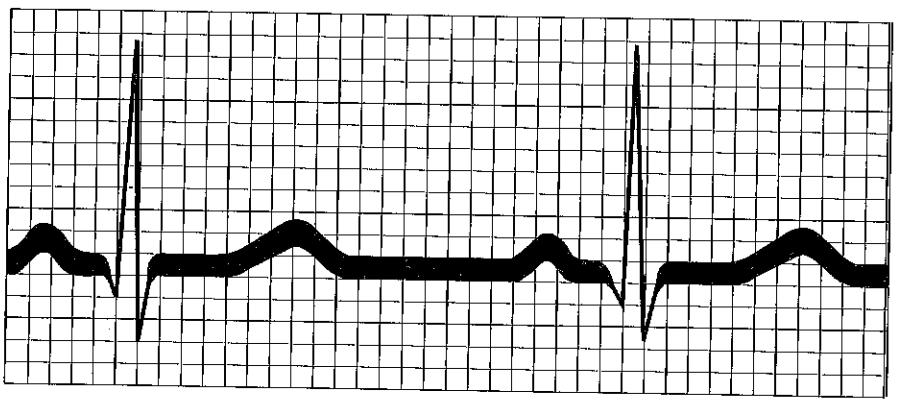


Figure 11–5

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

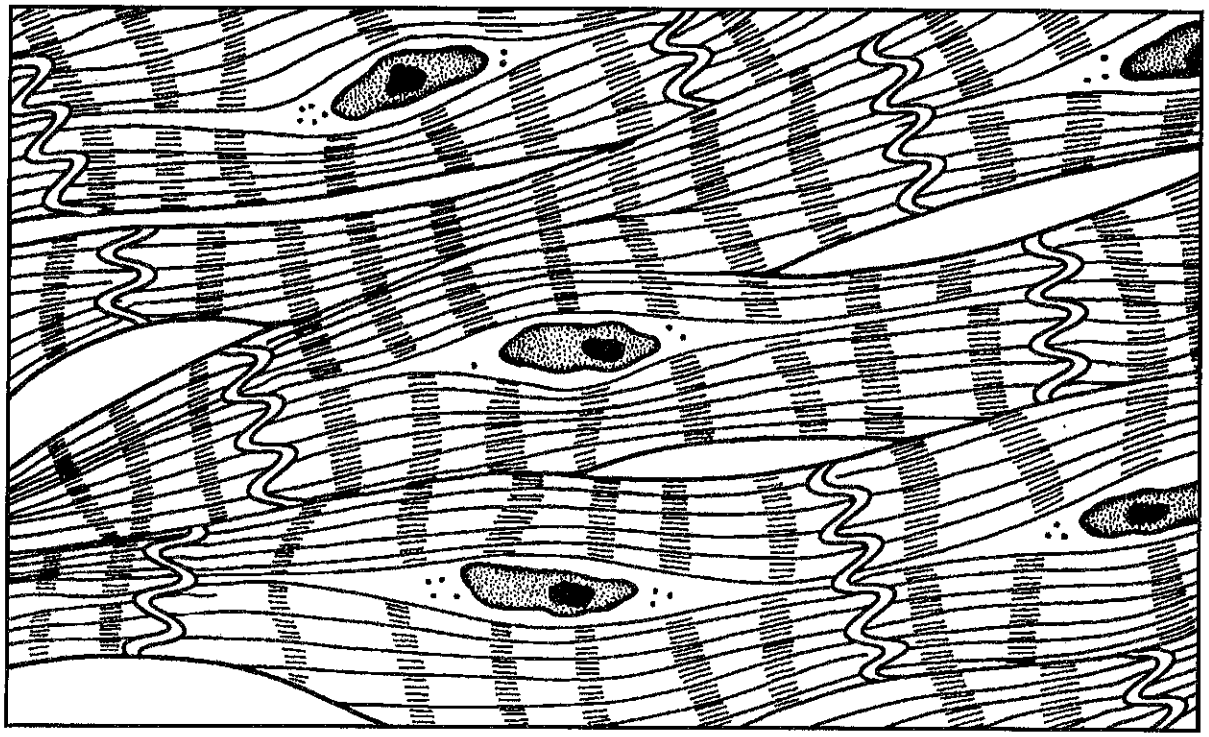


Figure 11–3

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

The contraction of the ventricles is referred to as __(1)__, and the period of ventricular relaxation is called __(2)__. The monosyllables describing heart sounds during the cardiac cycle are __(3)__. The first heart sound is a result of closure of the __(4)__ valves; closure of the __(5)__ valves causes the second heart sound. The heart chambers that have just been filled when you hear the first heart sound are the __(6)__, and the chambers that have just emptied are the __(7)__. Immediately after the second heart sound, the __(8)__ are filling with blood, and the __(9)__ are empty. Abnormal heart sounds, or __(10)__, usually indicate valve problems.

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.

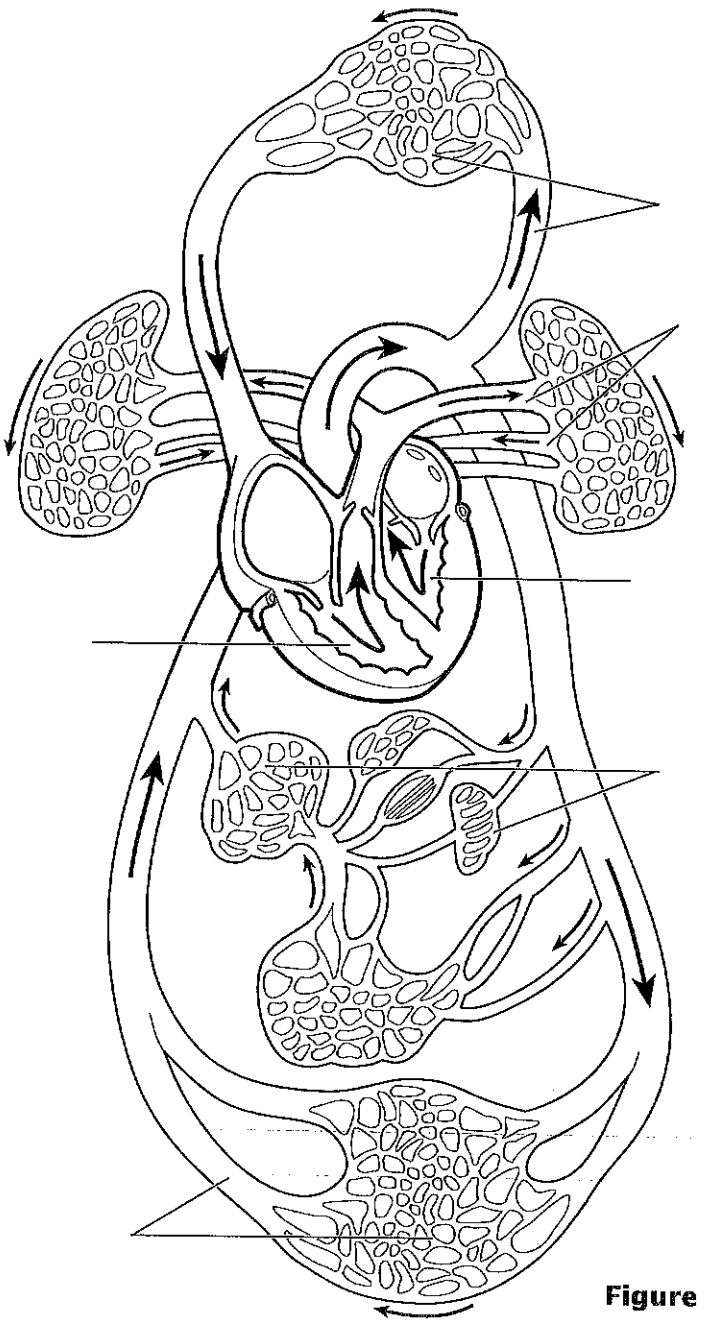


Figure 11–1

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"

7. Check (✓) all the factors that would serve as stimuli for erythropoiesis.

_____ 1. Hemorrhage

_____ 2. Aerobic exercise

_____ 3. Living at a high altitude

_____ 4. Breathing pure oxygen

HEMOSTASIS

8. Using key choices, correctly complete the following description of the blood-clotting process. Insert the key term or letter in the answer blanks.

Key Choices

A. Break
B. Erythrocytes
C. Fibrin
D. Fibrinogen
E. Platelets
F. Prothrombin
G. Serotonin
H. Thrombin
I. Tissue factor

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

Clotting begins when a __(1)__ occurs in a blood vessel wall. Almost immediately, __(2)__ cling to the blood vessel wall and release __(3)__, which helps to decrease blood loss by constricting the vessel. __(4)__ is also released by damaged cells in the area. This chemical substance causes __(5)__ to be converted to __(6)__. Once present, thrombin acts as an enzyme to attach __(7)__ molecules together to form long, threadlike strands of __(8)__, which then traps __(9)__ flowing by in the blood.

9. For each true statement, write *T*. If any statements are false, correct the underlined term by inserting the correction in the answer blank.

_____ 1. Normally, blood clots within 5–10 minutes.

_____ 2. The most important natural body anticoagulant is histamine.

_____ 3. Hemostasis means stoppage of blood flow.

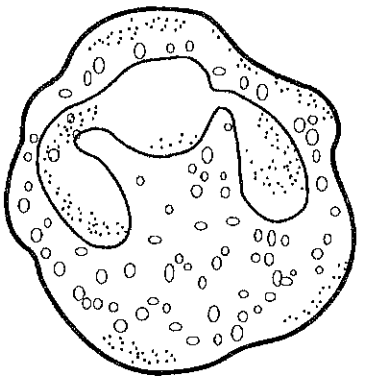
4. Four leukocytes are diagrammed in Figure 10–2. First, follow directions (given below) for coloring each leukocyte as it appears when stained with Wright's stain. Then, identify each leukocyte type by writing in the correct name in the blank below the illustration.

   A. Color the granules pale violet, the cytoplasm pink, and the nucleus dark purple.

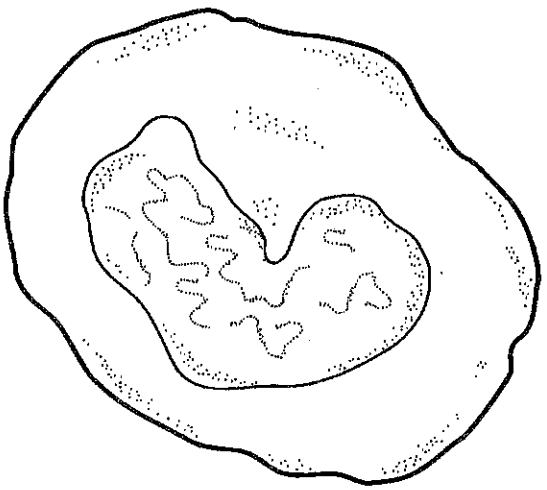
   B. Color the nucleus deep blue and the cytoplasm pale blue.

   C. Color the granules bright red, the cytoplasm pale pink, and the nucleus red/purple.

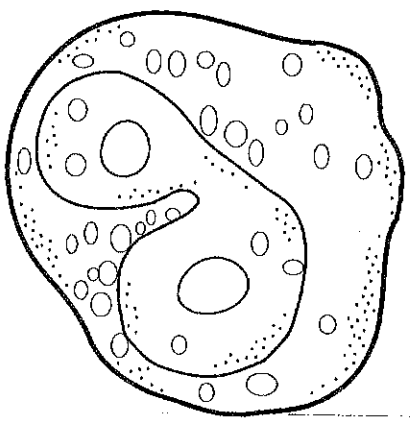
   D. For this smallest white blood cell, color the nucleus deep purple/blue and the sparse cytoplasm pale blue.



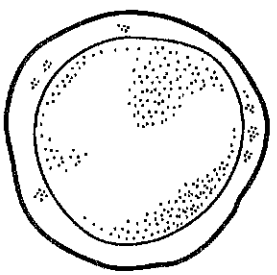
A _____



B _____



C _____



D _____

Figure 10–2

2. Using key choices, identify the cell type(s) or blood elements that fit the following descriptions. Insert the correct term or letter response in the spaces provided.

Key Choices

A. Red blood cell	D. Basophil	G. Lymphocyte
B. Megakaryocyte	E. Monocyte	H. Formed elements
C. Eosinophil	F. Neutrophil	I. Plasma

_____ 1. Most numerous leukocyte

_____ 2. _____ 3. _____ 4. Granular leukocytes

_____ 5. Also called an erythrocyte; anucleate

_____ 6. _____ 7. Actively phagocytic leukocytes

_____ 8. _____ 9. Agranular leukocytes

_____ 10. Fragments to form platelets

_____ 11. (A) through (G) are examples of these

_____ 12. Increases during allergy attacks

_____ 13. Releases histamine during inflammatory reactions

_____ 14. After originating in bone marrow, may be formed in lymphoid tissue

_____ 15. Contains hemoglobin

_____ 16. Primarily water, noncellular; the fluid matrix of blood

_____ 17. Increases in number during prolonged infections

_____ 18. Least numerous leukocyte

_____ 19. _____ 20. Also called white blood cells (#19–23)

_____ 21. _____ 22. _____ 23.

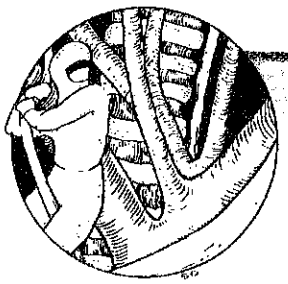
3. Figure 10–1 depicts in incomplete form the erythropoietin mechanism for regulating the rate of erythropoiesis. Complete the statements that have answer blanks, and then choose colors (other than yellow) for the color-coding circles and corresponding structures on the diagram. Color all arrows on the diagram yellow. Finally, indicate the normal life span of erythrocytes.

◯ Kidney ◯ Red bone marrow ◯ RBCs

DEVELOPMENTAL ASPECTS OF THE NERVOUS SYSTEM

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

Body temperature regulation is a problem in premature infants because the __(1)__ is not yet fully functional. Cerebral palsy involves crippling neuromuscular problems. It usually is a result of a lack of __(2)__ to the infant's brain during delivery. Normal maturation of the nervous system occurs in a __(3)__ direction, and fine control occurs much later than __(4)__ muscle control. The sympathetic nervous system becomes less efficient as aging occurs, resulting in an inability to prevent sudden changes in __(5)__ when abrupt changes in position are made. The usual cause of decreasing efficiency of the nervous system as a whole is __(6)__. A change in intellect due to a gradual decrease in oxygen delivery to brain cells is called __(7)__. Death of brain neurons, which results from a sudden cessation of oxygen delivery, is called a __(8)__.



INCREDIBLE JOURNEY

A Visualization Exercise for the Nervous System

You climb on the first cranial nerve you see . . .

39. Where necessary, complete statements by inserting the missing words in the answer blanks.

Nervous tissue is quite densely packed, and it is difficult to envision strolling through its various regions. Imagine instead that each of the various functional regions of the brain has a computerized room where you can observe what occurs in that particular area. Your assignment is to determine where you are at any given time during your journey through the nervous system.

You begin your journey after being miniaturized and injected into the warm pool of cerebrospinal fluid in your host's fourth ventricle. As you begin your stroll through the nervous tissue, you notice a huge area of branching white matter overhead. As you enter the first computer room you hear an announcement through the loudspeaker, "The pelvis is tipping too far posteriorly. Please correct. We are beginning to fall backward and will soon lose our balance." The computer responds immediately, decreasing impulses to the posterior hip muscles and increasing impulses to the anterior thigh muscles. "How is that, proprioceptor 1?" From this information, you determine that your first stop is the __(1)__.

_____ 5. Most anterior forearm muscles

_____ 6. Arm muscles

_____ 7. Abdominal wall (name plexus only)

_____ 8. Anterior thigh

_____ 9. Medial side of the hand

Autonomic Nervous System

35. Identify, by color coding and coloring, the following structures in Figure 7–10, which depicts the major anatomical differences between the somatic and autonomic motor divisions of the PNS. Also identify by labeling all structures provided with leader lines.

- ◯ Somatic motor neuron
- ◯ ANS preganglionic neuron
- ◯ ANS ganglionic neuron
- ◯ Autonomic ganglion
- ◯ Gray matter of spinal cord (CNA)
- ◯ Effector of the somatic motor neuron
- ◯ Effector of the automatic motor neuron
- ◯ Myelin sheath
- ◯ White matter of spinal cord (CNS)

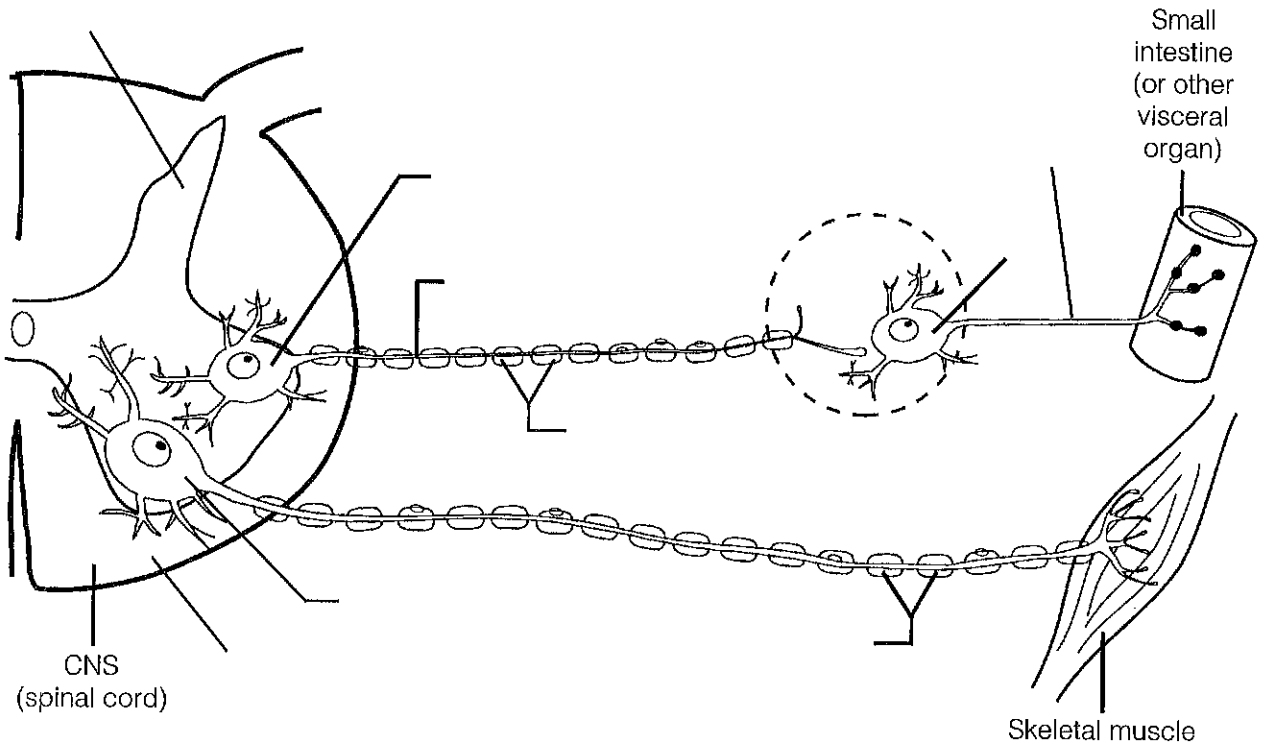


Figure 7–10

Cranial Nerves

31. The 12 pairs of cranial nerves are indicated by leader lines in Figure 7–9. First, label each by name and Roman numeral on the figure and then color each nerve with a different color.

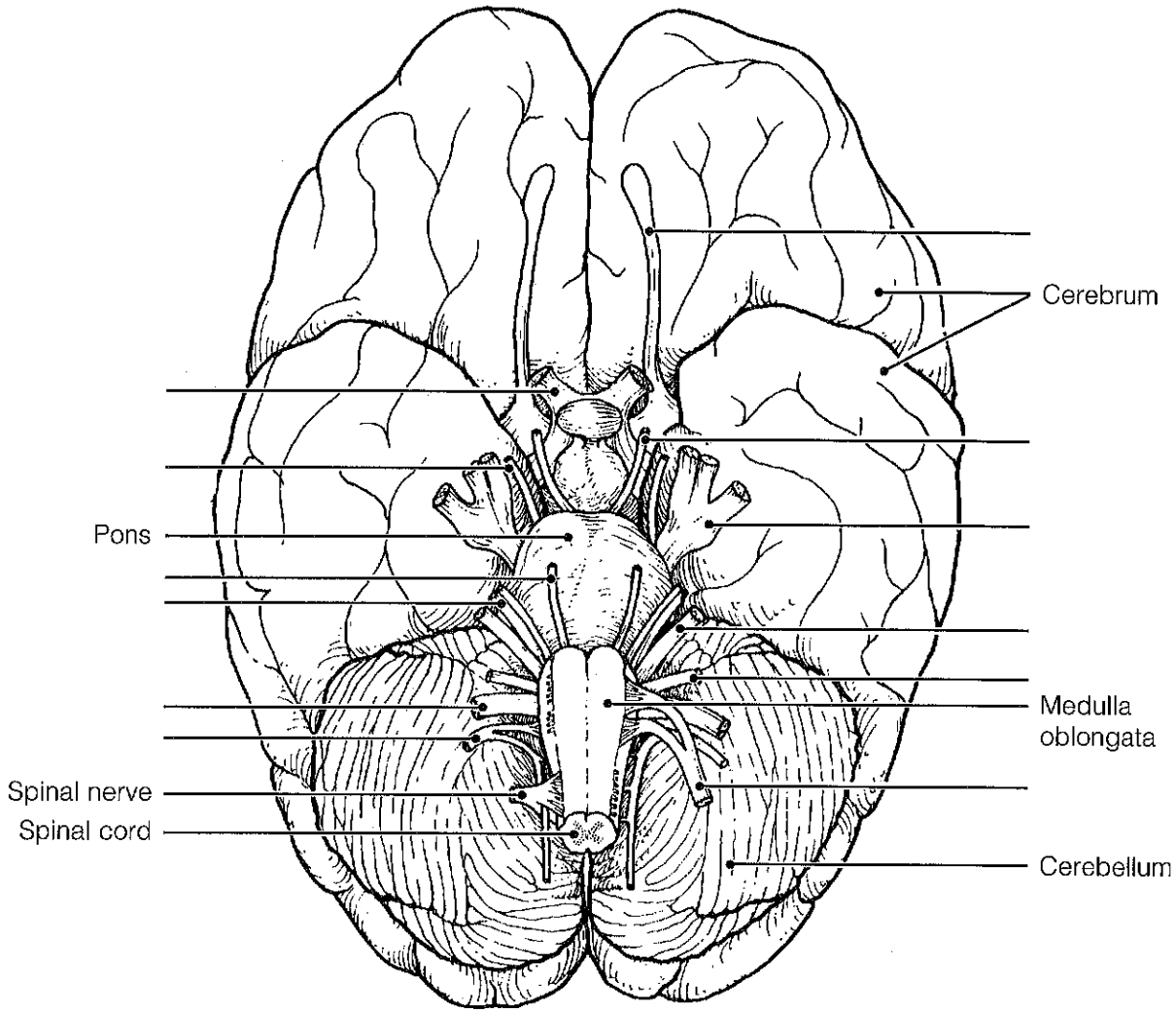


Figure 7–9

PERIPHERAL NERVOUS SYSTEM

Structure of a Nerve

28. Figure 7–7 is a diagrammatic view of a nerve wrapped in its connective tissue coverings. Select different colors to identify the following structures and use them to color the coding circles and corresponding structures in the figure. Then, label each of the sheaths indicated by leader lines on the figure.

◯ Endoneurium ◯ Perineurium ◯ Epineurium

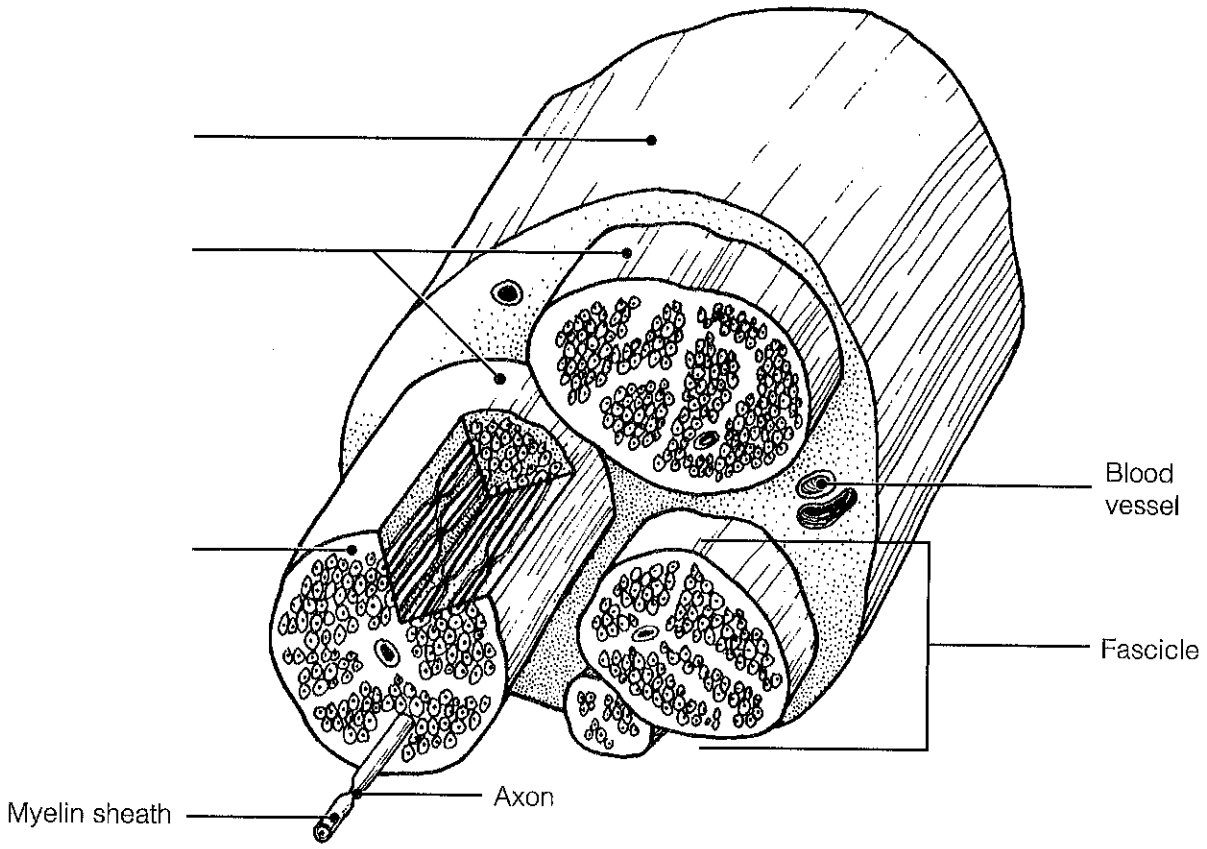


Figure 7–7

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

_____ 1.
_____ 2.
_____ 3.

Another name for a bundle of nerve fibers is __(1)__. Nerves carrying both sensory and motor fibers are called __(2)__ nerves, whereas those carrying just sensory fibers are referred to as sensory, or __(3)__, nerves.

Spinal Cord

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

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

The spinal cord extends from the __(1)__ of the skull to the __(2)__ region of the vertebral column. The meninges, which cover the spinal cord, extend more inferiorly to form a sac from which cerebrospinal fluid can be withdrawn without damage to the spinal cord. This procedure is called a __(3)__. __(4)__ pairs of spinal nerves arise from the cord. Of these, __(5)__ pairs are cervical nerves, __(6)__ pairs are thoracic nerves, __(7)__ pairs are lumbar nerves, and __(8)__ pairs are sacral nerves. The tail-like collection of spinal nerves at the inferior end of the spinal cord is called the __(9)__.

25. Using key choices, select the appropriate terms to respond to the following descriptions referring to spinal cord anatomy. Place the correct term or letter in the answer blanks.

Key Choices

A. Afferent (sensory)
B. Efferent (motor)
C. Both afferent and efferent
D. Association neurons (interneurons)

_____ 1. Neuron type found in the dorsal horn
_____ 2. Neuron type found in the ventral horn
_____ 3. Neuron type in a dorsal root ganglion
_____ 4. Fiber type in the ventral root
_____ 5. Fiber type in the dorsal root
_____ 6. Fiber type in a spinal nerve

_____ 8. A flat EEG is evidence of clinical death.

_____ 9. Beta waves are recorded when an individual is awake and relaxed.

Protection of the CNS—Meninges and Cerebrospinal Fluid

20. Identify the meningeal (or associated) structures described here.

_____ 1. Outermost covering of the brain, composed of tough fibrous connective tissue

_____ 2. Innermost covering of the brain; delicate and vascular

_____ 3. Structures that return cerebrospinal fluid to the venous blood in the dural sinuses

_____ 4. Middle meningeal layer; like a cobweb in structure

_____ 5. Its outer layer forms the periosteum of the skull

21. Figure 7–5 shows a frontal view of the meninges of the brain at the level of the superior sagittal (dural) sinus. First, label the *arachnoid villi* on the figure. Then, select different colors for each of the following structures and use them to color the coding circles and corresponding structures in the diagram.

◯ Dura mater

◯ Pia mater

◯ Arachnoid mater

◯ Subarachnoid space

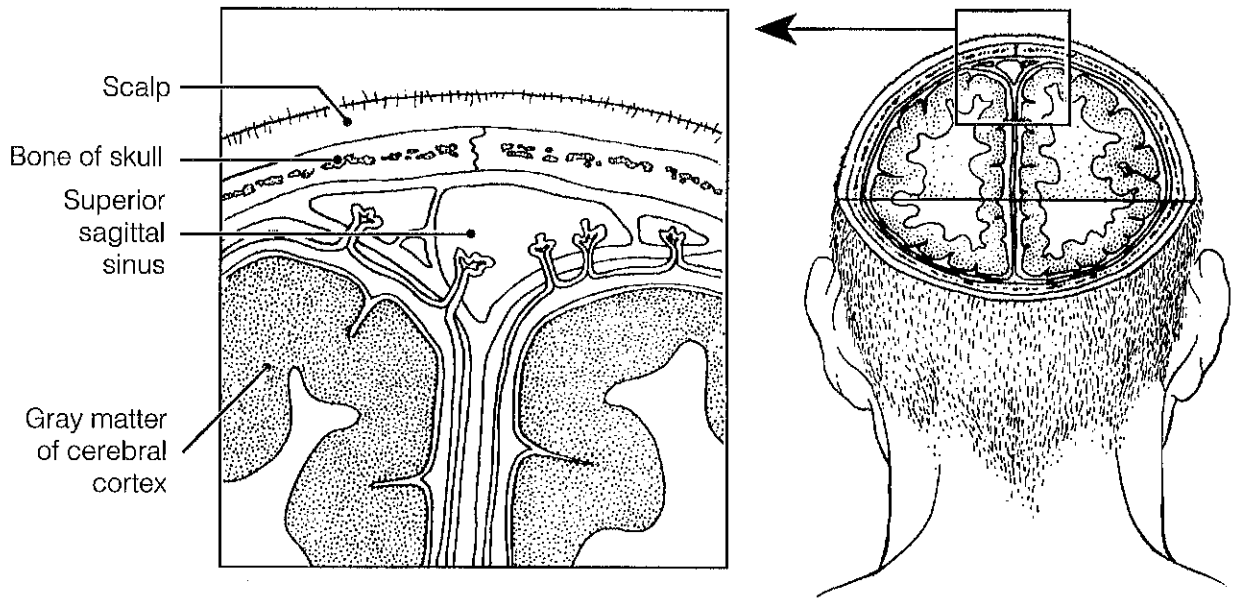


Figure 7–5

17. Figure 7–4 is a diagram of the sagittal view of the human brain. First, match the letters on the diagram with the following list of terms and insert the appropriate letter in each answer blank. Then, color the brain-stem areas blue and the areas where cerebrospinal fluid is found yellow.

_____ 1. Cerebellum

_____ 2. Cerebral aqueduct

_____ 3. Cerebral hemisphere

_____ 4. Cerebral peduncle

_____ 5. Choroid plexus

_____ 6. Corpora quadrigemina

_____ 7. Corpus callosum

_____ 8. Fourth ventricle

_____ 9. Hypothalamus

_____ 10. Medulla oblongata

_____ 11. Optic chiasma

_____ 12. Pineal body

_____ 13. Pituitary gland

_____ 14. Pons

_____ 15. Thalamus

18. Referring to the brain areas listed in Exercise 17, match the appropriate brain structures with the following descriptions. Insert the correct terms in the answer blanks.

_____ 1. Site of regulation of water balance and body temperature

_____ 2. Contains reflex centers involved in regulating respiratory rhythm in conjunction with lower brain-stem centers

_____ 3. Responsible for the regulation of posture and coordination of skeletal muscle movements

_____ 4. Important relay station for afferent fibers traveling to the sensory cortex for interpretation

_____ 5. Contains autonomic centers, which regulate blood pressure and respiratory rhythm, as well as coughing and sneezing centers

_____ 6. Large fiber tract connecting the cerebral hemispheres

_____ 7. Connects the third and fourth ventricles

_____ 8. Encloses the third ventricle

_____ 9. Forms the cerebrospinal fluid

_____ 10. Midbrain area that is largely fiber tracts; bulges anteriorly

_____ 11. Part of the limbic system; contains centers for many drives (rage, pleasure, hunger, sex, etc.)

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

1. Astrocytes Neurons Oligodendrocytes Microglia
2. K^+ enters the cell K^+ leaves the cell Repolarization Refractory period
3. Nodes of Ranvier Myelin sheath Unmyelinated Saltatory conduction
4. Predictable response Voluntary act Involuntary act Reflex
5. Oligodendrocytes Schwann cells Myelin Microglia
6. Cutaneous receptors Free dendritic endings Stretch Pain and touch
7. Cell interior High Na^+ Low Na^+ High K^+

CENTRAL NERVOUS SYSTEM

Brain

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

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

The largest part of the human brain is the (paired) __(1)__. The other major subdivisions of the brain are the __(2)__ and the __(3)__. The cavities found in the brain are called __(4)__. They contain __(5)__.

14. Circle the terms indicating structures that are *not* part of the brain stem.

Cerebral hemispheres Midbrain Medulla
Pons Cerebellum Diencephalon

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

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

A __(1)__ is an elevated ridge of cerebral cortex tissue. The convolutions seen in the cerebrum are important because they increase the __(2)__. Gray matter is composed of __(3)__. White matter is composed of __(4)__, which provide for communication between different parts of the brain as well as with lower CNS centers. The lentiform nucleus, the caudate, and other nuclei are collectively called the __(5)__.

9. Using the key choices, identify the terms defined in the following statements. Place the correct term or letter response in the answer blanks.

Key Choices

A. Action potential
B. Depolarization
C. Polarized
D. Potassium ions
E. Refractory period
F. Repolarization
G. Sodium ions
H. Sodium-potassium pump

_____ 1. Period of repolarization of the neuron during which it cannot respond to a second stimulus

_____ 2. State in which the resting potential is reversed as sodium ions rush into the neuron

_____ 3. Electrical condition of the plasma membrane of a resting neuron

_____ 4. Period during which potassium ions diffuse out of the neuron

_____ 5. Transmission of the depolarization wave along the neuron's membrane

_____ 6. The chief positive intracellular ion in a resting neuron

_____ 7. Process by which ATP is used to move sodium ions out of the cell and potassium ions back into the cell; completely restores the resting conditions of the neuron

10. Using the key choices, identify the types of reflexes involved in each of the following situations.

Key Choices

A. Somatic reflex(es)
B. Autonomic reflex(es)

_____ 1. Patellar (knee-jerk) reflex

_____ 2. Pupillary light reflex

_____ 3. Effectors are skeletal muscles

_____ 4. Effectors are smooth muscle and glands

_____ 5. Flexor reflex

_____ 6. Regulation of blood pressure

_____ 7. Salivary reflex

6. Using key choices, select the terms identified in the following descriptions by inserting the appropriate letter or term in the spaces provided.

Key Choices

A. Afferent neuron	F. Neuroglia	K. Proprioceptors
B. Association neuron	G. Neurotransmitters	L. Schwann cells
C. Cutaneous sense organs	H. Nerve	M. Synapse
D. Efferent neuron	I. Nodes of Ranvier	N. Stimuli
E. Ganglion	J. Nuclei	O. Tract

_____ 1. Sensory receptors found in the skin, which are specialized to detect temperature, pressure changes, and pain

_____ 2. Specialized cells that myelinate the fibers of neurons found in the PNS

_____ 3. Junction or point of close contact between neurons

_____ 4. Bundle of nerve processes inside the CNS

_____ 5. Neuron, serving as part of the conduction pathway between sensory and motor neurons

_____ 6. Gaps in a myelin sheath

_____ 7. Collection of nerve cell bodies found outside the CNS

_____ 8. Neuron that conducts impulses away from the CNS to muscles and glands

_____ 9. Sensory receptors found in muscle and tendons that detect their degree of stretch

_____ 10. Changes, occurring within or outside the body, that affect nervous system functioning

_____ 11. Neuron that conducts impulses toward the CNS from the body periphery

_____ 12. Chemicals released by neurons that stimulate other neurons, muscles, or glands

ORGANIZATION OF THE NERVOUS SYSTEM

2. Choose the key responses that best correspond to the descriptions provided in the following statements. Insert the appropriate letter or term in the answer blanks.

Key Choices

A. Autonomic nervous system
B. Central nervous system (CNS)
C. Peripheral nervous system (PNS)
D. Somatic nervous system

_____ 1. Nervous system subdivision that is composed of the brain and spinal cord

_____ 2. Subdivision of the PNS that controls voluntary activities such as the activation of skeletal muscles

_____ 3. Nervous system subdivision that is composed of the cranial and spinal nerves and ganglia

_____ 4. Subdivision of the PNS that regulates the activity of the heart and smooth muscle, and of glands; it is also called the involuntary nervous system

_____ 5. A major subdivision of the nervous system that interprets incoming information and issues orders

_____ 6. A major subdivision of the nervous system that serves as communication lines, linking all parts of the body to the CNS

NERVOUS TISSUE—STRUCTURE AND FUNCTION

3. This exercise emphasizes the difference between neurons and neuroglia. Indicate which cell type is identified by the following descriptions. Insert the appropriate letter or term in the answer blanks.

Key Choices

A. Neurons
B. Neuroglia

_____ 1. Support, insulate, and protect cells

_____ 2. Demonstrate irritability and conductivity, and thus transmit electrical messages from one area of the body to another area

_____ 3. Release neurotransmitters

_____ 4. Are amitotic

_____ 5. Able to divide; therefore are responsible for most brain neoplasms

17. Several criteria are applied to the naming of muscles. These are provided in Column B. Identify which criteria pertain to the muscles listed in Column A and enter the correct letter(s) in the answer blank.

	Column A	Column B
_____	1. Gluteus maximus	A. Action of the muscle
_____	2. Adductor magnus	B. Shape of the muscle
_____	3. Biceps femoris	C. Location of the muscle's origin and/or insertion
_____	4. Abdominis transversus	D. Number of origins
_____	5. Extensor carpi ulnaris	E. Location of muscle relative to a bone or body region
_____	6. Trapezius	F. Direction in which the muscle fibers run relative to some imaginary line
_____	7. Rectus femoris	G. Relative size of the muscle
_____	8. External oblique	

GROSS ANATOMY OF THE SKELETAL MUSCLES

Muscles of the Head

18. Identify the major muscles described in Column A by choosing a response from Column B. Enter the correct letter in the answer blank. Select a different color for each muscle described and color in the coding circle and corresponding muscle on Figure 6–6.

	Column A	Column B
◯ _____	1. Used in smiling	A. Buccinator
◯ _____	2. Used to suck in your cheeks	B. Frontalis
◯ _____	3. Used in winking	C. Masseter
◯ _____	4. Used to form the horizontal frown crease on the forehead	D. Orbicularis oculi
◯ _____	5. The "kissing" muscle	E. Orbicularis oris
◯ _____	6. Prime mover of jaw closure	F. Sternocleidomastoid
◯ _____	7. Synergist muscle for jaw closure	G. Temporalis
◯ _____	8. Prime mover of head flexion; a two-headed muscle	H. Trapezius
		I. Zygomaticus

12. Briefly describe how you can tell when you are repaying the oxygen debt.

_____

_____

13. Which of the following occur within a muscle cell during oxygen debt? Place a check (✓) by the correct choices.

_____ 1. Decreased ATP

_____ 2. Increased ATP

_____ 3. Increased lactic acid

_____ 4. Decreased oxygen

_____ 5. Increased oxygen

_____ 6. Decreased carbon dioxide

_____ 7. Increased carbon dioxide

_____ 8. Increased glucose

MUSCLE MOVEMENTS, TYPES, AND NAMES

14. Relative to general terminology concerning muscle activity, first label the following structures on Figure 6–5: insertion, origin, tendon, resting muscle, and contracting muscle. Next, identify the two structures named below by choosing different colors for the coding circles and the corresponding structures in the figure.

◯ Movable bone

◯ Immovable bone

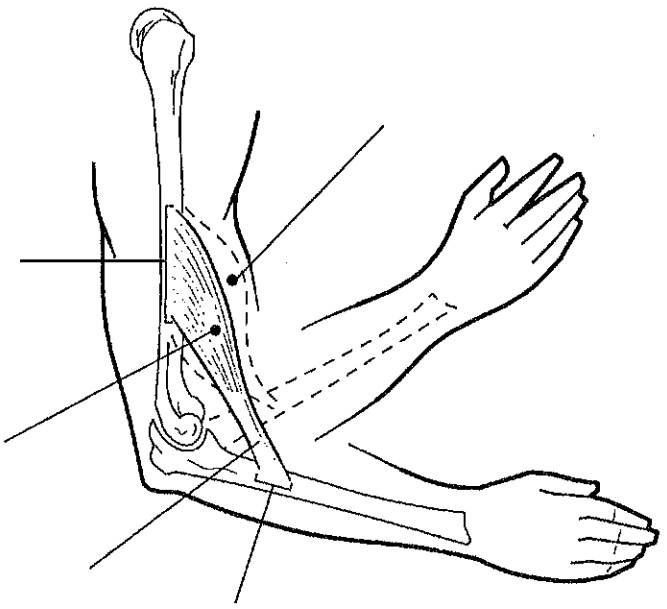


Figure 6–5

8. Number the following statements in their proper sequence to describe the contraction mechanism in a skeletal muscle cell. The first step has already been identified as number 1.

__1__ 1. Acetylcholine is released into the neuromuscular junction by the axonal terminal.

_____ 2. The action potential, carried deep into the cell, causes the sarcoplasmic reticulum to release calcium ions.

_____ 3. The muscle cell relaxes and lengthens.

_____ 4. Acetylcholine diffuses across the neuromuscular junction and binds to receptors on the sarcolemma.

_____ 5. The calcium ion concentration at the myofilaments increases; the myofilaments slide past one another, and the cell shortens.

_____ 6. Depolarization occurs, and the action potential is generated.

_____ 7. As calcium is actively reabsorbed into the sarcoplasmic reticulum, its concentration at the myofilaments decreases.

9. The following incomplete statements refer to a muscle cell in the resting, or polarized, state just before stimulation. Complete each statement by choosing the correct response from the key choices and entering the appropriate letter in the answer blanks.

Key Choices

A. Na^+ diffuses out of the cell

B. K^+ diffuses out of the cell

C. Na^+ diffuses into the cell

D. K^+ diffuses into the cell

E. Inside the cell

F. Outside the cell

G. Relative ionic concentrations on the two sides of the membrane during rest

H. Electrical conditions

I. Activation of the sodium-potassium pump, which moves K^+ into the cell and Na^+ out of the cell

J. Activation of the sodium-potassium pump, which moves Na^+ into the cell and K^+ out of the cell

_____ 1.

_____ 2.

_____ 3.

_____ 4.

_____ 5.

_____ 6.

There is a greater concentration of Na^+ __(1)__, and there is a greater concentration of K^+ __(2)__. When the stimulus is delivered, the permeability of the membrane is changed, and __(3)__, initiating the depolarization of the membrane. Almost as soon as the depolarization wave begins, a repolarization wave follows it across the membrane. This occurs as __(4)__. Repolarization restores the __(5)__ of the resting cell membrane. The __(6)__ is (are) reestablished by __(7)__.

_____ 7.

5. Figure 6–3 is a diagrammatic representation of a small portion of a relaxed muscle cell (bracket indicates the portion enlarged). First, select different colors for the structures listed below. Use them to color the coding circles and corresponding structures on Figure 6–3. Then bracket and label an A band, an I band, and a sarcomere. When you have finished, draw a contracted sarcomere in the space beneath the figure and label the same structures, as well as the light and dark bands.

◯ Myosin ◯ Actin filaments ◯ Z disc

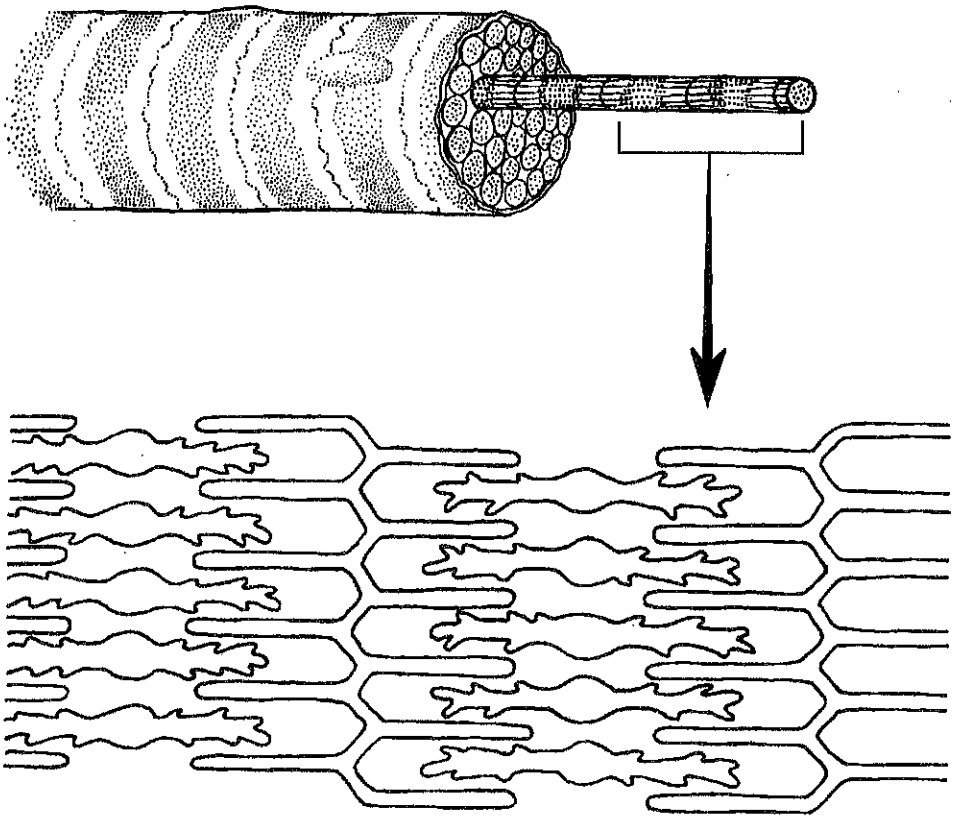


Figure 6–3

_____ 1. Looking at your diagram of a contracted sarcomere from a slightly different angle—which region of the sarcomere shortens during contraction—the dark band, the light band, or both?

Key Choices

A. Cardiac B. Smooth C. Skeletal

_____ 7. Moves bones and the facial skin

_____ 8. Referred to as the muscular system

_____ 9. Voluntary

2. Identify the type of muscle in each of the illustrations in Figure 6–1. Color the diagrams as you wish.

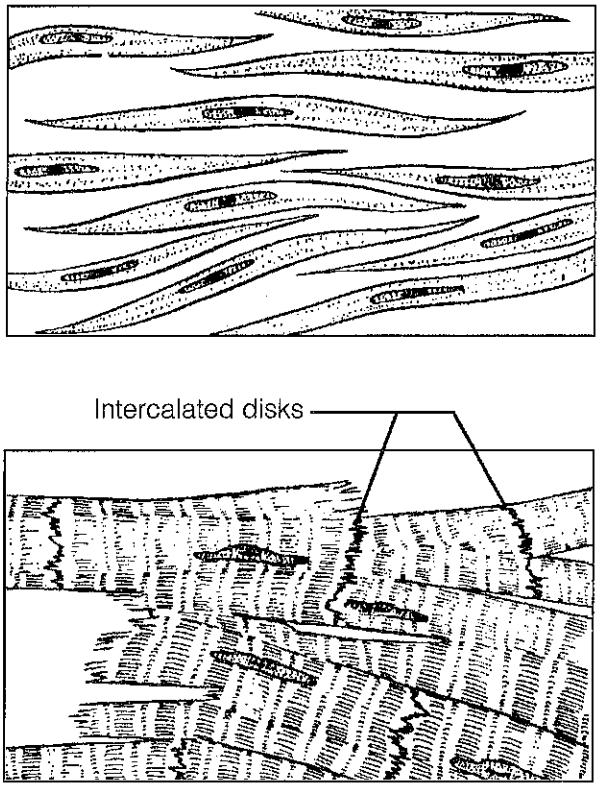


Figure 6–1

3. Regarding the functions of muscle tissues, circle the term in each of the groupings that does not belong with the other terms.

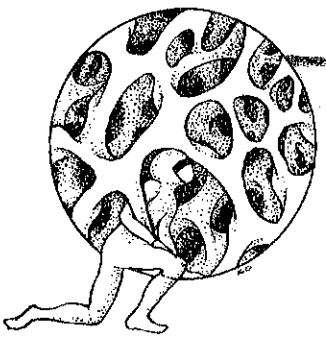
1. Urine Foodstuffs Bones Smooth muscle
2. Heart Cardiac muscle Blood pump Promotes labor during birth
3. Excitability Response to a stimulus Contractility Action potential
4. Ability to shorten Contractility Pulls on bones Stretchability
5. Maintains posture Movement Promotes growth Generates heat

36. Complete the following statements concerning fetal and infant skeletal development. Insert the missing words in the answer blanks.

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

"Soft spots," or membranous joints called __(1)__ in the fetal skull, allow the skull to be __(2)__ slightly during birth passage. They also allow for continued brain __(3)__ during the later months of fetal development and early infancy. Eventually these soft spots are replaced by immovable joints called __(4)__.

The two spinal curvatures well developed at birth are the __(5)__ and __(6)__ curvatures. Because they are present at birth, they are called __(7)__ curvatures. The secondary curvatures develop as the baby matures. The __(8)__ curvature develops as the baby begins to lift his or her head. The __(9)__ curvature matures when the baby begins to walk or assume the upright posture.



INCREDIBLE JOURNEY

A Visualization Exercise for the Skeletal System

. . . stalagmite- and stalactite-like structures that surround you. . . . Since the texture is so full of holes. . .

37. Where necessary, complete statements by inserting the missing words in the answer blanks.

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

For this journey you are miniaturized and injected into the interior of the largest bone of your host's body, the __(1)__. Once inside this bone, you look around and find yourself examining the stalagmite- and stalactite-like structures that surround you. Although you feel as if you are in an underground cavern, you know that it has to be bone. Since the texture is so full of holes, it obviously is __(2)__ bone. Although the arrangement of these bony spars seems to be haphazard, as if someone randomly dropped straws, they are precisely arranged to resist points of __(3)__. All about you is frantic, hurried activity. Cells are dividing rapidly, nuclei are being ejected, and disk-like cells are appearing. You decide that these disk-like cells are __(4)__, and that this is the __(5)__ cavity. As you explore further, strolling along the edge of the cavity, you spot many tunnels leading into the solid bony area on which you are walking. Walking into one of these drainpipe-like openings, you notice that it contains a glistening white rope-like structure (a __(6)__, no doubt), and blood vessels running the length of the tube. You eventually come to a point in the channel where

32. For each joint described below, select an answer from Key A. Then, if the Key A selection *is other than C* (a synovial joint), see if you can classify the joint further by making a choice from Key B.

Key Choices

Key A:	A. Cartilaginous	Key B:	1. Epiphyseal disk
	B. Fibrous		2. Suture
	C. Synovial		3. Symphysis

_____ 1. Has amphiarthrotic and synarthrotic examples

_____ 2. All have a fibrous capsule lined with synovial membrane surrounding a joint cavity

_____ 3. Bone regions united by fibrous connective tissue

_____ 4. Joints between skull bones

_____ 5. Joint between atlas and axis

_____ 6. Hip, elbow, and knee

_____ 7. All examples are diarthroses

_____ 8. Pubic symphysis

_____ 9. All are reinforced by ligaments

_____ 10. Joint providing the most protection to underlying structures

_____ 11. Often contains a fluid-filled cushion

_____ 12. Child's long-bone growth plate made of hyaline cartilage

_____ 13. Most joints of the limbs

_____ 14. Often associated with bursae

_____ 15. Have the greatest mobility

33. Which structural joint type is *not* commonly found in the axial skeleton and why not?

_____

_____

_____

BONE FRACTURES

29. Using the key choices, identify the fracture (fx) types shown in Figure 5–14 and the fracture types and treatments described below. Enter the appropriate key letter or term in each answer blank.

Key Choices

A. Closed reduction	D. Depressed fracture	G. Simple fracture
B. Compression fracture	E. Greenstick fracture	H. Spiral fracture
C. Compound fracture	F. Open reduction	

_____ 1. Bone is broken cleanly; the ends do not penetrate the skin

_____ 2. Nonsurgical realignment of broken bone ends and splinting of bone

_____ 3. A break common in children; bone splinters, but break is incomplete

_____ 4. A fracture in which the bone is crushed; common in the vertebral column

_____ 5. A fracture in which the bone ends penetrate through the skin surface

_____ 6. Surgical realignment of broken bone ends

_____ 7. A result of twisting forces

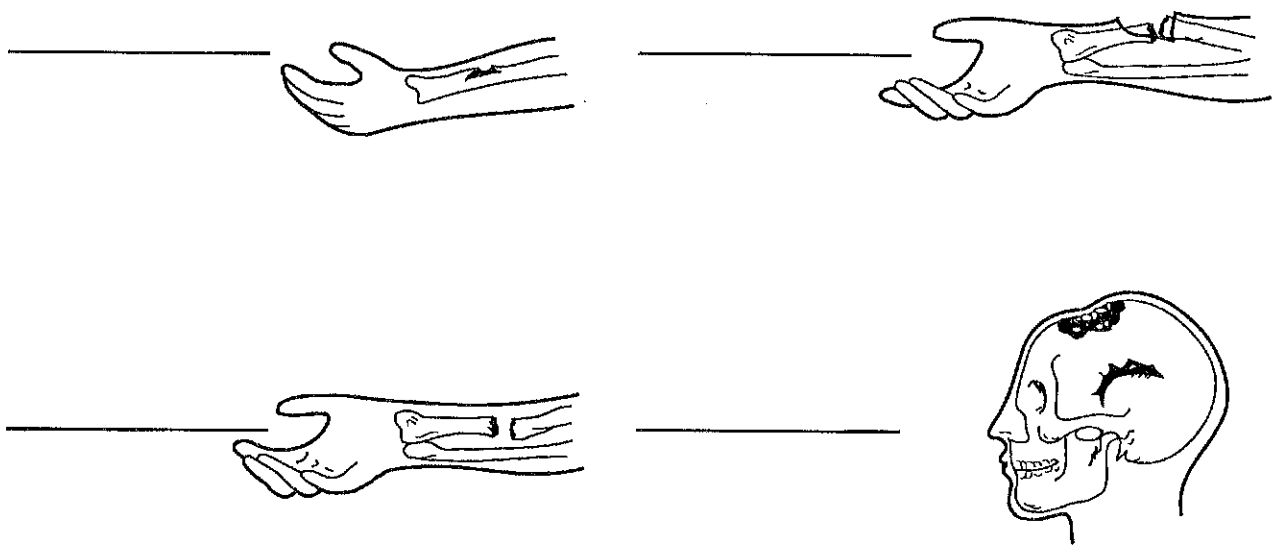


Figure 5–14

27. The bones of the thigh and the leg are shown in Figure 5–12. Identify each and put your answers in the blanks labelled A, B, and C. Select different colors for the lower limb bones listed below and use them to color in the coding circles and corresponding bones on the diagram. Complete the illustration by inserting the terms indicating bone markings at the ends of the appropriate leader lines in the figure.

◯ Femur	◯ Tibia	◯ Fibula
Head of femur	Anterior border of tibia	Head of fibula
Intercondylar eminence	Lesser trochanter	Medial malleolus
Tibial tuberosity	Greater trochanter	Lateral malleolus

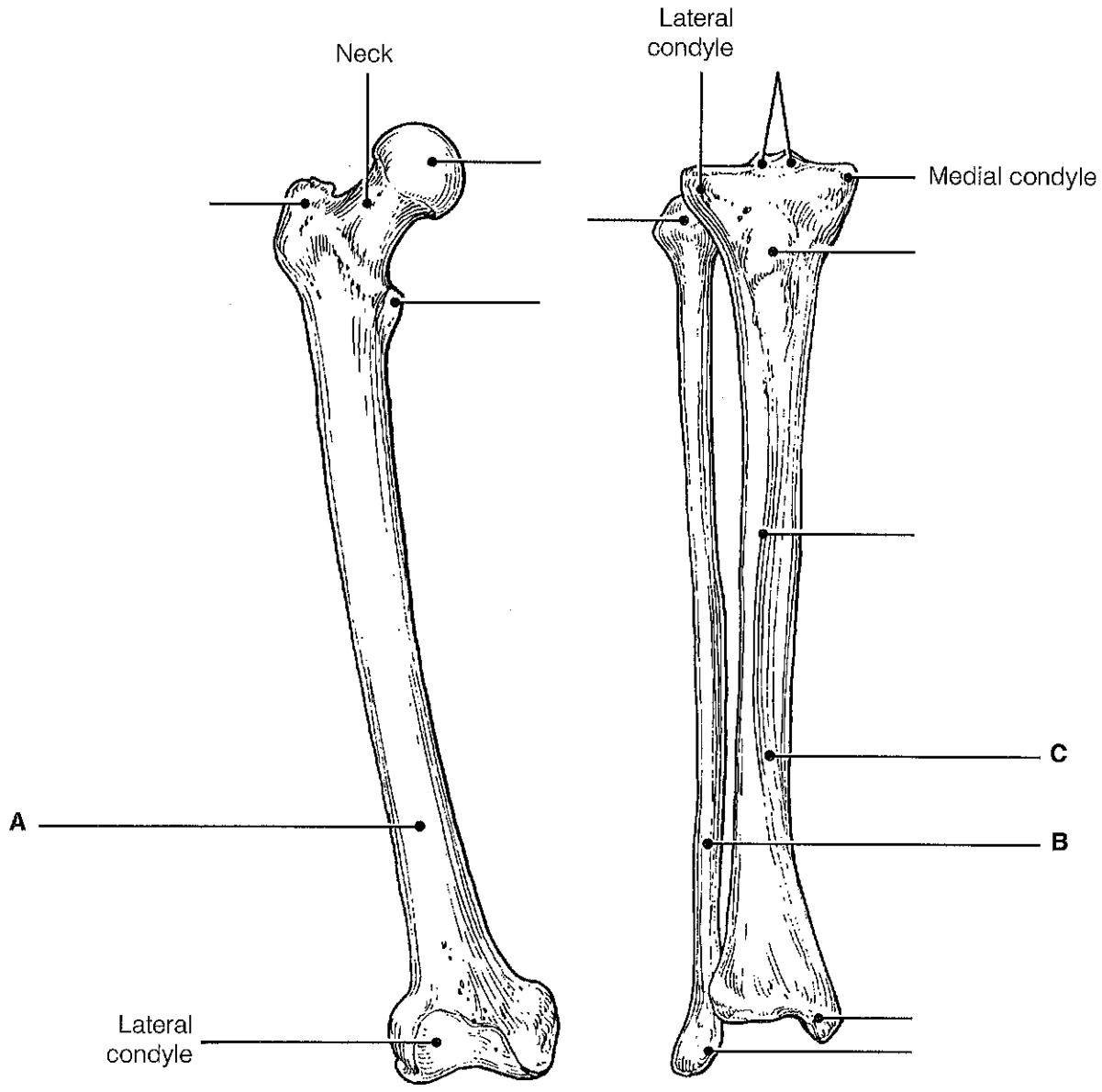


Figure 5–12

25. Using key choices, identify the bone names and markings, according to the descriptions that follow. Insert the appropriate key term(s) or letter(s) in the answer blanks.

Key Choices

A. Acetabulum	I. Ilium	Q. Patella
B. Calcaneus	J. Ischial tuberosity	R. Pubic symphysis
C. Femur	K. Ischium	S. Pubis
D. Fibula	L. Lateral malleolus	T. Sacroiliac joint
E. Gluteal tuberosity	M. Lesser sciatic notch	U. Talus
F. Greater sciatic notch	N. Medial malleolus	V. Tarsals
G. Greater and lesser trochanters	O. Metatarsals	W. Tibia
H. Iliac crest	P. Obturator foramen	X. Tibial tuberosity

_____ 1. Fuse to form the coxal bone (hip bone)

_____ 2. Receives the weight of the body when sitting

_____ 3. Point where the coxal bones join anteriorly

_____ 4. Upper margin of iliac bones

_____ 5. Deep socket in the hip bone that receives the head of the thigh bone

_____ 6. Point where axial skeleton attaches to the pelvic girdle

_____ 7. Longest bone in body, articulates with the coxal bone

_____ 8. Lateral bone of the leg

_____ 9. Medial bone of the leg

_____ 10. Bones forming the knee joint

_____ 11. Point where the patellar ligament attaches

_____ 12. Kneecap

_____ 13. Shinbone

_____ 14. Distal process on medial tibial surface

_____ 15. Process forming the outer ankle

_____ 16. Heel bone

22. Using key choices, identify the bone names or markings according to the descriptions that follow. Insert the appropriate term or letter in the answer blanks.

Key Choices

A. Acromion	F. Coronoid fossa	K. Olecranon fossa	P. Scapula
B. Capitulum	G. Deltoid tuberosity	L. Olecranon process	Q. Sternum
C. Carpals	H. Glenoid cavity	M. Phalanges	R. Styloid process
D. Clavicle	I. Humerus	N. Radial tuberosity	S. Trochlea
E. Coracoid process	J. Metacarpals	O. Radius	T. Ulna

_____ 1. Raised area on lateral surface of humerus to which deltoid muscle attaches

_____ 2. Arm bone

_____ 3. _____ 4. Bones composing the shoulder girdle

_____ 5. _____ 6. Forearm bones

_____ 7. Point where scapula and clavicle connect

_____ 8. Shoulder girdle bone that has no attachment to the axial skeleton

_____ 9. Shoulder girdle bone that articulates anteriorly with the sternum

_____ 10. Socket in the scapula for the arm bone

_____ 11. Process above the glenoid cavity that permits muscle attachment

_____ 12. Commonly called the collarbone

_____ 13. Distal medial process of the humerus; joins the ulna

_____ 14. Medial bone of the forearm in anatomical position

_____ 15. Rounded knob on the humerus that articulates with the radius

_____ 16. Anterior depression; superior to the trochlea; receives part of the ulna when the forearm is flexed

_____ 17. Forearm bone involved in formation of elbow joint

_____ 18. _____ 19. Bones that articulate with the clavicle

_____ 20. Bones of the wrist

_____ 21. Bones of the fingers

_____ 22. Heads of these bones form the knuckles

19. Identify the bones in Figure 5–9 by labeling the leader lines identified as A, B, and C. Color the bones different colors. Using the following terms, complete the illustration by labeling all bone markings provided with leader lines.

Trochlear notch	Capitulum	Coronoid process
Trochlea	Deltoid tuberosity	Olecranon process
Radial tuberosity	Head (three)	Greater tubercle
	Styloid process	Lesser tubercle

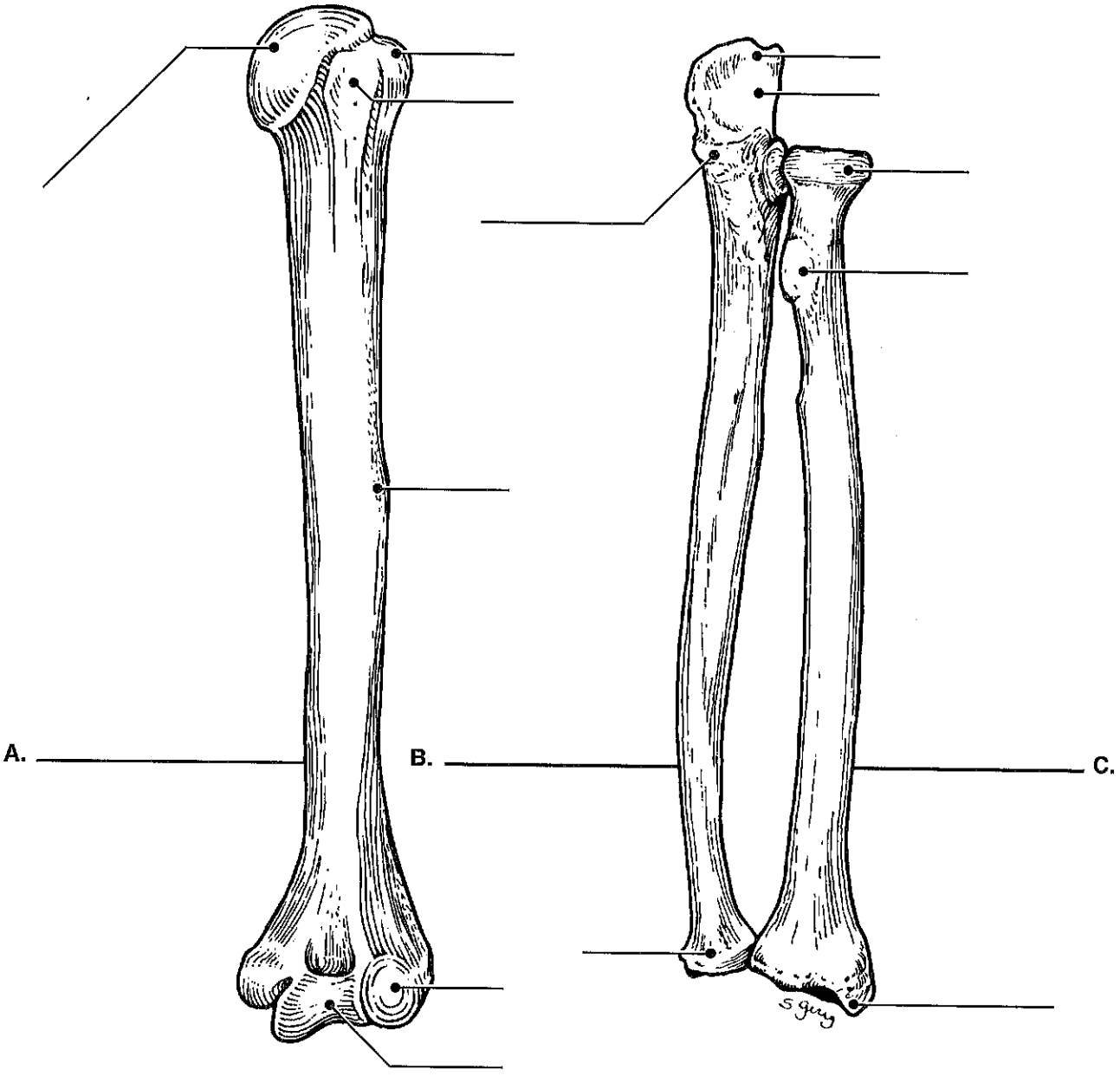


Figure 5–9

Bony Thorax

16. Complete the following statements referring to the bony thorax by inserting your responses in the answer blanks.

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

The organs protected by the thoracic cage include the __(1)__ and the __(2)__. Ribs 1 through 7 are called __(3)__ ribs, whereas ribs 8 through 12 are called __(4)__ ribs. Ribs 11 and 12 are also called __(5)__ ribs. All ribs articulate posteriorly with the __(6)__, and most connect anteriorly to the __(7)__, either directly or indirectly.

The general shape of the thoracic cage is __(8)__.

17. Figure 5–7 is an anterior view of the bony thorax. Select different colors to identify the structures below and color the coding circles and corresponding structures. Then label the subdivisions of the sternum indicated by leader lines.

◯ All true ribs
◯ All false ribs
◯ Costal cartilages
◯ Sternum

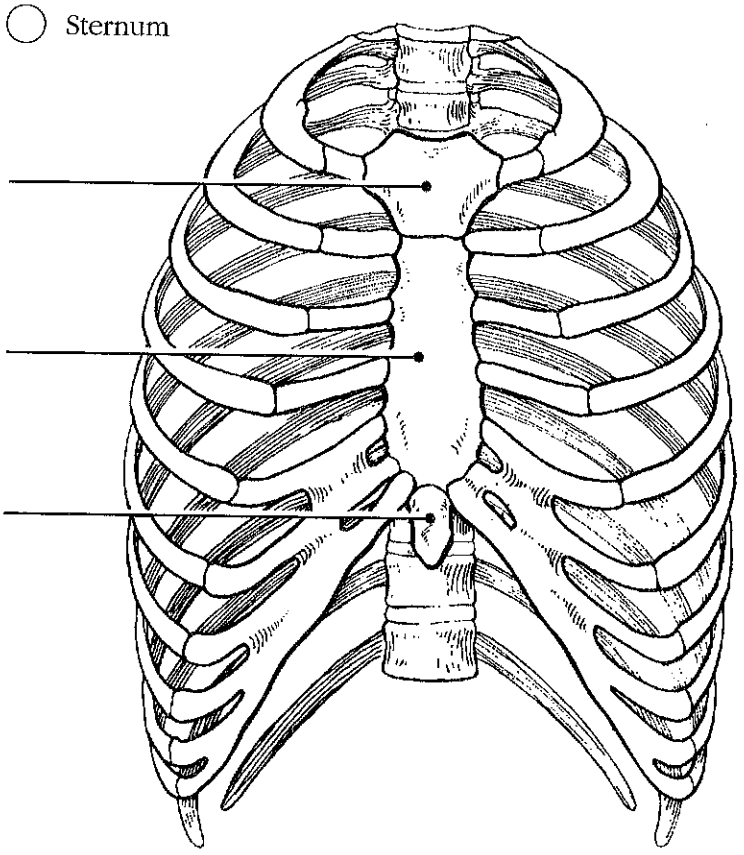


Figure 5–7

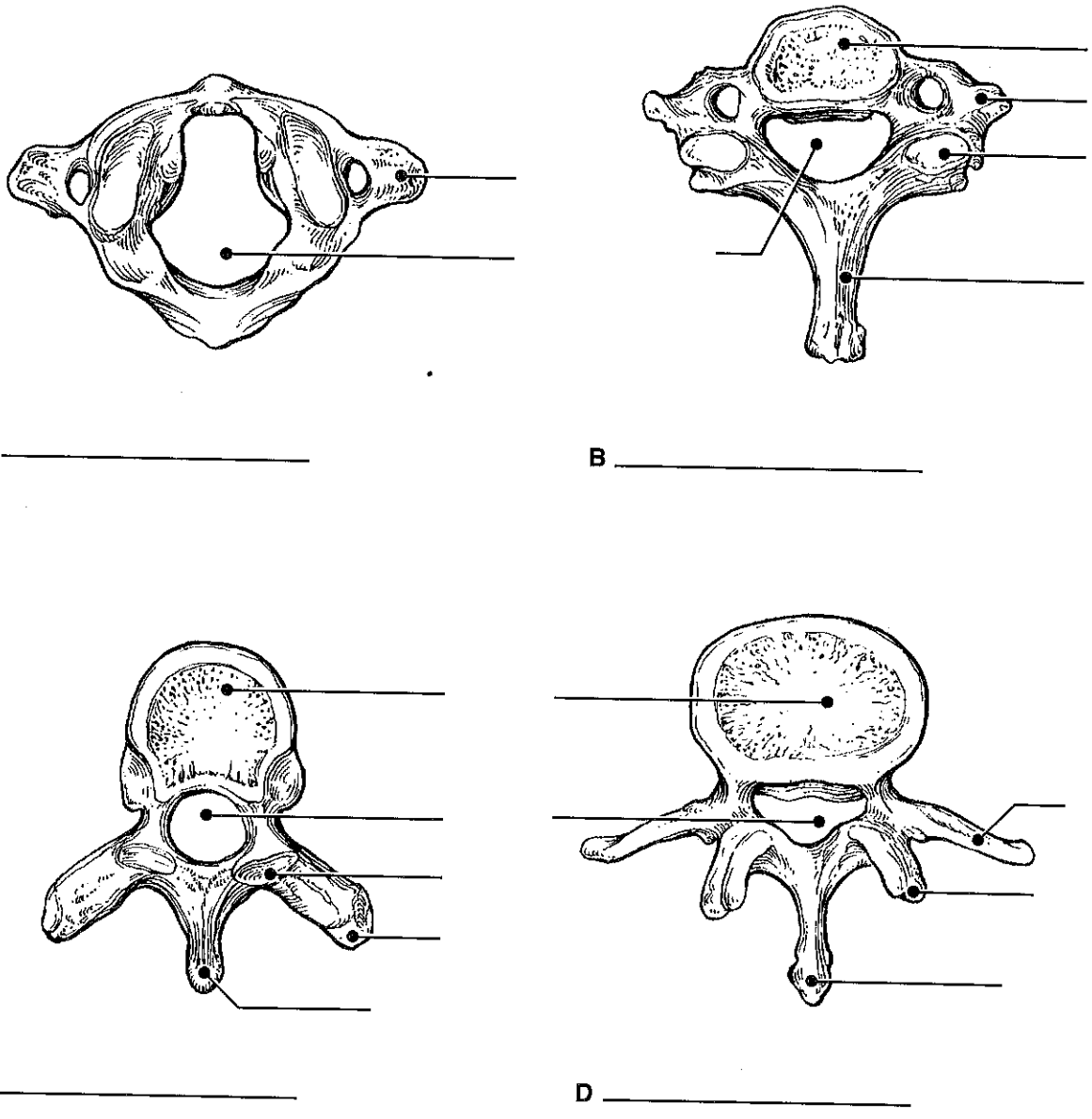
13. Complete the following statements by inserting your answers in the answer blanks.

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

In describing abnormal curvatures, it could be said that __(1)__ is an exaggerated thoracic curvature, and in __(2)__ the vertebral column is displaced laterally.

Invertebral discs are made of __(3)__ tissue. The discs provide __(4)__ to the spinal column.

14. Figure 5–5, A–D shows superior views of four types of vertebrae. In the spaces provided below each vertebra, indicate in which region of the spinal column it would be found. In addition, specifically identify Figure 5–5A. Where indicated by leader lines, identify the vertebral body, spinous and transverse processes, superior articular processes, and vertebral foramen.



A _____

B _____

C _____

D _____

Figure 5–5

10. An anterior view of the skull, showing the positions of the sinuses, is provided in Figure 5–4. First select different colors for each of the sinuses and use them to color the coding circles and the corresponding structures on the figure. Then briefly answer the following questions concerning the sinuses.

1. What *are* sinuses? _____

2. What purpose do they serve in the skull? _____

_____

_____

3. Why are they so susceptible to infection? _____

_____

_____

◯ Sphenoid sinus

◯ Frontal sinus

◯ Ethmoid sinuses

◯ Maxillary sinus

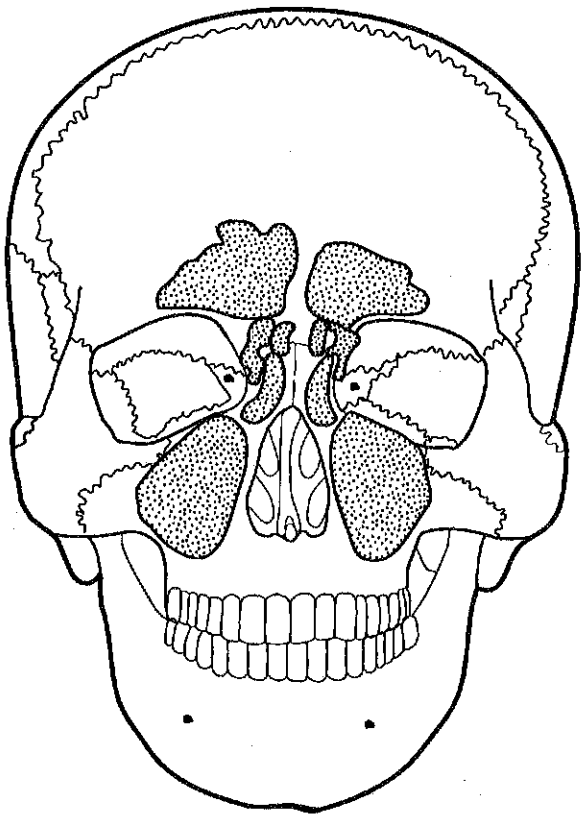
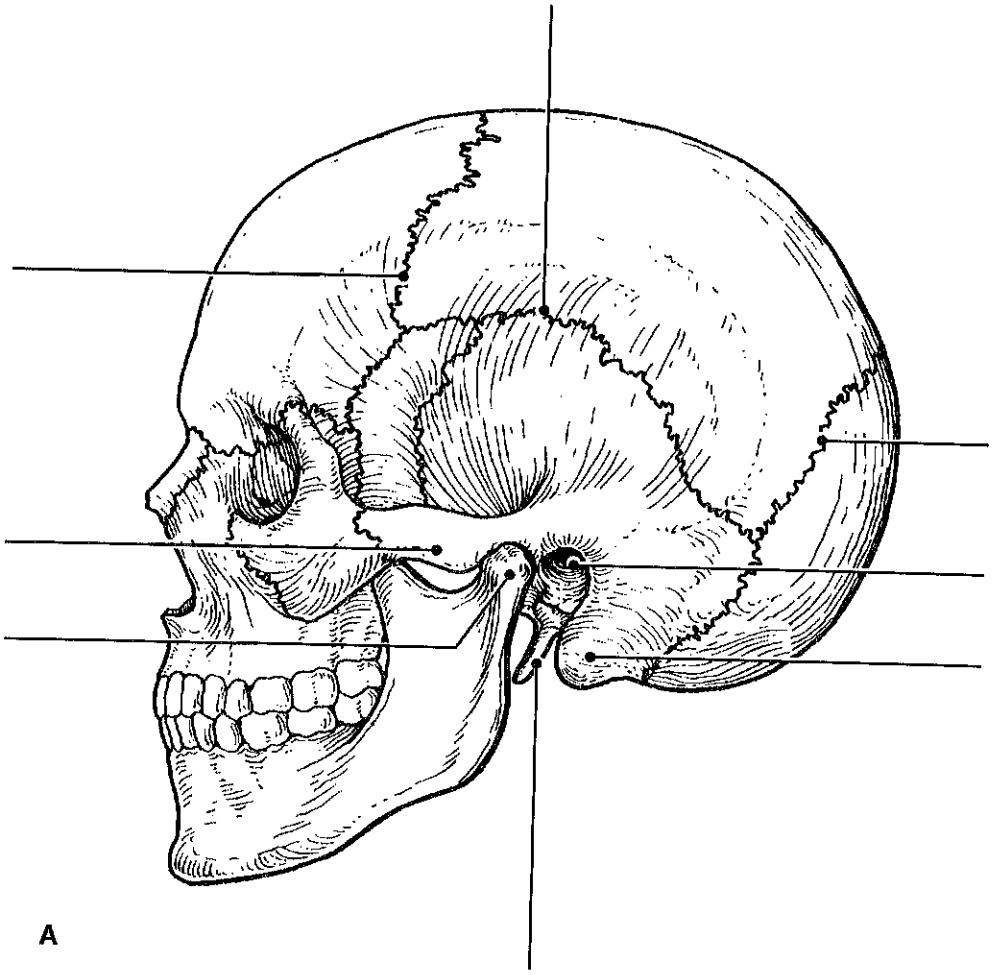


Figure 5–4

9. Figure 5–3, A–C shows lateral, anterior, and inferior views of the skull. Select different colors for the bones listed below and color the coding circles and corresponding bones in the figure. Complete the figure by labeling the bone markings indicated by leader lines.

◯ Frontal	◯ Sphenoid	◯ Zygomatic	◯ Nasal
◯ Parietal	◯ Ethmoid	◯ Palatine	◯ Lacrimal
◯ Mandible	◯ Temporal	◯ Occipital	◯ Vomer
◯ Maxilla			



A

Figure 5–3, A–C

7. Figure 5–2A is a midlevel, cross-sectional view of the diaphysis of the femur. Label the membrane that lines the cavity and the membrane that covers the outside surface.

Figure 5–2B is a drawing of a longitudinal section of the femur. Color the bone tissue gold. Do *not* color the articular cartilage; leave it white. Select different colors for the bone regions listed at the coding circles below. Color the coding circles and the corresponding regions on the drawing. Complete Figure 5–2B by labeling compact bone and spongy bone.

◯ Diaphysis

◯ Epiphyseal plate

◯ Area where red marrow is found

◯ Area where yellow marrow is found

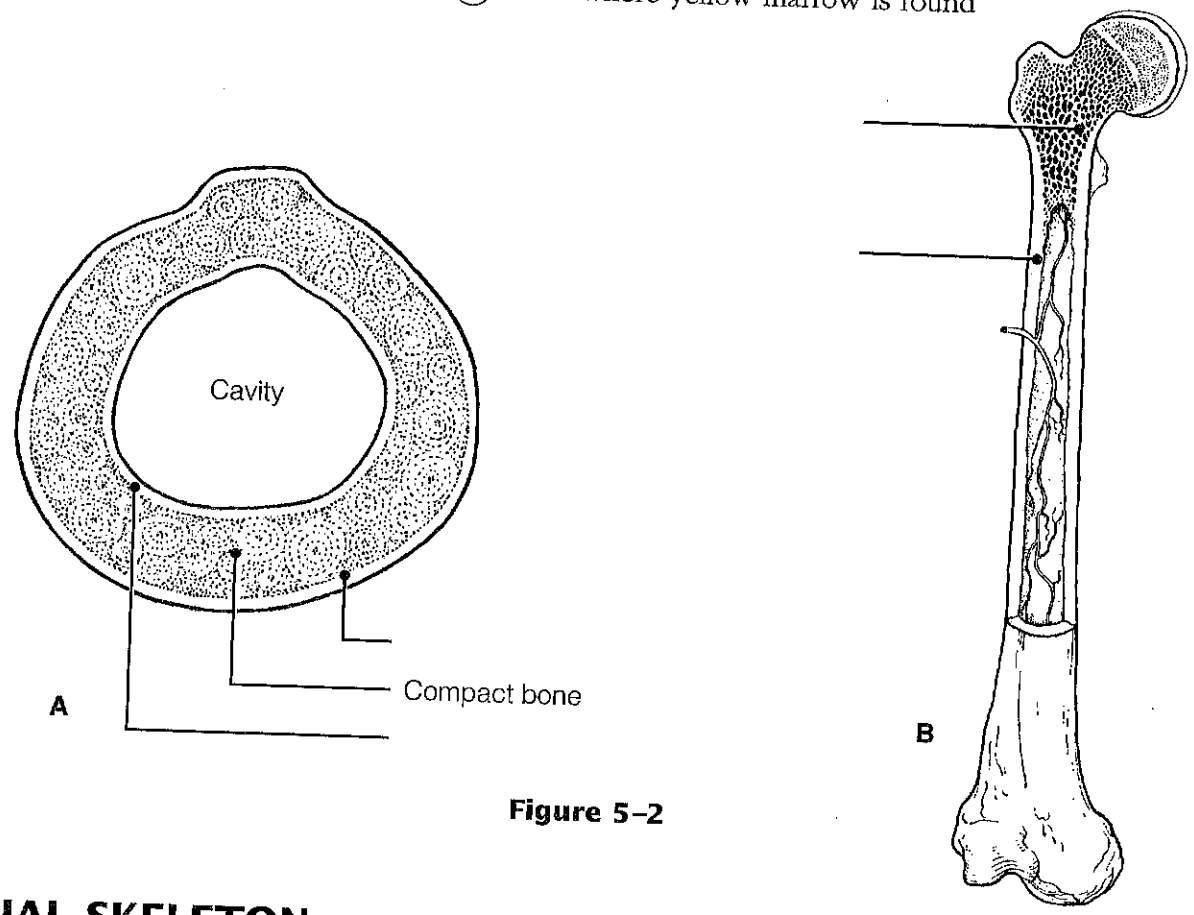


Figure 5–2

AXIAL SKELETON

Skull

8. Using key choices, identify the bones indicated by the following descriptions. Enter the appropriate term or letter in the answer blanks.

Key Choices

A. Ethmoid	E. Mandible	I. Palatines	L. Temporals
B. Frontal	F. Maxillae	J. Parietals	M. Vomer
C. Hyoid	G. Nasals	K. Sphenoid	N. Zygomatic
D. Lacrimals	H. Occipital		

3. Using the key choices, characterize the following statements relating to long bones. Enter the appropriate term(s) or letter(s) in the answer blanks.

Key Choices

A. Diaphysis
B. Epiphyseal plate
C. Epiphysis
D. Red marrow
E. Yellow marrow cavity

_____ 1. Site of spongy bone in the adult

_____ 2. Site of compact bone in the adult

_____ 3. Site of hematopoiesis in the adult

_____ 4. Scientific name for bone shaft

_____ 5. Site of fat storage in the adult

_____ 6. Site of longitudinal growth in a child

4. Complete the following statements concerning bone formation and destruction, using the terms provided in the key. Insert the key letter or corresponding term in the answer blanks.

Key Choices

A. Atrophy
B. Calcitonin
C. Gravity
D. Osteoblasts
E. Osteoclasts
F. Osteocytes
G. Parathyroid hormone
H. Stress and/or tension

_____ 1. When blood calcium levels begin to drop below homeostatic levels, __(1)__ is released, causing calcium to be released from bones.

_____ 2. Mature bone cells, called __(2)__, maintain bone in a viable state.

_____ 3. Disuse such as that caused by paralysis or severe lack of exercise results in muscle and bone __(3)__.

_____ 4. Large tubercles and/or increased deposit of bony matrix occur at sites of __(4)__.

_____ 5. Immature, or matrix-depositing, bone cells are referred to as __(5)__.

_____ 6. __(6)__ causes blood calcium to be deposited in bones as calcium salts.

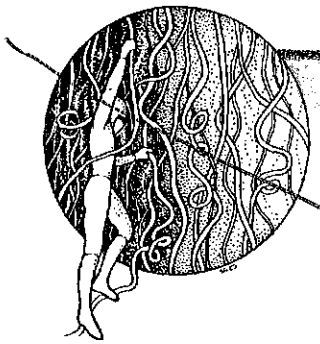
_____ 7. Bone cells that liquefy bone matrix and release calcium to the blood are called __(7)__.

_____ 8. Our astronauts must do isometric exercises when in space because bones atrophy under conditions of weightlessness or lack of __(8)__.

DEVELOPMENTAL ASPECTS OF THE SKIN AND BODY MEMBRANES

16. Match the choices (letters or terms) in Column B with the appropriate descriptions in Column A.

	Column A	Column B
_____	1. Skin inflammations that increase in frequency with age	A. Acne
_____	2. Cause of graying hair	B. Cold intolerance
_____	3. Small white bumps on the skin of newborn babies, resulting from accumulations of sebaceous gland material	C. Dermatitis
_____	4. Reflects the loss of insulating subcutaneous tissue with age	D. Delayed-action gene
_____	5. A common consequence of accelerated sebaceous gland activity during adolescence	E. Lanugo
_____	6. Oily substance produced by the fetus's sebaceous glands	F. Milia
_____	7. The hairy "cloak" of the fetus	G. Vernix caseosa



INCREDIBLE JOURNEY

A Visualization Exercise for the Skin

Your immediate surroundings resemble huge grotesquely twisted vines. . . . you begin to climb upward.

17. Where necessary, complete statements by inserting the missing words in the answer blanks.

_____ 1. For this trip, you are miniaturized for injection into your host's skin. Your journey begins when you are deposited in a soft

_____ 2. gel-like substance. Your immediate surroundings resemble huge grotesquely twisted vines. But when you peer carefully at the closest "vine," you realize you are actually seeing connective tissue fibers. Although tangled together, most of the fibers are fairly straight and look like strong cables. You identify these as the __(1)__ fibers. Here and there are fibers that resemble coiled springs. These must be the __(2)__ fibers that help to give skin its springiness. At this point,

9. Using key choices, complete the following statements. Insert the appropriate letter(s) or term(s) in the answer blanks.

Key Choices

A. Arrector pili
B. Cutaneous receptors
C. Hair
D. Hair follicle(s)
E. Sebaceous glands
F. Sweat gland (apocrine)
G. Sweat gland (eccrine)

_____ 1. A blackhead is an accumulation of oily material produced by __(1)__.

_____ 2. Tiny muscles attached to hair follicles that pull the hair upright during fright or cold are called __(2)__.

_____ 3. The most numerous variety of perspiration gland is the __(3)__.

_____ 4. A sheath formed of both epithelial and connective tissues is the __(4)__.

_____ 5. A less numerous variety of perspiration gland is the __(5)__. Its secretion (often milky in appearance) contains proteins and other substances that favor bacterial growth.

_____ 6. __(6)__ is found everywhere on the body except the palms of the hands, soles of the feet, and lips, and primarily consists of dead keratinized cells.

_____ 7. __(7)__ are specialized nerve endings that respond to temperature and touch, for example.

_____ 8. __(8)__ become more active at puberty.

_____ 9. Part of the heat-liberating apparatus of the body is the __(9)__.

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

1. Sebaceous gland Hair Arrector pili Epidermis
2. Radiation Absorption Conduction Evaporation
3. Stratum corneum Nails Hair Stratum basale
4. Freckles Blackheads Moles Melanin
5. Scent glands Eccrine glands Apocrine glands Axilla
6. Cyanosis Erythema Wrinkles Pallor
7. Keratin Carotene Melanin Hemoglobin

5. Complete the following statements in the blanks provided.

_____ 1. Radiation from the skin surface and evaporation of sweat are two ways in which the skin helps to get rid of body __(1)__.

_____ 2. Fat in the __(2)__ tissue layer beneath the dermis helps to insulate the body.

_____ 3. The waterproofing protein found in the epidermal cells is called __(3)__.

_____ 4. A vitamin that is manufactured in the skin is __(4)__.

_____ 5. A localized concentration of melanin is __(5)__.

_____ 6. Wrinkling of the skin is due to loss of the __(6)__ of the skin.

_____ 7. A decubitus ulcer results when skin cells are deprived of __(7)__.

_____ 8. __(8)__ is a bluish cast of the skin resulting from inadequate oxygenation of the blood.

6. Using key choices, choose all responses that apply to the following descriptions. Enter the appropriate letter(s) or term(s) in the answer blanks.

Key Choices

A. Stratum corneum
B. Stratum basale
C. Stratum granulosum
D. Stratum lucidum
E. Papillary layer
F. Reticular layer
G. Epidermis as a whole
H. Dermis as a whole

_____ 1. Translucent cells, containing keratin

_____ 2. Dead cells

_____ 3. Dermis layer responsible for fingerprints

_____ 4. Vascular region

_____ 5. Epidermal region involved in rapid cell division; most inferior epidermal layer

_____ 6. Scalelike cells full of keratin that constantly flake off

_____ 7. Site of elastic and collagen fibers

_____ 8. Site of melanin formation

_____ 9. Major skin area from which the derivatives (hair, nails) arise

2. Four simplified diagrams are shown in Figure 4–1. Select different colors for the membranes listed below, and use them to color the coding circles and the corresponding structures.

- ◯ Cutaneous membrane
- ◯ Mucosae
- ◯ Visceral pleura (serosa)
- ◯ Parietal pleura (serosa)
- ◯ Visceral pericardium (serosa)
- ◯ Parietal pericardium (serosa)
- ◯ Synovial membrane

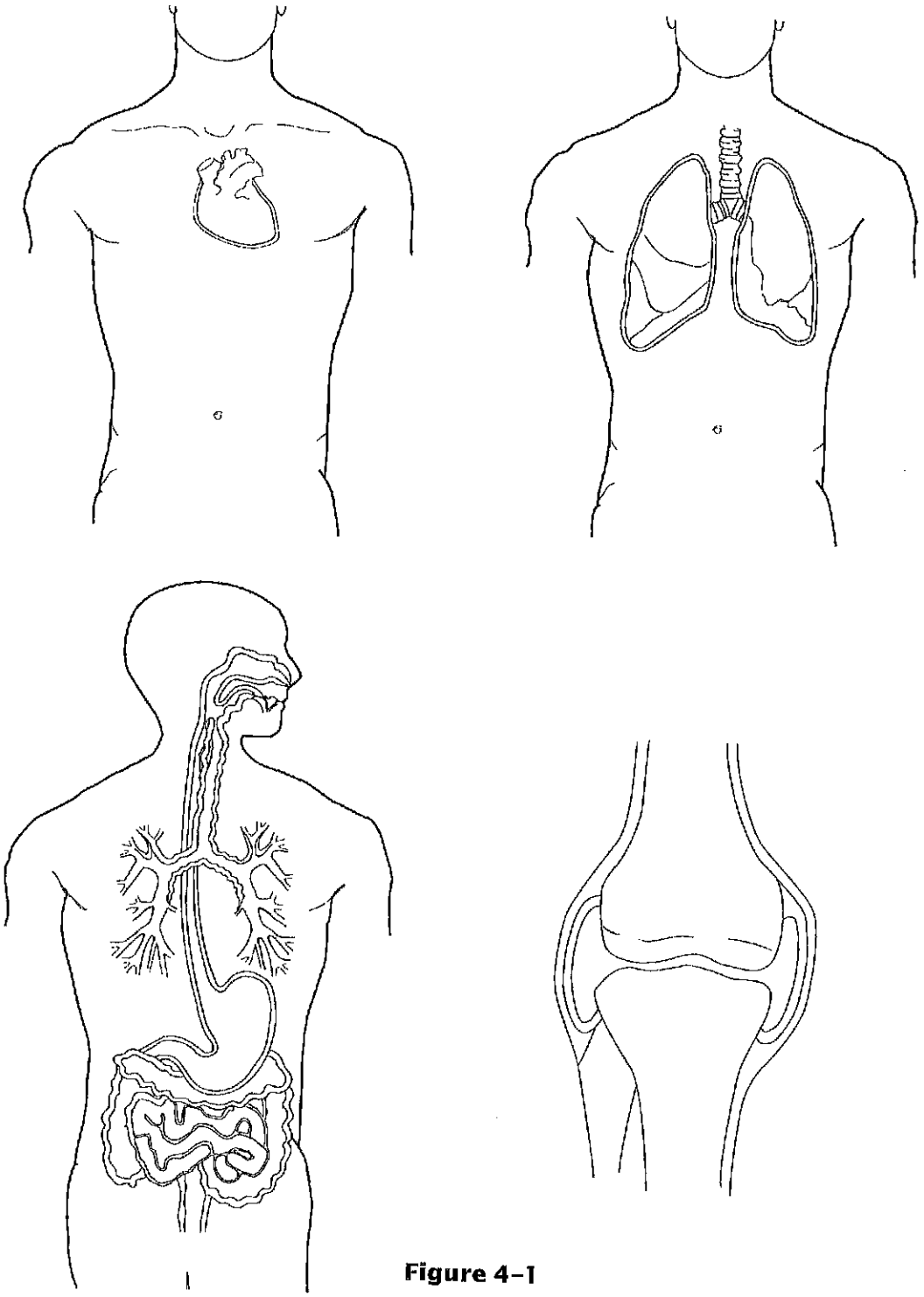


Figure 4–1

_____ 5. If tissue damage is very severe, tissue repair is more likely to occur by fibrosis, or scarring.

_____ 6. During fibrosis, fibroblasts in the granulation tissue lay down keratin fibers, which form a strong, compact, but inflexible mass.

_____ 7. The repair of cardiac muscle and nervous tissue occurs only by fibrosis.

DEVELOPMENTAL ASPECTS OF CELLS AND TISSUES

22. Correctly complete each statement by inserting your responses in the answer blanks.

_____ 1.
_____ 2.
_____ 3.
_____ 4.
_____ 5.
_____ 6.
_____ 7.
_____ 8.
_____ 9.
_____ 10.
_____ 11.
_____ 12.
_____ 13.
_____ 14.
_____ 15.
_____ 16.
_____ 17.
_____ 18.
_____ 19.
_____ 20.

During embryonic development, cells specialize to form __(1)__. Mitotic cell division is very important for overall body __(2)__. All tissues except __(3)__ tissue continue to undergo cell division until the end of adolescence. After this time, __(4)__ tissue also becomes amitotic. When amitotic tissues are damaged, they are replaced by __(5)__ tissue, which does not function in the same way as the original tissue. This is a serious problem when heart cells are damaged.

Aging begins almost as soon as we are born. Three explanations of the aging process have been offered. One states that __(6)__ insults, such as the presence of toxic substances in the blood, are important. Another theory states that external __(7)__ factors, such as X-rays, help to cause aging. A third theory suggests that aging is programmed in our __(8)__. Three examples of aging processes seen in all people are __(9)__, __(10)__, and __(11)__.

Neoplasms occur when cells "go wild" and the normal controls of cell __(12)__ are lost. The two types of neoplasms are __(13)__ and __(14)__. The __(15)__ type tends to stay localized and have a capsule. The __(16)__ type is likely to invade other body tissues and spread to other (distant) parts of the body. To correctly diagnose the type of neoplasm, a microscopic examination of the tissue called a __(17)__ is usually done. Whenever possible, __(18)__ is the treatment of choice for neoplasms.

An overgrowth of tissue that is not considered to be a neoplasm is referred to as __(19)__. Conversely, a decrease in the size of an organ or tissue, resulting from loss of normal stimulation, is called __(20)__.

18. The three types of muscle tissue exhibit certain similarities and differences. Check (✓) the appropriate spaces in the following table to indicate which muscle types exhibit each characteristic.

Characteristic	Skeletal	Cardiac	Smooth
1. Voluntarily controlled			
2. Involuntarily controlled			
3. Banded appearance			
4. Single nucleus in each cell			
5. Multinucleate			
6. Found attached to bones			
7. Allows you to direct your eyeballs			
8. Found in the walls of stomach, uterus, and arteries			
9. Contains spindle-shaped cells			
10. Contains cylindrical cells with branching ends			
11. Contains long, nonbranching cylindrical cells			
12. Displays intercalated disks			
13. Concerned with locomotion of the body as a whole			
14. Changes the internal volume of an organ as it contracts			
15. Tissue of the circulatory pump			

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

1. Collagen	Cell	Matrix	Cell product
2. Cilia	Flagellum	Microvilli	Elastic fibers
3. Glands	Bones	Epidermis	Mucosae
4. Adipose	Hyaline	Osseous	Nervous
5. Blood	Smooth	Cardiac	Skeletal

15. Using key choices, correctly identify the *major* tissue types described. Enter the appropriate letter or tissue type term in the answer blanks.

Key Choices

A. Connective B. Epithelium C. Muscle D. Nervous

_____ 1. Forms mucous, serous, and epidermal membranes

_____ 2. Allows for organ movements within the body

_____ 3. Transmits electrochemical impulses

_____ 4. Supports body organs

_____ 5. Cells of this tissue may absorb and/or secrete substances

_____ 6. Basis of the major controlling system of the body

_____ 7. The cells of this tissue shorten to exert force

_____ 8. Forms hormones

_____ 9. Packages and protects body organs

_____ 10. Characterized by having large amounts of nonliving matrix

_____ 11. Allows you to smile, grasp, swim, ski, and shoot an arrow

_____ 12. Most widely distributed tissue type in the body

_____ 13. Forms the brain and spinal cord

16. Using key choices, identify the following specific type(s) of epithelial tissue. Enter the appropriate letter or classification term in the answer blanks.

Key Choices

A. Pseudostratified columnar (ciliated) C. Simple cuboidal E. Stratified squamous

B. Simple columnar D. Simple squamous F. Transitional

_____ 1. Lines the esophagus and forms the skin epidermis

_____ 2. Forms the lining of the stomach and small intestine

_____ 3. Best suited for areas subjected to friction

_____ 4. Lines much of the respiratory tract

_____ 5. Propels substances (e.g., mucus) across its surface

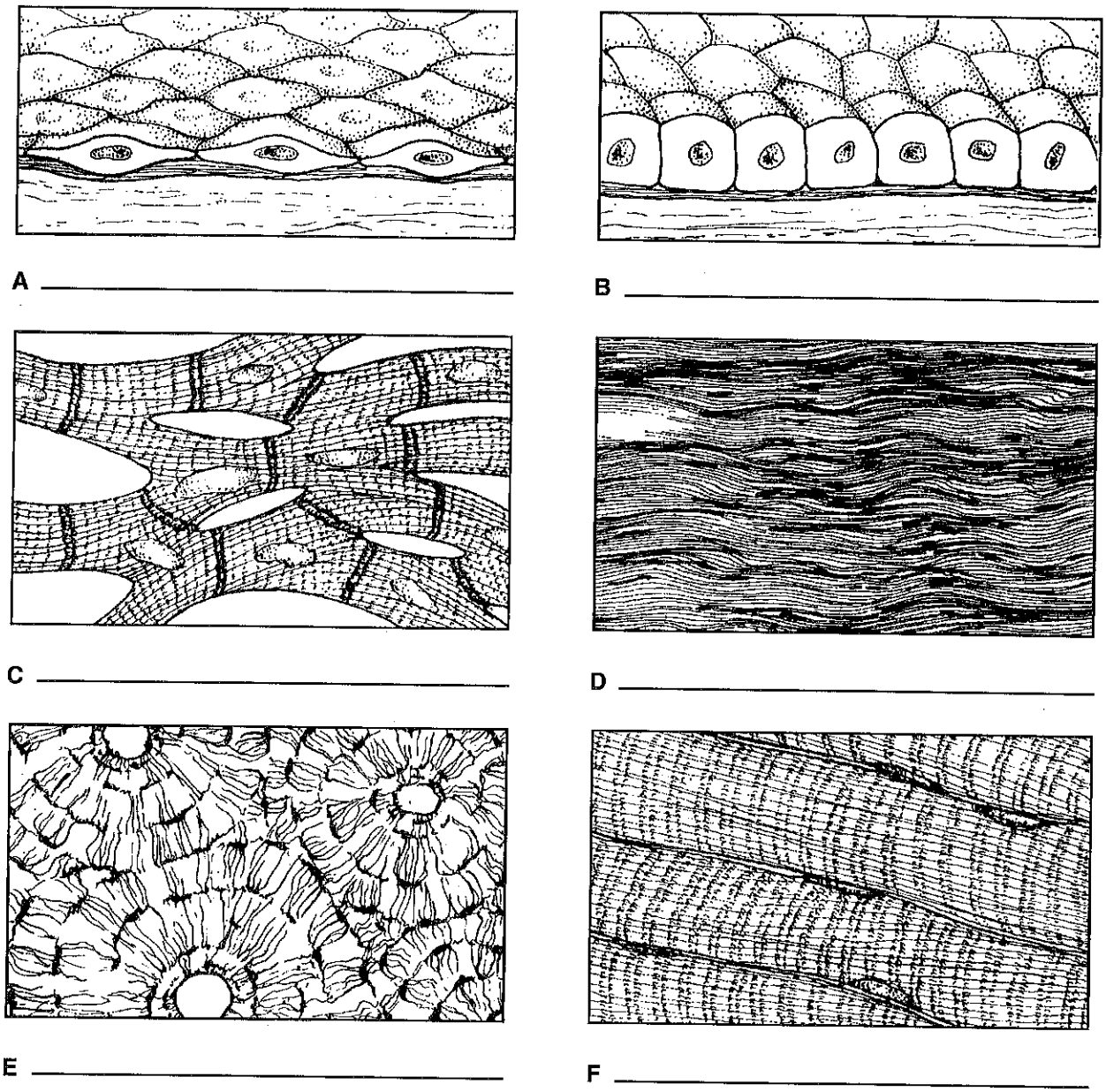
_____ 6. Found in the bladder lining; peculiar cells that slide over one another

_____ 7. Forms thin serous membranes; a single layer of flattened cells

BODY TISSUES

13. Twelve tissue types are diagrammed in Figure 3–6. Identify each tissue type by inserting the correct name in the blank below it on the diagram. Select different colors for the following structures and use them to color the coding circles and corresponding structures in the diagrams.

- ◯ Epithelial cells
- ◯ Muscle cells
- ◯ Nerve cells
- ◯ Matrix (Where found, matrix should be colored differently from the living cells of that tissue type. Be careful, this may not be as easy as it seems!)



A _____

B _____

C _____

D _____

E _____

F _____

Figure 3–6, A–F

10. The following statements describe events that occur during the different phases of mitosis. Identify the phase by choosing the correct response(s) from key choices and inserting the letter(s) or term(s) in the answer blanks.

Key Choices

A. Anaphase C. Prophase E. None of these

B. Metaphase D. Telophase

_____ 1. Chromatin coils and condenses to form deeply staining bodies.

_____ 2. Centromeres break, and chromosomes begin migration toward opposite poles of the cell.

_____ 3. The nuclear membrane and nucleoli reappear.

_____ 4. When chromosomes cease their poleward movement, this phase begins.

_____ 5. Chromosomes align on the equator of the spindle.

_____ 6. The nucleoli and nuclear membrane disappear.

_____ 7. The spindle forms through the migration of the centrioles.

_____ 8. Chromosomal material replicates.

_____ 9. Chromosomes first appear to be duplex structures.

_____ 10. Chromosomes attach to the spindle fibers.

_____ 11. A cleavage furrow forms during this phase.

_____ 12. The nuclear membrane is absent during the entire phase.

_____ 13. Period during which a cell carries out its *usual* metabolic activities.

11. Complete the following statements. Insert your answers in the answer blanks.

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

Division of the __(1)__ is referred to as mitosis. Cytokinesis is division of the __(2)__. The major structural difference between chromatin and chromosomes is that the latter are __(3)__. Chromosomes attach to the spindle fibers by undivided structures called __(4)__. If a cell undergoes nuclear division but not cytoplasmic division, the product is a __(5)__. The structure that acts as a scaffolding for chromosomal attachment and movement is called the __(6)__. __(7)__ is the period of cell life when the cell is not involved in division.

Cell Division

8. The following statements provide an overview of the structure of DNA (genetic material) and its role in the body. Choose responses from the key choices that complete the statements. Insert the appropriate answers in the answer blanks.

Key Choices

A. Adenine	G. Enzymes	M. Nucleotides	S. Ribosome
B. Amino acids	H. Genes	N. Old	T. Sugar (deoxyribose)
C. Bases	I. Growth	O. Phosphate	U. Template, or model
D. Codons	J. Guanine	P. Proteins	V. Thymine
E. Complementary	K. Helix	Q. Replication	W. Transcription
F. Cytosine	L. New	R. Repair	X. Uracil

_____ 1.
_____ 2.
_____ 3.
_____ 4.
_____ 5.
_____ 6.
_____ 7.
_____ 8.
_____ 9.
_____ 10.
_____ 11.
_____ 12.
_____ 13.
_____ 14.
_____ 15.
_____ 16.
_____ 17.
_____ 18.

DNA molecules contain information for building specific __(1)__. In a three-dimensional view, a DNA molecule looks like a spiral staircase; this is correctly called a __(2)__. The constant parts of DNA molecules are the __(3)__ and __(4)__ molecules, forming the DNA-ladder uprights, or backbones. The information of DNA is actually coded in the sequence of nitrogen-containing __(5)__, which are bound together to form the "rungs" of the DNA ladder. When the four DNA bases are combined in different three-base sequences, called triplets, different __(6)__ of the protein are called for. It is said that the N-containing bases of DNA are __(7)__, which means that only certain bases can fit or interact together. Specifically, this means that __(8)__ can bind with guanine, and adenine binds with __(9)__.

The production of proteins involves the cooperation of DNA and RNA. RNA is another type of nucleic acid that serves as a "molecular slave" to DNA. That is, it leaves the nucleus and carries out the instructions of the DNA for the building of a protein on a cytoplasmic structure called a __(10)__. When a cell is preparing to divide, in order for its daughter cells to have all its information, it must oversee the __(11)__ of its DNA so that a "double dose" of genes is present for a brief period. For DNA synthesis to occur, the DNA must uncoil, and the bonds between the N-bases must be broken. Then the two single strands of __(12)__ each act as a __(13)__ for the building of a whole DNA molecule. When completed, each DNA molecule formed is half __(14)__ and half __(15)__. The fact that DNA replicates before a cell divides ensures that each daughter cell has a complete set of __(16)__. Cell division, which then follows, provides new cells so that __(17)__ and __(18)__ can occur.

Cell Physiology

Membrane Transport

4. A semipermeable sac, containing 4% NaCl, 9% glucose, and 10% albumin, is suspended in a solution with the following composition: 10% NaCl, 10% glucose, and 40% albumin. Assume the sac is permeable to all substances *except* albumin. Using the key choices, insert the letter indicating the correct event in the answer blanks.

Key Choices

A. Moves into the sac B. Moves out of the sac C. Does not move

_____ 1. Glucose _____ 3. Albumin

_____ 2. Water _____ 4. NaCl

5. Figure 3–2 shows three microscopic fields (A–C) containing red blood cells. Arrows indicate the direction of net osmosis. Respond to the following questions, referring to Figure 3–2, by inserting your responses in the spaces provided.

1. Which microscopic field contains a *hypertonic* solution? _____

   The cells in this field are said to be _____

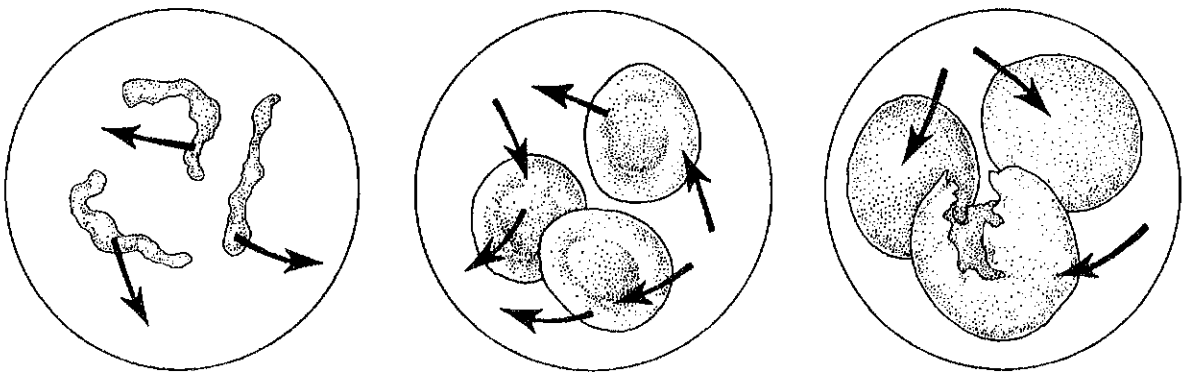
2. Which microscopic field contains an isotonic bathing solution? _____

   What does *isotonic* mean? _____

   _____

3. Which microscopic field contains a *hypotonic* solution? _____

   What is happening to the cells in this field and why? _____



A B C

Figure 3–2

_____ 13.

_____ 14.

_____ 15.

_____ 16.

_____ 17.

13–15. List three different cell shapes.

16. Name the fluid, similar to seawater, that surrounds and bathes all body cells.

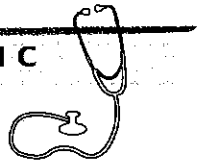
17. Name the flattened cells, important in protection, that fit together like tiles. (This is just one example of the generalization that a cell's structure is very closely related to its function in the body.)

Anatomy of a Generalized Cell

2. Complete the following table to fully describe the various cell parts. Insert your responses in the spaces provided under each heading.

Cell structure	Location	Function
	External boundary of the cell	Confines cell contents; regulates entry and exit of materials
Lysosomes		
	Scattered throughout the cell	Control release of energy from foods; form ATP
	Projections of the plasma membrane	Increase the membrane surface area
Golgi apparatus		
Nucleus		
	Two rod-shaped bodies near the nucleus	Direct formation of the mitotic spindle
Nucleolus		
Smooth ER		
Rough ER		
	Attached to membrane systems or scattered in the cytoplasm	Synthesize proteins
Chromatin		
	Scattered in cytoplasm	Detoxify alcohol, hydrogen peroxide, etc.
Inclusions		

AT THE CLINIC



26. It is determined that a patient is in acidosis. What does this mean, and would you treat the condition with a chemical that would *raise* or *lower* the pH?

27. A newborn is diagnosed with sickle-cell anemia, a genetic disease in which substitution of one amino acid results in abnormal hemoglobin. Explain to the parents how the substitution can have such a drastic effect on the structure of the protein.

28. Johnny's body temperature is spiking upward. When it reaches 104°F, his mother puts in a call to the pediatrician. She is advised to give Johnny children's acetaminophen or ibuprofen and sponge his body with cool to tepid water to prevent a further rise in temperature. How might a fever (excessively high body temperature) be detrimental to Johnny's welfare?

29. Mrs. Gallo's physician suspects that she is showing the initial signs of multiple sclerosis, a disease characterized by the formation of hardened plaques in the insulating sheaths surrounding nerve fibers. What medical imaging technique will the physician probably order to determine if such plaques are present?

30. Stanley has indigestion and is doubled over with pain. How could an antacid reduce his stomach discomfort?

24. The biochemical reaction shown in Figure 2–6 represents the complete digestion of a polymer (a large molecule as consumed in food) down to its constituent monomers, or building blocks. Select two colors and color the coding circles and the structures. Then, select the one correct answer for each statement below and insert your answer in the answer blank.

◯ Monomer ◯ Polymer

Figure 2–6

_____ 1. If starch is the polymer, the monomer is:

A. glycogon B. amino acid C. glucose D. maltose

_____ 2. During polymer digestion, water as H^+ and OH^- ions would:

A. be a product of the reaction.

B. act as a catalyst.

C. enter between monomers, bond to them, and keep them separated.

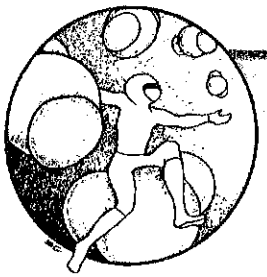
D. not be involved in this reaction.

_____ 3. Another name for the chemical digestion of polymers is:

A. dehydration B. hydrolysis C. synthesis D. displacement

_____ 4. If the monomers are amino acids, they may differ from each other by their:

A. R group B. amino group C. acid group D. peptide bond



INCREDIBLE JOURNEY

A Visualization Exercise for Biochemistry

. . . you are suddenly up-ended and are carried along in a sea of water molecules at almost unbelievable speed.

25. Complete the narrative by inserting the missing words in the answer blanks.

For this journey, you are miniaturized to the size of a very small molecule by colleagues who will remain in contact with you by radio. Your instructions are to play the role of a water molecule and

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

1. Adenine Guanine Glucose Thymine
2. DNA Ribose Phosphate Deoxyribose
3. Galactose Glycogen Fructose Glucose
4. Amino acid Polypeptide Glycerol Protein
5. Glucose Sucrose Lactose Maltose

22. For each true statement, insert *T* in the answer blank. If any are false, correct the underlined term and insert your correction in the answer blank.

_____ 1. Phospholipids are polarized molecules.

_____ 2. Steroids are the major form in which body fat is stored.

_____ 3. Water is the most abundant compound in the body.

_____ 4. Nonpolar molecules are generally soluble in water.

_____ 5. The bases of RNA are A, G, C, and U.

_____ 6. The universal energy currency of living cells is RNA.

_____ 7. RNA is single stranded.

_____ 8. The four elements comprising over 90% of living matter are C, H, N, and Na.

23. Figure 2–5 shows the molecular structure of DNA, a nucleic acid.

A. First, identify the two unnamed nitrogen bases and insert their correct names and symbols in the two blanks beside the color-coding circles.

B. Complete the identification of the bases on the diagram by inserting the correct symbols in the appropriate spaces on the right side of the diagram.

C. Select different colors and color the coding circles and the corresponding parts of the diagram.

D. Label one d-R sugar unit and one P unit of the "backbones" of the DNA structure by inserting leader lines and labels on the diagram.

E. Circle the associated nucleotide.

◯ Deoxyribose sugar (d-R) ◯ Adenine (A) ◯ _____ ( )

◯ Phosphate (P) ◯ Cytosine (C) ◯ _____ ( )

Then answer the questions following Figure 2–5 by writing your answers in the answer blanks.

16. Using the key choices, fully characterize weak and strong acids.

Key Choices

A. Ionize completely in water

B. Ionize incompletely in water

C. Act as part of a buffer system

D. When placed in water, always act to change the pH

E. Ionize at high pH

F. Ionize at low pH

G. Ionize at pH 7

Weak acid: _____ Strong acid: _____

17. Use an *X* to designate which of the following are organic compounds.

_____ Carbon dioxide _____ Fats _____ Proteins _____ H_2O

_____ Oxygen _____ KCl _____ Glucose _____ DNA

18. Match the terms in Column B to the descriptions provided in Column A. Enter the correct letter(s) or term(s) in the answer blanks.

Column A

_____ 1. Building blocks of carbohydrates

_____ 2. Building blocks of fat

_____ 3. Building blocks of protein

_____ 4. Building blocks of nucleic acids

_____ 5. Cellular cytoplasm is primarily composed of this substance

_____ 6. The single most important fuel source for body cells

_____ 7. Not soluble in water

_____ 8. Contain C, H, and O in the ratio CH_2O

_____ 9. Contain C, H, and O, but have relatively small amounts of oxygen

_____ 10. _____ 11. These building blocks contain N in addition to C, H, and O

_____ 12. Contain P in addition to C, H, O, and N

_____ 13. Used to insulate the body and found in all cell membranes

_____ 14. Primary components of meat and cheese

_____ 15. Primary components of bread and lollipops

_____ 16. Primary components of egg yolk and peanut oil

Column B

A. Amino acids

B. Carbohydrates

C. Lipids (fats)

D. Fatty acids

E. Glycerol

F. Nucleotides

G. Monosaccharides

H. Proteins

11. Figure 2–3 illustrates five water molecules held together by hydrogen bonds. First, correctly identify the oxygen and hydrogen atoms both by color and by inserting their atomic symbols on the appropriate circles (atoms). Then label the following structures in the figure:

- ◯ Oxygen
- ◯ Hydrogen
- ◯ Positive pole (end)
- ◯ Negative pole (end)
- ◯ Hydrogen bonds

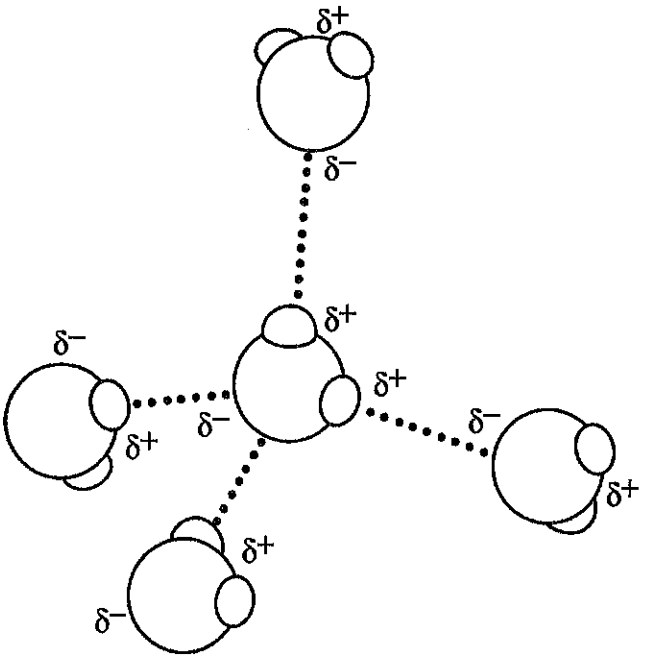
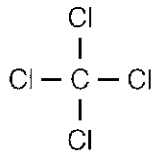


Figure 2–3

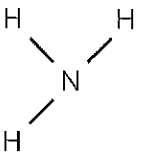
12. Circle each structural formula that is *likely* to be a polar covalent compound.

A



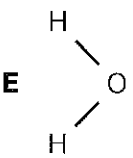
B H — Cl

C



D Cl — Cl

E



13. Respond to the instructions following the equation:

$$H_2CO_3 \longrightarrow H^+ + HCO_3^-$$

1. In the space provided, list the chemical formula(s) of compounds. _____
2. In the space provided, list the chemical formula(s) of ions. _____
3. Circle the product(s) of the reaction.
4. Modify the equation by adding a colored arrow in the proper place to indicate that the reaction is reversible.

MOLECULES, CHEMICAL BONDS, AND CHEMICAL REACTIONS

7. Match the terms in Column B to the chemical equations listed in Column A. Enter the correct letter or term in the answer blanks.

	Column A	Column B
_____	1. $A + B \rightarrow AB$	A. Decomposition
_____	2. $AB + CD \rightarrow AD + CB$	B. Exchange
_____	3. $XY \rightarrow X + Y$	C. Synthesis

8. Figure 2–1 is a diagram of an atom. Select two different colors and use them to color the coding circles and corresponding structures on the figure. Complete this exercise by responding to the questions that follow, referring to the atom in this figure. Insert your answers in the answer blanks provided.

◯ Nucleus

◯ Electrons

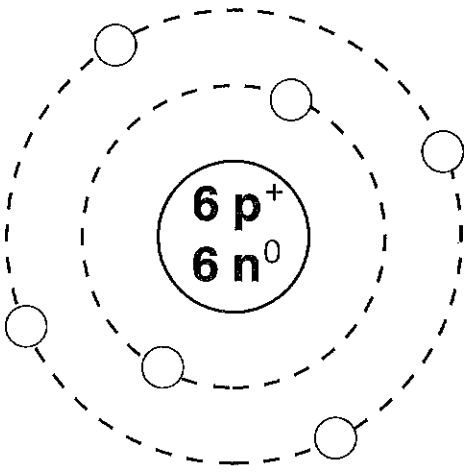


Figure 2–1

1. What is the atomic number of this atom? _____

2. What is its atomic mass? _____

3. What atom is this? _____

4. If this atom had one additional neutron but the other subatomic particles remained the same as shown, this slightly different atom (of the same element) would be called a(n) _____

5. Is this atom chemically active or inert? _____

6. How many electrons would be needed to fill its outer (valence) shell? _____

2. Use choices from the key to identify the energy *form* in use in each of the following examples.

Key Choices

A. Chemical B. Electrical C. Mechanical D. Radiant

_____ 1. Chewing food

_____ 2. Vision (two types, please—think!)

_____ 3. Bending your fingers to make a fist

_____ 4. Breaking the bonds of ATP molecules to energize your muscle cells to make that fist

_____ 5. Lying under a sunlamp

COMPOSITION OF MATTER

3. Complete the following table by inserting the missing words.

Particle	Location	Electrical charge	Mass
		+ 1	
Neutron			
	Orbitals		

4. Insert the *chemical symbol* (the chemist's shorthand) in the answer blank for each of the following elements.

_____ 1. Oxygen _____ 4. Iodine _____ 7. Calcium _____ 10. Magnesium

_____ 2. Carbon _____ 5. Hydrogen _____ 8. Sodium _____ 11. Chloride

_____ 3. Potassium _____ 6. Nitrogen _____ 9. Phosphorus _____ 12. Iron

5. Using the key choices, select the correct responses to the following descriptive statements. Insert the appropriate answers in the answer blanks.

Key Choices

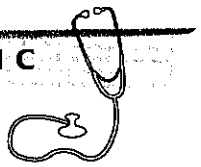
A. Atom C. Element E. Ion G. Molecule I. Protons

B. Electrons D. Energy F. Matter H. Neutrons J. Valence

_____ 1. An electrically charged atom or group of atoms

_____ 2. Anything that takes up space and has mass (weight)

AT THE CLINIC



20. A jogger has stepped in a pothole and sprained his ankle. What systems have suffered damage?

21. A newborn baby is unable to hold down any milk. Examination reveals a developmental disorder in which the esophagus fails to connect to the stomach. What survival needs are most immediately threatened?

22. The Chan family was traveling in their van and had a minor accident. The children in the back seat were wearing lap belts but they still sustained bruises around the abdomen and had some internal organ injuries. Why is this area more vulnerable to damage than others?

23. John, a patient at Jones City Hospital, is in tough shape. He has a hernia in his inguinal region, pain from an infected kidney in his lumbar region, and severe bruises and swelling in his pubic region. Explain where each of these regions is located.

24. The hormone thyroxine is released in response to a pituitary hormone called TSH. As thyroxine levels increase in the blood, they exert negative feedback on the release of TSH by the pituitary gland. What effect will this have on the release of TSH?

16. From the key choices, select the body cavities where the following surgical procedures would occur. Insert the correct letter or term in the answer blanks. Be precise: also select the name of the cavity subdivision if appropriate.

Key Choices

A. Abdominal	C. Dorsal	E. Spinal	G. Ventral
B. Cranial	D. Pelvic	F. Thoracic	

_____ 1. Removal of the uterus, or womb

_____ 2. Coronary bypass surgery (heart surgery)

_____ 3. Removal of a serious brain tumor

_____ 4. Removal of a "hot" appendix

_____ 5. A stomach ulcer operation

17. Complete the following statements by choosing an anatomical term from the key choices. Enter the appropriate letter or term in the answer blanks.

Key Choices

A. Anterior	D. Inferior	G. Posterior	J. Superior
B. Distal	E. Lateral	H. Proximal	K. Transverse
C. Frontal	F. Medial	I. Sagittal	

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

In the anatomical position, the face and palms are on the __(1)__ body surface, the buttocks and shoulder blades are on the __(2)__ body surface, and the top of the head is the most __(3)__ part of the body. The ears are __(4)__ to the shoulders and __(5)__ to the nose. The heart is __(6)__ to the spine and __(7)__ to the lungs. The elbow is __(8)__ to the fingers but __(9)__ to the shoulder. In humans, the dorsal surface can also be called the __(10)__ surface; however, in four-legged animals, the dorsal surface is the __(11)__ surface.

14. Select the key choices that identify the following body parts or areas. Enter the appropriate letter or corresponding term in the answer blanks.

Key Choices

A. Abdominal	E. Buccal	I. Inguinal	M. Pubic
B. Antecubital	F. Cervical	J. Lumbar	N. Scapular
C. Axillary	G. Femoral	K. Occipital	O. Sural
D. Brachial	H. Gluteal	L. Popliteal	P. Umbilical

_____ 1. Armpit

_____ 2. Thigh region

_____ 3. Buttock area

_____ 4. Neck region

_____ 5. "Belly button" area

_____ 6. Genital area

_____ 7. Anterior aspect of elbow

_____ 8. Posterior aspect of head

_____ 9. Area where trunk meets thigh

_____ 10. Back area from ribs to hips

_____ 11. Pertaining to the cheek

15. Using the key terms from Exercise 14, correctly label all body areas indicated with leader lines on Figure 1–8.

In addition, identify the sections labeled A and B in the figure.

Section A: _____

Section B: _____

HOMEOSTASIS

10. The following statements refer to homeostatic control systems. Complete each statement by inserting your answers in the answer blanks.

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

There are three essential components of all homeostatic control mechanisms: control center, receptor, and effector. The __(1)__ senses changes in the environment and responds by sending information (input) to the __(2)__ along the __(3)__ pathway. The __(4)__ analyzes the input, determines the appropriate response, and activates the __(5)__ by sending information along the __(6)__ pathway. When the response causes the initial stimulus to decline, the homeostatic mechanism is referred to as a __(7)__ feedback mechanism. When the response enhances the initial stimulus, the mechanism is called a __(8)__ feedback mechanism. __(9)__ feedback mechanisms are much more common in the body.

THE LANGUAGE OF ANATOMY

11. Complete the following statements by filling in the answer blanks with the correct term.

_____ 1.
_____ 2.
_____ 3.

The abdominopelvic and thoracic cavities are subdivisions of the __(1)__ body cavity; the cranial and spinal cavities are parts of the __(2)__ body cavity. The __(3)__ body cavity is totally surrounded by bone and provides very good protection to the structures it contains.

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

1. Transverse Distal Frontal Sagittal
2. Lumbar Thoracic Antecubital Abdominal
3. Sural Brachial Femoral Popliteal
4. Epigastric Hypogastric Right iliac Left upper quadrant

- ◯ Stomach
- ◯ Esophagus
- ◯ Intestines
- ◯ Oral cavity
- ◯ Ovaries
- ◯ Uterus

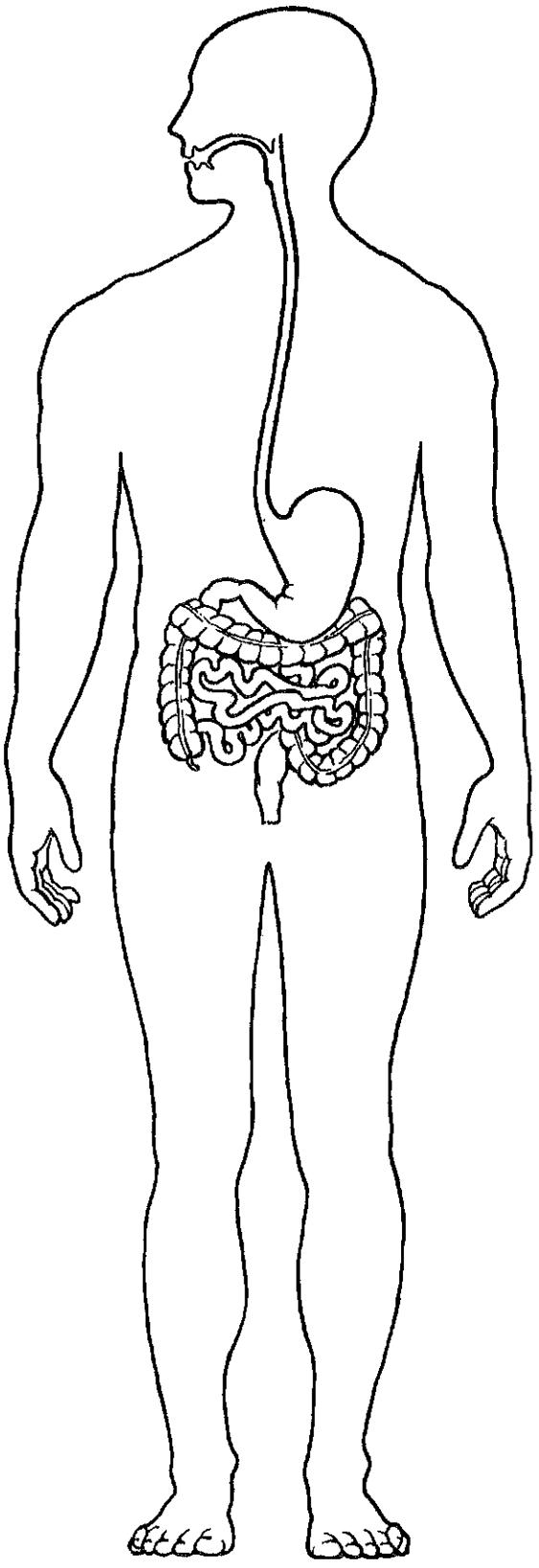


Figure 1–5

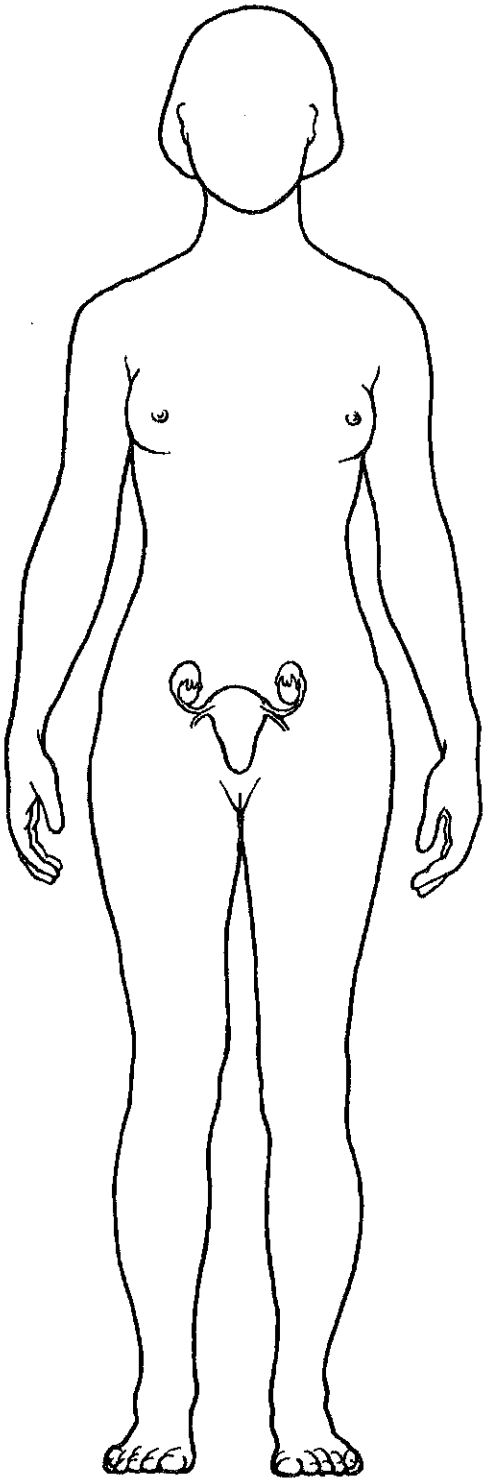


Figure 1–6

- ◯ Blood vessels
- ◯ Heart

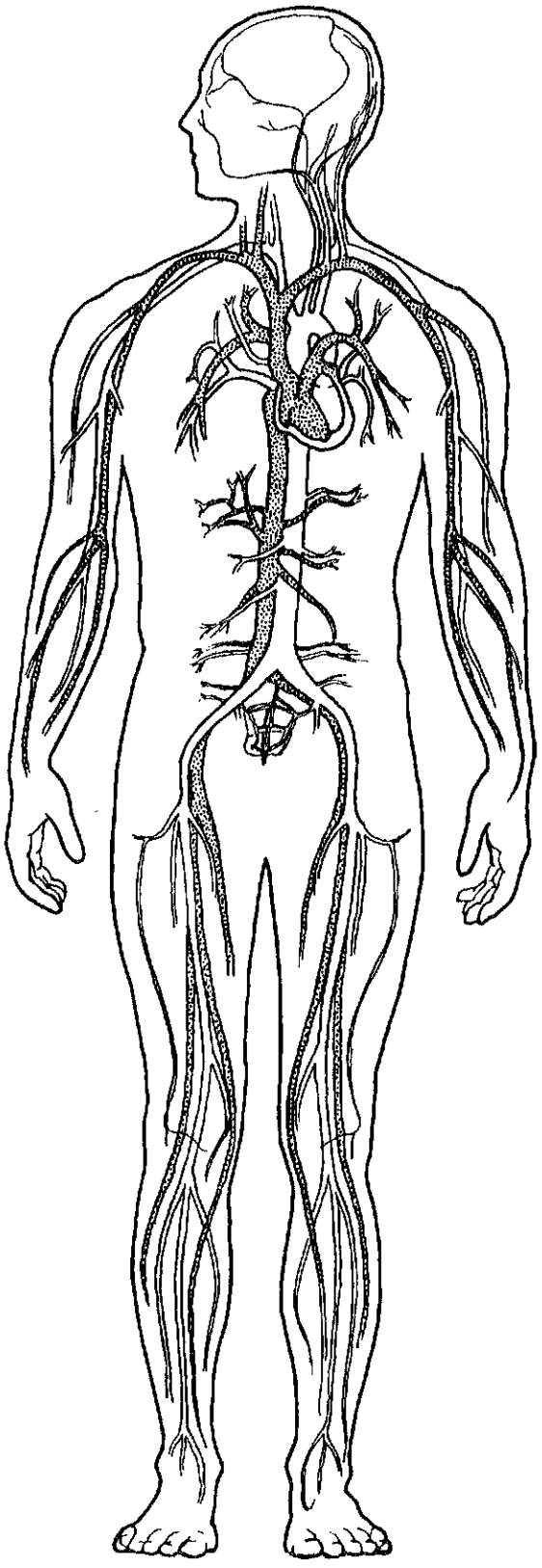


Figure 1-1

- ◯ Nasal cavity
- ◯ Lungs
- ◯ Trachea

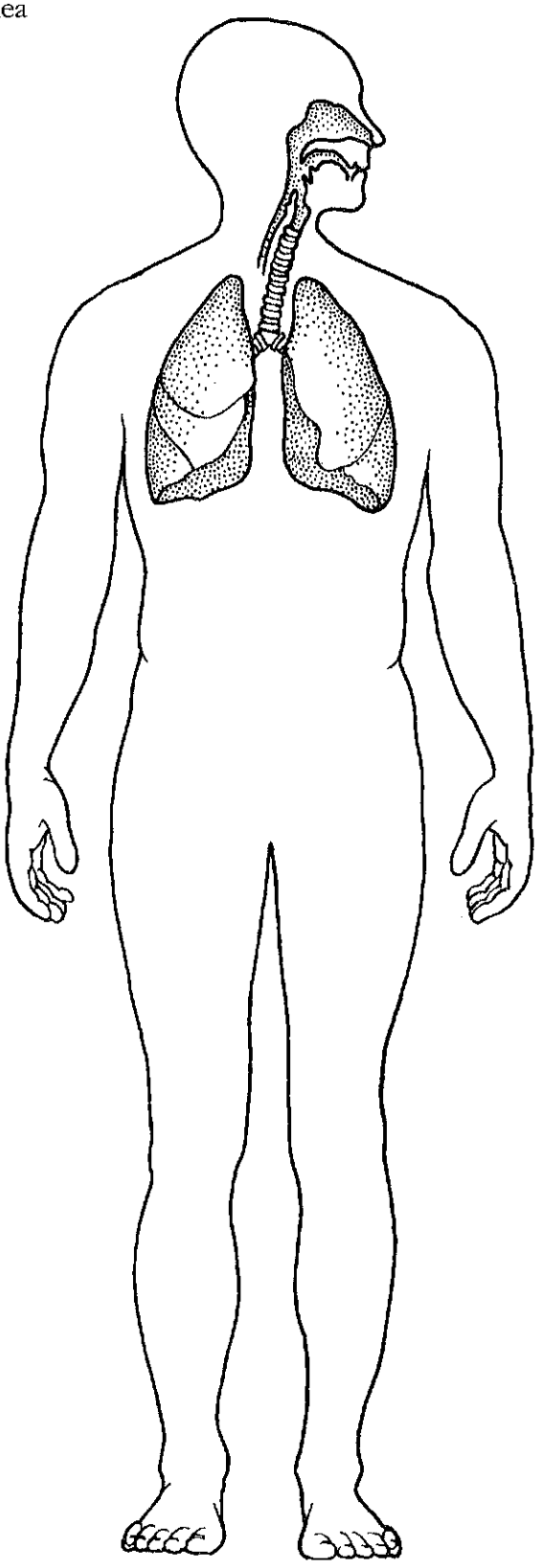


Figure 1-2

2. Circle all the terms or phrases that correctly relate to the study of *physiology*. Use a highlighter to identify those terms or phrases that pertain to the study of *anatomy*.

A. Measuring an organ's size, shape, and weight
B. Can be studied in dead specimens
C. Often studied in living subjects
D. Chemistry principles
E. Measuring the acid content of the stomach
F. Principles of physics
G. Observing a heart in action
H. Dynamic
I. Dissection
J. Experimentation
K. Observation
L. Directional terms
M. Static

LEVELS OF STRUCTURAL ORGANIZATION

3. The structures of the body are organized into successively larger and more complex structures. Fill in the answer blanks with the correct terms for these increasingly larger structures.

Chemicals → _____ → _____ →
_____ → _____ → Organism

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

1. Atom Cell Tissue Alive Organ
2. Brain Stomach Heart Liver Epithelium
3. Epithelium Heart Muscle tissue Nervous tissue Connective tissue
4. Human Digestive system Horse Pine tree Amoeba

5. Using the key choices, identify the organ systems to which the following organs or functions belong. Insert the correct letter or term in the answer blanks.

Key Choices

A. Cardiovascular
B. Digestive
C. Endocrine
D. Integumentary
E. Lymphatic/Immune
F. Muscular
G. Nervous
H. Reproductive
I. Respiratory
J. Skeletal
K. Urinary