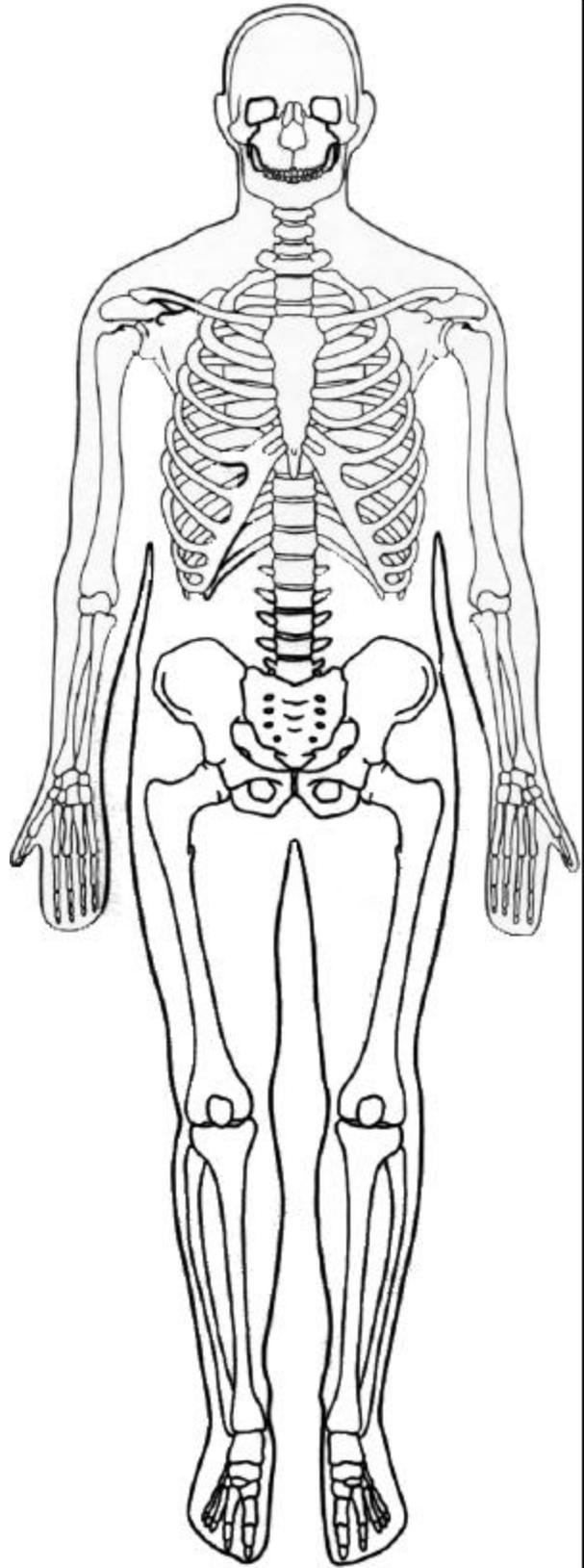


ANATOMY AND PHYSIOLOGY

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OBJECTIVES

Following training, the employee will be able to:

1. Define anatomy, physiology, systems, and cytology.
2. Describe the skeletal system and its role in the human body.
3. Identify the anatomical positions of the major bones within the skeletal system.
4. Describe the joints/articulation system and its role in the human body.
5. Identify the different types of articulation types within the human body.
6. Describe the muscular system and its role in the human body.
7. Identify the anatomical positions of the major muscles in the human body.
8. Describe the nervous system and its role in the human body.
9. Identify the anatomical positions of the structures of the nervous system.
10. Identify the anatomical positions of the structures of the eye and ear.
11. Describe the vascular system.
12. Trace the flow of blood through the heart.
13. Define the difference between oxygenated and unoxygenated blood.
14. Define blood and its use within the human body.
15. Explain the role of the lymphatic system.
16. Describe the respiratory system and its role in the human body.
17. Explain the differences between inspiration, expiration, and ventilation.
18. Identify the anatomical positions of the organs of the respiratory system.
19. Define the process of respiration.
20. Describe the alimentary system and its role in the human body.

21. Identify the anatomical positions of the organs of the alimentary system.
22. Describe the process of digestion.
23. Describe the urogenital system and its role in the human body.
24. Identify the anatomical positions of the organs of both the female and male urogenital systems.
25. Describe how the body filters waste by way of the urinary system.
26. Explain the role of the female and male reproductive organs.
27. Describe the process known as fertilization.
28. Describe the chemical role of the endocrine system.
29. Identify the anatomical positions of the female and male endocrine organs.
30. Explain the role of the integumentary system.
31. Identify the anatomical positions of the integumentary organs.
32. Label the parts of a cell.
33. Describe the differences between mitosis and meiosis.
34. Describe the biological, radiation, chemical, and physical hazards that put us at risk for the development of cancerous cells.

HUMAN ANATOMY AND PHYSIOLOGY

1. This chapter gives a general overview of **anatomy**, **physiology**, and **cytology**.

Medical supply technicians need basic knowledge of human anatomy, physiology, and cytology in order to understand the reasons for policies and procedures regulating the processing, storing, and distribution of supplies and equipment used for patient care.

2. **Anatomy** is defined as the study of the structure of the human body. **Physiology** is defined as the study of the functions of the human body. The human body is made up of 10 systems, which will be reviewed in this chapter. A **system** is defined as a group of organs working together to achieve common goals. These 10 systems are the **skeletal, joints or articulations, muscular, nervous, vascular, respiratory, alimentary, urogenital, endocrine, and integumentary systems**. The basic building block of all living things is called a cell. Its structure and functions will also be discussed.

3. The Skeletal System

a. The **skeletal system** forms the hard framework which contains the human body systems. The skeleton system is made up of 206 bones classified by their shape. There are four shape classifications: **long** (bones of the legs and arms), **short** (bones of the fingers and toes), **flat** (such as ribs), and **irregular** (bones of the skull and pelvis). See the illustration for the anatomical position and medical names of the human skeletal, articulation, and muscular systems.

b. The study of bones is called **osteology**. Bones provide the general framework of the human body. They are held in place by strong fibrous bands called **ligaments** which form joints or articulations.

c. Muscles are attached to the bone across the joints. Muscular contractions allow for movement of the bone at the joint. This interaction produces movement. The skeletal system also provides protection to the vital internal organs, such as the brain, heart, lungs. Calcium and phosphorus make up the large percent of its mineral content. These minerals make bones hard and dense, thus making them excellent materials for use in the framework, movement, and protection of vital organs.

d. **Bone marrow** is a soft, fatty tissue which is found in most bones. There are two types of marrow, yellow and red. Bone marrow is where red and white blood cells are formed and passed into the blood stream.

e. The following terms are used to describe the skeletal system:

cephal – head

crano - skull

osteo - bone

sacro - sacrum (tailbone)

thoraco – chest

ischi - hip

calc - foot (calcaneous bone)

capit - head

costa - rib

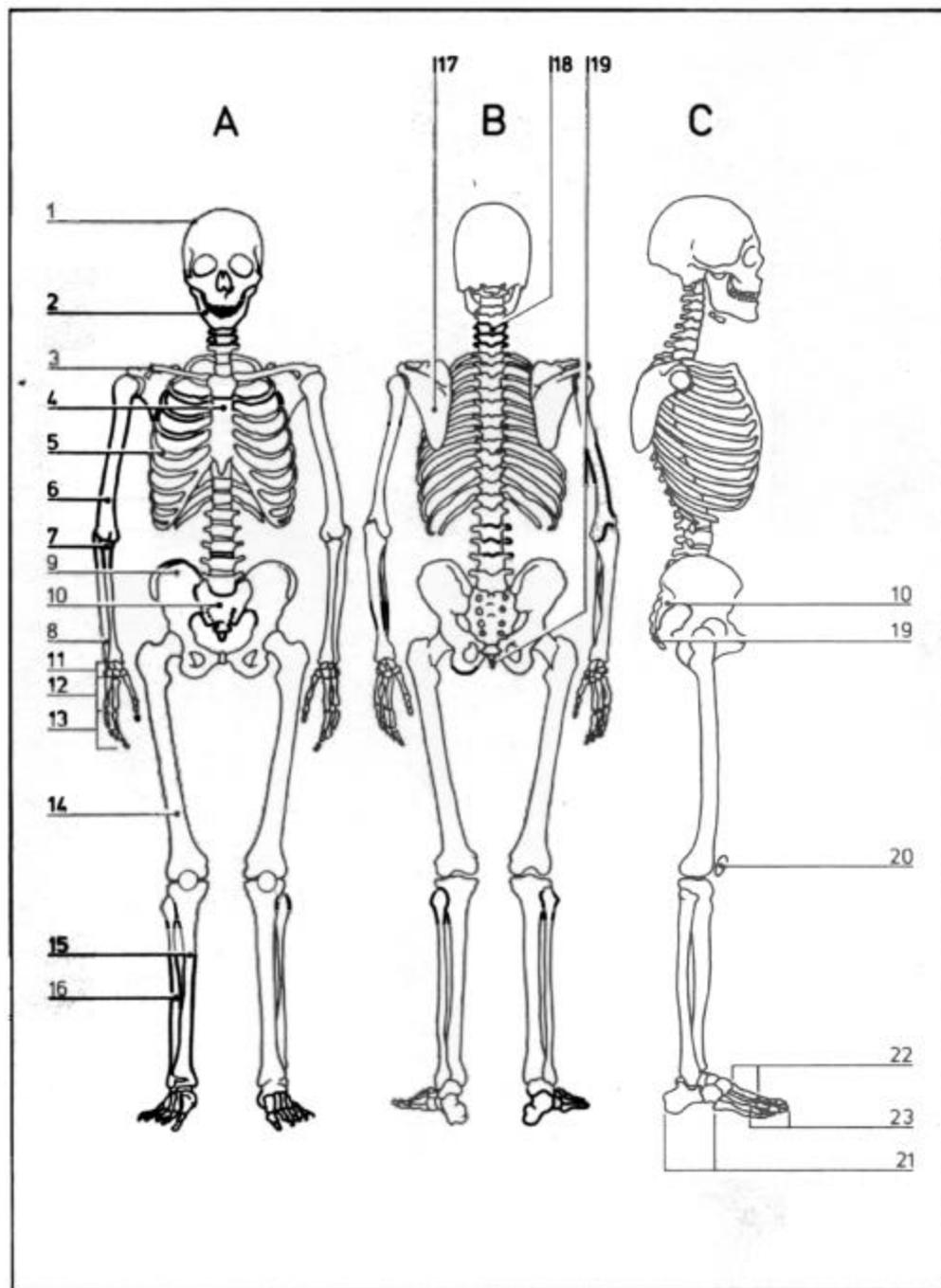
crur - leg

dactyl - finger

oss - bone

f. **Osteomyelitis**, for example, is the inflammation of a bone. A **craniotomy** is any operation on the cranium (skull), and the instrument that would be used to cut the cranium is a **craniotome**.

SKELETAL SYSTEM



A Front view
B Rear view
C Side view

1 Skull
 2 Mandible
 3 Clavicle
 4 Sternum
 5 Ribs
 6 Humerus
 7 Radius

8 Ulna
 9 Hip bone
 10 Sacrum
 11 Carpus
 12 Metacarpus
 13 Phalanges
 14 Femur
 15 Tibia
 16 Fibula
 17 Scapula
 18 Spinal vertebrae

19 Coccyx
 20 Patella
 21 Tarsus
 22 Metatarsus
 23 Phalanges

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JOINTS/ARTICULATION SYSTEM

1. The study of joints is called **arthrology**. There are three types of joints/articulations found throughout the human body. **Fibrous** joints allow only slight movement, such as the bones of the skull. The movement required in the skull is basically for growth. As the human body matures, this union hardens and does not allow movement. Fibrous joints (skull, teeth to the jaw bone) are held together by **ligaments**. Fibrous ligaments are tough collagenous bundles that allow as little movement as possible.

2. **Cartilagenous joints** are held together by cartilage and are slightly moveable. The spinal column is an example of a cartilagenous joint. The spinal cord can allow for bending and receiving the impact of the force of walking. A thick disk of cartilage connects the vertebrae and allows for bending and twisting of the spinal column.

3. **Synovial joints** allow for free movement. The shoulder, elbow, and leg joints are examples of this type of joint. In this type of joint the ends of the bone are connected by ligaments and cartilage, but separated by a cavity filled with **synovial fluid**. Synovial fluid helps lubricate and protect this free movement joint. See illustrations for joint/articulation types.

4. The following terms are used to describe the joint/articulation system:

artho - joint

chondro - cartilage

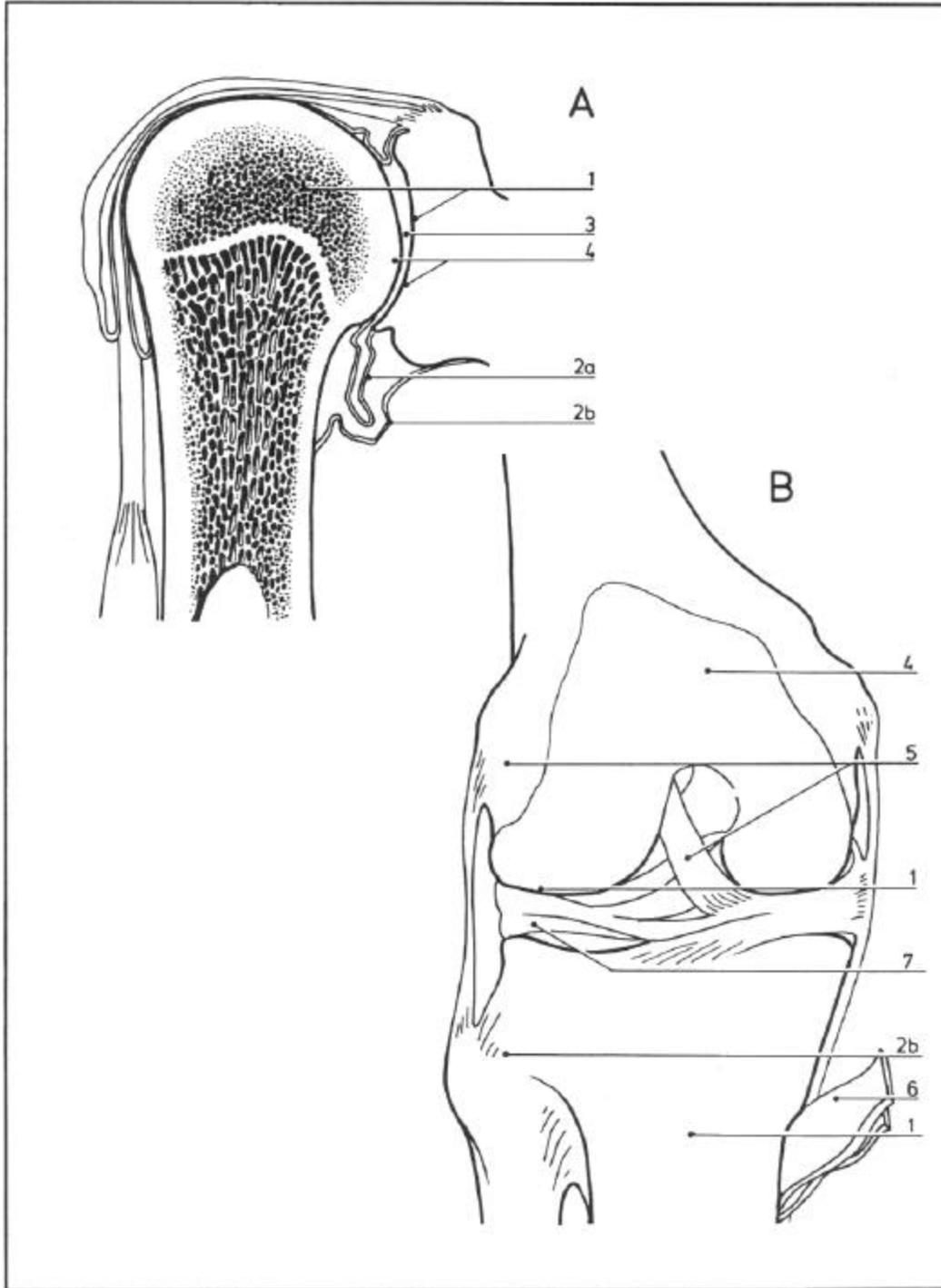
articul - joint

fibro - connective tissue

synovi - synovial fluid

5. **Arthrotome** is an instrument used to cut into a joint. An **arthroscope** is an endoscope which is used to view the interior of a joint. A **chondrectomy** would be the surgical removal of a cartilage.

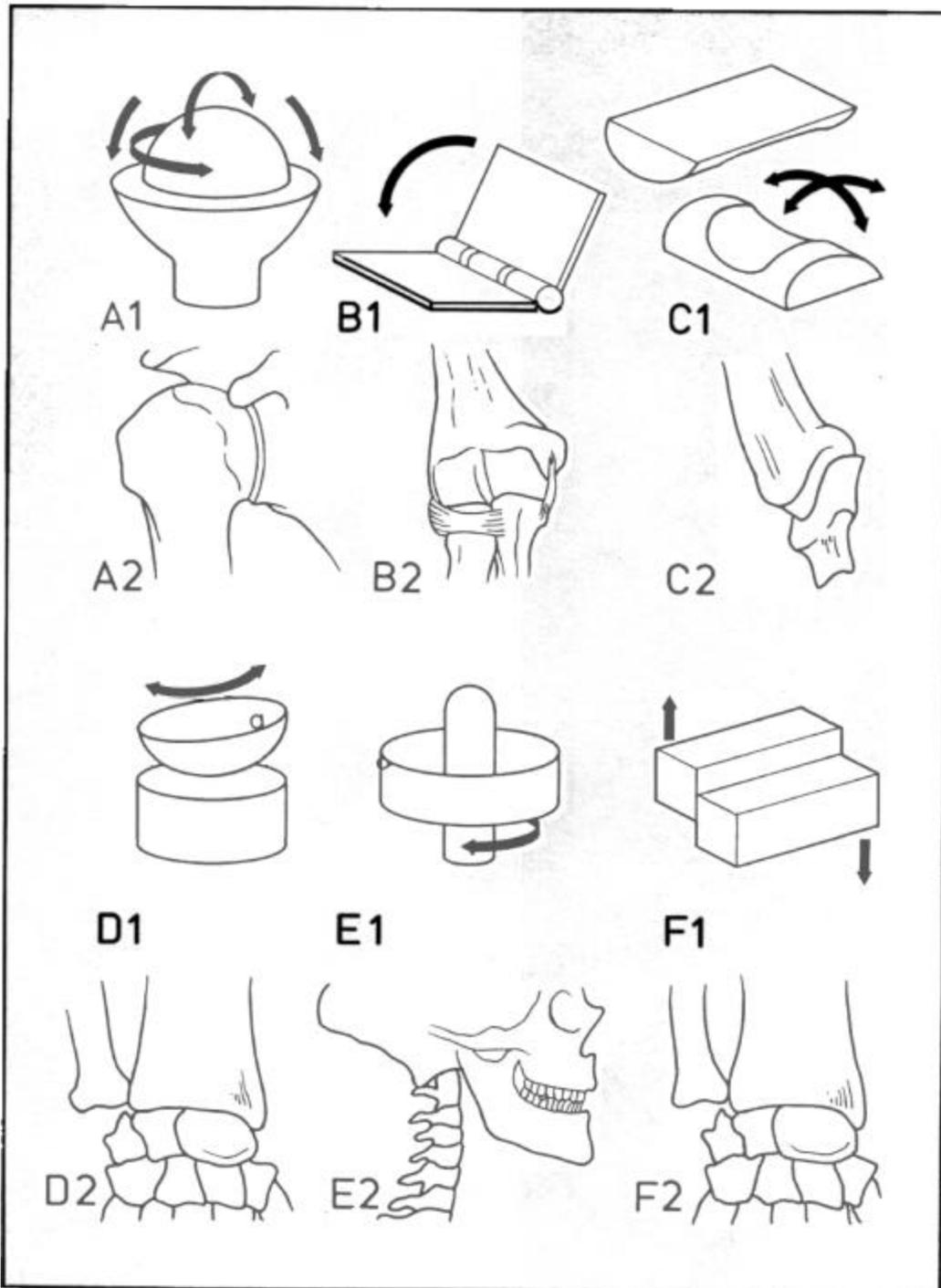
Articulating joints



- | | |
|---|------------------------------|
| A Section through shoulder joint (ball and socket) | 4 Articular cartilage |
| B Anterior view of knee joint (hinge joint) | 5 Ligaments |
| | 6 Tendons |
| | 7 Menisci |
| 1 Articulating joints | |
| 2 Articular capsule | |
| 2a Synovial membrane | |
| 2b Fibrous membrane | |
| 3 Joint cavity | |

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Joints: types



- | | | |
|--|--|------------------------------|
| Types of synovial joint | | |
| A1 Ball-and-socket (spheroidal) joint mechanism | C2 Carpometacarpal joint of thumb | F2 Intercarpal joints |
| A2 Shoulder joint | D1 Ellipsoid joint mechanism | |
| B1 Hinge joint (ginglymus) mechanism | D2 Wrist (radiocarpal) joint | |
| B2 Elbow joint | E1 Pivot (trochoid) joint mechanism | |
| C1 Saddle (sellar) joint mechanism | E2 Median atlanto-axial joint | |
| | F1 Plane (gliding) joint | |

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MUSCULAR SYSTEM

1. The **muscular system** is made up of more than 600 muscles. This system provides for our ability to maintain our posture, produce body heat, interact with our environment through motion and movement, and operation of automatic functions of the body. There are three types of muscles: **voluntary** (or skeletal), **involuntary** (or visceral), and **cardiac** (heart).

2. The **voluntary muscles** are most generally attached to the skeletal structures and are under voluntary control. In other words, we must tell them to help us move, reach, and grasp through conscious effort. They are also called **striated** muscles because under a microscope a striped appearance is observed. Voluntary muscles are made up of bundles of muscle fibers and are attached to bones by **tendons**, which are tough, white, cords of inelastic muscle tissue. Movement occurs when these bundles contract and extend. Contraction and extension of voluntary muscles can be achieved relatively quickly; however, they tire easily. See illustrations for anatomical location of voluntary muscles of the human body.

3. **Involuntary muscles** (visceral) provide for the movement of blood throughout the vascular system. They also aid in the digestion of food. **Peristalsis** is the wavelike motion seen in the large and small intestines in order to facilitate the movement of their contents. Involuntary muscles are under the control of the **autonomic nervous system** and are not consciously controlled. These muscles are also found in the various glands of the human body, blood vessels, and the uterus. These types of muscles are made up of much smaller muscle fibers and do not appear striped under the microscope, as the voluntary muscles appear. They appear smoother under such inspection and are often referred to as **smooth muscles**.

4. The **cardiac muscle** is a unique muscle in that the muscle fibers interlace with one another and have very small amounts of connective tissue at their joining. No other muscle in the human body has this distinction. This type of muscle contracts and relaxes in a slow rhythmical action and helps produce sounds that can determine normal or abnormal functioning of the heart.

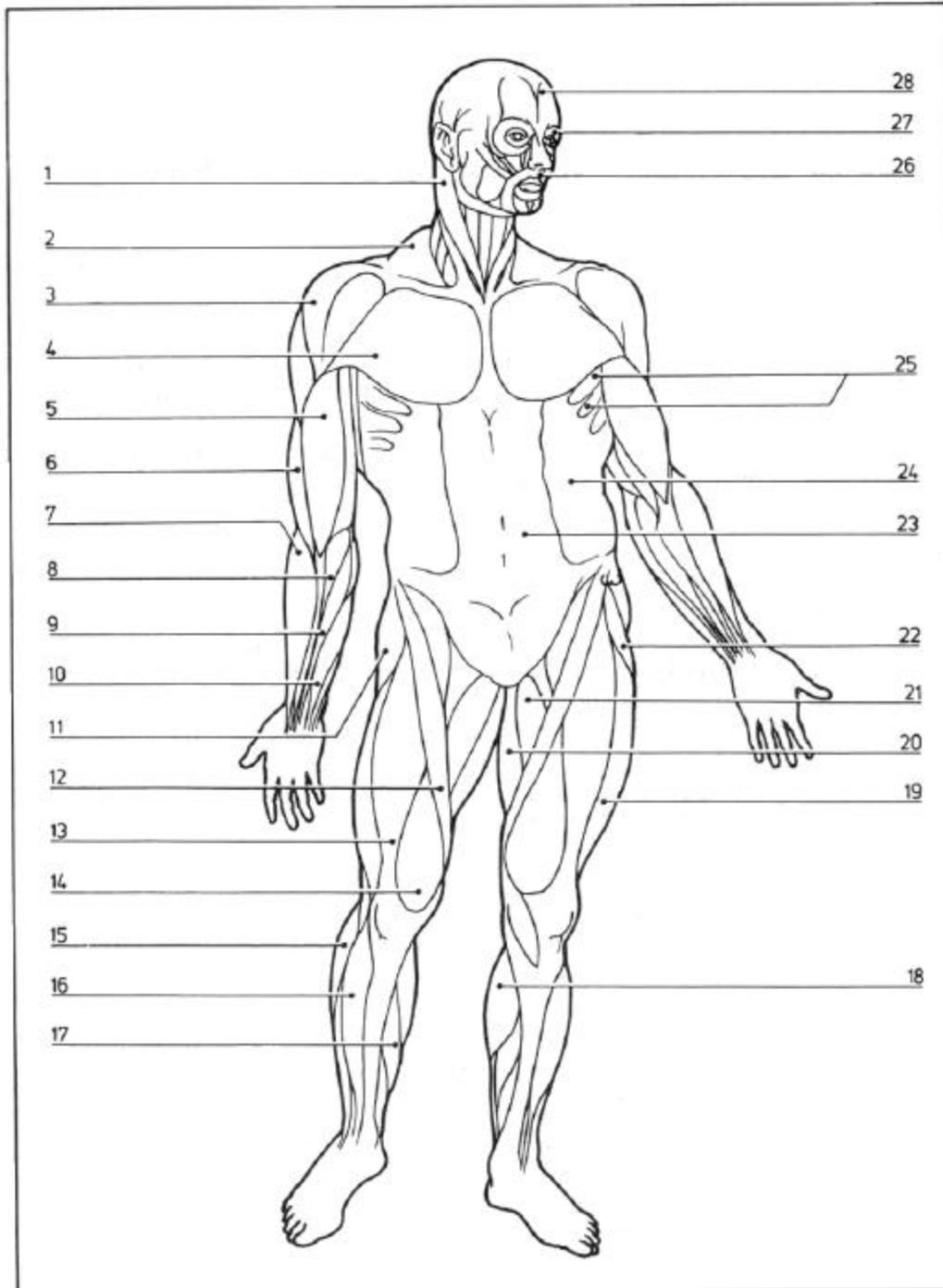
5. The following terms are used to describe the muscular system.

my - muscle

ten - tendon

6. **Myology** is the study of muscles. **Myopathy** is any disease of a muscle. **Tendonitis** is the inflammation of a tendon. A **myotome** is a surgical instrument used to cut a muscle.

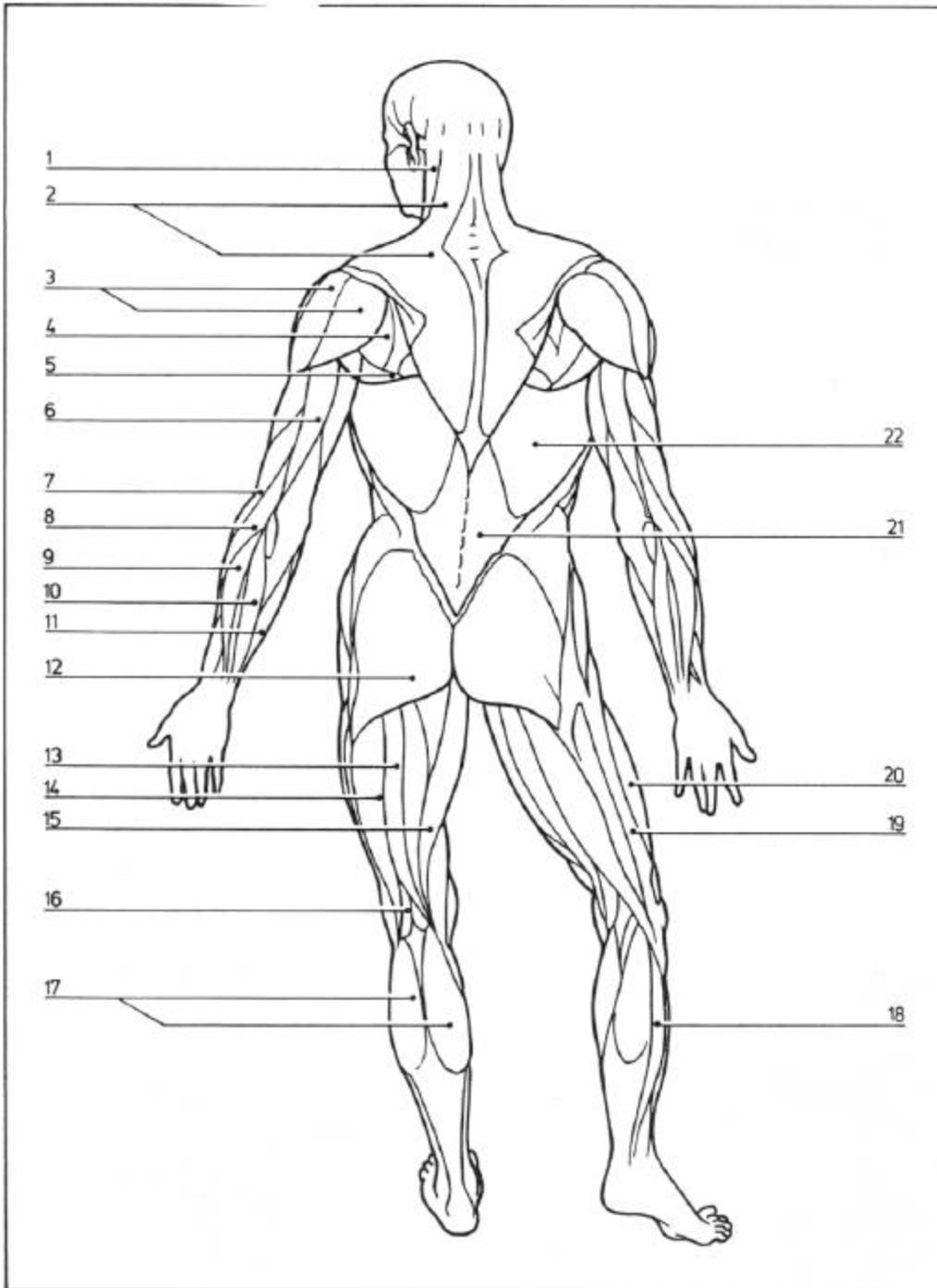
ANTERIOR VIEW OF SUPERFICIAL MUSCLES



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- | | | |
|---|--|--------------------------------------|
| Anterior view of superficial muscles | 9 Palmaris longus | 19 Vastus lateralis |
| 1 Sternocleidomastoid | 10 Flexor digitorum superficialis | 20 Gracilis |
| 2 Trapezius | 11 Gluteus medius | 21 Adductor longus |
| 3 Deltoid | 12 Sartorius | 22 Tensor fasciae latae |
| 4 Pectoralis major | 13 Rectus femoris | 23 Rectus abdominis |
| 5 Biceps brachii | 14 Vastus medialis | 24 External abdominal oblique |
| 6 Brachialis | 15 Peroneus longus | 25 Serratus anterior |
| 7 Brachioradialis | 16 Tibialis anterior | 26 Orbicularis oris |
| 8 Flexor carpi radialis | 17 Soleus | 27 Orbicularis oculi |
| | 18 Gastrocnemius | 28 Occipitofrontalis |

POSTERIOR VIEW OF SUPERFICIAL MUSCLES



Posterior view of superficial muscles

- 1 Sternocleidomastoid
- 2 Trapezius
- 3 Deltoid
- 4 Infraspinatus
- 5 Teres major
- 6 Triceps brachii
- 7 Brachioradialis
- 8 Extensor carpi radialis

- 9 Extensor digitorum
- 10 Extensor digiti minimi
- 11 Extensor carpi ulnaris
- 12 Gluteus maximus
- 13 Biceps femoris
- 14 Semitendinosus
- 15 Gracilis
- 16 Semimembranosus
- 17 Gastrocnemius
- 18 Soleus
- 19 Fascia lata

- 20 Vastus lateralis
- 21 Thoracolumbar fascia
- 22 Latissimus dorsi

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NERVOUS SYSTEM

1. The nervous system consists of the **central nervous system**, the brain and the spinal cord, the **peripheral nervous system**, the nerve fibers, ganglia, and end organs (in other words, the nervous system outside of the brain and spinal cord), and the **sensory organs**, eyes, ears, nose, and tongue.
2. The nervous systems are only separated anatomically, they actually interact and intertwine so that we can communicate within ourselves and with our environment. The nervous system is, however, separated functionally into two systems: the **involuntary** (autonomic), which is unconsciously controlled, and the **voluntary**, which is controlled by conscious thought.
3. **Nerve cells** or **neurons** connect all parts of the human body in order to receive, process, and send messages. The nerve cell has three parts: **the body**, which is the nerve cell; the **dendrite**, which resembles tree branches and is responsible for receiving incoming messages, and **the axon**, which is generally not branch-like but a single extension that transmits messages to the next neuron.
4. There are basically three groups of neurons. One group acts as **sensory** nerve cells and tells the body that pain is present in our hand. Another group acts as **motor** nerve cells and tells the body to respond to the pain by contracting a muscle to move our hand from the source of pain. The third group can carry both **sensory** and **motor impulses**.
5. The brain is the command center for the central nervous system; without its interaction the human body is considered clinically dead. The **medulla oblongata**, which is located at the base of the brain, controls our heartbeat, respiration, and body temperature. The **cerebellum**, which is located at the back of the brain behind the medulla oblongata, controls equilibrium, body balance, and muscle coordination. The **cerebrum**, which is located above the cerebellum in the back of the brain, is the largest part and controls our memory and thought processes, our voluntary impulses (decisions and movements), and interpretation of all sensory nerve impulses (information).
6. The **spinal cord** connects the brain to the peripheral nervous system (all other parts of the body). It consists of a large bundle of neurons, which branch off into **ganglia**, which in turn are the beginning of the peripheral nervous system. The peripheral nervous system extends out to all other parts of the body where it picks up stimuli and returns it to the spinal cord and brain for interpretation and response messages. See illustration for the nervous system.

7. The **sensory nerves** of the peripheral nervous system are divided into two groups. One group consists of the sensory nerves of the **special senses**, which are **sight, sound, smell, and taste**. The other group consists of nerve endings, which give us the sensation of heat, cold, touch, pain, and pressure. This chapter will only discuss the organs of the special senses.

8. The **eye** is the globular organ of vision (sight). The eye has three layers called the **sclera, choroid, and the retina**. See the illustration for a diagram of the eye. The **sclera** is the white, dense, inelastic membrane that helps the eye maintain its globular shape and provides protection. The **choroid** is the thin, dark brown middle layer. The **rods and cones** within the retina receive the light impressions which enter the eye through the pupil. The **pupil**, which is surrounded by a colored ring called the **iris**, dilates and constricts (by involuntary muscles) to control the amount of light which is reflected onto the retina by lens. The rods and cones then transmit the impressions by way of the optic nerves to the brain where they are interpreted.

9. The **ear** is the sensory organ of hearing and equilibrium. See the illustration for a diagram of the ear. The ear is divided into three parts: **outer ear, middle ear, and inner ear**. The **outer ear** protrudes from the sides of the head and collects sound waves which it directs to the ear drum. The ear drum then conducts the sound waves to the middle ear. Within the **middle ear** are three tiny, connected bones called the hammer, the anvil, and the stirrup. After receiving the sound waves, these tiny bones conduct (by vibrating) the sound waves into the inner ear. The **inner ear** contains the sensory nerves and as sound waves enter, they are converted into nerve impulses and are conducted to the brain for interpretation by the auditory nerves. The eustachian tube, which is located in the middle ear, connects the middle ear to the pharynx. This tube helps to equalize pressure on both sides of the ear drum.

10. The organ of smell is the **nose**. The sensory nerve cells for smell are located in the mucous membrane that lines the upper portion of the nasal cavity. As smells pass through the nasal cavity, they are transmitted to the brain by the olfactory sensory nerve.

11. The **tongue** is the sensory organ of taste. Tiny buds cover the surface of the tongue and they are capable of distinguishing four kinds of taste: sweet, sour, bitter, and salty. The **taste receptors** (buds) are constantly being replaced by new cells.

11. The following terms are used to describe the nervous system:

encephalo - brain

myel - spine

mening - membrane

gloss - tongue

neuro - nerve

naso - nose

sens - sensory

ocul - eye

spina - spinal cord

ophthalm - eye

ot - ear

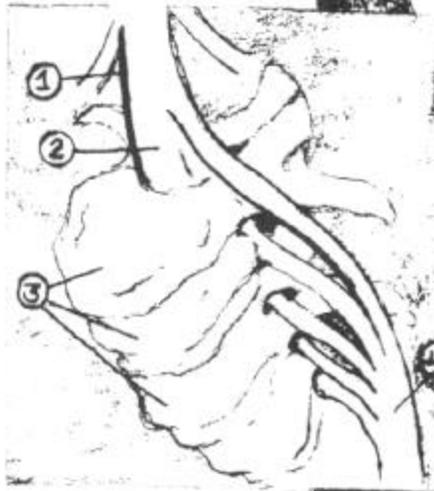
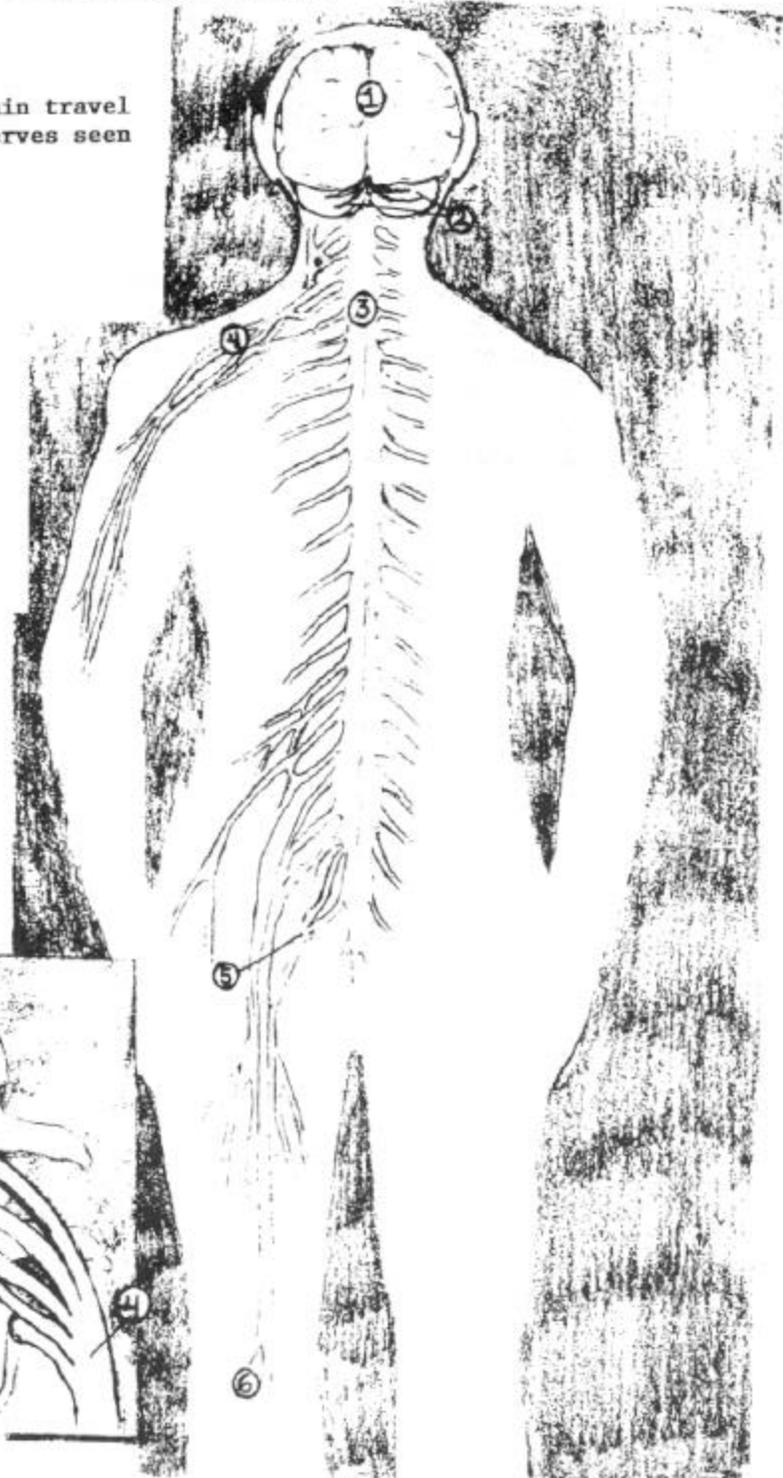
rhin - nose

12. **Spinal meningitis** is an inflammation of the membranes covering the spinal cord. **Neuritis** is the inflammation of a neuron/nerve. When an **EEG** is ordered for a patient, a test using an electroencephalograph records the electrical activity of the brain. A **myelogram tray** contains instruments and supplies used for a diagnostic photograph of the spinal cord by introducing a contrast medium (radiopaque dye). **Ophthalmoscopes** and **otoscopes** are instruments used to view the eyes, ears, and nose. A **rhinoplasty tray** contains surgical instruments used in nasal surgery.

CENTRAL NERVOUS SYSTEM

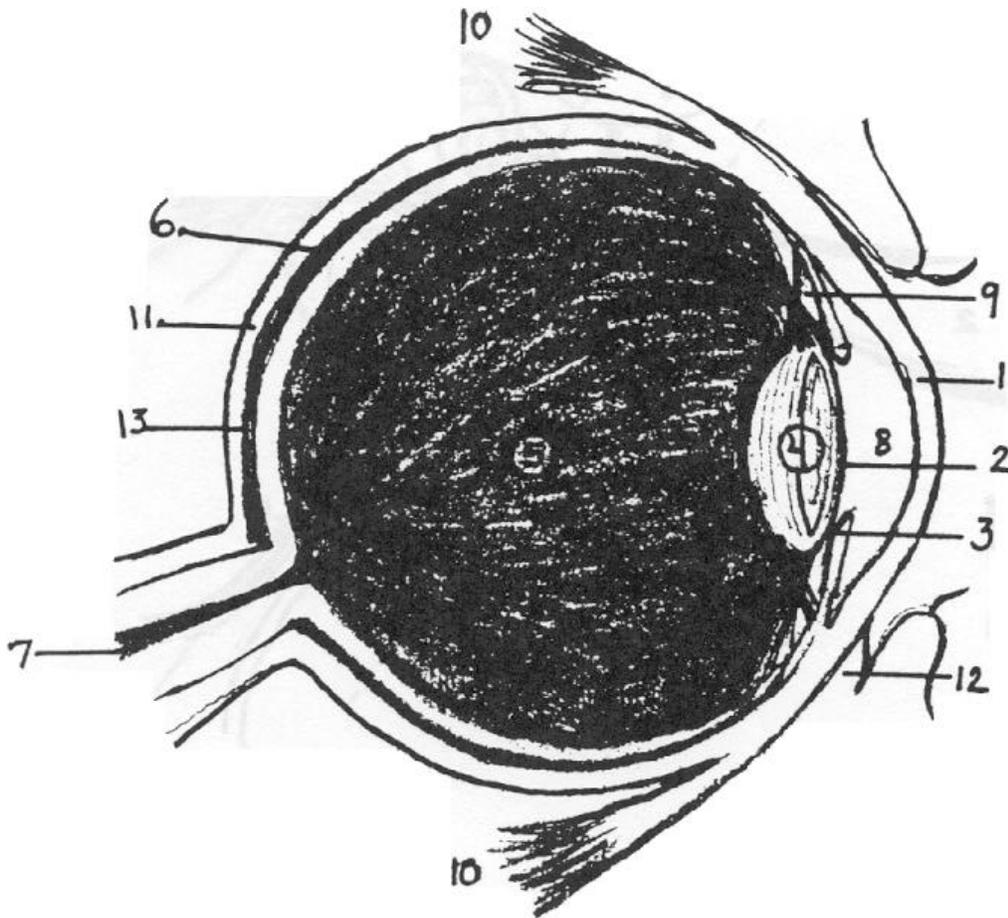
Messages to and from the brain travel along the spinal cord and nerves seen branching off the cord.

1. Cerebrum
2. Cerebellum
3. Spinal cord
4. Brachial plexus
5. Sacral plexus
6. Peripheral nerve



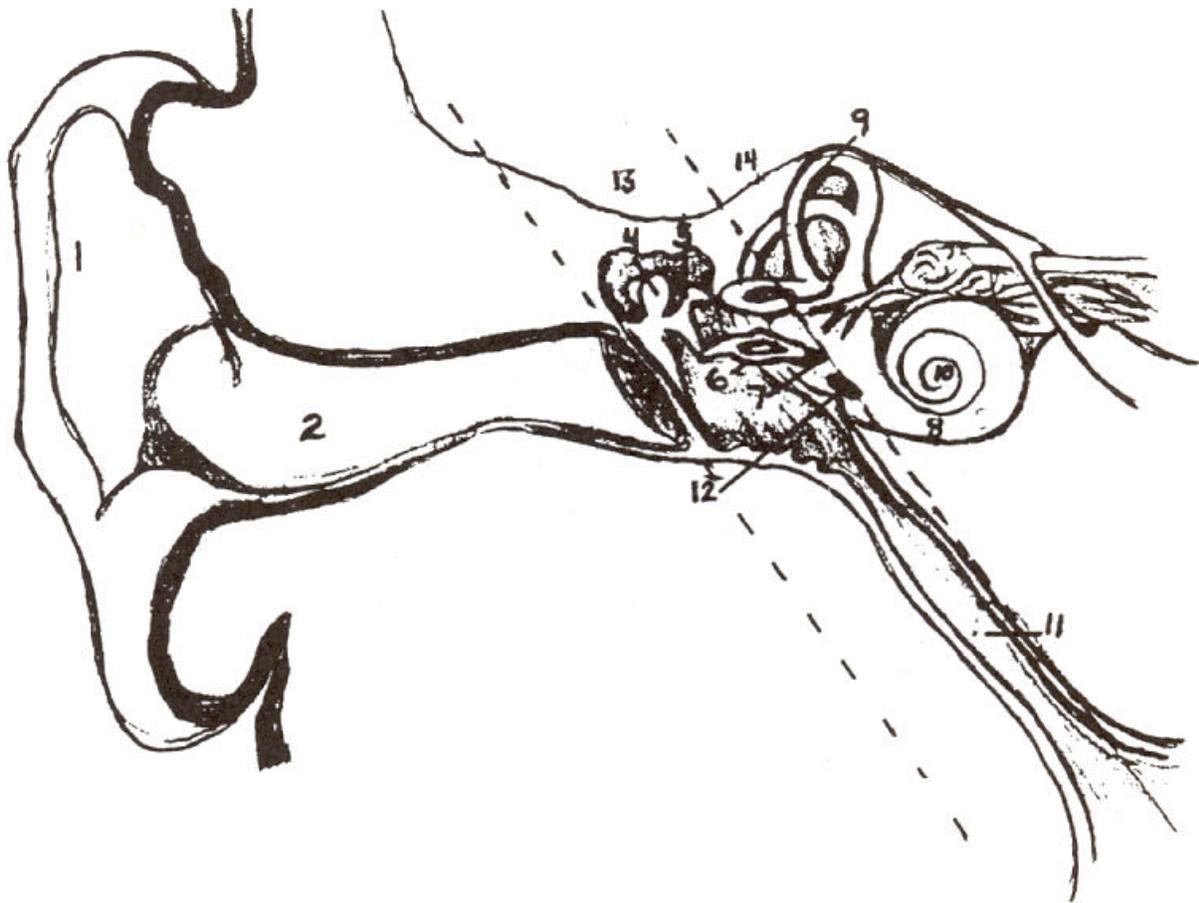
Section of Vertebral Column
(upper vertebrae have been removed to show location of the spinal cord within the canal.)

1. Meninges
2. Spinal cord
3. Vertebrae



STRUCTURE OF THE EYE

- | | |
|---------------------|----------------------|
| 1. Cornea | 8. Anterior chamber |
| 2. Pupil | 9. Posterior chamber |
| 3. Iris | 10. Muscle |
| 4. Crystalline lens | 11. Sclera |
| 5. Vitreous body | 12. Conjunctiva |
| 6. Retina | 13. Choroid |
| 7. Optic nerve | |



STRUCTURE OF THE EAR

- | | |
|---------------------------------|------------------------|
| 1. External ear (pinna) | 8. Vestibule |
| 2. External auditory canal | 9. Semicircular canals |
| 3. Tympanic membrand (ear drum) | 10. Cochlea |
| 4. Malleus | 11. Eustachian tube |
| 5. Incus | 12. Round window |
| 6. Stapes | 13. Middle ear |
| 7. Oval window | 14. Inner ear |

VASCULAR SYSTEM (CIRCULATORY)

1. The vascular or circulatory system is made up of two parts, the **blood vascular** and the **lymphatic systems**. The **blood vascular system** consists of the **heart, arteries, arterioles, capillaries, venules, veins, and blood**. This system is responsible for transporting oxygen, nutrients, minerals, chemicals, disease fighting cells, and hormones to all parts of the body. This same system is responsible for removing waste products and carbon dioxide from all parts of the body. The circulatory system allows us to maintain **hemostasis** (internal stability) by regulating body temperature and electrolyte balance. The **lymphatic system** consists of thin walled capillaries, larger lymphatic vessels, firm, rounded bodies which are called **lymph nodes**, and **lymphatic organs** that resemble lymph nodes, such as the **spleen, tonsils, thymus**, areas of the **alimentary system** (digestive system), and **bone marrow**. The lymphatic system helps remove foreign material and plays an important part in the body's immunologic protection.

2. The **heart** is a four-chambered muscular pump which facilitates the circulation of blood. See the illustration for a diagram of the blood flow through the heart. The four chambers are: the **right atrium**, the **right ventricle**, the **left atrium**, and the **left ventricle**. These chambers contract in pairs, the atriums contract first and then the ventricles. Even though the contractions are the force that pumps the blood through the heart, the actual "lub, dub" sound, which is heard, is caused by the valves between the atriums and the ventricles opening and closing. The **right atrium** receives blood from the upper part of the body through the **superior vena cava** and the **inferior vena cava** delivers the blood from the lower part of the body. The blood is then pumped from the right atrium to the **right ventricle**. From the right atrium blood is then pumped through the **pulmonary arteries** to the **lungs**. The blood is **oxygenated** (oxygen is added to the blood cells) in the lungs and is then pumped into the **pulmonary veins** which carry the blood back to the heart's **left atrium**. The pulmonary arteries and veins are unique in the fact that the pulmonary arteries are the only arteries in the body that carry **unoxygenated** (oxygen has been removed from the blood cells by the tissues) blood and the pulmonary veins are the only veins in the body that carry oxygenated blood (arteries and veins will be discussed later in this section). The blood is then pumped from the left atrium to the **left ventricle**. The left ventricle then pumps the blood out of the heart into the **aorta** (the largest artery of the human body) where the blood is pumped to all other parts of the body. **Arteries** carry oxygenated blood (except for the pulmonary artery) to the tissues of the body. Arteries branch off into **arterioles**, which further branch off into **capillaries** and it is at the capillaries where nutrients, oxygen, and other products are absorbed for use by the body's tissues. **Veins** carry deoxygenated blood back from the tissues. Waste products are removed from the tissues by **venules**, which are branches of the veins. The veins carry deoxygenated blood back to the heart and the process starts all over. In 24 hours, 7,200 quarts of

blood pass through the heart. There are approximately 5 quarts of blood, recycled through the heart once every minute, in the average adult body. See the illustration for a diagram of arteries and veins of the human body.

3. **Blood** is the fluid that is circulated through the heart, arteries, capillaries, and veins. Blood carries nutrients and oxygen to the body's cells. It consists of **plasma** -- a pale yellow liquid, **erythrocytes** -- or red blood cells, **leukocytes** -- or white blood cells, and **thrombocytes** or platelets. **Erythrocytes** (red blood cells) are small disk-shaped blood cells that are saturated with **hemoglobin**. When blood is pumped through the lungs, oxygen attaches itself to the hemoglobin and the hemoglobin carries it to the body's cells. **Leukocytes** (white blood cells) are of various sizes and in less number than erythrocytes and are mainly concerned with destroying pathogenic (disease producing) organisms. Thrombocytes/platelets aid in the clotting of blood. Their irregular shape also aids in the clotting process.

4. Blood is an essential need of the human body. The brain's requirement is constant; however, other systems may need more or less at any given time. For example, after you have eaten a meal, the stomach requires an extra supply in order to facilitate digestion and absorption of nutrients. During physical exercise, the muscular system requires larger amounts in order to perform and remove waste products produced by strenuous activity. The venous system relies on activities of daily living to facilitate pushing blood back to the heart. The simple act of walking causes muscles in the legs to contract and extend which helps squeeze and push blood along the veins. Thigh-length and knee-length compression devices are used in hospitals on bed ridden patients in order to prevent **venous stasis** (pooling of blood in the extremities). This device is used to push the blood back up towards the heart and prevent blood clots, which could lead to **thrombophlebitis** (inflammation of a vein caused by a blood clot) or even more serious complications, such as death, due to a blood clot that has become mobile and occludes (completely blocks the passage of a vessel so that blood is unable to feed the heart muscle) a vessel in the heart, causing a heart attack.

5. The **lymphatic system** drains excess fluids away from the tissues, transports dead blood cells and waste products away from the tissues, and functions as another line of defense against pathogens. The lymphatic vessels carry **lymph** -- a clear, watery fluid containing **lymphocytes**. **Lymphocytes** are cells that eat up disease producing cells. The **lymph nodes** are located throughout the body along the lymph vessels. These nodes are largely responsible for our disease fighting processes. Lymphocytes are concentrated in the lymph nodes and, as the fluid passes through the nodes, it is filtered and recycled and then directed back to the vascular system for recirculation throughout the body for reuse.

6. The **spleen, tonsils, lymph nodes, and parts of the digestive tract** act as **secondary lymphoid organs** in that they filter and fight pathogens. The **primary lymphoid organs** are the thymus and bone marrow. These organs are responsible for making the lymphocytes that help the human body fight disease and produce antibodies.

7. The following terms are used to describe the vascular system:

angi - vessel

arteri - artery

cardi - heart

cyt - cell

erythr - red

hemat - blood

hem - blood

leuk - white

lymph - water (lymphatic)

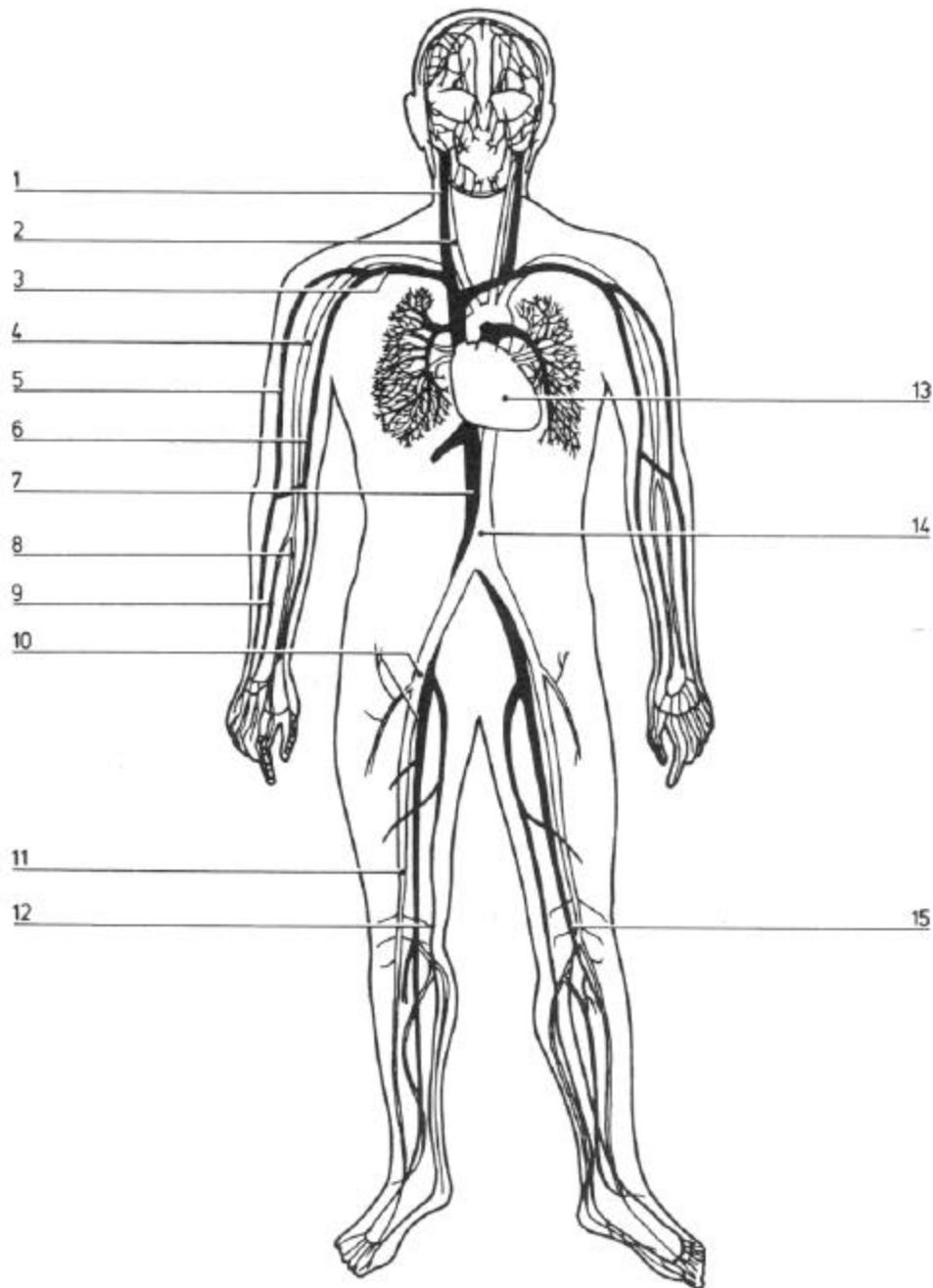
phleb - vein

vas - vessel

em - blood

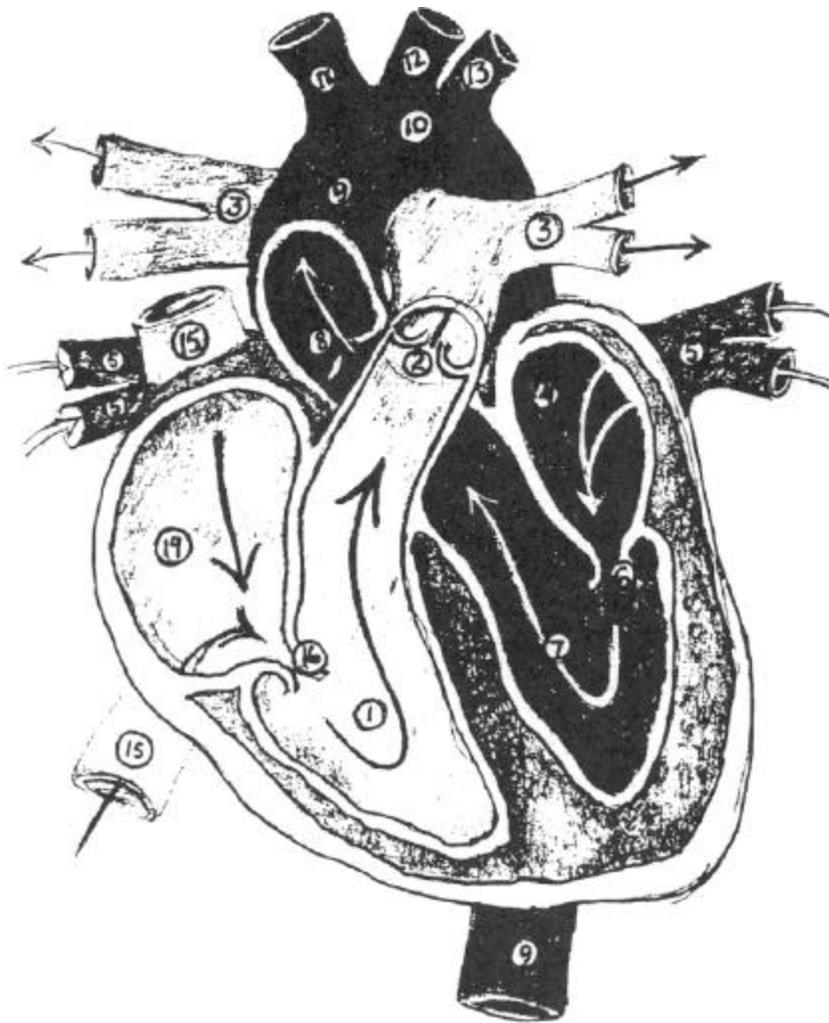
8. **Arteriosclerosis** is a disease where the walls of arteries become thick and lose their elasticity. Cardiology is the study of the heart. **Phlebitis** is the inflammation of a vein. A **hemostat** is a clamp used for preventing bleeding from vessels during surgery.

Key diagram



Anterior view showing major arteries (white) and veins (black)

- | | | | |
|---|----------------------------|----|------------------------------|
| 1 | Internal jugular vein | 6 | Basilic vein |
| 2 | Common carotid artery | 7 | Inferior vena cava |
| 3 | Subclavian vein and artery | 8 | Radial artery |
| 4 | Brachial artery | 9 | Ulnar artery |
| 5 | Cephalic vein | 10 | Common iliac artery and vein |
| | | 11 | Femoral artery |
| | | 12 | Great saphenous vein |
| | | 13 | Heart |
| | | 14 | Aorta |
| | | 15 | Femoral vein |



BLOOD FLOW THROUGH THE HEART

- | | |
|-------------------------------------|--------------------------------------|
| 1. Right ventricle | 9. Aorta |
| 2. Pulmonary valve | 10. Aortic arch |
| 3. Pulmonary artery, right and left | 11. Innominate artery |
| 4. Left atrium | 12. Common carotid artery |
| 5. Pulmonary veins, right and left | 13. Subclavian artery |
| 6. Mitral (bicuspid) valve | 14. Right atrium |
| 7. Left ventricle | 15. Vena cava, inferior and superior |
| 8. Aortic valve | 16. Tricuspid valve |

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RESPIRATORY SYSTEM

1. The **respiratory system** is responsible for supplying life sustaining oxygen which the body requires to produce energy and remove the waste product, carbon dioxide, which is given off when oxygen is released to the cells. Breathing consists of two phases: **inspiration** and **expiration**. **Inspiration**, or **inhalation**, is the process of drawing air into the lungs. **Expiration** is the process of pushing air out of the lungs. This process is called **ventilation**.

2. The organs of the respiratory system are the **nostrils** (nose), **pharynx**, **larynx** (voice box), **trachea** (windpipe), **bronchi**, and the **lungs**. See the illustration for a diagram of the respiratory system.

3. When air is taken into the lungs (inspiration), it first passes through the **nostrils**, where it is warmed, moistened, and filtered. It then proceeds through the **pharynx**, **larynx**, and **trachea**. The trachea then branches to form the **left and right main stem bronchi**. The bronchi keep dividing many times so that it resembles the branches of a tree. These branches are called **bronchioles** and they end in tiny air sacs called **alveoli**. These clusters of tiny air sacs are where respiration actually takes place. **Respiration** is the process by which oxygen and carbon dioxide are exchanged at the cellular level. The alveoli contain capillaries and these structures are surrounded by very thin membranes which make the exchange of oxygen and carbon dioxide in the blood easier. After the exchange, carbon dioxide is then exhaled by the process of expiration and exhaled back out the way oxygen was brought in. Oxygenated blood is then circulated throughout the vascular system.

4. The following terms are used to describe the vascular system:

aer - air bronchi - windpipe

cyan - blue nas - nose

pleur - rib, side thorac - chest

pne - breathing pneum - breath, air

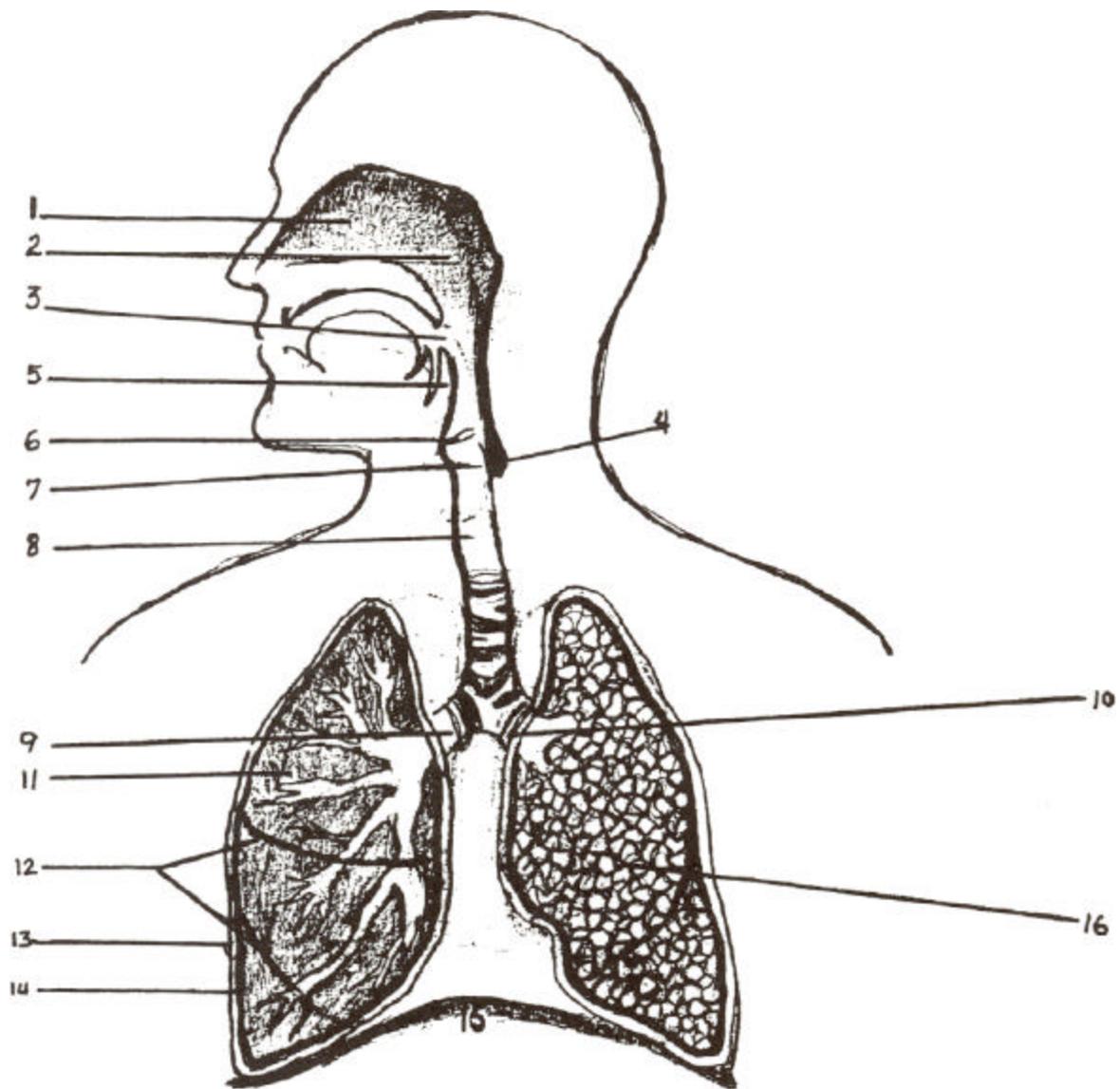
pneumo - lung pulmo - lung

rhin - nose sin - sinus (fold, hollow)

trache - windpipe (trachea) spir - breathing

5. A **pneumothorax** is a collapsed lung. When a patient is said to be cyanotic (blue) they are oxygen deprived. A **rhinoplasty tray** is a surgical tray containing instruments

for a surgical operation on the nose. **Pneumonia** is an inflammation of the lungs. A **thoracotomy tray** contains instruments used in making a surgical incision into the chest wall.



RESPIRATORY SYSTEM

- | | |
|-----------------|--|
| 1. Nasal cavity | 9. Right main stem bronchus |
| 2. Nasopharynx | 10. Left main stem bronchus |
| 3. Pharynx | 11. Right lung (lobar and segmental bronchi exposed) |
| 4. Esophagus | 12. Lobe divisions |
| 5. Epiglottis | 13. Parietal pleura |
| 6. Vocal cords | 14. Visceral pleura |
| 7. Larynx | 15. Diaphragm |
| 8. Trachea | 16. Left lung |

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UROGENITAL SYSTEM

1. The **urinary** and **genital systems** are so closely related they are usually grouped together as the **urogenital system**. In both males and females, the urinary (renal) system is responsible for the formation and elimination of urine, and the genital system is responsible for producing hormones which influence the development of feminine and masculine characteristics and human reproduction.
2. The **urinary system** or **renal system** (renal means kidneys or pertaining to the kidneys) is responsible for filtering waste products for the blood and eliminating them from the body. It consists of the **kidneys, ureters, bladder, and urethra**. See the illustration for a diagram of the urinary system. The **kidneys** are where urine is formed. They are two bean-shaped organs located in the back upper left and right quadrants of the abdominal cavity. The blood vessels are filtered through **nephrons** (tiny filtering units of the kidney of which there are many), and the waste liquids and other particles removed are what make up urine. The **ureters** are thick walled tubes that connect each kidney to the urinary bladder. These tubes can be up to 10-15 inches long and, if they become blocked (such as with a kidney stone or other renal diseases), the kidneys will continue to produce urine and eventually the kidney is destroyed. As with the liver, the human body must have at least one functioning kidney to maintain life. The loss of both kidneys requires artificial removal of waste products called **hemodialysis**. During hemodialysis, blood is filtered through a machine which acts like a kidney and removes harmful wastes. Human kidney transplants have also been successful and are a welcomed relief from having to stay on a dialysis machine up to 3 days per week and 4 hours each treatment.
3. The ureters empty urine into the bladder which is an extremely muscular sac. The bladder normally rests in the pelvic cavity but, as it fills with urine, it can rise up into the abdominal cavity. The bladder stores the urine until it is eliminated outside of the body by the **urethra**.
4. The kidneys are not only responsible for forming and removing urine but are also helpful in reabsorbing water, salts, sugar, and protein from the blood. This process enables the body to maintain homeostasis by controlling the acid-base balance of the blood and maintaining adequate levels of water, salts, proteins, and electrolytes (such as potassium).
5. The human body excretes about **one and one-half quarts** of urine daily. The kidneys can filter **one quart** of blood per minute or **360 gallons per day**.
6. The **genital system** in the female is comprised of the **ovaries, fallopian tubes, uterus, vagina (birth canal), and mammary glands**. See the illustrations for diagrams of the female and male genital systems. The **ovaries** are almond-shaped organs that produce **ova** (eggs) that contain the female genes. They also produce the female

hormones estrogen and progesterone, which regulate the menstrual cycle and produce the development of secondary feminine characteristics. The **fallopian tubes** connect the ovaries to the uterus and are how the ova (egg) travels to the uterus after being fertilized. The **uterus** is a large muscular organ where the fertilized ova develops into a fetus. The uterus nourishes and holds the fetus during pregnancy. The **vagina** is the canal that extends from the uterus (the cervix is the lower portion of the uterus to which the vagina extends from) to the exterior of the body. The **mammary glands** (breasts), under hormonal control, fill with milk after child birth. Breast milk is nutritious, easily digested, and contains the mother's antibodies which will nourish and protect the child from diseases.

7. The male genital system consists of the **testes** (testicles), **penis**, and **prostate gland**. The **testes** produce sperm (spermatozoa) which carry the male genes. They also produce testosterone, the male hormone responsible for secondary male characteristics such as body hair. The **penis** is the external appendage used for urination and sexual intercourse. The **prostate gland** is the male organ responsible for secreting a liquid alkaline substance which allows for the mobility of the sperm. The fluid also protects the sperm from the acidic conditions of the female vagina.

8. **Human reproduction** begins when a sperm from the male penetrates the female ova (egg). This process is known as **fertilization** and it takes place in the fallopian tubes of the female. After the egg is fertilized by the sperm, it then travels to the uterus where it attaches itself to the uterine wall. The ovaries then secrete hormones which tell the body to protect and nourish the developing fetus and prepare the body for the birth process. When labor begins, the cervix of the uterus dilates (opens) to allow the baby to be pushed through the birth canal (vagina) and delivered. This seems like a simple process, yet human reproduction is an amazing intricate and delicate process and it is a wonder that reproduction takes place at all.

9. The following terms are used to describe the urogenital system:

andr - man

lact- milk

blast - bud, child

mamm - breast

bry - be full of life

mast - breast

colp - vagina

metr - womb

galact - milk

oo - egg (ovary)

gest - bear, carry

orchi - testicle

gyn - women

ov - egg

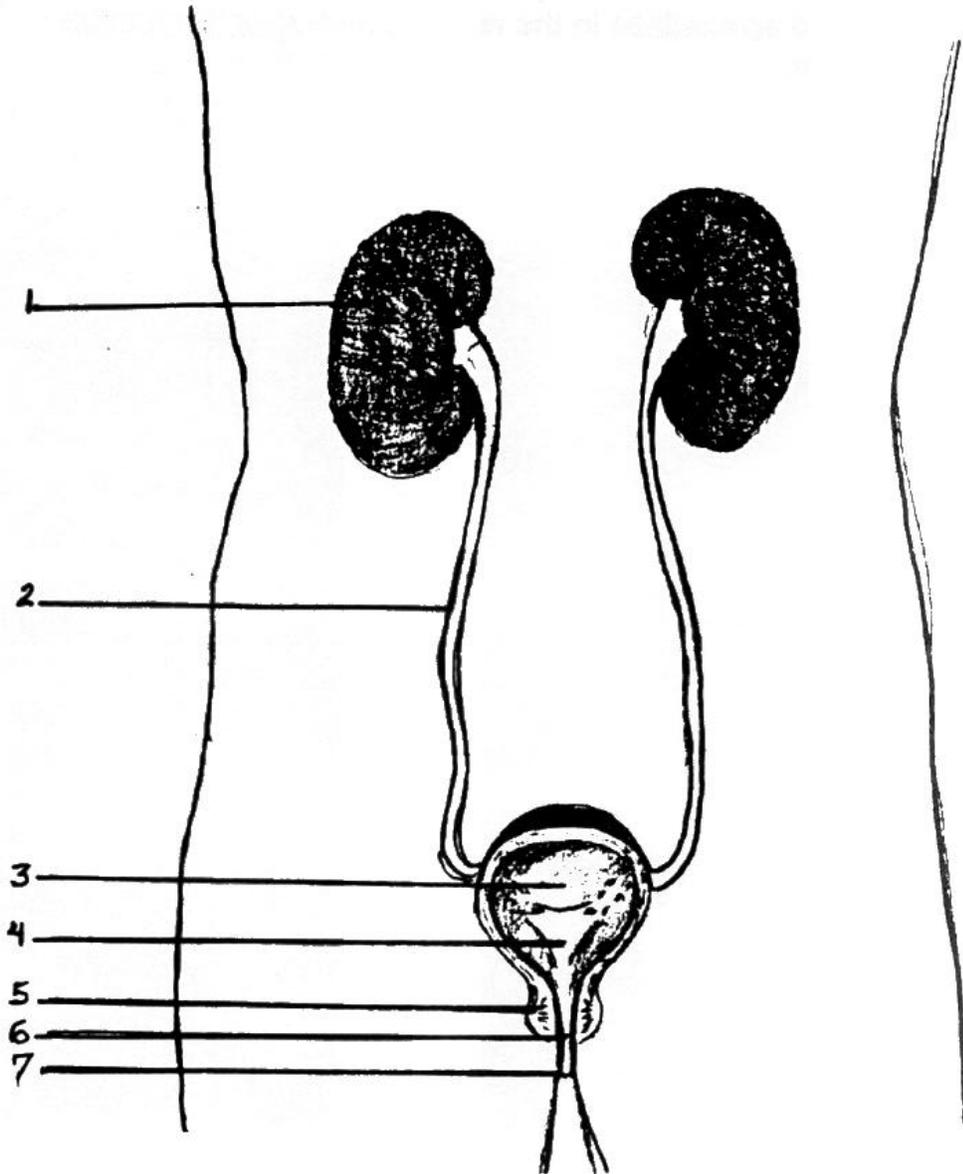
hyster - womb

salping - tube

sperm - seed

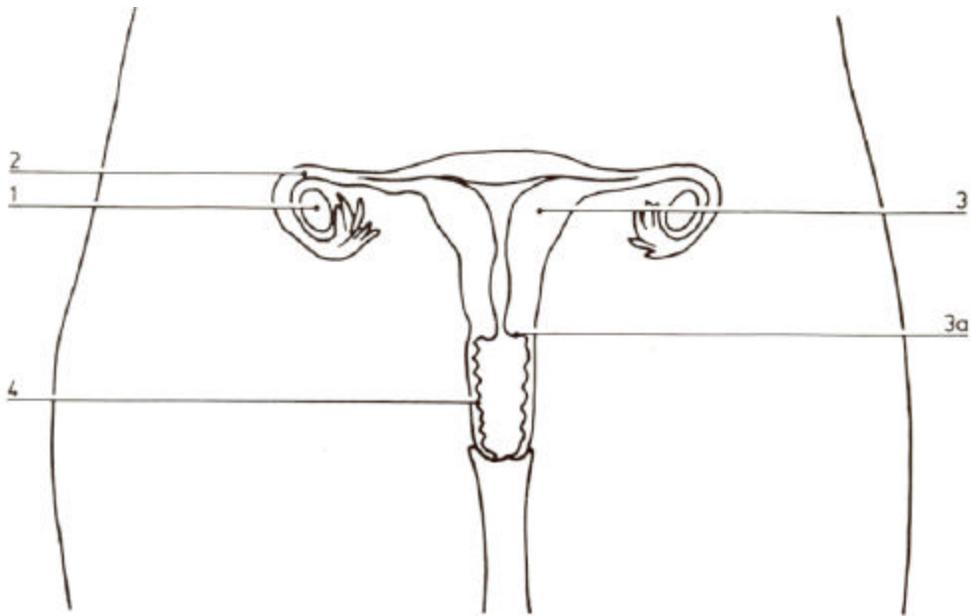
test - testicle

10. A **hysterectomy** is the surgical removal of the uterus. An **orchietomy** is the surgical removal of a testicle. A **mammogram** is an x-ray of the breasts to detect the presence of cancer. A **prostatectomy** is the surgical removal of the prostate gland. A **gynecologist** is a physician who specializes in the reproductive system and the diseases associated with women.

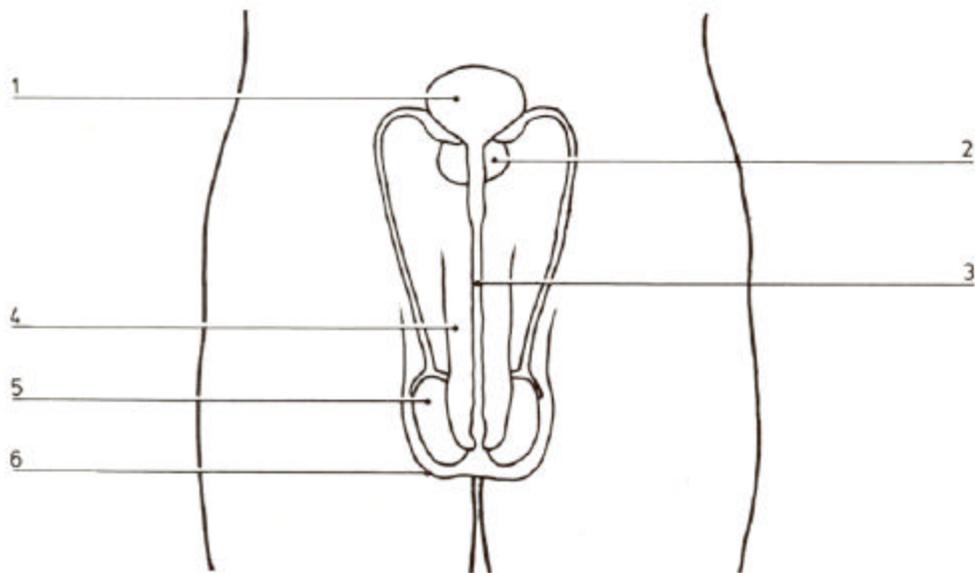


URINARY SYSTEM

- | | |
|----------------------|---------------------------|
| 1. Right kidney | 4. Trigone of the bladder |
| 2. Left ureter | 5. Prostate (male) |
| 3. Bladder | 6. Urethra |
| 7. Meatus of urethra | |



- 1 Ovary
 2 Fallopian tube
 3 Uterus
 3a Cervix
- 4 Vagina **Anterior view of the female genital system**



Anterior view of the male genital system

- | | |
|-------------|------------|
| 1. Bladder | 4. Penis |
| 2. Prostate | 5. Testes |
| 3. Urethra | 6. Scrotum |

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ALIMENTARY SYSTEM

1. The **alimentary** (digestive) **system** is responsible for the digestion of food. The process involves the breaking down of large, complex compounds into simple ones that are easily absorbed into the blood stream for use by the body's cells. The main functions of the alimentary system are to take in nutrients and eliminate wastes.
2. The alimentary system consists of the **alimentary canal** which, for general purposes, is a tube about 30 feet long and runs from the mouth to the anus, and accessory organs which empty their contents into the alimentary canal. The alimentary canal is comprised of the **mouth, esophagus, stomach, small intestine, large intestine, rectum, and anus**. The accessory organs are the **salivary glands, liver and biliary tract, and the pancreas**. See the illustration for a diagram of the digestive system.
3. The digestive process begins even before you take in food. The sight and smell of food will trigger the central nervous system to instruct the accessory organs to prepare the canal for food intake. The salivary gland, stomach, and pancreas start to secrete a watery solution in order to aid in the process of digestion. These secretions help to make the food easier to chew, swallow, and digest. They also aid in the protection of the canal from trauma by lubricating the lining of the canal. The accessory glands also secrete enzymes which aid in the breakdown of the large compounds into smaller ones so that they can be readily absorbed into the bloodstream.
4. Food is first taken into the canal through the **mouth**. In the mouth, food is mixed with saliva which is secreted by the salivary glands, chewed, and swallowed. The contents are then passed through the esophagus into the stomach, a large muscular organ, which mixes the food with the secretions from the gastric glands and converts the contents into a semiliquid called **chyme**. The chyme then leaves the stomach and enters the small intestine. In the small intestine, chyme is then mixed with the secretions from the liver and biliary tract and the pancreas. This mixing breaks down the chyme into absorbable compounds which are readily taken into the bloodstream. In the small intestine **bile** is secreted by the liver and biliary tract. The gall bladder stores bile until it is needed for digestion. Bile is required for the breakdown of fats into simpler compounds. The **liver**, which is vital to the alimentary canal for secreting bile, has other life sustaining responsibilities. This organ (liver) is responsible for purifying blood by removing and breaking down chemicals that could be harmful to our bodies.
5. Almost all the organs which make up the alimentary canal can be bypassed or removed, and life can still be maintained by use of **feeding tubes** by which nutrients can be delivered either through the nose/mouth or directly into the stomach or small intestine. Administration of insulin and synthetic pancreatic enzymes can replace the loss of function of the pancreas. The liver's function cannot be replaced synthetically

and, without the liver, life cannot be sustained. Liver transplants, fortunately, have made it possible for individuals with liver disease to lead a normal life.

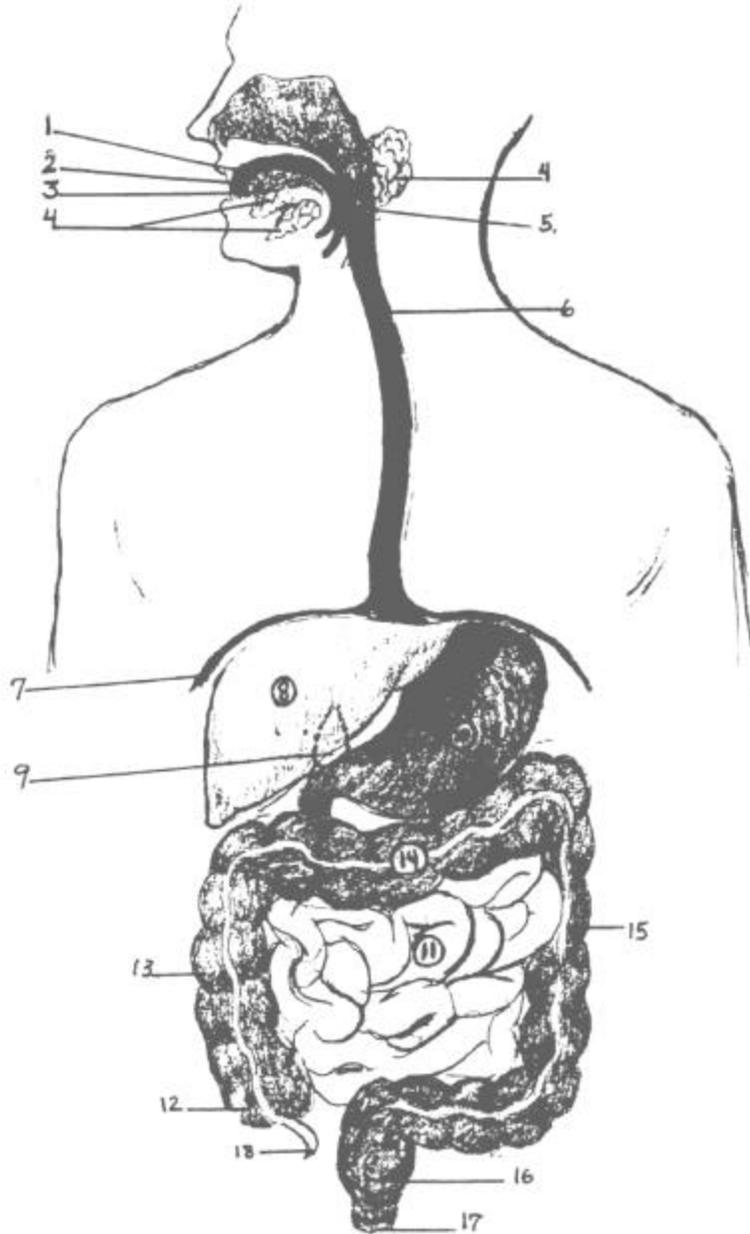
6. The **small intestine** is divided into three parts: the **duodenum**, **jejunum**, and the **ileum**. It is the longest segment of the alimentary canal, averaging about 23 feet long. Most all of the absorption of nutrients and water takes place in the small intestine. Contents that are not absorbed in the small intestine are then emptied into the large intestine. The large intestine consists of five portions: the **ascending colon**, **transverse colon**, **descending colon**, **sigmoid colon**, **rectum**, and **anus**. As the contents move through the large intestine more water is absorbed into the bloodstream. The contents not absorbed are collected into the rectum and eliminated through the anus as fecal waste.

7. As mentioned earlier in this chapter, the movement of contents through the alimentary canal is brought about by **peristalsis**, the wave like motion which is caused by the involuntary muscles of the canal.

8. The following terms are used to describe the alimentary system:

bil - bile	chol - bile
col - colon	gastr - stomach
gloss - tongue	glotl - tongue
hepat - liver	ile - intestines (ileum)
insul - insulin	nutri - nourish
or - mouth	peps - digest
pept - digest	phag - eat
proct - anus	sial - saliva
stomata - mouth	

9. A **colonoscopy** is the visual inspection of the colon by means of a flexible endoscope. A **proctoscope** would view the rectum and anus areas and a gastroscope would view the stomach. **Stomatitis** is an inflammation of the mouth. A cholecystectomy is the surgical removal of the gall bladder. An **ileostomy** is the surgical creation of an opening in the ileum through the abdominal wall, thus creating a **stoma** (mouth) for the removal of fecal wastes.



DIGESTIVE SYSTEM

- | | |
|--------------------|----------------------|
| 1. Mouth | 10. Stomach |
| 2. Teeth | 11. Small intestine |
| 3. Tongue | 12. Cecum |
| 4. Salivary glands | 13. Ascending colon |
| 5. Pharynx | 14. Transverse colon |
| 6. Esophagus | 15. Descending colon |
| 7. Diaphragm | 16. Rectum |
| 8. Liver | 17. Anus |
| 9. Gallbladder | 18. Appendix |

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INTEGUMENTARY SYSTEM

1. The **skin** or **integument** is not often thought of as a system, but the skin and its appendages play an important role in maintaining homeostasis. The **skin** is composed of two layers: the **epidermis** and the **dermis**. The skin's appendages are the **hairs** and **nails**. See the illustration for a diagram of skin. The primary function of skin is to provide protection from the environment. It protects deeper tissues from injury by containing the fluids within the body to keep the tissues moist and viable, and creates a barrier so that foreign organisms cannot penetrate and cause injury or disease. It also protects us from the ultraviolet rays of the sun.
2. The **epidermis** is the outer layer of skin, which is a thin layer (except on the palms of the hands and soles of the feet) of epithelial tissue. The exposed outer portion is actually made up of dead skin cells that are constantly shedding off and being replaced with new tissue from the bottom. The new cells continue to move upward toward the surface where they die and are sloughed off. The epidermis contains only a few nerve cells and no blood vessels. The epidermis has many delicate creases in its outer surface. These creases help give skin its elasticity. The palms of the hands and the soles of the feet differ from the other areas. These areas have ridges and grooves which become elaborated loops and whorls as they extend out the digits (fingers and toes). These intricate patterns are what we call **fingerprints** and **footprints**. These same ridges and grooves are what enable us to achieve a firm grasp when holding or walking on smooth objects. These elaborate loops and whorls are unique in that none are alike, which is why we can use fingerprints and footprints to identify individuals.
3. The **dermis**, which lies underneath the epidermis, is thicker than the top layer and provides cushioning during injury. This layer contains a dense network of blood vessels (capillaries) and numerous nerve cells. The capillary network not only provides needed nutrients to the skin tissue but helps regulate body temperature. When the vessels dilate, large amounts of blood are circulated to the exterior surface and heat is radiated to the outside of the body. During colder temperatures, the vessels constrict to conserve body temperature. Thus the skin serves as a temperature regulator by controlling the amount of heat loss to the outside or retained by the body. The nerve cells located in the dermis serve to help us communicate with our environment. These nerve cells help communicate stimuli to the nervous system in order to perceive **pressure, pain, heat, cold, and touch**. The dermis also contains cutaneous glands of which there are two types: **sweat** (sudoriferous) and **oily** (sebaceous). The sweat glands help with temperature regulation. As the body temperature rises, the nervous system alerts these glands and they respond by producing sweat which is excreted to the outside of the body and is evaporated. This process lowers the body temperature. The oily glands are located around hair follicles and secrete sebum which coats and protects hair follicles.

4. The **appendages** of the skin are the **hairs** and **nails**. **Hair follicles** are surrounded by nerve cells which increase our awareness to touch. They are surrounded by tiny bundles of smooth muscles which, when contracted, help put pressure on the oily glands to secrete sebum. These tiny clusters of smooth muscles are also responsible for giving rise to "**goose bumps**" when they contract as a group. The **nails** are very hard epithelial cells which are located at the end of each digit (finger/toe). Their primary function is to serve as a barrier to wear and tear to the end of the digits.

5. The skin and its appendages serve as our first line of defense against infection and invasion by organisms. Keeping the skin intact decreases our susceptibility to disease processes. Large areas of skin loss (such as in burns) can be fatal due to loss of body fluids and infection.

6. The following terms are used to describe the integumentary system:

cut - skin

derm - skin

hidr - sweat

onych - nail

pell - skin

pil - hair

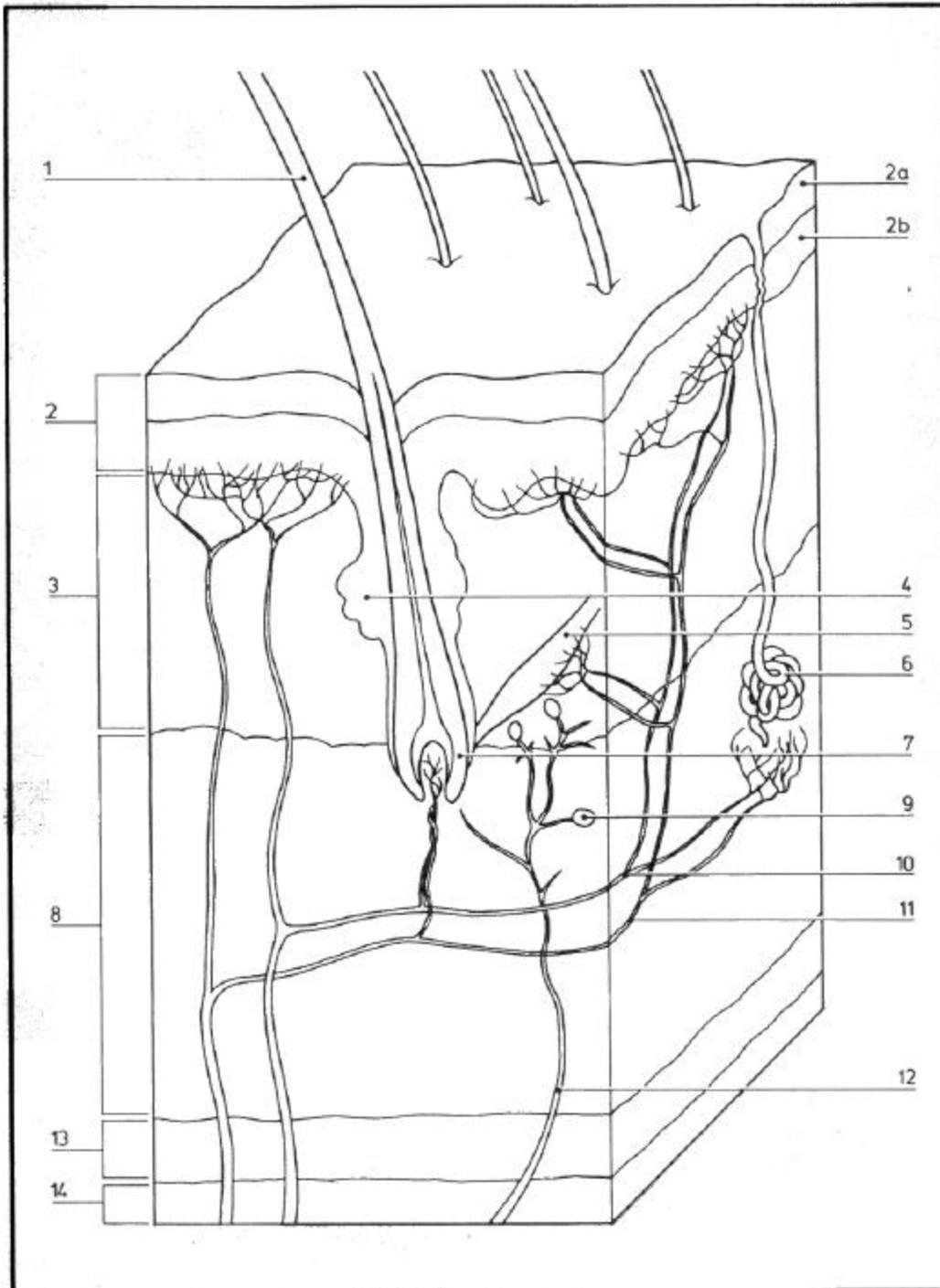
sarc - flesh

tact - touch

teg - to cover

7. A **dermatologist** is a physician who is concerned with the diagnosis and treatment of skin disorders. **Dermatitis** is an inflammation or infection of the skin. The **integumentary system** is the outside covering of the human body.

Skin



Section through hairy skin

- 1 Hair shaft
- 2 Epidermis
- 2a Layers of keratinization
- 2b Germinative layers
- 3 Corium (dermis)
- 4 Sebaceous gland
- 5 Arrector pili

- 6 muscle
- 7 Sweat gland
- 8 Hair bulb
- 9 Subcutis (subcutaneous tissue)
- 10 Bulbous nerve ending
- 11 Branch of vein
- 12 Branch of artery
- 13 Cutaneous nerve

- 13 Deep fascia
- 14 Muscle layer

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ENDOCRINE SYSTEM

1. The **endocrine system** is unique in that it is not an anatomically connected system. The glands that comprise this system are located throughout the human body. The term endocrine means to secrete from within. The glands do not have ducts and are sometimes referred to as the "**ductless glands.**" The endocrine glands deliver their secretions directly into the bloodstream where they are directed throughout the body. The glands secrete substances called **hormones**. Hormones are chemical substances which tell other tissues of the body to perform a task. Some hormones even direct other endocrine glands. They are directly responsible for growth and development, the movement of chemicals in the body, blood pressure, labor and lactation (breast milk), metabolism, stress responses, and other body functions. The major endocrine glands are the **pituitary** (hypophysis), **thyroid**, **thymus**, **parathyroids**, **adrenal glands**, **pancreatic islets**, **ovaries**, and the **testes**. See the illustrations for the female and male endocrine systems.

2. The **pituitary gland** (hypophysis), which is called the **master gland** because of its control over the functions of the other endocrine glands, regulates growth (skeletal), reproductive activities, muscle, and blood functions. The **thyroid gland** regulates metabolism and requires the compound iodine for normal function. The **parathyroid glands**, usually there are four, control the amount of calcium in the blood. The **adrenal glands** are responsible for our responses to stressful situations. During emergency situations the suprarenals secrete adrenalin which acts on smooth muscles, and increases the circulation of glucose for use by the bodies tissues. This effect is known as the "**fight or flight**" syndrome. This reaction allows the body to prepare to fight for its life or remove itself from the situation by providing the energy necessary to generate the response. The **pancreatic islands** or **islands of langerhans** of the pancreas secrete **insulin**. Insulin regulates the sugar content of the body. As mentioned in the urogenital system section, the **ovaries** and **testes** secrete hormones that control secondary female and male sex characteristics.

3. The following terms are used to describe the endocrine system:

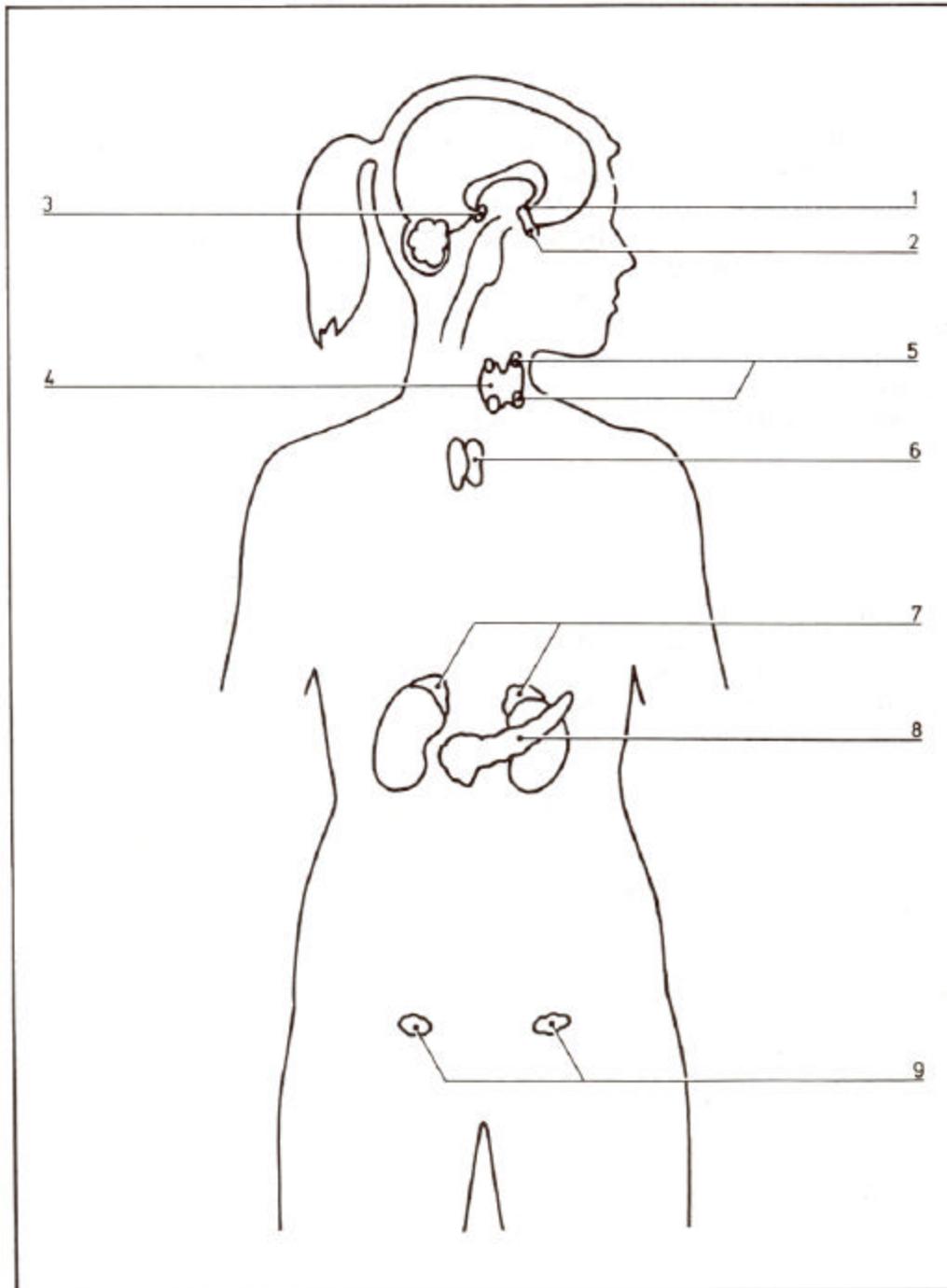
adren - adrenal gland (suprarenal)

insul - insulin

thyr - thyroid

4. An **insulin pump** is a device which is implanted under the skin which delivers synthetic insulin for the metabolism of sugar. A **thyroidectomy** is the surgical removal of the thyroid gland. **Thyropenia** is a condition where the thyroid gland does not produce enough of the thyroid hormones.

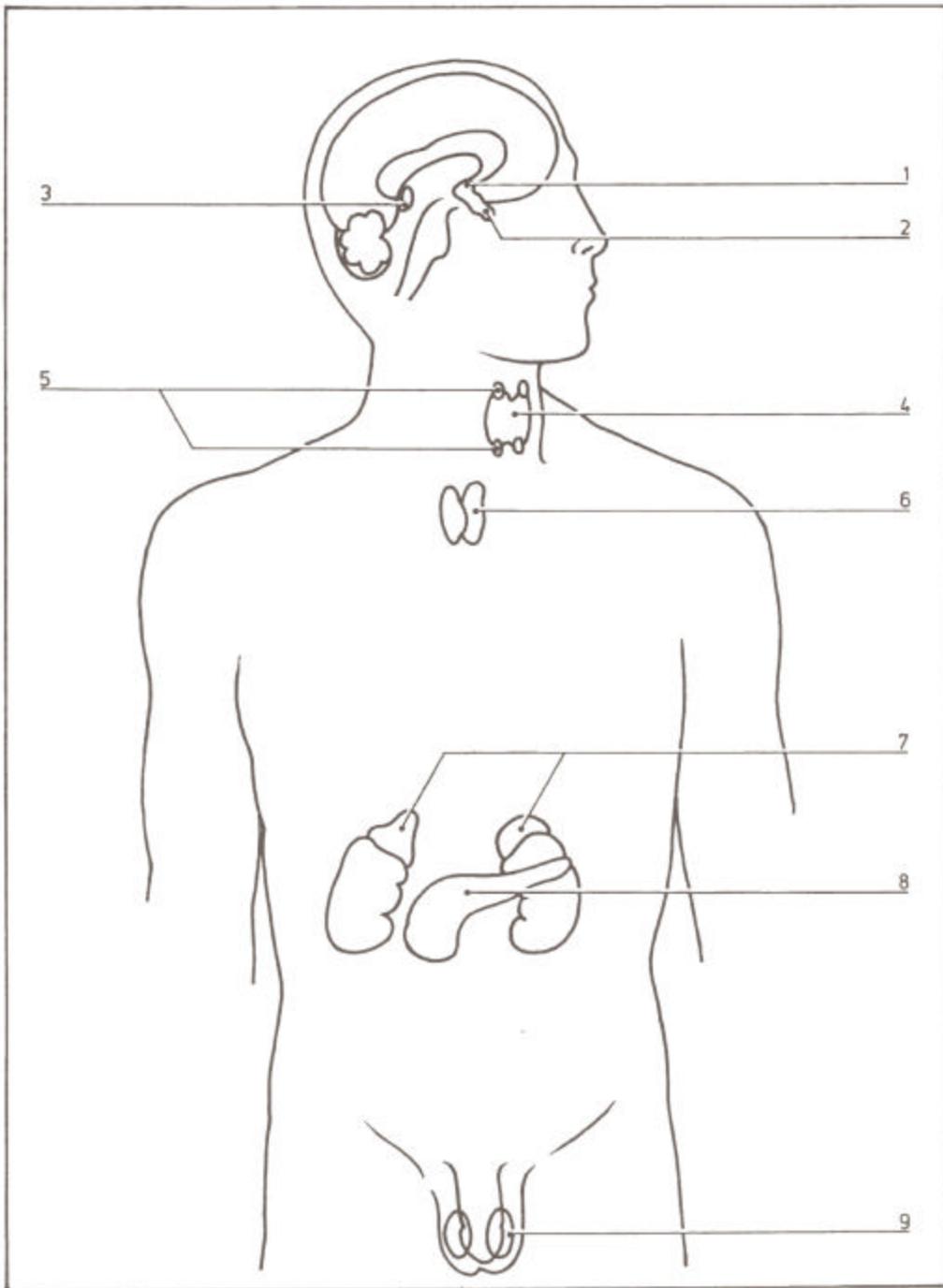
DIAGRAM: FEMALE



- 1 Hypothalamus
- 2 Pituitary gland (hypophysis)
- 3 Pineal gland (epiphysis)
- 4 Thyroid gland
- 5 Parathyroid glands
- 6 Thymus
- 7 Adrenal (suprarenal) glands
- 8 Pancreas
- 264 9 Gonads (ovaries)

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DIAGRAM: MALE



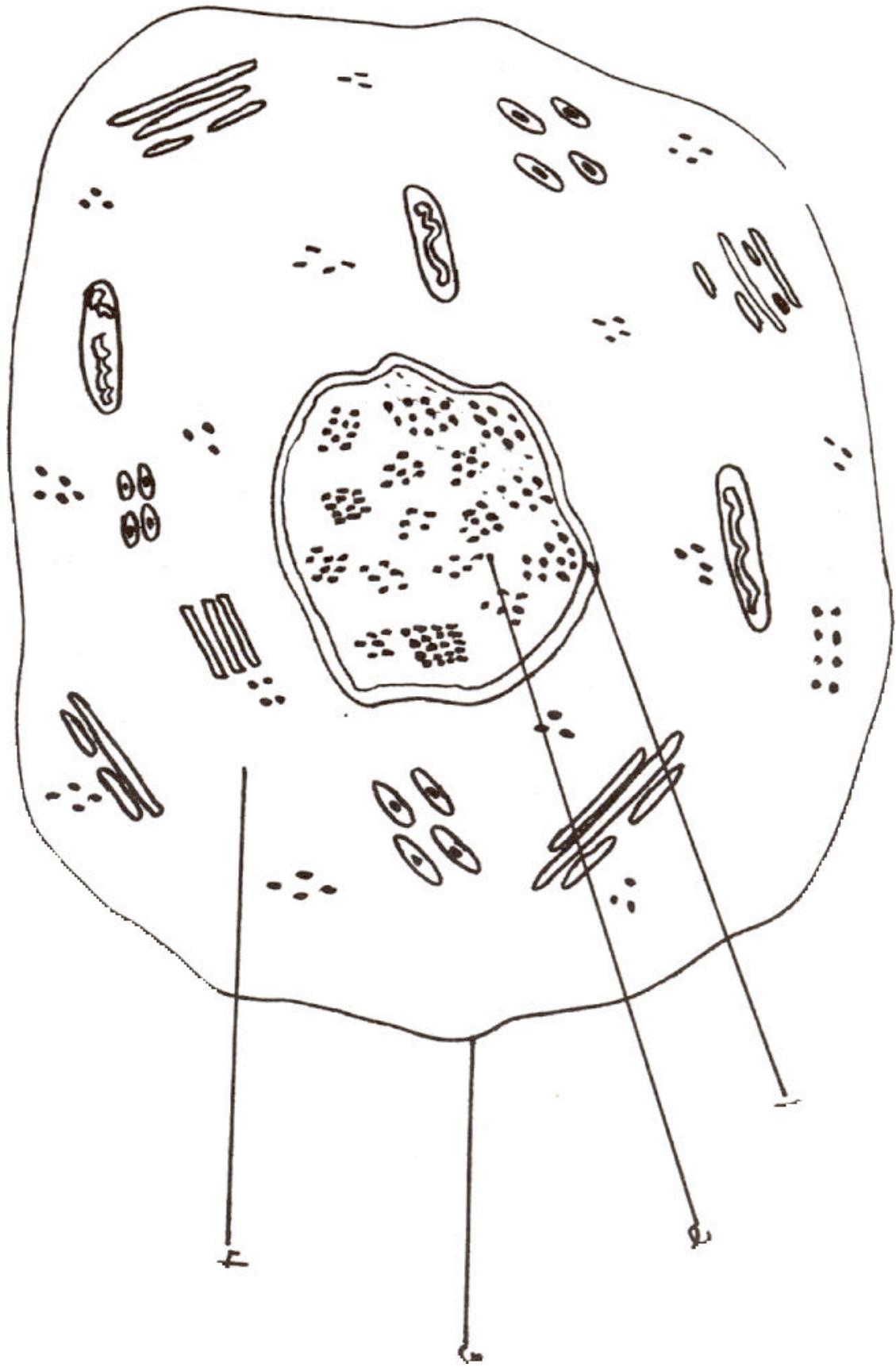
- 1 Hypothalamus
- 2 Pituitary gland (hypophysis)
- 3 Pineal gland (epiphysis)
- 4 Thyroid gland
- 5 Parathyroid glands
- 6 Thymus
- 7 Adrenal (suprarenal) glands
- 8 Pancreas
- 9 Gonads (testes)

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CYTOLOGY

1. Cytology is the study of the structure and function of cells. Cells are the basic building blocks of all living things. Cells are microscopic in size and each specializes in a particular function. Although cells differ functionally, they all have common physical features and multiply by the same basic process. Cytology is necessary for the medical supply technician in order to understand how diseases are transmitted and how to control the spread of diseases through infection control mechanisms.
2. The basic structure of a human cell contains: a **nucleus**, a **nuclear membrane**, **cytoplasm**, and a **cell membrane**. See the illustration for a diagram of a cell. The **nucleus** of the cell contains the genetic substance which carries all the information involved in determining the genetic or hereditary makeup of each individual. This genetic substance is called **DNA** (Deoxyribonucleic Acid). DNA molecules are arranged as a double helix or double spiral chains which are connected together by amino acids. These connections are arranged specifically to generate an individual's traits. During cell multiplication, DNA thins out into threads which become chromosomes. Each cell in the human body contains 46 chromosomes. A **nuclear membrane** surrounds the nucleus. **Cytoplasm** is the jelly-like filled area outside of the nuclear membrane. This area is the work area of the cell and contains numerous structures (intracellular bodies and organelles) that produce energy for the cell's functions. Cellular functions include protein synthesis and cellular metabolism (growth, maintenance, and repair). The cytoplasm is surrounded by a **cell membrane**.
3. New cells are needed on a continuous basis and the requirements change as we age. As infants, children, and adolescents, the human body requires numerous new cells for growth and development. As we age new cells are required to replace those that are dying. The skeletal system's cells are replaced every 7 years. Taste buds in the mouth are replaced every 30 hours. Blood cells are in constant demand by the body. However, there are some types of cells that are not replaced as they age and die. The muscle and nerve cells are examples of cells that are not replaced.
4. Cells multiply by a process called **mitosis**. When the process is completed, two identical cells emerge. The process begins when the 46 chromosomes thicken, contract, and form 23 pairs. They then proceed to make 23 exact copies of themselves through a process called **replication**. When replication is completed, the 23 pairs line up along the center of the cell and the new chromosomes split and go to the opposite ends. A new cell membrane forms across the middle of the cell, the cell then divides, the chromosomes begin to lengthen, and two identical cells are formed.
5. **Cancer** is usually caused by cellular genes that have been abnormally activated or mutated. These cells are usually those that control cell growth and mitosis. These abnormal cells are called oncogenes. **Oncology** is the study of tumors.



ANATOMY AND PHYSIOLOGY

TRUE/FALSE

1. The study of human anatomy and physiology provides the medical supply technician with basic knowledge in order to understand the reasons for policies and procedures.
2. A system is defined as a group of systems working together to achieve common goals.
3. The basic building block of all living things is called the neuron.
4. Bones are strong fibrins bands.
5. The skeletal systems forms the hard framework which contains the human body systems.
6. The spinal column is an example of bones held together by synovial joints.
7. A surgical instrument used to cut a joint is called a ligatome.
8. A muscular system provides for our ability to maintain posture.
9. Striated muscle has a smooth appearance under the microscope.
10. Skeletal muscles are attached to bones by ligaments.
11. Voluntary muscles tire easily.
12. The digestive process begins after food is swallowed.
13. Food is first taken into the canal through the mouth.
14. As the contents move through the large intestines water is added for easier passage.
15. An inflammation in the mouth is called stomatitis.
16. A cholecystectomy is the surgical removal of the gallbladder.
17. A colonoscopy is the visual inspection of the colon by means of a rigid telescope.
18. In the mouth food is mixed with chyme.

19. In the small intestine chyme is mixed with the secretions from the liver, biliary tract and the pancreas.
20. The alimentary systems main function is to take in nutrients and produce white blood cells.
21. The small intestine is composed of three parts, the duodenum, jejunum and the ileum.
22. The kidney can filter a quart of blood per minute.
23. The human body must have at least one functioning kidney to maintain life.
24. Human reproduction begins when the sperm penetrates the fallopian tubes.
25. The genital system is responsible for filtering waste products from the blood and eliminating from the body.
26. An orchiectomy is the surgical removal of the prostate gland.
27. A gynecologist is a physician who specializes in the reproductive system and diseases associated with women.
28. The bladder is where urine is formed.
29. The glands that comprise the endocrine system lead into the pelvis of the kidney.
31. The glands of the endocrine system secrete substances called hormones.
32. Growth and development are responsibilities of the endocrine system.
33. The pituitary gland is called the master gland, because of its control over the functions of the other endocrine glands.
34. The thyroid gland controls the amount of calcium in the blood.
35. The suprarenal glands regulate metabolism and requires the compound iodine for normal functions.
36. The aruba islands or islands of the Bahamas secrete insulin.

37. A device that delivers synthetic insulin for the metabolism of sugar is called an insulin pump.
38. The endocrine glands deliver their secretions directly into the lungs where oxygen is directed throughout the body.
39. Cytoplasm produces energy for the cells function.
40. All human cells are replaced when they die.
41. Cells are basic building blocks of all living things.
42. DNA is the genetic substance which determines the genetic or hereditary traits of each individual.

COMPLETE THE BLANKS

43. The skeleton is made up of _____ bones.
44. Bones are _____ by their shape.
45. The four classifications of bones are _____, _____, _____, and _____.
46. _____ is the study of bones.
47. Bones are held in place by _____.
48. Muscular _____ allow for movement of the bones at the joint.
49. The minerals _____ and _____ make bones hard and dense.
50. _____ is the inflammation of a bone.
51. Arthrology is the study of _____.
52. The three types of joints are _____, _____, and _____.
53. Bones of the skull are examples of _____ joints.
54. _____ joints allow for free movement.
55. Examples of synovial joints are the _____, _____, and _____.

56. _____ fluid helps lubricate and protect a free movement joint.
57. _____ is the study of the structure of the human body.
58. _____ is the study of the functions of the human body.
59. The human body is made up of _____ systems.
60. The human body is made up of the _____, _____, _____, _____, _____, _____, _____, and _____ systems.
61. There are three types of muscles, _____ (or skeletal), _____ (or visceral), and _____ (or heart).
62. Voluntary muscles are also called _____ muscles.
63. _____ muscles provide for the movement of blood throughout the vascular system.
64. Involuntary muscles are sometimes referred to as _____ muscles.
65. _____ is the study of muscles.
66. The vascular system is made of two parts, the _____ and the _____ system.
67. The vascular system consists of the _____, _____, _____, _____, _____, _____, and _____.
68. The _____ system is responsible for transporting _____ which is used by the respiratory system.
69. The lymphatic system consists of _____, _____, and _____.
70. The lymphatic system helps remove foreign _____.
71. The heart is a four chambered _____, which facilitates the circulation of _____.
72. The four chambers of the heart are the _____, the _____, the _____, and the _____.

73. The _____ veins are the only veins in the body that carry oxygenated blood.
74. The _____ is the largest artery of the human body.
75. Arteries carry _____ to the tissues of the body.
76. Arteries branch of into _____, which further branch of into _____.
77. It is at the _____ where nutrients, oxygen and other products are absorbed for use by the bodies tissues.
78. Veins carry _____ blood back from the tissue to the heart.
79. Waste products are removed from the tissue by _____, which are branches of the _____.
80. In 4 hours, _____ quarts of blood pass through the heart.
81. The average adult has approximately five quarts of blood in their body, which is recycled through the heart once every _____.
82. Blood consists of _____, _____, _____, and _____.
83. When blood is pumped through the lungs _____ attaches itself to the _____.
84. During physical exercise the muscular system requires large amounts of _____.
85. _____ causes muscles in the _____ to contract and extend which helps squeeze and push blood along the veins.
86. The _____ system drains excess fluids, transports dead blood cells, and _____ products away from the tissue.
87. _____ are cells that eat up disease producing cells.
88. The lymph nodes are located throughout the body along the _____.
89. The spleen, tonsils, lymphnodes and part of the digestive tract act as _____ in that they filter and fight _____.

90. The primary lymphoid organs are the _____ and _____.
91. The urinary systems consists of the _____, _____, _____, and _____.
92. _____ are tiny filtering units of the kidney.
93. The human body excretes about _____ of urine daily.
94. The _____ produce the female hormones estrogen and progesterone.
95. The _____ stores the urine until it is eliminated outside of the body by the _____.
96. A hysterectomy is the surgical removal of the _____.
97. The artificial removal of waste products from the blood is called _____.
98. The _____ produce sperm and testosterone.
99. The urinary (or renal) system is responsible in the formation and elimination of _____.
100. The body maintains _____ by controlling the acid-base balance of the blood and maintaining adequate levels of water, salts, proteins and electrolytes.
101. _____ is the study of structure and function of cells.
102. The basic structure of the human cell consists of _____, _____, _____, and _____.
103. Each cell in the human body contains _____ chromosomes.
104. _____ is the reproductive cell division process.
105. Skeletal system cells are replaced every _____ years.
106. Two examples of cells that do not replace themselves are _____ and _____ cells.
107. The jelly-like filled area outside the nuclear membrane called the work area is the _____.
108. The _____ of the cell contains the genetic substance which determines the genetic makeup of each individual.

MULTIPLE SELECTION

109. The skeletal system provides _____ to the vital internal organs.

- a. water
- b. nerve stimulation
- c. protection
- d. heat

110. Bone marrow is:

- a. soft, fatty tissue which is yellow or red
- b. found inside most bones
- c. firm red and white blood cells
- d. all of the above

111. Peristalsis is: _____.

- a. movement of food from mouth to stomach
- b. rhythmic action of the cardiac muscle
- c. contracting and extension of tendons.
- d. wavelike motion of large and small intestine

112. The alimentary system is responsible for:

- a. Circulation of blood
- b. Carries messages to all parts of the body
- c. Gives form and support to the body
- d. The digestion of food

113. The alimentary canal is about how long:

- a. 3 Ft.
- b. 13 Ft.
- c. 300 Ft.
- d. 30 Ft.

114 Which of these organs are part of the alimentary canal?

- a. Mouth, esophagus and lungs
- b. Stomach, small intestine and rectum
- c. Right atrium, anus, liver
- d. Large intestines, biliary tract and vena cava

115. When chyme leaves the stomach it enters the;
- Liver
 - Small intestine
 - Large intestine
 - Kidneys
116. The small intestine is divided into these three parts:
- Nasal cavity, duodenum, spinal cord
 - Jejunum, pulmonary artery, descending colon
 - jejunum, duodenum, ileum
 - Sigmoid colon, ileum, duodenum
117. The large intestine is divided into these five parts:
- Ascending colon, transverse colon, descending colon, sigmoid colon, rectum and anus
 - Rectum, ascending colon, descending colon, vertical colon, rectum and anus
 - Transverse colon, sigmoid colon, rectum and anus, Horizontal colon, and descending colon
 - Sigmoid colon, ascending colon, descending colon, transverse colon, jejunum
118. The movement of contents through the alimentary canal is brought about by:
- The voluntary muscle movement of the legs
 - The wavelike motion of the trachea
 - Constant pressure on the stomach, caused by voluntary muscle movement
 - Peristalsis the wavelike motion which is caused by the involuntary muscles of the canal
119. Food is first taken into the alimentary system through the:
- Nasal passages
 - Subclavian artery
 - Ascending colon
 - Mouth
120. The accessory glands secrete enzymes which aid in the breakdown of large compounds into smaller ones so they can be readily absorbed into the:
- Chyme
 - Sigmoid colon
 - Blood stream
 - Respiratory system

121. What instrument is used to view the rectum and anus areas:

- a. Endoscope
- b. Gastroscope
- c. Telescope
- d. Proctoscope

Matching:

122. Myo

a. Involuntary

123. Tendonitis

b. Muscle

124. Striated Muscle

c. Inflammation of a tendon

125. Smooth Muscle

d. Voluntary

126. Cytology

e. Basic building blocks

127. Cells

f. Cellular multiplication

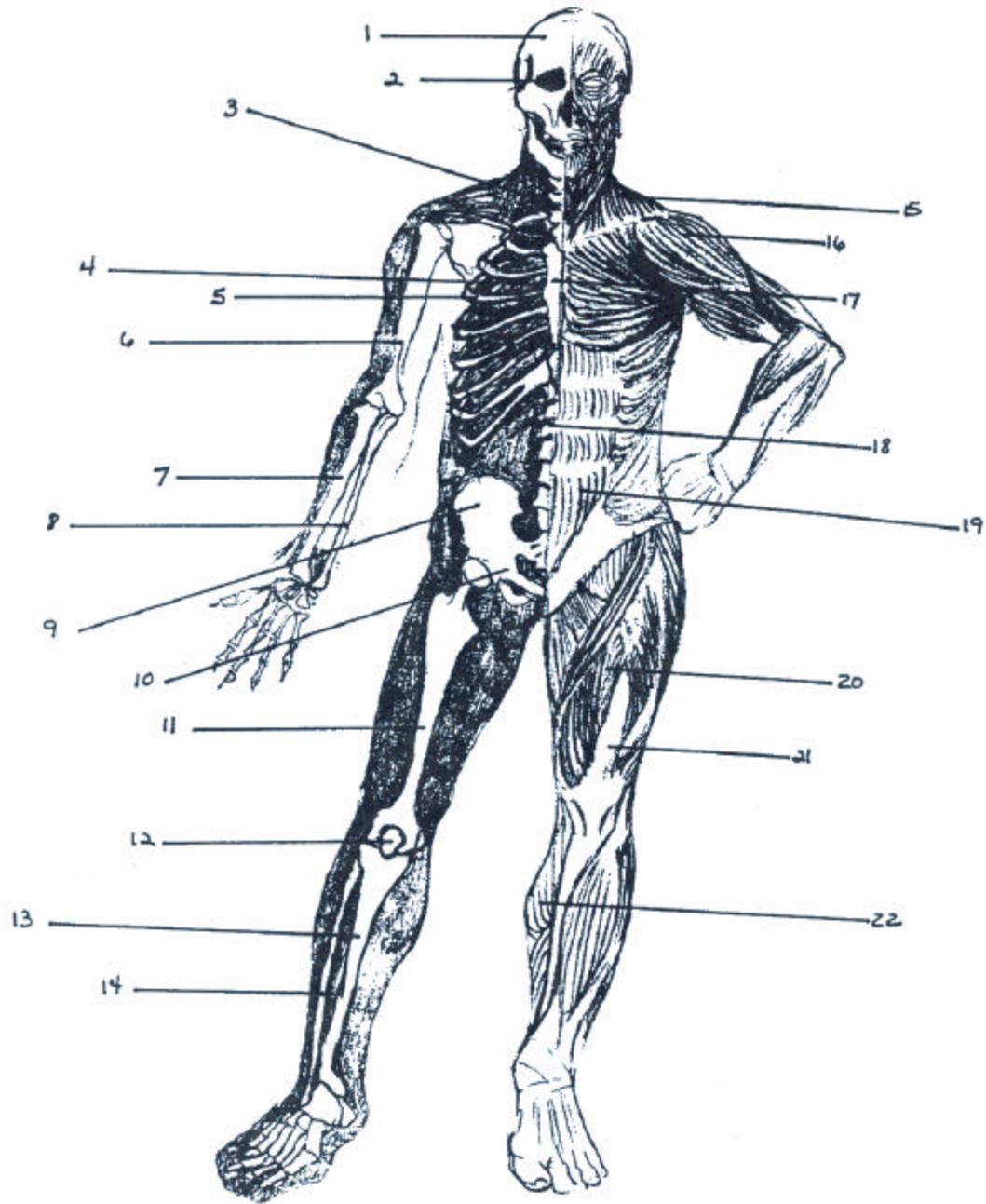
128. Mitosis

g. Study of structure and function of cells

129. Meiosis

h. Reproductive cell division process

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INTRODUCTION SPD

MICROBIOLOGY

DECONTAMINATION

PACKAGING

STERILIZATION

SURGICAL INSTRUMENTATION

STERILE STORAGE

DISTRIBUTION

INVENTORY MANAGEMENT

ANATOMY AND PHYSIOLOGY