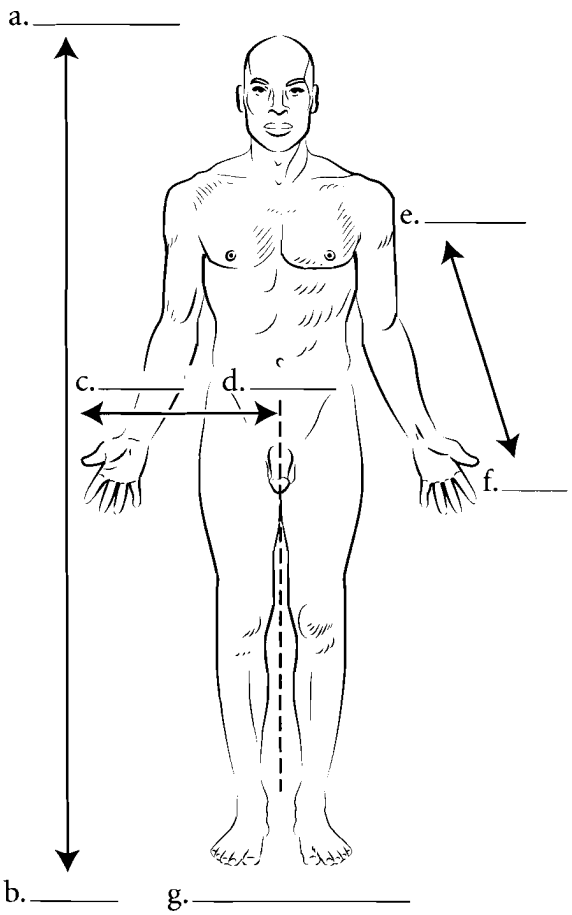
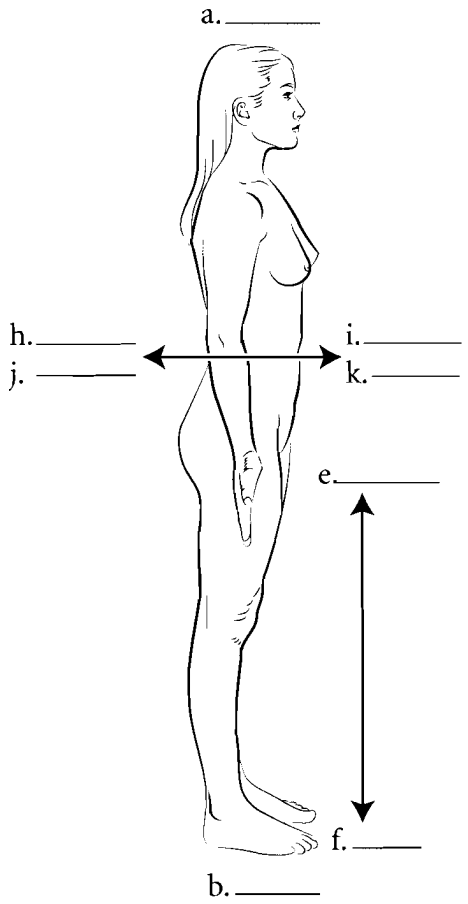
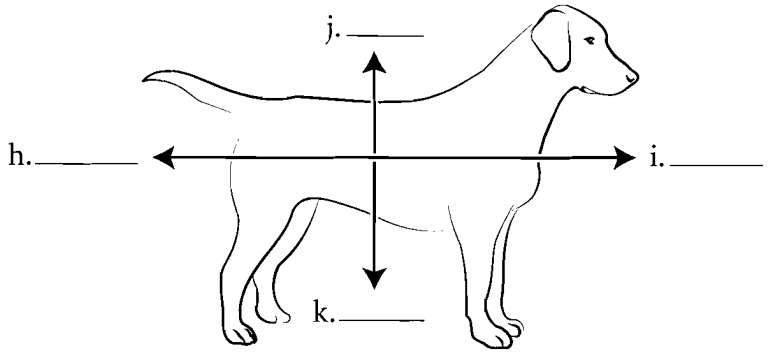
ANATOMICAL POSITION AND TERMS OF DIRECTION

When studying the human body it is important to place the body in anatomical position. **Anatomical position** is described as the body facing you, feet placed together and flat on the floor. The head is held erect, arms straight by the side with palms facing forward. All references to the body are made as if the body is in this position so when you describe something as being above something else it is always with respect to the body being in anatomical position.

The relative position of the parts of the human body has specific terms. **Superior** means above while **inferior** means below. **Medial** refers to being close to the midline while **lateral** means to the side. **Anterior** or **ventral** is to the front while **posterior** or **dorsal** is to the back. Superficial is near the surface while deep means to the core of the body. When working with the limbs, **proximal** means closer to the trunk while **distal** is to the ends of the extremities. Write the directional terms in the spaces provided and color in the arrows in reference to these terms. Note that these terms are somewhat different for four legged animals.



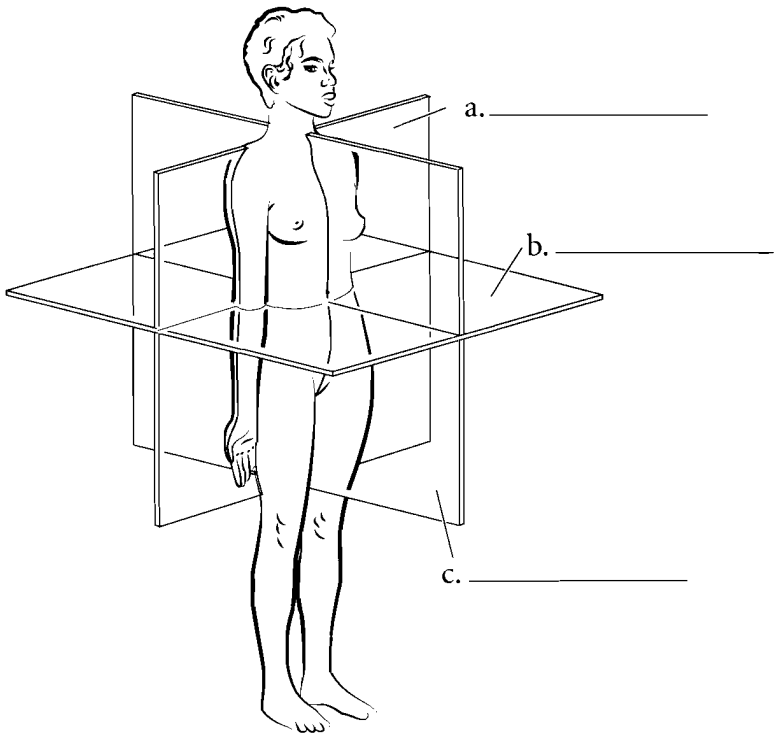


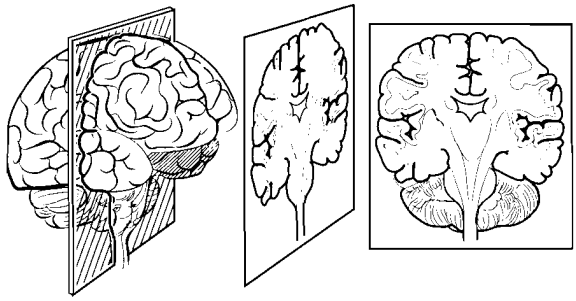


Answer Key: a. Superior, b. Inferior, c. Lateral, d. Medial, e. Proximal, f. Distal, g. Anatomical position, h. Posterior, i. Anterior, j. Dorsal, k. Ventral

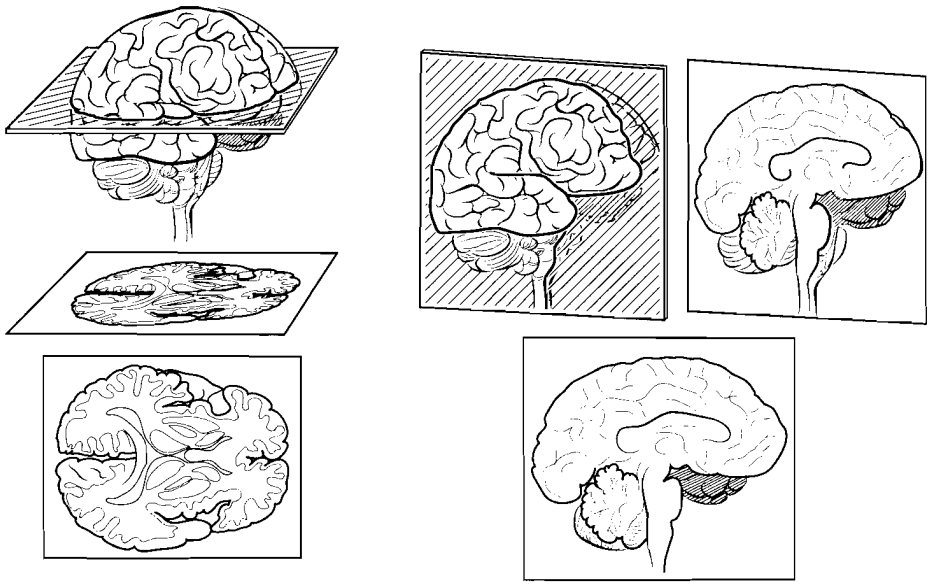
ANATOMICAL PLANES OF THE BODY

Many specimens in anatomy are sectioned so that the interior of the organ or region can be examined. It is important that the direction of the cut is known so that the proper orientation of the specimen is known. A heart looks very different if it is cut along its length as opposed to horizontally. A horizontal cut is known as a **transverse section** or a **cross section.** A cut that divides the body or an organ into anterior and posterior parts is a **coronal section** or **frontal section.** One that divides the structure into left and right parts is a **sagittal section.** If the body is divided directly down the middle the section is known as a **midsagittal section.** A midsagittal section is usually reserved for dividing the body into to equal left and right parts. If an organ (such as the eye) is sectioned into two equal parts such that there is a left and right half then this is known as a **median section.** Label the illustrations and color in the appropriate planes.





a. _____

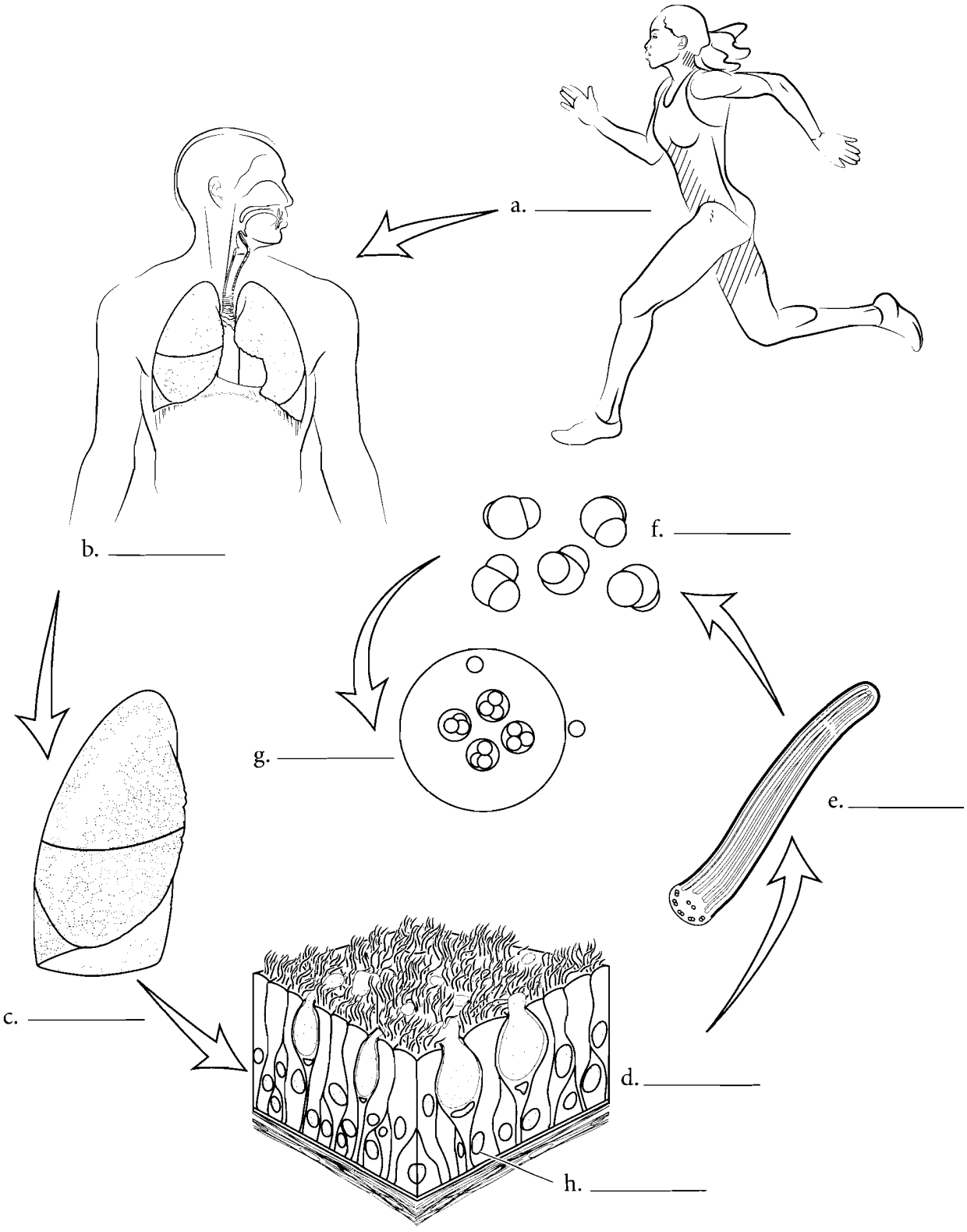


b. _____ c. _____

Answer Key: a. Frontal (coronal) plane, b. Transverse (cross-section) plane, c. Median (midsagittal) plane

HIERARCHY OF THE BODY

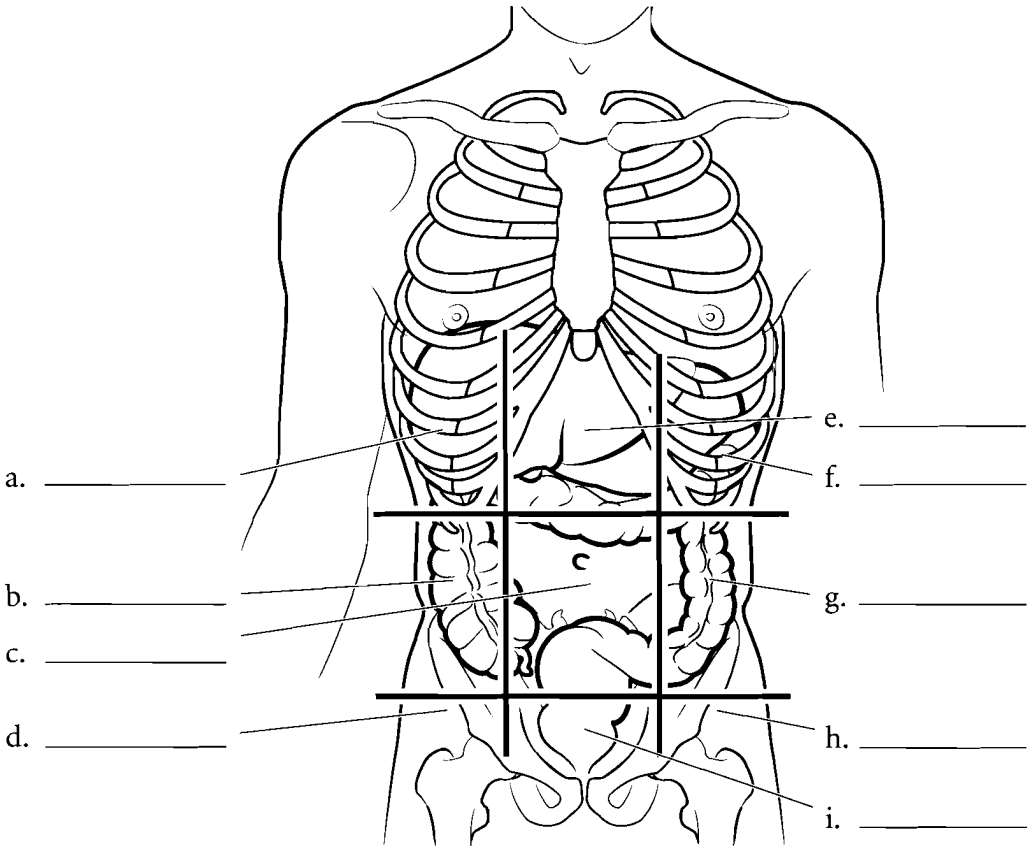
The human body can be studied at different levels. Organs such as the stomach can be grouped into organ systems (digestive system) or can be studied on a smaller scale like the cellular level. The ranking of these levels is called a **hierarchy**. The smallest organizational unit is the **atom**. Individual atoms are grouped into larger structures called **molecules**. These in turn make up **organelles**, which are part of a larger, more complicated systems called **cells**. Cells are the structural and functional units of life. Cells are clustered into **tissues. Organs** are discreet units made up of two or more tissues and organs are grouped into **organ systems** that compose the **organism**. Label the levels of the hierarchy and color each item a different color.



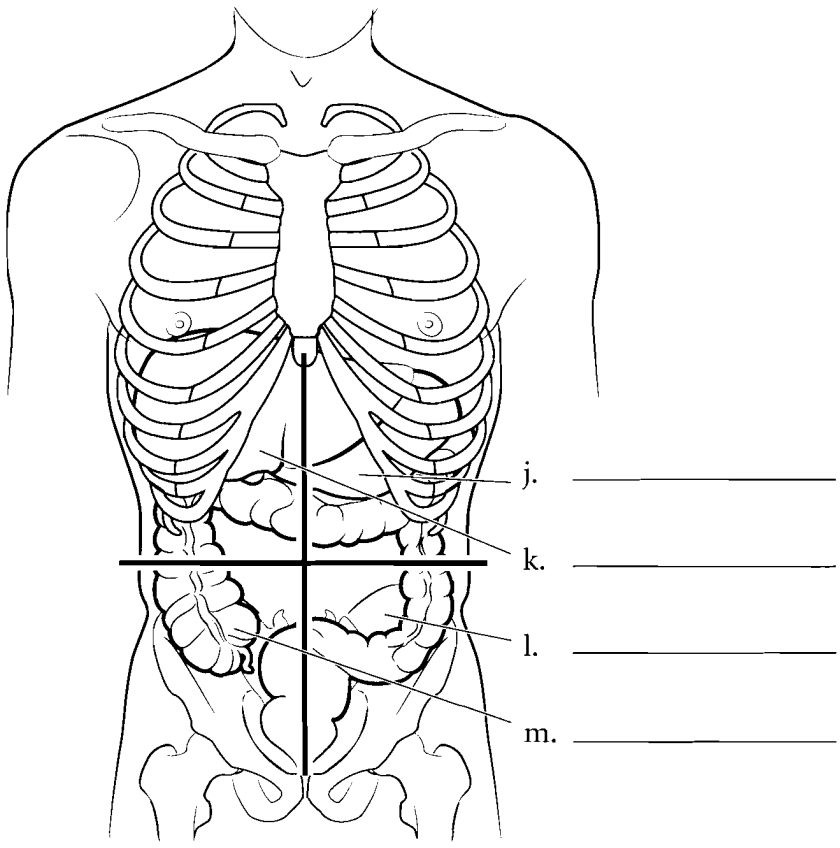
Answer Key: a. Organism (human), b. Organ system (respiratory system) c. Organ (lung), d. Tissue (epithelium), e. Organelle (cilia), f. Molecule, g. Atom, h. cells

REGIONS OF THE ABDOMEN

In anatomy the abdomen is divided into nine regions. Write the names of the regions in the spaces indicated. Color both the left and right **hypochondriac** regions in light blue. Hypochondriac means "below the cartilage." The common use of the word (someone who thinks they are sick all the time) reflects the Greek origin of the word as the ancient Greeks considered the region to be the center of sadness. Inferior to the hypochondriac regions are the **lumbar** or **lateral abdominal** regions. These are commonly known as the "love handles." Use yellow for these regions. Below the lumbar regions are the **inguinal** or **iliac** regions. You should color in these regions with the same shade of green. In the middle of the abdomen is the **umbilical** region. Color this region in red. Above this is the **epigastric** region (*epi* = above and *gastric* = stomach). Color this region in purple. Below the umbilical region is the **hypogastric** region (*hypo* = below). Color this region in a darker blue.



In clinical settings a quadrant approach is used. Write the names of the regions (**right upper quadrant, left upper quadrant, right lower quadrant, left lower quadrant**) in the spaces provided. Color each quadrant a different color.

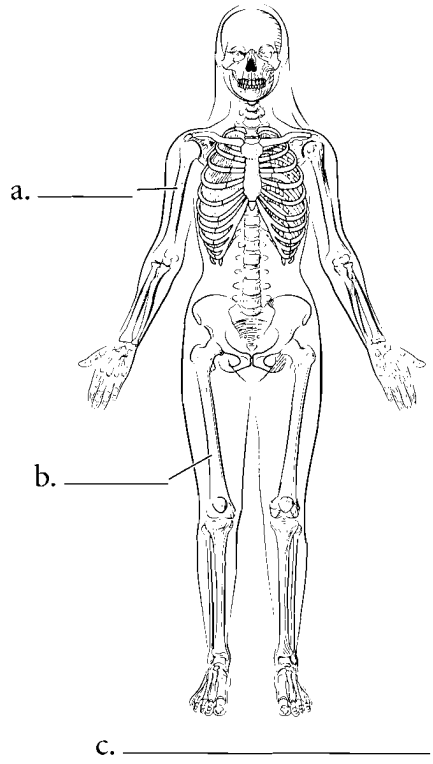


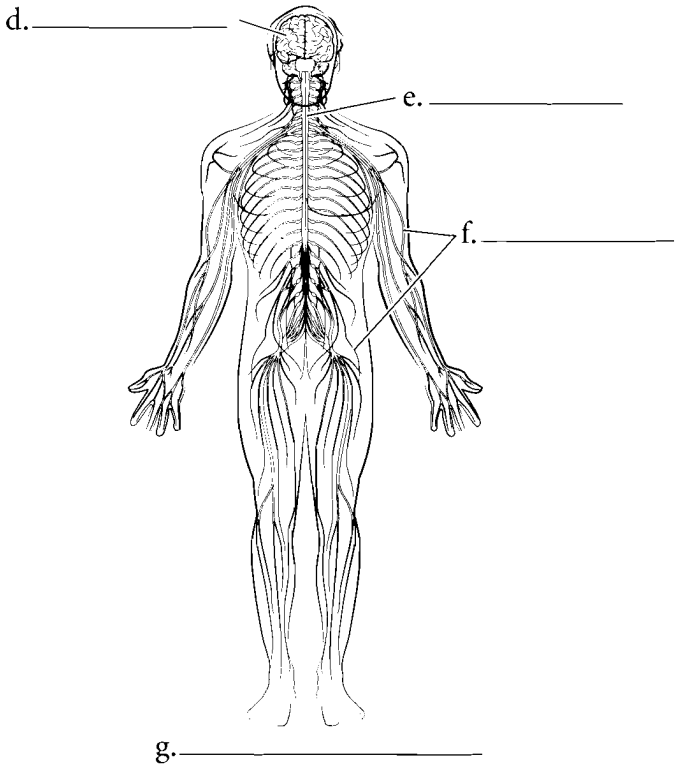
Answer Key: a Right hypochondriac, b. Right lumbar (lateral abdominal), c. Umbilical, d. Right inguinal or iliac, e. Epigastric, f. Left hypochondriac, g. Left lumbar (lateral abdominal), h. Left inguinal or iliac, i. Hypogastric, j. Left upper quadrant, k. Right upper quadrant, l. Left lower quadrant, m. Right lower quadrant

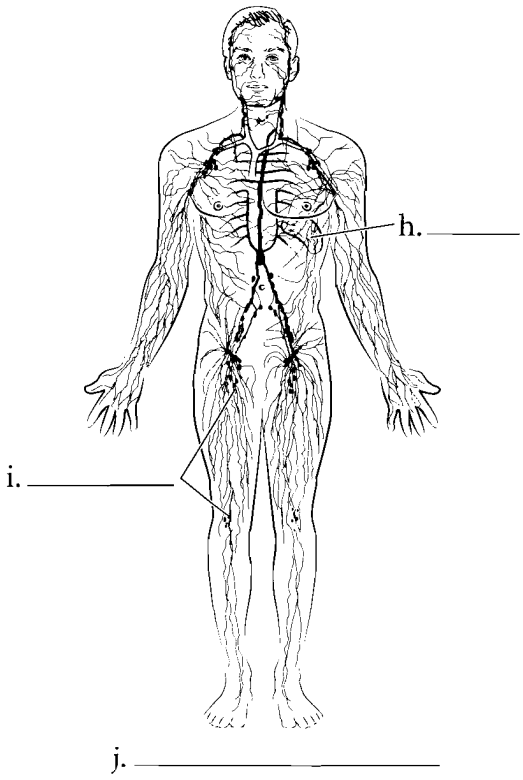
ORGAN SYSTEMS

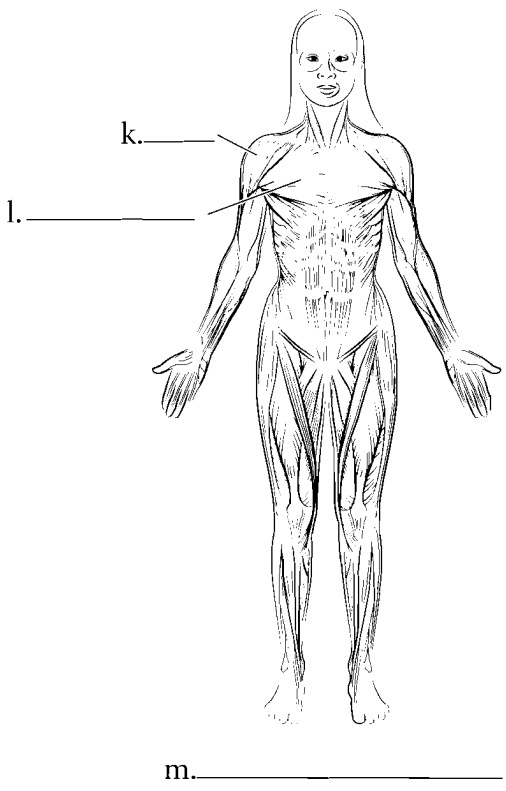
The human body is either studied by regions or by organs systems. This book uses the organ system approach in which individual organs (such as bones) are grouped into the larger organ system (for example, the skeletal system). Typically eleven organ systems are described. The **skeletal system** consists of all of the bones of the body. Examples are the **femur** and the **humerus**. The **nervous system** consists of the **nerves, spinal cord,** and **brain** while the **lymphatic system** consists of **lymph glands**, conducting tubes called **lymphatics**, and organs such as the **spleen**. The term immune system is more of a functional classification and will not be treated as a separate system here. The **muscular system** consists of individual skeletal muscles as organs such as the **pectoralis major** and **deltoid**. Label the organ systems underneath each illustration and label the selected organs by using the terms available. When you finish, select different colors for each organ system and color them in.

Organ System	Organ	Organ	Organ
Skeletal system	Femur	Humerus	
Nervous system	Nerves	Spinal cord	Brain
Lymphatic system	Lymph glands	Spleen	
Muscular system	Pectoralis major	Deltoid	









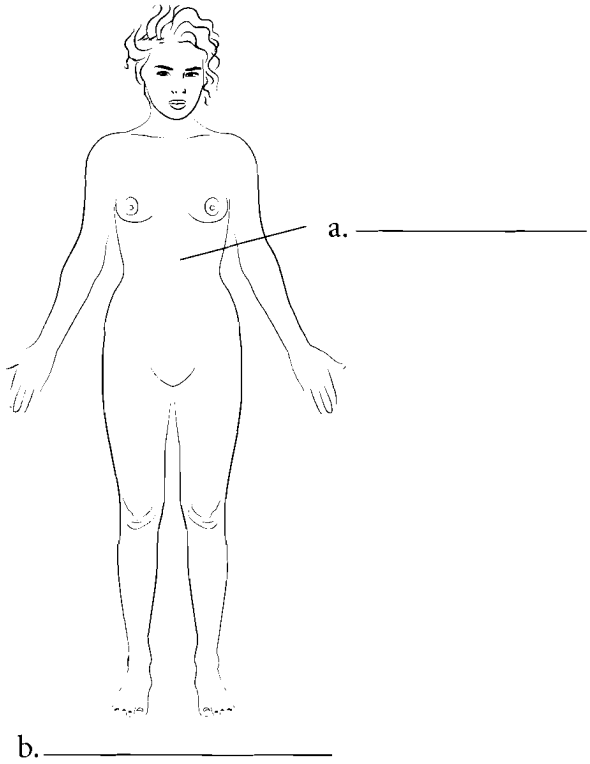
Answer Key:
a. Humerus,
b. Femur, c. Skeletal,
d. Brain, e. Spinal cord, f. Nerves,
g. Nervous,
h. Spleen, i. Lymph nodes, j. Lymphatic,
k. Deltoid,
l. Pectoralis major,
m. Muscular

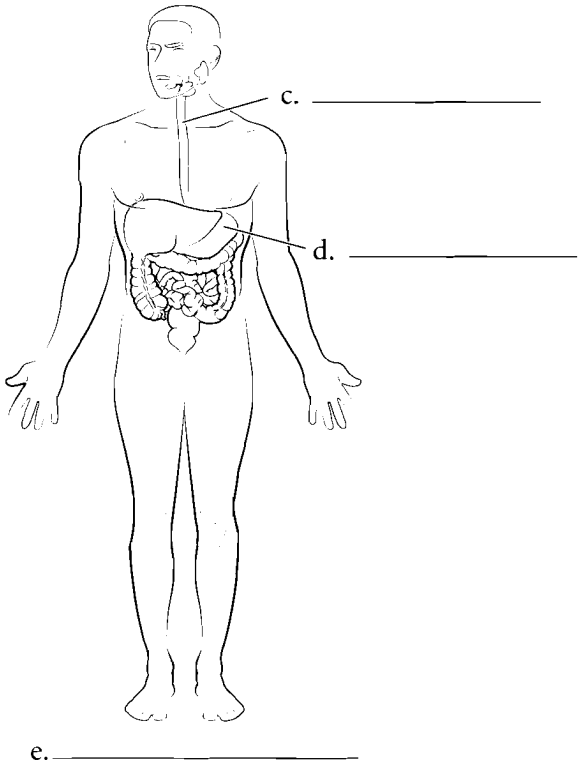
ORGAN SYSTEMS (CONTINUED)

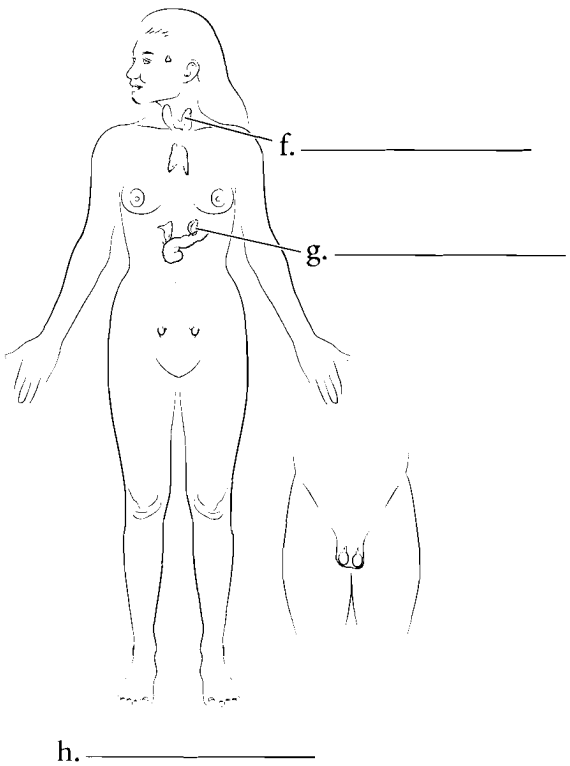
The **skin** and other structures are in the **integumentary system** and the **digestive system** involves the breakdown and absorption of food with organs such as the **esophagus** and **stomach**. The **endocrine system** is made of the glands that secrete hormones such as the **thyroid gland** and the **adrenal glands**. The **respiratory system** involves the transfer of oxygen and carbon dioxide between the air and the blood. The respiratory system consists of organs such as the **trachea** and **lungs**.

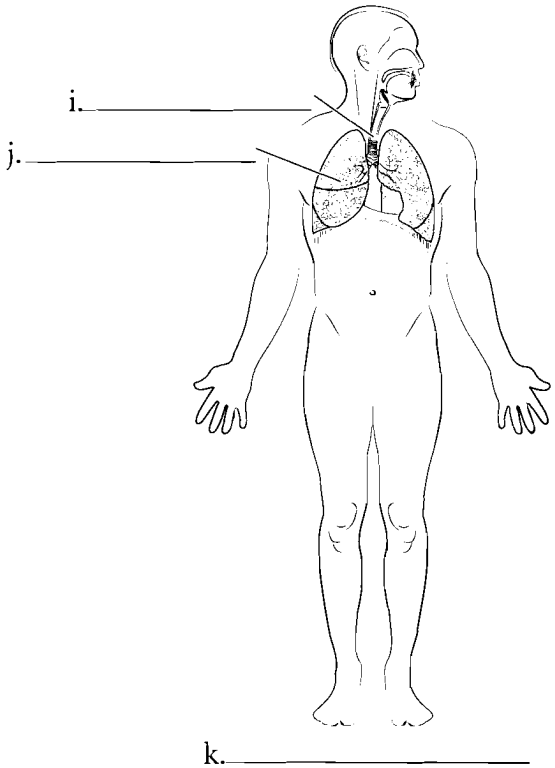
Label the organ systems underneath each illustration and label the selected organs by using the terms available. When you finish, select different colors for each organ system and color them in.

Organ System	Organ	Organ
Integumentary system	Skin	
Digestive system	Esophagus	Stomach
Endocrine system	Thyroid gland	Adrenal glands
Respiratory system	Trachea	Lungs







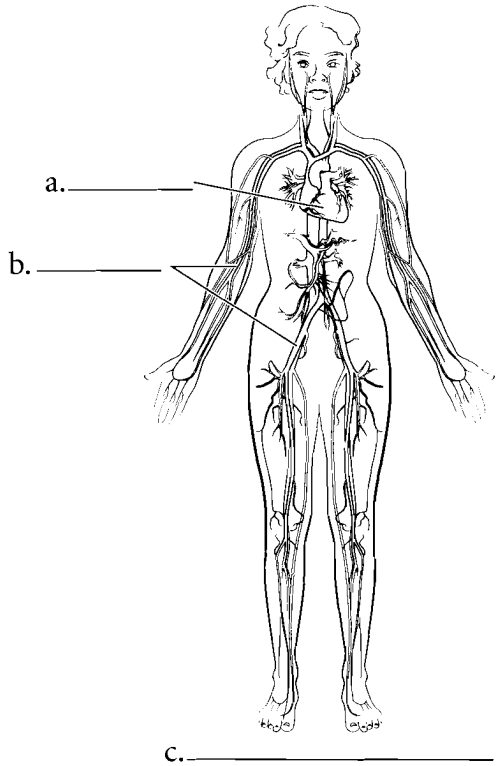


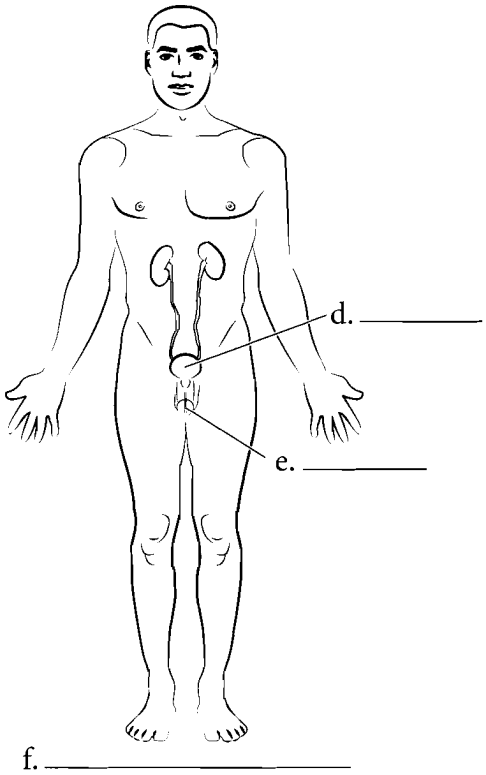
Answer Key: a. Skin, b. Integumentary, c. Esophagus, d. Stomach, e. Digestive, f. Thyroid gland, g. Adrenal gland, h. Endocrine, i. Trachea, j. Lung, k. Respiratory

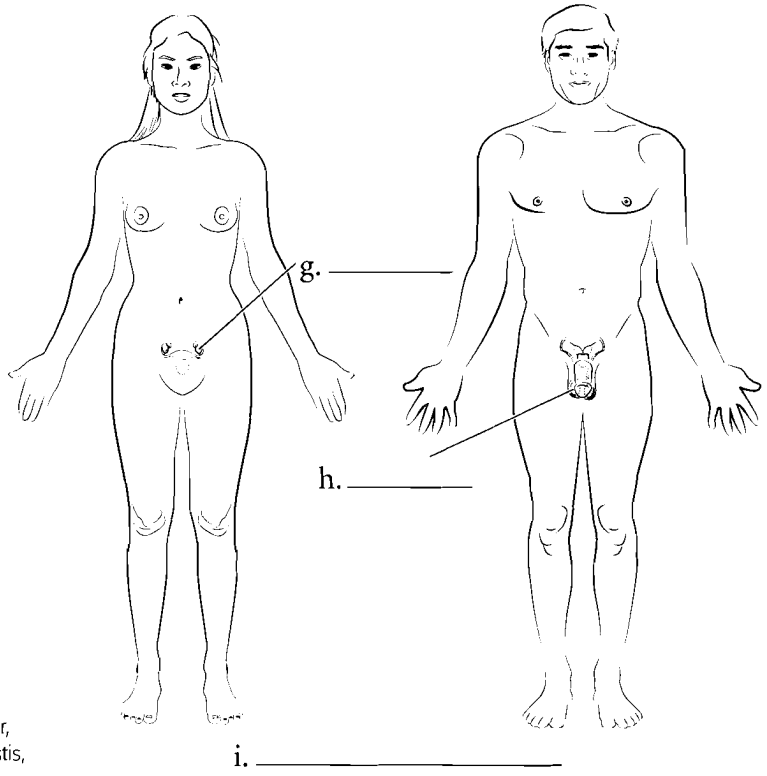
ORGAN SYSTEMS (CONTINUED)

The **heart** and associated **blood vessels** compose the **cardiovascular system** which circulates blood throughout the body. The **urinary system** filters, stores, and conducts some wastes from the body. The **bladder** and **urethra** are part of the **urinary system.** The **testes** and **ovaries** are part of the **reproductive system** and this system perpetuates the species. The differentiation of male and female systems makes this organ system unique among the other systems. These eleven organs systems can be remembered by the memory clue **LN Cries Drum.** Each letter represents the first letter of a name of an organ system. Label the organ systems underneath each illustration and label the selected organs by using the terms available. When you finish, select different colors for each organ system and color them in.

Organ System	Organ	Organ
Cardiovascular system	Heart	Blood vessels
Urinary system	Bladder	Urethra
Reproductive system	Testes	Ovaries





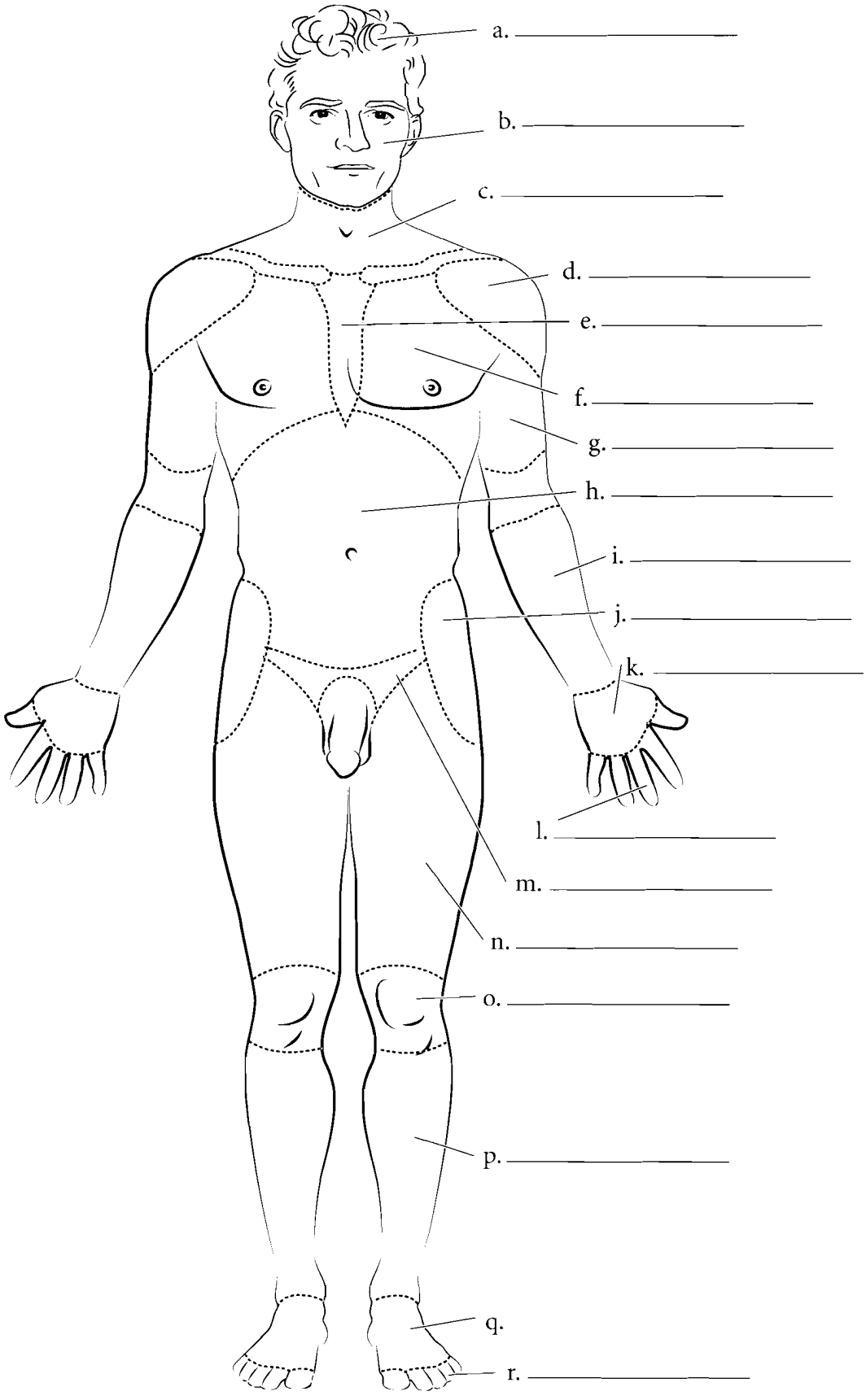


Answer Key: a. Heart, b. Blood vessels, c. Cardiovascular, d. Bladder, e. Urethra, f. Urinary, g. Ovary, h. Testis, i. Reproductive

BODY REGIONS (ANTERIOR)

There are specific anatomical terms for regions of the body. These areas or regions frequently have Greek or Latin names because early western studies in anatomy occurred in Greece and Rome. During the Renaissance, European scholars studied anatomy and applied the ancient names to the structures. Label the various regions of the body and fill in their names. You can use a standard anatomy text or follow the key at the bottom of the page. A list of terms and their common names follows for the anterior side of the body. Color in the regions of the body.

cranial (head)
facial (face)
cervical (neck)
deltoid (shoulder)
pectoral (chest)
sternal (center of chest)
brachial (arm)
antebrachial (forearm)
manual (hand)
digital (fingers)
abdominal (belly)
inguinal (groin)
coxal (hip)
femoral (thigh)
genicular (knee)
crural (leg)
pedal (foot)
digital (toes)

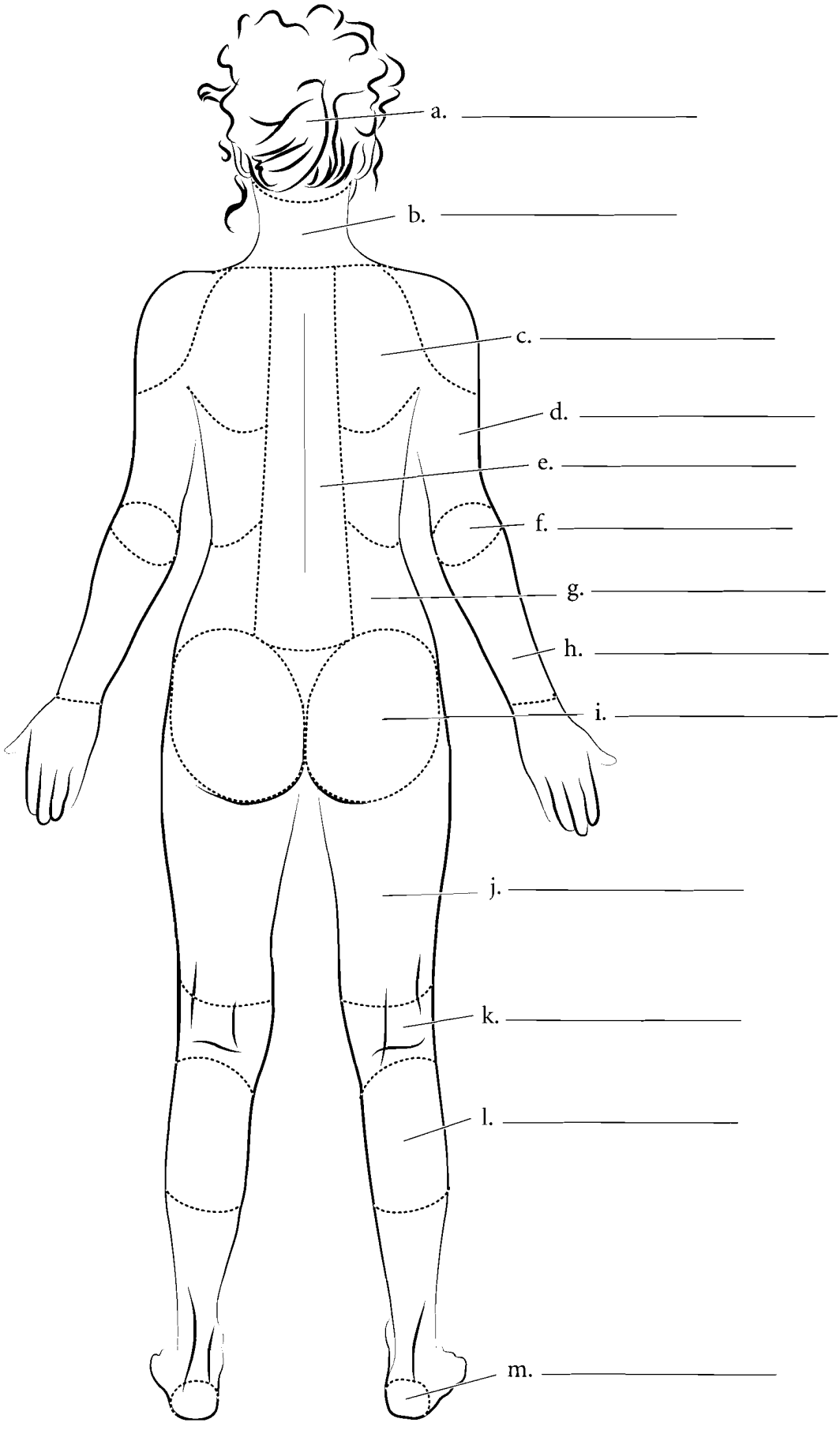


Answer Key: a. Cranial (head), b. Facial (face), c. Cervical (neck), d. Deltoid (shoulder), e. Sternal (center of chest), f. Pectoral (chest), g. Brachial (arm), h. Abdominal (belly), i. Antebrachial (forearm), j. Coxal (hip), k. Manual (hand), l. Digital (fingers), m. Inguinal, n. Femoral (thigh), o. Genicular (knee), p. Crural (leg), q. Pedal (foot), r. Digital (toes)

BODY REGIONS (POSTERIOR)

For the posterior view of the body fill in the terms and color the regions of the body. The anatomical names are given first with the common names in parentheses.

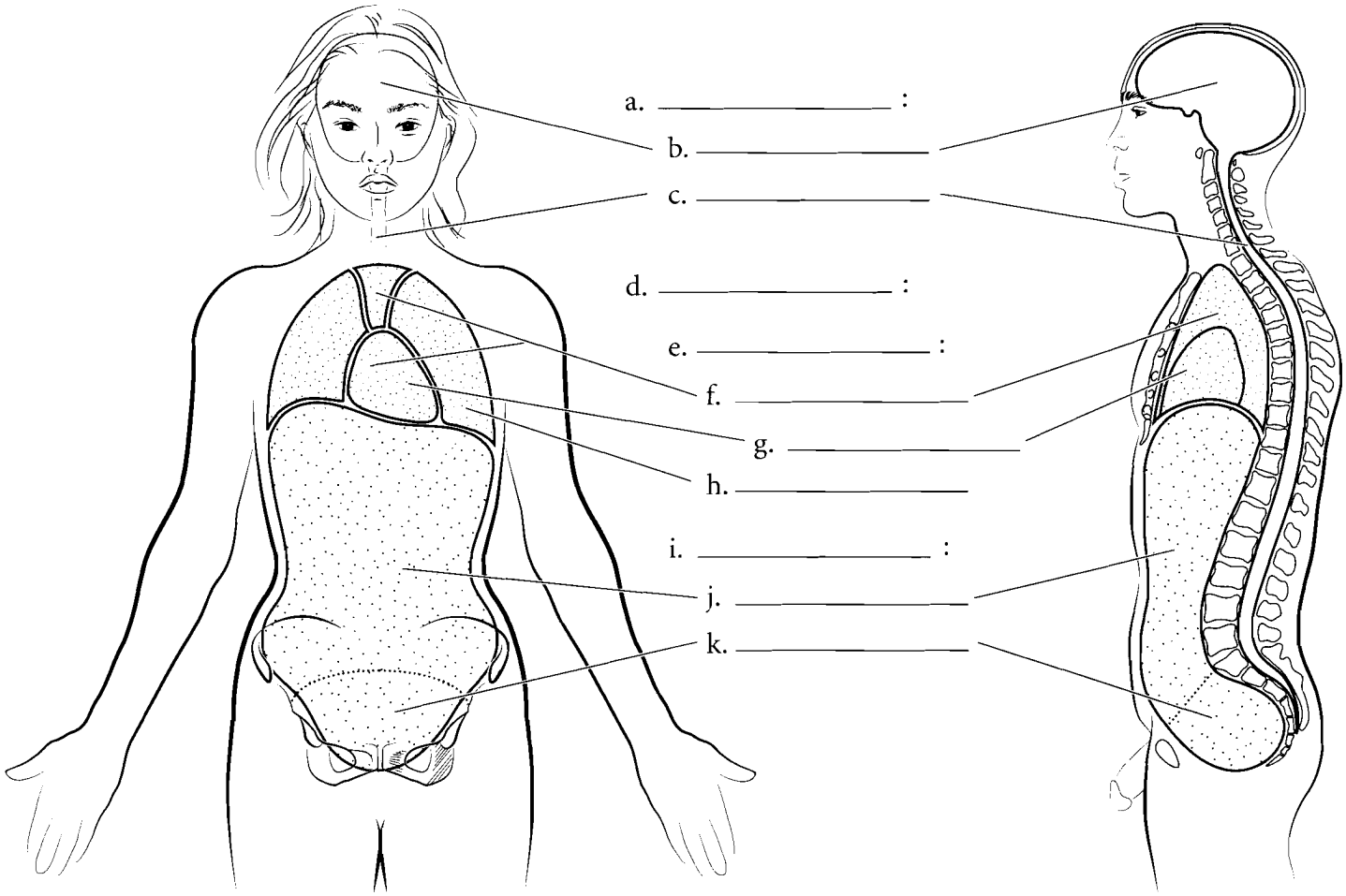
cephalic (head)
nuchal (neck)
scapular (shoulder blade)
vertebral (backbone)
lumbar (love handles)
brachial (arm)
olecranon (elbow)
antebrachial (forearm)
gluteal (buttocks)
femoral (thigh)
popliteal (back of knee)
sural (calf)
calcaneal (heel)



Answer Key: a.Cephalic (head), b. Nuchal (neck), c. Scapular (shoulder blade), d. Brachial (arm), e. Vertebral (backbone), f. Olecranon (elbow), g. Lumbar (love handles), h. Antebrachial (forearm), i. Gluteal (buttocks), j. Femoral (thigh), k. Popliteal (back of knee), l. Sural (calf), m. Calcaneal (heel)

BODY CAVITIES

The organs of the body are frequently found in body cavities. The body is divided into two main cavities, the **dorsal body cavity** and the **ventral body cavity**. The dorsal body cavity consists of the **cranial cavity,** which houses the brain and the **spinal canal**, which surrounds the spinal cord. The ventral body cavity contains the upper **thoracic cavity**, which is subdivided into the **pleural cavities**, housing the lungs, and the **mediastinum**. The mediastinum contains the heart in the **pericardial cavity**, the major vessels near the heart, nerves, and the esophagus. Below the thoracic cavity is the **abdominopelvic cavity**, which contains the upper **abdominal cavity**, housing the digestive organs, and the inferior **pelvic cavity,** which holds the uterus and rectum in females or just the rectum in males. Label the specific and major cavities of the body and color them with different colors.



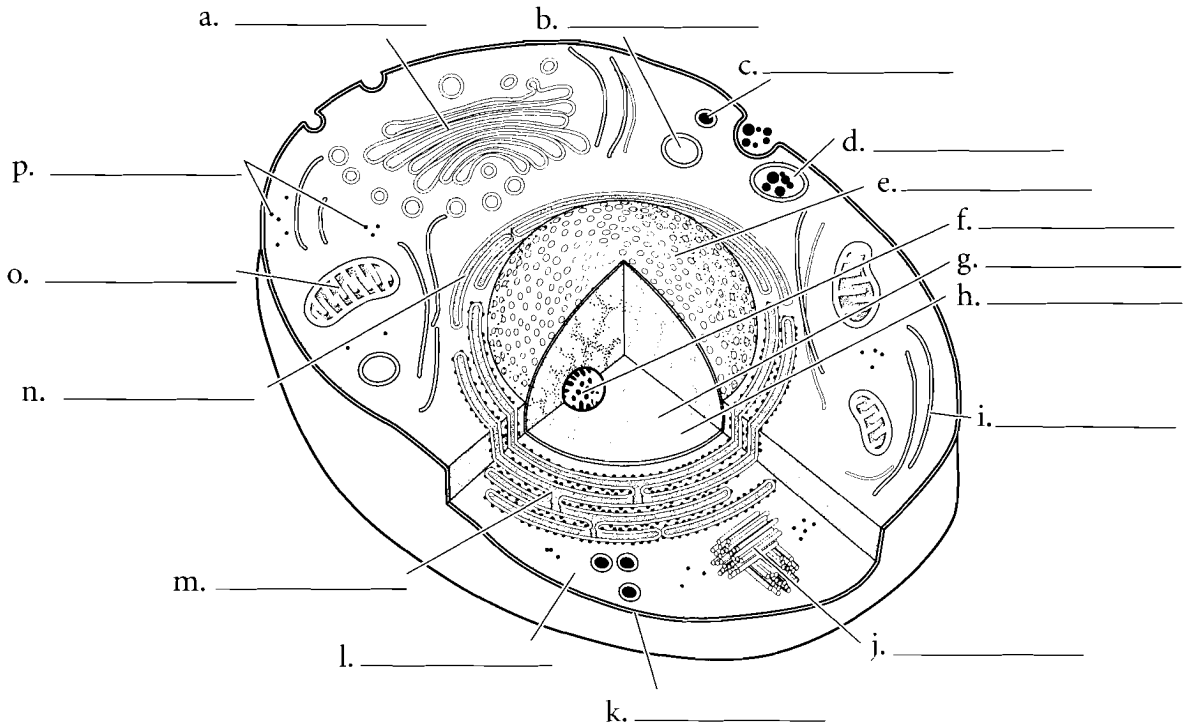
Answer Key: a. Dorsal body cavity, b. Cranial cavity, c. Spinal canal, d. Ventral body cavity, e. Thoracic cavity, f. Mediastinum, g. Pericardial cavity, h. Pleural cavity, i. Abdominopelvic cavity, j. Abdominal cavity, k. Pelvic cavity

OVERVIEW OF CELL AND CELL MEMBRANE

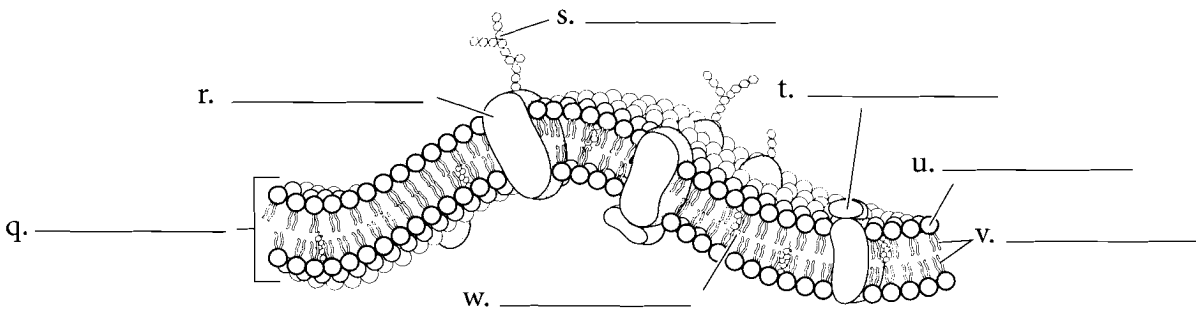
Cells consist of an enclosing **plasma membrane**, an inner **cytoplasm** with numerous **organelles**, and other cellular structures. The fluid portion of the cell is called the **cytosol**. Color the cytosol in last after you color the rest of the cellular structures. One of the major structures in the cell is the **nucleus**. It is the genetic center of the cell and consists of fluid **karyoplasm**, **chromatin** (containing DNA), and the **nucleolus**. Color these features and label them on the illustration.

The **cytoskeleton** consists of microtubules, intermediate filaments and microfilaments. It is involved in maintaining cell shape, fixing organelles, and directing some cellular activity.

Label the organelles of the cell and use a different color for each one. The **mitochondria** are the energy-producing structures of the cell while the **Golgi apparatus** assembles complex biomolecules and transports them out of the cell. Proteins are made in the cell by ribosomes. If the ribosomes are found by themselves in the cytoplasm, they are called **free ribosomes**. If they are attached to the **rough endoplasmic reticulum**, they are called **bound ribosomes**. The **smooth endoplasmic reticulum** manufactures lipids and helps in breaking down toxic materials in the cell. Other structures in the cell are **vesicles** (sacs that hold liquids). **Phagocytic vesicles** ingest material into the cell. **Lysosomes** contain digestive enzymes while **peroxisomes** degrade hydrogen peroxide in the cell. After you label and color the organelles make sure to go back and shade in the cytosol. **Centrioles** are microtubules grouped together and are involved in cell division.



The **plasma membrane** is composed of a **phospholipid bilayer**. Color the **phosphate molecules** on the outside and inside of the membrane one color and the **lipid layer** another color. **Cholesterol molecules** occur in the membrane and, depending on their concentration, can make the membrane stiff or more fluid. Proteins that are found on the outside of the membrane are called **peripheral proteins** while proteins that pass through the membrane are called **integral proteins**. Frequently these make up gates or channels that allow material to pass through the membrane. Attached to proteins on the cell membrane are **carbohydrate chains**. These provide cellular identity. Label and color the cell membrane structures.

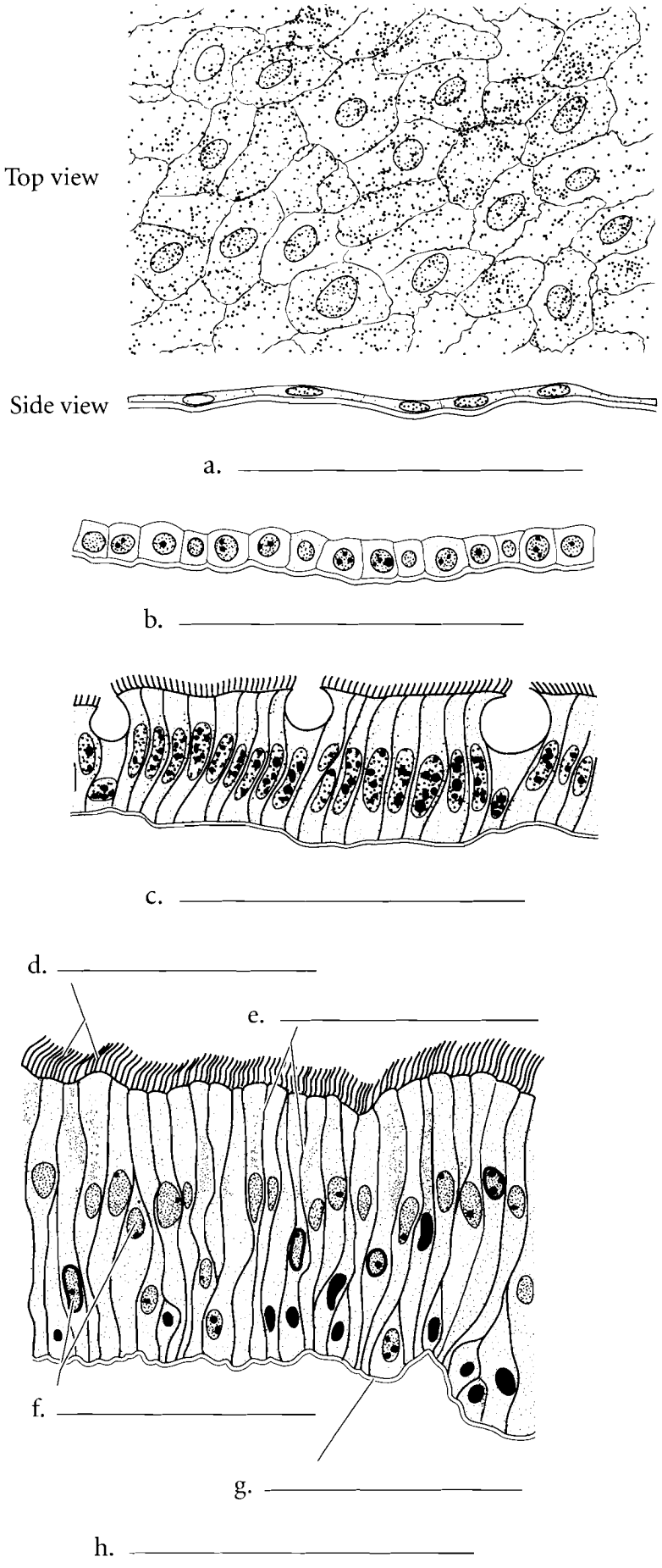


Answer Key: a. Golgi apparatus, b. Lysosome, c. Peroxisome, d. Phagocytic vesicle, e. Nucleus, f. Nucleolus, g. Chromatin, h. Karyoplasm, i. Cytoskeleton, j. Centrioles, k. Plasma membrane, l. Cytoplasm, m. Rough endoplasmic reticulum, n. Smooth endoplasmic reticulum, o. Mitochondrion, p. Free ribosomes, q. Phospholipid bilayer, r. Integral protein, s. Carbohydrate chain, t. Peripheral protein, u. Phosphate molecule, v. Lipid layer, w. Cholesterol molecule

SIMPLE EPITHELIA

There are four types of tissues in humans and these make up all of the organs and binding material in the body. **Epithelial tissue** makes up linings of the body. In many cases, where there is exposure (outside, such as the skin, or inside, such as in blood vessels), epithelium is the tissue found. It is named according to its layers (typically simple or stratified) and the shape of cells (such as cuboidal). **Simple squamous epithelium** is a single layer of flattened cells. **Simple cuboidal epithelium** is also a single layer of cells but the cells are in the shape of cubes. **Simple columnar epithelium** is a single layer of long columnar cells. Label and color these epithelial types and pay attention to the **basement membrane**, the noncellular layer that attaches the epithelium to lower layers. It should be colored red. Color the **nuclei** in purple, the **cytoplasm** blue, and label the cells.

Pseudostratified ciliated columnar epithelium is in a single layer of cells but it looks stratified on first appearance. Not all of the cells reach the surface of the tissue. All of the cells reach the basement membrane. Label and color the **nuclei**, **basement membrane, cell membrane** and the **cilia** in this tissue.

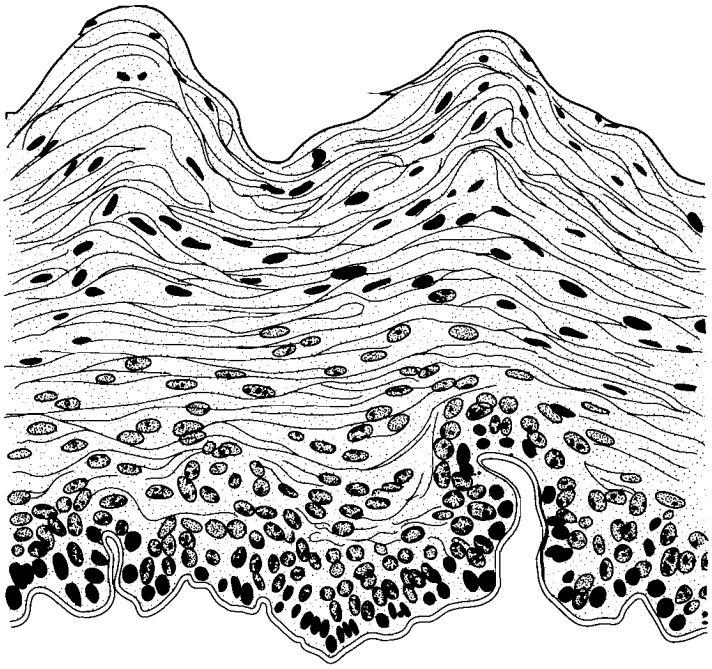


Answer Key: a. Simple squamous epithelium, b. Simple cuboidal epithelium, c. Simple columnar epithelium, d. Cilia, e. Cell membrane, f. Nuclei, g. Basement membrane, h. Pseudostratified ciliated columnar epithelium

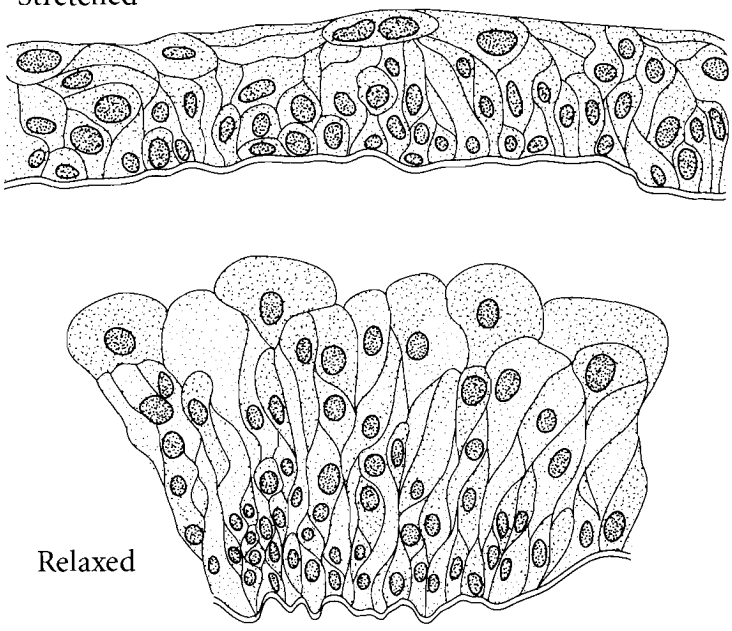
STRATIFIED EPITHELIA

There are two common epithelial tissues that are many-layered. **Stratified squamous epithelium** is many layers of flattened cells. Label and color the basement membrane red, color the cytoplasm blue, and the nuclei purple. There are two major types of stratified squamous epithelium. Keratinized epithelium is found on the skin and is toughened by the protein keratin. Non-keratinized stratified squamous epithelium is found in the oral cavity and vagina and is a mucous membrane.

Another main type of layered epithelial tissue is **transitional epithelium**. This is tissue that lines part of the urinary tract including the bladder. When the bladder is empty, the cells bunch up on one another and the tissue is thick. When the bladder is full, the cells stretch out into a few layers. Label the cell types for each picture and color the structures in the same way as in previous illustrations.



a. _____



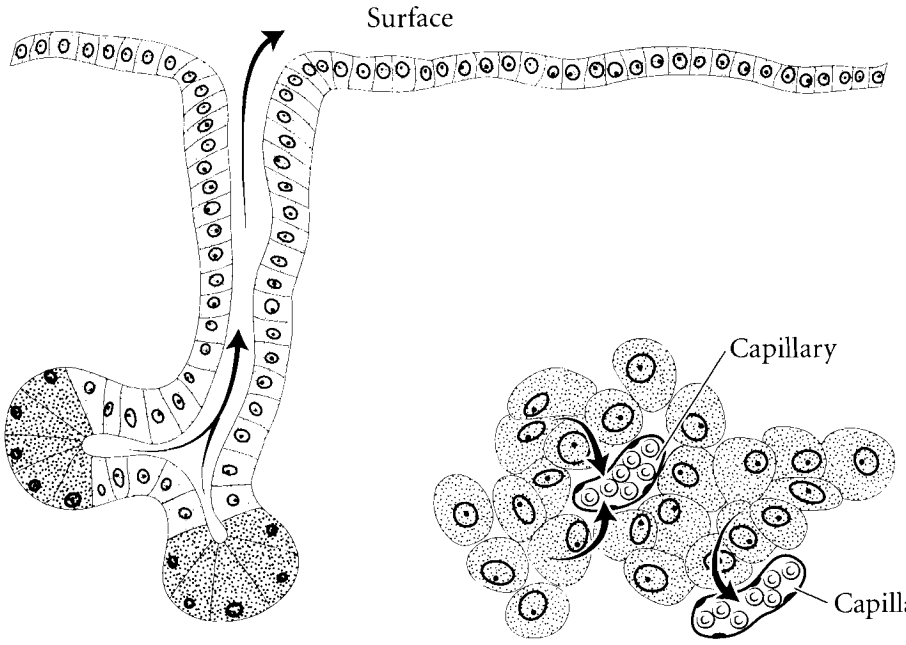
b. _____

Answer Key: a. Stratified squamous epithelium, b. Transitional epithelium

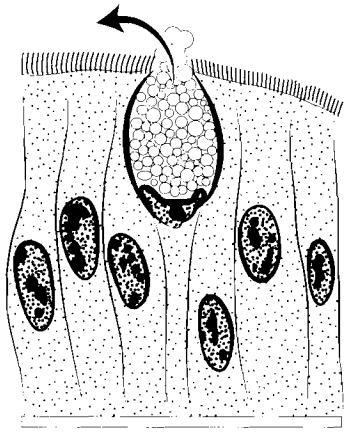
GLANDS

There are several types of glands in the human body. Some of these glands secrete their products into tubes or ducts. These are known as **exocrine** glands. Other glands secrete their products into the spaces between cells where they are picked up by the blood or lymph system. These are the **endocrine** glands. Endocrine glands secrete hormones that have an impact on target tissues of the body.

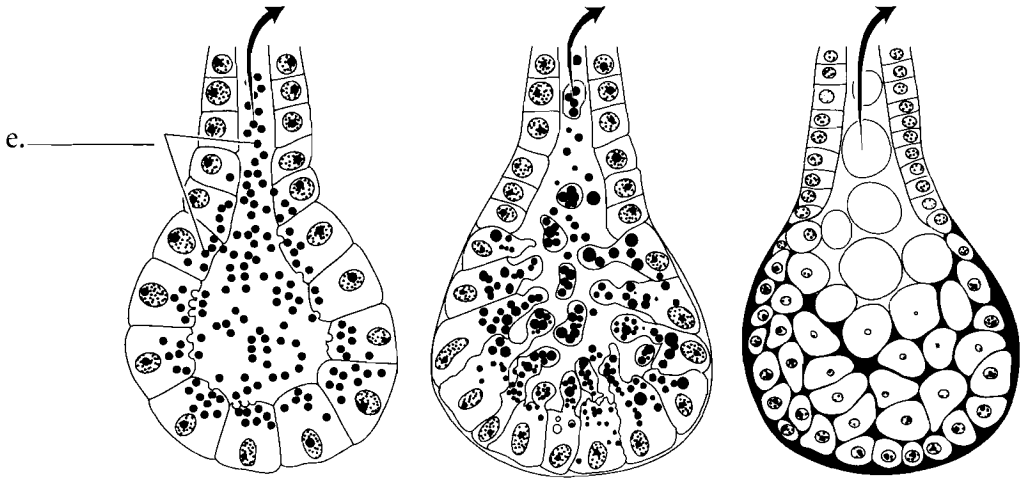
Glands can be unicellular or multicellular. Glands that consist of just one cell are called **goblet cells**. They secrete mucus, which is a lubricant. There are many types of multicellular glands. They are classified by how they secrete their products. Some glands secrete products from **vesicles** pinched off from the cell. These are called **merocine** glands. In these glands no cellular material is lost in the secretion of material. An example of a merocine gland is a sweat gland. Some cells squeeze parts of the cell off to secrete cellular products. These are known as **apocrine** glands. The lactiferous glands that produce milk are apocrine glands. Some secretions occur by the entire cell rupturing. These are called **holocrine** glands. Oil glands of the skin are holocrine glands. Label the glands and color them in on the figure.



a. _____ b. _____



c. _____

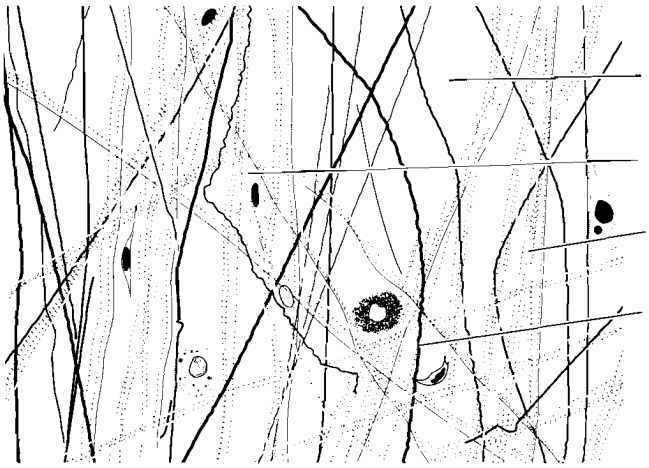


e. _____ d. _____ f. _____ g. _____

Answer Key: a. Exocrine gland, b. Endocrine gland, c. Goblet cell, d. Merocine glands, e. Vesicles, f. Apocrine glands, g. Holocrine glands

CONNECTIVE TISSUE

Connective tissue is a varied group of associated tissues, all of which are derived from an embryonic tissue known as mesenchyme. Connective tissue not only has cells, as do all of the other tissues, but it also has **fibers** and a large amount of background substance called **matrix**. There are many specific tissues that belong to connective tissue. **Loose connective tissue** is found wrapping around organs or under the epidermis and it is composed of **collagenous**, **elastic**, and **reticular fibers**, a liquid matrix and numerous cells, many of which have an immune function. **Dense regular connective tissue** has a few cells called **fibrocytes** and a small amount of matrix with most of the tissue composed of a regular arrangement of **collagenous fibers**. This specific tissue makes up tendons and ligaments. If the fibers are not in an orderly arrangement, then the tissue is called **dense irregular connective tissue**. This tissue is found in places like the white of the eye.

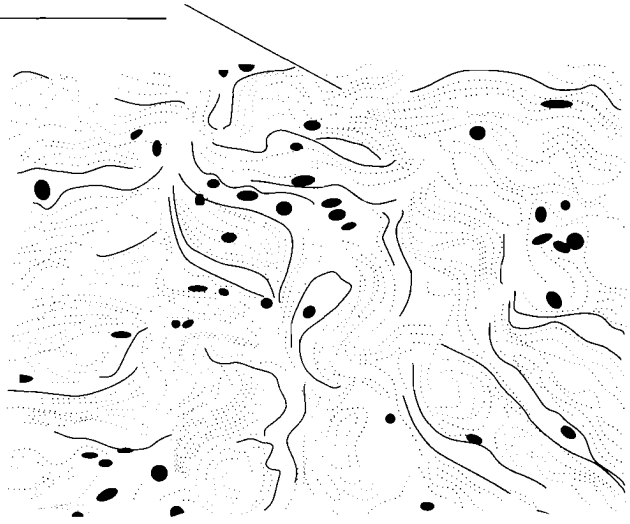


e. _____

c. _____

f. _____

c. _____



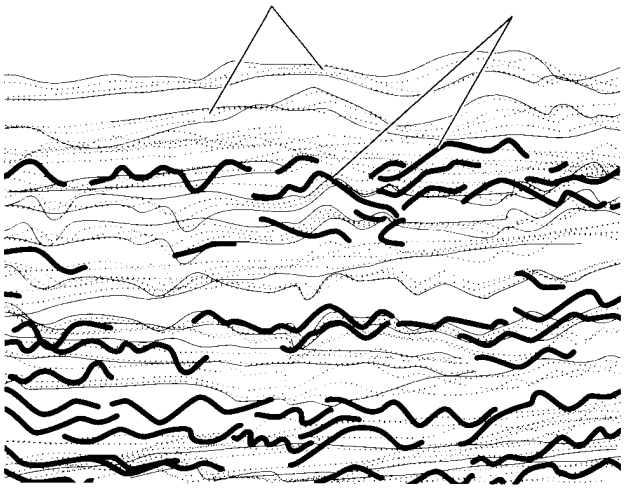
g. _____

Answer Key: a. Matrix, b. Fibrocyte, c. Collagenous fiber, d. Elastic fiber, e. Loose connective tissue, f. Dense regular connective tissue, g. Dense irregular connective tissue

CONNECTIVE TISSUE (CONTINUED)

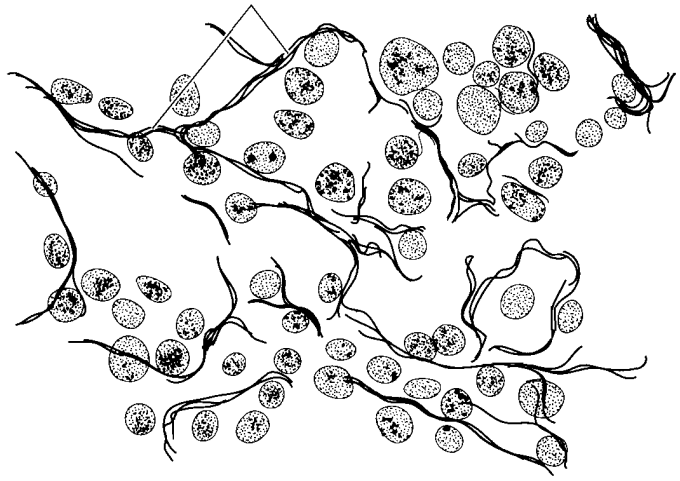
Elastic connective tissue contains **elastic fibers** and is found in areas that recoil when stretched such as in the walls of arteries. **Reticular connective tissue** consists of **reticular fibers** that form an internal support in soft organs such as the liver and spleen. **Adipose tissue** consists of specialized fat-storing cells called adipocytes. Label and color the components of these connective tissues.

a. _____ b. _____

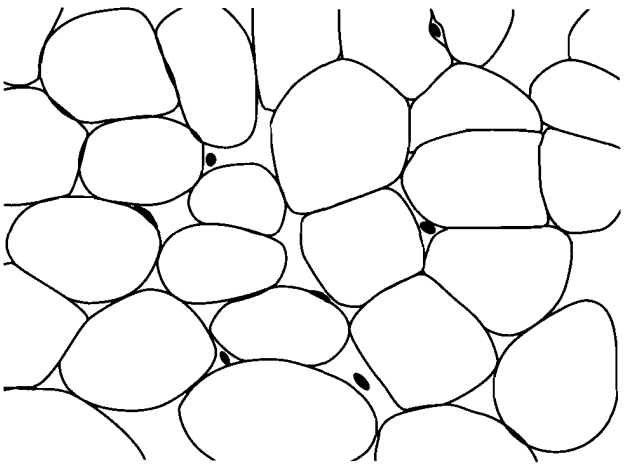


c. _____

d. _____



e. _____



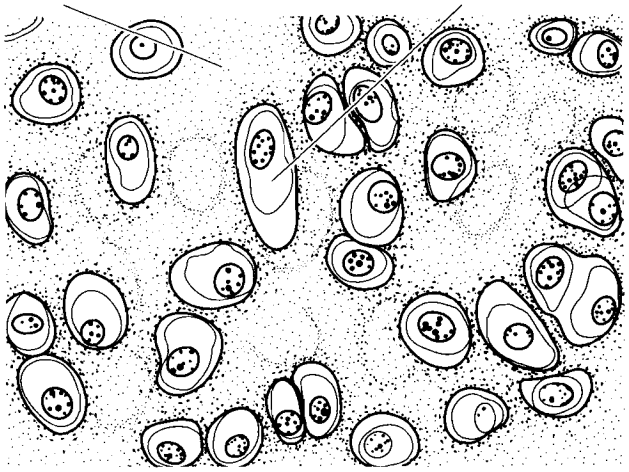
f. _____

Answer Key: a. Collagenous fibers, b. Elastic fibers, c. Elastic connective tissue, d. Reticular fibers, e. Reticular connective tissue, f. Adipose tissue

CARTILAGE

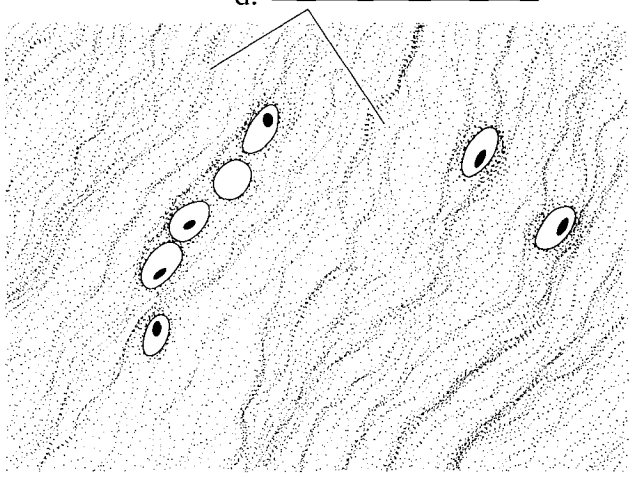
There are three types of cartilage in connective tissue. The most common kind of cartilage is **hyaline cartilage.** It contains a semisolid **matrix, collagenous fibers,** and **chondrocytes** (cartilage cells). The end of the nose is pliable due to hyaline cartilage. **Fibrocartilage** is like hyaline cartilage, having the same components, but there are more collagenous fibers in fibrocartilage. It is found in areas where there is more stress, such as the joint between the bones of the thigh and leg. **Elastic cartilage** has a matrix, chondrocytes, and **elastic fibers.** These fibers make the cartilage more bendable than hyaline cartilage. Label and color the cells and fibers of cartilage and use a light color to shade the matrix such as a pale pink or blue.

a. _____ b. _____



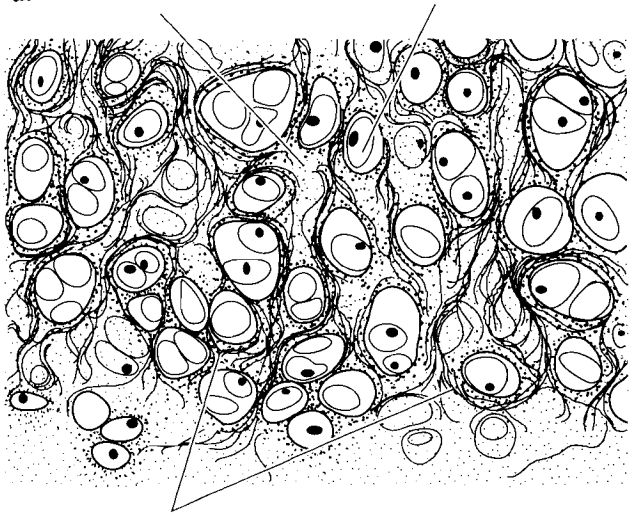
c. _____

d. _____



e. _____

a. _____ b. _____



f. _____

g. _____

Answer Key: a. Matrix, b. Chondrocytes, c. Hyaline cartilage, d. Collagenous fibers, e. Fibrocartilage, f. Elastic fibers, g. Elastic cartilage

BONE AND BLOOD

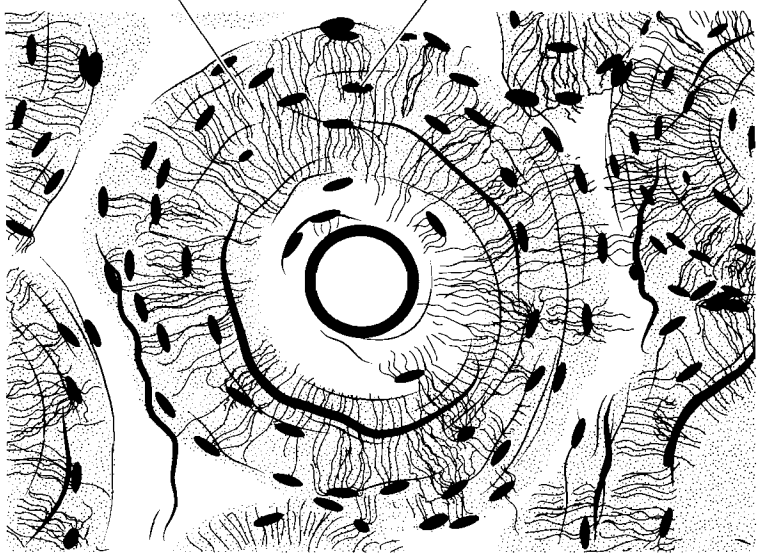
Bone is a connective tissue. The cells are the **osteocytes** and the fibers are collagenous fibers enclosed in a hard matrix of bone salts. You will not see the fibers in the illustration because they are covered by the dense matrix. Label and color the osteocytes and matrix of bone.

Blood is another kind of connective tissue. The matrix in blood is the **plasma** and the cells are **erythrocytes** (red blood cells) and **leukocytes** (white blood cells).

Platelets are small flat disks in the blood that aid in clotting.

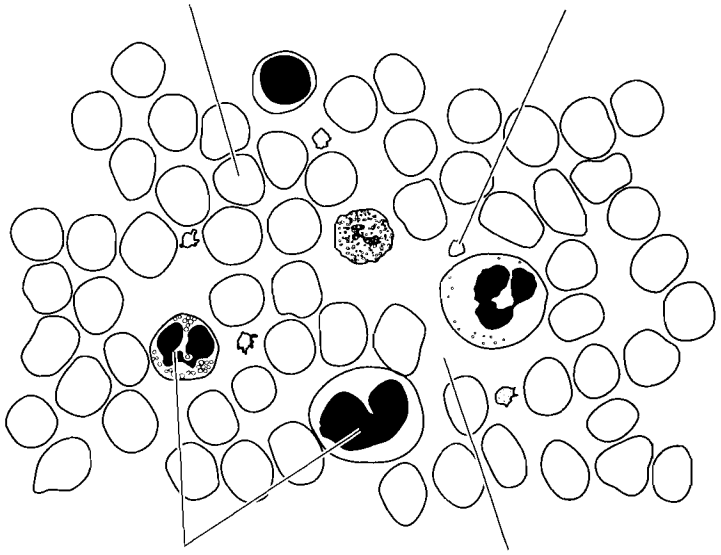
a. _____

b. _____



c. _____

d. _____ e. _____



f. _____ g. _____

h. _____

Answer Key: a. Matrix, b. Osteocyte. c. Bone, d. Erythrocyte, e. Platelet, f. Leukocytes, g. Plasma, h. Blood

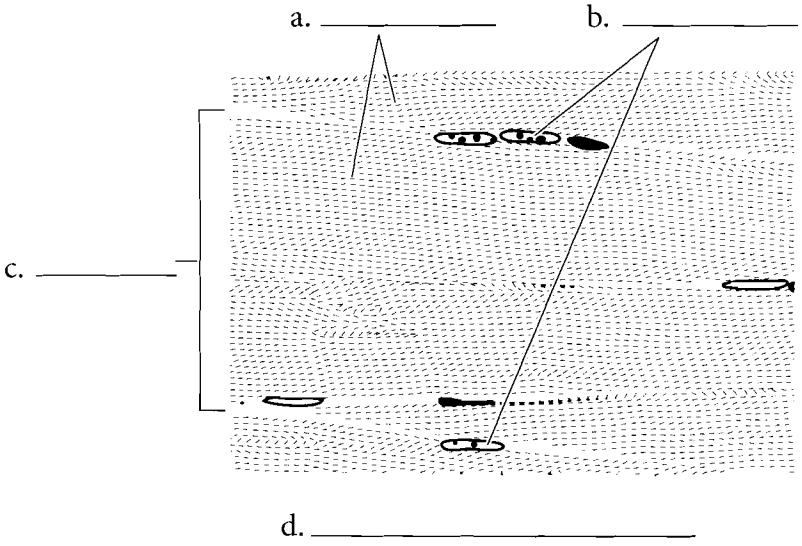
MUSCLE AND NERVOUS TISSUE

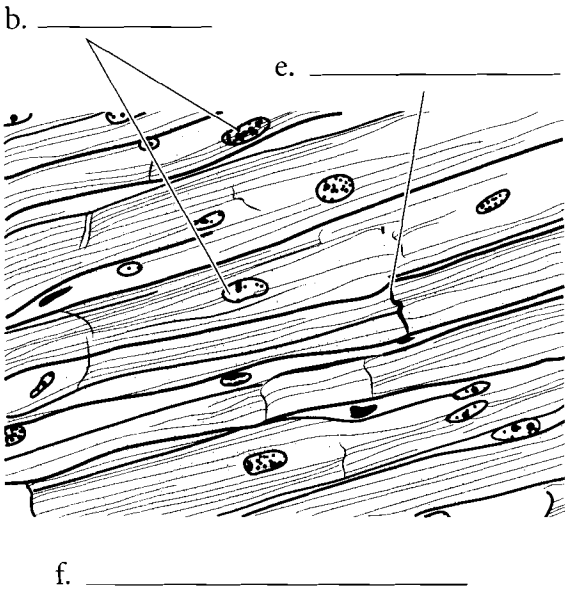
Muscular tissue is composed of specialized cells involved in contraction. **Skeletal muscle** makes up body muscles and represents around 40 percent of the body mass. Skeletal muscle is striated and the fusion of individual cells produces longer, mature cells that are multinucleate. These nuclei are found on the edges of the cells. Skeletal muscle can be consciously controlled and is called voluntary muscle. Label and color the **striations** of the skeletal muscle cells, the **nuclei**, and individual **cells**.

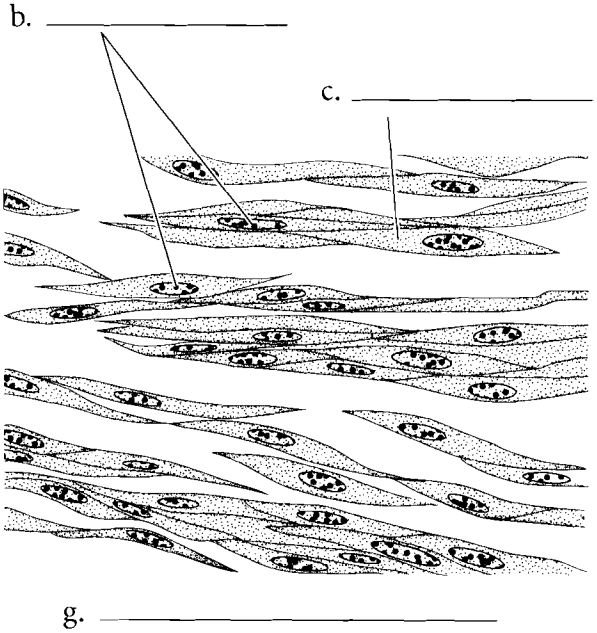
Cardiac muscle is also **striated** but the striations are not as obvious as in skeletal muscle. This muscle is found in the heart and is involuntary. It does not involve conscious control. Cardiac muscle typically has only one centrally located **nucleus** per cell, and the cells themselves are branched. They attach to other cells by **intercalated discs**, which allow communication between cells for the conduction of impulses during the cardiac cycle. Label and color these features on the illustration.

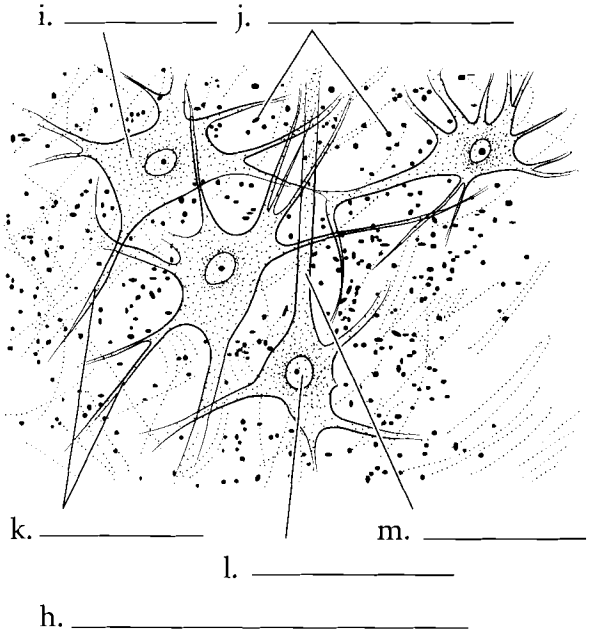
Smooth muscle is not striated and it is involuntary. The cells are slender and have one nucleus located in the center of the cell. It is widely distributed in the body, making up, among other things, part of the digestive system, reproductive system, and integumentary system. Smooth muscle is found in glands and other areas not under conscious control. Label and color the **nucleus** and **cell** of smooth muscle.

Nervous tissue consists of the **neuron** and associated **glial cells.** Neurons have numerous branched extensions called **dendrites**, a central **nerve cell body** (**soma**) that houses the **nucleus**, and a long extension called an **axon**. The glial cells, also known as **neuroglia**, have many functions. Some of these are supportive of the neuron and some may involve processing of neural information. Label and color the parts of the neuron and the glial cells.







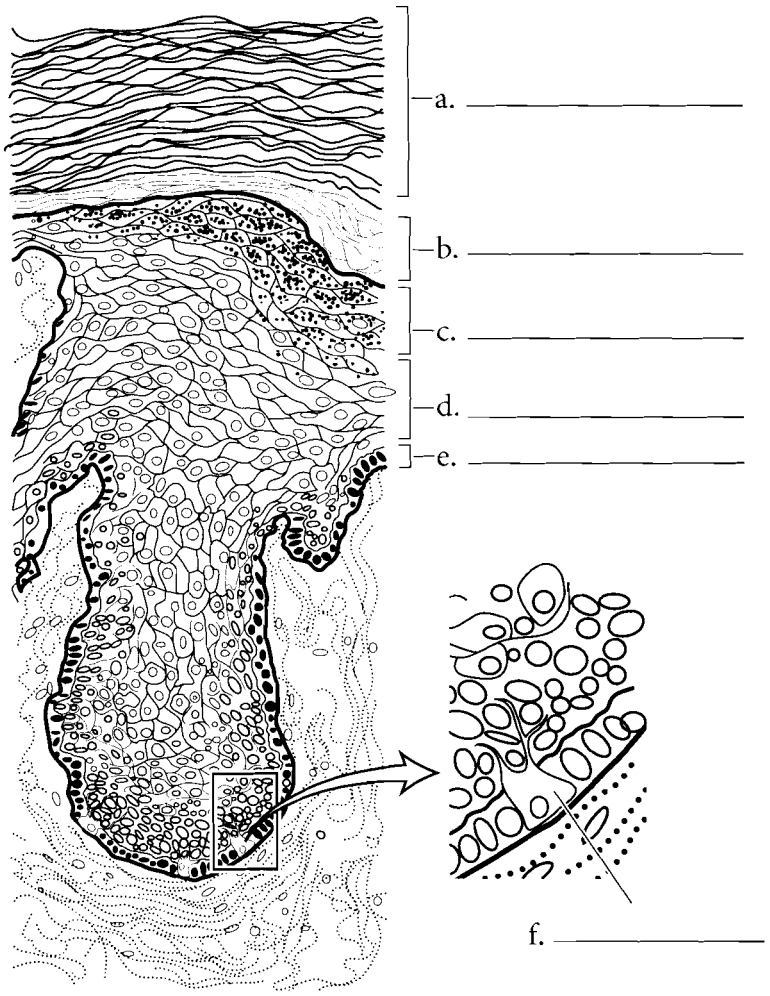


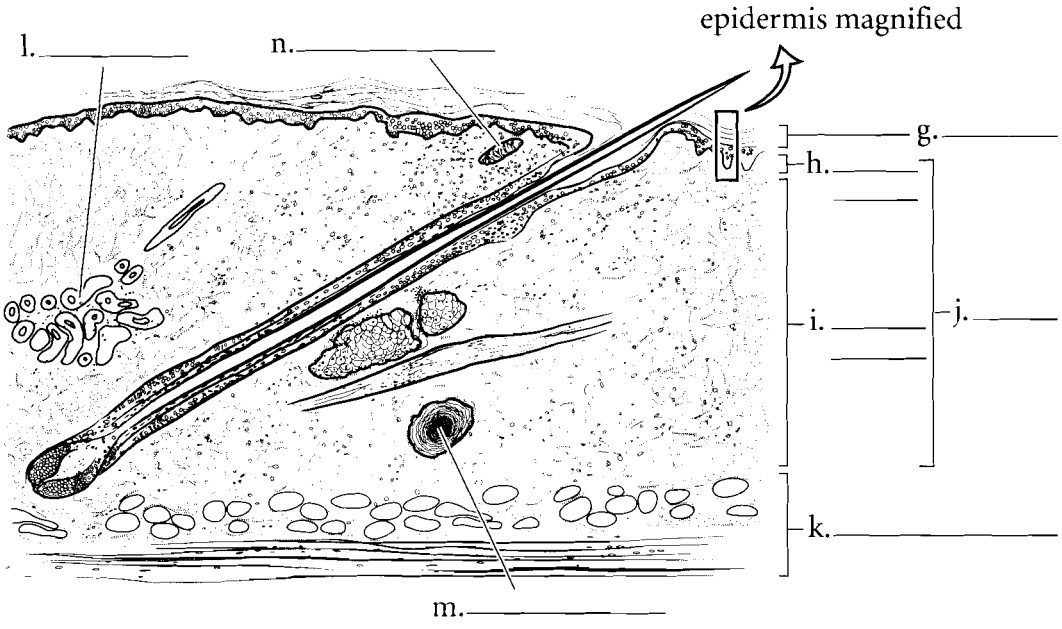
Answer Key: a. Striations, b. Nuclei, c. Cell, d. Skeletal muscle, e. Intercalated disc, f. Cardiac muscle, g. Smooth muscle, h. Nervous tissue, i. Nerve cell body, j. Glial cells (Neuroglia), k. Dendrites, l. Nucleus, m. Axon

INTEGUMENTARY SYSTEM

The most superficial layer of the skin is the epidermis. Color the five layers of the epidermis. The deepest layer is the **stratum basale** and there are specific cells called **melanocytes** that secrete the brown pigment **melanin**. Color the majority of the stratum basale pink but color the melanocytes brown. Color the **stratum spinosum** a light blue. The **stratum granulosum** has purple granules in it so color that layer using purple dots. The **stratum lucidum** (found only in thick skin) is a thin, light colored layer so yellow or white are good colors for this tissue. Color the superficial **stratum corneum** orange.

The overview of the skin contains many layers. Color the **epidermis** a red-orange. The **dermis** consists of two layers, an upper **papillary layer,** which should be colored in a light pink, and a deeper **reticular layer,** which should be colored a darker pink. There are **sweat glands** that are found in the dermis that can be colored purple. You should color the **hypodermis** (not a part of the integument) yellow because of the amount of fat found there. Two types of touch receptors can easily be seen in microscopic sections. These are the **Meissner corpuscles** and the **Pacinian corpuscles**.





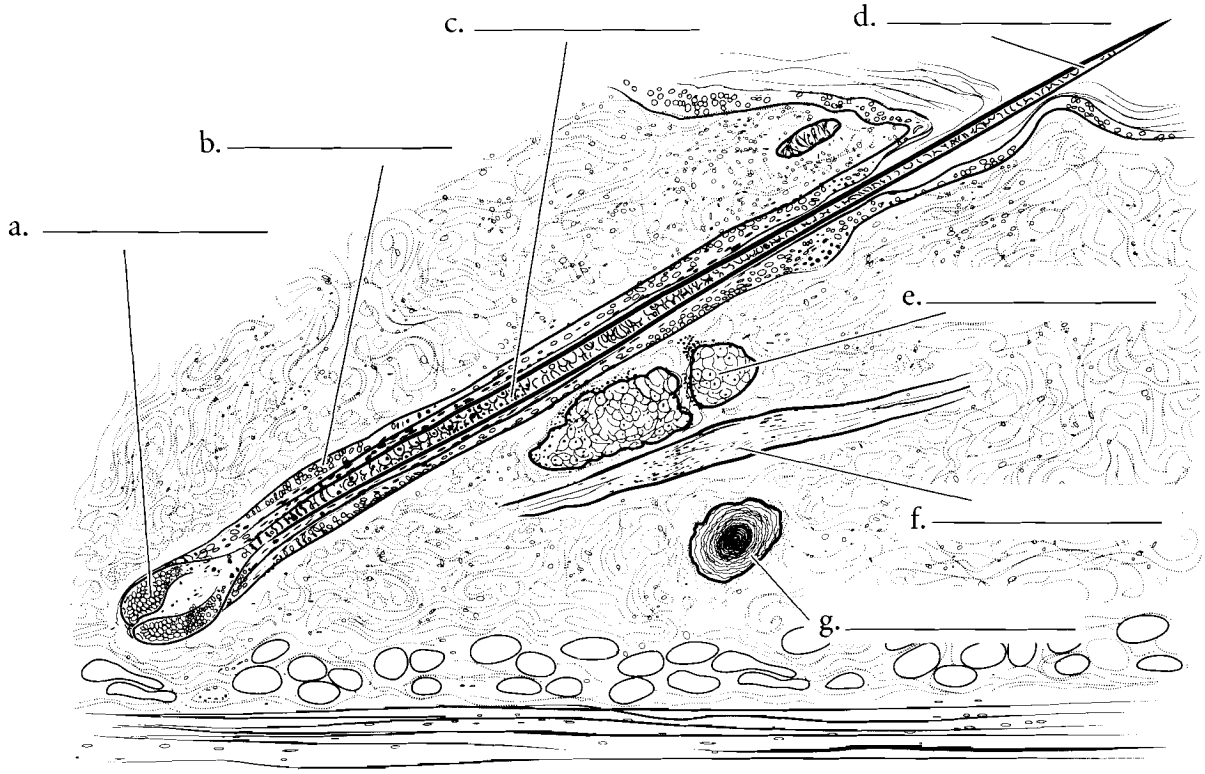
Answer Key: a. Stratum corneum, b. Stratum lucidum, c. Stratum granulosum, d. Stratum spinosum, e. Stratum basale, f. Melanocyte, g. Epidermis, h. Papillary layer, i. Reticular layer, j. Dermis, k. Hypodermis, l. Sweat gland, m. Pacinian corpuscle, n. Meissner corpuscle

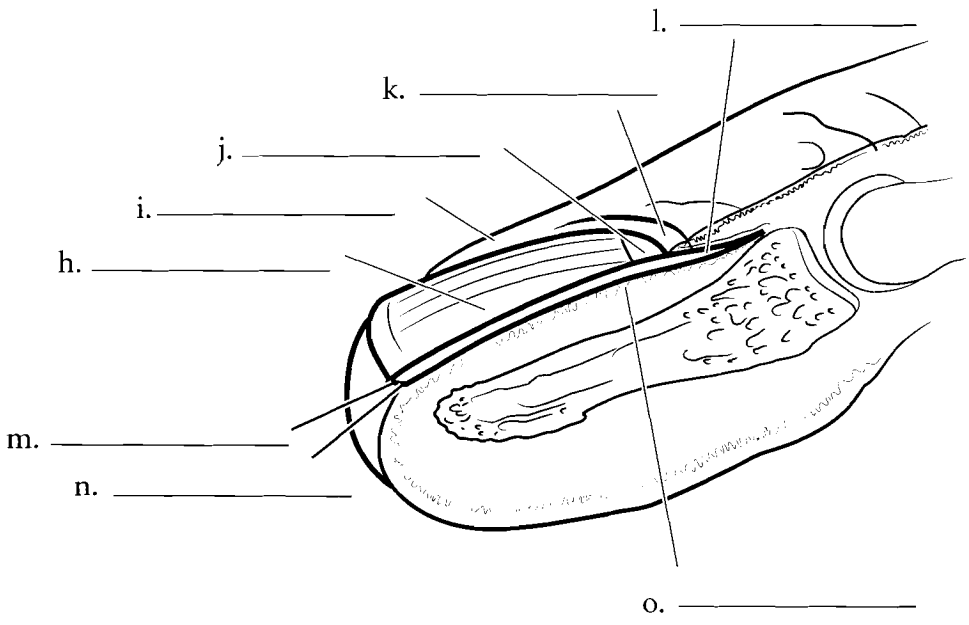
HAIR AND NAILS

Hair consists of several parts. The hair originates from the dermal papilla and the deepest part of the hair is known as the **hair bulb**. The hair is pushed superficially and forms the **hair root** (the part of the hair enclosed in the skin). Once the hair erupts from the skin it is known as the **hair shaft**. Color the three sections of hair different shades of blue. The hair is enclosed by the **hair follicle**, which should be colored purple.

Associated with the hair are the **arrector pili** muscle, which is made of smooth muscle and is colored pink, and an oil-secreting gland known as the **sebaceous gland**, which should be colored yellow.

Fingernails and toenails are considered accessory structures of the integument. Color the diagram labeling the **nail plate**, the **free edge**, the **nail fold**, the **lunula**, **eponychium** (cuticle), **nail root**, **hyponychium** and the **nail bed**.





Answer Key: a. Bulb, b. Follicle, c. Root, d. Shaft, e. Sebaceous gland, f. Arrector pili. g. Pacinian corpuscle, h. Nail plate, i. Nail fold, j. Lunula, k. Eponychium, l. Nail root, m. Free edge, n. Hyponychium, o. Nail matrix (Nail bed)