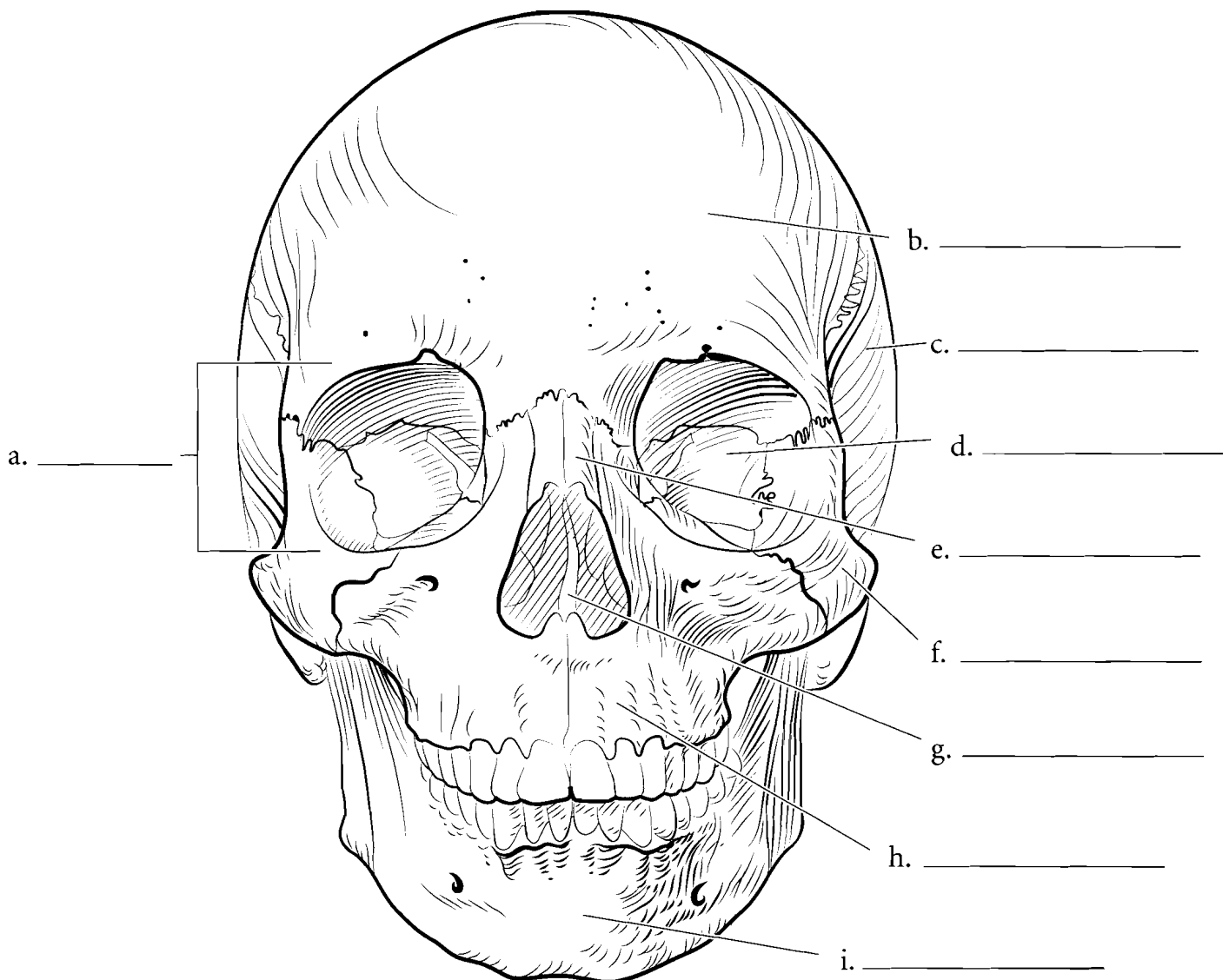


FRONTAL ASPECT OF THE SKULL

The skull is a complex structure. There are 8 cranial bones and 14 facial bones in the skull. From the anterior view most of the facial bones can be seen and some of the cranial bones are visible too. The bone that makes up the forehead and extends beyond the eyebrows is the **frontal bone**. This bone forms the upper rim of the **orbit**, which is a socket that encloses the eye. In the back of the orbit is the **sphenoid bone** and the lateral walls of the orbit are composed of the **zygomatic bones**. The bridge of the nose consists of the paired **nasal bones** and just lateral to

them are the two **maxillae**. These bones hold the upper teeth. The lower teeth are held by the **mandible**. Inside the nasal cavity two projections can be seen. These are the inferior nasal conchae. The wall that divides the nasal cavity is the **nasal septum** and it consists of two bones, the ethmoid bone and the vomer. Along the side of the skull are the **temporal bones**, located posterior to the zygomatic bones. Label the major bones of the skull and color them in. As you color in the skull try to use the same color for the same bone on different pages. This will help you associate the same bone with various views from which it can be seen.

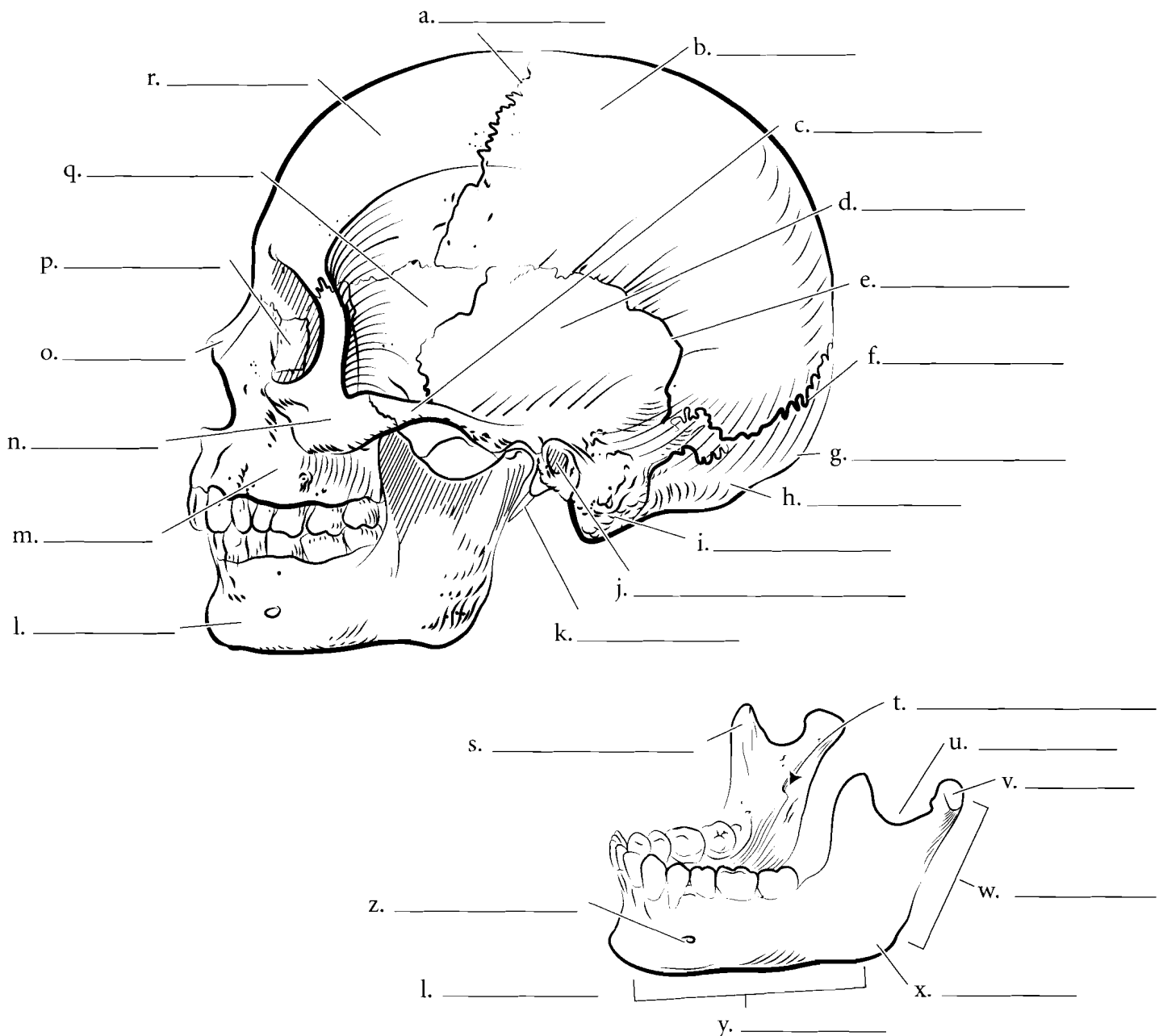


LATERAL VIEW OF THE SKULL

Many bones seen from the anterior view can also be seen from the lateral view. The **frontal bone** is joined to the **parietal bones** by the **coronal suture**. The parietal bones span much of the cranium and articulate with the **occipital bone** at the **lambdoid suture**. There is a posterior extension of the **occipital bone** known as the **external occipital protuberance**. The exterior aspect of the **temporal bone** is seen from the lateral view and many of the significant features such as the **mastoid process**, **external acoustic meatus**, and **styloid process** are visible. On the side is the elongated **zygomatic process**. The temporal bone articulates with other cranial bones by the **squamous suture**. The bone anterior to the temporal bone is the **sphenoid bone**. It is a bone that is found in the middle of the skull. The **nasal bone** is visible from the lateral view and its relationship with the **maxilla** can be seen here. Behind the maxilla is the

lacrima bone which houses the nasolacrimal canal, a duct that drains tears from the eye into the nose. The **mandible** articulates with the rest of the skull at the **mandibular condyle**. A depression in front of the condyle is the **mandibular notch** and the anterior section of bone in front of the notch is the **coronoid process**. Label the major features of the skull seen in lateral view and color each bone a different color.

Details of the mandible can be seen in the isolated bone. In addition to the features of the mandible listed above, find the **mandibular foramen** and the **mental foramen** of the mandible. These are holes for the passage of nerves and blood vessels. The main portion of the mandible is the **body** and the upright part is the **ramus**. The **angle** is the posterior junction of these two parts. The teeth are located in alveoli and the small segments of bone between the teeth are the alveolar processes. Label the features of the mandible.

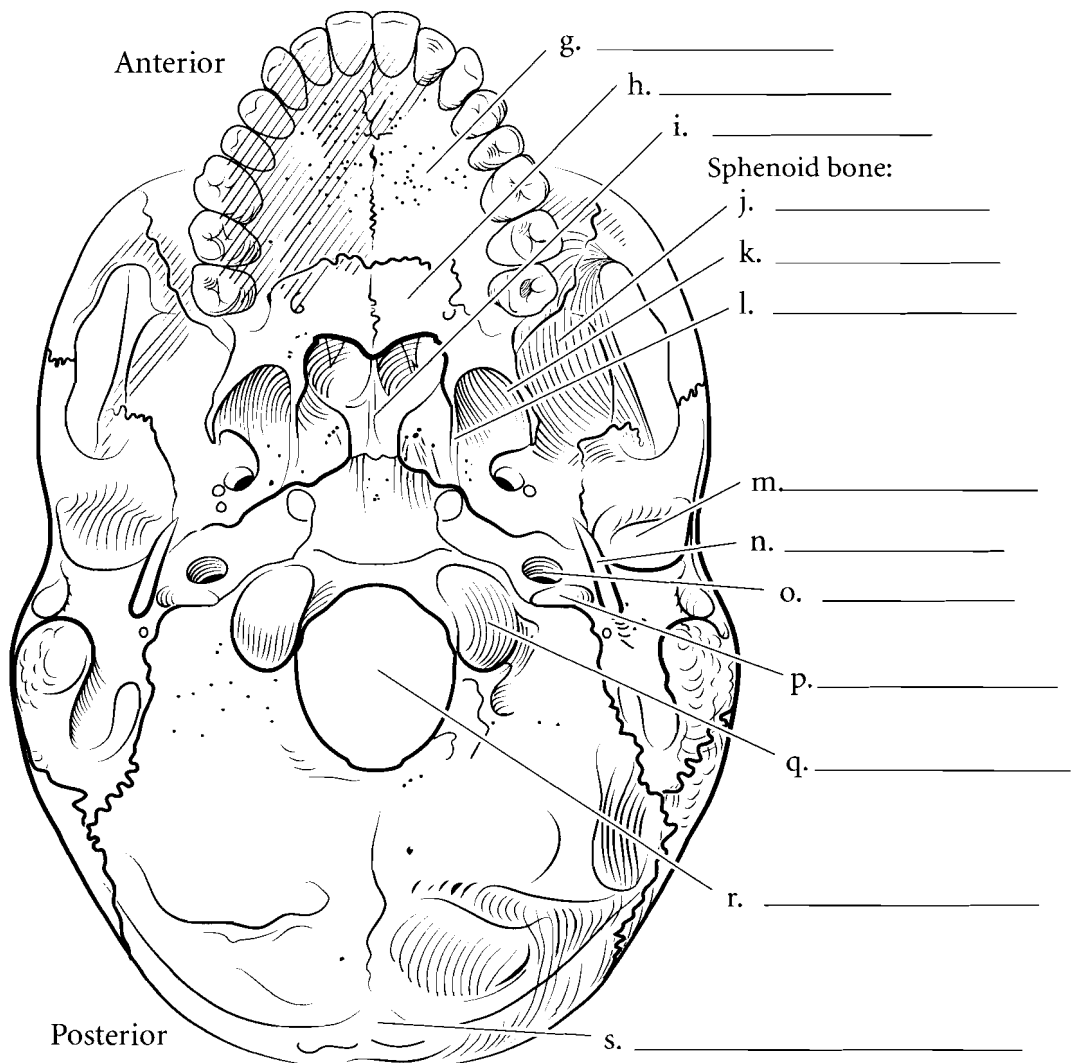
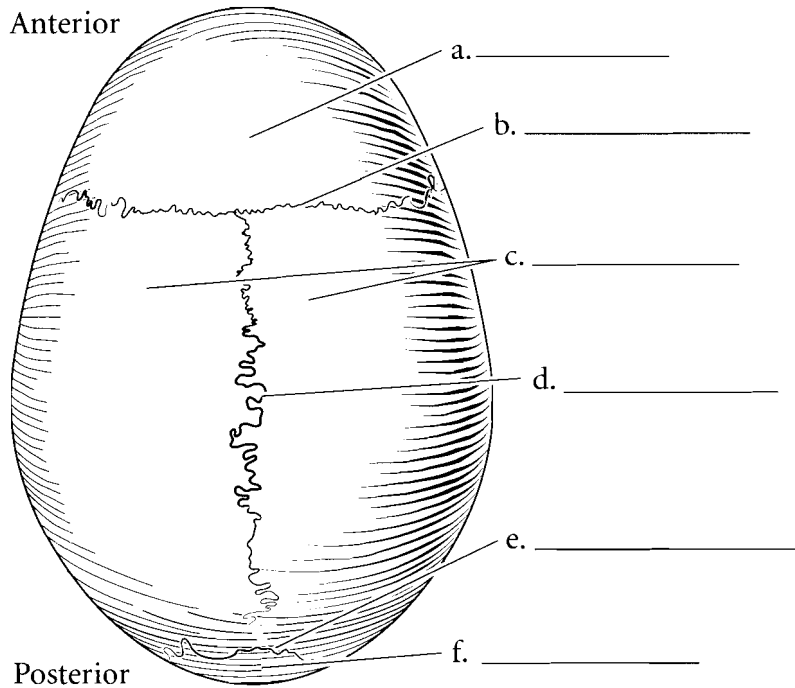


Answer Key: a. Coronal suture, b. Parietal bones, c. Zygomatic process, d. Temporal bone, e. Squamous suture, f. Lambdoid suture, g. External occipital protuberance, h. Occipital bone, i. Mastoid process, j. External acoustic meatus, k. Styloid process, l. Mandible, m. Maxilla, n. Zygomatic bone, o. Nasal bone, p. Lacrima bone, q. Sphenoid bone, r. Frontal bone, s. Coronoid process, t. Mandibular foramen, u. Mandibular notch, v. Mandibular condyle, w. Ramus, x. Angle, y. Body, z. Mental foramen

SKULL—TOP AND BOTTOM VIEWS

The superior aspect of the skull consists of few bones and few sutures. The **frontal bone** is the most anterior bone with the **parietal bones** directly posterior to it. The **coronal suture** separates the two and the **sagittal suture** separates the parietal bones. The **lambdoid suture** separates the parietal bone from the **occipital bone**. Label the bones and sutures and color the bones in the illustrations.

The inferior aspect of the skull is more complex than the superior view. In the inferior view the mandible has been removed so some of the underlying structures can be seen. The large opening in the occipital bone is the **foramen magnum**. The two bumps lateral to the foramen magnum are the **occipital condyles** and the raised bump at the posterior part of the skull is the **external occipital protuberance**. The more anterior and lateral bone to the occipital bone is the temporal bone. The **jugular foramen** is located between the occipital and temporal bone. Another opening nearby is the **carotid canal**. Lateral to this is the **styloid process**, an attachment point for muscles. Lateral to this is a depression called the **mandibular fossa**. It is here that the mandible articulates with the temporal bone. The **sphenoid bone** spans the skull and the major features seen from the inferior view are the **greater wing**, and the **lateral and medial pterygoid plates**. The hard palate is made of the **palatine process of the maxilla** and the **palatine bones**. The bone that opens into the nasal cavity is the **vomer**. Label and color these features of the skull.

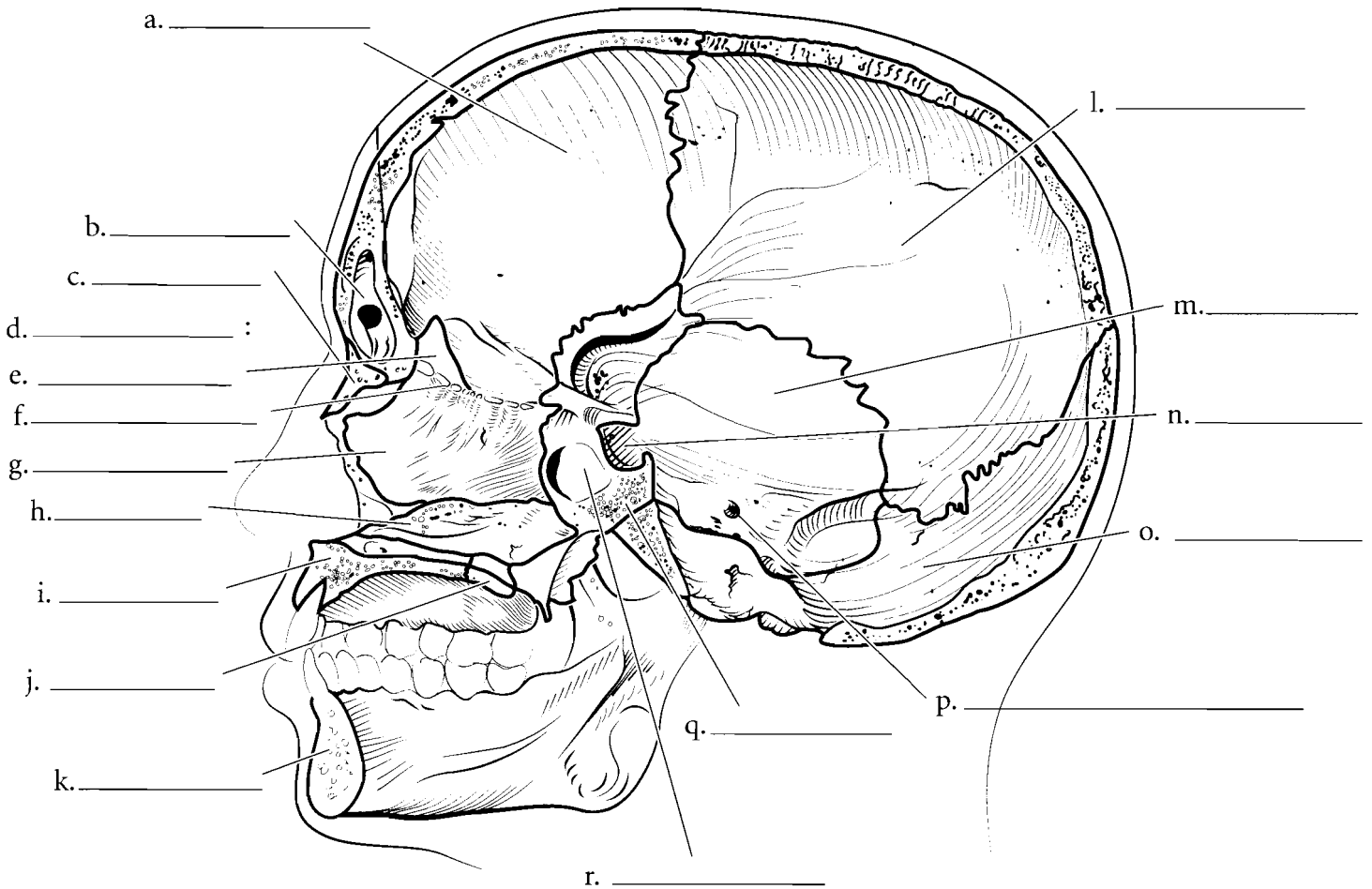


Answer Key: a. Frontal bone, b. Coronal suture, c. Parietal bones, d. Sagittal suture, e. Lambdoid suture, f. Occipital bone, g. Palatine process of the maxilla, h. Palatine bone, i. Vomer, j. Greater wing, k. Lateral pterygoid plate, l. Medial pterygoid plate, m. Mandibular fossa, n. Styloid process, o. Carotid canal, p. Jugular foramen, q. Occipital condyles, r. Foramen magnum, s. External occipital protuberance

MIDSAGITTAL SECTION OF THE SKULL

Several features of the skull can be seen when it is sectioned in the midsagittal plane. Locate the major bones of the skull and the features seen in this section. The nasal septum consists of two bony structures, the **perpendicular plate of the ethmoid bone** and the **vomer**. The **crista galli** extends superiorly from the **cribriform plate** of the ethmoid bone. The junction of the **maxilla** and the **palatine bone** that make up the hard palate can be seen from this view as well. The **frontal sinus** and the **sphenoid sinus** are two cavities seen here. Label the bones and the major features of the midsagittal section of the skull using the terms provided. Color the bones different colors and shade the sinuses in a darker shade of the color used for the specific bones that hold the sinuses.

- | | | |
|-----------------|---------------|------------------------------------|
| Frontal bone | Parietal bone | Occipital bone |
| Temporal bone | Sphenoid bone | Ethmoid bone |
| Maxilla | Mandible | Internal acoustic meatus |
| Styloid process | Sella turcica | Cribriform plate of the ethmoid |
| Nasal bone | Palatine bone | Perpendicular plate of the ethmoid |
| Vomer | Crista galli | Frontal sinus |
| Sphenoid sinus | | |



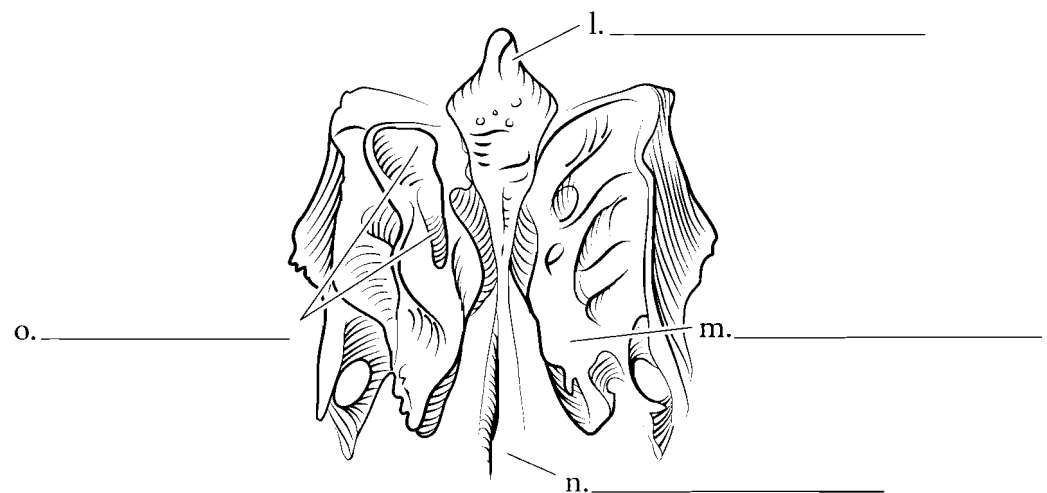
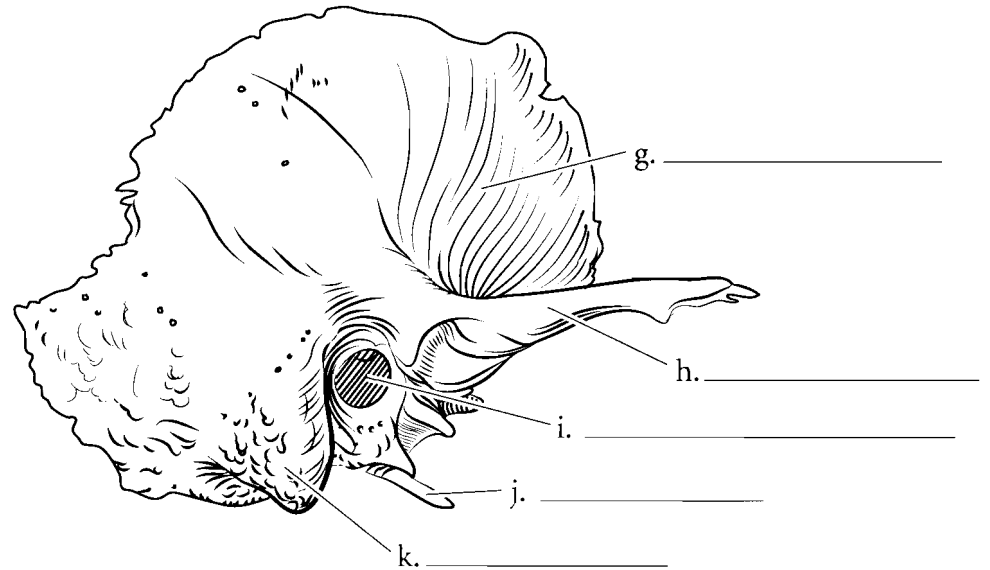
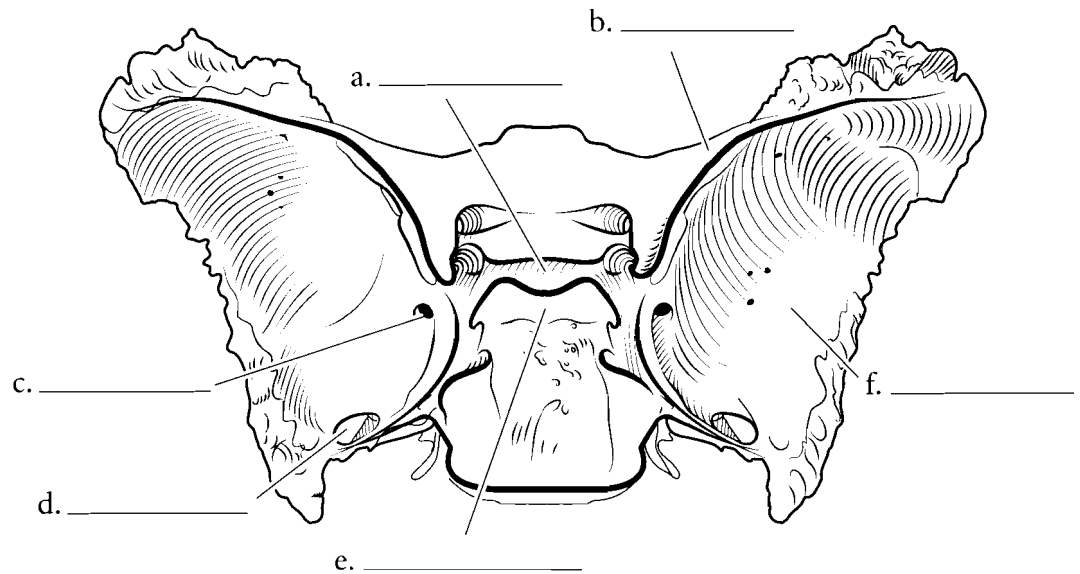
Answer Key: a. Frontal bone, b. Frontal sinus, c. Nasal bone, d. Ethmoid bone, e. Crista galli, f. Cribriform plate of the ethmoid, g. Perpendicular plate of the ethmoid, h. Vomer, i. Maxilla, j. Palatine bone, k. Mandible, l. Parietal bone, m. Temporal bone, n. Sella turcica, o. Occipital bone, p. Internal acoustic meatus, q. Sphenoid bone, r. Sphenoid sinus

SPHENOID, TEMPORAL, AND ETHMOID BONES

A few bones of the skull are frequently studied as separate bones. The sphenoid bone has a superficial resemblance to a bat or butterfly. There are the **lesser wings**, the **greater wings**, and the **pterygoid plates**, all of which resemble wings. The **dorsum sellae** is the posterior part of the **sella turcica** (a depression that holds the pituitary gland). Locate the **foramen rotundum** and the **foramen ovale** on the sphenoid bone. These holes enclose parts of the trigeminal nerve.

The temporal bone has a flat **squamous portion** and a denser petrous portion. The section of the temporal bone that connects to the zygomatic bone is the **zygomatic process**. There are two significant canals or meatuses for hearing. These are the **external acoustic meatus** and the internal acoustic meatus. The **mastoid process** is a large bump that can be palpated directly posterior to the ear. The **styloid process** anchors a number of small muscles.

The ethmoid bone is located just posterior to the nose and is best seen isolated from the rest of the skull bones. The cribriform plate that has small holes called olfactory foramina in it. Locate the **crista galli** and the **perpendicular plate**. The ethmoid has four curved structures lateral to the perpendicular plate. These are the two **superior nasal conchae** and the two **middle nasal conchae**. The **ethmoid sinuses** are numerous small holes in the bone. Locate the structures of these skull bones. Label the illustration and color in the features of the bones.



Answer Key:

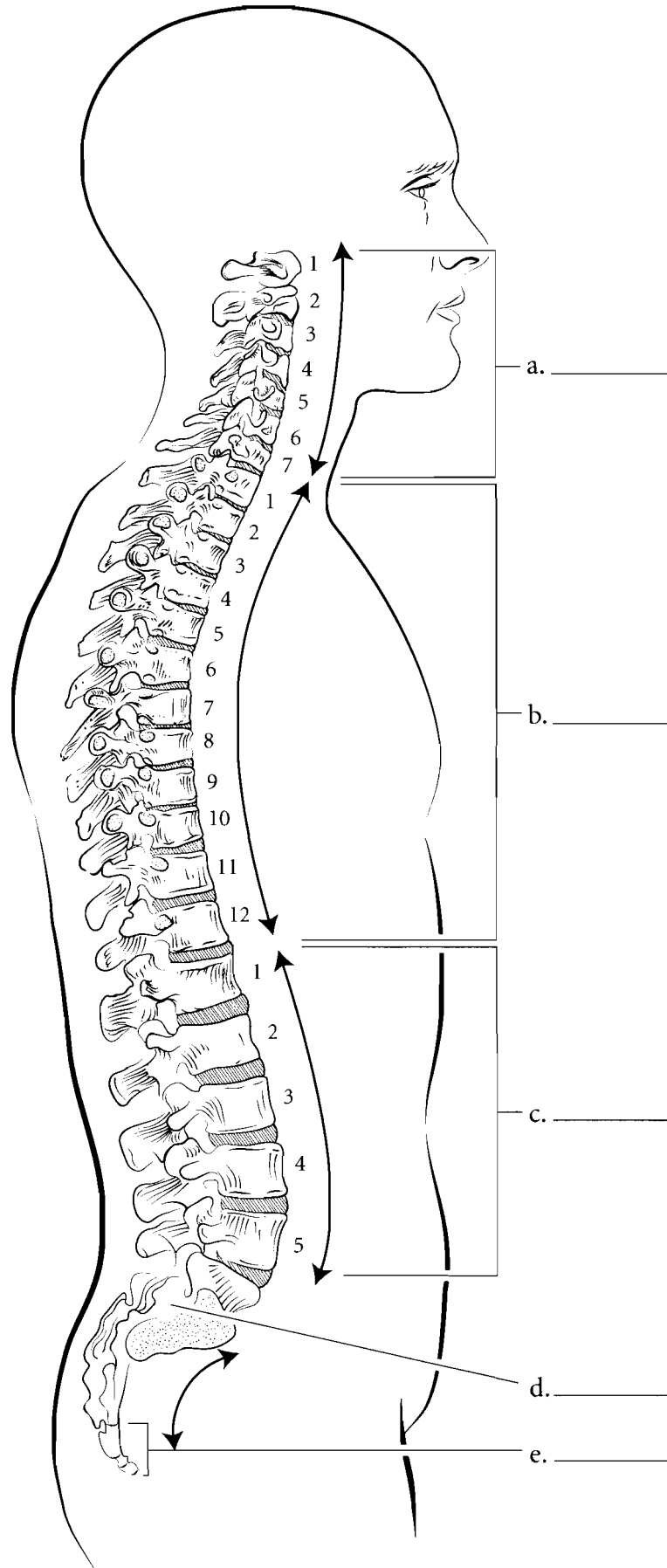
(Sphenoid features), a. Sella turcica, b. Lesser wing, c. Foramen rotundum, d. Foramen ovale, e. Dorsum sellae, f. Greater wing

(Temporal features), g. Squamous portion, h. Zygomatic process, i. External acoustic meatus, j. Styloid process, k. Mastoid process

(Ethmoid features), l. Crista galli, m. Middle nasal concha, n. Perpendicular plate, o. Superior nasal concha

VERTEBRAL COLUMN

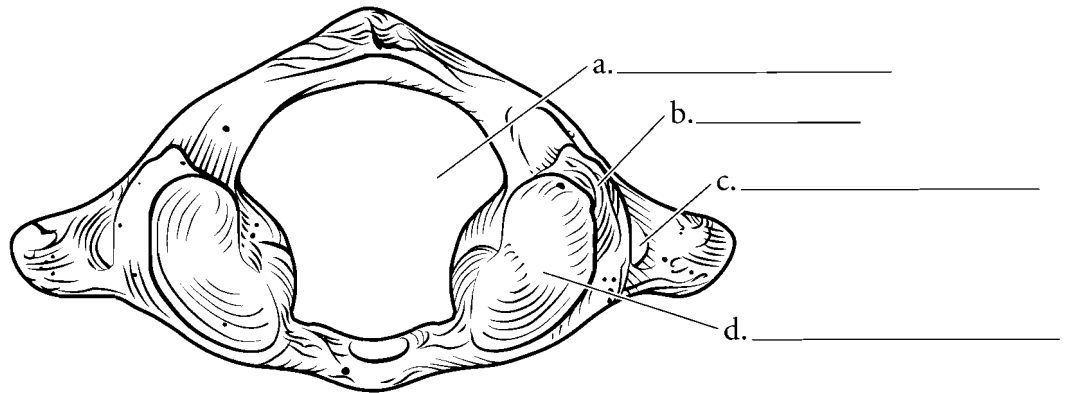
We are unique as animals because of our upright posture. The vertical position of the spine is reflected in the increase in size of the vertebra from superior to inferior. The vertebral column is divided into five major regions. There are 7 **cervical vertebrae** that occur in the neck while the 12 **thoracic vertebrae** have ribs attached to them. The 5 **lumbar vertebrae** are found in the lower back and the **sacrum** consists of 5 fused **sacral vertebrae**. The **coccyx** is the terminal portion of the vertebral column consisting of 4 **coccygeal vertebrae**. The vertebral column in the adult has curves. The uppermost is the **cervical curvature** and the lower ones are the **thoracic, lumbar, and pelvic curvatures**. Label the illustration with the regions and the curvatures and color in the regions with different colors. Color in the curved arrows for the curvatures.



Answer Key: a. Cervical vertebrae (cervical curvature), b. Thoracic vertebrae (thoracic curvature), c. Lumbar vertebrae (lumbar curvature), d. Sacrum (pelvic curvature), e. Coccyx

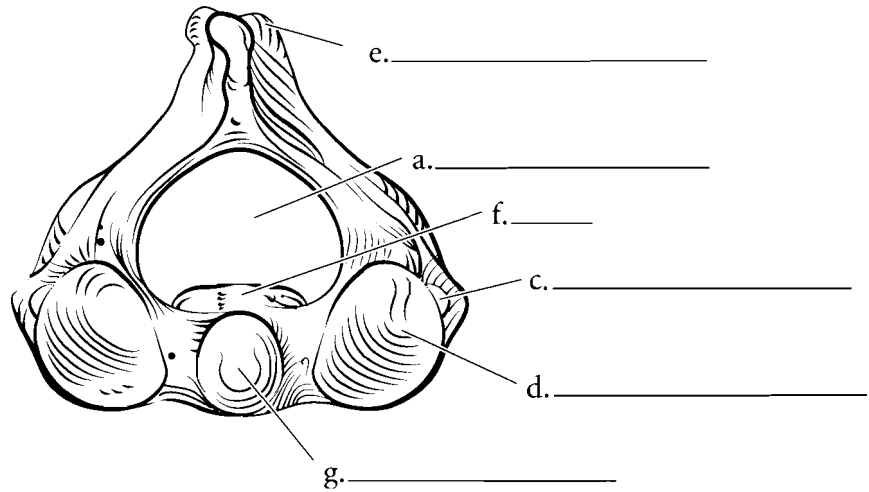
ATLAS

The **atlas** is the first cervical vertebra. It is unique among the vertebrae because it has no body. Label the **vertebral foramen**, **superior articular facet**, the **transverse foramen**, and the **lateral masses**.



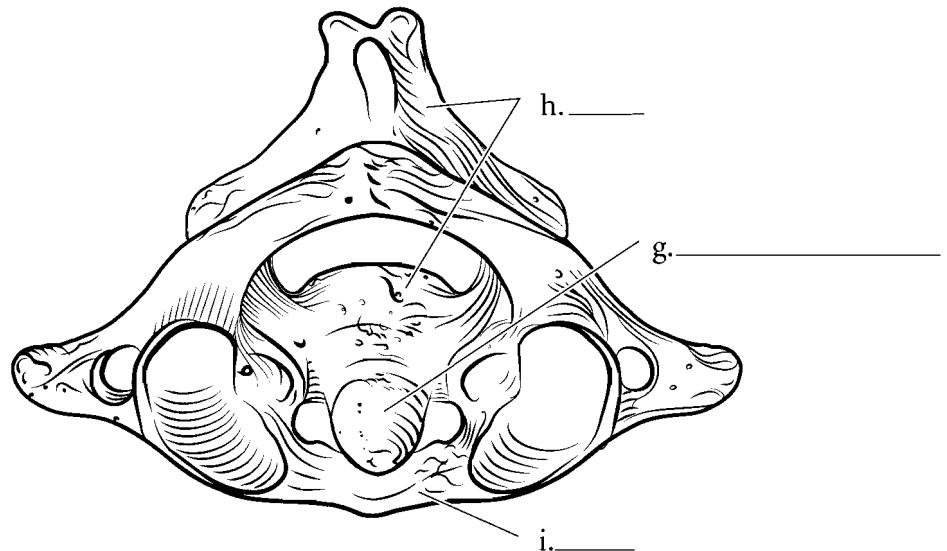
AXIS

The **axis** is the second cervical vertebra and it has a **body** with a projection that arises from the body known as the **odontoid process** or **dens**. Label the axis including the **superior articular facets**, the **transverse foramen**, the **spinous process**, and the **vertebral foramen**. Color these features in.



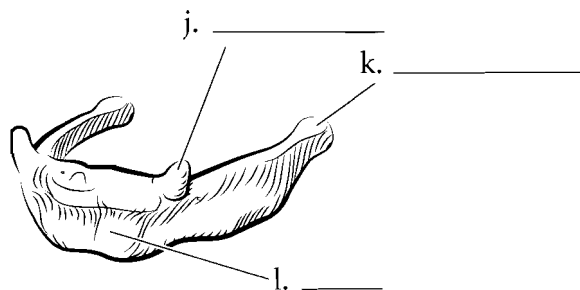
ATLAS AND AXIS

Here are the **atlas** and **axis** together. Color the two bones separate colors.



HYOID

The hyoid bone is a floating bone, which means that it has no hard attachments to other bones. The main part of the hyoid is the **body** and the two horns that arise from the hyoid are the **greater cornua** and the **lesser cornua**. Label these parts of the bone and color them in separate colors.



Answer Key: a. Vertebral foramen, b. Lateral masses, c. Transverse foramen, d. Superior articular facet, e. Spinous process, f. Body, g. Odontoid process (dens), h. Axis, i. Atlas, j. Lesser cornua, k. Greater cornua, l. Body

CERVICAL, THORACIC, AND LUMBAR VERTEBRAE

Features common to vertebrae

The opening where the spinal cord passes through the vertebra is known as the **vertebral foramen**. The **body** of the vertebra is the weight-bearing part of the vertebra and the **spinous process** is the part that extends posteriorly. This process is an extension from the **vertebral arch** that curves from the body enclosing the vertebral foramen. This arch is composed of the two **pedicles** and the two **laminae**. The **superior articular process** and the **superior articular facet** (the flat surface on the process) are the parts that join with the vertebra above. The **inferior articular process** and the **inferior articular facet** are the parts of the vertebra that join with the vertebra below.

Typical cervical vertebrae superior and lateral view

Cervical vertebrae are distinct from all other vertebrae by having two **transverse foramina**. These house blood vessels. Another characteristic of the cervical vertebrae is that several of them have a **bifid spinous process**

Typical thoracic vertebrae superior and lateral view

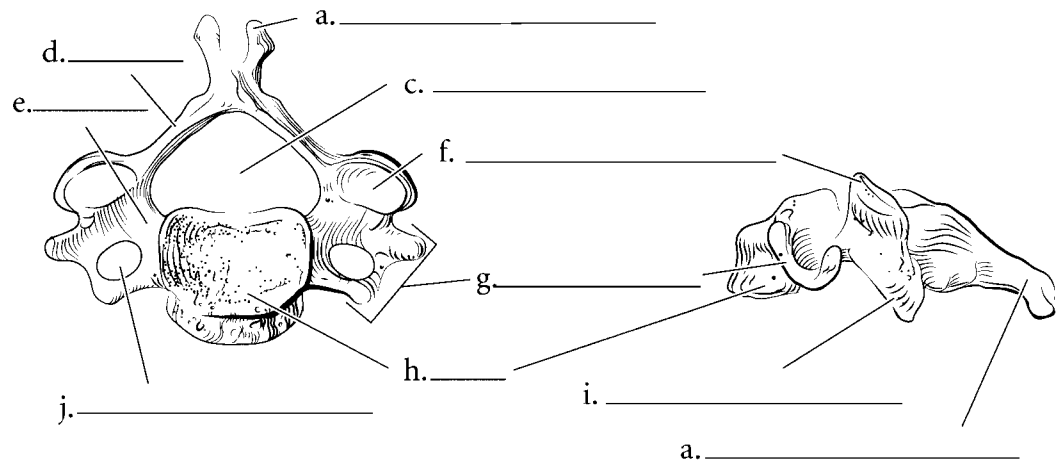
The thoracic vertebrae typically have longer **spinous processes** than cervical vertebrae and many of them point in an inferior direction. The **body** is larger in thoracic vertebrae, and they are the only bones with **costal facets** that are attachment points for the heads of ribs. The **transverse processes** can be seen along with the **transverse costal facets**.

Typical lumbar vertebrae superior and lateral view

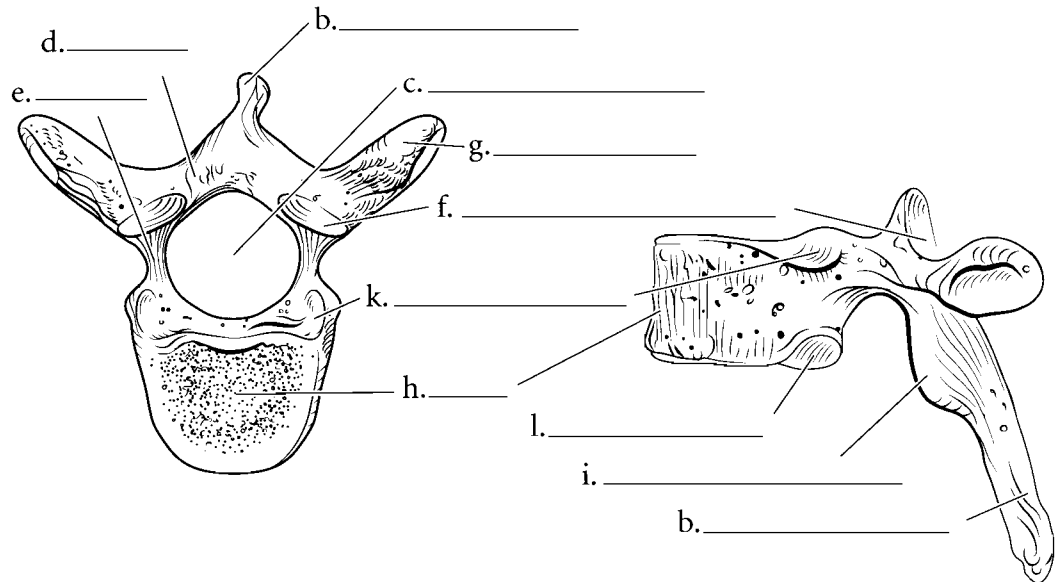
The lumbar vertebrae have larger bodies because they support more weight. The **spinous process** is shorter and more horizontal in lumbar vertebrae than in thoracic vertebrae. There are no costal facets and no transverse foramina. Label the parts of the vertebrae illustrated and color them in.

Answer Key: a. Bifid spinous process, b. Spinous process, c. Vertebral foramen, d. Lamina, e. Pedicle, f. Superior articular process, g. Transverse process, h. Body, i. Inferior articular process, j. Transverse foramen, k. Superior costal facet, l. Inferior costal facet

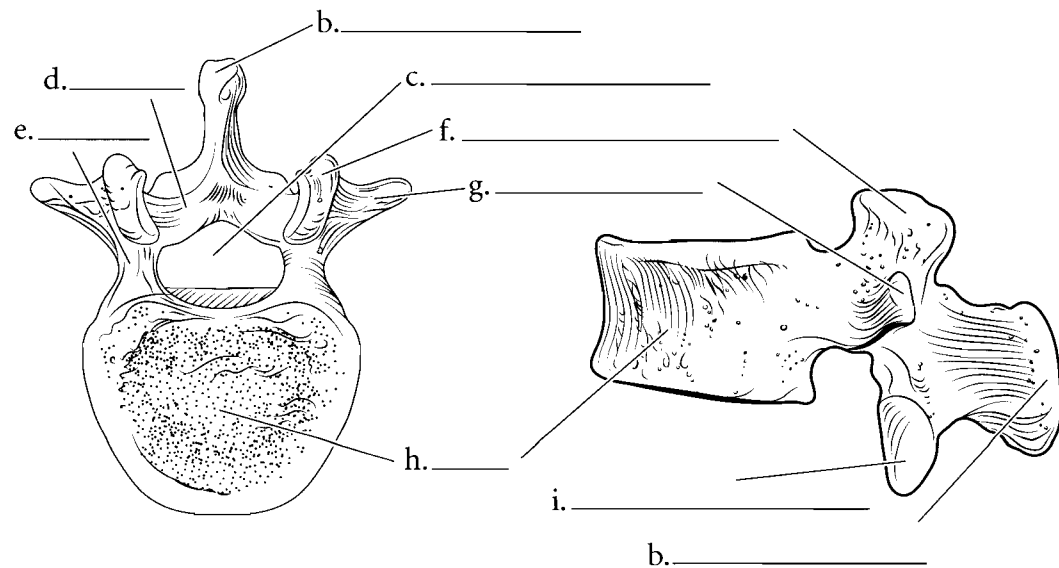
Cervical Vertebra



Thoracic Vertebra



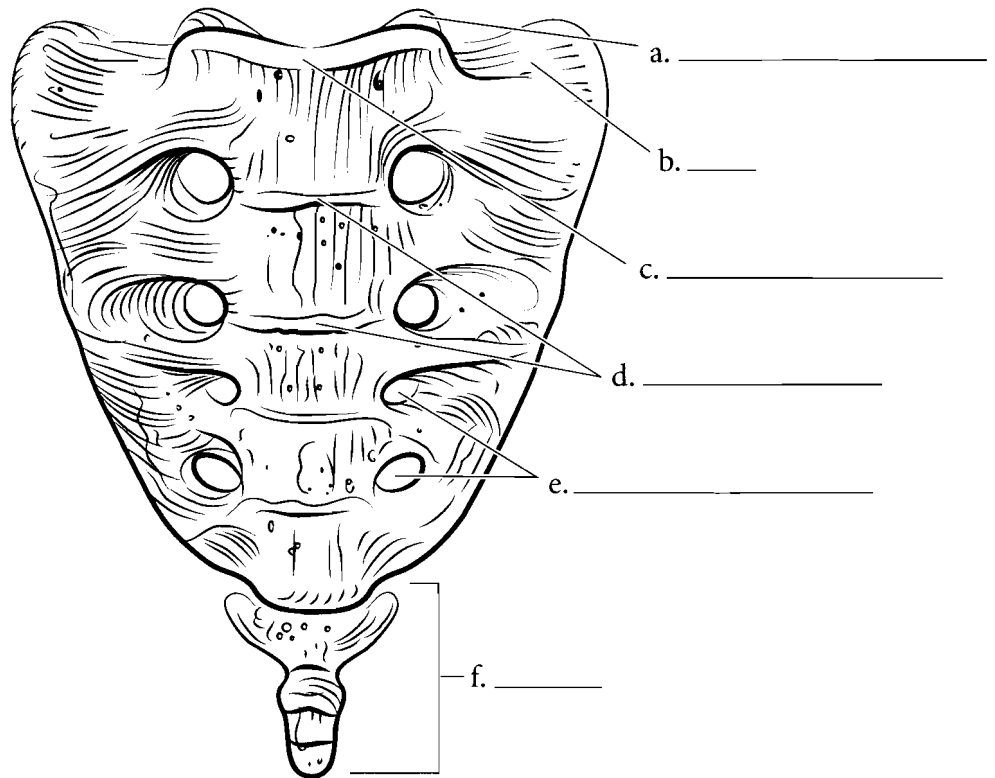
Lumbar Vertebra



SACRUM AND COCCYX

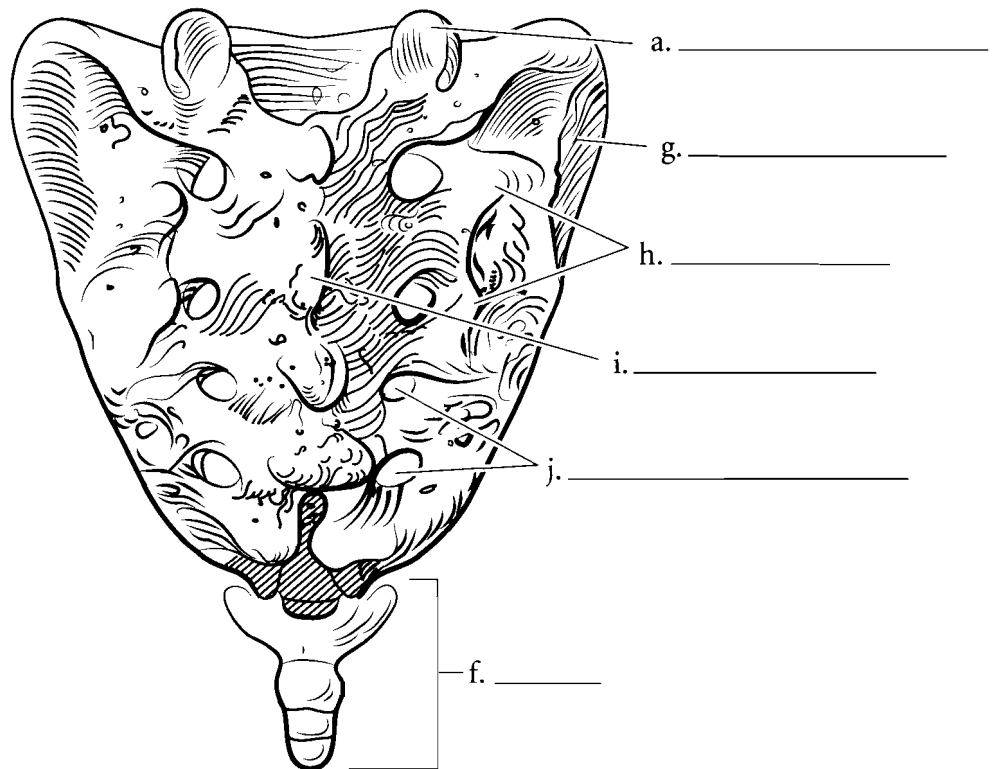
Sacrum and coccyx, anterior view

The terminal portion of the vertebral column consists of two structures that are fused bones. The **sacrum** is 5 fused vertebrae and the **coccyx** is 3–5 fused vertebrae. The top rim of the sacrum is the **sacral promontory** and the wing-like expansion where the ilium attaches is the **ala**. The area where the vertebrae join are the **transverse lines**. The holes running down each side are the **anterior sacral foramina**. At the top of the sacrum are the **superior articular processes** and they attach to the lumbar vertebra. Label and color the parts of the sacrum and the coccyx.



Sacrum and coccyx, posterior view

From the posterior view the **median sacral crest** is the fused remains of the spinous processes of the vertebrae. The **posterior sacral foramina** are on each side of the crest and the **lateral sacral crests** are lateral to the foramina. The **superior articular processes** can be seen from this view and also the **auricular surface** which forms part of the sacroiliac joint. Label the features of the sacrum and the coccyx and color them in.

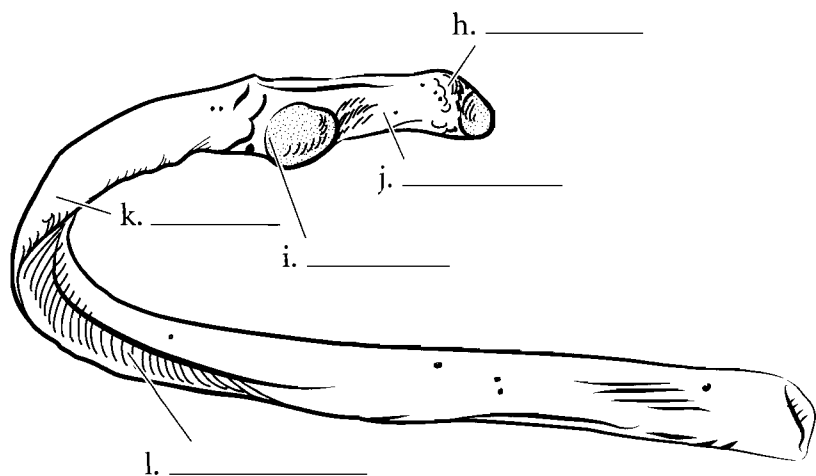
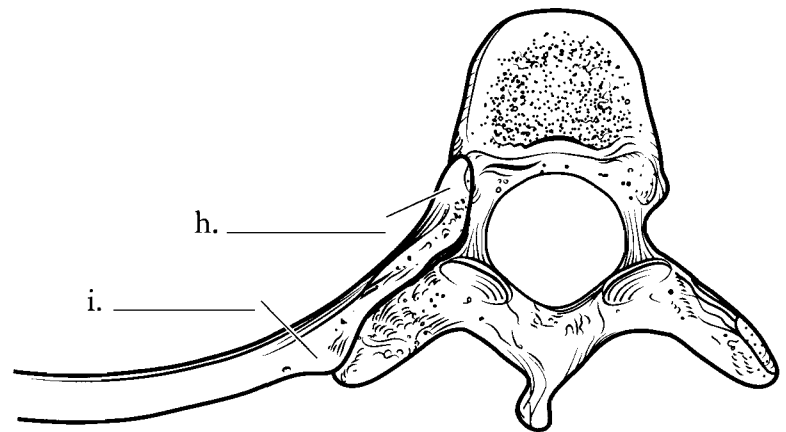
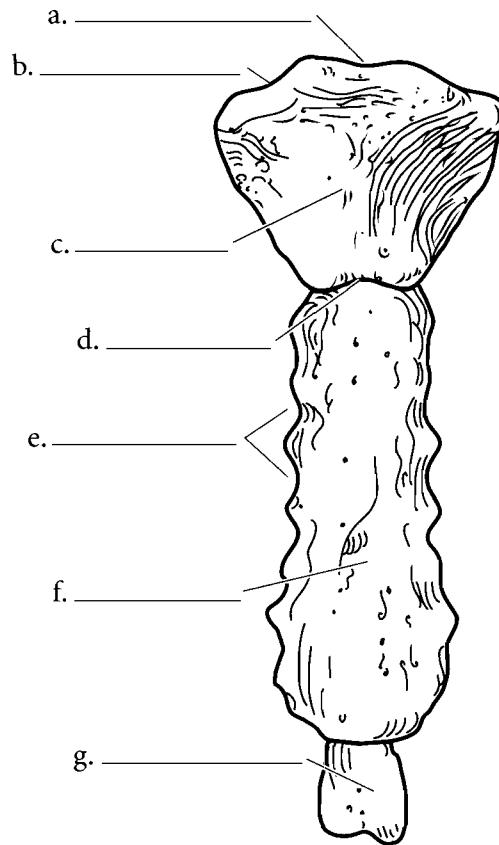


Answer Key: a. Superior articular process, b. Ala, c. Sacral promontory, d. Transverse lines, e. Anterior sacral foramina, f. Coccyx, g. Auricular surface, h. Lateral sacral crest, i. Median sacral crest, j. Posterior sacral foramina

STERNUM / RIBS / HYOID

The **sternum** is commonly known as the breastbone and is divided into three areas, the upper **manubrium** with the **suprasternal notch** and the **clavicular notches**, the **body** with the **costal notches** (where the ribs attach), and the **xiphoid process**. Between the manubrium and the body is the **sternal angle**. Label these features on the illustration and color the three major areas of the sternum different colors.

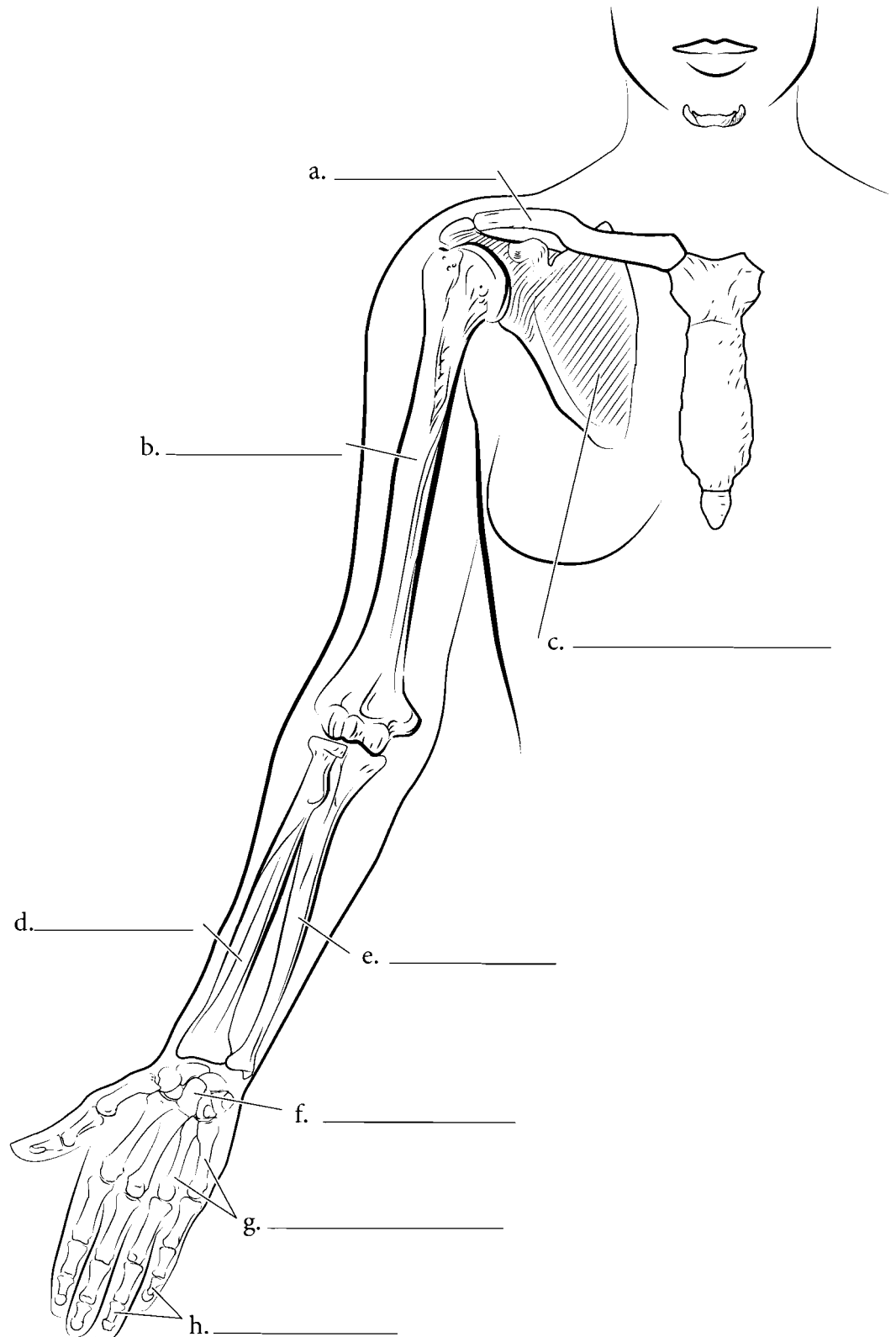
If you select a rib as a representative bone for all of the ribs, you will find the terminal portion of the rib is expanded in a **head**. The constricted region below that is the **neck**. The **tubercle** of the rib is a bump that attaches to the transverse process of the vertebra. The bend in the rib is known as the **angle** and the depressed area of the rib where nerves and blood vessels are found is the **costal groove**. Color in the individual parts of a rib after you label the figure and color the rib as it joins with a vertebra.



Answer Key: a. Suprasternal notch, b. Clavicular notch, c. Manubrium, d. Sternal angle, e. Costal notches, f. Body, g. Xiphoid process, h. Head, i. Tubercle, j. Neck, k. Angle of rib, l. Costal groove

APPENDICULAR SKELETON—PECTORAL GIRDLE AND UPPER EXTREMITY

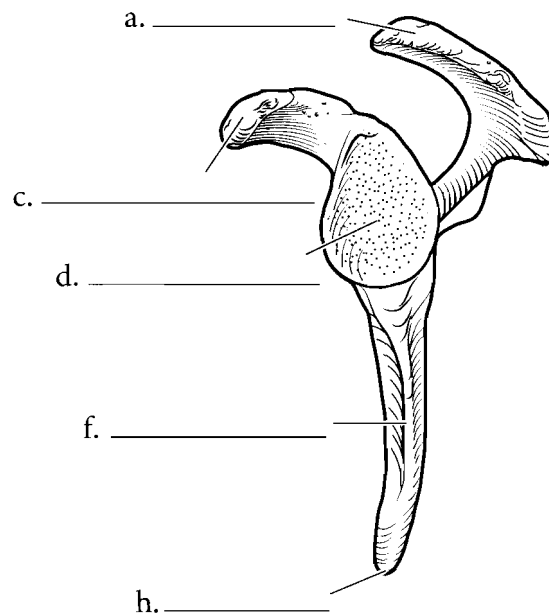
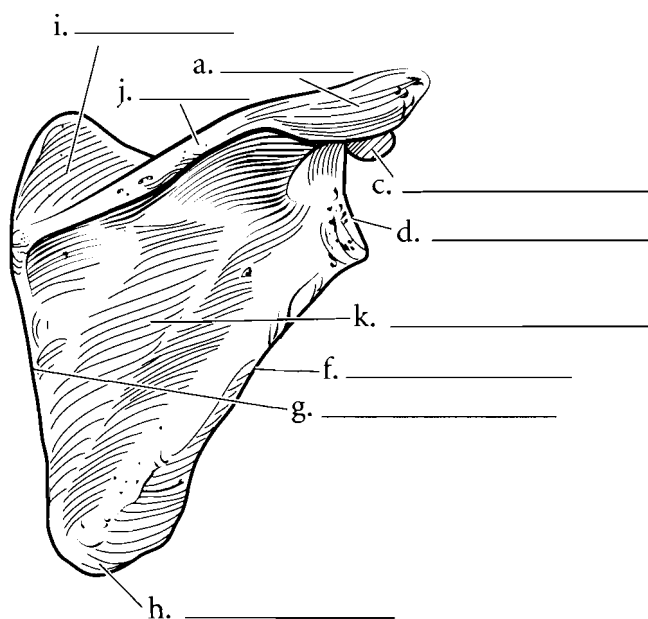
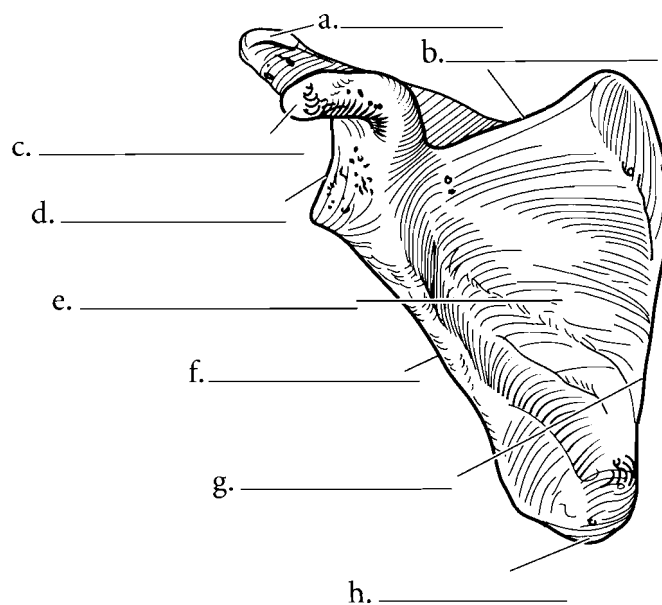
The pectoral girdle is made of the **clavicles** and the **scapulae**. The upper extremity consists of the **humerus** of the arm, the **radius** and **ulna** of the forearm, and the **carpals**, **metacarpals**, and **phalanges** of the hand. Locate these major regions of the upper extremity and label them on the diagram. Color these areas in different colors on the illustration.



Answer Key: a. Clavicle, b. Humerus,
c. Scapula, d. Radius, e. Ulna, f. Carpals,
g. Metacarpals, h. Phalanges

SCAPULA

The pectoral girdle consists of the scapulae and the clavicles. Each scapula is a triangular bone and the three edges are known as the **superior border**, the **lateral border**, and the **medial border**. The **scapular spine** is on the posterior surface and it expands into a terminal process known as the **acromion process**. Above the spine is the **supraspinous fossa**. Below the spine is the **infraspinous fossa** and on the anterior side of the scapula is the **subscapular fossa** and the **coracoid process**. The **inferior angle** of the scapula is at the junction of the medial and lateral borders. Inferior to the acromion process is the **glenoid fossa**. This is a depression where the head of the humerus articulates with the scapula. Label the various features of the scapula and color in the regions of the bone with different colors. Locate as many of the features from the various angles presented.

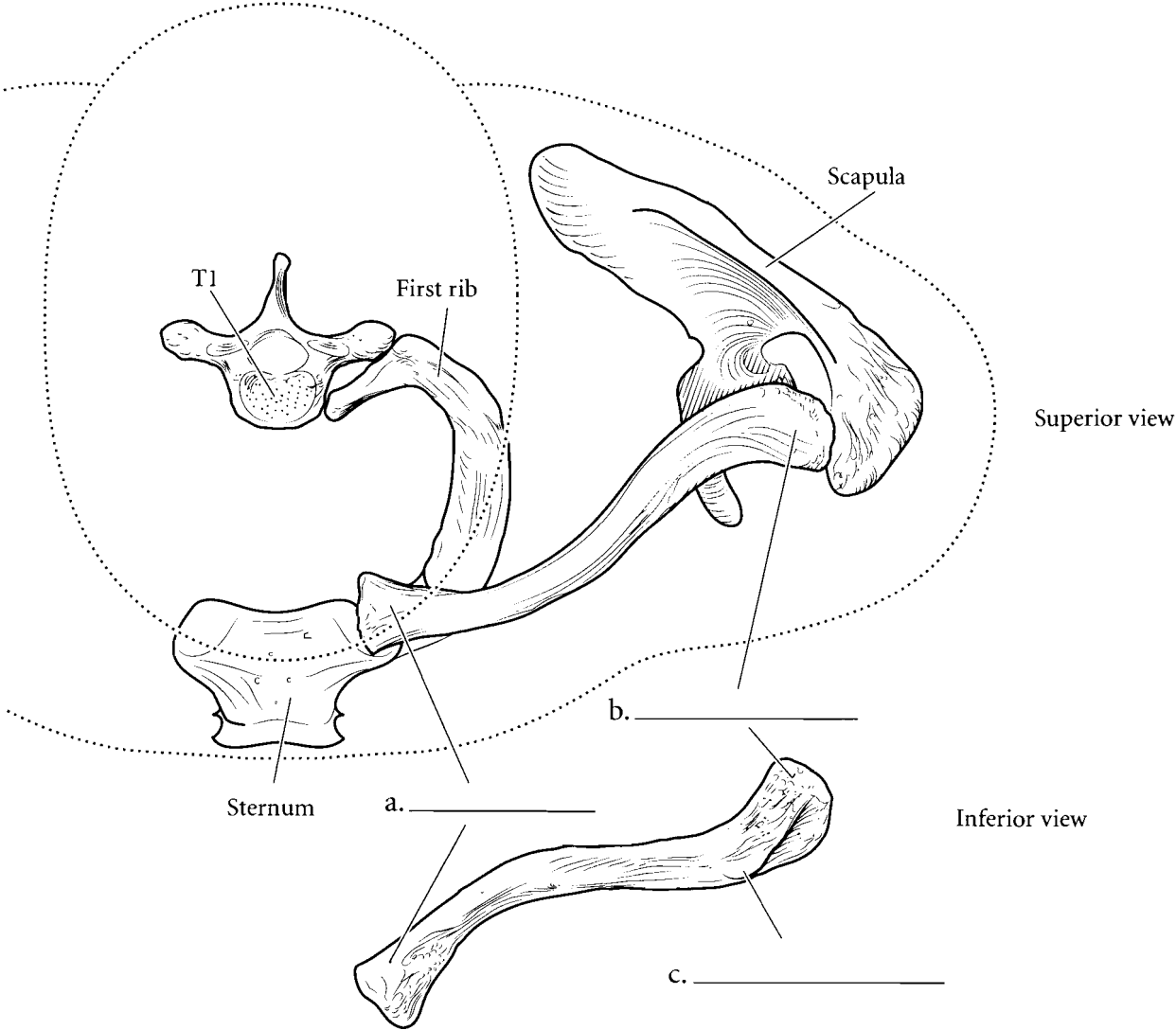


Answer Key: a. Acromion process, b. Superior border, c. Coracoid process, d. Glenoid fossa, e. Subscapular fossa, f. Lateral border, g. Medial border, h. Inferior angle, i. Supraspinous fossa, j. Scapular spine, k. Infraspinous fossa

CLAVICLE

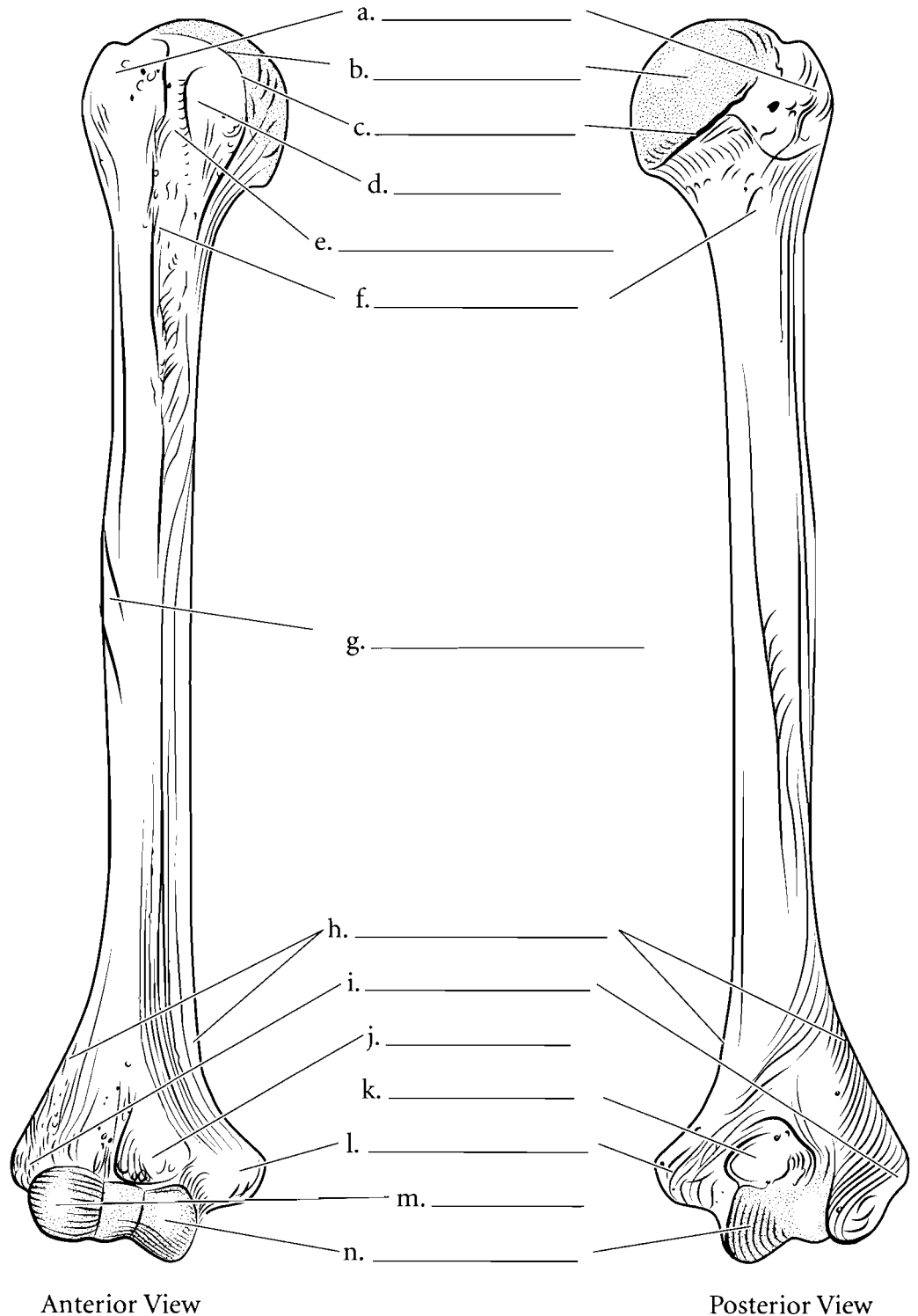
The clavicle is a thin bone that stabilizes the shoulder joint in a lateral position. It has a blunt end that articulates with the sternum (the **sternal end**) and a flattened end that joins with the acromion process of the

scapula. This is called the **acromial end**. A small bump on the inferior part of the clavicle has a ligament that attaches to the coracoid process of the scapula. This bump is called the **conoid tubercle**. Label the clavicle and color the ends and the conoid tubercle.



HUMERUS

The humerus has a proximal **head** that fits into the glenoid fossa of the scapula. Just at the edge of the head is a rim known as the **anatomical neck**. Below this neck are the **greater** and **lesser tubercle** and the depression between the two is the **intertubercular groove**. Below these is the **surgical neck** of the humerus. The deltoid muscle attaches to the humerus at the **deltoid tuberosity** and the two expanded wing-like processes at the distal end of the humerus are the **supracondylar ridges**. Inferior to these are the **medial** and **lateral epicondyles** and at the articulating ends of the humerus are the lateral **capitulum** and the medial **trochlea**. The depression on the anterior surface of the humerus into which the ulna fits is called the **coronoid fossa** and the posterior depression where the elbow locks into the humerus is called the **olecranon fossa**. Label the figure and color in the specific parts of the illustration.



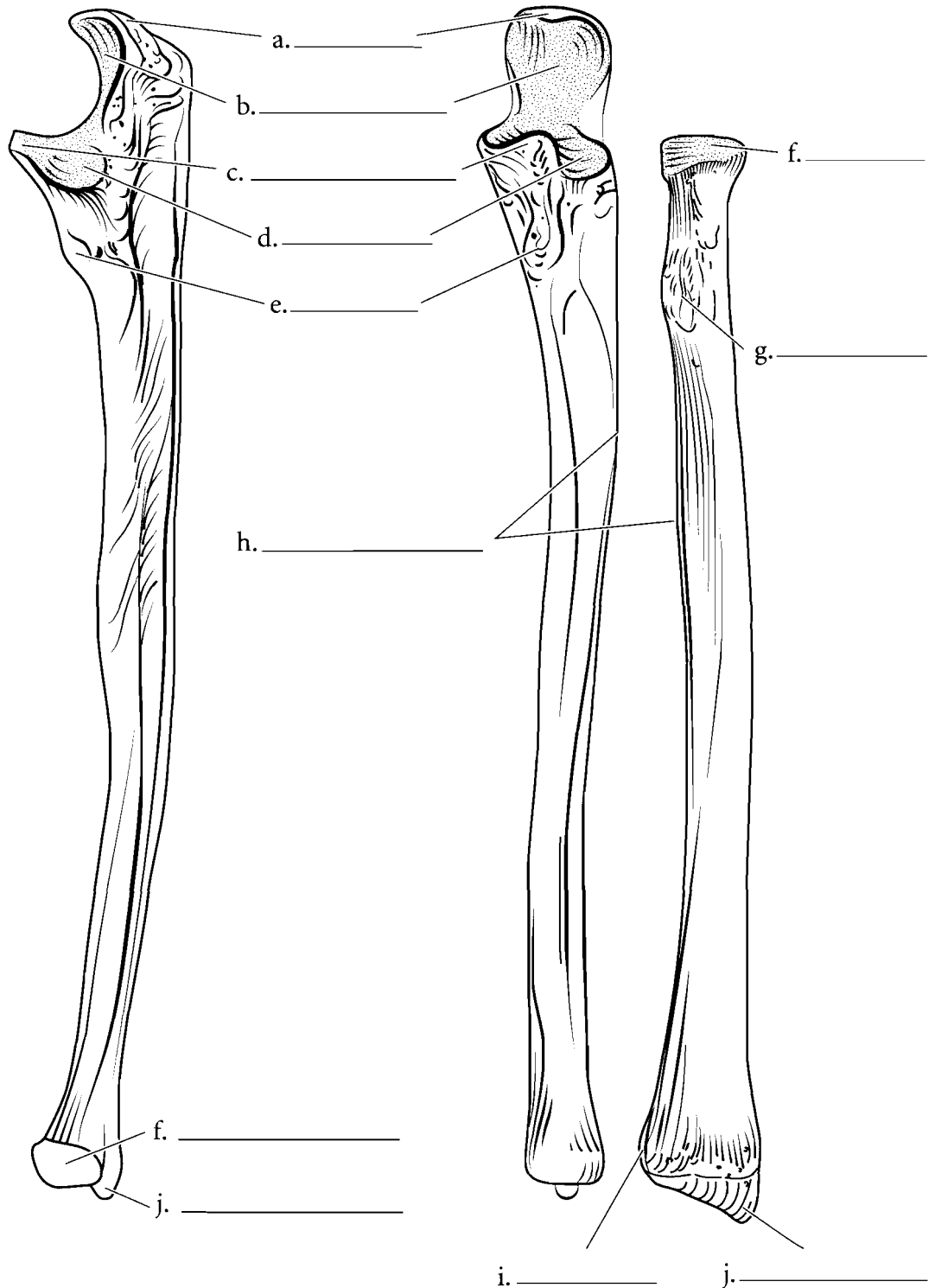
Answer Key: a. Greater tubercle, b. Head, c. Anatomical neck, d. Lesser tubercle, e. Intertubercular groove, f. Surgical neck, g. Deltoid tuberosity, h. supracondylar ridges, i. Lateral epicondyle, j. Coronoid fossa, k. Olecranon fossa, l. Medial epicondyle, m. Capitulum, n. Trochlea

FOREARM BONES

The radius has a circular **head**, a **radial tuberosity** on the shaft (where the biceps brachii muscle attaches), and a distal **styloid process**. At the distal end of the radius is a depression where the ulna joins with the radius. This is known as the **ulnar notch** of the radius.

The ulna has a proximal **olecranon process**, a **coronoid process**, and the **trochlear notch** between the two. Just distal to the coronoid process of the ulna is the **tuberosity of the ulna**, a projection where muscles attach. The **head** of the ulna is distal and it also has a **styloid process**. At the proximal portion of the ulna is a depression where the head of the radius articulates with the ulna. This depression is known as the **radial notch** of the ulna.

When the two bones are joined you can see where each fits into the other. On the edge of each bone is the **interosseus margin**. This is a ridge where the interosseus membrane connects the bones.

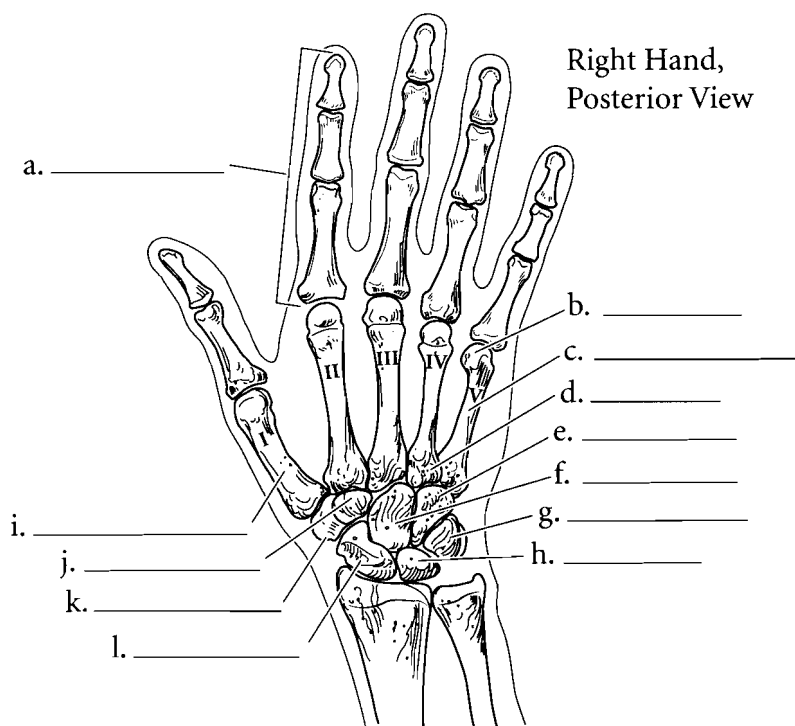


Answer Key: a. Olecranon process, b. Trochlear notch, c. Coronoid process, d. Radial notch, e. Tuberosity of the ulna, f. Head, g. Radial tuberosity, h. Interosseus margin, i. Ulnar notch, j. Styloid process

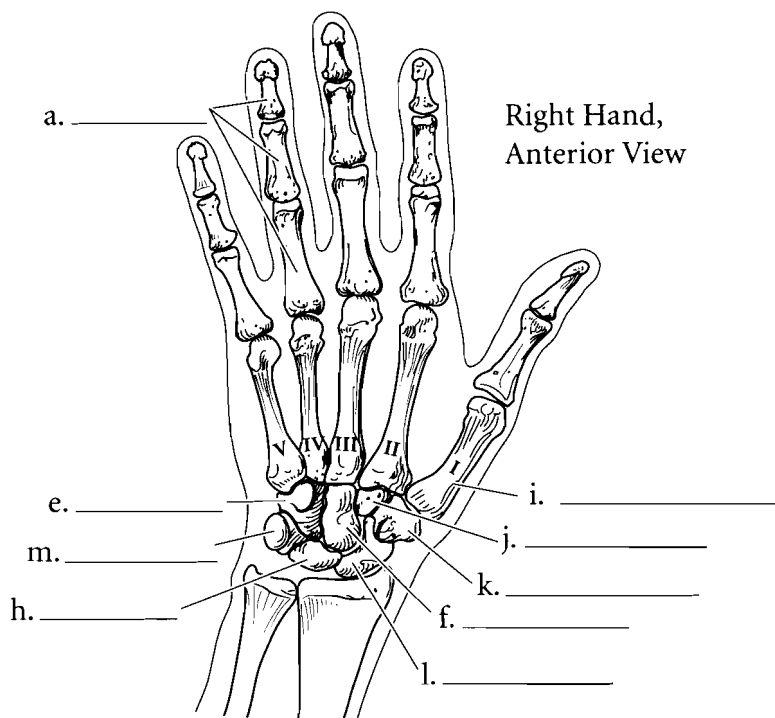
HAND BONES

The hand consists of 27 bones divided into three groups: the **carpals**, the **metacarpals**, and the **phalanges**. The thumb is known as the **pollex** and is listed as the first digit of the hand. The index finger is the second digit and the fingers are listed sequentially with the little finger being the fifth digit. The bones of the fingers are known as **phalanges** and they are named according to what digit they belong and as being proximal, middle or distal. Therefore the bone of tip of the little finger is the distal phalanx of the fifth digit while the bone in the place where you would normally wear a wedding ring is the proximal phalanx of the fourth digit. Each phalanx has a proximal base, a shaft, and a distal head. The **metacarpals** are the bones of the palm of the hand. Each metacarpal also has a proximal base, a shaft, and a distal head. There are five metacarpals and they are named for the phalanges that extend from them. The first metacarpal articulates with the thumb. The carpals are the bones of the wrist. There are eight carpal bones in two rows. The bone under the thumb is the **trapezium**. The one medial to it is the **trapezoid**. The **capitate** is found under the third metacarpal and the **hamate** finishes that row. Proximal to the trapezium is the **scaphoid**, which joins with the radius. The next bone in line is the **lunate**, followed by the **triquetrum**, and finally the little **pisiform** bone. If you memorize the bones in this sequence you can use a mnemonic device to remember them. This mnemonic is *The Tom Cat Has Shaken Loose To Prowl*. The first letter of the mnemonic represents the first letter of the carpal bone. Label the illustration and color all of the phalanges one color. Color the metacarpals another color and color the carpal bones individual colors. As you color the various illustrations of the hand use the same color scheme for the bones.

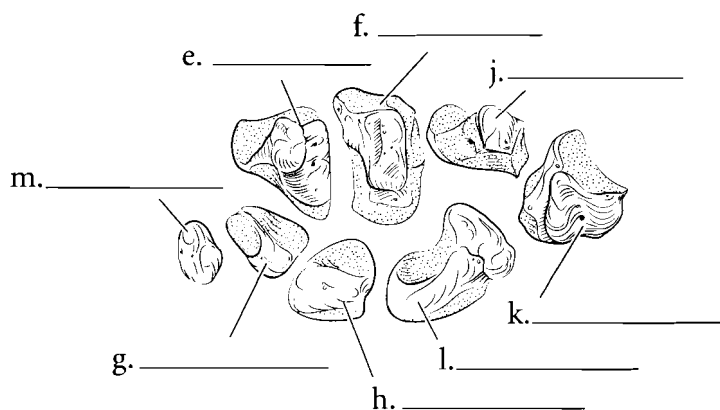
Right Hand,
Posterior View



Right Hand,
Anterior View



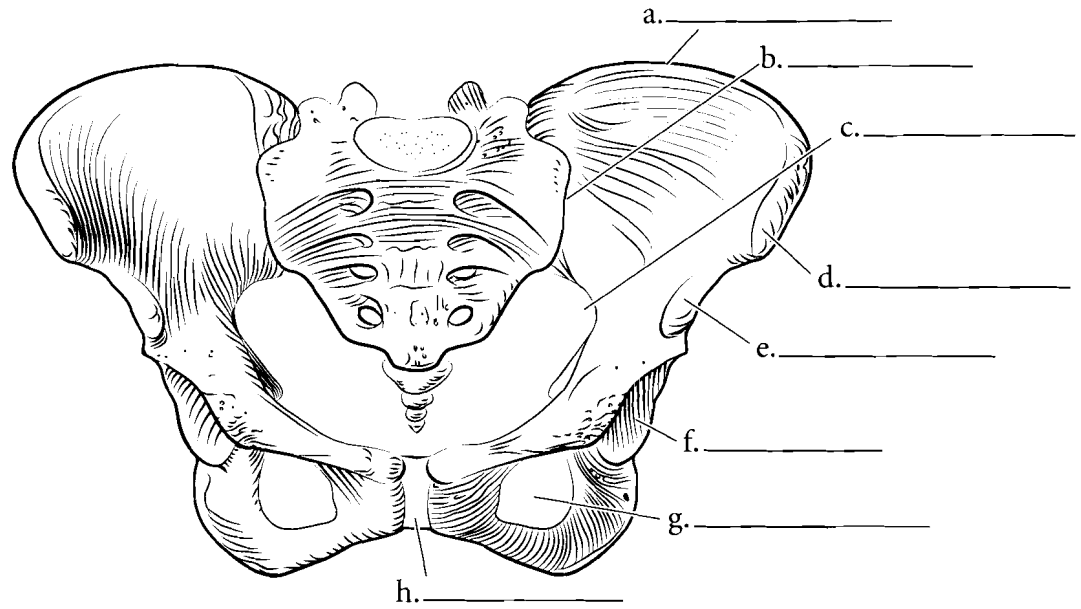
Right Hand,
Anterior View,
Carpals



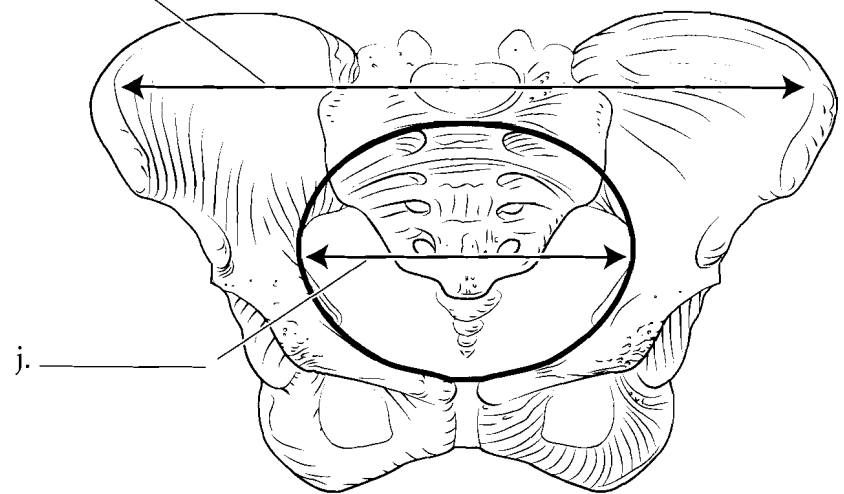
Answer Key: a. Phalanges, b. Head, c. Shaft, d. Base, e. Hamate, f. Capitate, g. Triquetrum, h. Lunate, i. Metacarpal, j. Trapezoid, k. Trapezium, l. Scaphoid, m. Pisiform

HIP

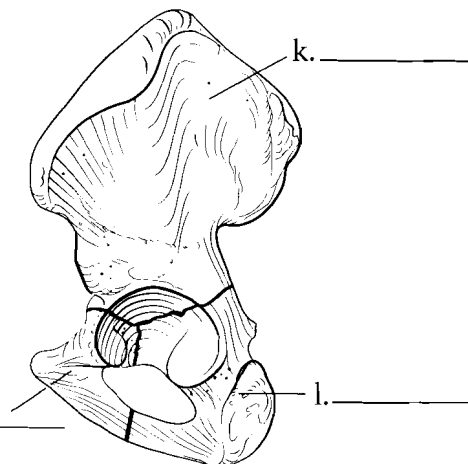
The hip bones are known as the os coxae. Each os coxa is a result of the fusion of three bones, the **ilium**, the **ischium**, and the **pubis**. Label and color in these three fused bones using a different color for each area. The two os coxae, when joined together by the **pubic symphysis**, form the pelvis and it can be divided into an upper **false pelvis** and a lower **true pelvis** separated by the pelvic brim. The **anterior superior iliac spine** and the **anterior inferior iliac spine** can be seen from the front. The top ridge of the pelvis is the **iliac crest**. The large, inferior hole is the **obturator foramen** and the depression superior to it is the **acetabulum**. Note the junction of the sacrum and the ilium that forms the **sacroiliac joint**. Label the features of the anterior view and color them in.



i. _____



j. _____



m. _____

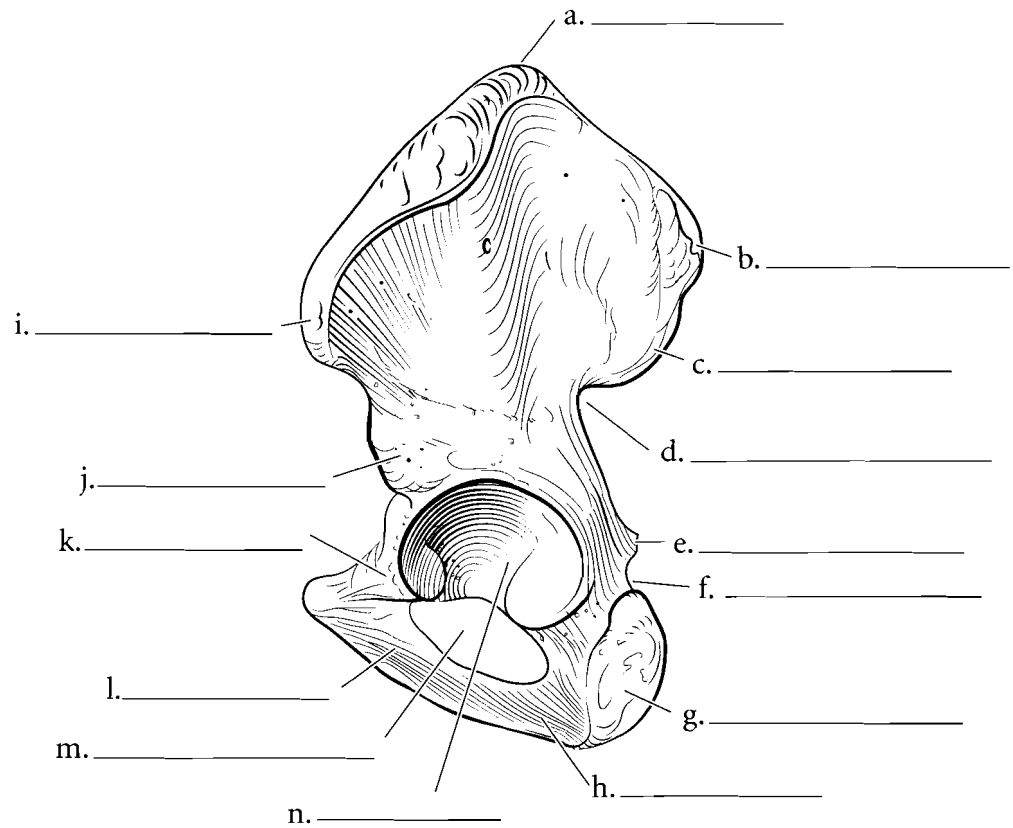
l. _____

Answer Key: a. Iliac crest, b. Sacroiliac joint, c. Greater sciatic notch, d. Anterior superior iliac spine, e. Anterior inferior iliac spine, f. Acetabulum, g. Obturator foramen, h. Pubic symphysis, i. False pelvis, j. True pelvis, k. Ilium, l. Ischium, m. Pubis

HIP (CONTINUED)

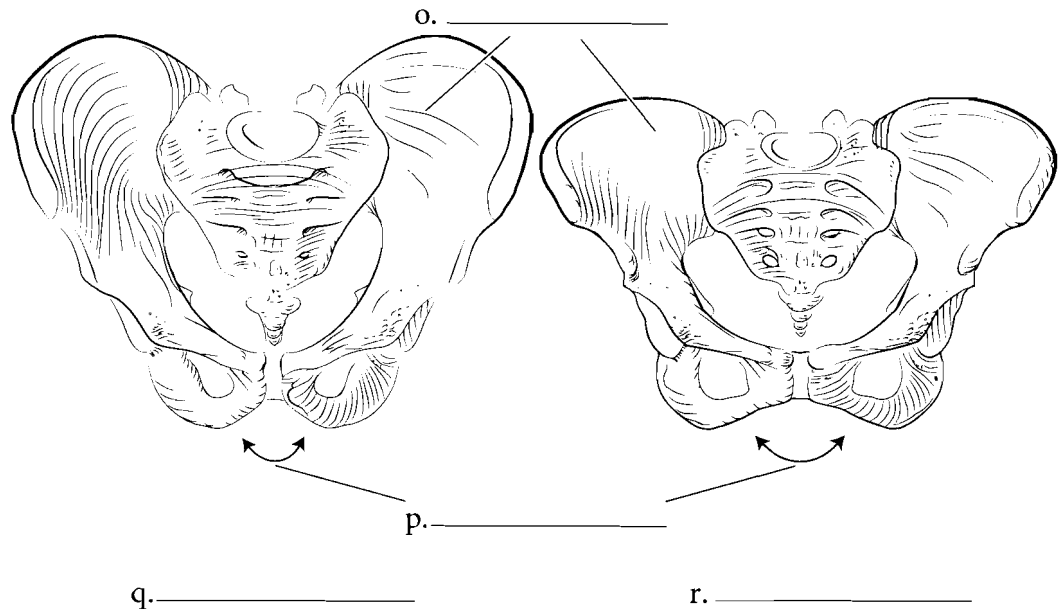
Lateral View

When seen from a lateral view, several features are apparent in the os coxa. Locate the **posterior superior iliac spine** and the **posterior inferior iliac spine** along with the **greater sciatic notch**, the **spine of the ischium**, and the **lesser sciatic notch**. The **ischial tuberosity** is at the posterior, inferior edge of the ischium. Just anterior to the tuberosity is a strip of bone called the **ischial ramus** that attaches to the **inferior pubic ramus**. The body of the pubis is the most anterior part of the pubis and the **superior pubic ramus** is the portion that forms part of the acetabulum. Label and color these features on the illustration.



MALE AND FEMALE PELVIS

Differences can be seen between the male and female pelvis. The **subpubic angle** in males is less than 90 degrees and the female angle is greater than 90 degrees. The ilium in males is more vertical than in a pelvis of a woman who has had children. A further distinction is seen in the side view of a pelvis in which the sciatic notch in the female pelvis has a much wider angle than in males. Color in the upper portion of the ilium.

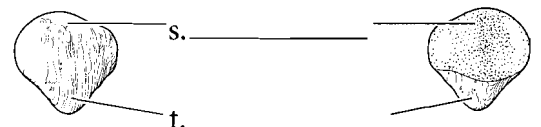
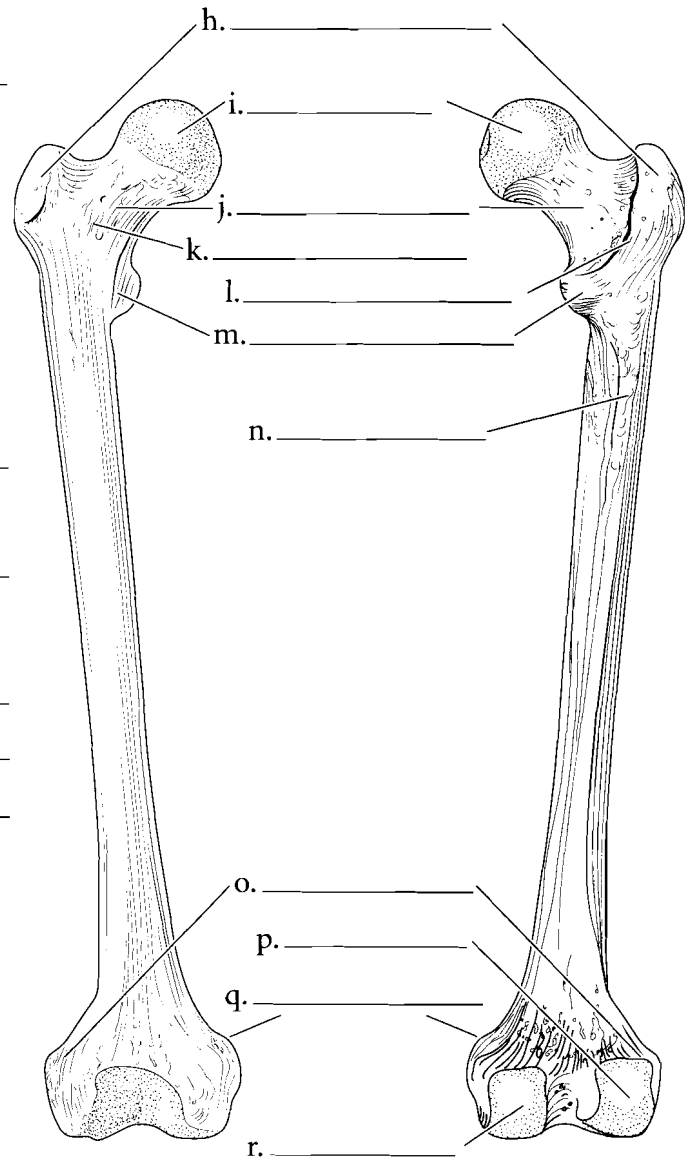
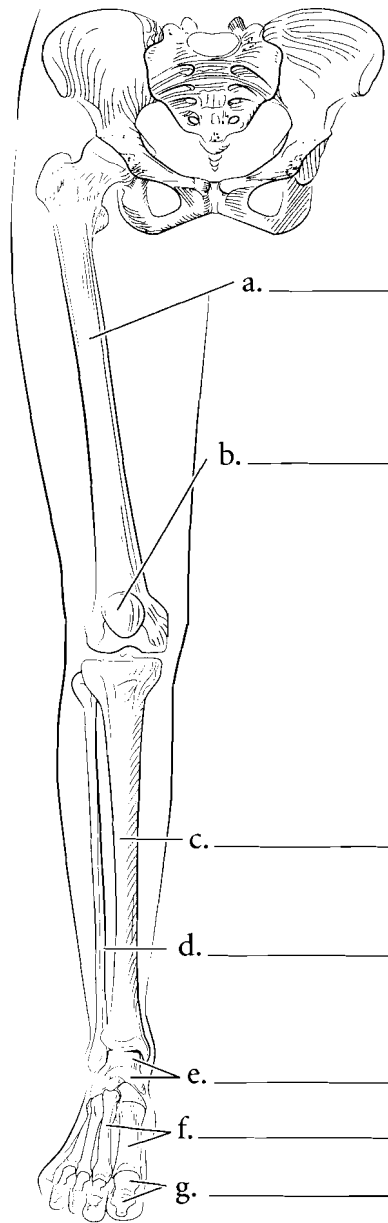


Answer Key: a. Iliac crest, b. Posterior superior iliac spine, c. Posterior inferior iliac spine, d. Greater sciatic notch, e. Spine of the ischium, f. Lesser sciatic notch, g. Ischial tuberosity, h. Ischial ramus, i. Anterior superior iliac spine, j. Anterior inferior iliac spine, k. Superior pubic ramus, l. Inferior pubic ramus, m. Obturator foramen, n. Acetabulum, o. Iliac blade, p. Subpubic angle, q. Male (less than ninety degrees), r. Female (more than ninety degrees)

LOWER EXTREMITY— FEMUR/PATELLA

The lower extremity consists of the **femur** of the thigh, the **tibia** and **fibula** of the leg, and the **tarsals**, **metatarsals**, and **phalanges** of the foot. Locate these major regions of the lower extremity and label them on the diagram. Color these areas in different colors on the illustration.

The femur seen from the anterior view shows a proximal **head** and a constricted **neck**. Two large processes are distal to the neck. These are the **greater trochanter** and the **lesser trochanter**. There is a raised section of bone between them called the **intertrochanteric line**. The main part of the bone is the shaft and the **lateral epicondyle** and **medial epicondyle** are the distal expansions of the bone. The posterior view of the femur has additional features such as the **intertrochanteric ridge**, the **linea aspera**, and the **lateral condyle** and the **medial condyle**. The femur is bowed and this can be seen from a lateral view as well as the placement of the **patella**. The **base** of the patella is superior and the **apex** is inferior. Label the features of the femur and patella and color in the various parts.



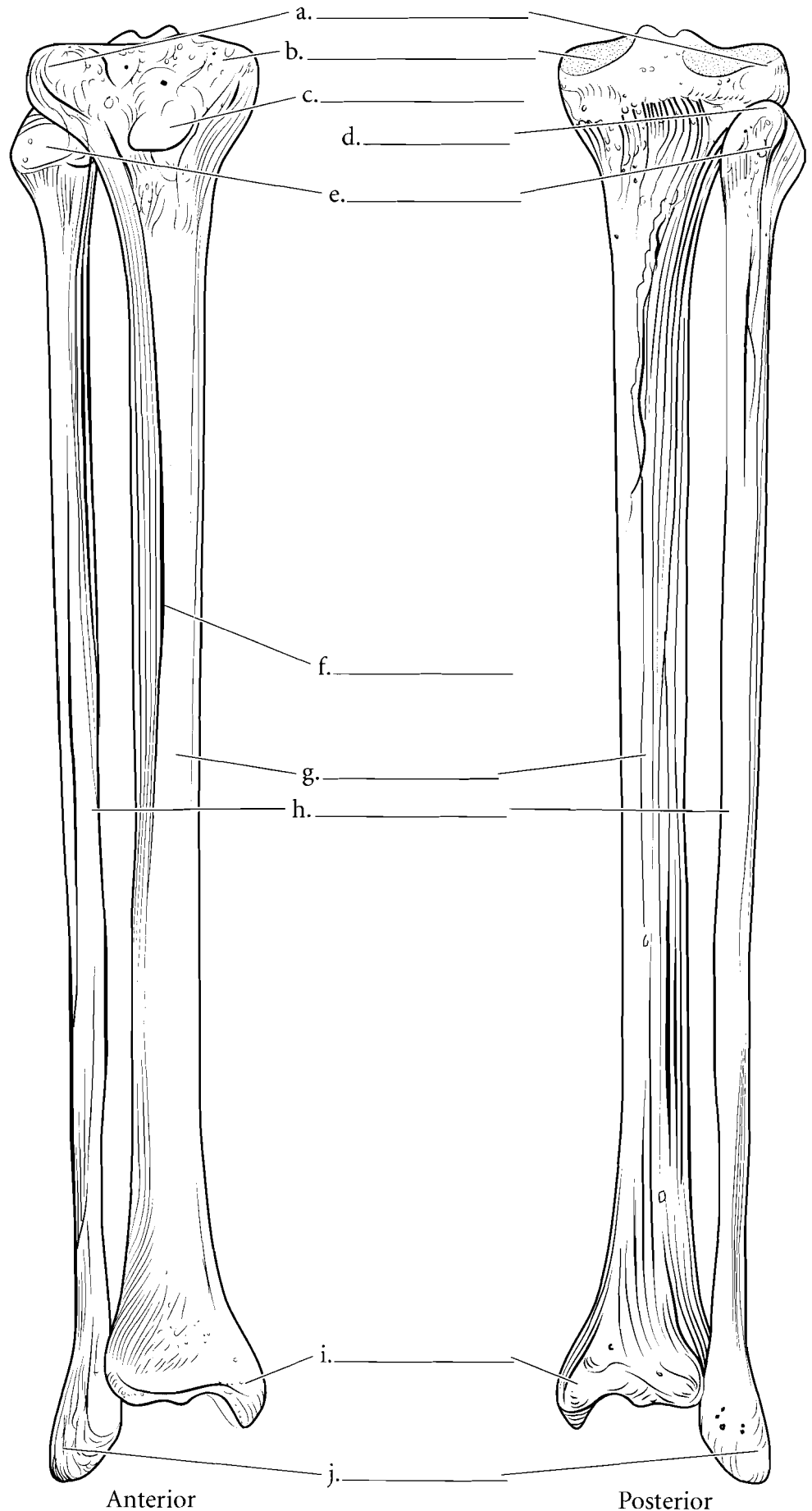
Anterior

Posterior

Answer Key: a. Femur, b. Patella, c. Tibia, d. Fibula, e. Tarsals, f. Metatarsals, g. Phalanges, h. Greater trochanter, i. Head, j. Neck, k. Intertrochanteric line, l. Intertrochanteric ridge, m. Lesser trochanter, n. Linea aspera, o. Lateral epicondyle, p. Lateral condyle, q. Medial epicondyle, r. Medial condyle, s. Base of patella, t. Apex of patella

TIBIA / FIBULA

The **tibia** supports the weight of the body and is the bone that articulates with the femur. The **fibula** is more slender and is a bone to which muscles attach. The top of the tibia is expanded into a triangular shape with the **medial tibial condyle** and **lateral tibial condyle** articulating with the condyles of the femur. The quadriceps femoris muscles attach to the **tibial tuberosity** on the anterior surface of the tibia just below the condyles. The **anterior tibial crest** is a large ridge that runs the length of the bone. At the terminal portion of the tibia is the **medial malleolus**. This process, along with the **lateral malleolus** of the fibula, join with the talus of the foot. The **head** of the fibula is proximal. It is a triangular region with a pointed **apex**. Label the tibia and fibula illustrations and color in the various regions of the bones.

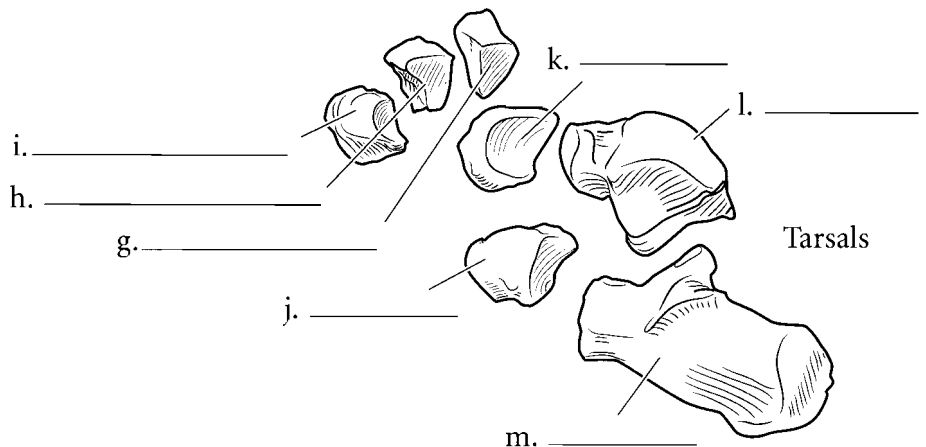
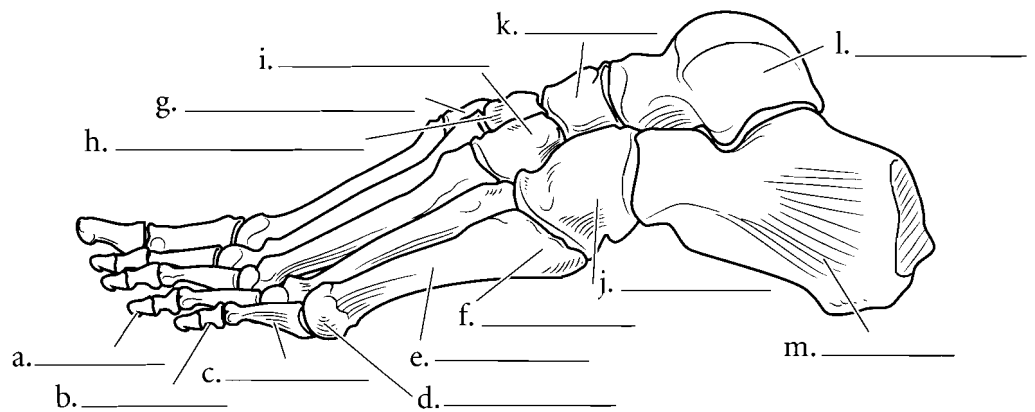
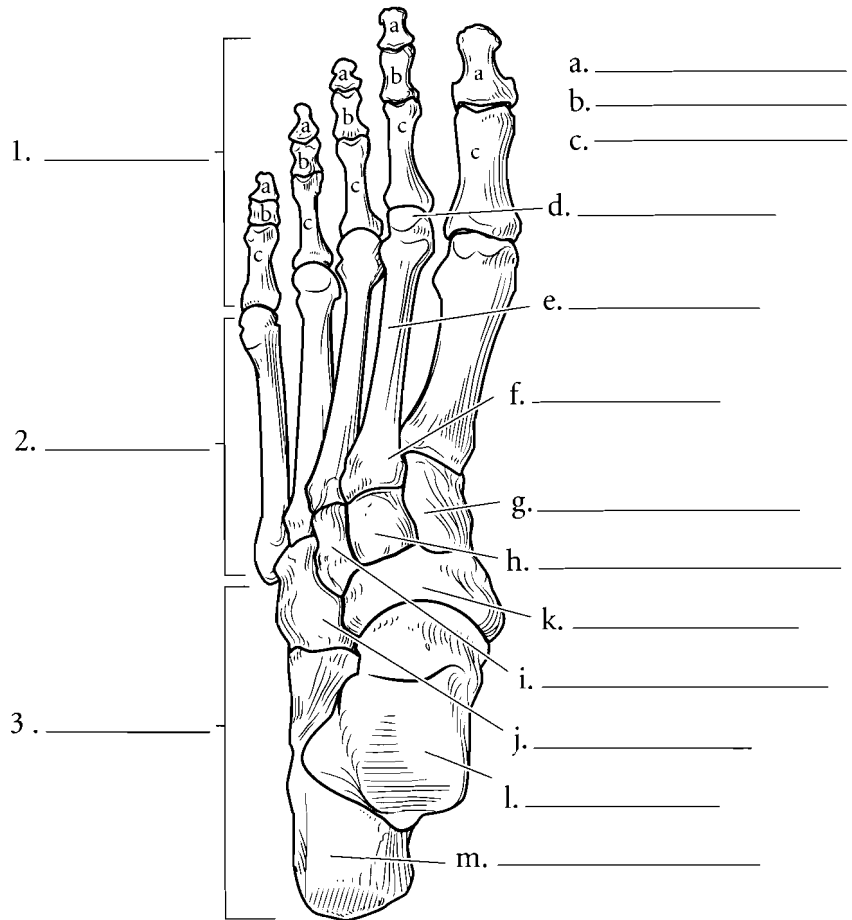


Answer Key: a. Lateral tibial condyle, b. Medial tibial condyle, c. Tibial tuberosity, d. Apex, e. Head of fibula, f. Anterior tibial crest, g. Shaft of tibia, h. Shaft of fibula, i. Medial malleolus, j. Lateral malleolus

LEFT FOOT

Color in the seven **tarsal** bones using different colors for each bone. The **calcaneus** is the heel bone and takes the major weight of the body during walking. The **talus** connects the foot to the tibia and fibula forming the ankle joint. The **cuneiforms** are so called because they are wedge-shaped bones and they form a natural arch of bone in the foot.

Note that each of the **metatarsals** and each of the **phalanges** has a distal head, a shaft, and a proximal base. Color all of the five metatarsals the same color. The first metatarsal is under the big toe and the fifth is under the smallest toe. Color all of the fourteen phalanges another color. All of the proximal phalanges are given the same letter in the illustration as are the middle and distal phalanges. Write **proximal**, **middle**, or **distal** in the appropriate space next to the toes. The big toe (hallux) has two phalanges while the other toes have three.



Answer Key:

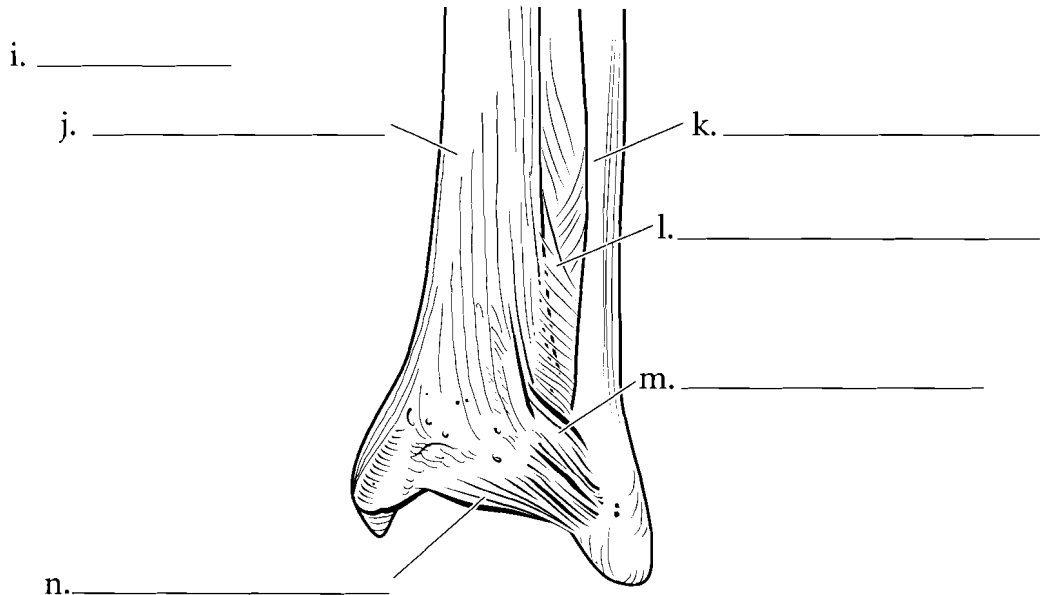
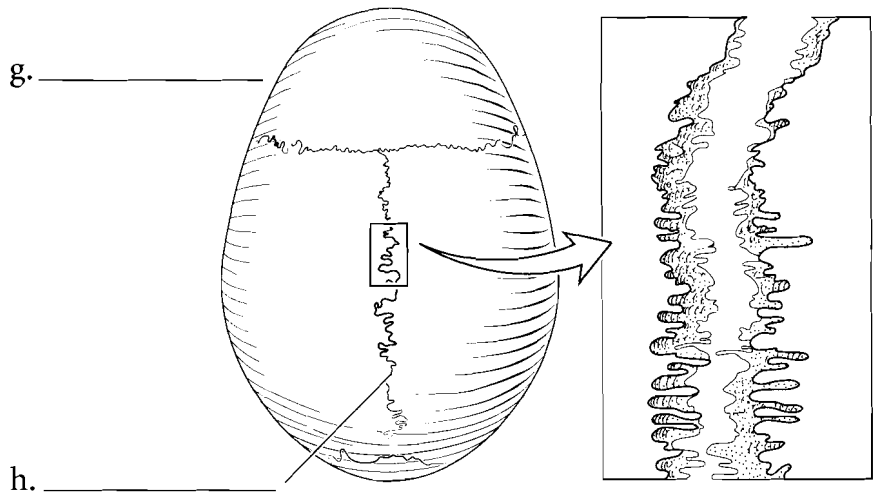
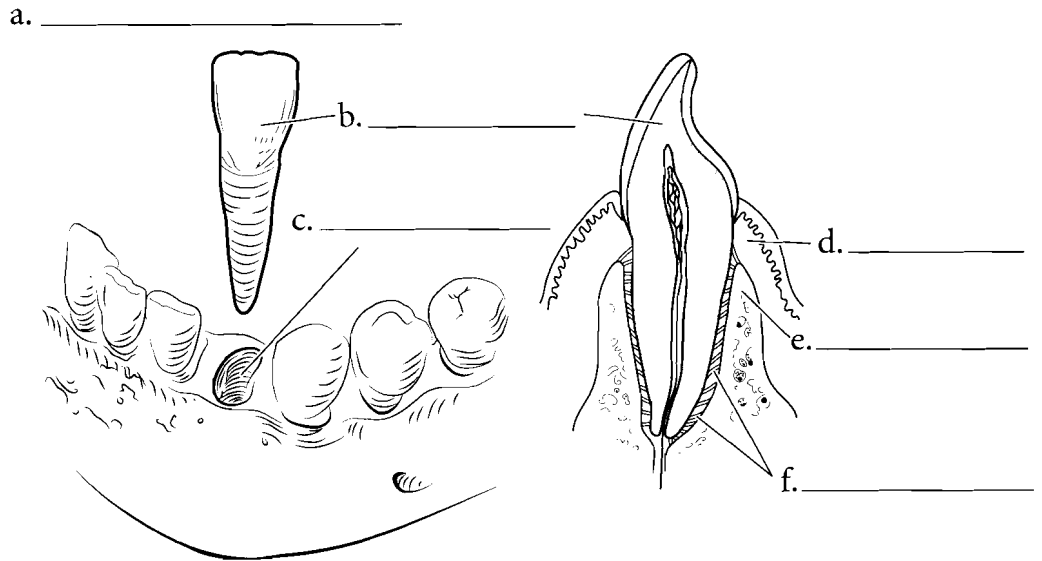
1. Phalanges
2. Metatarsals
3. Tarsals
- a. Distal phalanges,
- b. Middle phalanges, c. Proximal phalanges, d. Head, e. Shaft, f. Base,
- g. First (medial) cuneiform, h. Second (intermediate) cuneiform,
- i. Third (lateral) cuneiform, j. Cuboid,
- k. Navicular, l. Talus, m. Calcaneus

CLASSIFICATIONS OF ARTICULATIONS

Articulations are the joints that occur between bones. They can be classified either according to movement or by structure. Joints can be immovable (**synarthroses**), semimovable (**amphiarthroses**), or freely movable (**diarthroses**). The composition of joints can be **fibrous, cartilaginous, or synovial**.

FIBROUS JOINTS

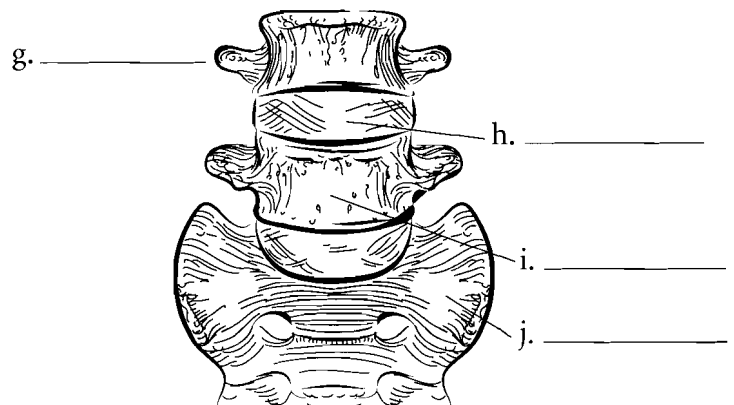
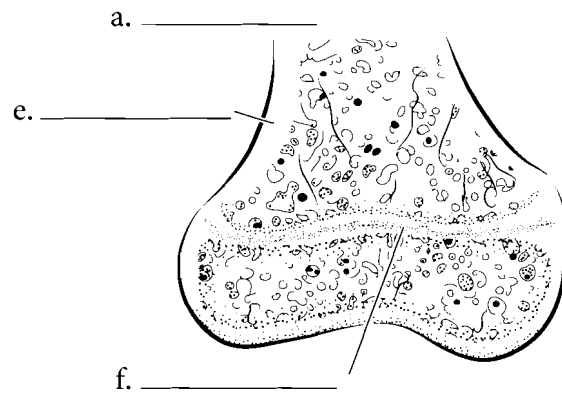
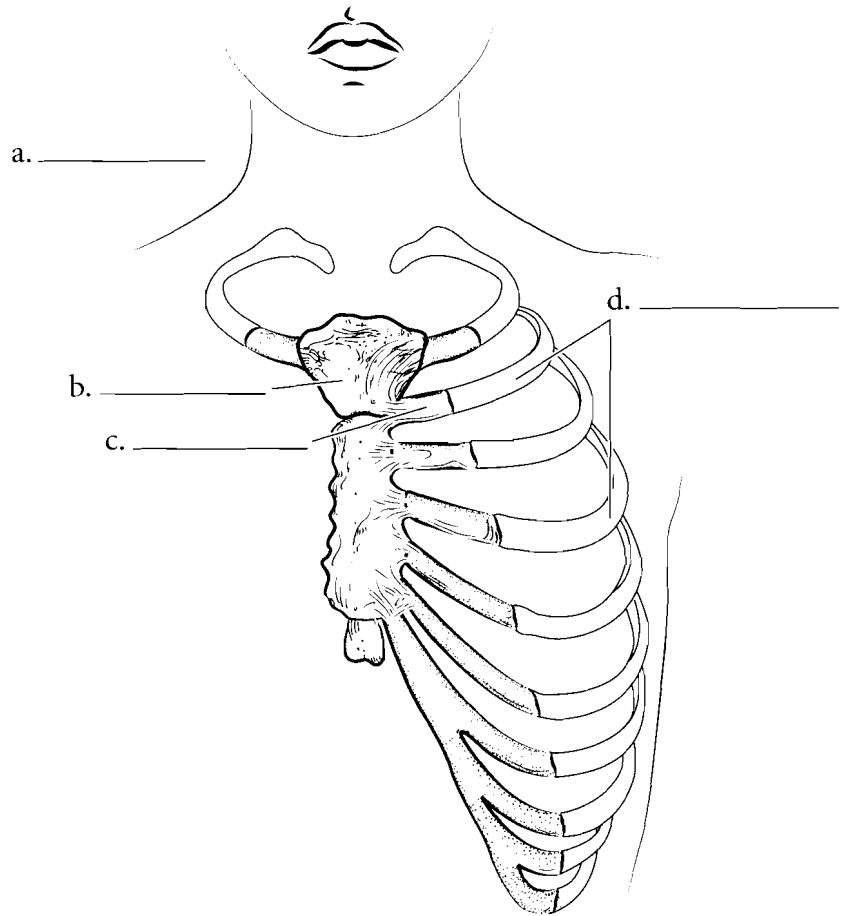
Fibrous joints are held together by collagenous fibers, the same fibers that make up tendons and ligaments. These joints do not have a joint cavity. **Sutures** are immovable fibrous joints of the skull. Color in the suture illustrated on the page. A **gomphosis** is a fibrous joint in which a round peg is held into a socket. Gomphoses are represented by the teeth held into the maxilla or the mandible. Another fibrous joint is the **syndesmosis**. This joint is found between the distal radius and ulna (or tibia and fibula) and is semimovable. Color in the various fibrous joints.



Answer Key: a. Gomphosis (peg suture), b. Tooth, c. Alveolar socket, d. Gingiva, e. Alveolar ridge, f. Periodontal ligaments, g. Suture, h. Sagittal suture, i. Syndesmosis, j. Tibia, k. Fibula, l. Interosseous membrane, m. Posterior tibiofibular ligament, n. Transverse tibiofibular ligament

CARTILAGINOUS JOINTS

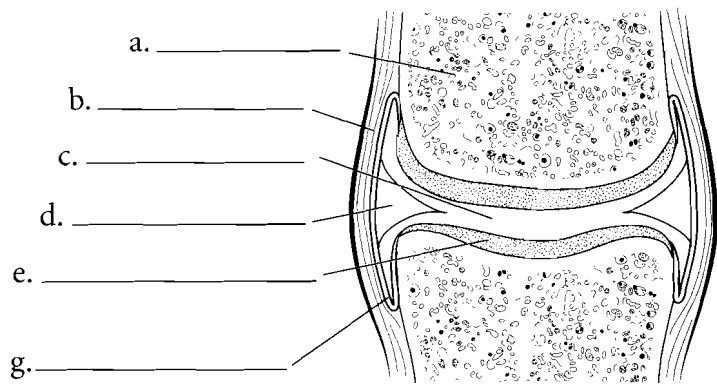
Cartilaginous joints are bones held together by **cartilage** and do not have a joint cavity. If the joint is held together by hyaline cartilage it is known as a **synchondrosis**. If the cartilage is short then the joint is immovable. An example of this kind of joint is an **epiphyseal plate**. If the cartilage is a little longer then the joint is a semimovable joint. This is represented by the **sternal-rib junction**. A cartilaginous joint that is composed of **fibrocartilage** is known as a **symphysis** (**symphyses** plural). These are semimovable joints. Examples of symphyses are the pubic symphysis and intervertebral discs. Color the cartilaginous joints. Use different colors for the hyaline cartilage from the fibrocartilage.



Answer Key: a. Synchondrosis,
b. Sternum, c. Costal cartilage,
d. Ribs, e. Femur, f. Epiphyseal plate,
g. Symphysis, h. Intervertebral disc,
i. Lumbar vertebra, j. Sacrum

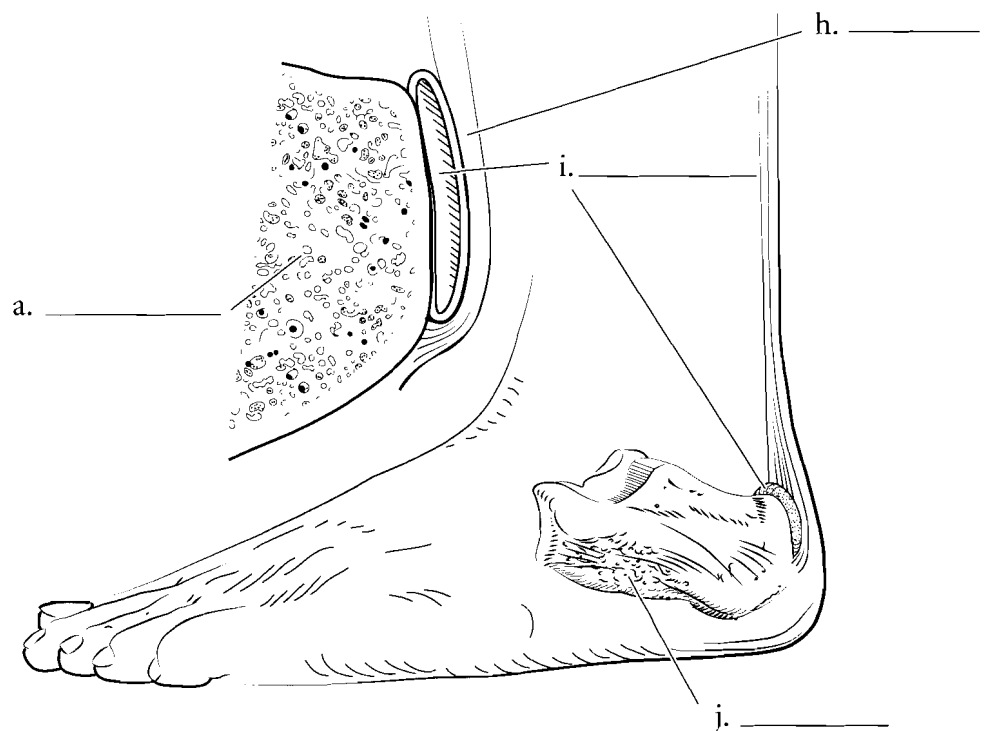
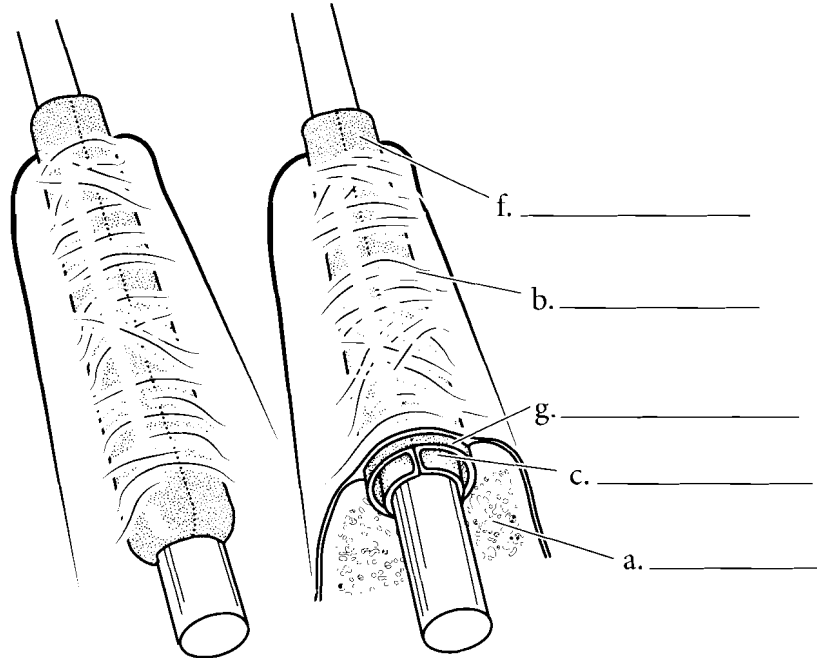
SYNOVIAL JOINTS, BURSA, AND TENDON SHEATH

Synovial joints are complex joints that are all freely movable. There are variations with the joints but all synovial joints consist of two **bones** enclosed by a **joint capsule**, **articular cartilages**, **synovial membranes** that secrete **synovial fluid** in the **synovial cavity**. Some synovial joints have fibrocartilage pads in the cavity called **menisci** (**meniscus** singular). Color the synovial joint and pay attention to the general structure of the joint. Color each part of the joint a different color.



MODIFIED SYNOVIAL STRUCTURES—BURSAE AND TENDON SHEATHS

There are structures in the body that consist of synovial membranes and fibrous capsules. These are not synovial joints but are associated with joints. A bursa is one such structure. It is a fluid-filled sac with an internal synovial membrane that cushions tendons as they pass over bones. The bursa occurs between the tendon and the bone. Another structure is a tendon sheath. It also is composed of a synovial membrane and fibrous sheath and it encloses tendons. The sheaths can provide lubrication to the tendon so it does not become irritated as it passes over bones or next to other tendons. Color in the layers of the bursa and the tendon sheaths.



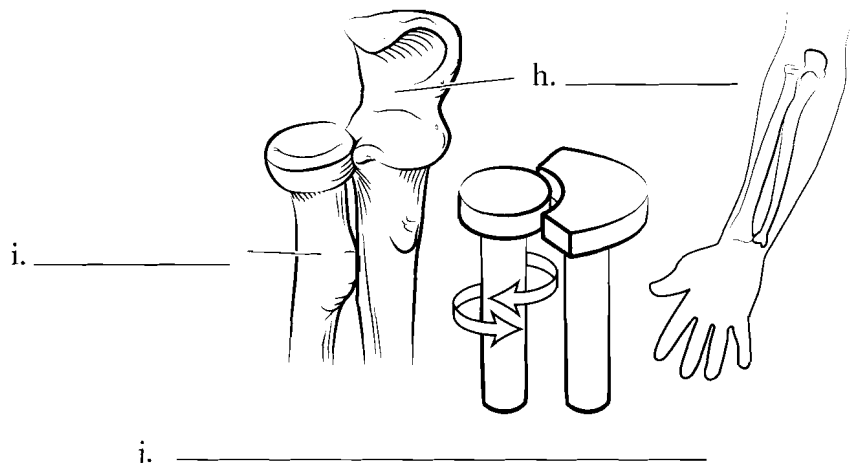
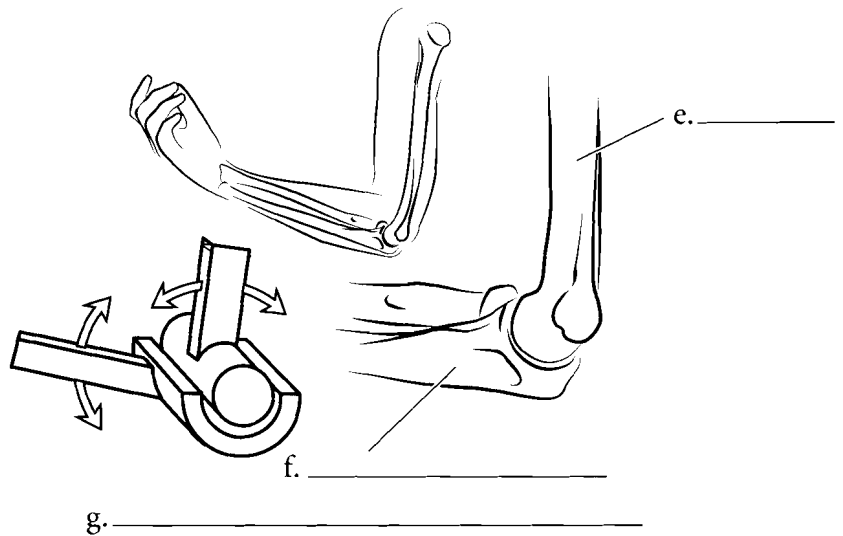
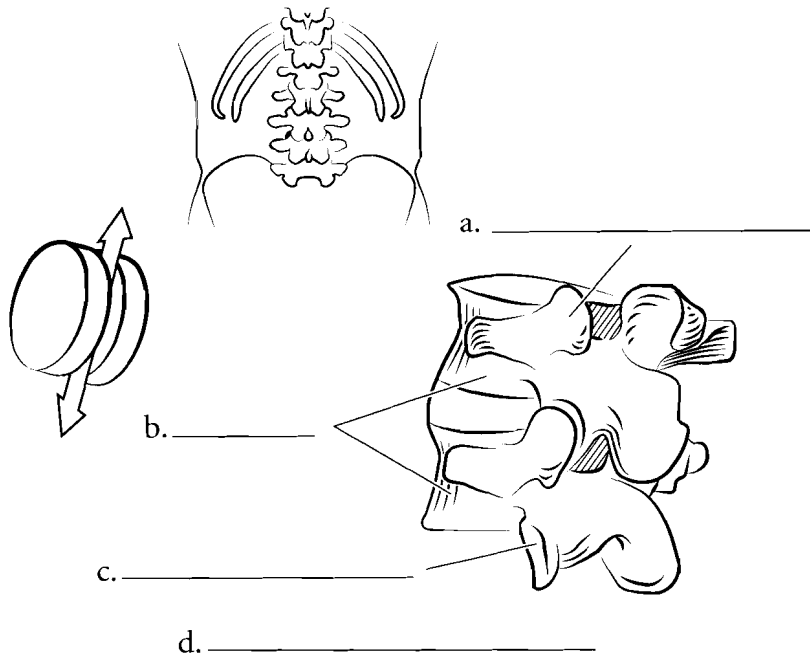
Answer Key: a. Bone, b. Joint capsule, c. Synovial cavity (synovial fluid), d. Meniscus, e. Articular cartilage, f. Synovial membrane, g. Tendon sheath, h. Achilles tendon, i. Bursa, j. Calcaneus

SPECIFIC SYNOVIAL JOINTS

Synovial joints are classified by what kind of motion they have. **Gliding joints** move in one plane like two sheets of glass sliding across one another. **Hinge joints** have angular movement like a door hinge.

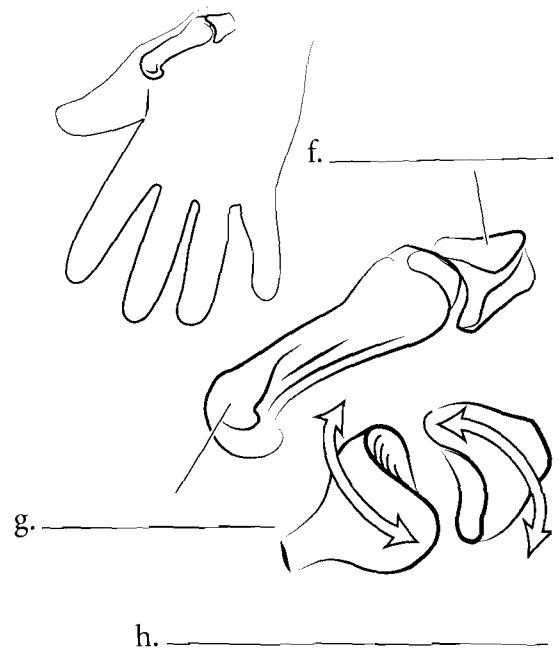
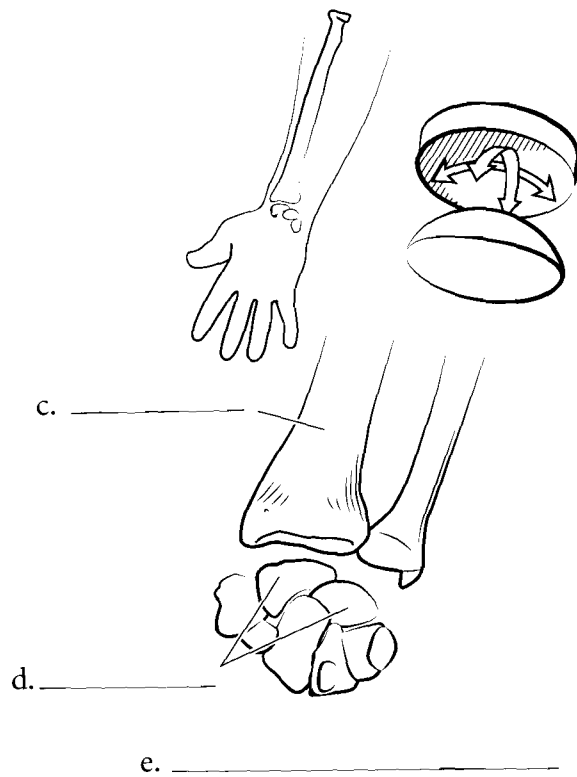
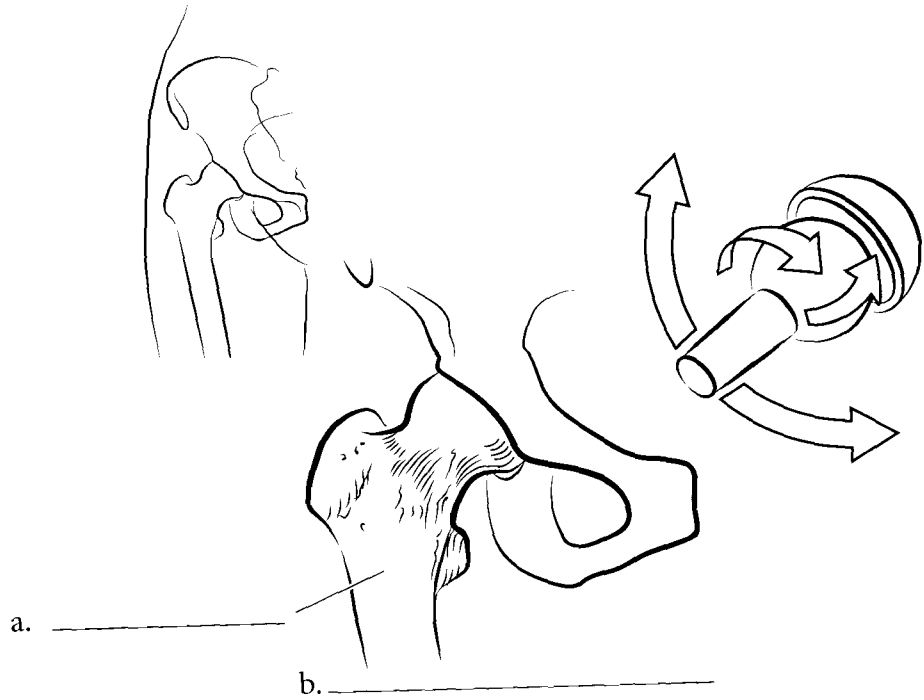
Rotating (pivot) joints move like a wheel of a car around an axle.

Condyloid (ellipsoidal) joints move like hinges in two directions. In these joints there is a convex surface and a concave surface. **Saddle joints** have two concave surfaces. They allow for greater movement than condyloid joints. **Ball and socket joints** allow for the greatest range of movement and are found in the shoulder and hip. Color the illustrations of these joints.



Answer Key: a. Superior articular process, b. Vertebrae, c. Inferior articular process, d. Gliding (plane), e. Humerus, f. Ulna, g. Hinge, h. Ulna, i. Radius, j. Rotating

SPECIFIC SYNOVIAL
JOINTS (CONTINUED)

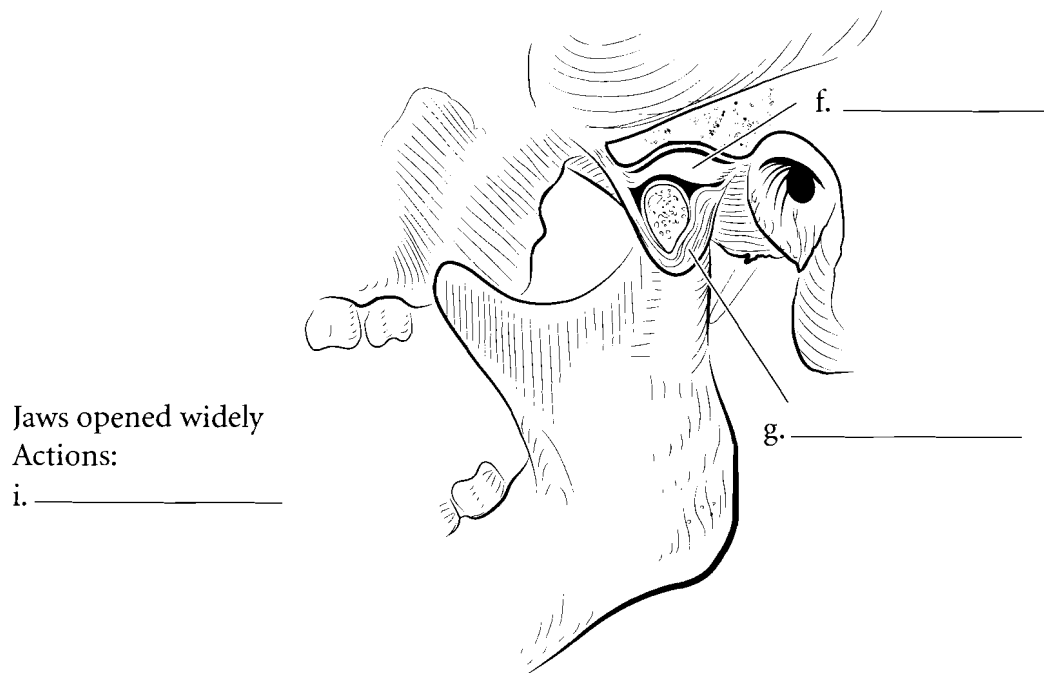
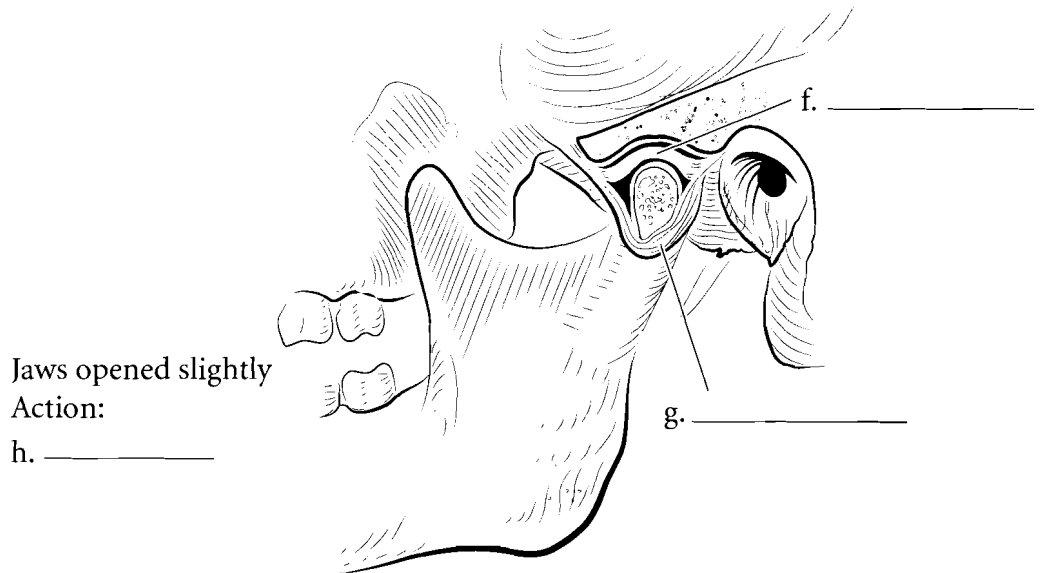
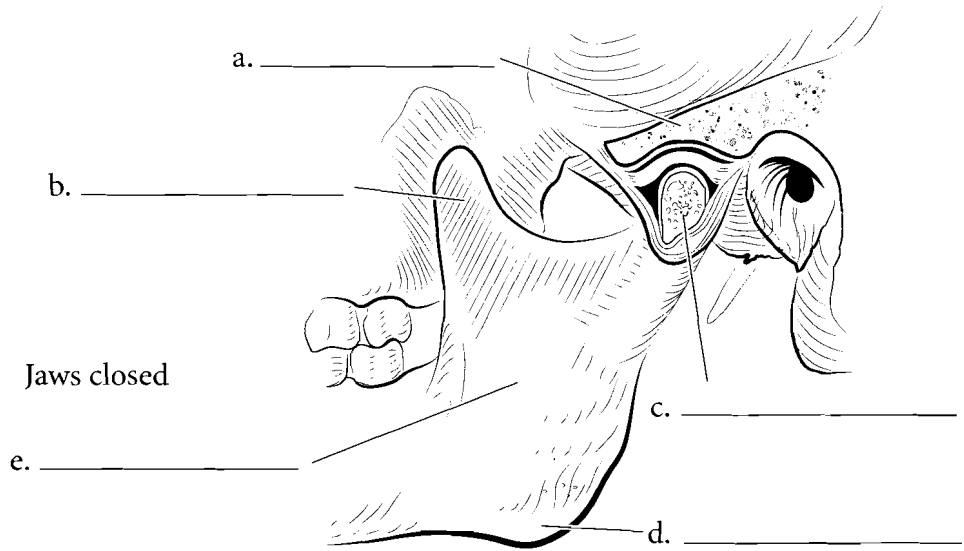


Answer Key: a. Femur, b. Ball-and-socket, c. Radius, d. Carpals, e. Condyloid, f. Trapezium, g. First metacarpal, h. Saddle

SPECIFIC JOINTS

TEMPOROMANDIBULAR JOINT

Some joints of the body warrant special attention. The **temporomandibular joint** or **jaw joint** is both a gliding joint and a **hinge joint**. The **condyle** of the mandible articulates with the **mandibular fossa** of the temporal bone. An **articular disc** is found in the joint that decreases the stress on the joint. Ligaments (dense connective tissue that joins bone to bone) connect the mandible to the temporal bone.

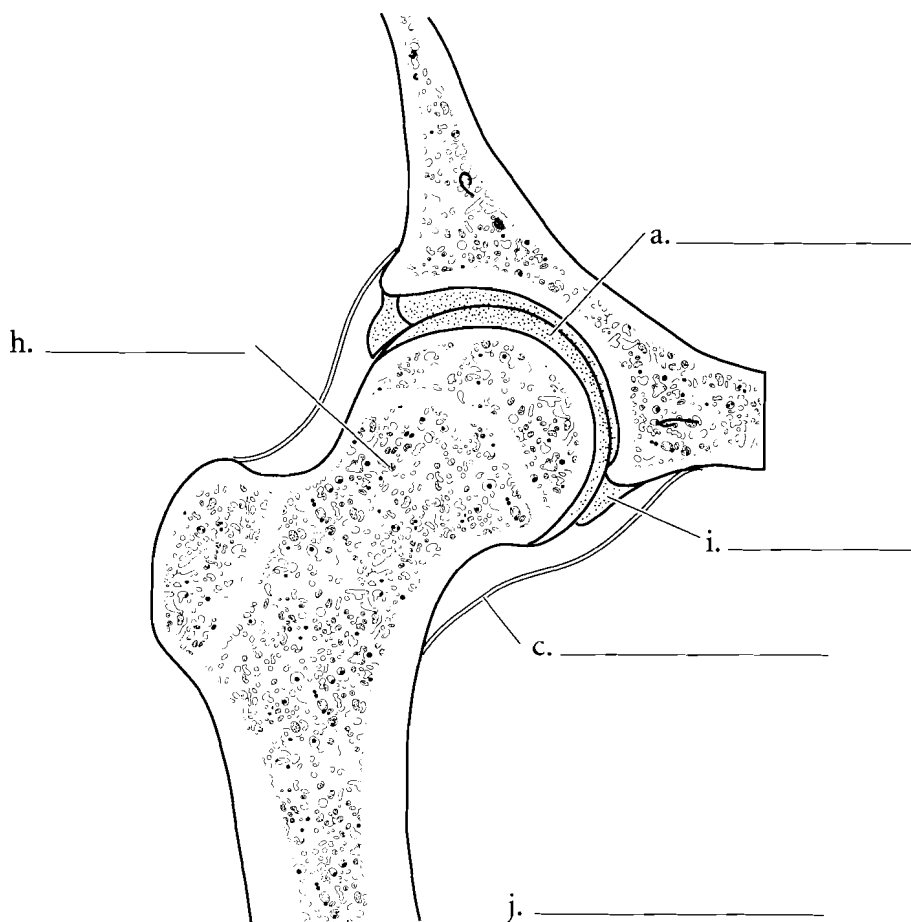
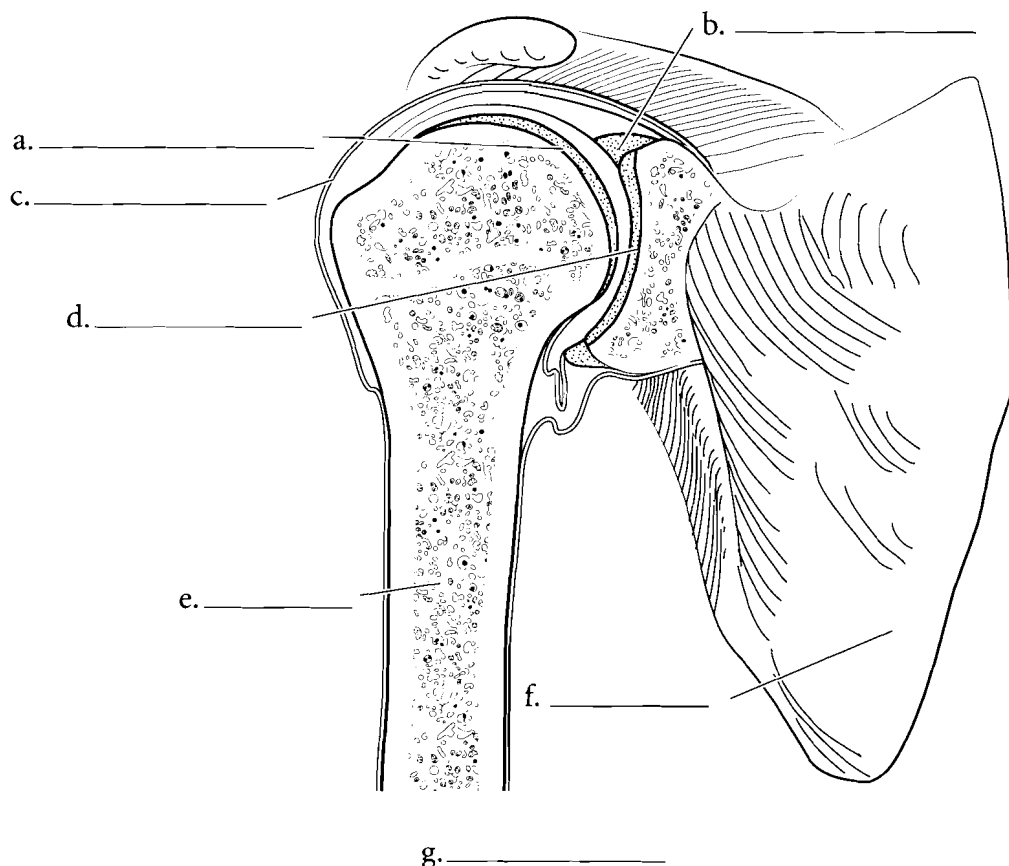


Answer Key: a. Temporal bone, b. Coronoid process, c. Condylloid process (cut), d. Angle of mandible, e. Mandible, f. Articular disc, g. Capsule, h. Hinge, i. Hinge and glide

HUMEROSCAPULAR AND ACETABULOFEMORAL JOINTS

The **humeroscapular joint** or shoulder joint is a ball-and-socket joint that connects the **humerus** to the **glenoid fossa** of the scapula. The joint is deepened by the **glenoid labrum** which is a **fibrocartilage** ring. There are numerous ligaments that connect the scapula to the humerus.

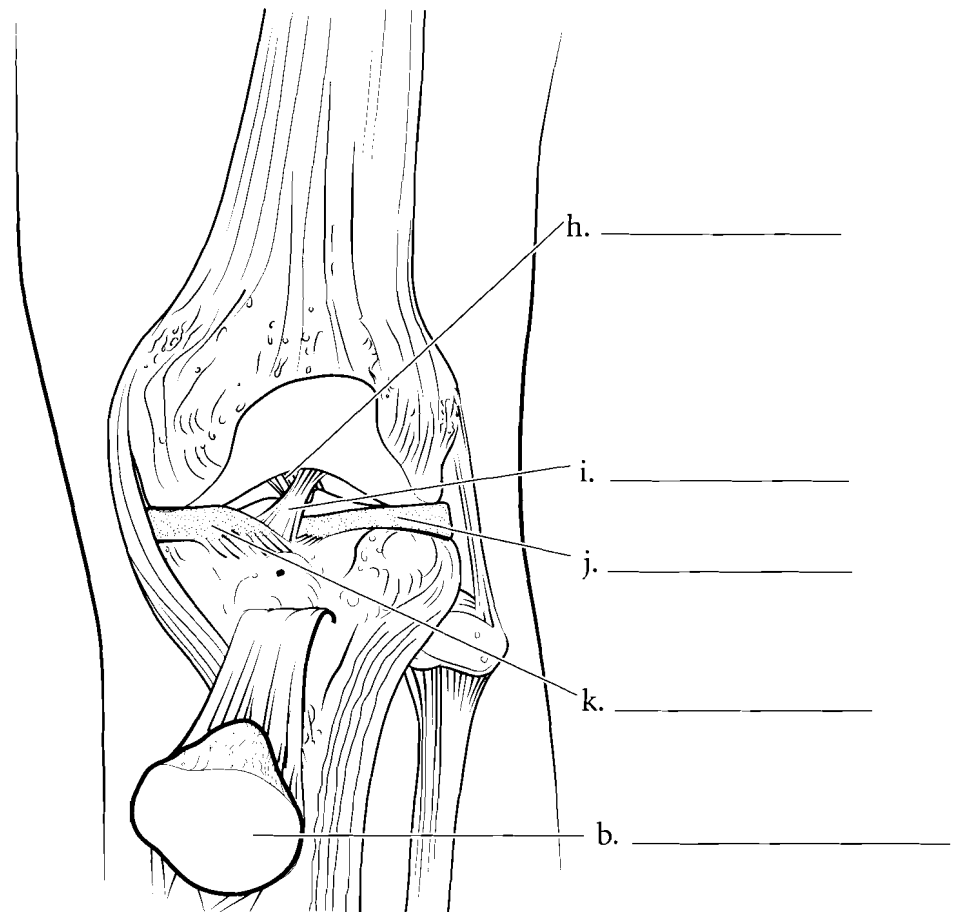
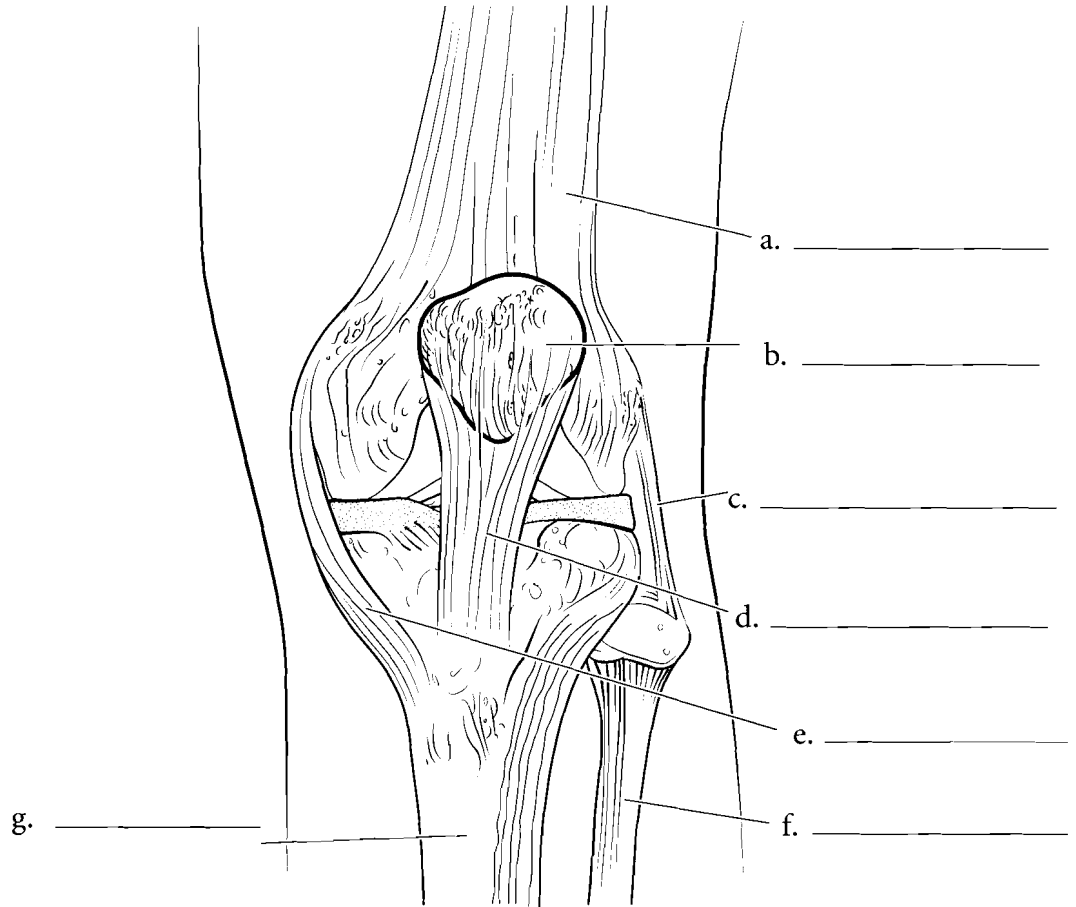
Another ball and socket joint is the **acetabulofemoral joint**. It also has an **acetabular labrum** and numerous ligaments that joint the femur to the hip.



Answer Key: a. Articular cartilage,
b. Glenoid labrum, c. Capsule,
d. Glenoid fossa, e. Humerus,
f. Scapula, g. Shoulder joint,
h. Femur, i. Acetabular labrum,
j. Hip joint

TIBIOFEMORAL JOINT

The **tibiofemoral joint** is special in humans because it is the largest joint in the body and because it is particularly vulnerable to injury. The joint is stabilized by the **patellar tendon**, the **medial and lateral collateral ligaments**, the **anterior and posterior cruciate ligaments** and the **medial and lateral menisci**. Label the structures in the anterior view, with the patella in place and with it reflected, and color them in.



Answer Key: a. Femur, b. Patella, c. Fibular collateral ligament, d. Patellar tendon, e. Tibial collateral ligament, f. Fibula, g. Tibia, h. Posterior cruciate ligament, i. Anterior cruciate ligament, j. Lateral meniscus, k. Medial meniscus

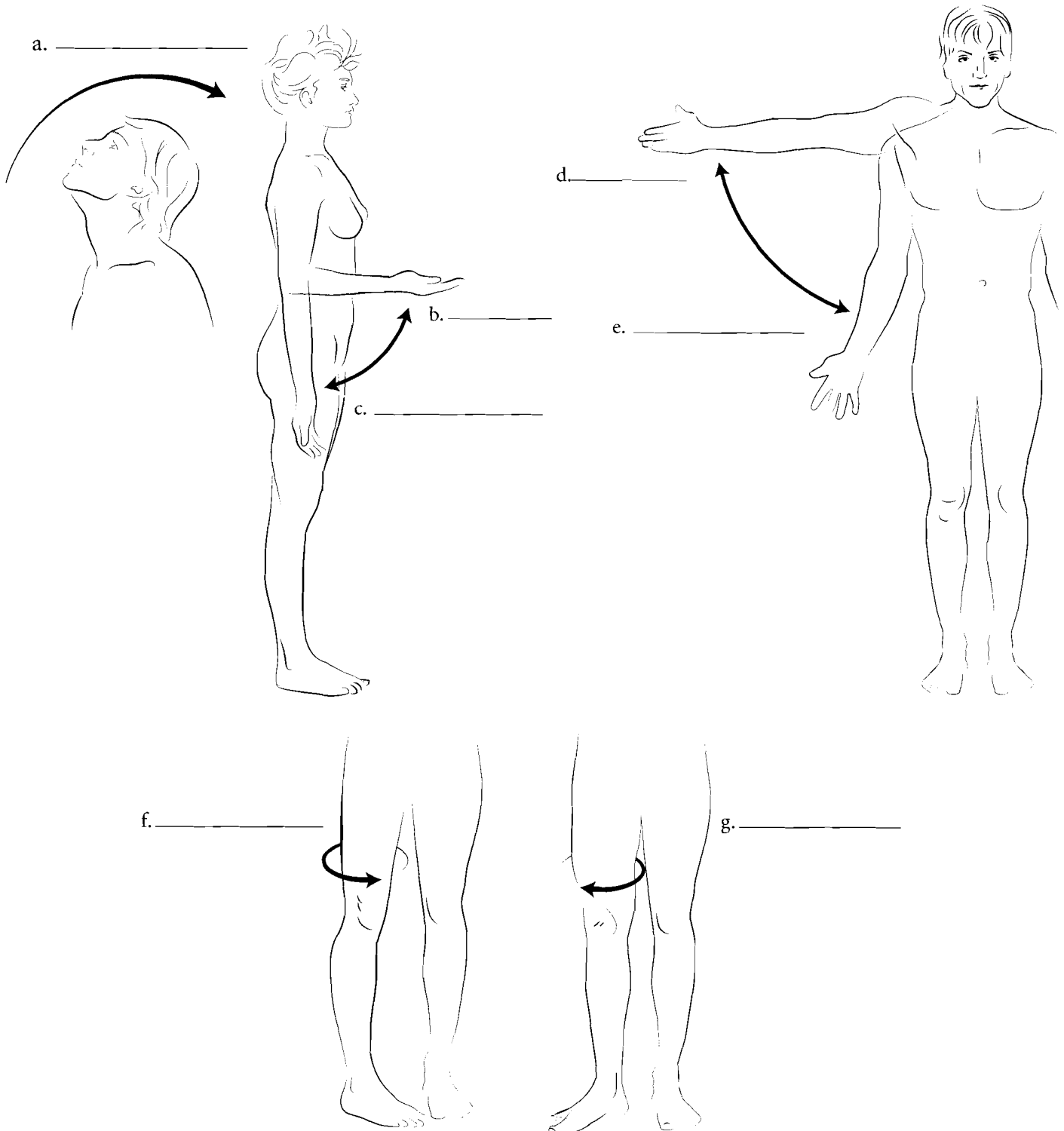
MOVEMENT AT JOINTS

There is a broad range of motion that occurs at joints. These motions should be referenced with the body in anatomical position. **Flexion** of a joint is a decrease in the joint angle from the body in anatomical position. When the elbow is bent the forearm is flexed. Most flexion takes place in a forward direction. The exception to this is the leg where flexion of the leg results in the bending of the knee. **Extension** of the joint is when the joint is returned to anatomical position. **Hyperextension** is a condition

where the joint is extended beyond anatomic position. Looking up at the ceiling is hyperextension of the head.

Abduction occurs when the extremities or head are moved in the coronal plane, laterally from the body. **Adduction** is the return of the limbs to the body.

Rotation is the movement of part of the body in a circular pattern. **Lateral rotation** is the movement of the body in a lateral direction and **medial rotation** is in the opposite direction.



Answer Key: a. Hyperextension of the head, b. Flexion of the forearm, c. Extension of the forearm, d. Abduction of the arm, e. Adduction of the arm, f. Medial rotation of the thigh, g. Lateral rotation of the thigh