The distal (acromial) end of the clavicle looks like a field hockey stick. Remember that the end of the hockey stick that touches the ground is distal to your hands. The inferior side is recognized by the fact the distal end has a concavity that faces downward. It articulates with the acromion process of the scapula.

The proximal (sternal) end of clavicle can be recognized because it is very blunt. It articulates with the manubrium and lies superficial to rib 1.

The hyoid bone does not articulate with any other bones. It is held in place by ligaments to the styloid process of the temporal bone and the thyroid cartilage of the larynx. It also has muscle attachments. In spite of the fact that is not attached to the skull, it is considered part of the axial skeleton, specifically part of the skull. It has a shape similar to the mandible, suggesting a common origin. Functionally it is important because it is the origin of muscles that move the larynx during the act of swallowing. It is the favorite bone of the seven dwarves and made famous in their song "Hyoid, hyoid, its off to work we goid".
The body of the rib is the surface that the intercostal muscles attach to. The bodies of the ribs are the origin for:
1. pectoralis minor (ribs 3, 4, and 5 near the costal cartilage),
2. serratus anterior (ribs 1-8, superior lateral surface).

The head of the rib is functionally important because this is where it articulates with the superior demifacet of the vertebra it is numbered for and the inferior demifacet of the vertebra superior to it. For example, rib 5 articulates with thoracic vertebra 5 at its superior demifacet and with thoracic vertebra 4 at its inferior demifacet.

The neck is a narrow region of the rib between the head and the body.

The subcostal (costal) groove is functionally important because a neurovascular bundle runs deep to it. This bundle has a vein as the superior structure, then an artery, and lastly a nerve (VAN from superior to inferior). If one were to describe its location it would be on the deep, inferior side of the rib. Dr. J prefers subcostal as the name since it should help remind you of its location.

The tubercle of the rib is functionally important because this is the point of articulation with the transverse costal facet of the vertebra the rib is numbered for. For example, the tubercle of rib 5 articulates with the transverse costal facet of thoracic vertebra 5. There are ligaments that hold the rib and transverse process together.
The body of the sternum is formed from four fused bones (sternebrae). The fusion of these bones is complete after puberty. It articulates superiorly with the manubrium (this is the sternal angle or angle of Louis) and inferiorly with the xiphoid process. It also articulates with the inferior half of rib 2 (this is a demifacet), ribs 3 through 6, and the superior half of rib 7 (this too is a demifacet) directly. Ribs 8, 9 and 10 attach to the body indirectly by joining the costal cartilage of rib 7. It forms part of the origin for the pectoralis major and the diaphragm.

The manubrium (handle) is the superior most of the sternebrae and is at the level of the bodies of thoracic vertebrae 3 and 4. It articulates inferiorly with the body of the sternum (this is the sternal angle or angle of Louis). It also articulates with the clavicle, rib 1 and the superior half of rib 2 (demifacet) on each side. Superior to the manubrium we find the suprasternal (jugular) notch. The manubrium forms part of the origin of pectoralis major as well as part of the origin for the sternocleidomastoid, sternothyroid, and sternohyoid muscles.

The sternal angle (angle of Louis) is the name of the manubriosternal joint. It is a fibrocartilage joint that allows for some movement acting like a hinge so that the body can move anteriorly during deep inspiration. It is also a landmark used to identify the boundary between the superior and inferior mediastinal cavities. It is at the level of the intervertebral disc between thoracic vertebrae 4 and 5. This is the superior extent of the heart as well as the inferior end of the trachea when a person is supine.

The xiphoid (like a sword) or xiphoid process is the most inferior of the sternebrae. It has no “z”s or “y”s in its name. In a young person it is hyaline cartilage, but is bone by the time one is 40 years old. It is sometimes broken when a person receives CPR. It is part of the origin for the diaphragm and insertion for the rectus abdominis muscle. The joint between the xiphoid and the body of the sternum is at the level of the ninth thoracic vertebra. Although it begins as an amphiarthrosis, it often becomes a synostosis in older people. It also has a demifacet on each side that articulates with the inferior portion of the costal cartilage of rib 7.
The external occipital protuberance is a raised area on the midline of the occipital bone where the posterior wall meets the base of the skull. It is medial to the two superior nuchal lines. It is at the superior extent of the ligamentum nuchae that connects the cervical vertebrae to the skull.

The mastoid process is part of the temporal bone. It is the insertion for the sternocleidomastoid muscle. In fact it is this muscle that causes this landmark to develop. Several other muscles that you will not be responsible for also attach to this landmark. As a group these muscles are responsible for rotation or extension of the head. It gets its name from the similarity it has to the appearance of a breast. Dr. J did not name this landmark - he is just the messenger.

The occipital condyles are functionally important because they articulate with the superior articular facets of the atlas (C1). This joint functions as a hinge joint allowing flexion and extension of the head. When one shakes their head "no" the two bones move as one piece. Dr. J thinks these structures are shaped like the rockers of a rocking chair which facilitates the flexion and extension of the skull relative to the atlas. We find the hypoglossal canal in the lateral base of the occipital condyles, immediately superior to the condyles. This foramen is important as it transmits the hypoglossal nerve (XII). As the name implies, they are landmarks of the occipital bone.

The nuchal lines of the occipital bone are where many muscles and ligaments of the neck and back attach to the skull. Generally areas that serve as points of attachment for muscles have raised bone due to the stress on the bone and the stimulation that causes bone growth. The median nuchal line is also known as the external occipital crest and this is formed because of the attachment of the ligamentum nuchae that connects the cervical vertebrae to the skull. The superior and inferior nuchal lines form attachments with the muscles and ligaments that stabilize the articulation of the occipital condyles with the atlas, thereby balancing the mass of the head over the cervical vertebrae. The superior nuchal lines are adjacent to the external occipital protuberance, while the inferior nuchal lines are approximately 2.5 centimeters (1 inch) inferior to the superior nuchal lines.
The acromion process articulates with the distal (acromion end) of the clavicle. It is also important as it is a portion of the origin for the deltoid muscle as well as the insertion of part of the trapezius muscle.

The glenoid cavity is functionally important because it forms a joint with the head of the humerus. This is a ball and socket joint that allows for triaxial motion: flexion/extension, abduction/adduction, and rotation. It gets its name from the famous senator and astronaut John Glenoid.

The inferior angle is at the level of thoracic vertebra 7, spinous process. It is functionally important because its posterior surface is the origin of teres major. The scapular line passes through it.

In the adult human, the medial (vertebral) border of the scapula is normally about three fingers width lateral to the vertebral border. The medial (vertebral) border of the scapula is the insertion for:
1. rhomboideus major,
2. rhomboideus minor,
3. serratus anterior (anterior surface along the medial border).

The superior angle of the scapula is at the level of the spinous process of thoracic vertebra 2. It is where the medial and superior borders of the scapula meet.

The supraspinous fossa of the scapula is an important landmark because it is the origin of the supraspinatus muscle. The supraspinatus muscle is one of the four rotator cuff muscles. The supraspinous fossa is separated from the infraspinous fossa by the spine of the scapula.
The coracoid process can be palpated in the infraclavicular fossa. The name implies that it looks like a crow's beak but Dr. J thinks it looks more like Woodstock, Snoopy's friend. The coracoid process of the scapula is the origin for:
1. biceps brachii,
2. coracobrachialis.

The infraspinous fossa is functionally important because it serves as the origin of the infraspinatus muscle. The infraspinatus muscle is one of the four rotator cuff muscles. As the name implies, it is inferior to the spine of the scapula.

The suprascapular notch is an important landmark of the scapula because it is through this that the suprascapular artery and the suprascapular nerve pass. That would make this a Grant, Grant, Grant thing. This nerve goes on to control the supraspinatus and infraspinatus muscles. The suprascapular artery is a branch of the transverse scapular artery.

The spine of the scapula lies at the level of thoracic vertebra 3, spinous process. It separates the supraspinous fossa from the infraspinous fossa. It serves as part of the origin of the deltoid muscle as well as the insertion of part of the trapezius muscle.

The metacromion process of the cat is the insertion of the acromiotrapezius muscle and the levator scapulae ventralis (omotransversarius) muscle. Humans do not have a metacromion process.

The subscapular fossa serves as the origin of the subscapularis muscle. The subscapularis muscle is one of the four rotator cuff muscles. As the name implies, it is on the deep side of the scapula.
The atlas is the name for the first cervical vertebra (C1). It is derived from a reference to the legendary person who held the world on his shoulders, much as the atlas holds the head (globe shaped) on its shoulders. The occipital condyles of the occipital bone articulate with the superior articular facets to form a tongue and groove joint that allows for flexion and extension of the skull. This is a specialized type of hinge joint. When one shakes their head “no” the occipital bone and atlas move as one piece. The atlantoaxial joint is a mortise and tenon joint which is a specialized type of pivot joint. It allows for rotation. The atlas is unusual in that it lacks a well developed spinous process. Another distinguishing feature is that there is no intervertebral disc between the atlas and the axis. There was a disc, but it becomes part of the dens and body of the axis when they fuse during fetal development or early childhood. The atlas has no body but does have an anterior arch and a posterior arch that connect the lateral masses. The lateral masses include the articular surfaces. The fact that it lacks a body led it to write the song “I ain’t got no body!” for David Lee Roth.

The axis is the name for the second cervical vertebra (C2). It is unusual in that it has the dens (odontoid process) that the atlas rotates around when one shakes their head “no”. During this motion the occipital bone and the atlas move as one piece. This atlantoaxial joint is a mortise and tenon joint which is a specialized type of pivot joint. It allows for rotation. There are strong ligaments, the alar ligaments, that connect the dens to the medial surfaces of the occipital condyles. These ligaments are important to prevent excessive rotation of the occipital bone and atlas around the dens. The dens was the body of the atlas during embryonic development, however, it breaks away. The dens fuses to the body of the axis during fetal development or early childhood. Because it is not yet fused, violent motion of the head can cause the dens to dislocate and damage the spinal cord. After it has fused violent motion of the head can dislocate atlantoaxial joint and push the dens into the base of the brain or posteriorly into the spinal cord. Another distinguishing feature of the axis is that there is no intervertebral disc between the atlas and the axis. There was a disc, but it becomes part of the dens and body of the axis when they fuse during embryological development. The name of the axis sounds a little like the part of a car (axel) around which the wheel rotates. It was named for the famous rock star Axis Rose.
The superior most seven vertebrae are the cervical vertebrae. They are unique in several ways. Most have a bifid spinous process, although the seventh cervical vertebra has a single spinous process. The bodies are wider from side to side than from anterior to posterior. In the adult the body will be smaller than that of the other areas as they carry less weight. The vertebral foramen is triangular and large. This is important because the spinal cord is largest at its superior end. They have a transverse foramen (foramen transversarium) that houses the vertebral artery and vein in the first six vertebrae and only the vertebral vein in the seventh. The vertebral artery is of particular importance because it serves the brain and spinal cord. The vertebral vein does not serve much of the brain, but rather receives blood from the cervical spinal cord, cervical vertebrae, and some of the small muscles in the superior portion of the neck. The articulations of the cervical vertebrae are in an oblique plane. This is important functionally because it increases the range of motion that we have in the cervical region including rotation, lateral flexion, flexion, and extension.

The twelve thoracic vertebrae are easily recognized because from the posterior side they look like the head of a giraffe. That is not a good answer for a quiz, but it may help you make a quick identification. Remember the movie "Thoracic Park" with all the giraffes! The reasons that should be used on a quiz include the long spinous process that points in an inferior direction. Also, we find the transverse process projects posteriorly like a "V". We find articulations for the ribs including the transverse costal facet, the superior costal demifacet, and the inferior costal demifacet. Exceptions to this would include thoracic vertebra 1 and thoracic vertebrae 10 through 12. They typically have a single facet on the lateral side of the vertebral body. Thoracic vertebrae 11 and 12 lack a transverse costal facet. Lastly, the articulations between adjacent vertebrae are nearly in a coronal plane. This effectively prevents flexion and extension, but does allow for rotation of the vertebral column. Lateral flexion should be possible, but this motion is prevented by the presence of the ribs. Functionally, the limited movement of thoracic vertebrae is important to provide a volume in which the lungs and heart can undergo changes in volume without risk of compression.

The five lumbar vertebrae can be recognized by several features. They have a short, blunt spinous process that projects in a posterior direction. Their transverse processes project laterally and are relatively long (Dr. J says they look like the wings of a glider). They have relatively small vertebral foramina since the spinal cord is very thin by the time it gets to the lumbar region. In fact, it normally ends at the inferior edge of L1 body in the adult human. The sagittal plane of the lumbar vertebrae allow for the most flexibility in anterior/posterior direction. In the adult the body is relatively large when compared to vertebrae from other regions. This size is important because the lumbar vertebrae are supporting more weight than any of the vertebrae superior to them.
The coccygeal vertebrae are the most inferior of the vertebrae. They form part of the bony pelvis. The vertebral features are poorly developed or missing. The coccyx is usually 4 vertebrae although it varies from 2 to 5 vertebrae. Normally the inferior vertebrae are fused together, while the first forms an amphiarthrosis with the fifth sacral vertebra. In elderly people (60 or more years old) it may become fused to the sacrum. Fusion of the coccygeal vertebrae occurs at variable rates, normally beginning by the mid twenties and reaching completion during later years. It fuses at an earlier age in males than in females. Because in males the coccyx continues the sacral curve, it can provide some support for pelvic viscera, although it points inferiorly in postpubescent females. The coccyx serves as a point of attachment for some muscles. It can be broken during a fall, or sometime during the delivery of a baby. In nursery school we called it the tailbone. It got its name from the thought by some anatomists that it resembled the beak of a cuckoo! What party were they at?

The sacral vertebrae are the most unusual of them all. There are five sacral vertebrae and they are all fused. Actually, fusion begins after puberty and is complete by the time a person is 30 years old. Part of the structure is the remains of the sacral ribs, which fuse to the vertebrae during development. The vertebral foramina join to form a canal within the sacrum, terminating inferiorly as the sacral hiatus. There are four pairs of anterior and posterior sacral foramina that allow the sacral rami to exit from the sacral canal. Superiorly the sacrum articulates with the fifth lumbar vertebra. Inferiorly it articulates with the coccyx. Laterally it articulates with the ilium. The anterior edge of the body at the superior end of the sacrum projects anteriorly into the pelvic cavity. This is called the sacral promontory. The sacrum forms part of the pelvic wall. The sacrum has a concave anterior surface and convex posterior surface, this being the sacral curve. The flat surfaces of the sacrum are important as areas for muscle attachment for muscles of the thigh and lower back. The sacrum is usually shorter and wider in women than in men. We will spend more time on the sacrum in lab 11.
Vertebrae—Articular Facets / Articular Process

A facet is a flat or nearly flat surface on a bone. The vertebral articular facets are where two vertebrae articulate. There will be one pair of facets on the superior side of the vertebrae and one pair on the inferior side of the vertebrae. These facets are on an oblique plane in the cervical region, nearly a coronal plane in the thoracic region, and in a sagittal plane in the lumbar region. The oblique plane of the cervical vertebrae increase the range of motion possible for the neck. This is important functionally because it increases the range of motion that we have in the cervical region including rotation, lateral flexion, flexion, and extension. The coronal plane of the thoracic vertebrae effectively prevents flexion and extension, but does allow for rotation of the vertebral column. Lateral flexion should be possible, but this motion is prevented by the presence of the ribs. Functionally, the limited movement of thoracic vertebrae is important to provide a volume in which the lungs and heart can undergo changes in volume without risk of compression. The sagittal plane of the lumbar vertebrae allow for the most flexibility in anterior/posterior direction.

Dr. J tells his students that a process is a part of the bone they can pinch between their fingers. The articular facets are on one side of the process. The angles for the various regions is discussed under the articular facets.
The body (centrum) of the vertebra is the surface that bears most of the weight of the structures superior to it. Since we walk on two appendages, the weight progressively gets greater as one moves from the cervical to the lumbar regions. Therefore, it makes sense that the superior vertebrae have much smaller bodies and that the size of the body progressively gets larger as we move inferiorly. Compare the size of the body of the lumbar vertebra on the left with the size of the body of the cervical vertebra on the right. The depth (thickness) of the lumbar vertebrae is greater than the superior areas.

Vertebrae—Costal Demifacets

A facet is a flat or nearly flat surface on a bone. A demifacet is actually half of a facet and is where part of the head of the rib or part of the costal cartilage articulates and these are usually found on ribs 2 through 9. The superior demifacet of the body of the vertebra receives the head of the rib with the same number as the vertebra of interest. For example, rib 5 articulates with thoracic vertebra 5 at its superior demifacet. The inferior demifacet of the body of the vertebra receives the head of the rib with a number greater than the number of the vertebra. For example, rib 5 articulates with thoracic vertebra 4 at is inferior demifacet. Instead of a single facet for the costal cartilage of rib 7 on the body of the sternum, there may a demifacet on the inferior end of the body of the sternum as well as one on the xiphoid process. These demifacets articulate with the costal cartilage of rib 7.

Vertebrae—Transverse Costal Facet

The transverse costal facet is the surface that articulates with the tubercle of the rib with the same number for the first ten thoracic vertebrae. For example, the transverse costal facet of thoracic vertebra 5 articulates with the tubercle of rib 5. There are ligaments that hold the rib and transverse process together. Functionally these articulations in combination with the articulations with the head of the rib at the body of the vertebrae are important because they limit the mobility of the thoracic vertebrae. Thoracic vertebrae 11 and 12 do not have costal facets.

Vertebrae—Lamina

The lamina form the posterior portion (roof) of the vertebral arch (neural arch). The left and right lamina join at the midline. The spinous process projects from the midline where the laminae meet. Laterally they attach to the pedicle that originate from the body. The transverse process projects from where the lamina and the pedicle meet. The superior articular process projects in a superior direction from the junction of the lamina and the pedicle meet. The superior articular process projects in an superior direction from the junction of the lamina and the pedicle meet. The inferior articular process projects in an inferior direction from that junction. The above lamina is part of a thoracic vertebra.
Vertebrae—Odontoid Process (Dens)

The odontoid process (dens) was the body of the atlas during embryonic development, however, it breaks away. The dens fuses to the body of the axis during fetal development or early childhood. It then serves as a pivot point for the atlas (C1). This joint is sometimes described as a mortise and tenon joint, the only such joint in the body. It allows for rotation. We find an oval facet on the anterior surface of the odontoid process. This is where articulation with the anterior arch of the atlas occurs. The alar ligaments attach the odontoid process to the medial surfaces of the occipital condyles, and they prevent excessive rotation of the atlas and head relative to the axis. Another ligament, the transverse ligament of the atlas, runs posterior to the odontoid process and this ligament holds the dens in position. See the write-up about the axis for details of problems that may arise during injuries involving the atlantoaxial joint. The odontoid process gets its name from its resemblance to a tooth.
Vertebrae—Spinous Process

Superior view, cervical vertebrae

Posterior view, thoracic vertebrae

Lateral view, lumbar vertebrae

The spinous (spinal) process projects in a posterior direction from the junction of the lamina of a vertebra. Each region has a characteristic shape. When we palpate vertebrae, it is the spinous process that we detect. We find that most cervical vertebrae have a bifid spinous process. The atlas lacks a spinous process and C7 is usually single. The thoracic vertebrae have long spinous processes that point in an inferior direction making them look like a giraffe. Remember the movie “Thoracic Park” with all the giraffes! The spinous process of the lumbar vertebrae are short, blunt, and project in a posterior direction. Muscles that help move the vertebrae attach to the spinous process. The spinous process also serves as a point of attachment for ligaments that stabilize the vertebral column. Lastly, one should note that the transition from one type of vertebra to the next is gradual so the first vertebra from one area looks much like the last vertebra from the preceding area.
Vertebrae—Transverse Process

The transverse process projects laterally from the junction of the lamina and the pedicle on each side of the vertebrae. The transverse process serves as a point of attachment for muscles that help move the vertebrae as well as ligaments that stabilize the vertebral column. Additionally, in the superior ten thoracic vertebrae there is a transverse costal facet on the transverse process. This has an articulation with the tubercle of the rib. Each area has characteristic shapes for this structure. In the cervical region the transverse process has a transverse foramen (see pictures associated with the cervical vertebrae). Additionally, the transverse process of the atlas is projects further laterally than other cervical vertebrae, and this extra length serves as a mechanical advantage for the muscles that move the head and atlas relative to the axis. Also, the cervical vertebrae have anterior and posterior tubercles on the transverse process which serves as points of muscle attachment. The anterior tubercles are formed from the remains of the embryonic cervical ribs. The thoracic vertebrae have transverse processes that tend to project obliquely both posteriorly and laterally making a "V" shape when viewed from the superior or inferior side. The lumbar vertebrae have long, slender transverse processes that project laterally like the wings of a glider. In fact the long piece of bone in a "T bone" steak is the transverse process of the lumbar vertebra. If that piece were the spinous process it would have been called an "S bone" steak. Hmm. There is one exception in the lumbar region and that is lumbar five vertebra. It has large cone-shaped transverse processes that serve as points of attachment for the iliolumbar ligaments that attach to the os coxae. The transverse process of the first sacral vertebra is wing-like and named the ala. The other sacral transverse processes fuse laterally, thereby closing off the intervertebral foramina. Lastly, the first coccygeal vertebra has small poorly developed transverse processes.
The intervertebral foramen is of functional importance because this is where the spinal nerves, covered with spinal meninges, leave or enter the vertebral foramen. It is formed by the arches of the pedicles of two adjacent vertebrae. Because there can be no support where this opening occurs, it is often a location for injury to the intervertebral disc.

The vertebral foramen is of functional importance since it provides for the passage of the spinal cord and the meninges. This foramen gets progressively smaller as one moves inferiorly. The large size is not necessary in the inferior regions because the spinal cord becomes smaller in diameter (tapers like a carrot) as it moves inferiorly. This occurs because the spinal nerves are leaving it at each intervertebral foramen. The spinal cord normally ends in the adult human at the level of the inferior edge of L1 body, although it may end close to T12 body or as far inferiorly as L2 body. In an infant it usually terminates in the area of L3 or L4. The foramen is triangular in shape for the cervical vertebrae. The thoracic vertebrae have a circular vertebral foramen. The lumbar vertebrae have triangular foramina. Together the vertebral foramina form the vertebral canal.

The transverse foramen (foramen transversarium) of cervical vertebrae is an opening that is occupied by the vertebral artery and vein in the first six vertebrae and only the vertebral vein in the seventh. The vertebral artery is of particular importance because it serves the brain and spinal cord. The vertebral vein does not serve much of the brain, but rather receives blood from the cervical spinal cord, cervical vertebrae, and some of the small muscles in the superior portion of the neck. The foramen is formed by the union of the transverse process posteriorly and the remains of the cervical rib anteriorly. These foramina do not occur in the other regions of the vertebral column.