

## AXIAL SKELETON

The axial skeletal system consists of the Skull bones, the vertebral column, the sacrum, coccyx, and the thoracic cage (ribs and sternum). When studying these it is important to remember that these are bony structures so they can sometimes be felt to and used to find other important structures. Before looking at the bones it is vital to get some grasp to the vocabulary of the bones. Memorizing these words will aid in naming the other parts of the bone:

1. Process= an extension of bone
2. Styloid= pin shaped
3. Fossa= A groove
4. Foramen= a hole
5. Mastoid= Breast like
6. Sinus= an enclosed cavity

Materials:

1. Skull
2. Spinal column
3. Skeleton

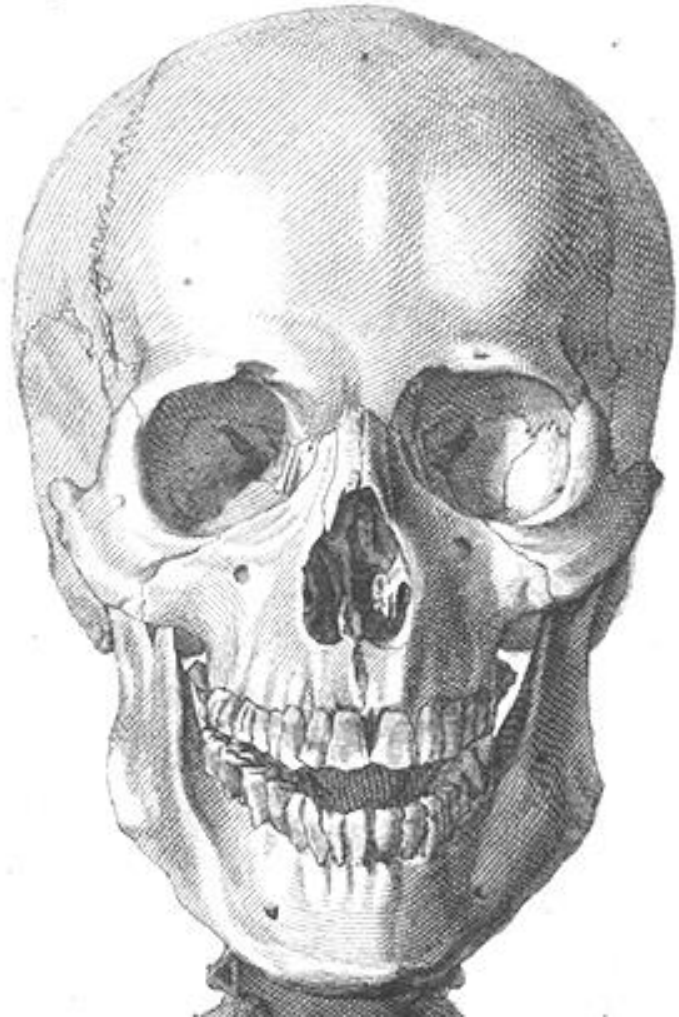
Skull:

The skull is divided into many different bones which can be seen in different angles. In an anterior view, one can see the main bone on the top of the skull which is called the frontal bone. It makes the superior border of the eye. Just over the eye socket one can notice where the brow would be found which we refer to as the super ciliary ridge. Above the ridge is a hollow point called the Glabella. If a pen light is placed in this area there is a spread of light. This is due to the hollow cavity called a sinus here. As it is in the frontal bone, it is called the frontal sinus.

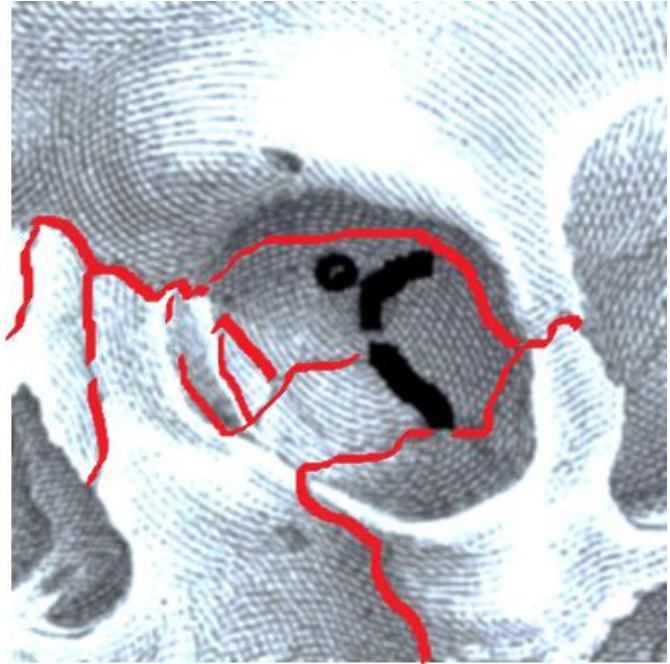
Next, just lateral to the nose and inferior to the orbit you will find the Maxilla. The Maxilla has a projection of bone which touches the frontal bone which will be called the Frontal process of the Maxilla. Lateral to the Maxilla you find the Zygomatic bone. As there is a projection of the Maxilla touching the Zygomatic bone it is called the Zygomatic process of the Maxilla. If one were to put a light on the body of the Maxilla, one will see a spread of light because this area is a hollow sinus.

1. What is the name of the hollow cavity in the frontal bone?
  
2. Why might the area of the glabella fracture in a motor vehicular accident?

There are many holes which allow nerves, arteries or other structures through. The Lacrimal duct has a tube which allows tears for the eyes to exit to the nose. This is the reason when you cry you get a runny nose. Within the frontal bone there is a foramen called the superior orbital foramen and in the Zygomatic bone we find the inferior orbital foramen. Inside, on the posterior most border of the orbit we can find two large slits called the superior and inferior orbital fissures and a canal which enters into the skull called the optic canal.



3. Looking at the orbit or eye socket, label the following bones:
  - a. Frontal
  - b. Zygomatic
  - c. Nasal
  - d. Maxilla
  - e. Sphenoid
  - f. Lacrimal
  - g. Ethmoid



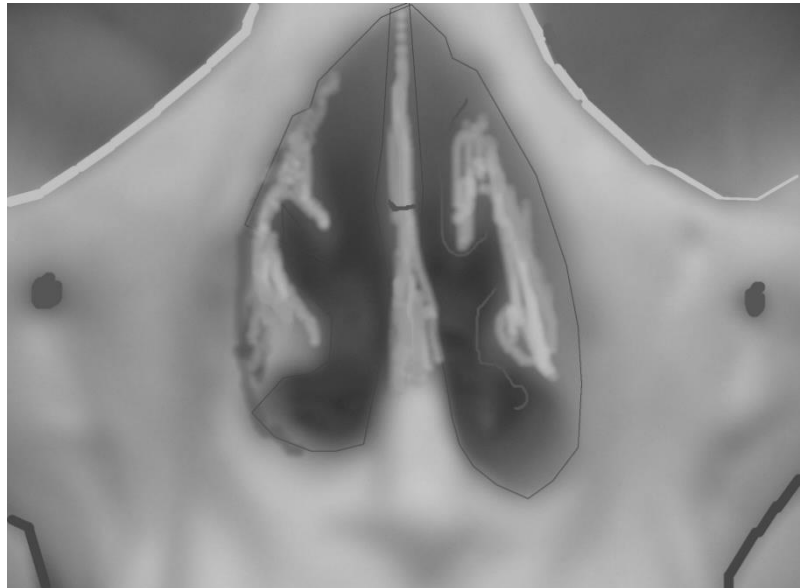
4. On the picture label the following:
  - a. Lacrimal duct
  - b. Optic canal
  - c. Supraorbital foramen
  - d. Infraorbital foramen
  - e. Superior orbital fissure
  - f. Inferior orbital fissure

Clinically, knowing the sutures and sinus in the facial bones is important as there are many fractures which can occur along those areas.

The Zygomaticomaxillary complex fracture shows this well. It is the second most common facial fracture (most common is nasal bone) ranging around 40% of facial fractures. The causes of this fracture include personal altercations, falls, motor vehicle accidents, and sports injuries.

The nasal cavity is made up of many different bones and structures. Surrounding it is the maxilla and nasal bones. When a person looks inside the nasal cavity there are many structures. Separating the nasal cavity into two parts is the nasal septum which is formed superiorly by the perpendicular plate of the Ethmoid bone and the vomer inferior. There are also three shell-like projections called Conchae. The three would be the superior, middle, and inferior nasal conchae.

5. Label the following structures surrounding the nasal cavity:
  - a. Maxilla
  - b. Nasal septum
  - c. Perpendicular plate of ethmoid
  - d. Vomer
  - e. Middle nasal conchae
  - f. Inferior nasal conchae
  - g. Infraorbital foramen



If one has a willing participant and will gently push up the tip of their nose, then slowly place the otoscope into the nasal cavity one should note the bulges covered in mucosa. The bony projections that make these bumps are called the nasal conchae.

Medial to the nasal conchae, there is a wall dividing the nasal cavity. This is called your nasal septum. It is made up of two bony structures. The Perpendicular plate of the ethmoid bone, and the vomer bone which is inferior. The nasal septum is completed with a Hyaline cartilage structure called the quadrangular cartilage.

6. What are the bumps seen inside the nasal cavity called?
7. Medial to in the nasal cavity is the septum, what bones make this up?

8. What is the name of the hyaline cartilage of the nasal septum?

Looking at the lateral aspect of the skull, one can see many of the facial bones discussed. On the anterior side, superior to most other bones we can find the Frontal bone. Posterior to the Frontal bone and forming the coronal suture where it joins are the Parietal bones. While the meaning of frontal is obvious, parietal refers to being on the top, so the parietal bone is the top bone. Posterior to the Parietal bone and forming the lambdoid suture is the Occipital bone. On the skull, follow the zygomatic bone onto the arch composed of the temporal process of the zygomatic bone until you meet the zygomatic process of the temporal bone

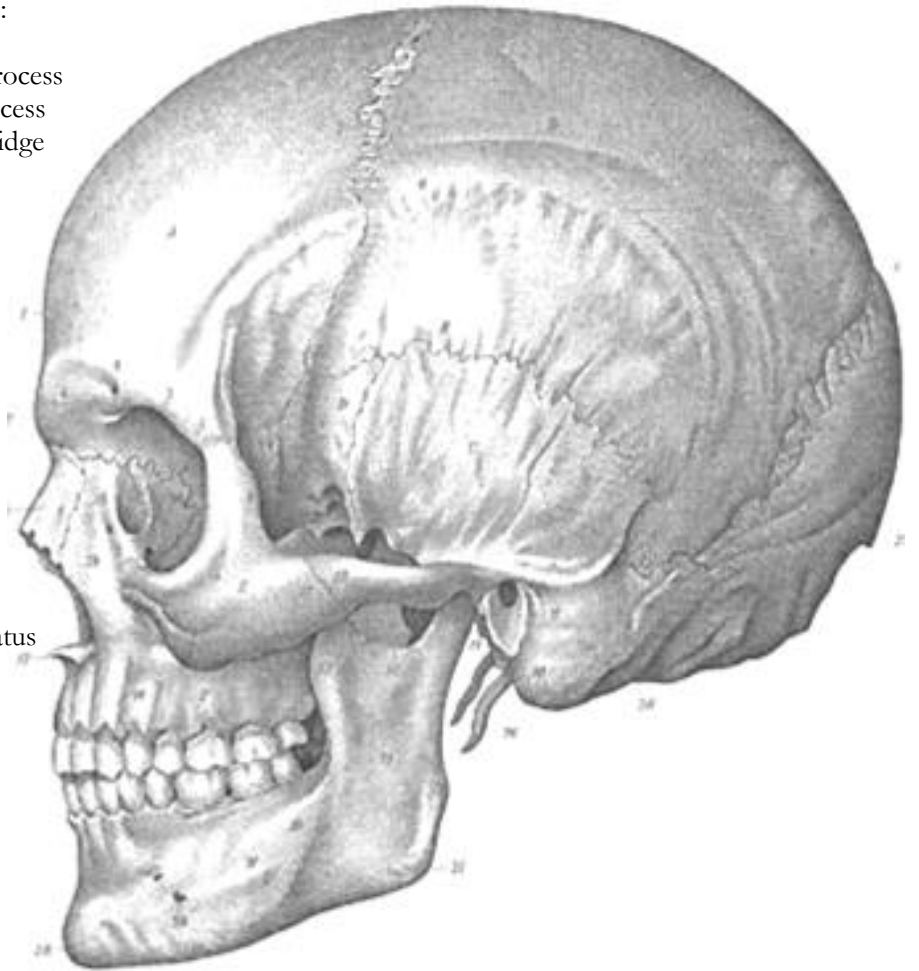
Inferior to the Parietal bone, along the Squamous suture, is the Temporal bone. The area of the temporal bone is usually the first place many get grey hair so it is the area that shows the effects of time (temporal) Anterior to the Temporal bone and inferior to both the parietal and Frontal bones is the Sphenoid bone. Surrounding the Sphenoid bone is an H-pattern of sutures called the pterion point which is the weakest part of the skull.

9. Label the following bones:

- a. Frontal
  - i. Zygomatic process
  - ii. Maxillary process
  - iii. Supraciliary ridge
- b. Parietal bone
- c. Occipital
- d. Nasal
  - i. Frontal process
  - ii. Nasal spine
  - iii. Alveolar process
- f. Mandible
  - i. Alveolar process
  - ii. Mental process
  - iii. Mental foramen
- g. Temporal
  - i. Zygomatic process
  - ii. Squamous portion
  - iii. External acoustic meatus
  - iv. Styloid process
  - v. Mastoid process
- h. Sphenoid
  - i. Zygomatic bone
  - i. Frontal process
  - ii. Temporal process

10. Label the following:

- a. Coronal suture
- b. Squamous suture
- c. Lambdoid suture
- d. Pterion
- e. Zygomatic arch



For clinical relevance, it should not be left out that in many bones there exist hollow chambers called sinuses. These are found in the frontal bone, the sphenoid bone, and maxilla. These areas are places where infections can occur leading to Sinusitis. They can also be areas which fracture due to trauma. There is one classification of facial fractures called LeFort's fractures which can happen either at the areas of sinuses or the sutures. Lefort's I fracture for instance will occur along the alveolar process where the air cavities are found. Type II would be fractures leading to the separation of the maxilla from the zygomatic bone and the frontal bone taking with it the nasal

bone. While type III would remove the zygomatic bone from the temporal and frontal bones as well as the maxilla from the frontal bone.

11. Look at the location of the zygomatic bone on the skull and compare it to your partner, describe the location of the zygomatic bone about its position forming the orbit.

12. You should notice that there is another bone medial to the arch, what is that bone?

Attached to the temporal bone is the mandible, commonly called the jawbone, there are many projections and name which were presented in other bones. Usually attached to the Temporal fossa, are the Mandibular Condyles of the mandible. Passed the heads are the necks of the mandibles and the mandibular notches. One can see a thorny projection called the Coronoid process protruding from the area.

We can then find the mandibular ramus, which means hand, connects the superior aspect to the angle and then the body. There is then a protrusion of the mandible on the medial side called the mental protuberance with pair of holes called the mental foramen. As with the Maxilla, the area that hold the teeth is called the alveolar process. Of an interesting note, the alveolar processes (both in the maxilla and mandible) are composed of cavities where the teeth used to be. This makes it a common site of various fractures seen as sport injuries, motor vehicular accidents, or assaults.

13. Label the following

- a. Head
- b. Neck
- c. Body
- d. Ramus
- e. Angle
- f. Mental protuberance
- g. Mental foramen
- h. Coronoids processes
- i. Alveolar process



Continue to follow the Zygomatic arch to temporal bone, compare its location to your partner's skull, you can orient yourself by looking at the external acoustic canal. Again, on the skull feel the area of the Mastoid process, note its location to the external acoustic canal and attempt to feel the Mastoid process on yourself.

Take the skull and feel the tempo-mandibular joint, note that the Mandible can open and close like a door. This is usually misleading as the jaw slides forward as it opens and back when it closes. You can feel the joint on your own head then open then close your mouth, note that there is a slide in the jaw when it opens and closes.

14. When does it slide forward and when does it slide back?

15. Ask you partner to slide their jaw side to side, what does this tell you about the joint?

16. Why is it important that the jaw can do this?

While the Frontal sinus was mentioned previously, there are several bones which have sinuses or sinus like cavities which lighten the skull. Those with sinuses include the sphenoid, and maxilla. Beside the true sinus, there are air-pockets within the Alveolar processes of both the maxilla and mandible. In the Mastoid process of the Temporal bone, we also have the air-cells present in the alveolar processes.

Besides lightening the skull, these cavities have clinical relevance. The Alveolar process of the maxilla, for instance is the site of Type I LeFort's which is caused by direct blunt trauma. The Mastoid process of the temporal bone can become infected and requires surgical intervention at times. At the site of the maxillary sinus, near the junction of the Zygomatic process of the maxilla and the Maxillary process of the zygomatic bone, there is another fracture that can be produced called the Zygomaticomaxillary complex fracture.

Look at the Maxilla and follow it to its inferior border where it contacts with the teeth, now turn it to look at its inferior view you will notice that the maxilla is fused in its midline. Posterior to the Palatine plate of the Maxilla is the Palatine bone. Together, these bones make up the hard palate. During development, both bones are supposed to fuse. At time the fusion of the hard palate does not occur which leads to a condition known as cleft palate. If one looks just posterior to the two front teeth, named the incisors of the maxilla, one can find an opening called the incisive fossa.

There are many visual landmarks on the inferior view of the skull. Many of the bones seen in other areas are visible as are some of the other projections and holes. One can see the Nuchal lines (Nuchal is neck in Latin) along the occipital bone as well as the external occipital protuberance. The big hole called the foramen Magnum, and two knuckle-like projections on either side of the Foramen Magnum called the Occipital Condyles. Posterior to the Condyles are the condylar fossa and foramen while anterior to them are the hypoglossal canal (hypo means below and gloss is tongue) which is where the hypoglossal nerve will exit from.

Lateral and anterior to the Occipital bone is the Temporal bone. Projecting off it, the temporal bone has a styloid process, and a large breast shaped structure called the Mastoid process (Mast means breast). It also has the zygomatic process which connects to the zygomatic bone at the Zygomatic arch.

The foramen of the Temporal bone includes the external acoustic meatus can be seen Anterolateral and superior to the mastoid process. Between the styloid process and mastoid process is the stylomastoid foramen. Just medial to the styloid process, where the temporal and occipital bone meet, we can see a large opening called the Jugular foramen. Anterior to the jugular foramen is the Carotid Canal. The last hole of the temporal bone is where it connects with the sphenoid and occipital bone, and it is called the foramen lacerum. Continuing anteriorly, we find the Sphenoid and can see the greater wing of the sphenoid bone where two foramens are present, the foramen spinosum and the one just medial to that is the oval shaped Foramen Ovale.

If one removed the top portion of the skull, called the Calavera off you can see many of the landmarks mentioned previously but now some new structures are present. Starting anteriorly, we can see the Frontal bone. Just posterior and embedded medial to the frontal bone is the Ethmoid Bone. In this area we can see that there is a plate with many holes called the Cribriform plate of the Ethmoid bone. This is the area where the olfactory nerve will leave the cranial cavity to enter the nose. Medial to the Cribriform plate is a projection called the crista galli (rooster's comb).

Posterior to the Ethmoid bone, we can see the lesser wing of the Sphenoid which also contacts the frontal bone. The greater wing of the Sphenoid is also seen inferior and posterior to the lesser wing. Medial to the greater wings and posterior to the lesser wings is the Sella Turcica which is where the pituitary sits. Besides the foramen mentioned earlier, one can see the foramen mentioned earlier, one can see two holes in the Sphenoid bone. Just anterior to the Sella Turcica, inferior to the lesser wings, there is the outline of the optic canal. Then, on the greater wing, anterior and medial to the Foramen Ovalis is the foramen rotundum.

On the Temporal bone, we can now see what is called the petrous portion which is where the Carotid canal passes through. Its opening, where the internal carotid artery enters the brain is next to Sella Turcica. If we follow the petrous portion of the Temporal bone lateral, we can find the opening to the Internal acoustic meatus.

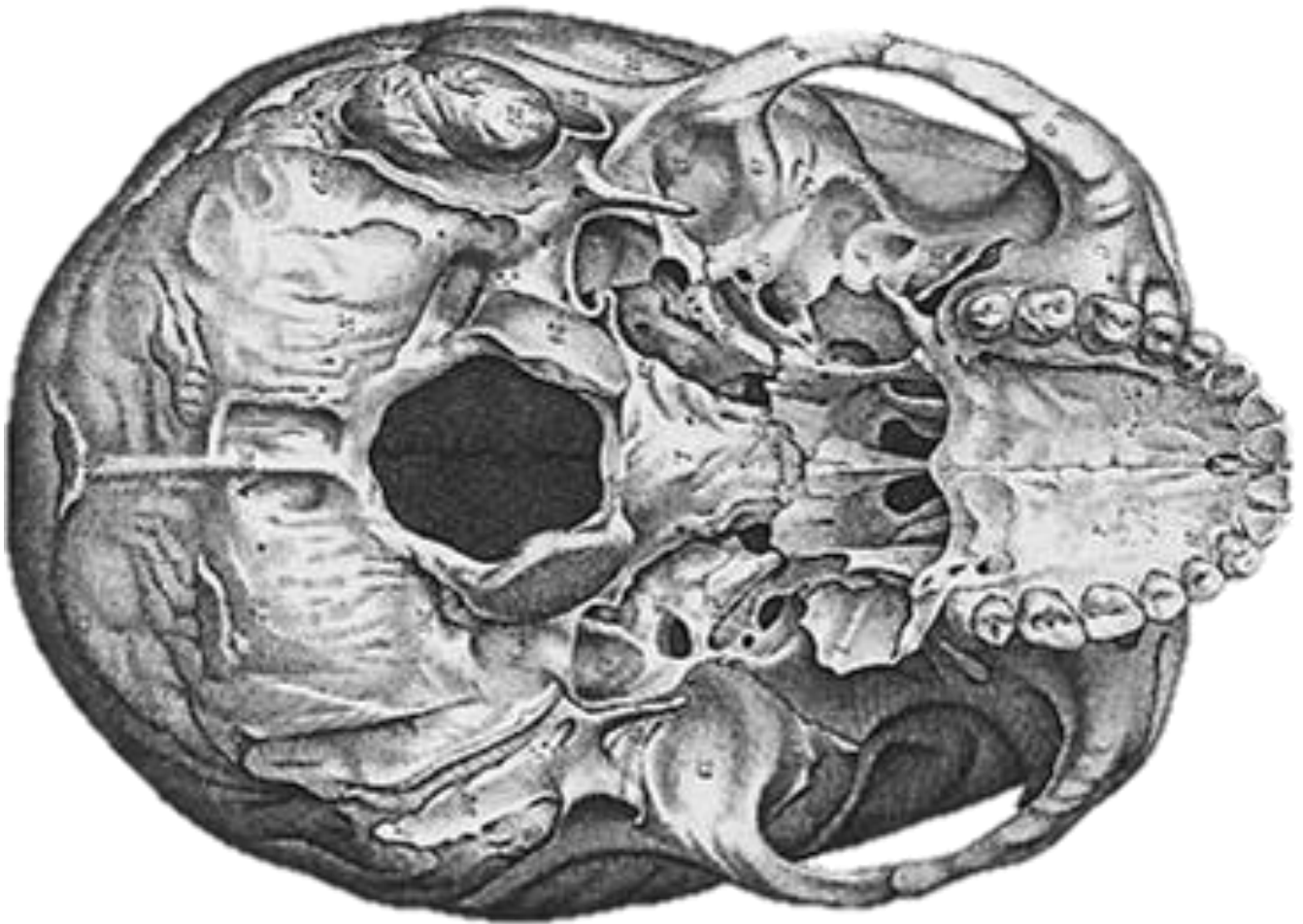
17. What are the names of the bones which make up the hard palate?

18. What is the condition when the hard palate fails to fuse in its midline?

19. Label the following:

- a. Maxilla
  - i. Incisor fossa
- b. Palatine bone
  - i. Medial plate
  - ii. Lateral plate
- c. Zygomatic arch
  - i. Temporal process
  - ii. Zygomatic process
- d. Occipital
  - i. Occipital Condyles
  - ii. Condylar foramen
  - iii. Hypoglossal canal
  - iv. Nuchal lines

- e. Sphenoid
  - i. Greater wing
  - ii. Lesser wing
  - iii. Foramen ovale
  - iv. Foramen Spinosum
- f. Vomer
- g. Temporal bone
  - i. Mastoid process
  - ii. Mastoid foramen
  - iii. Styloid process
  - iv. Stylomastoid foramen
  - v. External acoustic meatus
  - vi. Carotid canal opening
  - vii. Foramen Spinosum
  - viii. Foramen lacerum



20. Label the following

- a. Occipital bone
  - i. Foramen Magnum
  - ii. Jugular foramen
- b. Temporal
  - i. Internal acoustic meatus
  - ii. Carotid canal
  - iii. Foramen lacerum
- c. Ethmoid
  - i. Cribriform plate
  - ii. Crista Galli
- d. Sphenoid
  - i. Lesser wing
  - ii. Greater wing
  - iii. Sella Turcica
  - iv. Foramen ovale
  - v. Foramen spinosum
  - vi. Foramen rotundum
  - vii. Optic canal
- e. Frontal



Spine:

There are many regions of the spinal column which allow you to flex and extend around a central axis. The first region which is under the occipital bone is the Cervical bones. These seven bones make up your neck. Following the cervical area are the twelve thoracic vertebrae to which the ribs attach on the lateral side. The Thoracic vertebrae are then supported up by the five lumbar bones. It is said that to remember the spine just remember the times of your meals 7 breakfast, 12 lunch, and 5 dinner (or your retired neighbor).

The Spine start just below the skull at Atlas (Mythology Atlas hold up the world, in anatomy Atlas hold up your melon) which is referred to as C1. The last of the seven Cervical vertebrae, is atypical and protrudes out more than the others. Together the Cervical region has a concave curvature when viewed from the posterior.

The Thoracic region with its twelve bones, tends to follow a concave curvature in adults. While this area has

little pivotal movement, its ability to flex and extend allows for changed needed for normal breathing.

When one looks at the lumbar region from the posterior side, one notices as normal concave curvature. This area is more mobile which allows for flexion, extensions, and rotations around the area.

Now have your partner stand straight and look at the floor and feel the back part of their neck until you feel this projection. Now feel the curvature of the cervical vertebra on the skeleton and note its curvature. Then moved to the thoracic region and feel the curvature of the spine there and continue to the lumbar region. You will notice that in each section there is a natural curvature.

It should be noted that during development, a structure called the Notochord, is cut and placed between the vertebrae making a structure called the nucleus pulposus. It is then covered with fibrocartilage forming the intervertebral disc. It should also be noted that between the vertebrae there are holes for nerves to pass through called intervertebral foramen.

21. How many Cervical vertebrae are there?
22. How many Thoracic vertebrae are there?
23. How many lumbar vertebrae are there?
24. Feel the curve on the skeleton and your partner determine if the region is it convex or concave?
  - A. Cervical
  - B. Thoracic
  - C. Lumbar
25. Following the cervical area, a spine protrudes more than the rest, what Cervical vertebra is this?
26. On the image provided, label the regions of the vertebral column as well as one intervertebral foramen.

Connected to Lumbar 5, is the sacrum which is a set of five fused bones. This area is where the hip bone, called the Iliac is attached. The last bone of the vertebrae is the coccyx which is again a collection of 5 bones.

Between the vertebrae are special discs called intervertebral discs. These disks are made up of fibrocartilage and a gelatinous center called the Nucleus pulposus. The Nucleus pulposus is made of the notochord which is broken apart during embryology. This is the disc that herniates and can cause impingement of nerves.

Look at the hip bone called the iliac and pay close attention to its upper border is called the Crest. Using a ruler place it on most posterior of the Crest so it goes over the spine, you should be at the level between L4 and L5. This is where the needle goes in for spinal taps. Feel the iliac crest on your partner and find the L4/L5 space, an important landmark for spinal taps.

With the basic understanding of the name of each vertebral region, we can begin to understand the structures which are present in all vertebrae. Every feature discussed is different in each vertebra, but the modifications will be





addressed later. The first noticeable structure present in almost all vertebrae is a large flat portion called the body. Off the body we can find a bony projection coming off the side called the Transverse process. This transverse process has a projection heading medial and posterior called the lamella which connects at the spine.

If we begin with the typical Cervical Vertebrae in the neck region, we can see that it has two holes on a lateral projection which is missing from the other two. These are called the transverse foramen. The spine of the cervical vertebrae is also different as it has a bifid spine. Those vertebrae found in the thoracic region, called the thoracic vertebrae, tend to have a long narrow spine which typically points inferiorly. There are also facets for the ribs called costal facets. The Lumbar Vertebrae has a large body and ax-shaped spine.

While other distinguishing features for each region, these tend to be the most common. When looking at the entire vertebrae more will become apparent. These include variations on the sizes of the bodies, the positioning of the articulating facets, and size of vertebral foramen.

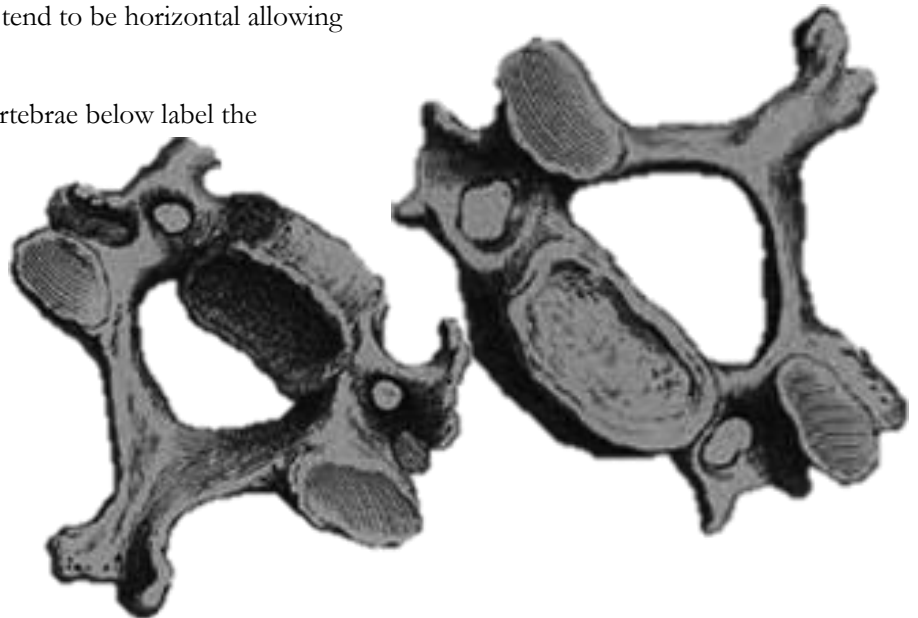
27. On the pictures below, label the type of vertebrae and one identifying feature of each.



The typical cervical vertebrae are usually C2-6 as variations are dramatic in the other ones. We can see that the cervical vertebrae usually have a relatively small body as they tend to be under less weight than the rest of the regions. One can see a vertebral foramen which is roughly triangle-shaped. Along the transverse process, is the transverse foramen. There are two tubercles on the transverse process, an anterior and a posterior tubercle. The spine, as a bifurcation which is only found in that region. The articulating facets, both the superior and inferior, which make contact with other bones tend to be horizontal allowing for movement of the neck.

28. On the typical cervical vertebrae below label the following structures:

- a. Body
- b. Transverse process
- c. Spinous process
- d. Superior articular facet
- e. Lamina
- f. Anterior tubercle
- g. Posterior tubercle



There are three atypical Cervical vertebrae. Starting with C7, we can see that it does not have the bifid spine and its spine projects posterior more than the rest leading to the cervical protuberance, an anatomical site. C1 and C2, on the other hand, can be quite different from the rest of the cervical vertebrae. C1, named Axis after the titian who held up the world, is a ring-like bone which is missing a body and spine. Instead, the two superior articulating facets are converted to lateral masses. Rather than a spine, it has two tubercles, one anterior and the other posterior. It also has a special articular process for a special projection of C2 called the dens.

29. Name and label the following:

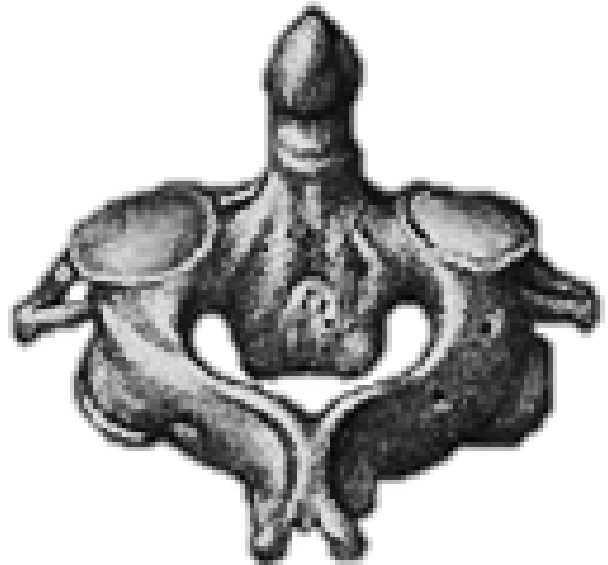
- a. Posterior tubercle
- b. Anterior tubercle
- c. Transverse process
- d. Lateral mass
- e. Articular process for dens
- f. vertebral foramen
- g. transverse foramen



C2, called the Axis, is just inferior to the Atlas. The most noticeable modification is the Dens or Odontoid process. During development, the body of the atlas becomes fused with the axis. Otherwise, the dens maintain most characteristics of the cervical vertebrae.

30. Name and label the cervical vertebrae

- a. Superior articular facet
- b. Spinous process
- c. Transverse process
- d. Vertebral foramen
- e. Transverse foramen
- f. Dens



The Cervical area of the spine has some clinically important presentations. The Atlas can be fractured usually during spearing in American Football which leads to a compression fracture called a Jefferson's fracture.

The Axis can be fractured when hyperextended which is called a "Hangman's fracture" as it was determined that if a 75 kg person falls six feet onto a rope positioned perfectly it causes this fracture which can sever the Spinal Cord. Today this fracture is usually caused by a motor vehicular accident.

The last major fracture of this region is called a tear drop fractures which are usually seen in sport injuries. These fractures occur at the body and about 85% of this type of fracture will lead to neurological problems. These can be classified as anterior or posterior teardrop.

Besides fractures, the mobility of the cervical vertebrae can lead to vertebral disc herniation. The herniation is usually a result of whiplash injuries and will not show up on X-ray. Herniations of the discs can lead to life-long chronic pain so must be evaluation in all victims of head or neck trauma.

The Thoracic vertebrae are the second group which are where the ribs articulate. Some of the changes are obvious, for instance, as they are holding more weight, the body will be larger. As the ribcage is needed for breathing, the movement of the joints will reflect that and the superior articular facets will be in a position to allow extension and flexion of the spine but limited rotation. This means that the superior articular facets will be angled as will the inferior articular facets.

Besides that, variation, the transverse processes will have transverse costal facets which will be places where the tubercles of the ribs to articulate with. On the body, we have two other areas for the head of the ribs. On the

superior portion of the body we can see the superior costal facet and below the body is the inferior costal facet. We can also see that the spine points downward rather than outward.

31. Label the following on the two images provided:

- a. Body
- b. Transverse process
- c. Lamina
- d. Spinous process
- e. Vertebral foramen
- f. Superior articular facet
- g. Transverse costal facet
- h. Superior costal facet

The main complication of the thoracic area is that there can be a hyper-curvature called Kyphosis. This is usually a result of pathological fractures due to osteoporosis. One of the complications of this condition is that it limits the movement of the thoracic cage leading to decreased lung functions.

While there is also a lumbar vertebra you should attempt to label as much of it as you can. You will notice that it is not as complicated as the other vertebrae. It is easy to see that the costal facets of the Thoracic vertebrae and the transverse foramina of the cervical bones are also missing. The most distinguishing feature is the large body and the superior articular facet.

The lumbar area, being under most of the weight of the upper body, as well as its mobility, allows for herniation of the intervertebral disks. While it can occur anywhere, the area between L4-L5 seems to be more common.

32. Label the following on the image provided:

- a. Body
- b. Transverse process
- c. Lamina
- d. Transverse process
- e. Spinous process
- f. Superior articular facet
- g. Inferior articular facet
- h. Vertebral foramen

The other clinically important aspects of the lumbar area are that it is prone to hyper-curvature which some call sway back but is known as Lordosis in clinic. This can cause back pain in the obese and pregnant woman. There is also a condition called hypolordosis where there is a decrease and sometime lack of normal curvature of the lower back. Hypolordosis can also cause back pain. Both conditions decrease the size of the intervertebral foramen.

As for the following bones of the back you should look at the sacrum. The sacrum connects with the coccyx on its inferior point and with the lumbar vertebrae on its superior border. In actuality, the sacrum is five fused bones.

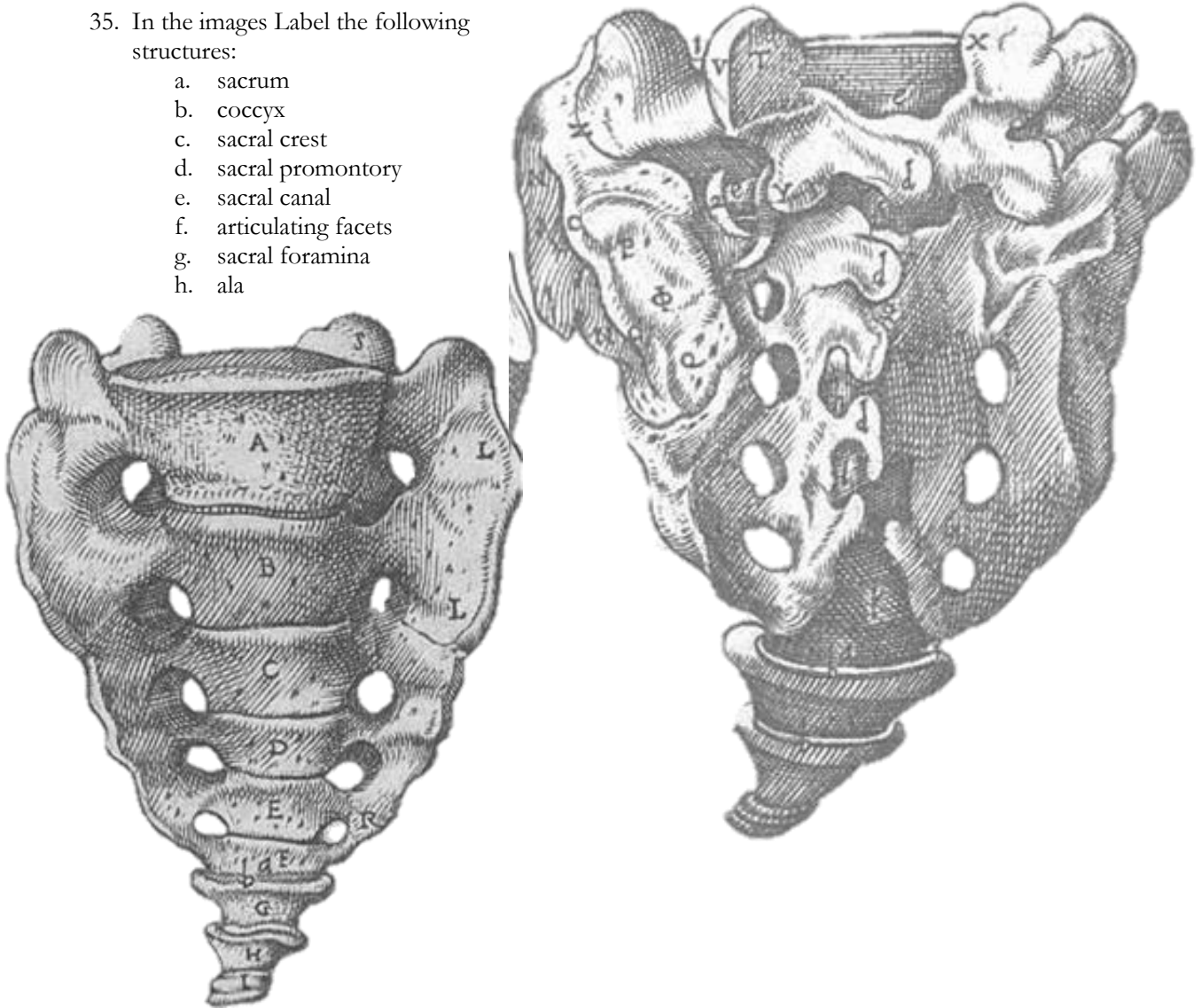
The Sacrum has a lip in the superior portion called the sacral promontory. You can also see an area which connects with the fifth lumbar vertebrae where one can find two articulating facets. The canal going down the back of the sacrum is the sacral canal. Over the sacral canal, you can see a crest called the medial sacral crest. Lateral to the



medial sacral crest is the lateral sacral crest. Along the sacrum are five holes called the sacral foramina. The area of the sacrum which looks like a wing is called the Ala of the sacrum.

33. What has occurred in a herniated disc?
34. Which regions are herniated discs most common?
35. In the images Label the following structures:

- a. sacrum
- b. coccyx
- c. sacral crest
- d. sacral promontory
- e. sacral canal
- f. articulating facets
- g. sacral foramina
- h. ala



#### Chest and sternum:

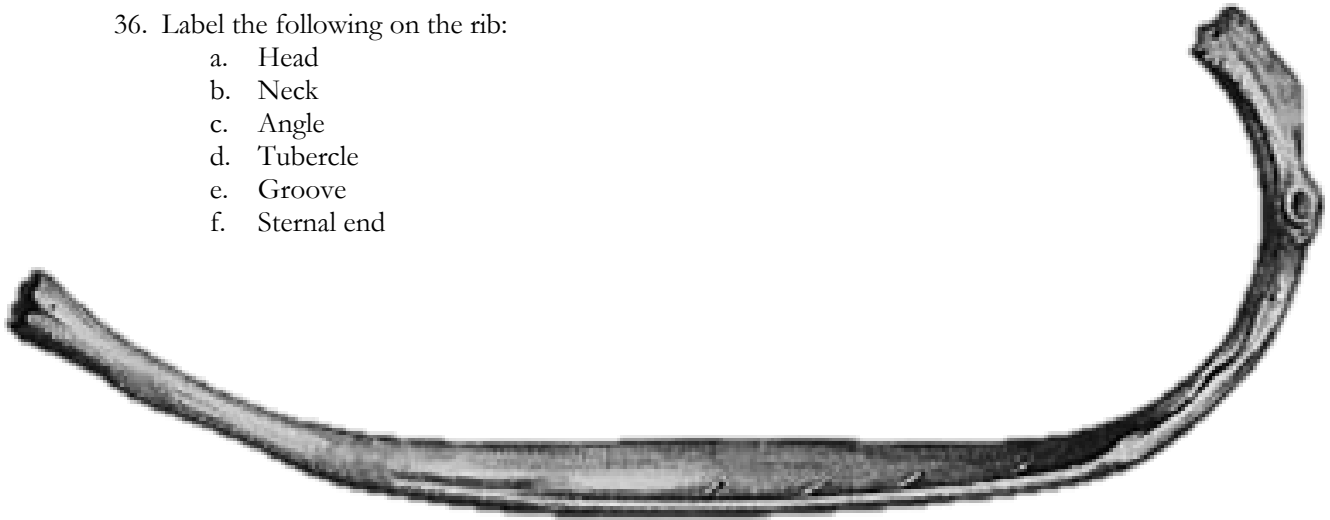
As we have twelve thoracic vertebrae, we have twelve pairs of ribs. These tend to share a similar shape but for the size. At the body of the Thoracic vertebrae we can see how ribs attach via their heads at the inferior and superior costal facets and by their tuberosity at the transverse costal facets. Between the head and tuberosity is a neck and the rib arches so that it reaches the sternum in front. The area of the rib with the most amount of bend is its angle. On the main body of the rib, on the inferior surface, one can feel a groove, called the costal groove. This area is important as it is where the intercostal vein, artery and nerve run.

When we look at the entire thoracic cage together, we find that the twelve ribs fit in a certain way. These are named by the number from the top. The first eight ribs, called the true ribs, connect to the sternum via independent cartilages. The next two, called your false ribs, attach via a shared cartilage. The last two, which are the smallest are the floating ribs. Looking closely, one can see that ribs seven and eight protrude more than the rest. This lead to them being the most fractured ribs in the human body.

Clinically many problems may occur when a rib is fractured. The most obvious complication is pain but as there is a nerve directly under the rib, any time the rib moves it can lead to severe pain. There is also the fact that the ribcage moves when breathing so breathing can become difficult and in patients with rib fractures Respirator therapist may be needed. Another complication can be puncturing the lung or a pneumothorax.

36. Label the following on the rib:

- a. Head
- b. Neck
- c. Angle
- d. Tubercle
- e. Groove
- f. Sternal end



Looking at the sternum, you will note that it is divided into three parts. The top portion, called the Manubrium, has a notch at the top called the jugular notch. It also has the attachment for the first rib. Just under the Manubrium is the body where the rest of the ribs connect. You will notice that there is a projection where the manubrium and body come together forming a joint. This bump is called the sternal angle and is used clinically to find the second rib and second intercostal space. Hanging off the body is the Xyphoid process. It is usually made up of hyaline cartilage until the age of 35.

37. On the picture label the following:

- a. Body of sternum
- b. Manubrium
- c. Xyphoid process
- d. Sternal angle (Angle of Lewis)
- e. True ribs
- f. Second intercostal space



If you look closely at the ribcage, you will notice that the ribs move downward from the spine. One can best see this if one places a pen or stray on the jugular notch of the sternum and looks at where it ends up, the second thoracic vertebrae.

There are many important clinical landmarks in the sternum. It has been mentioned that the sternal angle

helps clinicians find the second intercostal space. This is important because the intercostal spaces are where different heart valves can be heard. It is also used to determine hand placement in CPR.

The last clinically important landmark of the sternum is the Xiphoid process which, as mentioned is hyaline cartilage prior to 35 years of age. This little projection can break due to trauma and pierce either the heart or liver. Regardless this injury can be life threatening.

38. Place a straw on the notch of the sternum and pass it until it is against the spine in a horizontal plane, what vertebra are you at?
39. What is the structure that can be felt in the middle of the sternum between the Manubrium and body?
40. What rib will the answer to the question above help you find?
41. Looking at a skeleton, count to determine which ribs are most protruded.
42. Why might these two ribs fracture more than the other ribs?
43. What is the space between two ribs called?

Returning to the neck region, we find a bone that does not articulate directly with any part of the body which is called the hyoid bone. It is a bone which is associated with eating and swallowing. It is evident that the has two sets of horns. The larger ones are called the greater horns while the smaller ones are the lesser horns. These two horns are attached to the body which is medial to the horns.

44. Looking at the picture label the following
  - a. Greater horn
  - b. Lesser horn
  - c. Body

