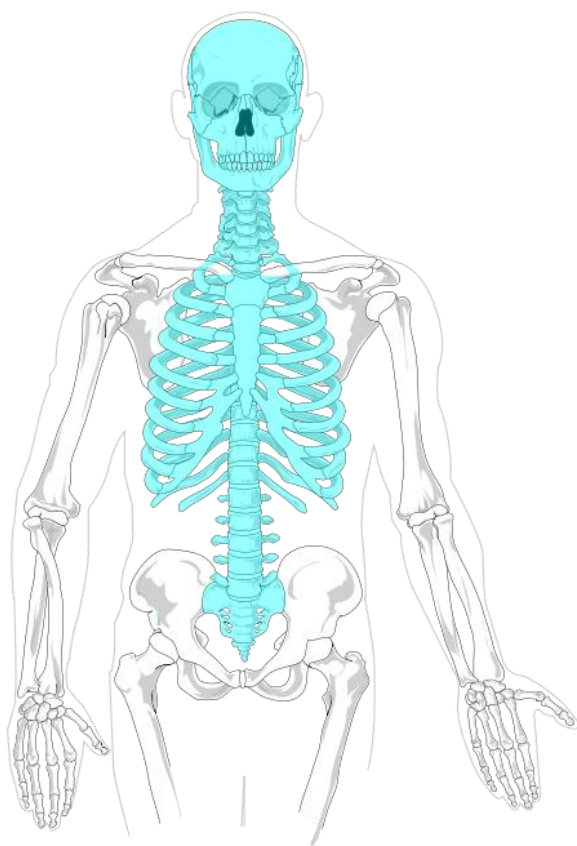
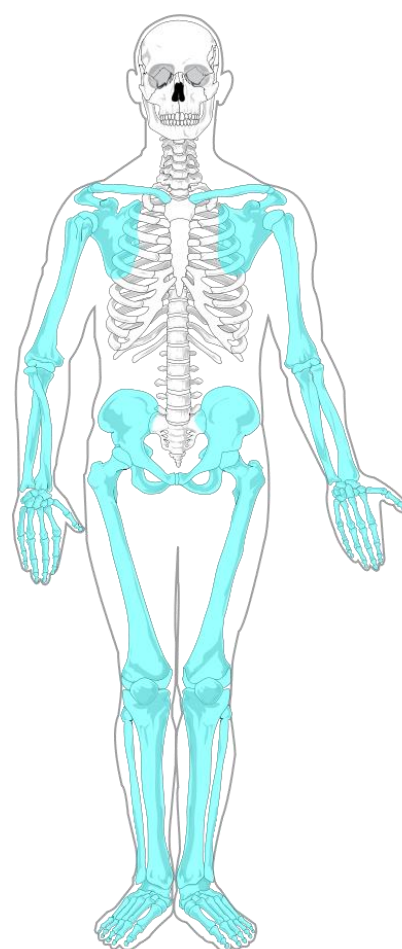


Module 3 - The Skeletal System

Introduction to the Skeletal System and the Skull



Axial



Appendicular

The skeletal system can be divided into two parts: the **axial skeleton** and the **appendicular skeleton**. The axial skeleton includes the skull, the vertebrae, the sacrum, the sternum and the ribs. The appendicular skeleton includes the bones of the appendages plus the bones of the girdles that attach the appendages, i.e. the scapula and clavicles for the upper limb and the coxal bones for the lower limbs (see figure 1).

For the skeletal system, we will divide all of the bones and bony landmarks that we want you to learn into modules. The first will cover the anatomy of the skull. The second will cover the anatomy of the trunk and arms. Finally, the third skeletal module will cover the bones of the pelvis and legs. The third skeletal module will also cover the types of joints in the skeletal system and the movements that occur at these joints.

As you use the online atlas to study images of these bones, please note a link towards the top of the menu for these bones. It is called "Anatomical Terms" and it lists common prefixes, suffixes and words that we find in our studies of the skeletal system. If you become well acquainted with these terms, you will have an easier time memorizing all the bones and bony landmarks.

The Skull

The skull is a bony structure that protects the brain and supports the structures of the face. There are about 22 bones in the skull. We say "about" because some anatomy textbooks can differ just a little bit on exactly how some of the bones are classified. All of the bones of the skull except the mandible are joined together by a type of immovable joint called a suture.

All of the muscles for facial expressions and chewing must associate with skull bones. Many nerves involved in sight, hearing, skin sensation, taste, smell and balance must negotiate through and around skull bones. A large number of blood vessels must negotiate through and around skull bones as well. For all of these reasons, the skull has a lot of angles, grooves, canals, raised areas and depressed areas. It also has sinuses and cavities. It will take an entire module to learn a good basic list of skull structures.

The skull has a lot of parts to learn and so we teach it first in the modules of the skeleton. This is so that you can review the skull through the other two skeletal modules and finally get a good handle on it before the skeletal exam. Don't underestimate how much time you should spend studying the skull bones and skull bone structures. There is a lot to learn.

List of Terms

Spend as much time as you need reviewing the skull bones and skull bone structures. The most important thing will be for you to practice identifying all of the structures listed in the table below. Use your online resources, open lab, and any other tool that you have to become confident in your identification skills. Your exam will ask you to identify and then write in (Fill in the Blank) the correct term for your identification. The table below is a comprehensive list of all the terms from this section that we would consider asking about on an exam (The bolded terms).

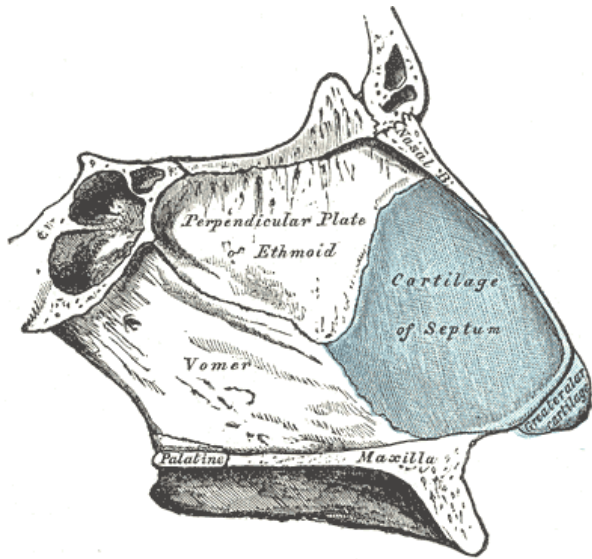
LIST OF TERMS FOR THE BONES AND BONY LANDMARKS OF THE SKULL

<p>Ear Bones (bones of the middle ear)</p> <ul style="list-style-type: none"> • Malleus • Incus • Stapes 	<p>The Malleus, Incus and Stapes are the three smallest bones of the human body. Together we call these bones Ossicles. They transmit sound from the air to the portion of our hearing apparatus called a cochlea</p>
<p>Ethmoid Bone</p> <ul style="list-style-type: none"> • Cribriform Plate • Crista Galli • Nasal Conchae • Perpendicular Plate 	<p>The ethmoid bone is hard to see as it is buried deep to the face. The bulleted structures of this bone can be seen in the cranial cavity, the socket of the eye or the nasal cavity. This bones separates the nasal cavity from the brain. It makes up the "roof" of the nose.</p>
<p>Fossas, Sinuses, and Sutures</p> <ul style="list-style-type: none"> • Anterior Cranial Fossa (floor of the cranial cavity) • Middle Cranial Fossa (floor of the cranial cavity) • Posterior Cranial Fossa (floor of the cranial cavity) • Mandibular Fossa (where jawbone connects) • Frontal Sinus • Maxillary Sinus • Sphenoid Sinus • Coronal Suture • Lambdoid Suture • Sagittal Suture • Squamous Suture 	<p>A Fossa is a depression or hollow. A sinus is a cavity within a bone and a suture is a union between two bones that creates an immovable joint</p>
<p>Frontal Bone</p> <ul style="list-style-type: none"> • Glabella • Supraorbital Foramen • Supraorbital Margin • Zygomatic Process of the Frontal Bone 	<p>Frontal comes from the Latin root "frons" which means forehead. The glabella is an area without clear boundaries but is generally considered to be a region between the eyebrows and above the nose. Supraorbital means "above the eye". Finally, note that the zygomatic process of the frontal bone refers to a process on the frontal bone that is "pointing" towards and actually makes a union with the zygomatic bone. It is NOT actually a part of the zygomatic bone. This happens other times in the skull, be on the lookout for this type of naming strategy.</p>
<p>Hyoid Bone</p>	<p>The hyoid bone is shaped like a horse shoe and is not actually connected to the skull. Some would say that this is not a skull bone, but we will list it here as one of the bones to learn in this module. This bone is actually found in the anterior midline of the neck between the chin and the "adams apple"</p>

<p>Lacrimal Bone</p> <ul style="list-style-type: none"> • Nasolacrimal Canal 	<p>The lacrimal bone is the smallest bone of the face. It is found on the medial surface of the eye socket. Tears from the eye can move through a canal in this bone and enter the nasal cavity. This anatomical structure explains why a runny nose follows a good cry.</p>
<p>Mandible</p> <ul style="list-style-type: none"> • Alveolar Processes-Mandible • Angle of Mandible • Body of Mandible • Condylar Process of Mandible • Coronoid Process of Mandible • Mandibular Condyle • Mandibular Notch • Mandibular Symphysis • Mental Foramen • Ramus of Mandible 	<p>The mandible is also known as the "jawbone". This bone forms a moveable joint with other bones of the skull and is important for containing the lower teeth and for most of the movement that occurs with chewing. There are several specific areas and structures that we learn on this bone.</p>
<p>Maxilla</p> <ul style="list-style-type: none"> • Alveolar Processes of the Maxilla • Anterior Nasal Spine • Frontal Process of the Maxilla • Infraorbital Foramen • Palatine Process • Zygomatic Process of the Maxilla 	<p>The maxilla consists of the anterior part of the roof of the mouth. It is also known as the upper jaw. It contains the upper teeth. The maxilla is another bone that helps form the eye socket. Notice that similar to the frontal bone, there is a zygomatic process that refers to an area of the bone that "points" towards and actually forms a union with the zygomatic bone but is not part of the zygomatic bone. Also, this same technique for naming is found with the palatine process. This is a part of the maxilla that "points" to and joins with the palatine bone but is not part of the palatine bone.</p>
<p>Nasal Bone</p>	<p>There are actually two nasal bones. They are quite small and form the "bridge" of the nose. They can differ quite a bit in size and form between individuals.</p>
<p>Occipital Bone</p> <ul style="list-style-type: none"> • External Occipital Protuberance • Foramen Magnum • Hypoglossal Canal • Nuchal Lines • Occipital Condyles 	<p>The occipital bone sits on the very back of the skull. It is kind of bowl shaped and makes up the floor of the cranial cavity on the very posterior side. Look for the foramen magnum in the center of the occipital bone.</p>
<p>Palatine Bone</p> <ul style="list-style-type: none"> • Horizontal Plate • Palatine Foramina 	<p>The Palatine bone contributes to the posterior part of the roof of the mouth (just behind the maxilla). It also contributes to the floor and lateral walls of the nasal cavity. You generally have to turn the skull upside down, remove the mandible and look at the posterior nasal cavity to get a good glimpse of this bone.</p>

<p>Parietal Bone</p> <ul style="list-style-type: none"> • Temporal Lines 	<p>Two parietal bones meet in the center and form much of the sides and roof of the skull. The latin root "pariet-" means wall. The temporal lines can be hard to see sometimes. It depends on the skull. Generally the temporal lines are slightly raised ridges that mark the attachment of the temporalis muscle.</p>
<p>Sphenoid Bone</p> <ul style="list-style-type: none"> • Foramen Lacerum • Foramen Ovale • Foramen Rotundum • Foramen Spinosum • Greater Wing • Inferior Orbital Fissure • Lateral Pterygoid Plate • Lesser Wing • Medial Pterygoid Plate • Optic Canal • Sella Turcica • Superior Orbital Fissure 	<p>The sphenoid bone kind of resembles a butterfly. It is situated towards the front of the skull, but much of it is hidden behind the face. It is another bone that helps make up the eye socket. This bone has quite a few important structures on it that we must learn.</p>
<p>Temporal Bone</p> <ul style="list-style-type: none"> • Carotid Canal • External Acoustic Meatus • Internal Acoustic Meatus • Jugular Foramen • Mastoid Process • Petrous Portion • Squamous Portion • Styloid Process • Stylomastoid Foramen • Zygomatic Process of the Temporal Bone 	<p>The temporal bone contains the part of the face called the temple. This bone also contains the ear canal and the structures used for hearing. This bone also contains quite a few important anatomical structures that we learn.</p>

Vomer



The vomer is a small bone right in the middle of the nasal cavity. If you look in the nasal cavity there will be a plate of bone right in the center. The top part of this plate is the perpendicular plate of the ethmoid bone. The bottom part of this plate is the vomer. If you look at the center plate of bone from the posterior nasal cavity, the entire plate is the vomer. A drawing of this relationship is placed here to help you.

Zygomatic Bone

- **Infraorbital Margin**
- **Temporal Process of the Zygomatic bone**
- **Zygomatic Arch**

The zygomatic bone is the “cheek” bone. It also helps make up part of the eye socket.

FYI: (Just for fun...don't worry about for an exam)

Based on various features of the skull, it is possible to determine the gender of the skull. In the table below is a list of features that differ between the sexes. Look at several skulls and see if you can determine their gender. For this exercise, it is better to use the real skulls rather than the models. Note that it is common for some of the features to appear more “male” and others “female”—if this happens, sex is determined by the greatest number of features. For example, if the skull demonstrates 4 male-like traits and 7 female-like traits, then you would classify the skull as female.

Gender Differences in the Skull

Skull Feature	Male Characteristic	Female Characteristic
general size	more robust	more gracile/delicate
external occipital protuberance and nuchal lines	well-demarcated nuchal lines and prominent bump or “hook”	external surface of occipital bone is smooth, with no bony projection
mastoid process	large, projects below the external auditory canal	Smaller
supraorbital margin (upper orbit rim)	thick, rounded, blunt border	thin, sharp border
supraorbital ridge (“brow ridges”)	prominent	little or no prominence
mandible	squarish, greater forward projection	more pointed, little forward projection
angle of the mandible	125 degrees or less	125 degrees or more
ramus of the mandible	wide	Narrow
orbit	rectangular	Round
frontal bone	flattened and sharply angled	rounded both ways
hard palate	definite “U” shape	“V” shaped