The ethmoid bone is a single bone of the cranium. It is anterior to the sphenoid and posterior to the nasal bones. It forms most of the area between the nasal cavity and the orbit of the eye. It has a number of landmarks associated with it including: crista galli, cribiform and perpendicular plates, the ethmoid sinuses, superior and middle conchae. Each of these will be discussed in turn.
The frontal bone is a single bone of the cranium and the face, forming the forehead. It forms the roof for each of the orbits and the majority of the anterior cranial fossa. Superiorly it forms the coronal suture with the parietal bones, laterally it forms a suture with the zygomatic bones and anteriorly it meets nasal bones. One landmark is the frontal sinus. It also houses the supraorbital notch (foramen). These landmarks will be discussed in turn. We find that it is actually two bones in the fetus.
The incus is one of the three auditory ossicles. In nursery school we called it the anvil. Functionally it is important because in association with the other ossicles it helps amplify the pressure of vibrations associated with sound by about 20 times.

The malleus is one of the three auditory ossicles. These three bones are located in the middle ear which is within the temporal bone. When we were in nursery school we called it the hammer. The "handle" of the malleus attaches to the eardrum. Functionally it is important because in association with the other ossicles it helps amplify the pressure of vibrations associated with sound by about 20 times.

The stapes is one of the three auditory ossicles. In nursery school we called it the stirrup. The base of the stapes contacts the oval window, a hole in the medial wall of the middle ear. Functionally it is important because in association with the other ossicles it helps amplify the pressure of vibrations associated with sound by about 20 times.
Inferior Nasal Concha Bone

There are two inferior nasal conchae (inferior turbinate), one on the lateral wall of each nasal cavity. Functionally they are important because their curved surface causes turbulence as air moves into the nasal cavity. The turbulence helps warm, moisten, and filter the air before it enters the lower respiratory tract. In addition, the conchae help recover moisture and heat during expiration. This is especially important in cold and dry conditions. An additional benefit has been proposed based on a recent finding that the air flow is different for the two nasal cavities. It has been shown that the mucosa that covers the conchae becomes swollen on one side, and then after a few hours the swelling reduces on that side and the other side becomes swollen. A possible advantage of this would be that the sense of smell is better on the swollen side because the air moves more slowly and there is more intense stimulation by scents when air flow is slow. Additional conchae are part of the ethmoid bone where we find middle conchae, superior conchae, and supreme conchae.
**The Human Skull**

### Lacrimal Bones

The two lacrimal bones are bones of the face. They each contain the lacrimal canal which is functionally important as this is the passage for the tear duct. The canal terminates in the nasal cavity. They make up part of the medial wall of the orbit. They contact the maxillary bone anteriorly, the ethmoid bone posteriorly, and the frontal bone superiorly.

### Maxillary Bones

The two maxillary bones are considered part of the face. They form the upper jaw, as well as the anterior two thirds of the hard palate. They also form the lateral walls of the nasal cavities, and a portion of the bony orbit of the eye. They have a number of landmarks including: sinuses, alveoli, and the palatine processes. In addition they have the infraorbital foramina and form part of the inferior orbital fissure that will be discussed in turn. All facial bones except the mandible articulate with the maxillary bones. These bones were named in honor of the famous spy, Maxilla Smart.
Nasal Bone

The two small nasal bones are considered facial bones. They form the bridge of the nose. They articulate with the maxillary bones laterally, the perpendicular plate of the ethmoid bone posteriorly, and the frontal bone superiorly. Inferiorly cartilages that form most of the external nasal skeleton attach to the nasal bones.
Mandibular Bone

The mandible is a single bone of the face. It articulates with the mandibular fossa of the temporal bone and irritation of this joint leads to the condition known as TMJ syndrome. When we were in nursery school we called it the lower jaw. It has a number of landmarks associated with it including: rami, alveoli, coronoid and condyloid processes, mandibular fossa, body, and the mandibular (sigmoid) notch. It also houses two important foramina, the mandibular and mental foramina. These landmarks will be discussed in turn. We find that it is actually two bones in the fetus.

In these two pictures of a fetal mandible one can see where the two portions have not yet fused.
The single occipital bone is part of the cranium. It is found on the posterior side of the skull. It articulates via the lambdoidal suture with the parietal bones. It also articulates with the sphenoid bone, temporal bones, and the atlas. It has a number of landmarks including: nuchal lines, condyles, and the protuberance. It also contains the foramen magnum, hypoglossal canals, and part of the jugular foramina. Each of these will be discussed in turn.
The two palatine bones are facial bones. They form the posterior third of the hard palate where they articulate with the palatine process of the maxillary bones. The portion of those bones that forms the hard palate is called the horizontal plate. Each bone also has a perpendicular (vertical) plate.
The two parietal bones are cranial bones. They articulate anteriorly with the frontal bone at the coronal suture, posterior with the occipital bone at the lambdoidal suture, and inferiorly with the temporal bone at the squamosal suture. They also articulate with each other along the sagittal suture on the superior surface of the skull.
**Sphenoid Bone**

The single sphenoid bone is considered a cranial bone. It articulates with every other cranial bone. It also articulates with the zygomatic, vomer, maxillary, and palatine bones. It has many important landmarks including: the greater and lesser wings, the sinuses, the sella turcica, and the pterygoid processes. It also has a number of significant foramina including: rotundum, ovale, the optic canal, the superior orbital fissure, as well as others. These will be discussed in turn.

**Temporal Bone**

The two temporal bones are bones of the cranium. They are positioned inferior to the parietal bone and articulate with the parietal bone at the squamosal suture. Anteriorly it articulates with the zygoma, posteriorly with the occipital bone, and inferiorly with the mandible. It forms most of the middle fossa of the cranium. There are a number of landmarks of the temporal bone including: the petrous ridge, the mastoid, zygomatic, and styloid processes, and the mandibular fossa. It also contains the stylomastoid foramen, the internal auditory meatus and external auditory meatus, and forms part of the jugular foramen. Each of these will be discussed in turn.
**Vomer Bone**

The vomer is a single bone of the face. It is of functional importance because it forms the inferior portion of the nasal septum. It starts as a large portion of that septum posteriorly and then narrows to a point at its anterior end, often being called plow shaped. Anteriorly the septum is cartilage.

**Zygomatic Bone**

The two zygomatic bones are facial bones. In nursery school we called it the cheekbone. They articulate posteromedially with the sphenoid bone, posterolaterally with the temporal bone, superiorly with the frontal bone and anteriorly with the maxillary bones. The zygomatic bone is a portion of the bony orbit of the eye. The temporal process is the only landmark we will study. It will be discussed in turn.
**Foramina**

**External Auditory Meatus**

The external auditory meatus is found in the temporal bone. Functionally it is important because sound enters the ear through this canal and comes in contact with the tympanic membrane (ear drum) at its deep end.

**Hypoglossal Canal**

The hypoglossal canal is found in the occipital bone on the lateral surface of the foramen magnum. It provides a passage for the hypoglossal nerve (XII).

**Supraorbital Foramen (Notch)**

The supraorbital foramen (notch) of the frontal bone is a passageway for the ophthalmic nerve (V1) as it moves onto the face. This is the second of the two foramina it passes through. The order of foramina that it passes through is superior orbital fissure and supraorbital foramen.
Inferior Orbital Fissure

The inferior orbital fissure is formed by the maxilla, the greater wing of the sphenoid, the palatine, and the zygomatic bones. The maxillary nerve (V2) passes through this fissure having come from the foramen rotundum and on its way to the infraorbital foramen.

Infraorbital Foramen

The infraorbital foramen is found in the maxillary bone, just inferior to the orbit. It is the third foramen through which the maxillary nerve (V2) passes to the face.

Internal Auditory Meatus

The internal auditory meatus is found on the vertical portion of the petrous ridge of the temporal bone. The facial nerve (VII) and vestibulocochlear (VIII) nerves pass into this canal. They separate once inside the temporal bone.

Jugular Foramen

The jugular foramen is between the temporal and occipital bones. The glossopharyngeal (IX), vagus (X), spinal accessory (XI), and internal jugular vein all pass through this foramen.
Lacranial Foramen

The lacrimal canal holds the lacrimal duct. The duct serves to conduct the fluid from the eye into the nasal cavity. The duct is sometimes called the nasolacrimal duct.

Foramen Magnum

Several structures pass through the foramen magnum. They include the medulla oblongata and the meninges that surround it, the ascending portions of the spinal accessory nerves (XI), and the two vertebral arteries. The medulla oblongata connects to the spinal cord.

Mandibular Foramen

This is the second foramen that the mandibular nerve (V3) passes through as it moves toward the mental foramen. Dentists usually try to anesthetize this nerve near this foramen when working on teeth in the mandible.

Mental Foramen

This is the last foramen that the mandibular nerve (V3) passes through as it courses away from the brain. In order they are the foramen ovale, mandibular foramen, and finally the mental foramen. Repetition is your friend.

Optic Foramen

The optic canal is occasionally referred to as the optic foramen. It may seem there isn’t much difference, but remember that the name canal suggests that this is an opening with appreciable depth. Here we have another Grant thing - the optic canal houses the optic nerve (II). Note that if you pass a wooden applicator stick through this canal on each side, the sticks crisscross inside the cranium.
The foramen ovale of the sphenoid bone houses the mandibular nerve (V3) as it passes toward the mental foramen. This is the first of the three foramina it passes through. The order of foramina that it passes through is foramen ovale, mandibular foramen, and mental foramen.

The foramen rotundum of the sphenoid bone houses the maxillary nerve (V2) as it passes toward the infraorbital foramen of the maxillary bone. This is the first of the three foramina it passes through. The order of foramina that it passes through is foramen rotundum, inferior orbital fissure, and infraorbital foramen.

The stylomastoid foramen of the temporal bone surrounds the facial nerve (VII) as it passes away from the cranium toward the face. This is the second of the two foramina it passes through. The order of foramina that it passes through is internal auditory meatus and stylomastoid foramen.

The superior orbital fissure of the sphenoid bone provides passage for the oculomotor (III), trochlear (IV), ophthalmic (V1), and abducens (VI) from the cranium to the orbit. This fissure separates the lesser wing of the sphenoid from the greater wing of the sphenoid.